Cityview Ridge Subdivision

Preliminary Servicing & Stormwater Management Report

GMBP File: 105172

Revised: June 2023

GUELPH | OWEN SOUND | LISTOWEL | KITCHENER |LONDON | HAMILTON | GTA

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TABLE OF CONTENTS

1. INTRODUCTION 1
2. LOCATION 2
3. EXISTING CONDITIONS 2
3.1 Land Use 2
3.2 Topography 2
3.3 Soils 2
3.4 Slope Stability Assessment 3
3.5 Guelph Permeameter Testing 4
4. PROPOSED DEVELOPMENT 5
4.1 Site Grading 5
4.2 Streets 5
4.3 Water Supply 6
4.4 Sanitary Sewer 7
4.5 Storm Sewer 7
4.6 Clean Water Collector 8
4.7 Salt Management Plan 8
4.8 Water Budget 9
5. STORMWATER MANAGEMENT PLAN 11
5.1 Stormwater Management Criteria 12
5.2 Stormwater Management Design 13
5.2.1 Lot Level Controls 13
5.2.2 Conveyance Controls 13
5.2.3 Proposed Stormwater Management Facility Quality and Quantity Control 14
5.2.4 Existing Stormwater Quality Facility No. 2 Quality Control 15
5.2.5 Cooling Trench and Linear Energy Dissipation and Dispersion Trench 16
5.2.6 Pre-Development Stormwater Management Analysis 17
5.2.7 Post-Development Stormwater Management Analysis 21
5.2.8 Sediment Forebay Design 28
5.2.9 Minor/Major Drainage System 31
5.2.10 Floodplain Analysis 31
6. SEDIMENT AND EROSION CONTROL PLAN 32
7. MAINTENANCE PLAN 33
8. CONCLUSIONS 34

LIST OF FIGURES

After Page

1. Site Location 2
2. Draft Plan of Subdivision 5
3. Overall Drainage Areas 11
4. Existing Conditions Drainage Area 17
5. Post-Development Drainage Areas Western Portion of Subdivision 21
6. Post-Development Drainage Areas Eastern Portion of Subdivision 24

APPENDICES

A Geotechnical Investigation, Naylor Engineering Associates Ltd., 2012

B Groundwater Level Measurements, GM BluePlan Engineering Limited

C Slope Stability Assessment Report, Englobe Corp., 2016
Slope Stability Assessment of South Facing Slope, Englobe Corp., 2019
Updated Slope Stability Assessment of East Facing Slope, Englobe Corp., 2020
Slope Stability Assessment – SWMP Outlet Slope Stability, JLP Services Inc., 2023

D Guelph Permeameter Testing, CMT Engineering, 2020

E Hydrogeological Investigation, Banks Groundwater Engineering Limited, 2014

F Water Balance Calculations

G Oil/Grit Separator Sizing Calculations

H Cooling Trench Calculations

I Pre-Development Stormwater Management Analysis
MIDUSS Output Files for the Cityview Ridge Subdivision

J Post-Development Stormwater Management Analysis
Stormwater Management system calculations
Post-Development Controlled Conditions MIDUSS Modeling Output Files (Western Portion of Cityview Ridge Subdivision – to Clythe Creek)
Hadati Creek Watershed Schematic (Post-Development – Including Cityview Ridge)
Hadati Creek Stormwater Management Analysis (Post-Development – Including Cityview Ridge)

K Floodplain Analysis

CITYVIEW RIDGE SUBDIVISION

PRELIMINARY SERVICING AND STORMWATER MANAGEMENT REPORT

REVISED: JUNE 2023

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1. INTRODUCTION

In support of the Draft Plan of Subdivision Application for Part of Lot 4, Concession 3, Division 'C' (Geographic Township of Guelph) and Part of Lots 30, 32 & 33 and all of Lot 34, Registered Plan 53 (Division 'C' – Geographic Township of Guelph), in the City of Guelph herein after referred to as Cityview Ridge Subdivision, GM BluePlan Engineering Limited has prepared this revised report to address the preliminary servicing and stormwater management requirements for the site and to address the comments provided by the City of Guelph (Environmental Planning Comments dated June 3, 2022 and Development Engineering Comments dated June 8, 2022) as well as comments provided by the Grand River Conservation Authority (GRCA) dated December 14, 2021.

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

- Final Stormwater Management Design Report for the Southern Hadati Creek Watershed prepared by Schaeffers Consulting Engineers (May 1997).
- Stormwater Management Design Report Draft Plan 23T-96501 and 23T-99501 Martini/Valeriote Subdivision prepared by Gamsby and Mannerow Limited (March 2004).
- Clythe Creek Subwatershed Overview prepared by Ecologistics Limited (January 1998).
- Eastview Secondary Plan and Addendum prepared by Cosburn Patterson Wardman Limited (1991 and 1992).
- Environmental Impact Study prepared by North-South Environmental Inc. (July 2017 Amendment).
- Environmental Impact Study prepared by North-South Environmental Inc. (July 30, 2021 update memorandum)
- Hydrogeological Investigation prepared by Banks Groundwater Engineering Limited (November 2014).
- Geotechnical Investigation prepared by Naylor Engineering Associates Limited (February 2012).
- Slope Stability Assessment of East-Facing Slope prepared by Englobe Corp. (December 14, 2020).
- Slope Stability Assessment of South-Facing Slope prepared by Englobe Corp. (March 1, 2019).

Together, these reports form the overview for the design and development of the Cityview Ridge lands. Please note that some of these reports pre-date the current Draft Plan layout, though the findings of these reports are not affected by the change.

The following sections of this report will describe the grading, servicing and stormwater management design for the Cityview Ridge Subdivision. As part of the detailed engineering design, further details of the Erosion and Sediment Control Plan and Monitoring Plan will be provided in an Environmental Impact Report.

2. LOCATION

Figure 1 shows the location of the Cityview Ridge Subdivision and the surrounding area. The site is bound by lands which have received Draft Plan approval to the north, Watson Parkway to the east, CN Railway lands to the south and existing residential development (Valleyhaven Subdivision Phase 3) to the west.

3. EXISTING CONDITIONS

3.1 Land Use

The existing land use on the site is vacant field, one existing residential dwelling, a barn and shed. Previously a portion of the site (east of Cityview Drive) was utilized as a Christmas tree farm with the remaining Christmas trees being harvested in 2006. The site has also been used as a borrow site for fill material in the past.

The lands to the north have received Draft Plan approval and are being developed for residential purposes. The lands to the east, on the opposite side of Watson Parkway, are zoned to permit future commercial development and protection of existing conservation and flood plain lands. The lands to the south of the CN Railway lands have been developed for residential/commercial/industrial use. The lands to the west have been developed for residential use and are commonly referred to as the Valleyhaven Subdivision Phase 3.

3.2 Topography

The westerly portion of the site, west of Cityview Drive, generally drains in an east to west direction towards Hadati Creek. The average gradient across the westerly portion of the site ranges from 3.0% to 12.0%. The central portion of the site, east of Cityview Drive, generally drains in a west to southeast direction towards the low-lying area and Clythe Creek. East of Cityview Drive, the southwesterly portion of the site drains towards Hadati Creek via the roadside ditch along Cityview Drive. The average gradient across the central portion of the site, which includes the slope of the drumlin, ranges from 3.0% to 20.0%. The eastern portion of the site, adjacent to Watson Parkway, generally drains in an east to southwest direction towards the low-lying area and Clythe Creek. The average gradient across this portion of the site ranges from 2.0% to 12.0%.

3.3 Soils

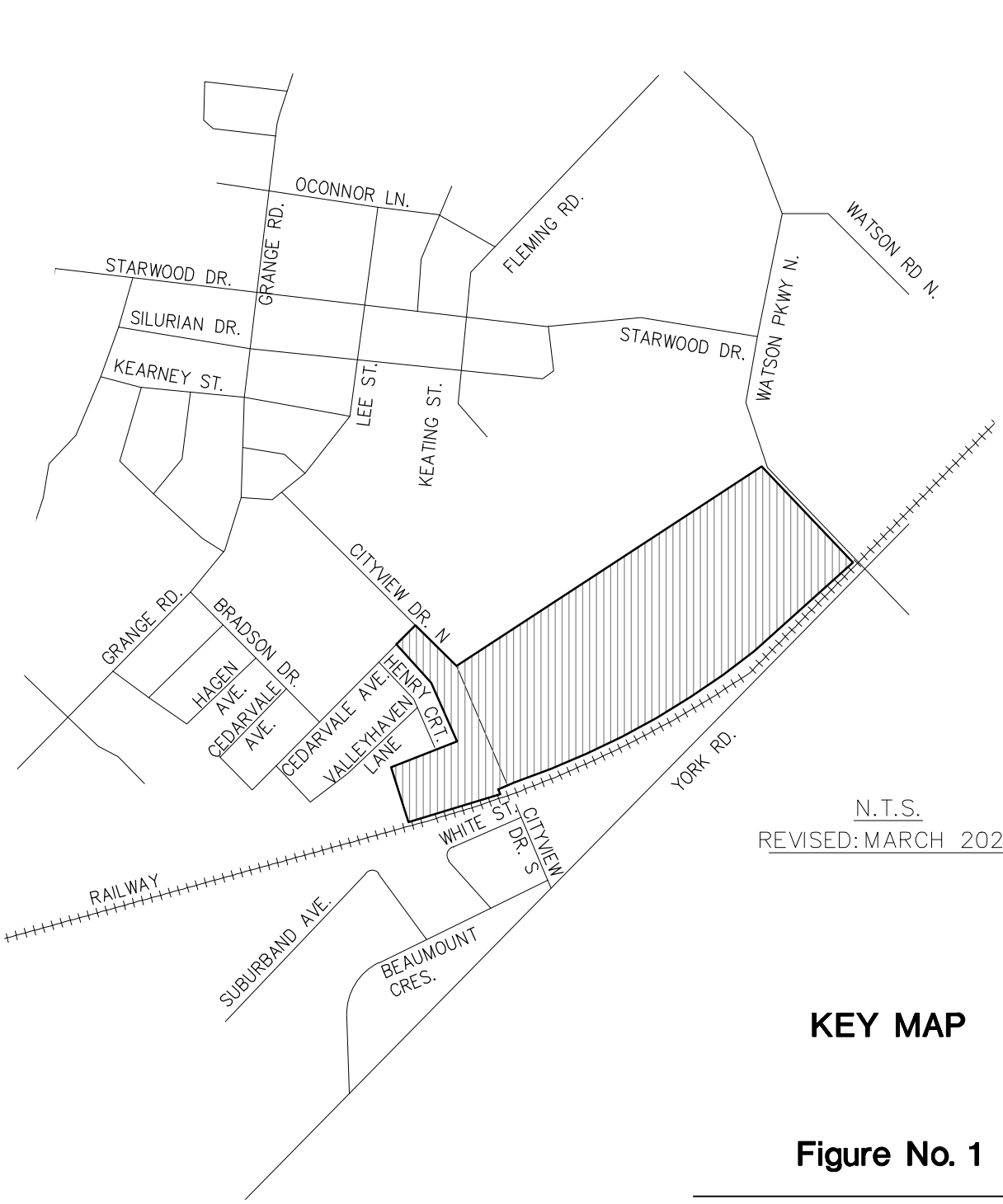
The predominant surface soil type across the site is Guelph Loam (Soil Survey of Wellington County Report No. 35). Guelph Loam has a hydrologic soil classification of BC and generally has good drainage characteristics.

The Geotechnical Investigation by Naylor Engineering Associates Limited (February 2012) established the characteristics of the underlying soils for the lands on the east side of Cityview Drive. The boreholes identified the underlying soils as topsoil overlying silt tills for the majority of the property and as topsoil overlying sand and gravel for the low lying easterly portions of the site. The results of the geotechnical investigation are included in **Appendix A**.

As part of the Geotechnical Investigation, groundwater observation wells were installed. Groundwater measurements have been collected by GM BluePlan Engineering Limited from 2006 to the present to establish seasonably high groundwater elevations. From the groundwater measurements and the Geotechnical Investigation, the seasonably high groundwater level is estimated to range from 0.10 metres to 6.70 metres below ground surface. Groundwater level measurements are found in **Appendix B**.

A seasonal high groundwater level surface is included in Appendix B and was interpolated using the maximum groundwater level recorded at each monitoring well location: through the low-lying wooded area in the easterly part of the site in which there is little available groundwater level data, the seasonal high groundwater level was assumed to lie approximately at ground surface. In locations with a nest of wells (i.e., two co-located wells), the reading from the shallower of the two wells was typically used. The exception to this was at monitoring well nest BH103U/L, for which the groundwater level was taken from the deeper of the two wells (i.e., BH103L) because

PRELIMINARY SERVICING AND STORMWATER MANAGEMENT REPORT CITYVIEW RIDGE SUBDIVISION CITY OF GUELPH



N.T.S.

REVISED: MARCH 2023

KEY MAP

Figure No. 1

BluePlan ENGINEERING

Plotted On: March 15, 2023 105172-FIG1.dwg

of anomalous behaviour at BH103U, which in the springtime of certain years would sometimes register a groundwater level well above ground surface. These readings were inconsistent with the other phenomena observed at the site (i.e., no standing water at this location, no vertical upward gradient) and are interpreted to be due to the shallow depth of the well (2.5 m below ground surface), possible imperfections in well construction (e.g., incomplete annular seal), and potential influence from freeze-thaw, leading to increased localized pore pressures that raised the water level in the monitoring well casing above the actual groundwater level.

Across the western and central portions of the Site in which the proposed development would be built, seasonal high groundwater levels vary from approximately 346 masl (meters above sea level) in the north central part of the Site down to about 334 masl in the southwest portion of the Site and about 329 masl in the southeasterly part of the developable area.

It is noted that the pattern of groundwater levels on-Site is dominated by the silt till soils that make up the overburden. It is emphasized that the groundwater levels across the developable area of the Site are due to seasonal infiltration and precipitation processes, not persistent groundwater discharge conditions. Groundwater levels rise to levels near the ground surface in the spring due to the increased availability of moisture and infiltration and the comparatively low rate of seepage though the soil mass. This annual rise in groundwater levels is enhanced by the natural microtopography and uneven ground surface which encourages infiltration.

Under post-development conditions, groundwater levels can be expected to decrease somewhat due to a number of factors, including the increased imperviousness of the site, engineered grading with uniform and constructed slopes, and the installation of services which create preferential drainage paths. The former two factors will reduce the opportunity for infiltration, whereas the latter will increase the capacity for seepage and internal drainage of groundwater through the soil mass.

Permeameter testing at various locations throughout the site was completed in October 2020 by CMT Engineering Inc., further discussion regarding the testing results is discussed in Section 3.5.

Further discussion regarding the on-site soils can be found in the Environmental Impact Study completed by North-South Environmental Inc.

3.4 Slope Stability Assessment

An updated slope stability analysis was completed for the south and east facing steep slopes adjacent to the development, specifically, the slopes adjacent to the rail corridor and Lots 64 to 78. The results of the updated slope stability analysis' have been included in **Appendix C**. Three cross sections of the east-facing slope were analysed to determine the location of the top of stable slope with a factor of safety of 1.5. The total development setback of 7.0m from the top of slope of the east-facing slope is required. As shown on Drawing No. 2 of the Englobe Report and the Preliminary Grading and Drainage Plan, no portion of the development is proposed to be within the total development setback of the east facing slope.

Four sections of the south facing slope were analysed to determine the location of the top of stable slope with a factor of safety of 1.5. The resultant total development setback is indicated on Drawing No. 1 of the report prepared by Englobe Corp. and the Preliminary Grading and Drainage Plans.

As shown on the Preliminary Grading and Drainage Plans, no portion of the development is proposed to be within the top of stable slope, or the development setback.

JLP Services Inc. (JLP) prepared a Slope Stability Assessment in 2023 at the stormwater management facility outlet location to assess the slope stability and erosion over the existing slope. The JLP Slope Stability Assessment calculated the stability of the existing slope under low water level conditions (i.e. water level is at the permanent pool elevation) and critical conditions where the water is routed through the cooling trench and

constantly discharged through the linear energy dissipation and dispersion trench over the existing slope. It has been concluded that the existing slope is considered to be stable under both conditions.

JLP notes that the lower portion of the existing slope is natural and will remain undisturbed by the proposed development and the disturbed portions are to be topsoiled, seeded (or sodded) and re-vegetated following the construction of the stormwater management facility works. Furthermore, the use of natural or synthetic erosion control products (i.e. erosion control blanket) over the disturbed areas is recommended following construction until vegetation takes place to mitigate the potential for erosion. These mitigation measures will be implemented as part of the detail design stage to ensure that erosion is mitigated during and following construction.

It is noted that the limits of grading and construction of the stormwater management facility complete with cooling trench and linear energy dissipation and dispersion trench are outside of the 10m natural heritage system buffer limits. As such, the stabilizing measures required following construction i.e. topsoil, seeding or sodding, the installation of erosion control products and re-vegetation of the slope will take place outside of the 10m natural heritage system buffer.

The JLP Slope Stability Assessment recommends a monitoring plan for the slope profile at the stormwater management facility outlet location to be implemented as part of the operations manual for the proposed stormwater management facility. The slope monitoring plan can include quarterly site visits during the first two years of operation, followed by yearly visits afterwards. The slope monitoring plan will be prepared at the detail design stage once Draft Plan approval has been granted.

A copy of the JLP Slope Stability Assessment is included in **Appendix C.**

3.5 Guelph Permeameter Testing

As per the City of Guelph Development Engineering Manual requirements, Guelph Permeameter testing was completed on-site to determine the in-situ infiltration rates of the native soils. The field investigation was completed by CMT Engineering Inc. on September 30 and October 1, 2020 and the report can be found in **Appendix D**.

Infiltration rates were calculated for the soils at the bottom of the infiltration structure, and any soil horizon encountered within 1.5 m of the bottom of the infiltration structures. A factor of safety was then added to the infiltration rates per the Low Impact Development Stormwater Management Planning and Design Guide. The design infiltration rates for the majority of the site range from 5 mm to 10 mm per hour (after the safety factors are applied) with the exception of the area of the lots between Street 3 and Street 1 which are closer to 0.2 mm per hour.

Further discussion regarding the site infiltration rates is found in Section 4.8, Water Budget.

4. PROPOSED DEVELOPMENT

The Draft Plan of Subdivision prepared by J.D. Barnes Limited (November 9, 2022), **Figure 2,** illustrates the proposed lot fabric and road network. Cityview Drive will serve as the main connection and access point for the eastern portion of the development (lands east of Cityview Drive). For the western portion of the development, the existing Henry Court cul-de sac is proposed to be extended to service the proposed nine lots fronting Henry Court.

The proposed development generally consists of 76 single family residential lots, 54 semi-detached units, 20 on-street townhome units, a cluster townhome block, neighbourhood park, roadways, open space and stormwater management blocks.

4.1 Site Grading

The site layout and internal roads are shown on the Preliminary Grading and Drainage Plans prepared by GM BluePlan Engineering Limited. The grade and elevation of the streets are controlled by the elevation of Cityview Drive and the major overland flow route to the existing municipal stormwater management facility (Stormwater Quality Facility No. 2, constructed as part of the Valleyhaven Subdivision Phase 3) and proposed stormwater management facility. The site has been graded to match the existing elevations along the property limits of the lands to the north and the CN Railway lands to the south. We note that no grading is proposed east of the total development setback from the easterly steep slopes.

Under post-development conditions the existing watercourse in the east half of the site which runs north to south is to remain unchanged. This existing surface drainage feature is located within the identified Natural Heritage System and is not within 100m of the closest lot line.

Under post-development conditions, the drainage swale which runs through the middle of the site from the northwest to the southeast will be removed. This swale is dry and no surface runoff has been observed, however, any flows which may occur during a major precipitation event would be routed via the on-site storm sewer system to the proposed stormwater management facility and cooling trench, ultimately discharging to the proposed linear energy dissipation and dispersion trench prior to outleting to Clythe Creek. There will be no grading within the natural features and associated buffers with the exception of minor grading to accommodate the trail construction.

To facilitate development of the site while minimizing impacts on the adjacent natural areas and in order to match existing elevations at the limits of the development, retaining walls have been proposed to reduce or eliminate grading encroachments into the natural areas. To minimize the construction footprint during the construction of the retaining walls, only small (for example mini excavator) equipment shall be used when adjacent to the protected natural areas. Additionally, prior to construction of the retaining walls, the natural areas will be flagged and a minimum of one row of heavy-duty silt fence will be placed along the boundary of the natural area to provide protection from sediment runoff during construction of the retaining walls.

4.2 Streets

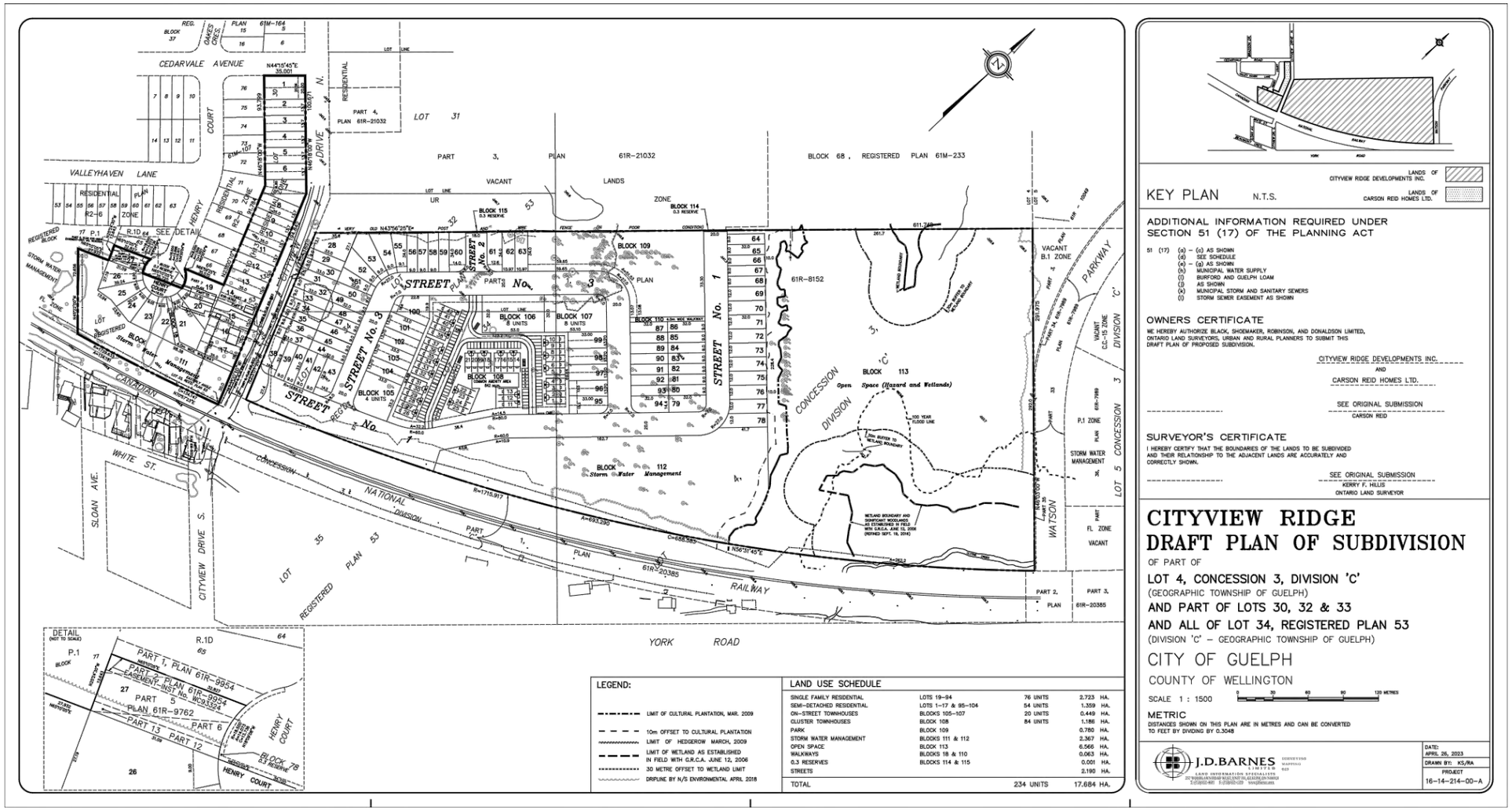
All streets will be constructed with a minimum slope of 0.5% to a maximum slope of 5.0%. An urban road cross-section with concrete curb and gutter will be used along all streets.

Cityview Drive and Street Numbers 1 and 3 are proposed to have a 20.0 metre right-of-way width.

Street 2 stub which connects to the Draft Plan approved lands to the north is proposed to have an 18m right-of-way width. The 18 m right-of-way width matches the right-of-way width for the approved development to the north.

The existing portion of Henry Court has a 20 m right-of-way width. The extension of the cul-de-sac on Henry Court has an 18.5 metre radius.

PRELIMINARY SERVICING AND STORMWATER MANAGEMENT REPORT
CITYVIEW RIDGE SUBDIVISION
CITY OF GUELPH



LAND USE SCHEDULE			
SINGLE FAMILY RESIDENTIAL	LOTS 19-94	76 UNITS	2.723 HA.
SEMI-DETACHED RESIDENTIAL	LOTS 1-17 & 95-104	54 UNITS	1.359 HA.
ON-STREET TOWNHOUSES	BLOCKS 105-107	20 UNITS	0.449 HA.
CLUSTER TOWNHOUSES	BLOCK 108	84 UNITS	1.186 HA.
PARK	BLOCK 109		0.780 HA.
STORM WATER MANAGEMENT	BLOCKS 111 & 112		2.367 HA.
OPEN SPACE	BLOCK 113		6.566 HA.
WALKWAYS	BLOCKS 18 & 110		0.063 HA.
0.3 RESERVES	BLOCKS 114 & 115		0.001 HA.
STREETS			2.190 HA.
TOTAL		234 UNITS	17.684 HA.

LANDS OF CITYVIEW RIDGE DEVELOPMENTS INC.

LANDS OF CARSON REID HOMES LTD.

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) BURFORD AND GUELPH LOAM
(j) AS SHOWN
(k) MUNICIPAL STORM AND SANITARY SEWERS
(l) STORM SEWER EASEMENT AS SHOWN

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.

CITYVIEW RIDGE DEVELOPMENTS INC.
AND
CARSON REID HOMES LTD.

SEE ORIGINAL SUBMISSION
CARSON REID

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.

SEE ORIGINAL SUBMISSION
KERRY F. HILLIS
ONTARIO LAND SURVEYOR

CITYVIEW RIDGE
DRAFT PLAN OF SUBDIVISION

OF PART OF
LOT 4, CONCESSION 3, DIVISION 'C'
(GEOGRAPHIC TOWNSHIP OF GUELPH)
AND PART OF LOTS 30, 32 & 33
AND ALL OF LOT 34, REGISTERED PLAN 53
(DIVISION 'C' – GEOGRAPHIC TOWNSHIP OF GUELPH)
CITY OF GUELPH
COUNTY OF WELLINGTON

SCALE 1 : 1500 0 30 60 90 120 METRES

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

J.D.BARNES LIMITED SURVEYING MAPPING LAND INFORMATION SPECIALISTS

DATE: APRIL 26, 2023
DRAWN BY: KS/RA
PROJECT 16-14-214-00-A

N.T.S.
REVISED: APRIL 2023

DRAFT PLAN OF SUBDIVISION

Figure No. 2

BluePlan ENGINEERING

Plotted On: April 26, 2023 105172-FIG2.dwg

Concrete sidewalks, with a width of 1.5 metres, will be constructed along one side of the street for 18 m wide rights-of-way and both sides of the street for 20 m wide rights-of-way per City of Guelph standards. For Street No. 2, 18 m wide right-of-way, the proposed concrete sidewalk will be constructed on the same side of the street as the approved development to the north.

4.3 Water Supply

As part of the municipal servicing of the Valleyhaven Subdivision Phase 3, a 150 mm diameter watermain was constructed at the current limits of Henry Court and a 150 mm diameter watermain stub was extended from the 200 mm diameter watermain which crosses the CN Railway lands and terminated within the limits of the existing municipal stormwater management facility (Stormwater Quality Facility No. 2). A 200 mm diameter watermain was also terminated at the intersection of Cedarvale Avenue and Cityview Drive as part of these works.

The extension of the existing 150 mm diameter watermain on Henry Court will provide water service to the residential lots fronting on to Henry Court.

The extension of the 200 mm diameter watermain southerly on Cityview Drive from the intersection of Cedarvale Avenue and Cityview Drive will provide water supply to the residential lots fronting onto Cityview Drive and the remainder of the Cityview Ridge Subdivision. A proposed 150 mm diameter watermain will be extended along Streets 2 and 3, while Street 1 will have a 200 mm diameter watermain which will connect to the proposed 200 mm diameter on Cityview Drive and ultimately form a form a loop connection with the Draft Plan approved lands to the north. The proposed 150 mm diameter watermain on Street No. 2 will also connect to the Draft Plan approved lands to the north.

Water supply for the cluster townhome units, Block 108, will be provided to property line via the extension of a 150mm diameter connection to the proposed watermain in the adjacent rights-of-way. A 50 mm diameter water service will be provided to the proposed park, Block 109. The water service size for the proposed park is to be confirmed with City Parks during the detail design stage. A 25 mm diameter water service lateral will be provided for each dwelling in the proposed development.

Fire hydrants are proposed to be placed at a minimum distance of 150 m measured along the centerline of the roadway to provide fire protection in accordance with City of Guelph standards.

Preliminary domestic water demands for the proposed development are calculated in Table 1 below.

Table No. 1: Preliminary Domestic Water Demand Requirements

Unit Type	Population	Average Day (390 Lpcd)	Max Day (Factor = 1.34)
76 Single Family Lots (at 3.25 persons/lot)	247	1.11 L/s	1.49 L/s
54 Semi-Detached Units (at 3.25 persons/lot)	176	0.79 L/s	1.06 L/s
20 On-Street Townhome Units (at 2.44 persons per lot)	48	0.22 L/s	0.29 L/s
84 Cluster Townhouse Units – Block 108 (at 2.44 persons per unit)	205	0.93 L/s	1.24 L/s
Total On-site Domestic Demands	**676**	**3.05 L/s**	**4.09 L/s**

Note: Population has been rounded up to the nearest whole number.

The proposed water distribution system is shown on the Preliminary Water Distribution Plan prepared by GM BluePlan Engineering Limited.

4.4 Sanitary Sewer

As part of the municipal servicing of the Valleyhaven Subdivision Phase 3, a 200 mm diameter sanitary sewer was terminated at the current limits of Henry Court and a 200 mm diameter sanitary sewer stub was extended across the CN Railway lands and terminated within the limits of the existing municipal stormwater management facility (Stormwater Quality Facility No. 2).

The extension of the existing 200 mm diameter sanitary sewer on Henry Court will provide sanitary service to the residential lots fronting on to Henry Court.

Sanitary service for the lots fronting on to Cityview Drive and the remainder of the Cityview Ridge Subdivision (east of Cityview Drive) will be provided by the extension of a 200 mm diameter sanitary sewer from the existing 200 mm diameter sanitary sewer stub located in the existing municipal stormwater management facility block. The alignment of the proposed sanitary sewer extension through the stormwater management block has been updated for ease of future access, inspection and maintenance.

Sanitary service for Block 108 will be provided to property line via a connection to the proposed sanitary sewer in the adjacent rights-of-way. A 100 mm diameter sanitary service lateral will be provided for each dwelling in the proposed development.

The proposed sanitary sewer system is shown on the Preliminary Servicing Plans prepared by GM BluePlan Engineering Limited.

4.5 Storm Sewer

All storm sewers within the Cityview Ridge Subdivision will be sized to accommodate the 5-year design storm event.

The storm sewers on Henry Court will discharge to existing municipal storm sewers, ultimately discharging to the existing municipal stormwater management facility (Stormwater Quality Facility No. 2) constructed as part of the Valleyhaven Subdivision Phase 3. Storm sewers on the northerly reach of Street No. 2, and the westerly reach of Street No. 1 and Cityview Drive will outlet to a proposed stormwater conveyance channel and forebay, ultimately discharging to the existing Stormwater Quality Facility No. 2. The existing Stormwater Quality Facility No. 2 was designed, approved and constructed to accommodate drainage from the western 11.1-ha of the Cityview Ridge Subdivision, Draft Plan approved lands to the north and existing Valleyhaven Subdivision Phase 3. The storm sewers along the remainder of Street No. 1 and the easterly portion of Street No. 3 will outlet to the proposed stormwater management facility on-site.

Major storm runoff generated from the extension of Henry Court will be conveyed via the existing municipal right-of-way, ultimately discharging to the existing Stormwater Quality Facility No. 2. Major storm runoff from Cityview Drive and the western portion of the site will be conveyed through the street rights-of-way to the proposed stormwater conveyance channel and forebay, ultimately discharging to the existing Stormwater Quality Facility No. 2. Major storm runoff from the remainder of the development will be conveyed through the municipal rights-of-way to the proposed stormwater management facility.

Foundation drainage will be provided by sump pumps discharging to the grassed areas at the rear yard of the proposed buildings to promote natural infiltration and groundwater recharge. The proposed locations will have sufficient grading to keep discharge away from foundations and convey runoff to lot swales.

The proposed storm sewer system is shown on the Preliminary Servicing Plans prepared by GM BluePlan Engineering Limited.

4.6 Clean Water Collector

A clean water collector (CWC) system is proposed to be extended along Street Numbers 1 and 3 within the proposed subdivision to collect "clean" drainage from proposed building rooftops and direct it to the proposed infiltration galleries on site. The clean water collector system will be installed at minimum depths of 1.5 m so that the clean water collector pipes will not interfere with the proposed storm and sanitary sewer pipes at crossing locations.

A 150 mm diameter clean water collector service lead will be installed to service each dwelling on Streets 1 and 3. The clean water collector system will include a bypass or emergency overflow pipe to the storm sewer system, in the event that the proposed infiltration gallery is full to ensure that runoff is directed to the stormwater management facilities.

The proposed clean water collector system is shown on the Preliminary Servicing Plans prepared by GM BluePlan Engineering Limited.

4.7 Salt Management Plan

As per the requirements of the City of Guelph, the following Salt Management Plan has been developed for the Cityview Ridge Subdivision. This plan has been developed using the Curb The Salt and Smart About Salt Program, as these are well respected programs and guidelines for reducing salt usage and minimizing the concentration of salt in infiltration and runoff. A two-stage salt management plan is recommended as per the Curb The Salt and Smart About Salt Program. Stage I of the salt management plan will address the ploughing of snow and the application of salt/sand within the limits of the rights-of-way by municipal forces. Stage II of the salt management plan will include snow removal and placing of salt on private property by the homeowner.

The recommended best management practices for the removal of snow and application of salt/sand within the limits of the municipal rights-of-way (Stage I) include the following:

- Ploughing of snow as required following snowfall events or as directed by the municipality to ensure safe passage for motorists.
- Application of salt/sand immediately following ploughing if required or as directed by the municipality. The application of salt/sand is not mandatory after each snow clearing operation.
- Monitor and document the application of salt/sand on municipal rights-of-way (i.e. frequency, concentration, etc.).
- Storage of all ploughed snow in an area appropriately designated for snow storage to minimize the impact of salt/sand on environmental features and to ensure that surface drainage is maintained. As part of the detailed engineering design, an appropriate snow storage area will be confirmed with the City.

Stage II of the salt management plan, which includes the removal and stockpiling of snow and application of salt/sand on private property, the recommended best management practices are as follows:

- Ploughing or shovelling snow on driveways and sidewalks immediately following a snowfall event to ensure the safe passage of motorists and pedestrians.
- Application of salt/sand immediately following ploughing or shovelling only as required (sand is recommended). The application of salt/sand is not mandatory after each snow clearing operation.
- Storage of all ploughed or shovelled snow in the front yards and boulevard areas (i.e. grassed areas) to a height which will not block the view of motorists and pedestrians and will not impede surface drainage.

As part of the two stage Salt Management Plan, an annual review of the plan shall be conducted by the Owner as a way to incorporate some adaptive strategies for continual improvement and reduction of salt concentrations in runoff and infiltration.

4.8 Water Budget

Based on the Canadian Climate Normals for the Guelph Arboretum from 1971-2000 and discussions with Banks Groundwater Engineering Limited, the average annual precipitation, for the area in which the site is located is estimated to be 924.9 mm. The potential for evapotranspiration for this area is estimated to be 555 mm for the drumlin and 495 mm for the low-lying easterly portion of the site. Therefore, 370 mm is available for infiltration and runoff from the drumlin and 430 mm remains available for infiltration and runoff from the low-lying areas.

From the Geotechnical Investigation (Naylor Engineering Associated Limited, February 2012), the surficial deposits across the majority of the site are described as silt tills, with sand and gravel across the low-lying easterly portion of the site. A copy of the Geotechnical Investigation has been included in **Appendix A**. Typically, infiltration and runoff rates in areas mapped as tills are estimated to be 180 mm and 190 mm, respectively. For the low-lying easterly portion of the site, the average infiltration and runoff were estimated to be 380 mm and 50 mm, respectively. A copy of the Hydrogeological Investigation prepared by Banks Groundwater Engineering Limited has been included in **Appendix E**.

Therefore, based on the annual infiltration rates, as shown on the Monthly Water Balance calculations attached in **Appendix F**, the existing annual average groundwater recharge occurring within the 18.28-hectare site is estimated to be 38,076 m^3. Under post-development conditions, the annual natural groundwater recharge occurring on-site is estimated to be 25,602 m^3 prior to the addition of the enhanced infiltration system.

Under existing conditions, the annual average runoff from the site is estimated to be 31,596 m^3. As a result of the proposed development the impervious area (rooftop and paved surfaces) of the site increases which causes an increase in runoff volume to 68,697 m^3 per year prior to the addition of the enhanced infiltration system.

Enhanced infiltration has been proposed to reduce the difference between existing and post-development condition infiltration volumes. The enhanced infiltration system will consist of a clean water collector system proposed to collect clean rooftop runoff from the single family, semi-detached and townhome units as well as collect clean runoff from the park block. The clean water collector system will discharge to two infiltration galleries located within public areas of the site (the first infiltration gallery is located in the stormwater management block and the second is located south of Street 1 in the multi-use trail area). The enhanced infiltration calculations assume that only the front half of the roof area from a townhome block can be captured in the clean water collector system as there is limited space to bring in piping to the back of the units. For the single and semi-detached lots, the clean water collector system will collect the entire roof area. A table has been included in **Appendix F** which calculates the roof area of the lots captured by the clean water collection system.

The Guelph Permeameter infiltration testing results discussed in previous sections of this report have been used in the calculations to determine the drawdown time for the enhanced infiltration structures.

Infiltration Gallery 1 located in the stormwater management block is proposed to have a bottom of gallery elevation of 341.14 m. The seasonal high groundwater elevation reading at this location is 339.00 m. Therefore a separation of 2.14m is achieved from the seasonal high groundwater elevation to the bottom of the infiltration gallery. Infiltration Gallery 1 will provide up to 9,182 m^3 per year of enhanced recharge volume.

Infiltration Gallery 2 located south of Street 1 is proposed to have a bottom of gallery elevation of 329.50 m. Seasonal high groundwater level readings are not available at this location as the proposed infiltration gallery is located west of the monitoring well / borehole locations, however, the seasonal high groundwater reading patterns from BH 102 will be used as this is the closest borehole. It is noted that during drier parts of the year, the groundwater elevation readings are approximately 2.5m below existing ground elevation, while during the spring melts, the groundwater level readings are close to ground surface. It is assumed that the seasonal high groundwater levels at the location of Infiltration Gallery 2 will behave in a similar manner to the recorded levels at BH 102, although this would form a conservative assumption as the existing topography drops significantly south of the gallery location towards the CN Railway (8-10m change in elevation).

A sensitivity analysis has been calculated for Infiltration Gallery 2 to determine the enhanced recharge potential and provide a range of yearly recharge volumes that could occur depending on the seasonal high groundwater levels. Assuming that it is a drier year where the gallery's performance will not be impacted by the seasonal high groundwater levels, Infiltration Gallery 2 has a potential to infiltrate up to 4,211 m^3 of runoff yearly. If the spring melts result in higher seasonal high groundwater levels, the infiltration gallery has a potential to infiltrate approximately 1,709 m^3 per year. This assumes that there will be no infiltration occurring during the months of March to July, although this is somewhat conservative as there could be periods during this time where the gallery would infiltrate and contribute to the yearly recharge volumes. A third scenario was considered in the water balance calculations by removing Infiltration Gallery 2 completely to determine the impact on the site's ability to meet the water balance objectives.

The summary of the yearly post-development recharge volumes using the above noted assumptions as well as comparison to existing conditions recharge and runoff volumes are summarized in Table 2 below.

Table No. 2: Summary of Recharge and Runoff Volume

	Total Estimated Recharge	Total Estimated Runoff
Existing Conditions	38,076 m^3	31,596 m^3
Post-Development Conditions with Infiltration Gallery 2 – Assuming Dry Year	38,996 m^3	55,304 m^3
Change from Existing Conditions	2%	75%
Post-Development Conditions with Infiltration Gallery 2 – No Infiltration During Spring Melt (March to July)	36,493 m^3	57,806 m^3
Change from Existing Conditions	-4%	83%
Post-Development Conditions Without Infiltration Gallery 2	34,785 m^3	59,515 m^3
Change from Existing Conditions	-9%	88%

Infiltration Gallery 1 is included in all of the above scenarios.

The summary above indicates that with the construction of the Infiltration Galleries 1 and 2, the proposed development conditions can meet the water balance objectives for the site. Though discussions with Banks Groundwater Engineering Limited, it is noted that post-development recharge rates within 10% of existing conditions is considered suitable for drumlin soils. For years experiencing a drier spring, the post-development yearly recharge volumes can exceed the existing conditions recharge volumes by 2%. For years experiencing a wet spring with higher seasonal high groundwater levels, the post-development recharge volumes can be approximately 4% less than existing conditions. If Infiltration Gallery 2 is removed completely from the calculations, then the post-development yearly recharge volumes are approximately 9% lower than existing conditions recharge volumes.

Therefore the infiltration targets for the site are being achieved through the implementation of Infiltration Galleries 1 and 2.

The water balance analysis also considered other alternative locations for infiltrating runoff based on discussions with City staff in October 2022. These alternatives include the following:

- Placing an infiltration gallery within the park block to infiltrate runoff from the park lands,
- Private infiltration galleries located in the rear yard areas of the proposed lots,
- Infiltration gallery buried within the Cityview Drive right-of way (travelled portion of the road).

Based on subsequent discussions with City Staff in January 2023, it was advised upon that the above noted infiltration locations will not be supported at this time.

5. STORMWATER MANAGEMENT PLAN

In line with current practices and guidelines, the stormwater management plan for the Cityview Ridge Subdivision is a "treatment train" to attenuate post-development flows and to remove sediments prior to discharge to both Clythe Creek and Hadati Creek. Enhanced (80% total suspended solids removal) water quality control will be provided by the stormwater management system. Post-development runoff generated from the site will be attenuated to the existing conditions levels. The "treatment train" will include a combination of lot level, conveyance and end-of-pipe best management practices.

Lot level controls will consist of capturing "clean" rooftop runoff in a clean water collector system and discharging it to the proposed infiltration galleries.

Conveyance controls will include the use a stormwater conveyance channel, oil/grit separator structures, a cooling trench for thermal mitigation and proposed linear dispersion trench to provide quality control treatment for the site, prior to discharge to the stormwater management facilities then Clythe Creek and Hadati Creek.

End-of-pipe controls will be provided by existing stormwater management facilities constructed as part of the Valleyhaven Subdivision Phase 3 (Stormwater Quality Facility No. 2 and Stormwater Quantity Control Facility) and a proposed stormwater management facility on-site prior to discharge to both Clythe Creek and Hadati Creek.

As part of the overall stormwater management analysis and design for the Valleyhaven Subdivision Phase 3, a stormwater management system consisting of both quality and quantity control facilities was designed, approved and constructed along Hadati Creek upstream of the CN Railway Tracks.

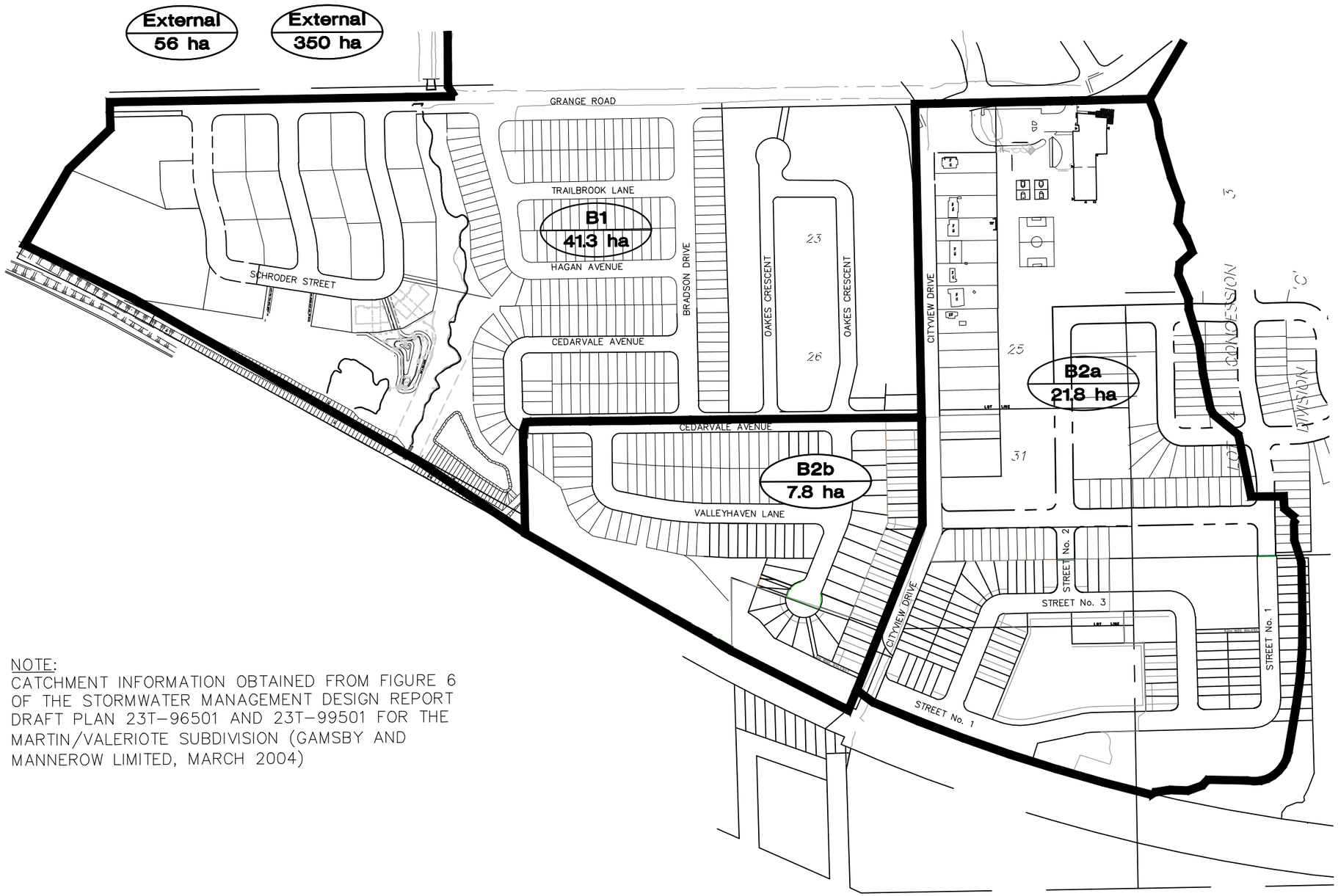
The existing Stormwater Quality Facility No. 2 was designed to provide Basic (60% total suspended solid removal, formerly Level 3) quality control treatment for a maximum drainage area of 29.6-hectares based on a maximum imperviousness coverage of 42%. The 29.6-hectare drainage area is described as Catchments B2a (21.8 ha) and B2b (7.8 ha) in the Stormwater Management Design Report Draft Plan 23T-96501 and 23T-99501 for the Martini/Valeriote Subdivision (Gamsby and Mannerow Limited, March 2004), which was used to design and approve the existing Stormwater Quality Facility No. 2. **Figure 3** illustrates the original drainage catchments from the Martini/Valeriote Subdivision.

The existing Stormwater Quantity Control Facility, consisting of a detention pond located on-line with Hadati Creek, a quantity control berm and an outlet structure connected to the existing CN culvert, was designed to attenuate flows from the study area (Stormwater Quality Facility No. 2 discharge) and external drainage areas to the rates recommended in the Eastview Secondary Plan.

To provide quality and quantity control for the runoff generated from the Cityview Ridge Subdivision, while also maintaining the existing drainage patterns discharging to both Hadati Creek and Clythe Creek, runoff generated from the westerly portion of the development (approximately 6.95-hectares), which includes Henry Court and Cityview Drive, will be directed to the existing stormwater management Quality Facility No. 2 constructed as part of the Valleyhaven Subdivision Phase 3 and ultimately to the existing stormwater quantity control facility.

Runoff generated from the central portion of the Cityview Ridge Subdivision will be directed to the proposed stormwater management facility on-site. To minimize the impact of development on the adjacent lands, the stormwater management system has been designed to provide enhanced water quality treatment and to attenuate the post-development peak flows to the pre-development levels. In addition, the proposed stormwater management facility will discharge to a cooling trench for thermal mitigation followed by which flows will outlet to the proposed linear energy dissipation and dispersion trench which will spread the flow over a large broad surface, ultimately sheetflowing overland towards Clythe Creek.

PRELIMINARY SERVICING AND STORMWATER MANAGEMENT REPORT
CITYVIEW RIDGE SUBDIVISION
CITY OF GUELPH



LEGEND

CATCHMENT BOUNDARY

B2a
21.8 ha
CATCHMENT
DRAINAGE AREA

N.T.S.
REVISED: MARCH 2023

NOTE:
CATCHMENT INFORMATION OBTAINED FROM FIGURE 6 OF THE STORMWATER MANAGEMENT DESIGN REPORT DRAFT PLAN 23T-96501 AND 23T-99501 FOR THE MARTIN/VALERIOTE SUBDIVISION (GAMSBY AND MANNEROW LIMITED, MARCH 2004)

EXISTING STORMWATER QUALITY FACILITY No. 2 DRAINAGE AREAS
Figure No. 3

BluePlan ENGINEERING

Plotted On: March 20, 2023 105172-FIG3.dwg

5.1 Stormwater Management Criteria

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

- Stormwater Management Planning and Design Manual, 2003
- Design Principles for Stormwater Management Facilities, 1996
- Eastview Secondary Plan and Addendum, 1991 and 1992
- Low Impact Development Stormwater Management Planning and Design Guide, 2010
- The Interim Stormwater Quality Control Guidelines, 1991
- The Stormwater Quality Best Management Practices Manual, 1991
- The MTO Drainage Management Technical Guidelines, 1989
- The Ontario Urban Design Guidelines, 1987

The stormwater management criteria for the proposed Cityview Ridge Subdivision, are as follows:

1. Provide Enhanced level of quality control (80% Total Suspended Solids (TSS) removal) from all runoff discharging from the site.
2. For areas of the site that discharge to Clythe Creek, post-development peak flow rates for must be controlled to pre-development rates for the 2 to 100 year design storm events.
3. For the westerly portion of the site discharging to the existing Stormwater Quality Facility No. 2, post-development peak flow rates from the facility are not to exceed the approved discharge rates of the facility. The approved discharge rates of the existing Stormwater Quality Facility No. 2 are outlined in the Stormwater Management Design Report Draft Plan 23T-96501 and 23T-99501 for the Martini/Valeriote Subdivision (Gamsby and Mannerow Limited, March 2004).
4. Route the major storm overland to the stormwater management facilities via the proposed municipal rights-of-way to minimize flood damage to public and private lands.
5. Maintain pre-development recharge rates for the site.

The method used to evaluate and design the stormwater management plan was as follows:

The City of Guelph design parameters were used to generate the mass rainfall data required to model the 2, 5, 25 and 100-year design storm events. The Regional Storm has also been modelled. The Chicago parameters and the total depth of rainfall for each storm event are as follows:

Table No. 3: Chicago Rainfall Parameters

	2-Year	5-Year	25-Year	100-Year
a	743.0	1,593.0	3,158.0	4,688.0
b	6.0	11.0	15.0	17.0
c	0.799	0.879	0.936	0.962
r	0.400	0.400	0.400	0.400
Duration (min)	180	180	180	180
Rainfall Depth (mm)	34.26	47.24	68.09	87.26

The Horton Infiltration method was used in the post-development runoff calculations. The parameters used in the MIDUSS modelling are given in Table No. 4.

Table No. 4: Horton Infiltration Parameters

	Impervious Areas	Pervious Areas
Maximum Infiltration	0.0 mm/hr	75.0 mm/hr
Minimum Infiltration	0.0 mm/hr	12.5 mm/hr
Lag Constant	0.05 mm/hr	0.25 mm/hr
Depression Storage	1.5 mm	5.0 mm

5.2 Stormwater Management Design

As part of the stormwater management system, a "treatment train" to remove sediments and thereby any absorbed contaminants prior to discharging to Hadati Creek and Clythe Creek will be provided. The "treatment train" will include lot level, conveyance and end-of-pipe best management practices.

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.

5.2.1 Lot Level Controls

Stormwater management practices recommended for providing lot level controls on this site are as follows:

a) Roof Drainage to Clean Water Collector System

Rooftop runoff from Streets A and C will be captured in a clean water collector system which will discharge to the proposed infiltration galleries located in the stormwater management block and south of Street 1. The proposed infiltration galleries will be municipally owned facilities and will not be located on private lands. Infiltration of clean rooftop runoff will maintain the existing recharge volumes for the site. As rooftop runoff is considered "clean" water, pre-treatment for rooftop runoff will not be provided.

b) Rear Yard Swales

The grading of the lots will be to current City of Guelph 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 more infiltration on the lots and in the swales, it is recommended that the average depth of graded topsoil be 300 mm.

c) Foundation Drainage

Sump pumps from all lots will be directed to the grassed yard areas and rear yard swales for conveyance, extended flow travel time and some infiltration.

5.2.2 Conveyance Controls

The storm conveyance system for the development will consist of storm sewers, oil/grit separators and a stormwater conveyance channel. Conveyance controls will be achieved through the regular maintenance of the conveyance channel and storm sewers as part of the City's annual maintenance program. Maintenance requirements will include the annual cleanout of the manholes, catch basins and oil/grit separators to remove sediment, oil and debris deposited during rainfall events.

Two (2) oil/grit separators have been sized to treat runoff from the western portion of the subject site (Stormceptor EFO10) and Cityview Drive (Stormceptor EFO12) prior to discharging to the conveyance channel and existing Stormwater Quality Facility No. 2. The pre-treatment of stormwater runoff in conjunction with the quality treatment of the existing Stormwater Quality Facility No. 2 will achieve an Enhanced level of protection (80% total suspended solids removal) which will be discussed further in subsequent sections of this report.

The stormwater conveyance channel will have the capacity to convey flows for design storms up to and including the 100-year design storm and Regional storm events from both the Cityview Ridge Subdivision and the Draft Plan approved lands to the north. The channel will be constructed along the northern limits of the CN Railway lands, to provide a link between the Cityview Ridge Subdivision and the existing Stormwater Quality Facility No. 2 constructed as part of the Valleyhaven Subdivision Phase 3. Prior to discharging to the existing Stormwater Quality Facility No. 2, the flows from the channel will be routed through a forebay sized to provide the required settling and dispersion lengths per the Stormwater Management Planning and Design Manual, 2003.

5.2.3 Proposed Stormwater Management Facility Quality and Quantity Control

Runoff generated from the central portion of the Cityview Ridge Subdivision will be directed towards the proposed stormwater management facility for quantity and quality control prior to discharging to Clythe Creek.

The proposed stormwater management facility will attenuate post-development peak flow rates to existing condition peak flow rates prior to discharging to the cooling trench, linear energy dissipation and dispersion trench and ultimately Clythe Creek.

The proposed stormwater management facility has been designed to function as a wetland complete with 0.3 m deep permanent pool and 1.0 m deep forebay. A proposed outlet riser structure complete with a two-stage orifice will attenuate runoff prior to discharging to the cooling trench and linear energy dissipation and dispersion trench. The outlet structure consists of a 2,400 mm diameter perforated CSP riser wrapped in clear stone complete with a 95 mm diameter orifice controlling the extended detention volume generated by the 4-hour 25 mm design storm event and a 300 mm diameter orifice controlling the storm events in excess of the 4-hour 25 mm design storm event.

Quality control will be provided by a sediment forebay and the permanent pool of the Stormwater Management Facility. From Table 3.2 of the Stormwater Management Planning and Design Manual (2003), a wetland type facility designed for Enhanced treatment (80% total suspended solids removal) requires 113 m^3/ha of storage volume for a contributing drainage area that is approximately 63% impervious. Of the 113 m^3/ha required volume, 40 m^3/ha represents the extended detention storage volume, while the remaining 73 m^3/ha represents the permanent pool storage volume. Based on a contributing drainage area of 4.12 hectares and a requirement of 73 m^3/ha of permanent pool, the required permanent pool storage is 301 m^3.

The proposed stormwater management pond has been designed with a 0.3 metre deep permanent pool which provides a permanent pool volume of 489 m^3. The remaining required permanent pool volume (approximately 280 m^3) will be provided in the sediment forebay.

Extended detention volume is calculated based on the runoff volume generated by the 4-hour 25 mm design storm event. The outlet structure has been designed to provide a 25.1-hour drawdown time of the required extended detention volume, which corresponds to a release rate of 0.008 m^3/s.

From the design of the stormwater management pond, the storage volume of 524 m^3 generated by the 4-hour 25mm design storm event corresponds to a ponding depth of approximately 0.27 metres. The outlet structure has been designed with a 95 mm diameter orifice, which will control the extended detention volume to the required release rate.

5.2.4 Existing Stormwater Quality Facility No. 2 Quality Control

Runoff generated from the westerly portion of the Cityview Ridge Subdivision and upstream Draft Plan approved lands will be discharged to the existing Stormwater Quality Facility No. 2. The existing Stormwater Quality Facility No. 2 was designed to provide 60% total suspended solids removal (Basic protection) as detailed in the Stormwater Management Design Report Draft Plan 23T-96501 and 23T-99501 for the Martini/Valeriote Subdivision (Gamsby and Mannerow Limited, March 2004).

The volume provided in the existing Stormwater Quality Facility No. 2 was reviewed with the areas and percent impervious values from the post-development conditions to ensure that the volume provided meets the criteria specified in Table 3.2 of the Stormwater Planning and Design Manual, 2003.

Under post-development conditions, it is anticipated that the total drainage area to the existing Stormwater Quality Facility No. 2 will be 22.65 ha with 57% impervious cover. Calculations showing the total drainage area and impervious cover are included in **Appendix J**. The catchments draining to the existing Stormwater Quality Facility No. 2 are discussed in greater detail in the subsequent sections.

The existing Stormwater Quality Facility No. 2 has been designed to function as a dry pond. From the 2003 Stormwater Management Planning and Design Manual Table 3.2, a dry pond requires 157 m^3/ha of storage volume for a drainage area that is 57% impervious. The required storage volume for the 22.65 ha drainage area is 3,556 m^3. The storage volume of 6,756 m^3 provided in the existing facility, exceeds the minimum storage volume of 3,556 m^3 required to achieve 60% total suspended solid reduction. Therefore, the design of the existing Stormwater Quality Pond as detailed in the Stormwater Management Design Report Draft Plan 23T-96501 and 23T-99501 for the Martini/Valeriote Subdivision (Gamsby and Mannerow Limited, March 2004) meets the 60% total suspended solid reduction target under post-development conditions.

To achieve the required 80% total suspended solid removal (Enhanced protection), two oil/grit separators are proposed to be installed upstream of existing Stormwater Quality Facility No. 2 with the objective to provide a minimum of 50% total suspended solid removal using the Canadian ETV particle distribution.

Quality treatment from the westerly portion of the Cityview Ridge Subdivision will require a Stormceptor EFO10, providing 53% total suspended solid removal prior to discharging runoff to the proposed grassed channel and Stormwater Quality Facility No. 2.

Quality treatment for Cityview Drive will be provided by a Stormceptor EFO12, providing 50% total suspended solid removal prior to discharge to the proposed stormwater conveyance chancel, forebay and Stormwater Quality Facility No. 2.

In the calculations for the proposed Stormceptor EFO12, it is assumed that the Draft Plan approved lands upstream of Cityview Drive which contribute drainage to the existing Stormwater Quality Facility No. 2 will have an oil/grit separator installed upstream of the Cityview Drive storm sewer connection, sized to provide a minimum of 50% total suspended solid removal prior to discharging to Cityview Drive. The percent impervious for the drainage area of the Draft Plan approved lands upstream of Cityview Drive was taken as half of the total percentage impervious when sizing the EFO12 unit to reflect the upstream oil/grit separator structure. Additional details and drainage area breakdown are provided in **Appendix G**.

The treatment train approach consisting of the oil/grit separators removing the initial 50% of total suspended solids (heavier particles), followed by routing though the proposed stormwater conveyance channel and sediment forebay, which will provide further sediment removal then final treatment by the existing Stormwater Quality Facility No. 2 which is designed for 60% total suspended solid removal will achieve the overall target of 80% total suspended solid removal target for the site.

Oil/grit separator sizing reports are included in **Appendix G.**

5.2.5 Cooling Trench and Linear Energy Dissipation and Dispersion Trench

As part of the stormwater management design for the Cityview Ridge Subdivision, thermal mitigation and flow dispersion are required prior to discharging flows to the existing wetland and Clythe Creek. Following discharge from the proposed stormwater management facility, flows are directed to the proposed cooling trench and linear energy dissipation and dispersion trench. The proposed cooling trench has been designed to be buried approximately 2 m below the ground surface adjacent to the stormwater management facility to limit the effects of solar radiation on the trench and will function by displacing cooler water from the trench using hydraulic grade lines.

The cooling trench is proposed to be 15m long by 4m wide by 2m deep, complete with 19mm diameter clear stone wrapped in filter cloth. Runoff will enter the cooling trench through the proposed distribution piping running along the top of the trench structure and will percolate through the stone layer. Runoff will then be collected by the bottom row of perforated collector pipes and directed to the linear energy dissipation and dispersion trench.

The linear energy dissipation and dispersion trench has been designed to accept runoff from the cooling trench (outflow from the proposed stormwater management facility) and grassed areas from the rear yards of Lots 64 to 78. The linear energy dissipation and dispersion trench is 55 m long by 2.0 m wide by 1.0 m deep, consisting of 19 mm diameter clear stone and perforated storm sewer which will dissipate the energy from the runoff and disperse/spread the flows over the length of the trench. Runoff will then percolate through the clear stone layer, ultimately discharging out the top of the stone, sheetflowing along the entire length of the structure (55 m) towards the wetland and Clythe Creek. The intent of the linear energy dissipation and dispersion trench is to provide a wide area for runoff to be discharged, replicating existing conditions and avoiding a point source discharge.

Detailed calculations for the proposed cooling trench are provided in **Appendix H**.

During the detailed design stage of the Subdivision, additional measures will be investigated and considered to enhance the function of the stormwater management facility from a thermal mitigation perspective. These measures may include but are not limited to the provision of plantings within the stormwater management facility to shade the permanent pool, the planting of trees and shrubs to reduce the direct impact of solar radiation on the pond, outlet structure and linear energy dissipation and dispersion trench.

5.2.6 Pre-Development Stormwater Management Analysis

Under existing conditions, the site consists of one (1) existing building, a barn and a shed, with the remainder of the site being open space. For hydrologic modelling purposes, the site was modelled as three (3) catchments. These catchments, which include the Cityview Drive right-of-way, are shown on the Existing Conditions Drainage Area Plan, **Figure 4**.

Catchment 10 (7.02 hectares, 8% impervious) represents the westerly portion of the development including the existing buildings, Cityview Drive and open space area. Runoff generated from the westerly portion of Catchment 10 sheetflows overland in an east to west direction, ultimately discharging to the existing Stormwater Quality Facility No. 2 constructed as part of the Valleyhaven Subdivision Phase 3.

Catchment 20 (4.78 hectares, 0% impervious) represents the central portion of the site. Runoff generated from Catchment 20 currently discharges to the existing drainage swale, ultimately discharging to the existing wetland and Clythe Creek.

Catchment 30 (6.48 hectares, 0% impervious) represents the easterly portion of the site, which consists of the existing woodlot and wetland areas. Runoff generated from Catchment 30 currently sheetflows overland in the southeast direction, ultimately discharging to the low-lying area and Clythe Creek.

Table No. 5 summarizes the pre-development condition flow rates and runoff volumes from the site for the full range of design storm events.

PRELIMINARY SERVICING AND STORMWATER MANAGEMENT REPORT
CITYVIEW RIDGE SUBDIVISION
CITY OF GUELPH

CEDARVALE AVENUE

VALLEYHAVEN LANE

HENRY COURT

CITYVIEW DRIVE

EXISTING MUNICIPAL STORMWATER MANAGEMENT FACILITY

10
7.02 ha

20
4.78 ha

30
6.48 ha

RAILWAY

CLYTHE CREEK

WATSON PARKWAY

SCALE = 1:2500

REVISED: MARCH 2023

LEGEND

100
6.11 ha — CATCHMENT
DRAINAGE AREA

CATCHMENT BOUNDARY

EXISTING CONDITIONS DRAINAGE AREA

Figure No. 4

BluePlan ENGINEERING

Plotted On: March 15, 2023 105172-FIG4.dwg

Table No. 5: Pre-Development Condition Flow Rates and Runoff Volumes

	Catchments					
	10	**Total to Ex. Stormwater Quality Facility No.2**	20	30	**Total to Wetland and Clythe Creek**	**Total from Site**
2-Year						
Flow Rate (m^3/s)	0.130	**0.130**	0.052	0.070	**0.122**	**0.210**
Runoff Volume (m^3)	315.4	**315.4**	99.4	134.8	**234.2**	**549.6**
5-Year						
Flow Rate (m^3/s)	0.492	**0.492**	0.331	0.448	**0.779**	**1.270**
Runoff Volume (m^3)	967.1	**967.1**	529.0	717.1	**1,246.1**	**2,213.2**
25-Year						
Flow Rate (m^3/s)	1.334	**1.334**	0.899	1.218	**2.117**	**3.451**
Runoff Volume (m^3)	2,183.8	**2,183.8**	1,343.7	1,821.6	**3,165.3**	**5,349.2**
100-Year						
Flow Rate (m^3/s)	2.153	**2.153**	1.478	2.004	**3.482**	**5.635**
Runoff Volume (m^3)	3,390.3	**3,390.3**	2,158.0	2,925.4	**5,083.4**	**8,473.7**
Regional Storm						
Flow Rate (m^3/s)	0.587	**0.587**	0.397	0.538	**0.936**	**1.522**
Runoff Volume (m^3)	6,423.1	**6,423.1**	3,728.8	5,054.9	**8,783.7**	**15,206.8**

The pre-development peak flow rates to the wetland and Clythe Creek will form the allowable release rates for the site under post-development conditions for the proposed areas of the site draining to the wetland and Clythe Creek.

A copy of the MIDUSS model output is included in **Appendix I**.

Allowable Release Rates – Clythe Creek

The allowable release rates to the wetland and Clythe Creek must be equal to or less than the pre-development peak flow rates from the site. Table No. 6, below, summarizes the pre-development peak flow rates from the site to the wetland and Clythe Creek.

Table No. 6: Pre-Development (Allowable) release rates to Clythe Creek

	Pre-Development (Allowable) Release Rate
2-Year	0.122 m^3/s
5-Year	0.779 m^3/s
25-Year	2.117 m^3/s
100-Year	3.482 m^3/s
Regional Storm	0.936 m^3/s

Therefore, post-development flows generated by the site which discharge to the existing wetland, and ultimately Clythe Creek, will be attenuated to the allowable release rates summarized above.

Allowable Release Rates – Existing Stormwater Quality Facility No. 2

The existing stormwater management facility constructed as part of the Valleyhaven Subdivision Phase 3 (Stormwater Quality Facility No. 2) was designed, approved and constructed to accommodate stormwater runoff generated from a total contributing drainage area of 29.6-hectares (42% imperviousness). The objective of the proposed stormwater management design is to maintain the approved peak discharge rates from the existing facility.

The approved stage/storage/discharge rates of the existing Stormwater Quality Facility No. 2 from the Valleyhaven Subdivision Phase 3 as detailed in the Stormwater Management Design Report Draft Plan 23T-96501 and 23T-99501 for the Martini/Valeriote Subdivision (Gamsby and Mannerow Limited, March 2004) are summarized below in Table No. 7.

Table No. 7: Approved Stage/Storage Discharge from the Stormwater Quality Facility No. 2

	Available Capacities			Actual Capacity Used		
	Peak Flow m^3/s	Storage Volume m^3	Storage Elevation m	Peak Flow m^3/s	Storage Volume m^3	Storage Elevation m
Pond Bottom	0.000	0	321.50	---	---	---
25mm	---	---	---	0.26	867	321.70
5 Year	---	---	---	0.29	4,082	322.10
Overflow Weir	0.297	4,502	322.20	---	---	---
25 Year	---	---	---	2.22	5,439	322.35
100 Year	---	---	---	4.00	5,996	322.40
Regional	---	---	---	3.55	5,800	322.40
Top of Bank	7.566	6,755	322.50	---	---	---

As part of this report, the existing Stormwater Quality Facility No. 2 will be analyzed with updated drainage areas and percent imperviousness to reflect the existing developments that have occurred over the years, proposed Cityview Ridge Subdivision development and Draft Plan approved subdivision upstream of Cityview Drive to confirm that the peak discharge rates under post-development conditions are equal to or less than the approved peak discharge rates for the existing facility.

5.2.7 Post-Development Stormwater Management Analysis

Under post-development conditions, site drainage will be split to mimic pre-development drainage patterns. Runoff generated from the westerly portion of the development will be directed towards the existing stormwater management facility constructed as part of the Valleyhaven Subdivision Phase 3 (Stormwater Quality Facility No. 2). Runoff generated form the central portions of the development will be directed towards the proposed stormwater management facility on-site and eventually to the existing wetland and Clythe Creek.

Two (2) separate hydrological models were prepared to analyze the proposed development and drainage outlets to the Stormwater Quality Facility No. 2 and Clythe Creek.

Flows to Existing Stormwater Quality Facility No. 2

The Visual OTTHYMO model for the western portion of the subdivision has been adapted from the hydrological modelling created for the Valleyhaven Subdivision, Phase 3 as detailed in the Stormwater Management Design Report Draft Plan 23T-96501 and 23T-99501 for the Martini/Valeriote Subdivision (Gamsby and Mannerow Limited, March 2004). The analysis includes the watershed discharging to the southern reach of Hadati Creek, including the external areas, existing and future development areas (including the western portion of the Cityview Ridge Subdivision) and the lands downstream of the CN Railway. The stormwater management catchments for this model are shown on **Figure 5** and described below.

Catchment B2a (ID 600 – 9.73 hectares, 52% impervious) represents the Draft Plan Approved residential lands north of the Cityview Ridge Subdivision, existing Cityview Drive and a portion of runoff from the William C. Winegard Public School (formerly Lee Street Public School). The catchment areas and percent impervious have been calculated based on information obtained form the Cityview Estates Subdivision Stormwater Management Report prepared by Stantec in 2016 and Lee Street Public School Stormwater Management Report prepared by Gamsby and Mannerow Limited in 2013. Stormwater runoff generated from Catchment B2a discharges to the proposed stormwater conveyance channel and forebay located in the southwest corner of the Cityview Ridge Subdivision prior to outleting to the existing Stormwater Quality Facility No. 2.

Catchment B2b (ID 607 – 5.97 hectares, 51% impervious) represents the existing Valleyhaven Subdivision Phase 3. Stormwater runoff generated from Catchment B2b discharges to the existing Stormwater Quality Facility No. 2 via the existing storm sewer system constructed as part of the Valleyhaven Subdivision Phase 3.

Catchment B2c (ID 601 – 6.95 hectares, 70% impervious) represents the western portion of the Cityview Ridge Subdivision. Stormwater runoff generated from Catchment B2c discharges to the proposed stormwater conveyance channel and forebay located in the southwest corner of the Cityview Ridge Subdivision prior to outleting to the existing Stormwater Quality Facility No. 2.

A copy of the Visual OTTHYMO model output, model schematic and percent impervious calculations for the various site catchments is included in **Appendix J**.

PRELIMINARY SERVICING AND STORMWATER MANAGEMENT REPORT
CITYVIEW RIDGE SUBDIVISION
CITY OF GUELPH



LEGEND

CATCHMENT BOUNDARY

B2a
21.8 ha
CATCHMENT
DRAINAGE AREA

N.T.S.

REVISED: MARCH 2023

POST-DEVELOPMENT DRAINAGE AREAS WESTERN PORTION OF SUBDIVISION

Figure No. 5

BluePlan ENGINEERING

Plotted On: March 15, 2023 105172-FIG5.dwg

Table No. 8 lists the uncontrolled post-development peak flow rates and runoff volumes for the catchments draining to the existing Stormwater Quality Facility No. 2.

Table No. 8: Post-Development Uncontrolled Flow Rate to Existing Stormwater Quality Facility No. 2

	25mm Storm		5 Year Storm		25 Year Storm		100Year Storm		Regional Storm	
	Flow (m^3/s)	Volume (m^3)	Flow (m^3/s)	Volume (m^3)	Flow (m^3/s)	Volume (m^3)	Flow (m^3/s)	Volume (m^3)	Flow (m^3/s)	Volume (m^3)
Catchment B2a (ID 600)	0.546	931	1.149	2,661	1.852	4,126	2.599	5,298	1.253	13,884
Catchment B2b (ID 607)	0.341	559	0.706	1,620	1.254	2,519	1.609	3,235	0.768	8,444
Catchment B2c (ID 601)	0.588	986	1.023	2,421	1.597	3,527	2.014	4,463	0.943	11,572
Total	**1.525**	**2,476**	**2.784**	**6,702**	**4.597**	**10,172**	**6.136**	**12,996**	**2.963**	**33,900**

Table No. 9 below compares the routing results through the proposed stormwater conveyance channel located in the southwest corner of the Cityview Ridge Subdivision prior to discharging to the proposed forebay and existing Stormwater Quality Facility No. 2.

Table No. 9: Stormwater Conveyance Channel Stage/Velocity/Depth of Flow

	Available Capacity			**Actual Capacity**		
	Peak Flow (m^3/s)	Channel Velocity (m/s)	Depth of Flow (m)	Peak Flow (m^3/s)	Channel Velocity (m/s)	Depth of Flow (m)
Channel Bottom	0.000	0.000	0.000	---	---	---
25mm	---	---	---	1.18	1.73	0.30
5-Year	---	---	---	2.08	2.01	0.40
25-Year	---	---	---	3.34	2.26	0.49
100-Year	---	---	---	4.53	2.44	0.57
Regional Storm	---	---	---	2.20	2.03	0.41
Top of Bank	16.90	3.38	1.00	---	---	---

Therefore the flow rates and flow depths generated by the proposed development, existing Cityview Drive and Draft Plan approved lands to the north are within the proposed channel's capacity. A freeboard of 0.43m is provided under highest flow event which is generated by the 100-year design storm.

Table No. 10 below summarizes the post-development routing results through the existing Stormwater Quality Facility No. 2 based on the updated catchment information above.

Table No. 10: Post-Development Stage/Storage Discharge from the Stormwater Quality Facility No. 2

	Available Capacities			Actual Capacity Used		
	Peak Flow m^3/s	Storage Volume m^3	Storage Elevation m	Peak Flow m^3/s	Storage Volume m^3	Storage Elevation m
Pond Bottom	0.000	0	321.50	---	---	---
25mm	---	---	---	0.27	1,417	321.73
5 Year	---	---	---	0.29	3,841	322.10
Overflow Weir	0.297	4,502	322.20	---	---	---
25 Year	---	---	---	1.56	5,194	322.29
100 Year	---	---	---	3.31	5,874	322.39
Regional	---	---	---	2.95	5,624	322.36
Top of Bank	7.566	6,755	322.50	---	---	---

Table No. 11 below compares the approved discharge rates form the existing Stormwater Quality Facility No. 2 as detailed in the Stormwater Management Design Report Draft Plan 23T-96501 and 23T-99501 for the Martini/Valeriote Subdivision (Gamsby and Mannerow Limited, March 2004) against the post-development routing results.

Table No. 11: Comparison of Approved Peak Discharge Rates and Post-Development Peak Flows from Existing Stormwater Quality Facility No. 2

	Approved Peak Discharge Rates from the Stormwater Quality Facility No. 2	Post Development Peak Flow Rates from the Existing Stormwater Quality Facility No. 2
25mm	0.26 m^3/s	0.27 m^3/s
5-Year	0.29 m^3/s	0.29 m^3/s
25-Year	2.22 m^3/s	1.56 m^3/s
100-Year	4.00 m^3/s	3.31 m^3/s
Regional	3.55 m^3/s	2.95 m^3/s

Therefore, the post-development peak flow rates discharging from the existing stormwater management facility (Stormwater Quality Facility No. 2) are less than the approved release rates for the full range of design storm events with the exception of the 25 mm design storm event. Flows generated from the 25 mm design storm event are exceeded by 0.01 m^3/s or 3.8%. Given that this is an isolated occurrence under the 25 mm storm event and that flows in larger storm events are significantly lower than the approved discharge rates from the facility, it is our opinion that the existing Stormwater Quality Facility No. 2 will generally function per the approved design as detailed in the Stormwater Management Design Report Draft Plan 23T-96501 and 23T-99501 for the Martini/Valeriote Subdivision (Gamsby and Mannerow Limited, March 2004).

Flows to Clythe Creek

For the lands draining to Clythe Creek, a MIDUSS model has been created to analyze the proposed stormwater management facility and peak flows discharging to Clythe Creek under post-development conditions. The site was modelled as three (3) catchments. These catchments are shown on **Figure 6** and described below.

Catchment 201 (3.63 hectares, 63% impervious) represents the central portion of the proposed development. Runoff generated from Catchment 201 will be captured by the proposed storm sewer system on site and will discharge to the proposed stormwater management facility prior to outleting to the existing wetland and Clythe Creek. Quality treatment for Catchment 201 will be provided by the proposed stormwater management facility.

Catchment 202 (1.22 hectares, 20% impervious) represents the rear yards of Lots 64-78 (no rooftops) and the open space/trail areas located within the proposed stormwater management facility. Runoff generated from Catchment 202 will be directed to the linear energy dissipation and dispersion trench prior to discharge to Clythe Creek. Quality control treatment for runoff generated from Catchment 202 is not required as runoff generated by the grassed areas and trail is considered “clean” runoff.

Catchment 300 (6.48 hectares, 2% impervious) represents the easterly portion of the site, which consists of the existing woodlot and wetland areas. Runoff generated from Catchment 300 currently sheetflows overland in the southeast direction, ultimately discharging to the low lying area and Clythe Creek.

Catchment 400 (0.49 hectares, 50% impervious) represents the park area from the upstream Draft Plan approved development. Runoff generated from the park area will drain in the southerly direction towards the Cityview Ridge Subdivision and will be collected by the proposed clean water collector system to be infiltrated. To be conservative in the stormwater management analysis, this catchment was assumed to be draining directly to the stormwater management facility as a bypass will be included to the stormwater management facility once the infiltration gallery fills up.

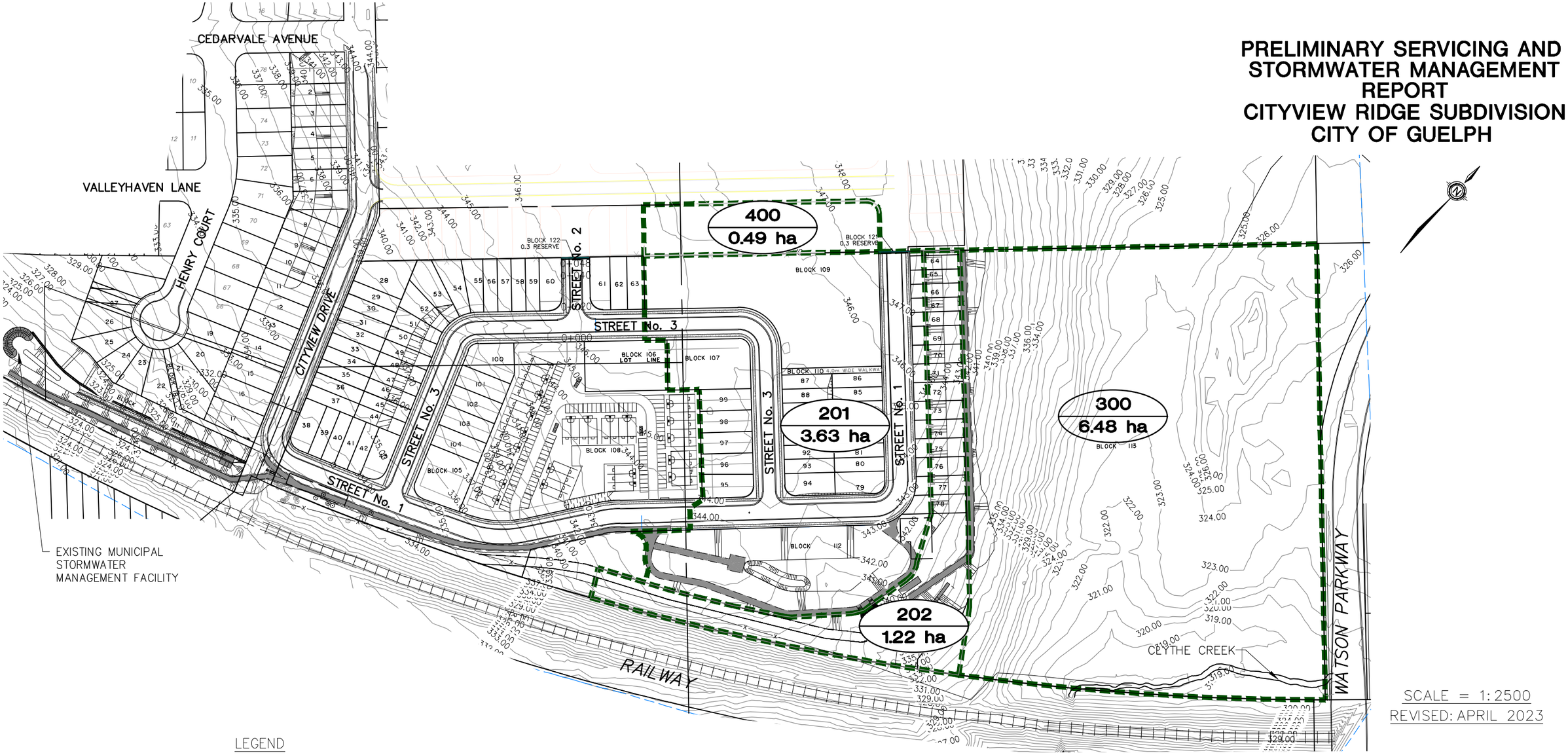
A copy of the MIDUSS model output and associated calculation files is included in **Appendix J.**

Table No. 12 below lists the uncontrolled post-development peak flow rates and runoff volumes from the site draining to Clythe Creek.

Table No. 12: Post-Development Uncontrolled Flows to Clythe Creek

	2 Year Storm		5 Year Storm		25 Year Storm		100Year Storm		Regional Storm	
	Flow (m^3/s)	Volume (m^3)	Flow (m^3/s)	Volume (m^3)	Flow (m^3/s)	Volume (m^3)	Flow (m^3/s)	Volume (m^3)	Flow (m^3/s)	Volume (m^3)
Catchment 201	0.510	766	0.712	1,173	1.055	1,875	1.399	2,537	0.383	6,710
Catchment 202	0.063	99	0.140	217	0.350	431	0.504	641	0.116	1,316
Catchment 300	0.073	174	0.450	761	1.221	1,870	2.000	2,976	0.539	5,273
Catchment 400	0.058	84	0.081	138	0.133	230	0.189	318	0.050	793
Total	**0.704**	**1,123**	**1.383**	**2,289**	**2.759**	**4,406**	**4.092**	**6,472**	**1.088**	**14,092**

PRELIMINARY SERVICING AND STORMWATER MANAGEMENT REPORT
CITYVIEW RIDGE SUBDIVISION
CITY OF GUELPH



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REVISED: APRIL 2023

LEGEND

100 / 6.11 ha — CATCHMENT / DRAINAGE AREA

CATCHMENT BOUNDARY

POST-DEVELOPMENT DRAINAGE AREAS EASTERN PORTION OF SUBDIVISION

Figure No. 6

BluePlan ENGINEERING

Plotted On: April 28, 2023 105172-FIG6.dwg

Table Nos. 13 and 14 compare the post-development routing results through the proposed stormwater management facility and linear energy dissipation and dispersion trench with the available stage/storage discharge capacities, respectively.

Table No. 13: Proposed Stormwater Management Facility Available Stage/Storage/Discharge

Control	Available Capacity			Actual Capacity Used		
	Peak Flow m^3/s	Storage Volume m^3	Storage Elevation m	Peak Flow m^3/s	Storage Volume m^3	Storage Elevation m
Bottom of Pond	0	0	339.65	--	--	--
25 mm Storm	--	--	--	0.008	524	339.92
Orifice No 2	0.009	598	339.95	--	--	--
2 Year Storm	--	--	--	0.022	726	340.01
5 Year Storm	--	--	--	0.055	1,060	340.15
25 Year Storm	--	--	--	0.114	1,655	340.38
100 Year Storm	--	--	--	0.149	2,260	340.59
Regional Storm	--	--	--	0.180	3,047	340.83
Weir	0.194	3,464	340.95	--	--	--
Top of Pond	5.410	5,486	341.45	--	--	--

Table No. 14: Linear Energy Dissipation and Dispersion trench Available Stage/Storage/Discharge

	Available Capacity			Actual Capacity		
	Peak Flow (m^3/s)	Storage Volume (m^3)	Stage (m)	Peak Flow (m^3/s)	Storage Volume (m^3)	Stage (m)
Bottom of Stone	0.000	0	0.000	---	---	---
Top of Stone / Overflow	0.000	45	1.000	---	---	---
25mm Storm	---	---	---	0.018	45	1.003
2-Year Storm	---	---	---	0.054	46	1.007
5-Year Storm	---	---	---	0.154	46	1.013
25-Year Storm	---	---	---	0.388	46	1.022
100-Year Storm	---	---	---	0.575	46	1.029
Regional Storm	---	---	---	0.263	46	1.017

As illustrated in Table No. 14, above, the linear energy dissipation and dispersion trench will help spread the flows discharging from the proposed stormwater management facility over a wide area, reducing flow depth and avoiding a point source discharge. The depth of flow from the 55 m wide linear energy dissipation and dispersion trench will range from 3 mm (0.003 m) under the 25 mm storm event to 29 mm (0.029 m) under the Regional Storm event.

Table Nos. 15 to 17 compare the pre and post-development condition peak flow rate, velocity and flow depth, respectively, over the existing slope located at the southeast portion of the site (upstream of the existing wetland and Clythe Creek).

Table No. 15: Comparison of Pre and Post-Development Condition Peak Flow Rates Discharging Over the Existing Slope

Design Storm	Peak Flow (m^3/s)		
	Pre Development	Post Development	Difference
2-Year	0.052	0.054	0.002
5-Year	0.331	0.154	-0.177
25-Year	0.899	0.388	-0.511
100-Year	1.478	0.575	-0.903
Regional	0.397	0.263	-0.134

As illustrated in Table No. 15, above, during the larger storm events, the peak flow rate discharging over the existing slope has been reduced. There is a slight increase in peak flow rate during the 2-year design storm event, however this is considered negligible as the peak flows during the 5 to 100 year-design storm events and Regional storm have been significantly reduced.

Table No. 16: Comparison of Pre and Post-Development Condition Flow Velocity Discharging Over the Existing Slope

Design Storm	Flow Velocity (m/s)		
	Pre Development	Post Development	Difference
2-Year	0.147	0.193	0.046
5-Year	0.308	0.294	-0.014
25-Year	0.459	0.425	-0.034
100-Year	0.560	0.497	-0.063
Regional	0.331	0.364	0.033

As illustrated in Table No. 16, above, during the larger storm events, with the exception of the Regional storm, the flow velocities discharging over the existing slope has been reduced. There is a slight increase in velocity during the 2-year design storm and Regional storm event, however, this is considered negligible as the velocities during the 5 to 100 year-design storm events are reduced. In addition, post-development flow velocities are reduced to under 0.5m/s under the full range of design storms.

Table No. 17: Comparison of Pre and Post-Development Condition Flow Depth Discharging Over the Existing Slope

Design Storm	Flow Depth (m)		
	Pre Development	Post Development	Difference
2-Year	0.003	0.005	0.002
5-Year	0.010	0.010	0.000
25-Year	0.019	0.017	-0.002
100-Year	0.025	0.021	-0.004
Regional	0.011	0.013	0.002

As illustrated in Table No. 17, above, during the larger storm events, the flow depth discharging over the existing slope has been reduced. There is a slight increase (2 mm) in flow depth during the 2-year design storm event, however this is considered negligible as the flow depths during the larger storm events have been reduced. The Regional storm event also shows an increase of 2 mm in flow depth, however, due to the low frequency of the Regional storm event, the 2 mm increase in flow depth is considered negligible.

Table No. 18 compares the pre-development (allowable) release rates to the post-development peak flow rates discharging to the existing wetland and ultimately to Clythe Creek.

Table No. 18: Comparison of Pre and Post-Development Condition Peak Flow Rates Discharging to Clythe Creek

	Pre-Development Peak Flow Rates to Clythe Creek	Post-Development Peak Flow Rates Clythe Creek
2-Year	0.122 m^3/s	0.103 m^3/s
5-Year	0.779 m^3/s	0.584 m^3/s
25-Year	2.117 m^3/s	1.572 m^3/s
100-Year	3.482 m^3/s	2.520 m^3/s
Regional Storm	0.936 m^3/s	0.802 m^3/s

Therefore, the post-development peak flow rates discharging to the existing wetland, and ultimately Clythe Creek, have been attenuated to less than the pre-development (allowable) release rates, for the full range of design storm events.

5.2.8 Sediment Forebay Design

Existing Stormwater Quality Facility No. 2

The existing Stormwater Quality Facility No.2 will be outfitted with a proposed sediment forebay located at the proposed stormwater conveyance channel outlet location. The sediment forebay is 1.0 m deep and has been designed per the Ministry of Environment Stormwater Management Planning and Design Manual guidelines. The full sediment forebay sizing information has been included in **Appendix J**.

Table No. 19 summarizes the required and provided parameters within the sediment forebay design.

Table No. 19: Sediment Forebay Design Details

Required	**Dispersion Length (m)**	44.5
	Settling Length (m)	51.8
	Flow Velocity (m/s)	0.15
	Length to Width Ratio	2:1
	Settling Velocity (m/s)	0.0003
Provided	**Forebay Length (m)**	60
	Flow Velocity (m/s)	0.15
	Length to Width Ratio	3:1

Therefore, the sediment forebay has been designed to provide the required dispersion and flow lengths.

Sediment Loading and Cleanout Frequency

Table No. 20 illustrates sediment loading to the oil/grit separator systems and sediment forebay as well as the subsequent cleanout frequency required to maintain these systems. The oil/grit separator structures are designed to filter out large sediments before reaching the stormwater management facility. The oil/grit separators are proposed to be flushed out and cleaned on a yearly basis.

Table No. 20: Sediment Loading and Cleanout Frequency – Sediment Forebay and Oil Grit Separators

Catchment Area	Imp. (%)	Annual Sediment Loading	TSS Removal	Annual TSS Reduction	Remaining Annual Sediment Load	Cleanout Frequency
4.33 ha to Stormceptor EF010	70%	12.1 m^3 (based on 2.8 m^3/ha)	53%	6.4 m^3 (oil/grit separator sump to be designed to accommodate annual TSS reduction volume)	5.6 m^3	1 year
11.37 ha to Stormceptor EF012	38%*	9.1 m^3 (based on 0.8 m^3/ha)	50%	4.6 m^3 (oil/grit separator sump to be designed to accommodate annual TSS reduction volume)	4.6 m^3	1 year
Proposed Forebay		10.2 m^3	60%	6.1 m^3	4.1 m^3	~32.8 years Based on ~200 m^3 of sediment (~1/3 of forebay)

Sediment loadings obtained from Table 6.3 of the MOE Stormwater Management Planning and Design Manual, 2003 and prorated based on catchment percent impervious.

**It is assumed that upstream quality control treatment to a minimum 50% total suspended solid removal will be provided in the development of the Draft Plan approved lands located in Catchment B2a, upstream of Cityview Drive. As such, a reduction in percentage impervious has been applied to reflect the upstream quality controls. See Oil/Grit Separator Drainage Area calculations in Appendix G for additional information.*

Therefore, it is estimated that the sediment forebay will require a cleanout in approximately 32.8 years.

The above sediment loading calculations illustrate that the proposed treatment train approach of implementing oil/grit separators upstream of the existing Stormwater Quality Facility No. 2, along with the proposed sediment forebay will help remove a total of 17.1 m^3 of sediment from the annual sediment loading of 21.2m^3, therefore providing the required 80% total suspended solid reduction to achieve and Enhanced level of quality control.

Proposed Stormwater Management Facility

The proposed stormwater management facility has been designed with one sediment forebay located at the pond inlet. The sediment forebay is 1.0 m deep and has been designed per the Ministry of Environment Stormwater Management Planning and Design Manual guidelines. The full sediment forebay sizing information has been included in **Appendix J**.

Table No. 21 summarizes the required and provided parameters within the sediment forebay design.

Table No. 21: Sediment Forebay Design Details

Required	**Dispersion Length (m)**	12.7
	Settling Length (m)	10.3
	Flow Velocity (m/s)	0.15
	Length to Width Ratio	2:1
	Settling Velocity (m/s)	0.0003
Provided	**Forebay Length (m)**	40
	Flow Velocity (m/s)	0.08
	Length to Width Ratio	4:1

Therefore, the sediment forebay has been designed to provide the required dispersion and flow lengths.

Sediment Loading and Cleanout Frequency

Table No. 22 illustrates sediment loading to the sediment forebay as well as the subsequent cleanout frequency required to maintain this system.

Table No. 22: Sediment Loading and Cleanout Frequency – Sediment Forebays

Catchment Area	Imp. (%)	Annual Sediment Loading	TSS Removal	Annual TSS Reduction	Storage Volume	Cleanout Frequency
4.12 ha	63%	9.81 m^3 (based on 2.38 m^3/ha)	80%	7.85 m^3	93 m^3 (1/3 of forebay)	~ 11.8 years

Sediment loadings obtained from Table 6.3 of the MOE Stormwater Management Planning and Design Manual, 2003 and prorated based on catchment percent impervious.

Therefore, it is estimated that the sediment forebay will require a cleanout in approximately 11.8 years.

5.2.9 Minor/Major Drainage System

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

Major design storm flows from the westerly portion of the development will be conveyed to the existing Stormwater Quality Facility No. 2 via the municipal rights-of-way, the proposed stormwater conveyance channel and forebay. Major design storm flows from the central portion of the development will be conveyed to the proposed stormwater management facility via the municipal rights-of-way. Preliminary analysis indicates that the municipal rights-of-way have the capacity to convey the runoff from a major design storm events.

The major design storm drainage patterns expected for the Cityview Ridge Subdivision are shown on the Preliminary Grading Plans prepared by GM BluePlan Engineering Limited.

5.2.10 Floodplain Analysis

Cosburn Patterson Wardman Limited, as part of the Eastview Secondary Plan, analyzed the existing floodlines through Hadati Creek and Clythe Creek. As part of the Valleyhaven Subdivision Phase 3, the floodline analysis for Hadati Creek was updated. The floodline analysis for Clythe Creek was later revised by the Grand River Conservation Authority.

With the construction of the proposed stormwater management facility for the Cityview Ridge Subdivision, the flood storage volume for the major design storm event is being provided within the facility for the flows from the developable lands, the floodplain storage volume has been maintained to ensure that the hazard to the public is minimized.

The HEC-RAS modelling has been edited to show the existing condition and post-development floodlines. A comparison to the pre- and post-development floodlines (flow rate, water surface elevation and flood width) through the Clythe Creek floodplain to the CN Railway lands has been included in **Appendix K**. The post-development Regional Storm and 100-year Design Storm Event floodlines are shown on the preliminary Grading and Drainage Plans prepared by GM BluePlan Engineering Limited.

6. SEDIMENT AND EROSION CONTROL PLAN

A silt fence will be installed along the property boundary and along the outer edge of buffers to the Natural Heritage System as identified in the Memorandum to the Environmental Impact Study (North-South Environmental Inc. 2021). The silt fence will minimize the opportunity for water borne sediments to be transported from the site. The ecologist and/or the Environmental Inspector will flag the location of the silt fence with the contractor. In accordance with standard City practice, an Environmental Inspector will be retained to monitor the construction activities.

Temporary rock 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 topsoiled and seeded as per OPSS 572.

The proposed stormwater management facility will be graded and used as a temporary sediment pond for the central portion of the site during the servicing and house building construction. The storage capacity of this pond exceeds the combined 250 m^3/hectare of active and dead storage required by the Grand River Conservation Authority. A heavy-duty silt fence will be placed around the proposed stormwater management facility during construction.

Following the construction of the stormwater management facility complete with cooling trench and linear energy dissipation and dispersion trench, the disturbed areas along the existing slope will restored with topsoil, seed or sod, natural or synthetic erosion control products (i.e. erosion control blanket) and vegetated to mitigate the erosion potential of the existing slope.

As previously discussed, the southwest corner of the site currently serves as a discharge point for the site. Prior to construction, a temporary sediment pond will be constructed for sediment collection prior to flows discharging from the site to the existing roadside ditch and ultimately Clythe Creek. The design of this temporary sediment pond will be completed at the detailed design stage for the Cityview Ridge Subdivision.

A silt fence will be placed around the outlet structure of the existing stormwater management facility to restrict the movement of sediment. The discharge structure will restrict the release rate and provide extended detention for a minimum 24-hour period.

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. A full detailed design and monitoring program will be provided in the future Environmental Impact Report.

An Environmental Inspector will submit monthly reports on the conditions of the sediment and erosion control measures to the City of Guelph.

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. Upon final inspection by both the Environmental Inspector and City of Guelph, the monthly reporting on the condition of the sediment and erosion control measures will cease.

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

7. 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 control devices plus “as needed” inspection after any significant rainfall, with all immediate repair of any damaged works and collection of captured sediment. This work will be carried out by the Consultant and/or the Environmental Inspector during the construction of the works. A monthly status report will be prepared and distributed to the City of Guelph.

Phase II will be the maintenance carried out after all construction has been completed. This work will involve a yearly visual inspection of the stormwater management facilities to determine the amount of sediment accumulation. Sediment should be removed as required and the recommended vegetation replanted. This work will be carried out by the Consultant and/or the Environmental Inspector. A monthly status report will be prepared and distributed to the City of Guelph.

8. CONCLUSIONS

From the foregoing analysis, the following conclusions and recommendations are drawn:

1. Water supply for the proposed Cityview Ridge Subdivision will be provided by:
   - the extension of the existing 150 mm diameter watermain on Henry Court,
   - the extension of the existing 200 mm diameter watermain southerly on Cityview Drive from the current terminus at Cedarvale Avenue.
   - Connections to the Draft Plan approved lands to the north of the site – 150mm diameter watermain connection at Street 2 and 200mm diameter watermain connection at Street 1.
2. Sanitary service for the Cityview Ridge Subdivision will be provided by:
   - the extension of the existing 200 mm diameter sanitary sewer on Henry Court,
   - the extension of a 200 mm diameter sanitary sewer from the existing 200 mm diameter sanitary sewer stub located at the southwest portion of the Cityview Ridge Subdivision adjacent to the existing municipal stormwater management facility.
3. Storm sewers within the Cityview Ridge Subdivision will be sized to accommodate the 5-year design storm event. Major storm events will be conveyed by the municipal rights-of-way to the stormwater management facilities.
4. A clean water collector system is proposed to collect clean rooftop runoff from the proposed dwellings on Streets 1 and 3 in the subdivision and convey the flows to the proposed municipal infiltration galleries located in the stormwater management block and south of Street 1.
5. The infiltration targets for the site are achieved through the implementation of the proposed infiltration galleries located in the stormwater management pond and south of Street 1.
6. Quality control for runoff generated from the westerly portion of the development will be provided by the existing Stormwater Quality Facility No. 2. Oil/grit separators are proposed for pre-treatment prior to discharging to the existing facility.
7. Based on the analysis provided in this report, post-development peak flows discharging from the existing Stormwater Quality Facility No. 2, generally meet the approved design discharge rates as detailed in the Stormwater Management Design Report Draft Plan 23T-96501 and 23T-99501 for the Martini/Valeriote Subdivision (Gamsby and Mannerow Limited, March 2004).
8. Quality and quantity control for runoff generated from the central portion of the development will be provided by the proposed stormwater management facility, prior to discharge to the existing wetland and ultimately Clythe Creek.
9. Temperature mitigation for runoff discharging from the proposed stormwater management facility will be provided by a proposed cooling trench prior to outleting to Clythe Creek.
10. The proposed stormwater management system provides an Enhanced level of protection (80% total suspended solid reduction) prior to discharging to Hadati Creek and Clythe Creek.
11. The stormwater management systems meet the current Provincial and Municipal guidelines.
12. During the construction phase, the proposed stormwater management facility will be used as part of the erosion and sediment control plan. This in conjunction, with the other 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:



Angela Kroetsch, P.Eng.
AK/SZ
Encl.
W:\Guelph\105-2005\105172\Documents\Reports, Manuals, Contracts\105172 SWM Design Report_Revised June 2023.docx

APPENDIX A:

GEOTECHNICAL INVESTIGATION
NAYLOR ENGINEERING ASSOCIATES LTD.
(FEBRUARY 2012)

105172

GEOTECHNICAL INVESTIGATION
P.T. VALERIOTE SUBDIVISION
CITYVIEW DRIVE
GUELPH, ONTARIO
for
CARSON REID HOMES LTD.

0353G4.R01_Rev.
February 2012

DISTRIBUTION:
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1cc: File

0353G4.R01_Rev.

February 17, 2012

Carson Reid Homes Ltd.
183 Dufferin Street
Guelph, Ontario
N1H 4B3

Attention: Mr. Carson Reid

Dear Sir:

Re: Geotechnical Investigation
P.T. Valeriote Subdivision
Cityview Drive
Guelph, Ontario

Naylor Engineering Associates Ltd. is pleased to submit this ***revised*** report for the geotechnical investigation recently completed for the above-referenced development site.

This report outlines the investigation procedures and provides a summary of the subsurface conditions encountered. Geotechnical comments and recommendations are provided for slope stability assessment, site grading, site servicing, pavement design, house foundations, industrial/commercial building foundations, stormwater infiltration, and stormwater management ponds design.

We trust that this report is suitable for your present requirements and we thank Carson Reid Homes Ltd. and Gamsby & Mannerow Limited for this opportunity to have been of service. If you have any questions or require any further geotechnical consultation, please do not hesitate to contact our office.

Yours very truly,

Dave S. Naylor, P.Eng.
Senior Consulting Engineer

TABLE OF CONTENTS

Page

1. Introduction 1

2. Investigation Procedure 1
   2.1 Field Program 1
   2.2 Laboratory Testing 2

3. Site Conditions 2
   3.1 Site Description 2
   3.2 Subsurface Soil Conditions 3
      3.2.1 Topsoil 3
      3.2.2 Sand and Gravel 3
      3.2.3 Silt Till 4
   3.3 Groundwater 4

4. Discussion and Recommendations 4
   4.1 Site Grading 5
   4.2 Site Servicing 6
   4.3 Pavement Design 7
   4.4 House Foundations 8
   4.5 Stormwater Management 9
   4.6 Commercial/Industrial Buildings 9
   4.7 Slope Stability Assessment 10

List of Abbreviations

Figure 1 – Particle Size Distribution Curves
Figures 2 and 3 – Standard Proctor Moisture-Density Test Results

Borehole Logs – Boreholes 101 through 110

Drawing 1 – Location Plan
Drawing 2 – Site Plan
Drawing 3 – Slope Stability A-A'
Drawing 4 – Typical Structural Fill Pad Detail
Drawing 5 – Typical Pavement Subdrain Detail

1. Introduction

Naylor Engineering Associates Ltd. was retained by Carson Reid Homes Ltd. to carry out a geotechnical investigation for a proposed residential subdivision on Cityview Drive in Guelph, Ontario, as shown on the appended Location Plan, Drawing 1. This work was authorized by Mr. Carson Reid of Carson Reid Homes Ltd. on July 13, 2006, following submission of a detailed proposal.

The project involves the residential development of a 17.682 ha property. The proposed residential subdivision will contain about 150 lots with full municipal services. An apartment block is proposed for the northeast corner of the property. A stormwater management pond is proposed at the south central area of the property.

The purpose of this investigation was to determine the subsurface soil and groundwater conditions and, based on that information, prepare this engineering report with geotechnical recommendations pertaining to slope stability, site grading, site servicing, pavement design, house foundations, industrial/commercial foundation design, stormwater infiltration and stormwater management pond design. The report does not address site environmental or hydrogeological issues.

2. Investigation Procedure

2.1 Field Program

The fieldwork for this investigation was carried out between July 31 and August 2, 2006 and involved the drilling of ten boreholes (Boreholes 101 through 110) to depths of 5.6 to 11.1 m at the locations shown on the appended Site Plan, Drawing 2. Twenty topsoil thickness holes were dug to measure the topsoil thickness. Approximate topsoil thickness hole locations are also shown on Drawing 2.

The boreholes were advanced with a CME-75 track-mounted drillrig equipped with continuous flight solid stem augers, supplied and operated by a specialist drilling contractor. Soil samples were recovered from the boreholes at regular 0.75 and 1.50 m depth intervals using a 50 mm O.D. split spoon sampler in accordance with the Standard Penetration Test (SPT) procedure. The SPT N-values recorded are plotted on the appended borehole logs.

Monitoring wells were installed in all of the boreholes to allow measurement of the stabilized groundwater levels. These installations comprised 50 mm diameter PVC pipes with slotted filters, as well as betonite seals. At Boreholes 103, 104, 105, 106, and 107, a shallow 19 mm diameter CPVC pipe was also installed to determine the vertical hydraulic gradient. Groundwater levels were measured in the standpipes and monitoring wells on August 8, 2006 by Naylor Engineering Associates Ltd. Details of installations and groundwater measurements are provided on the appended borehole logs.

All standpipes and monitoring wells were installed by licensed well technicians in accordance with Ontario Regulation 903. A well tag was attached to the standpipe at Borehole 011. The standpipes must be properly decommissioned by a licensed well technician within six months of last use, and certainly before construction begins.

The fieldwork was supervised throughout by a member of our engineering staff who directed the drilling and sampling procedures; conducted SPT testing; documented the soil stratigraphies, and cared for the recovered soil samples.

The borehole locations and ground surface elevations were surveyed by Gamsby & Mannerow Limited and the data was supplied to us in AutoCAD format. It is understood that the elevations are related to a geodetic datum.

2.2 Laboratory Testing

All soil samples secured during this investigation were returned to our laboratory for moisture content tests; the results of which are plotted on the borehole logs. Geotechnical laboratory tests carried out on selected samples of the major subsurface soils from the investigation comprised three particle size distribution test with results presented on Figure 1, and two standard Proctor moisture-density tests with results plotted on Figures 2 and 3.

The soil samples will be stored for a period of four months (December 2006) from the date of sampling. After this time, they will be discarded unless prior arrangements have been made for longer storage.

3. Site Conditions

3.1 Site Description

The subject development is approximately 17.682 ha and is located in the northeast area of Guelph, Ontario. For the purpose of this report it was assumed Watson Parkway runs north-south adjacent to the east side of the property. The property is bordered on the north by a vacant field, on the south by a Canadian National Railway Line, on the east by Watson Parkway, and on the west by existing residential development.

The property is split in two pieces: with the proposed residential development on the west side of the property and a proposed apartment block on the east side. From the low-lying lands in the east part of the property area, the grade slopes up about 20 m to the higher lands in the west section.

The residential property is moderately sloped. A hill runs north-south and divides the residential property into east and west sloping sides. The residential property is vegetated with mostly tall grass and some medium sized deciduous trees.

The proposed apartment block is relatively level and is at the northeast corner of the property. The apartment block is densely vegetated with spruce trees. The topographic relief for this part of the property is less than 1 m.

3.2 Subsurface Soil Conditions

We refer to the appended borehole logs for detailed soil descriptions and stratigraphies, SPT N-values, moisture content profiles, details of standpipe installations, and groundwater observations and measurements.

The subsurface stratigraphy at the site generally comprises topsoil overlying silt till in the proposed residential area. At the proposed apartment block at the northeast corner of the property, the subsurface stratigraphy generally comprises topsoil overlying sand and gravel. Descriptions of the various soil deposits and the groundwater conditions encountered are provided in the following subsections.

3.2.1 Topsoil

Topsoil was contacted surficially throughout the property. The topsoil is typically 200 to 350 mm thick in the proposed residential area, and 400 mm thick in the low lying land. The topsoil generally comprises dark brown silt. The average topsoil thickness in the residential lands and commercial lands are 250 mm and 300 mm, respectively.

3.2.2 Sand and Gravel

Sand and gravel was encountered in the low lying area at the northeast corner of the site (Boreholes 109 and 110). The sand and gravel continues below the termination depths of the boreholes. This deposit consists of sand and gravel with some silt; and there were frequent cobbles and boulders in the soil matrix. A particle size distribution analysis performed on one sample of the sand and gravel indicated the sample contained 44% gravel, 41% sand, and 15% silt (see Figure 1).

Typically, the sand and gravel is very dense based on SPT N-values of greater than 50 blows per 300 mm penetration of the split-spoon sampler. The moisture content of the sand and gravel is typically about 5% above the water table, and between 8 and 12% in saturated conditions.

3.2.3 Silt Till

Silt till was encountered in all boreholes located in the proposed residential area. The silt till continues below the termination depths of the boreholes in which it was encountered. In Boreholes 102 and 105, possible weathered bedrock was encountered at borehole termination depth. This deposit ranges in composition from sandy silt with some gravel and cobbles, to silt with some clay sand and gravel. Particle size distribution analyses performed on two samples of the silt till indicated the samples contained 5% to 11% gravel, 41% sand, 36 to 44% silt, and 10 to 11% clay (see Figure 1).

Typically, within 2 m of the ground surface, the silt till is loose to compact based on SPT N-values of 5 to 25 blows per 300 mm. Below this upper portion, the silt till is dense to very dense based on SPT N-values from 30 to greater than 50 blows per 300 mm.

The moisture content of the silt till is typically between 8 and 12%. Two standard Proctor moisture-density tests performed on samples of the silt till from Boreholes 105 and 106 indicated maximum dry densities of 2.065 t/m^3 and 2.185 t/m^3 and optimum moistures of 9.0% and 8.7% (see Figures 2 and 3).

3.3 Groundwater

Groundwater was encountered in saturated seams within the silt till, and under water table (unconfined) conditions in the sand and gravel deposit. The stabilized levels were between Elevation 321.0 m (Borehole 110) to 344.5 m (Borehole 107).

Within the apartment block at the northeast corner, the horizontal gradient of the groundwater in the sand and gravel is from north to south towards Clythe Creek. Within the remainder of the residential area, the variable groundwater levels in seams within the silt till generally follow the topography.

4. Discussion and Recommendations

The project involves the residential development of an approximately 17.682 ha property. The proposed subdivision will be provided with full municipal services. It is assumed that on-site stormwater management controls will be required for the apartment block abutting Watson Parkway North. A portion of the lands on the west half of the site will drain to an existing stormwater management facility located to the west of Cityview Drive.

The subsurface stratigraphy at the site generally comprises topsoil overlying silt till in the proposed residential area, and topsoil overlying sand and gravel in the apartment block. Groundwater is contained in thin seams within the silt till at variable depths, and in the sand and gravel at about 3 to 4 m depth.

The following sections of this report provide geotechnical recommendations for the construction of the subdivision including slope stability assessment, site grading, site servicing, pavement design, house foundations, apartment building foundations, stormwater infiltration and stormwater management pond design.

4.1 Site Grading

At the time of the report preparation, grading plans were not available for review; however, we would anticipate area grading of the property to prepare the land for construction of the proposed residential subdivision. In general, material may be cut from the high areas to raise grades in lower areas of the site.

Prior to carrying out any area grading of the site, the surficial topsoil should be removed from cuts and critical fill areas. In calculating the approximate quantity of topsoil to be stripped, we note that the average thickness of topsoil contacted in the boreholes is about 300 mm for the residential lands and 300 mm for the commercial/industrial lands. We recommend that the topsoil thickness be increased by 50 mm for volume calculations to account for variations, and some stripping of the mineral soil below. The topsoil material could be used for landscaping fill to raise grades in the rear yards of the house lots or in park areas.

Following stripping of topsoil, the exposed subgrade should be inspected by Naylor Engineering Associates Ltd. Fill should be placed in maximum 300 mm thick lifts and compacted to the following minimum percentages of standard Proctor maximum dry density (SPMDD):

Fill Use	Minimum Compaction Required
Structural fill to support residential houses	98% SPMDD
Structural fill to support commercial/industrial buildings	100% SPMDD
Subgrade fill beneath streets	95% SPMDD
Bulk fill in landscaped areas	90% SPMDD

The major soil likely to be generated from the cut areas of the residential lands is silt till. The moisture content of the silt till generally ranges between 8 and 12%, and the optimum moisture for compaction is about 9% (see Figures 2 and 3). The silt till will have to be allowed to dry before it can be used as structural fill, and therefore we recommend that any structural filling be carried out in the drier summer months.

The structural fill should extend at least 1.0 m beyond the footing edge of any building and down to the subgrade level at a slope of 45° to the horizontal. A typical detail for structural fill placement beneath house foundations is shown on Drawing 5, appended.

The major soil likely to be generated from the apartment block side of the site is sand and gravel and this material will be well-suited for compaction.

Full-time inspection by experienced geotechnical personnel should be carried out during fill placement and compaction to examine and approve potential sources of fill material, and to carefully monitor the placement and verify the compaction by insitu density testing.

4.2 Site Servicing

Following the site grading operations, the property will be serviced to provide the individual lots and blocks with full municipal services. It is anticipated that the invert levels for the watermains and sewers will be at conventional depths, some 2 to 4 m below finished grade.

Temporary excavations to conventional depths for installation of underground pipes at this site should comply with Regulation 213/91 (Construction Projects) under the Ontario Occupational Health and Safety Act. The predominant soils encountered in the test holes would be classified as Type 2 soils, and temporary side slopes should be cut near vertical in the bottom 1.2 m and then trimmed back to an inclination of maximum 1 horizontal to 1 vertical.

No major groundwater problems are envisaged for excavations at this site. In general, low to moderate rates of seepage are to be expected from the silt till. It is expected that the groundwater inflow can be handled using conventional sump pumping techniques.

The subgrade soils beneath the watermain and sewer pipes will comprise native mineral soils or compacted fill placed during the site grading operations. No bearing problems are anticipated for flexible or rigid pipes founded in the native deposits or compacted on-site soils. The bedding should be placed in accordance with Ontario Provincial Standard Drawings (OPSD 802.030 and 802.033).

Pipe bedding for water and sewer services should be conventional Class 'B' pipe bedding comprising a minimum 150 mm thick layer of OPSS Granular 'A' aggregate below the pipe invert. The bedding course may be thickened if portions of the subgrade become unduly wet during excavation. Granular 'A' type aggregate should be provided around the pipe to at least 300 mm above the pipe. The bedding aggregate should be compacted to a minimum 98% SPMDD.

The trenches above the specified pipe bedding should be backfilled with inorganic on-site soils placed in 300 mm thick lifts and compacted to at least 95% SPMDD. Based on the results of insitu moisture content and standard Proctor moisture-density tests carried out on the native overburden deposits, the majority of the on-site excavated materials will be compactable to the required 95% SPMDD. The silt till soil may require some drying prior to re-use as trench backfill.

To minimize potential problems, backfilling operations should follow closely after excavation so that only a minimal length of trench is exposed. Care should be taken to protect side slopes of excavations by diverting surface run-off away from the excavations. If construction extends into the winter, then the backfilling operations should be planned so that exposure of the backfill material to frost is kept to a minimum and to ensure that frozen material is not used as backfill.

Excavations for the installation of sewers across the apartment block may extend into saturated sand and gravel deposits. The hydraulic conductivity of the granular soil is estimated to be in the order of 10^{-5} m/s based on the gradation analysis. Moderate to significant groundwater inflow through the granular soil is expected where the excavations extend below an elevation of 320.4 m. It is believed that the groundwater inflow can be controlled with high capacity pumps and perimeter interceptor ditches. In order to facilitate sewer installation more than 0.6 m below the stabilized groundwater table, a dewatering system installed by a specialist dewatering contractor may be required to lower groundwater level prior to excavation.

Frequent inspection and compaction testing by experienced geotechnical personnel should be carried out to examine and approve backfill materials, and to verify that the specified degree of compaction has been achieved.

4.3 Pavement Design

A number of local residential streets are planned for the residential subdivision. Following site grading and installation of services, the pavement subgrade will comprise predominantly recompacted excavated silt tilt soils. The following pavement component thicknesses are recommended based on the proposed pavement usage, and the frost-susceptibility and strength of the subgrade soils:

Pavement Component	Local Streets
Asphaltic Concrete	90 mm
Granular 'A' Base Course	150 mm
Granular 'B' Subbase Course	450 mm

The pavement subgrade materials should be thoroughly proof-rolled under supervision of a geotechnical engineer prior to placement of the Granular 'B' subbase course. If any unstable areas are noted, then the Granular 'B' thickness may need to be increased to support pavement construction traffic. This should be left as a field decision at the time of construction, but it is recommended that these materials be carried as a provisional item under the construction contract.

Samples of both the Granular 'A' and Granular 'B' aggregates should be checked for conformance to OPSS 1010 prior to utilization on site and during construction. The Granular 'B' subbase and Granular 'A' base courses must be compacted to 100% SPMDD, as verified by insitu density testing.

The asphaltic concrete should comprise a binder layer of HL4 and a surface layer of HL3. It is recommended that the compacted thickness be 55 mm of HL4 binder and 35 mm of HL3 surface for the local streets. The purpose of the thicker HL4 layer is to support construction traffic during the time period before the HL3 is placed.

The asphaltic concrete paving materials should conform to the requirements of OPSS 1150. The asphalt should be placed in accordance with OPSS 310 and compacted to within the range of 92.0 to 97.5% of the plant produced Maximum Relative Density (MRD) value. The Performance Graded Asphalt Cement designation for the asphaltic concrete is 58-28.

The silt till subgrade soils has poor natural drainage and therefore continuous pavement subdrains are recommended. A typical detail of a pavement subdrain is provided in Drawing 4, appended.

The concrete for sidewalks, and curb and gutter should be proportioned, mixed, placed, and cured in accordance with the requirements of OPSS 351, 353, and 1350, and shall meet the following specific requirements:

- minimum 28-day compressive strength = 32 MPa
- slump = maximum 80 mm
- air entrainment = 6.5% ± 1.5%

During cold weather, the freshly placed concrete must be covered with insulating blankets to protect against freezing. Three cylinders from each day's pour should be taken for compressive strength testing. Air entrainment, temperature, and slump tests should be made from the same batch of concrete from which test cylinders are made.

The subgrade for the sidewalks should comprise undisturbed native mineral soil or well-compacted fill. A minimum 150 mm thick layer of compacted Granular 'A' type aggregate should be placed beneath the sidewalk slabs.

4.4 House Foundations

The undisturbed native mineral soil deposits underlying this site are considered suitable to support residential house foundations. Where the footing levels will be above the existing native mineral soil grade, structural fill will be utilized. The native soil or properly compacted structural fill will be suitable to support house footings proportioned to the minimum sizes provided in Part 9 of the Ontario Building Code.

All founding surfaces for residential dwellings on structural fill or native soils should be inspected by Naylor Engineering Associates Ltd. personnel prior to placing concrete. The purpose of the inspection is to ensure that the subgrade soils are capable of supporting the house foundations, and to confirm that the house envelope does not extend beyond the limits of the structural fill pad.

The subgrade soils are considered to be frost susceptible and must be protected from freezing at all times including during construction. The exterior footings, or footings in unheated areas, should be provided with a minimum 1.20 m of earth cover upon final grading for frost protection.

House basements at this site must be provided with perimeter weeping tile systems as per the Ontario Building Code. The drain tile or pipe should be laid on undisturbed or well-compacted soil so that the top of the tile or pipe is below the bottom of the basement floor slab. The weeping tile must drain to a suitable frost-free outlet or sump as per City of Guelph requirements. We recommend that the bedding for the tiles comprise concrete sand.

4.5 Stormwater Management

At the time of the report preparation, no design details of the SWM pond were available for review. In general, the silty soils at the site will not allow stormwater infiltration; however, the SWM pond will be suitable for storage and siltation control. The sand and gravel deposit on the east side of the property would allow stormwater infiltration.

It is anticipated that berms will be required to create the SWM pond. The berms should be constructed using the on-site silt till. The berm fill should be placed in thin lifts and compacted to at least 95% SPMDD.

The SWM pond berms should be sloped at 3 horizontal to 1 vertical, or flatter, and should be re-topsoiled and vegetated as soon as possible.

It is anticipated at-source dry well infiltration may be considered for the subdivision. The soils in the proposed residential area have a high silt content and are not suitable for at-source drywell infiltration. In the proposed apartment block, the sand and gravel deposits may be used for at-source infiltration. Based on particle size distribution analyses, we estimate that the hydraulic conductivity of the native sand and gravel is in the order of 10^{-5} m/s. We recommend that an infiltration rate of 15 mm/hr be assumed for sizing the dry wells. All drywell subgrades should be inspected by Naylor Engineering Associates Ltd. to confirm the conditions are suitable for infiltration.

4.6 Apartment Buildings

At the time of the report preparation, no building locations for the apartment blocks were available. We recommend further investigation when this information is available to determine subsurface condition details for foundations and services.

All organics and other deleterious materials should be removed from beneath the footprint of the proposed building(s) and new pavement areas.

Following removal of unsuitable material, the exposed subgrade should be inspected by a geotechnical engineer. Any soft or unstable areas should be subexcavated. The native subgrade soil will comprise sand and gravel and will be contacted below the topsoil.

The undisturbed native mineral soils are considered suitable to support conventional building foundations. If the footing levels will be above the existing native mineral soils, then structural fill should be placed as noted in Section 4.1. Building foundations constructed on the native mineral soil or approved structural fill may be proportioned for a nominal net allowable bearing pressure of 200 kPa.

All founding surfaces for buildings on structural fill or native soils should be inspected by Naylor Engineering Associates Ltd. personnel prior to placing concrete. The purpose of the inspection is to ensure that the subgrade soils are capable of supporting the foundations, and to confirm that the building envelope does not extend beyond the limits of the structural fill pad.

The subgrade soils are considered to be frost susceptible and must be protected from freezing at all times including during construction. The exterior footings or footings in unheated areas should be provided with a minimum 1.20 m of earth cover upon final grading for frost protection.

4.7 Slope Stability Assessment

In order to analyze the stability of the existing slope, Boreholes 104 to 106 were advanced near the top of slope. A slope profile at the steepest location is shown on Drawing 2. The information was then used for computer analyses of the slope stability using the Slope/W Program (Mortgenstern-Price Method). The results of the analyses are shown on Drawing 3.

The soil parameters used in the analyses have been estimated based on the results of the field and laboratory testing and are as follows:

Soil Material	Unit Weight (kN/m^3)	Angle of Internal Friction	Cohesion (kPa)
Silt Till	22	32°	20

The slope stability analyses were carried out for a number of potential failure types. The various failures analyzed included shallow slumping type failure of the slope surface, medium depth rotational failures in the silt till, and deep rotational failures through the entire height of the slope.

In order to determine an appropriate development setback from the top of slope, a minimum factor of safety of 1.50 was used as per Grand River Conservation Authority policy. The steepest slope profile was used for the analyses to determine the setback required to achieve this factor of safety. The setback is typically determined based on the point at which the failure slipcircle (for factor of safety of 1.50) intersects the tableland of the crest of the slope; however, the analyses revealed that the slope has a factor of safety of greater than 1.50. The analysis reveals that the slope has a factor of safety of 2.75 which is well above the Grand River Conservation Authority minimum slope factor of safety.

Toe erosion at the wetland at the bottom of the slope is expected to be minor. A nominal 100 year erosion setback of 1 m is recommended.

A 6 m erosion access allowance is recommended for slopes by the Ministry of Natural Resources. The erosion access allowance is the setback needed to ensure enough space is available for workers and vehicles to access the area.

In conclusion, the primary causes of potential instability for the slope embankment would be development and loading directly at the crest, and general surface erosion caused by run-off from the site. To ensure no loading at the crest (from buildings, pools, fill, etc.) and to compensate for possible long-term erosion, the following setbacks from the top of slope are recommended:

Cross-Section	Stability Setback for Factor of Safety of 1.50 (m)	100 year Erosion Setback (m)	Erosion Access Allowance Setback (m)	Total Development Setback from Top of Slope (m)
A-A'	0	1	6	7

The estimated top of slope and 'total development setback' lines are shown on Drawing 2, appended.

Surface run-off must be directed away from the slope crest if possible. No fill should be placed at the crest of the slope or over the face of the existing slope unless the fill placement is engineered. No excavation work should be carried out on the slope or at the bottom of the slope.

This investigation was conducted to determine geotechnical parameters for the construction of the proposed residential subdivision and apartment block on Cityview Drive in Guelph, Ontario. The recommendations in this report are based on subsurface conditions encountered at specific borehole locations, and conditions between the boreholes will vary. Should conditions be encountered which differ materially from those at the borehole locations, we ask that we be notified immediately in order to assess the additional information and its effects on our conclusions.

Respectfully submitted,

LICENSED PROFESSIONAL ENGINEER
D. S. NAYLOR
33646761
2012-02-17
PROVINCE OF ONTARIO

Neal Morris, B.Sc. (Eng)

Dave S. Naylor, P.Eng.
Senior Consulting Engineer

jb/jmp

LIST OF ABBREVIATIONS

The abbreviations commonly employed on the borehole logs, on the figures, and in the text of the report, are as follows:

Sample Types		Soil Tests and Properties	
AS	auger sample	SPT	Standard Penetration Test
CS	chunk sample	UC	unconfined compression
RC	rock core	FV	field vane test
SS	split spoon	ø	angle of internal friction
TW	thin-walled, open	γ	unit weight
WS	wash sample	w_p	plastic limit
		w	water content
		w_l	liquid limit
		I_L	liquidity index
		I_p	plasticity index
		PP	pocket penetrometer

Penetration Resistances

Dynamic Penetration Resistance	The number of blows by a 63.5 kg (140 lb.) hammer dropped 0.76 m (30 in.) required to drive a 50 mm (2 in.) diameter 60 ° cone a distance 0.30 m (12 in.). The cone is attached to 'A' size drill rods and casing is not used.
Standard Penetration Resistance, N (ASTM D1586)	The number of blows by a 63.5 kg (140 lb.) hammer dropped 0.76 m (30 in.) required to drive a standard split spoon sampler 0.30 m (12 in.)
WH	sampler advanced by static weight of hammer
PH	sampler advanced by hydraulic pressure
PM	sampler advanced by manual pressure

Soil Description

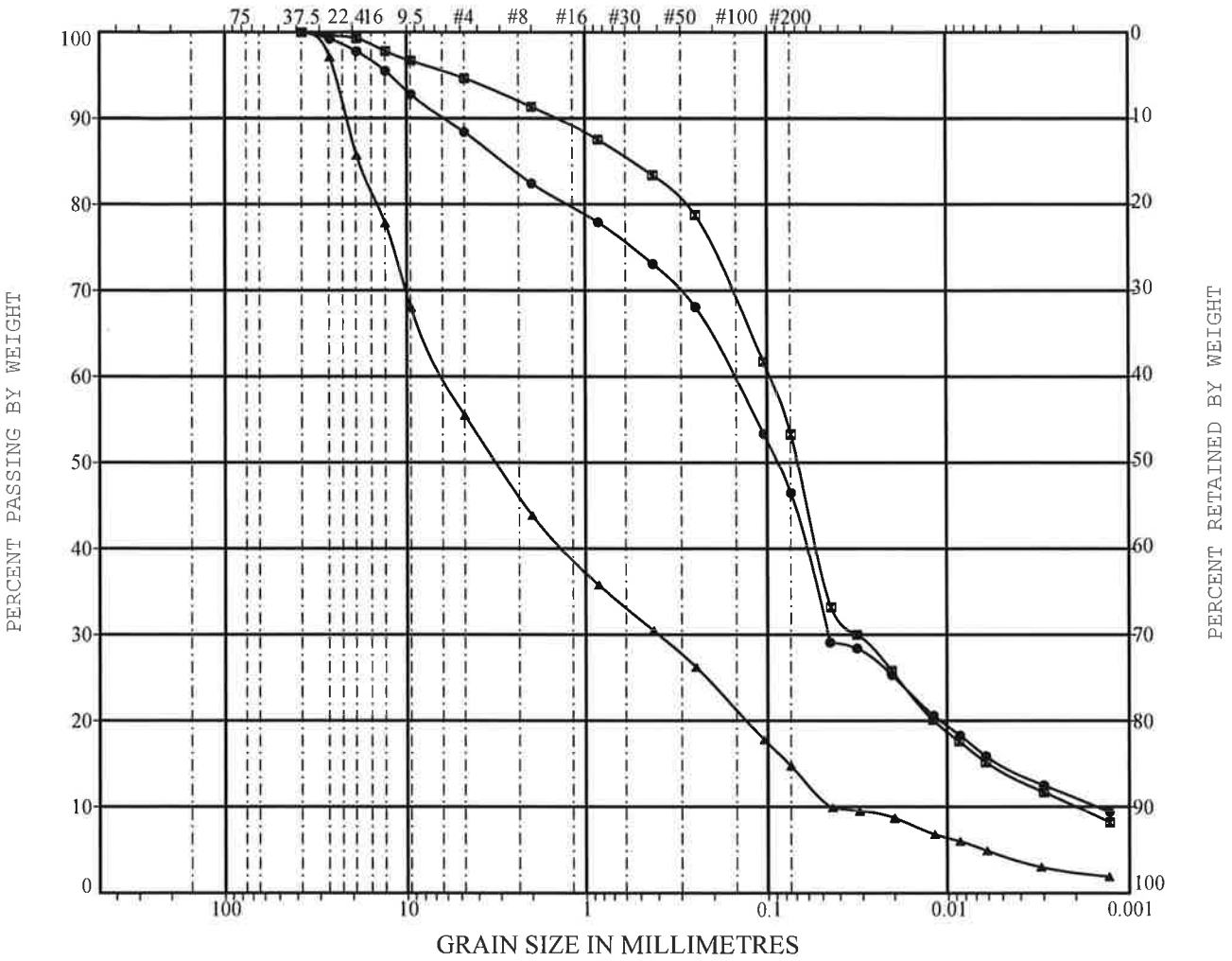
Cohesionless Soils	**SPT 'N' Value**	**D_r (%)**
Relative Density (D_r)	(blows per 0.30 m)	
Very Loose	0 to 4	0 to 20
Loose	4 to 10	20 to 40
Compact	10 to 30	40 to 60
Dense	30 to 50	60 to 80
Very Dense	over 50	80 to 100

Cohesive Soils	Undrained Shear Strength (C_u)	
Consistency	**kPa**	**psf**
Very Soft	less than 12	less than 250
Soft	12 to 25	250 to 500
Firm	25 to 50	500 to 1000
Stiff	50 to 100	1000 to 2000
Very Stiff	100 to 200	2000 to 4000
Hard	over 200	over 4000

DTPL	Drier than plastic limit
APL	About plastic limit
WTPL	Wetter than plastic limit

UNIFIED SOIL CLASSIFICATION

COBBLES	*GRAVEL*		*SAND*			*SILT OR CLAY*
	COARSE	FINE	COARSE	MEDIUM	FINE	
U.S. SIEVE SIZE IN MILLIMETRES			U.S. STANDARD SIEVE No.			HYDROMETER



PROJECT P.T. Valeriote Subdivision

LOCATION Cityview Drive, Guelph, Ontario JOB NO. 0353G4

CURVE ID	BOREHOLE/ TEST PIT	SAMPLE NO.	DEPTH (m)	SOIL DESCRIPTION
●	BH101	BS	1.85-3.05	SILT TILL: SILT and SAND, some Gravel, trace Clay
⊠	BH105	BS	1.22-2.13	SILT TILL: SAND and SILT, trace Gravel and Clay
▲	BH110	Sa2	5.00-6.50	SAND AND GRAVEL, some Silt

REMARKS

Naylor Engineering Associates Ltd.
CONSULTING ENGINEERS

Figure No. 1

FIGURE NO. 2

Naylor Engineering Associates
CONSULTING ENGINEERS

LABORATORY PROCTOR MOISTURE-DENSITY TEST

PROJECT P.T. Valeriote Subdivision

LOCATION Cityview Drive, Guelph, Ontario JOB NO. 0353G4

BOREHOLE NO. BH105 DATE TESTED August 21, 2006

SAMPLE DEPTH 1.22 - 2.13 TESTED BY WF

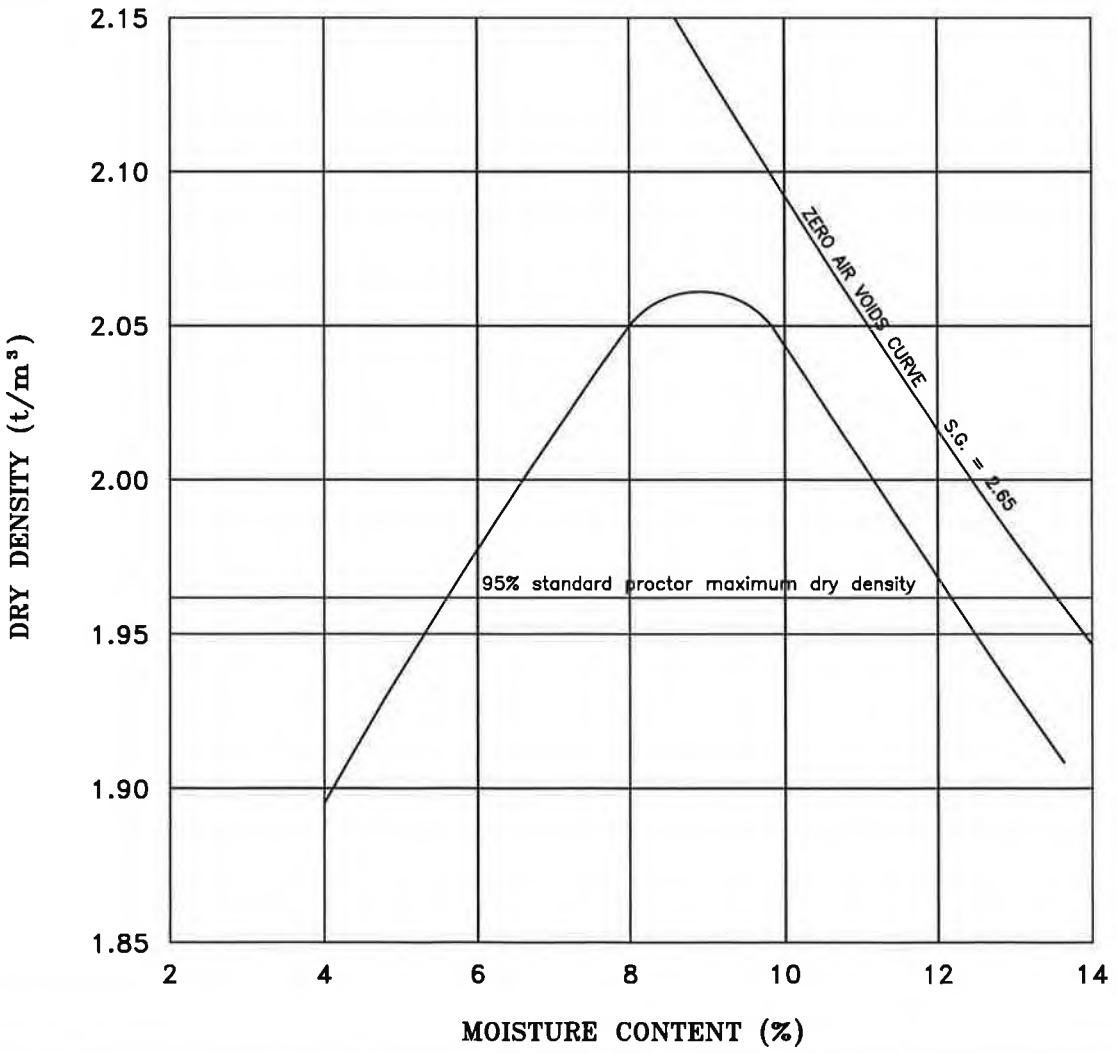
SOIL TYPE SILT TILL MOISTURE CONTENT 14.9%

REMARKS

STANDARD PROCTOR - ASTM D698-91
METHOD - A ☑ B ☐ C ☐ D ☐
MODIFIED PROCTOR - ASTM D1557-91
METHOD - A ☐ B ☐ C ☐ D ☐

MAXIMUM DRY DENSITY 2.065 t/m³

OPTIMUM MOISTURE 9.0%



F:\0353\0353G4\0353G4_Figure 1.dwg
August 25, 2006 (GRL)

FIGURE NO. 3

Naylor Engineering Associates
CONSULTING ENGINEERS

LABORATORY PROCTOR MOISTURE-DENSITY TEST

PROJECT P.T. Valeriote Subdivision

LOCATION Cityview Drive, Guelph, Ontario JOB NO. 0353G4

BOREHOLE NO. BH106 DATE TESTED August 21, 2006

SAMPLE DEPTH 1.52 - 3.05m TESTED BY KJ

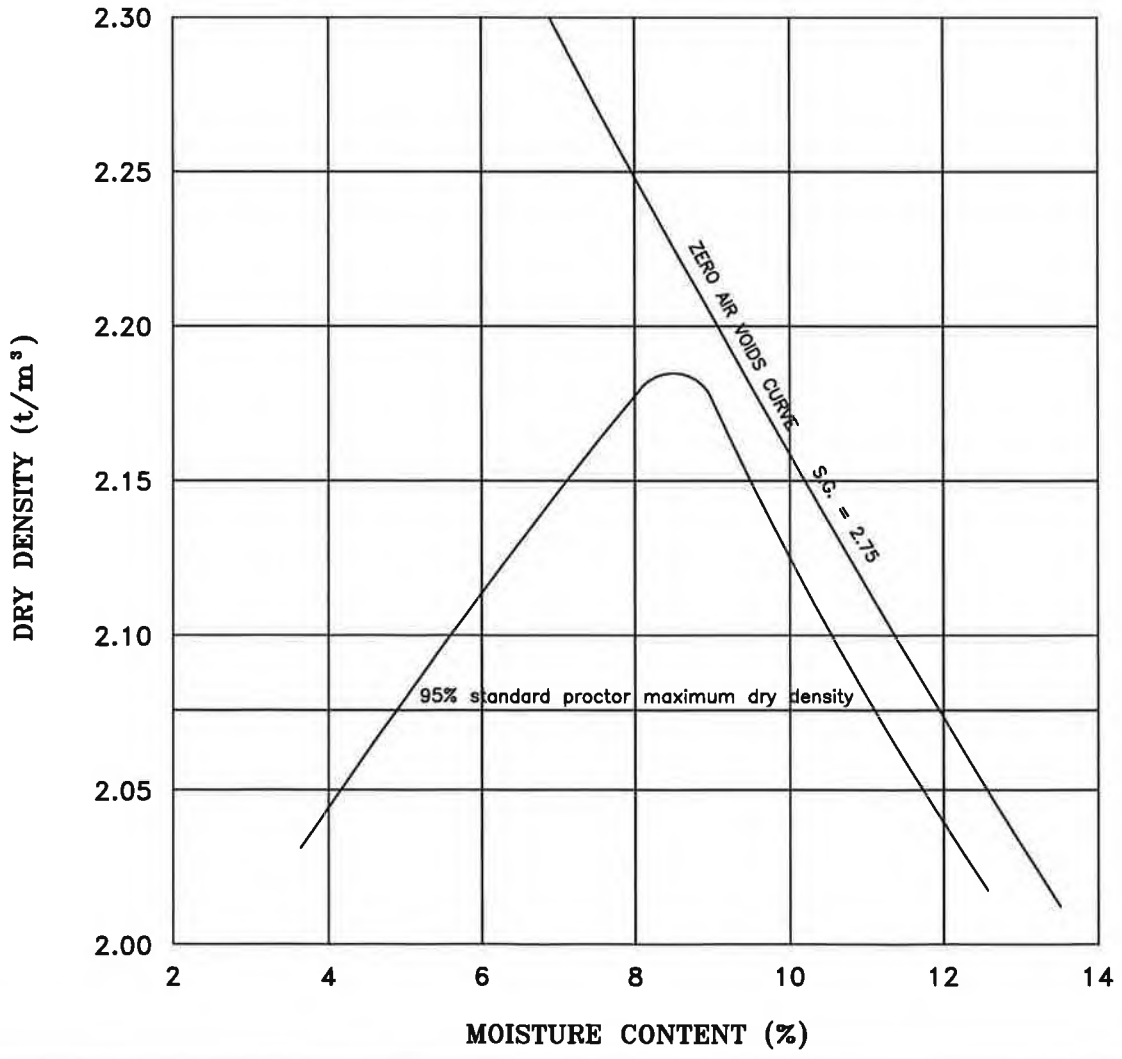
SOIL TYPE SILT TILL MOISTURE CONTENT 8.7%

REMARKS

STANDARD PROCTOR - ASTM D698-91
METHOD - A ☐ B ☐ C ☑ D ☐
MODIFIED PROCTOR - ASTM D1557-91
METHOD - A ☐ B ☐ C ☐ D ☐

MAXIMUM DRY DENSITY 2.185 t/m³

OPTIMUM MOISTURE 8.7%



F:\0353\0353G4\0353G4_Figure 2.dwg
August 28, 2006 (GRL)

Naylor Engineering Associates Ltd.
CONSULTING ENGINEERS

Borehole Number: 101

Ground Elevation: *338.61 m*

Project: *P.T. Valeriote Subdivision*

Job No.: *0353G4*

Location: *Cityview Drive, Guelph, Ontario*

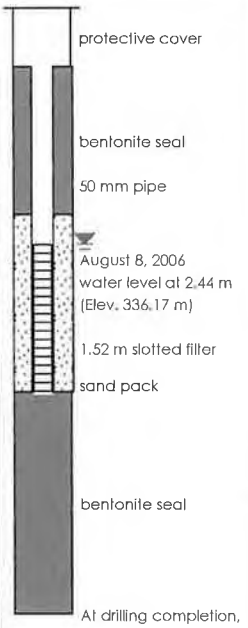
Drill Date: *August 2, 2006*

Depth (m)	Description	Symbol	Elevation (m)	SAMPLE Number	Type	N-Value
0.00	Ground Elevation		338.61			
	TOPSOIL: dark brown silt, moist					
1.00	***SILT TILL:*** compact brown sandy silt, some gravel, moist		338.00	1	SS	25
			337.00	2	SS	14
2.00	very moist					
			336.00	3	SS	16
3.00	dense to very dense, moist					
			335.00	4	SS	35
4.00						
			334.00	5	SS	45\150mm
5.00						
			333.00			
6.00				6	SS	50\150mm
	Borehole terminated at 6.25 m		332.00			
7.00						
			331.00			
8.00						
			330.00			
9.00						
			329.00			
10.00						
			328.00			
11.00						
			327.00			
12.00						

Dynamic Cone (X) 20 40 60 80 — Standard Penetration (●) 20 40 60 80

Shear Strength (PP) kPa ▲ 50 100 150 200 — Shear Strength (FV) kPa ■ 50 100 150 200

Water Content (%) WP WL 10 20 30



Reviewed by: *DN*

Drill Method: *Solid Stem Auger*

Notes: *Bulk sample taken from 1.83 to 3.05 m.*

Field Tech.: *RM*

Sheet: *1 of 1*

Drafted by: *DC(01a)*

Naylor Engineering Associates

Borehole Number: 102

Ground Elevation: *334.42 m*

Project: *P.T. Valeriote Subdivision*

Job No.: *0353G4*

Location: *Cityview Drive, Guelph, Ontario*

Drill Date: *August 2, 2006*

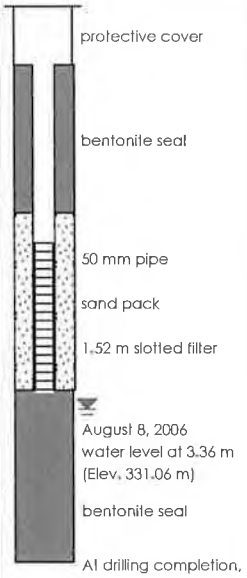
Depth (m)	Description	Elevation (m)	Number	Type	N-Value
0.00	Ground Elevation	334.42			
0.00	***TOPSOIL:*** dark brown silt, moist				
1.00	***SILT TILL:*** loose brown sandy silt, some gravel, trace clay, very moist		1	SS	9
		333.00			
2.00			2	SS	5
	compact, very moist	332.00	3	SS	11
3.00	very dense, moist		4	SS	50\150mm
		331.00			
4.00					
		330.00	5	SS	45\150mm
5.00					
	augering on weathered bedrock or boulder	329.00			
6.00	Borehole terminated at 5.74 m upon auger refusal on bedrock or boulder				
7.00		328.00			
		327.00			
8.00					
		326.00			
9.00					
		325.00			
10.00					
		324.00			
11.00					
		323.00			
12.00					

Dynamic Cone / Standard Penetration: X 20 40 60 80 X; ● 20 40 60 80 ●

Shear Strength (PP) kPa: ▲ 50 100 150 200 ▲

Shear Strength (FV) kPa: ■ 50 100 150 200 ■

Water Content (%): WP WL; 10 20 30



Reviewed by: *DN*

Drill Method: *Solid Stem Auger*

Notes:

Field Tech.: *RM*

Sheet: *1 of 1*

Drafted by: *DC(01a)*

Naylor Engineering Associates Ltd.

Borehole Number: 103

Ground Elevation: *344.44 m*

Project: *P.T. Valeriote Subdivision*

Job No.: *0353G4*

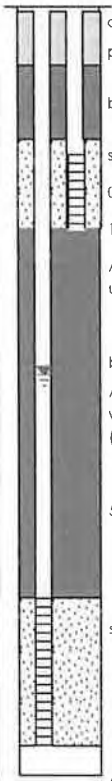
Location: *Cityview Drive, Guelph, Ontario*

Drill Date: *July 31, 2006*

Depth (m)	Description	Symbol	Elevation (m)	SAMPLE Number	Type	N-Value
0.00	Ground Elevation		344.44			
	TOPSOIL: dark brown silt, moist					
1.00	***SILT TILL:*** loose rusty brown silt, some sand, trace clay and gravel, trace tree roots, moist to very moist		343.00	1	SS	5
2.00				2	SS	6
	dense to very dense brown sandy silt, some gravel, trace clay, moist		342.00	3	SS	*
3.00						
4.00			341.00	4	SS	55\150mm
			340.00	5	SS	45\150mm
5.00			339.00			
6.00	grey, moist			6	SS	60\150mm
7.00			338.00			
			337.00	7	SS	75\150mm
8.00	Borehole terminated at 7.92 m					
9.00			336.00			
			335.00			
10.00			334.00			
11.00			333.00			
12.00						

Dynamic Cone (X) 20 40 60 80 X
Standard Penetration (●) 20 40 60 80
Shear Strength (PP) kPa ▲ 50 100 150 200 ▲
Shear Strength (FV) kPa ■ 50 100 150 200 ■
WP WL
Water Content (%) 10 20 30

Groundwater Observations and Standpipe Details



- concrete seal and protective cover
- bentonite seal
- sand pack
- 0.76 m slotted filter
- 19 mm pipe
- August 8, 2006, upper standpipe dry
- bentonite seal
- August 8, 2006 water level at 3.80 m (Elev. 340.64 m)
- 50 mm pipe
- sand pack
- 1.52 m slotted filter
- At drilling completion, dry cave at 7.62 m

Reviewed by: *DN*

Drill Method: *Solid Stem Auger*

Notes: * *Sampler driving on gravel.*

Field Tech.: *RM*

Sheet: *1 of 1*

Drafted by: *DC(01a)*

Naylor Engineering Associates Ltd

Borehole Number: 104

Ground Elevation: *339.95 m*

Project: *P.T. Valeriote Subdivision*

Job No.: *0353G4*

Location: *Cityview Drive, Guelph, Ontario*

Drill Date: *July 31, 2006*

Depth (m)	Description	Symbol	Elevation (m)	SAMPLE Number	Type	N-Value
0.00	Ground Elevation		339.95			
	TOPSOIL: dark brown silt, moist					
1.00	***SILT TILL:*** compact brown sandy silt, some gravel, trace clay, moist		339.00	1	SS	20
2.00			338.00	2	SS	25
	very dense, moist			3	SS	30\150mm
3.00			337.00	4	SS	51
4.00			336.00			
5.00			335.00	5	SS	45\150mm
	cobbles, some dolostone					
6.00			334.00	6	SS	65\150mm
7.00	Borehole terminated at 6.71 m		333.00			
8.00			332.00			
9.00			331.00			
10.00			330.00			
11.00			329.00			
12.00			328.00			

Dynamic Cone (X) 20 40 60 80 — Standard Penetration (●) 20 40 60 80

Shear Strength (PP) kPa (▲) 50 100 150 200 — Shear Strength (FV) kPa (■) 50 100 150 200

Water Content (%) WP WL 10 20 30

Groundwater Observations and Standpipe Details

- concrete seal and protective cover
- bentonite seal
- 19 mm pipe
- sand pack
- 1.22 m slotted filter
- August 8, 2006 water level at 2.63 m (Elev. 337.32 m)
- August 8, 2006 water level at 2.91 m (Elev. 337.04 m)
- bentonite seal
- sand pack
- 1.52 m slotted filter
- 50 mm pipe

At drilling completion, water level at 6.40 m

Reviewed by: *DN*

Drill Method: *Solid Stem Auger*

Notes:

Field Tech.: *RM*

Sheet: *1 of 1*

Drafted by: *DC(01a)*

Naylor Engineering Associates

Borehole Number: 105

Ground Elevation: *343.82 m*

Project: *P.T. Valeriote Subdivision*

Job No.: *0353G4*

Location: *Cityview Drive, Guelph, Ontario*

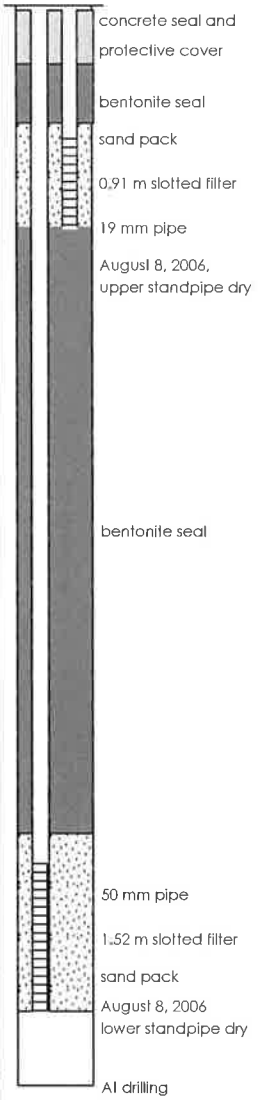
Drill Date: *July 31, 2006*

Depth (m)	Description	Elevation (m)	Number	Type	N-Value
0.00	Ground Elevation	343.82			
	TOPSOIL: dark brown silt, moist				
1.00	***SILT TILL:*** loose brown silt, some sand, trace clay and gravel, very moist	343.00	1	SS	8
2.00		342.00	2	SS	4
	dense to very dense brown sandy silt		3	SS	34
3.00		341.00	4	SS	50\150mm
4.00		340.00			
	some cobbles				
	grey, moist		5	SS	55\150mm
5.00		339.00			
6.00		338.00	6	SS	70\150mm
7.00		337.00			
8.00		336.00	7	SS	70\150mm
9.00		335.00			
			8	SS	60\150mm
10.00		334.00			
11.00	augering on bedrock or boulder	333.00			
	Borehole terminated at 11.13 m upon auger refusal on bedrock or boulder				
12.00		332.00			

Dynamic Cone (X) 20 40 60 80 — Standard Penetration (●) 20 40 60 80

Shear Strength (PP) kPa (▲) 50 100 150 200 — Shear Strength (FV) kPa (■) 50 100 150 200

Water Content (%) WP WL 10 20 30



Reviewed by: *DN*

Drill Method: *Solid Stem Auger*

Notes: *Bulk sample taken from 1.22 to 2.13 m.*

Field Tech.: *RM*

Sheet: *1 of 1*

Drafted by: *DC(01a)*

Naylor Engineering Associates

Borehole Number: 106

Ground Elevation: *347.25 m*

Project: *P.T. Valeriote Subdivision*

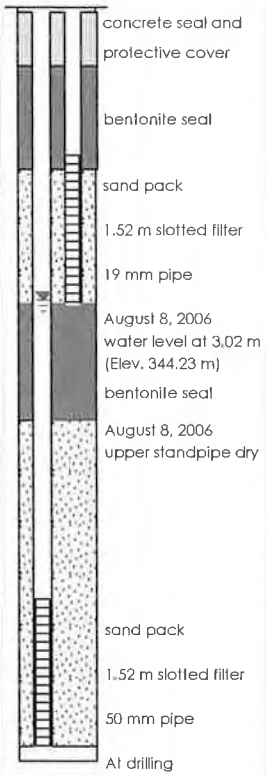
Job No.: *0353G4*

Location: *Cityview Drive, Guelph, Ontario*

Drill Date: *August 2, 2006*

Depth (m)	Description	Elevation (m)	Number	Type	N-Value
0.00	Ground Elevation	347.25			
	TOPSOIL: dark brown silt, moist				
1.00	***SILT TILL:*** compact brown sandy silt, some gravel, trace clay, moist	346.00	1	SS	19
	some cobbles		2	SS	23
2.00	very moist	345.00	3	SS	25
3.00	dense to very dense, moist	344.00	4	SS	50
4.00		343.00			
5.00		342.00	5	SS	*
6.00		341.00	6	SS	40\150mm
7.00		340.00	7	SS	40\150mm
8.00	Borehole terminated at 7.77 m	339.00			
9.00		338.00			
10.00		337.00			
11.00		336.00			
12.00		335.00			

Dynamic Cone (X) 20 40 60 80
Standard Penetration (●) 20 40 60 80
Shear Strength (PP) kPa (▲) 50 100 150 200
Shear Strength (FV) kPa (■) 50 100 150 200
WP WL
Water Content (%) 10 20 30



Reviewed by: *DN*

Field Tech.: *RM*

Drill Method: *Solid Stem Auger*

Sheet: *1 of 1*

Notes: *Bulk sample taken from 1.52 to 3.05 m. *Sampler bouncing on gravel.*

Drafted by: *DC(01a)*

Naylor Engineering Associates

Borehole Number: 107

Ground Elevation: *345.47 m*

Project: *P.T. Valeriote Subdivision*

Job No.: *0353G4*

Location: *Cityview Drive, Guelph, Ontario*

Drill Date: *July 31, 2006*

Depth (m)	Description	Elevation (m)	Sample Number	Sample Type	N-Value
0.00	Ground Elevation	345.47			
	TOPSOIL: dark brown silt, moist				
1.00	***SILT TILL:*** loose brown silt, some sand, trace clay, very moist		1	SS	8
	compact	344.00	2	SS	15
2.00	compact to very dense brown sandy silt, some gravel		3	SS	35\150mm
3.00		343.00	4	SS	50\150mm
	grey, moist	342.00			
4.00					
		341.00	5	SS	*
5.00					
		340.00			
6.00			6	SS	60\150mm
	Borehole terminated at 6.25 m	339.00			
7.00					
		338.00			
8.00					
		337.00			
9.00					
		336.00			
10.00					
		335.00			
11.00					
		334.00			
12.00					

Dynamic Cone: X 20 40 60 80 X

Standard Penetration: ● 20 40 60 80 ●

Shear Strength (PP) kPa: ▲ 50 100 150 200 ▲

Shear Strength (FV) kPa: ■ 50 100 150 200 ■

Water Content (%): WP | WL; 10 20 30

Groundwater Observations and Standpipe Details

- concrete seal and protective cover
- bentonite seal
- sand pack
- 0.76 m slotted filter
- 19 mm pipe
- bentonite seal
- sand pack
- 1.52 m slotted filter
- 50 mm pipe

At drilling completion, dry cave at 6.10 m

August 8, 2006 water level in upper standpipe at 1.05 m (Elev. 344.42 m) water level in lower standpipe at 3.20 m (Elev. 342.27 m)

Reviewed by: *DN*

Drill Method: *Solid Stem Auger*

Notes: * *Sampler bouncing on gravel.*

Field Tech.: *RM*

Sheet: *1 of 1*

Drafted by: *DC(01a)*

Naylor Engineering Associates

Borehole Number: 108

Ground Elevation: *342.70 m*

Project: *P.T. Valeriote Subdivision*

Job No.: *0353G4*

Location: *Cityview Drive, Guelph, Ontario*

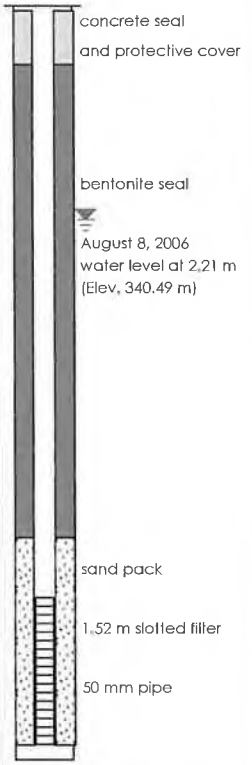
Drill Date: *July 31, 2006*

Depth (m)	Description	Elevation (m)	Number	Type	N-Value
0.00	Ground Elevation	342.70			
	TOPSOIL: dark brown silt, moist				
1.00	***SILT TILL:*** compact brown silt, some sand, gravel and clay, moist	342.00	1	SS	19
2.00		341.00	2	SS	24
	dense to very dense, trace clay, moist	340.00	3	SS	31
3.00	some cobbles				
4.00	grey, moist	339.00	4	SS	45\150mm
		338.00	5	SS	45\125mm
5.00		337.00			
6.00			6	SS	58\150mm
7.00		336.00			
		335.00	7	SS	65\150mm
8.00	Borehole terminated at 7.77 m	334.00			
9.00		333.00			
10.00		332.00			
11.00		331.00			
12.00					

Dynamic Cone: X 20 40 60 80 X
Standard Penetration: ● 20 40 60 80 ●

Shear Strength (PP) kPa: ▲ 50 100 150 200 ▲
Shear Strength (FV) kPa: ■ 50 100 150 200 ■

WP WL
Water Content (%): 10 20 30



Reviewed by: *DN*

Drill Method: *Solid Stem Auger*

Notes: *Bulk sample taken from 1.52 to 3.05 m.*

Field Tech.: *RM*

Sheet: *1 of 1*

Drafted by: *DC(01a)*

Naylor Engineering Associates Ltd.

Borehole Number: 109

Ground Elevation: *326.19 m*

Project: *P.T. Valeriote Subdivision*

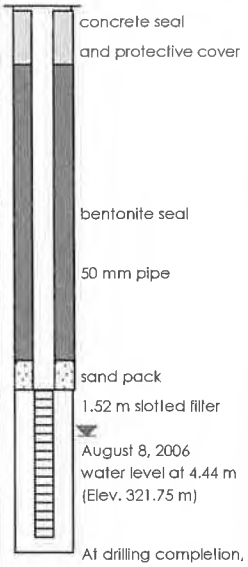
Job No.: *0353G4*

Location: *Cityview Drive, Guelph, Ontario*

Drill Date: *August 1, 2006*

Depth (m)	Description	Symbol	Elevation (m)	SAMPLE Number	Type	N-Value
0.00	Ground Elevation		326.19			
	TOPSOIL: dark brown silt, moist					
1.00	**SAND AND GRAVEL:** very dense brown sand and gravel, frequent cobbles and boulders, some silt, damp		325.00	1	SS	55
2.00				2	SS	30\150mm
			324.00	3	SS	*
3.00			323.00	4	SS	*
4.00	saturated		322.00			
5.00	augering on possible bedrock		321.00	5	SS	*
	Borehole terminated at 5.64 m					
6.00			320.00			
7.00			319.00			
8.00			318.00			
9.00			317.00			
10.00			316.00			
11.00			315.00			
12.00			314.00			

Dynamic Cone: X 20 40 60 80 X
Standard Penetration: ● 20 40 60 80 ●
Shear Strength (PP) kPa: ▲ 50 100 150 200 ▲
Shear Strength (FV) kPa: ■ 50 100 150 200 ■
WP WL
Water Content (%): 10 20 30



Reviewed by: *DN*

Drill Method: *Solid Stem Auger*

Notes: * *Sampler bouncing on gravel.*

Field Tech.: *RM*

Sheet: *1 of 1*

Drafted by: *DC(01a)*

Naylor Engineering Associates Ltd.

Borehole Number: 110

Ground Elevation: *323.60 m*

Project: *P.T. Valeriote Subdivision*

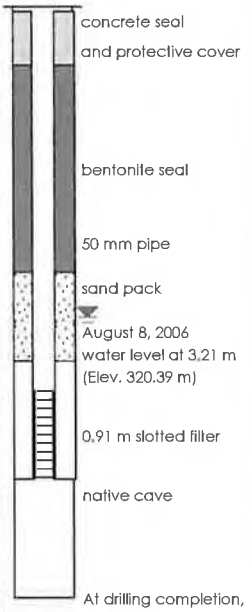
Job No.: *0353G4*

Location: *Cityview Drive, Guelph, Ontario*

Drill Date: *August 1, 2006*

Depth (m)	Description	Elevation (m)	Number	Type	N-Value
0.00	Ground Elevation	323.60			
0.00	***TOPSOIL:*** dark brown silt, moist				
1.00	***SAND AND GRAVEL:*** very dense brown sand and gravel, frequent cobbles and boulders, some silt, damp	323.00	1	SS	40\150mm
		322.00	2	SS	52
2.00					
		321.00	3	SS	35\150mm
3.00	saturated				
	some silt		4	SS	*
4.00		320.00			
		319.00	5	SS	55\150mm
5.00					
6.00	Borehole terminated at 6.10 m	318.00			
		317.00			
7.00					
		316.00			
8.00					
		315.00			
9.00					
		314.00			
10.00					
		313.00			
11.00					
		312.00			
12.00					

Dynamic Cone (X) 20 40 60 80
Standard Penetration (●) 20 40 60 80
Shear Strength (PP) kPa (▲) 50 100 150 200
Shear Strength (FV) kPa (■) 50 100 150 200
Water Content (%) WP WL 10 20 30



Reviewed by: *DN*

Drill Method: *Solid Stem Auger*

Notes: * *Sampler bouncing on gravel.*

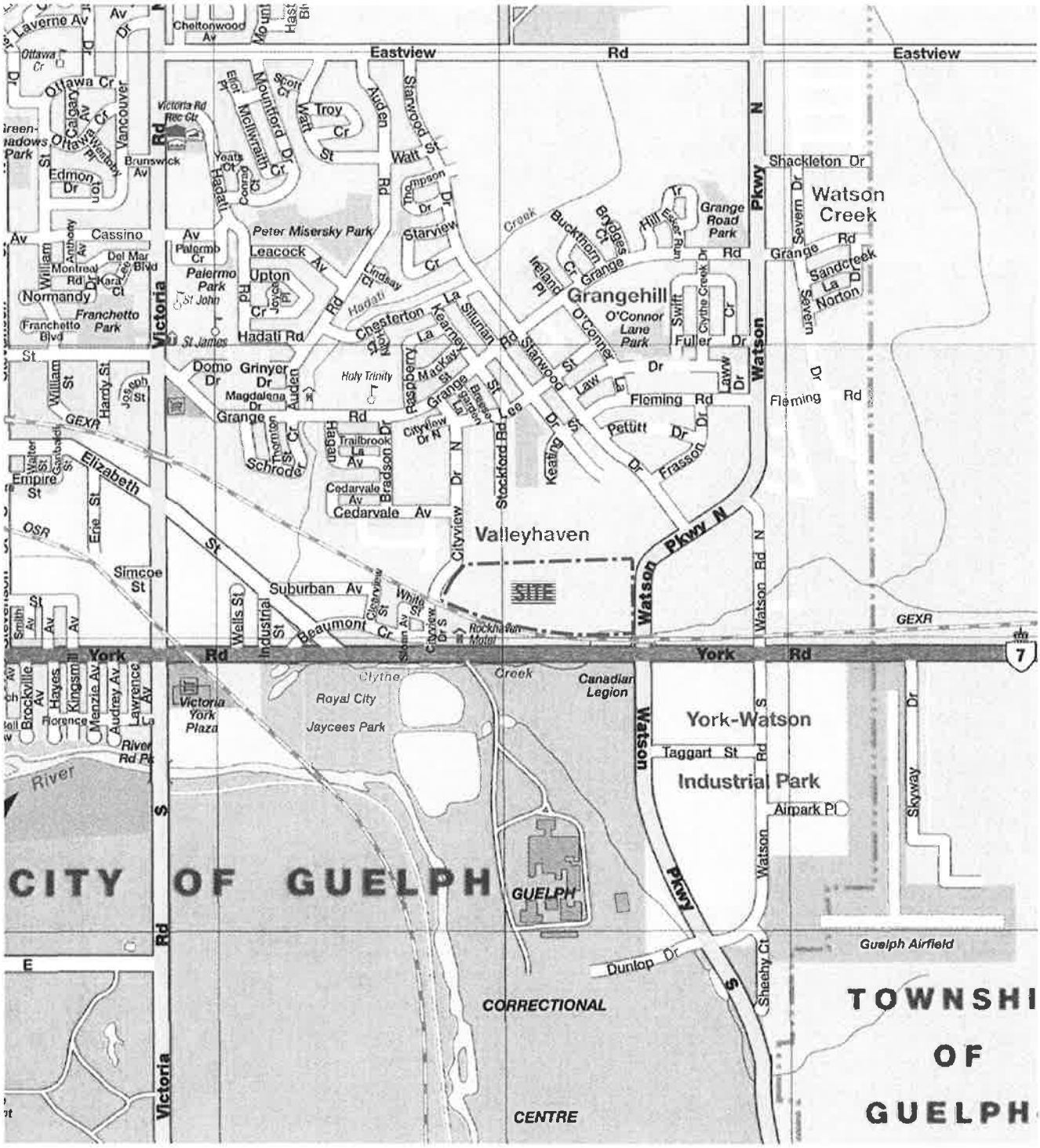
Field Tech.: *RM*

Sheet: *1 of 1*

Drafted by: *DC(01a)*

No.	Revisions	Date
0	**Report Issued**	**Sept. 2006**
1		
2		
3		

NORTH



Drawing Reference: Base drawing from page 61 of MapArt's Kitchener-Waterloo Map Book (2006).

P.T. Valeriote Subdivision

Cityview Drive

Guelph, Ontario

Naylor Engineering Associates Ltd
CONSULTING ENGINEERS

LOCATION PLAN

Date	Scale	Job No.	Drawing No.
Sept. 2006	**1:20000**	**0353G4**	**1**

F:\0353\0353G4\0353G4_01.dwg
August 14, 2006
(dc)



Legend

- Borehole Location
- EL.323.60 Ground Surface Elevation (m)
- Handhole Location
- 400 Handhole Depth (mm)
- A A' Slope Stability Line (see Drawing 3)
- Top of Slope
- Total Development Setback Line

Drawing Reference: Base drawing provided by City of Guelph.

Note:
Locations of site features in this drawing are approximate based on available information. Exact locations must be verified in the field.

No.	Revisions	Date
0	**Report Issued**	**Sept. 2006**
1	**Report Revised**	**Jan. 2012**
2		
3		

NORTH

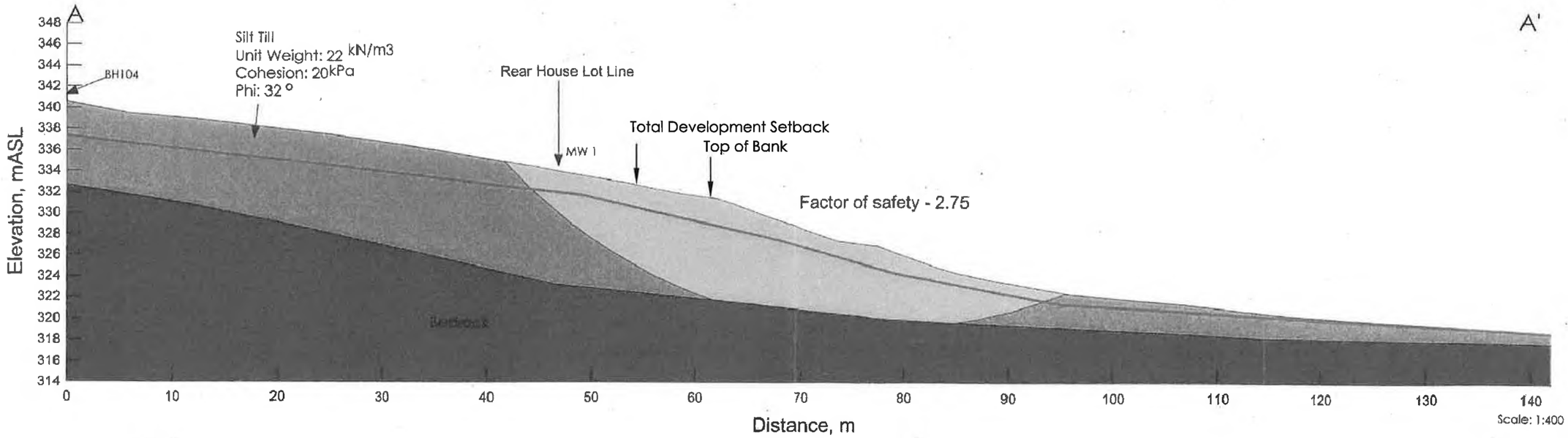
Naylor Engineering Associates Ltd.
CONSULTING ENGINEERS

P.T. Valeriote Subdivision
Cityview Drive
Guelph, Ontario

SITE PLAN

Date	Scale	Job No.	Drawing No.
Sept. 2006	**1:2000**	**0353G4**	**2**

F:\0353\0353G4\0353G4_02.dwg
August 31, 2006 (SR)



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September 8, 2006 (SR)

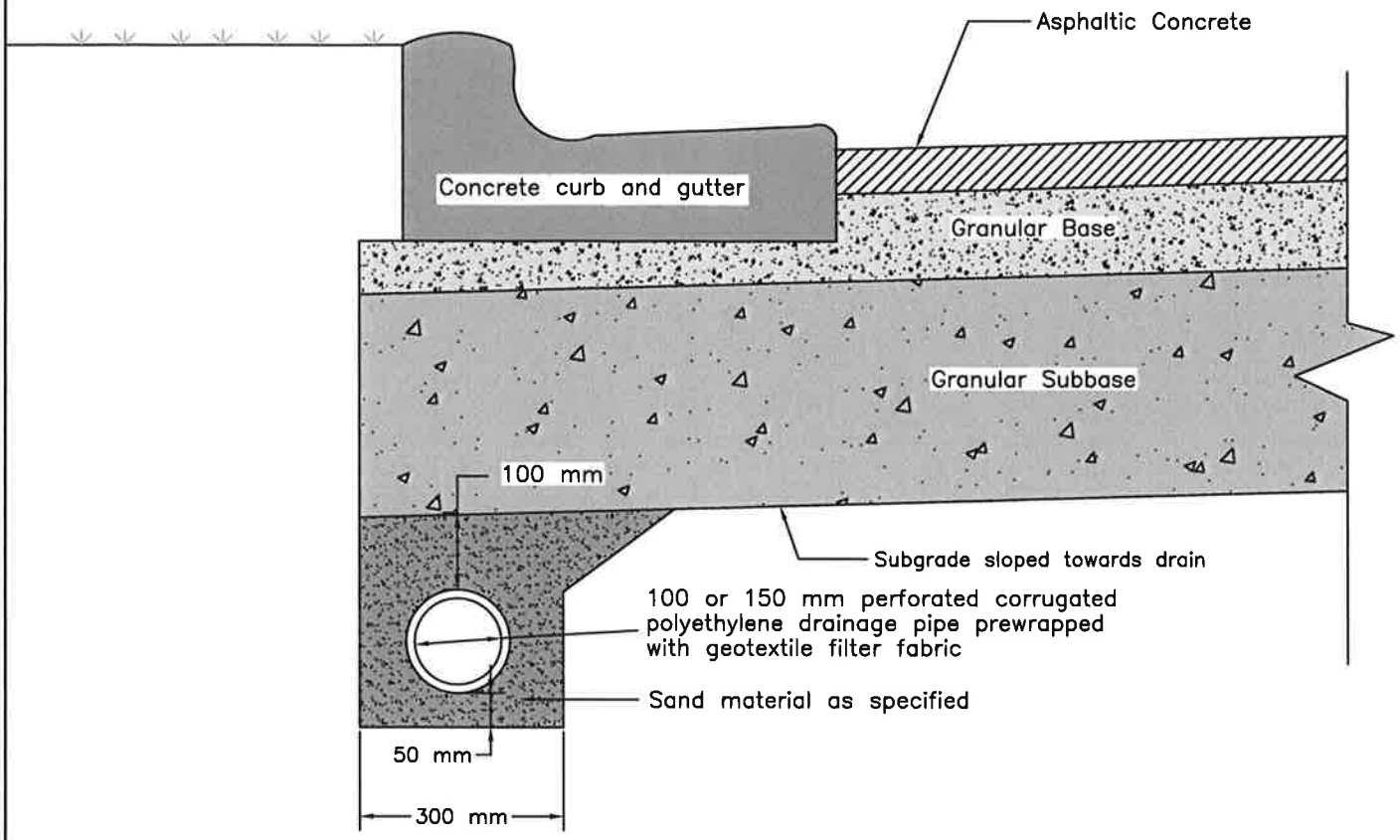
No.	Revisions	Date
0	**Report issued**	**Sept. 2006**
1		
2		
3		

Naylor Engineering Associates Ltd.
CONSULTING ENGINEERS

P.T. Valeriote Subdivision
Cityview Drive
Guelph, Ontario

SLOPE STABILITY A - A'

Date	Scale	Job No.	Drawing No.
Sept. 2006	**1:400**	**0353G4**	**3**



GENERAL REQUIREMENTS FOR PAVEMENT SUBDRAINS

1. Perforated corrugated polyethylene drainage pipe shall meet the requirements of OPSS 1840.

2. Pipe filter fabric conforming to OPSS 1860 for geotextile Class 1 with a filtration opening size of 150 to 450 microns shall be supplied on all sections of perforated pipe.

3. The open upstream ends of pipes should be capped.

4. Subdrain pipes to be set on at least 1% grade draining to a positive frost-free outlet. If the subdrains are outletted to a ditch then the last 1.5 m of the outlet pipe should consist of a corrugated galvanized steel pipe equipped with a rodent gate.

5. Bedding and backfill material shall be concrete sand meeting the gradation requirements of OPSS 1002 (Fine Aggregate for Concrete).

Naylor Engineering Associates
CONSULTING ENGINEERS

TYPICAL PAVEMENT SUBDRAIN DETAIL

Date	Scale	Job No.	Drawing No.
Sept. 2006	NTS	0353G4	4

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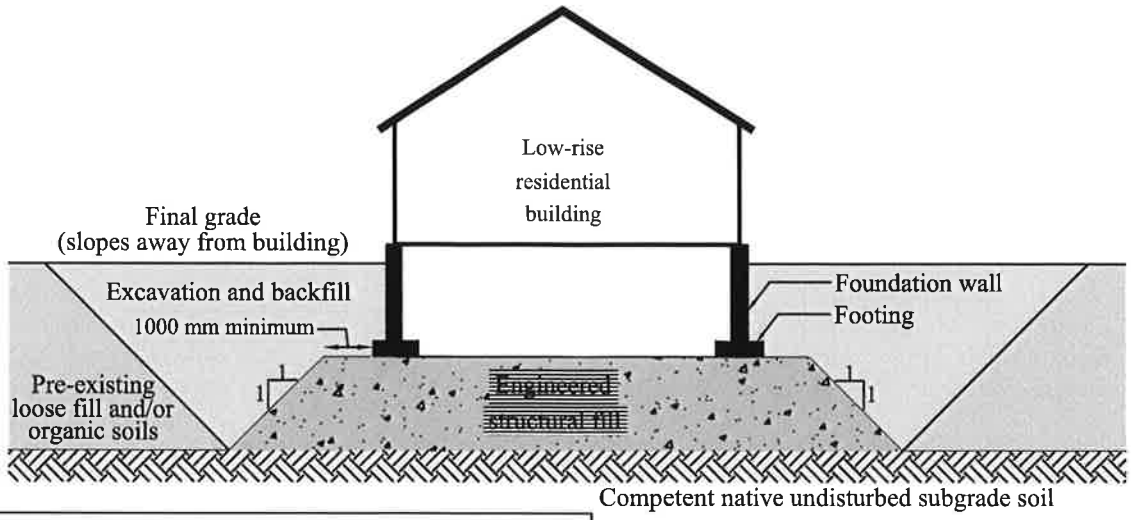
September 12, 2006 (SR)

ENGINEERED STRUCTURAL FILL PAD



GENERAL REQUIREMENTS FOR ENGINEERED STRUCTURAL FILL

1. The area must be excavated of all pre-existing loose fill, topsoil, and/or organic soil until competent native undisturbed soil is reached.

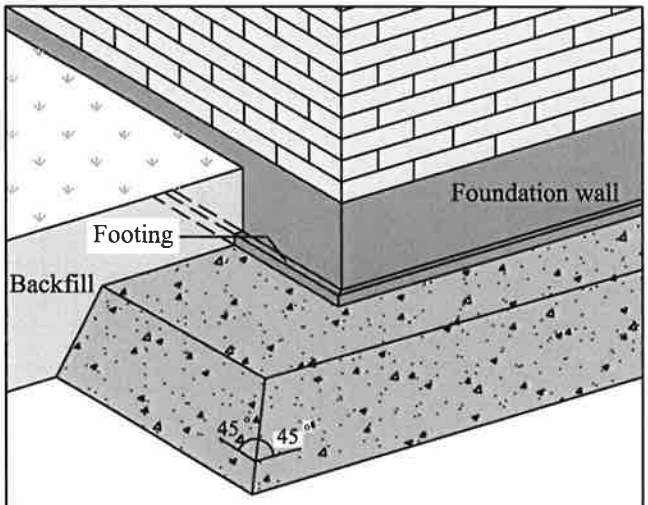
2. The excavation should allow for the structural fill to extend 1000 mm beyond the outside edge of the building footings and down to the approved subgrade soil at a slope of 1 horizontal to 1 vertical (45°).

3. The subgrade below the engineered fill should be inspected and approved by a geotechnical engineer prior to fill construction. Fill placement and compaction operations to be carried out under full-time geotechnical supervision.

4. The structural fill should comprise sand and gravel aggregate placed in 300 mm thick lifts and compacted to at least 98% Standard Proctor Maximum Dry Density (SPMDD). The exterior backfill should consist of approved inorganic soil also placed in 300 mm thick lifts and compacted to minimum 95% SPMDD.

5. All excavations must be carried out in conformance with the current Ontario Occupational Health and Safety Act and Regulations 213/91 for construction projects.

6. Exterior footings must be provided with minimum 1.2 m of soil cover for frost protection.



Naylor Engineering Associates
CONSULTING ENGINEERS

TYPICAL STRUCTURAL FILL PAD DETAIL

Date	Scale	Job No.	Drawing No.
Sept. 2006	NTS	0353G4	5

F:\0353\0353G4\0353G4_05.dwg
September 12, 2006 (SR)

APPENDIX B:

GROUNDWATER LEVEL MEASUREMENTS,
GM BLUEPLAN ENGINEERING LIMITED

Table 1
Summary of Groundwater Elevations

Well ID	TOC Elevation (masl)	8-Aug-06	17-Aug-06	3-Oct-06	22-Jan-08	3-Apr-08	30-May-08	21-Jul-08	15-Oct-08	18-Dec-08	4-Aug-09	19-Oct-09	15-Dec-09	12-Mar-10	17-Jul-10
BH 101	339.376	336.936	336.790	336.981	337.807	338.616	337.405	337.064	337.250	338.366	336.756	335.936	336.636	337.846	337.216
BH 102	335.223	330.983	331.499	330.613	333.468	334.428	333.256	331.396	332.558	334.043	330.583	-	330.624	332.148	332.091
BH 103 U	345.737	-	342.972	-	344.072	345.010	343.652	342.959	343.043	344.407	-	-	-	343.802	343.030
BH 103 L	345.696	341.356	341.167	340.706	342.482	343.735	342.208	341.234	341.594	-	-	-	338.396	342.056	341.566
BH 104 U	340.656	337.126	337.274	-	338.766	339.679	338.362	337.473	337.473	-	-	-	-	337.466	337.725
BH 104 L	340.586	336.936	336.636	336.056	337.587	338.492	336.898	336.096	336.719	338.356	334.576	-	-	337.036	336.544
BH 105 U	344.489	-	-	-	342.544	343.723	342.407	-	342.164	-	-	-	-	342.657	-
BH 105 L	344.414	333.664	334.530	334.854	-	337.335	337.387	335.876	335.840	-	334.824	-	-	334.235	335.785
BH 106 U	347.976	-	344.267	-	346.116	346.916	345.251	344.481	344.598	-	-	-	-	345.451	-
BH 106 L	347.924	344.274	344.203	343.884	346.089	346.846	345.214	344.298	344.533	346.264	-	340.564	343.734	345.409	344.459
BH 107 U	346.211	344.451	344.147	344.651	344.603	frozen	344.691	344.659	344.769	345.301	344.006	343.711	344.836	345.406	344.377
BH 107 L	346.170	342.300	344.710	dry	345.066	345.337	344.700	344.338	344.745	345.230	-	-	-	-	-
BH 108	343.247	340.457	340.289	340.387	341.624	342.119	340.811	340.265	340.384	341.927	339.812	339.217	339.312	341.112	340.335
BH 109	326.829	322.389	322.339	322.421	323.007	324.202	324.126	322.582	322.447	-	-	322.179	322.409	322.619	-
BH 110	324.249	321.039	320.957	321.094	321.647	322.897	320.386	321.135	321.002	-	-	320.709	320.929	321.028	-

Notes:
TOC - Top of Casing
masl - metres above sea level
"-" - no measurement due to well being dry, frozen, inaccessible or not located
Elevations are in masl

Table 1
Summary of Groundwater Elevations

Well ID	TOC Elevation (masl)	27-Sep-10	1-Dec-10	15-Feb-11	13-May-11	22-Jul-11	28-Sept-11	16-Dec-11	16-Feb-12	3-April-12	8-Jun-12	24-Aug-12	10-Oct-12	13-Dec-12	6-Feb-13
BH 101	339.376	336.379	337.164	337.287	338.132	337.071	336.030	338.452	338.080	338.023	337.129	335.967	335.908	338.135	338.011
BH 102	335.223	330.597	330.496	332.385	333.885	331.760	330.585	334.122	333.677	333.506	330.915	330.626	330.614	332.437	333.806
BH 103 U	345.737	-	343.171	-	344.037	-	-	344.297	343.684	343.591	-	-	-	343.561	344.067
BH 103 L	345.696	-	341.598	341.575	343.173	341.628	339.724	342.751	342.494	342.395	341.096	339.126	338.081	341.781	342.649
BH 104 U	340.656	-	336.826	-	338.684	337.405	337.024	338.931	338.475	338.476	337.021	337.005	336.998	338.031	338.723
BH 104 L	340.586	333.358	335.704	336.095	337.560	336.302	333.304	338.194	337.651	337.570	335.969	333.466	333.419	337.120	337.705
BH 105 U	344.489	-	342.397	342.197	342.763	341.886	-	342.833	342.708	342.675	341.884	-	-	342.535	343.108
BH 105 L	344.414	334.214	333.399	335.548	337.018	335.989	334.305	-	336.390	336.352	335.437	333.666	333.279	333.610	336.497
BH 106 U	347.976	-	344.161	344.705	345.885	344.459	344.316	345.445	-	344.854	344.266	344.301	344.314	345.266	345.304
BH 106 L	347.924	341.979	344.512	344.713	345.861	344.380	342.092	345.413	344.900	344.820	344.044	341.359	340.299	345.209	345.246
BH 107 U	346.211	343.763	345.388	344.870	345.030	344.118	343.261	345.393	-	345.102	344.453	343.361	343.256	345.289	-
BH 107 L	346.170	-	-	344.702	345.066	344.123	343.031	345.270	345.088	345.040	344.330	342.484	342.494	345.175	345.017
BH 108	343.247	339.598	340.234	341.471	341.434	340.228	-	-	-	-	-	-	-	-	-
BH 109	326.829	322.254	322.727	322.421	322.870	322.539	321.971	322.985	322.984	323.165	322.496	322.124	322.194	322.675	323.184
BH 110	324.249	320.795	321.097	320.982	321.851	-	320.474	321.523	321.539	321.772	321.052	320.682	320.766	321.275	321.835

Notes:
TOC - Top of Casing
masl - metres above sea level
"-" - no measurement due to well being dry, frozen, inaccessible or not located
Elevations are in masl

Table 1
Summary of Groundwater Elevations

Well ID	TOC Elevation (masl)	18-Apr-13	4-Jun-13	8-Aug-13	29-Oct-13	9-Dec-13	19-Feb-14	28-Apr-14	6-Jun-14	26-Aug-14	24-Nov-14	23-Jan-15	31-Mar-15	21-May-15	6-Jul-15
BH 101	339.376	338.466	337.828	337.681	337.677	338.064	337.792	338.326	337.622	337.026	338.676	337.846	338.302	337.496	337.366
BH 102	335.223	334.172	332.882	332.013	332.012	333.009	332.664	333.799	332.640	-	333.183	332.687	333.400	332.443	332.369
BH 103 U	345.737	344.672	343.211	343.032	343.135	343.278	343.060	344.050	343.252	-	342.978	343.070	343.595	343.112	343.027
BH 103 L	345.696	343.503	341.924	341.665	341.531	342.176	341.999	343.121	342.362	340.666	342.046	342.204	342.662	342.194	341.744
BH 104 U	340.656	339.294	338.202	338.175	337.576	337.986	337.784	338.645	338.064	-	337.421	337.713	338.286	337.539	337.760
BH 104 L	340.586	338.272	337.152	337.366	337.094	337.423	337.150	338.062	337.471	335.534	337.260	337.206	337.619	336.846	337.091
BH 105 U	344.489	343.893	342.760	342.284	342.145	342.476	-	343.322	342.466	-	342.321	342.243	342.512	342.484	342.447
BH 105 L	344.414	337.289	336.624	336.070	335.160	336.139	-	337.022	336.664	334.894	335.766	336.011	335.276	336.302	336.462
BH 106 U	347.976	345.992	344.686	344.413	345.008	345.004	344.660	345.418	344.703	-	345.362	344.633	345.061	344.708	
BH 106 L	347.924	345.920	344.641	344.333	344.980	344.963	344.620	345.382	344.690	343.153	345.412	344.612	345.043	344.654	344.872
BH 107 U	346.211	345.245	345.075	344.844	345.234	345.176	345.160	345.150	344.677	344.081	345.346	rozen at 345.34	-	344.466	344.486
BH 107 L	346.170	345.202	345.142	344.853	345.203	345.185	345.140	345.157	344.698	344.107	345.343	344.912	345.216	344.320	344.920
BH 108	343.247	-	-	-	-	-	-	-	-	-	-	-	-		
BH 109	326.829	323.721	322.994	322.757	322.683	322.716	322.694	323.278	322.911	322.487	322.946	322.697	322.795	322.785	322.827
BH 110	324.249	322.524	321.555	321.436	321.265	321.298	321.253	321.937	321.573	-	321.261	321.307	321.302	321.389	321.555

Notes:
TOC - Top of Casing
masl - metres above sea level
"-" - no measurement due to well being dry, frozen, inaccessible or not located
Elevations are in masl

Table 1
Summary of Groundwater Elevations

Well ID	TOC Elevation (masl)	21-Sep-15	25-Sep-15	9-Feb-16	17-Mar-16	3-May-16	15-Jul-16	15-Sep-16	7-Nov-16	16-Jan-17	13-Mar-17	18-May-17	19-Jul-17	28-Sep-17	28-Nov-17
BH 101	339.376	-	-	338.586	338.681	338.209	336.846	336.570	337.681	338.124	338.058	337.633	337.095	336.120	337.356
BH 102	335.223	-	-	333.895	334.103	333.758	330.653	330.613	330.609	331.946	334.038	333.596	331.913	330.623	330.615
BH 103 U	345.737	-	-	344.172	344.520	344.102	342.897	-	-	344.156	344.462	344.159	342.949	-	-
BH 103 L	345.696	339.666	-	342.889	343.329	343.011	340.806	338.822	337.586*	341.637	342.991	342.779	341.272	339.369	338.546
BH 104 U	340.656	-	-	338.847	339.196	338.766	337.056	-	-	338.773	339.064	338.782	337.702	-	-
BH 104 L	340.586	-	-	337.889	338.248	337.736	337.316	-	-	337.637	337.921	336.782	336.543	-	-
BH 105 U	344.489	-	-	342.999	343.618	343.289	342.219	-	-	342.606	342.606	343.406	342.314	-	-
BH 105 L	344.414	-	-	335.251	336.283	337.154	337.144	333.576	333.324*	-	-	-	336.744	334.797	333.576
BH 106 U	347.976	-	-	345.713	345.983	345.326	344.286	-	-	345.582	345.724	345.406	344.308	-	344.476
BH 106 L	347.924	-	342.986	345.688	345.966	345.324	340.654	340.564	339.669	345.498	345.639	345.332	344.094	341.114	344.412
BH 107 U	346.211	-	343.839	345.236	345.296	345.101	343.401	-	-	345.197	345.000	344.760	-	-	344.323
BH 107 L	346.170	-	-	345.230	-	-	-	342.060	341.175	345.150	345.040	344.880	-	343.003	344.090
BH 108	343.247	-	-	-	-	-	-	-	-	-	-	-	-	-	-
BH 109	326.829	322.233	-	323.084	323.439	323.206	322.809	322.006	322.332	323.521	323.312	323.227	322.621	322.045	322.501
BH 110	324.249	-	322.777	321.635	321.934	321.804	321.879	320.474	320.691	322.228	322.074	322.012	321.314	320.712	321.086

Notes:
TOC - Top of Casing
masl - metres above sea level
"-" - no measurement due to well being dry, frozen, inaccessible or not located
Elevations are in masl

Table 1
Summary of Groundwater Elevations

Well ID	TOC Elevation (masl)	19-Jan-18	5-Apr-18	27-Aug-18	19-Oct-18	17-Dec-18	4-Feb-19	5-Apr-19	18-Jul-19	30-Sep-19	20-Dec-19	16-Mar-20	6-May-20	25-Aug-20	19-Nov-20
BH 101	339.376	337.363	338.506	337.338	337.042	338.114	337.458	338.379	-	336.420	337.791	338.394	337.122	336.898	337.197
BH 102	335.223	330.613	334.407	330.611	330.588	330.578	332.550	334.113	331.097	330.591	331.023	334.181	333.228	330.630	330.616
BH 103 U	345.737	343.442	344.741	-	-	343.235	343.359	344.179	342.902	-	343.620	344.597	343.490	-	-
BH 103 L	345.696	341.559	343.581	339.846	-	341.611	342.025	342.927	341.691	339.516	342.241	343.616	342.376	339.825	338.196
BH 104 U	340.656	338.018	339.259	-	-	337.921	338.166	338.924	337.666	-	338.438	339.181	338.442	-	-
BH 104 L	340.586	336.821	338.106	-	-	336.778	337.093	337.986	336.710	-	337.500	338.266	337.391	333.473	-
BH 105 U	344.489	342.291	343.866	-	-	-	342.619	343.341	342.393	-	342.602	343.734	342.957	-	-
BH 105 L	344.414	-	337.112	334.634	333.399	-	336.060	336.222	336.204	334.305	334.811	336.694	336.541	334.494	-
BH 106 U	347.976	345.176	345.828	-	-	345.231	344.718	345.466	-	-	345.195	345.754	344.699	-	-
BH 106 L	347.924	345.125	345.780	341.790	342.021	345.190	344.663	345.432	344.099	341.099	345.145	345.693	344.648	342.267	340.038
BH 107 U	346.211	-	345.271	-	-	345.170	345.281	345.244	344.218	-	345.001	345.218	344.807	343.520	343.315
BH 107 L	346.170	345.075	345.218	343.120	343.015	345.213	344.943	345.265	344.145	342.925	345.000	345.255	344.872	343.492	343.383
BH 108	343.247	-		-	-	-	-	-	-	-	-	-		-	-
BH 109	326.829	322.896	323.386	-	-	-	322.778	323.396	322.529	322.002	322.804	323.362	322.796	322.346	322.224
BH 110	324.249	321.454	322.098	320.841	320.799	321.365	321.261	322.015	-	320.606	-	-	321.350	320.951	320.786

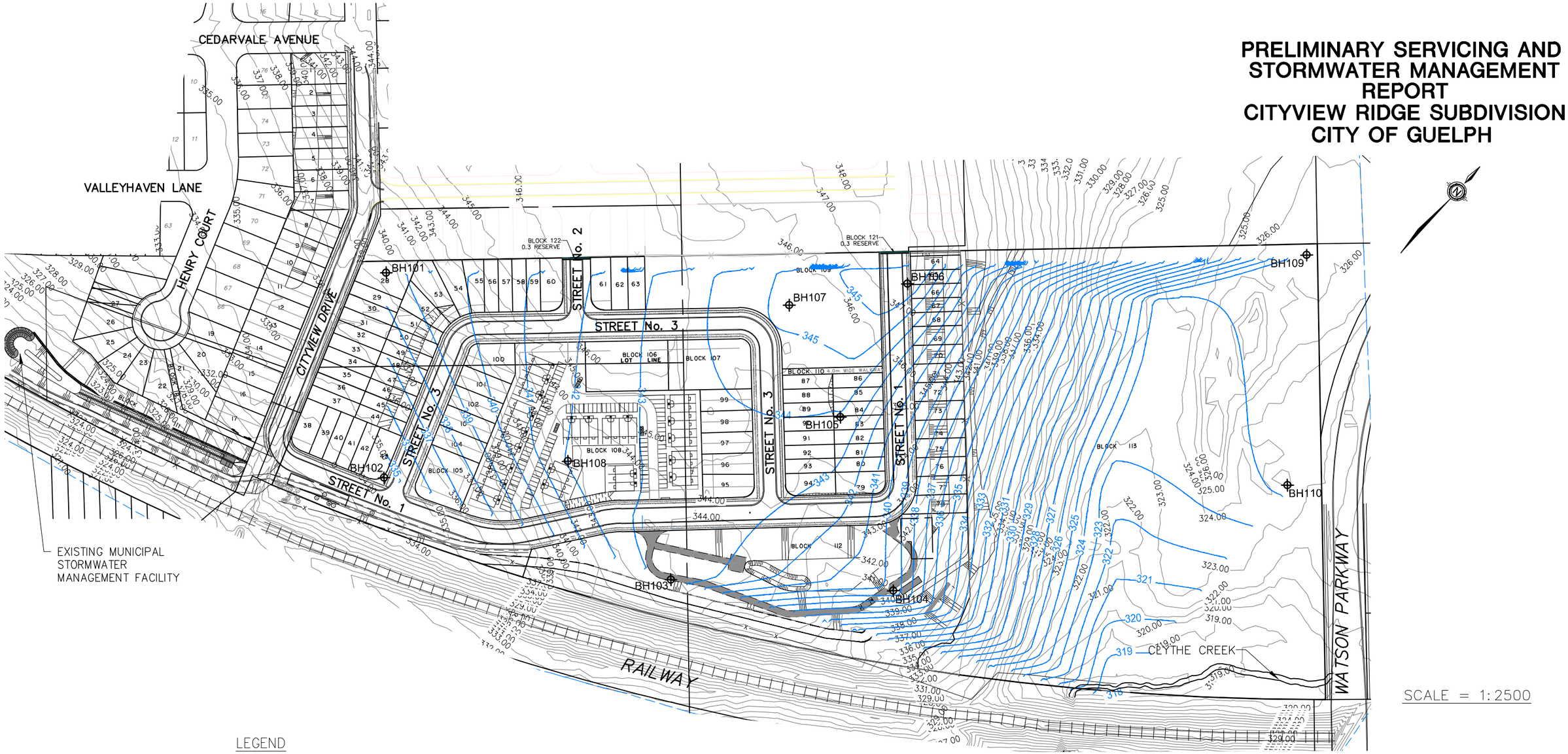
Notes:
TOC - Top of Casing
masl - metres above sea level
"-" - no measurement due to well being dry, frozen, inaccessible or not located
Elevations are in masl

Table 1
Summary of Groundwater Elevations

Well ID	TOC Elevation (masl)	8-Jan-21	19-Mar-21	30-Jun-21	1-Oct-21	3-Dec-21	30-Mar-22	31-May-22	9-Sep-22	21-Nov-22	10-Jan-23	13-Mar-23	SHGWL
BH 101	339.376	338.208	337.774	337.525	337.325	338.137	338.302	337.139	335.416	336.085	338.015	338.316	338.681
BH 102	335.223	330.612	332.980	330.616	330.608	332.666	334.039	332.409	330.620	330.610	330.607	331.680	334.428
BH 103 U	345.737	343.050	343.956	-	-	343.401	344.565	343.052	-	-	-	343.598	345.010
BH 103 L	345.696	340.495	342.379	341.026	340.439	342.068	343.659	342.103	338.683	-	-	341.628	343.735
BH 104 U	340.656	337.813	338.524	337.023	337.251	338.199	339.083	337.942	-	-	-	338.381	339.679
BH 104 L	340.586	336.396	337.329	335.751	334.714	337.391	338.326	337.219	-	-	-	337.036	338.492
BH 105 U	344.489	-	342.662	342.104	342.111	342.532	343.796	342.579	-	-	-	-	343.893
BH 105 L	344.414	-	334.766	335.524	333.976	335.797	338.068	336.818	333.714	-	-	-	338.068
BH 106 U	347.976	345.442	345.102	-	344.564	345.206	345.718	344.381	-	-	344.897	345.686	346.916
BH 106 L	347.924	345.386	345.021	343.448	344.527	345.198	345.669	344.340	340.538	339.659	344.902	345.559	346.846
BH 107 U	346.211	345.185	345.043	344.408	344.793	345.241	345.191	344.548	-	-	344.595	345.140	345.406
BH 107 L	346.170	345.202	345.125	344.148	344.852	345.263	345.205	344.703	342.142	341.458	343.840	345.190	345.343
BH 108	343.247	-	-	-	-	-	-	-	-	-	-	-	342.119
BH 109	326.829	322.819	323.279	322.415	322.662	322.741	323.393	322.606	321.916	321.919	322.741	323.155	324.202
BH 110	324.249	321.314	321.499	320.939	321.254	321.279	322.162	321.211	320.482	320.427	321.075	321.657	322.897

Notes:
TOC - Top of Casing
masl - metres above sea level
"-" - no measurement due to well being dry, frozen, inaccessible or not located
Elevations are in masl

PRELIMINARY SERVICING AND STORMWATER MANAGEMENT REPORT
CITYVIEW RIDGE SUBDIVISION
CITY OF GUELPH



SCALE = 1:2500

LEGEND

- 218.50 — EXISTING CONTOUR
- BH103 — BOREHOLE LOCATION
- 350 — SEASONAL HIGH GROUNDWATER CONTOUR

SEASONAL HIGH GROUNDWATER CONTOURS

Figure No. A

BluePlan ENGINEERING

Plotted On: April 18, 2023 105172-FIGA.dwg

APPENDIX C:

SLOPE STABILITY ASSESSMENT REPORT,
ENGLOBE CORP., 2016
SLOPE STABILITY ASSESSMENT OF SOUTH FACING SLOPE,
ENGLOBE CORP., 2019
UPDATED SLOPE STABILITY ASSESSMENT OF EAST FACING SLOPE,
ENGLOBE CORP., 2020
SLOPE STABILITY ASSESSMENT – SWMP OUTLET SLOPE STABILITY,
JLP SERVICES INC., 2023

February 11, 2016

Cityview Ridge Developments Inc.
c/o Ms. Angela Kroetsch, P.Eng.
GM BluePlan Engineering
330 Trillium Drive, Unit D
Kitchener, Ontario N2E 3J2

Subject: Cityview Ridge Subdivision
Slope Stability Assessment – Lots 62 to 78
Guelph, Ontario
Our ref.: 160-P-0009857-0-01-100-GE-L-0001-00

Dear Ms. Kroetsch:

Englobe Corp. (Englobe) is pleased to provide this letter report for the slope stability analysis recently completed for the proposed Cityview Ridge Subdivision at the location shown on the appended Location Plan, Drawing 1. The work for this investigation was authorized by Mr. Carson Reid of Cityview Ridge Developments Inc. on February 2, 2016.

The area being investigated comprises Lots 62 to 78 along the east side of the proposed development. It is understood that the proposed development will include the placement of fill and construction of retaining walls and a walking trail along the rear of the above mentioned lots.

The purpose of this slope stability analysis is to assess the impact of the proposed structures on the stability of the existing slope at the site.

General Information

The subject site is located on Cityview Drive, Guelph Ontario and the area being investigated is located at the east side of the site, near the top of a slope. A Grand River Conservation Authority (GRCA) regulated wetland is located at the base of the subject slope.

Naylor Engineering Associates Ltd. (NEA) previously completed a geotechnical investigation and slope stability assessment at the subject site including the drilling of three boreholes near the top of the slope (Boreholes BH104 to BH106) to depths of 6.7 to 11.1 m. The findings of this investigation illustrated that the existing slope is comprised of native non-cohesive silt till. Groundwater was found to occur in saturated seams at variable depths within the silt till deposit. A slope stability analysis was carried out along the steepest portion of the slope located in the southeast portion of the site. The results of the slope stability analysis found that the slope had a factor of safety of greater than 1.5. We refer the reader to the geotechnical investigation for further information (NEA, Geotechnical Investigation, P.T. Valeriote Subdivision, Cityview Drive, Guelph, Ontario. 0353G4.R01_Rev, February 2012). The relevant borehole logs of the previous investigation and site plan (NEA – Drawing 2 – Site Plan) illustrating the borehole locations have been appended to this letter.

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It is understood that proposed structures include three retaining walls, swales, houses, a walking trail, and fill placement will occur with the proposed site development, near the top of the slope. The three proposed retaining walls will traverse along the east side of Lots 72 to 78, Lot 67, and along the east side of the walking trail behind Lots 77 and 78 (Gamsby and Mannerow Engineers, Carson Reid Homes Cityview Ridge, Project Number 105-172, Preliminary Site Grading and Drainage Plan [Drawing 2] and Trail Plan and Sections [Drawing 8], Revised March 30, 2015). It is further understood that grades at the rear of Lots 75 to 78 are to be raised by up to 3.5 m with final grades near Elevation 340.5 to 341.0 m. The fill will be partially retained by the retaining walls, beyond which it is to be sloped to the east at an inclination of 3 horizontal to 1 vertical, then blends into the existing grades. The thickness of the fill decreases toward the north, and along Lots 68 to 72, the proposed elevation at the rear of the lots is close to or below the existing grades.

Slope Stability Assessment

Cross-Section B-B' was created based on topographic data provided by Gamsby and Mannerow Engineers and the location of the section is shown on our Drawing 2 – Site Plan, and is illustrated in Drawing 3 – Cross Section B-B'. The cross section was created to represent a worst case scenario, where the slope was the steepest and the proposed additional loading was greatest. Cross-Sections X-X and O-O from the provided topographic plan were also used to assess the slope stability.

The information from the boreholes and cross-sections were used for computer analyses of the slope stability using the Slope/W Program (Morgenstern-Price Method). The soil parameters used in this analysis have been estimated based on the information from the existing boreholes, laboratory testing, as well as local experience and available literature values and are provided in Table 1.

Table 1 Soil Parameters

SOIL MATERIAL	UNIT WEIGHT (kN/m^3)	ANGLE OF INTERNAL FRICTION (º)	COHESION (kPa)
Silt Till	22	32	0

The following assumptions have been made in order to assess the possible impact of the proposed structures on the slope stability at the subject site:

- Soil conditions at the site comprise native silt till deposits. Suspected bedrock was encountered but was not proven by coring during the NEA investigation. As such the soil was assumed to be continuous to Elevation 300 m.
- Foundations will be designed as per the previous geotechnical report (NEA, 0353G4.R01_Rev).
- The proposed retaining wall will be adequately designed for sliding and overturning.
- Grades of the site will be raised (where applicable) with well compacted subgrade or structural fill. The fill is placed in 300 mm thick lifts and compacted to 95% SPMDD (subgrade fill) or 98% SPMDD (structural fill for residential buildings and below retaining walls) at a minimum.
- The proposed fill and retaining wall were assumed to have a unit weight of 24 kN/m3.
- The assumed groundwater depth is 2.6 m at the top of the slope and at ground surface at the GRCA 100-year floodplain.

A slope stability analysis was carried out on the three cross sections for a number of potential failure types. The various failures analyzed included shallow slumping type failure of the slope surface, medium depth rotational failures, and deep rotational failures.

Following the GRCA policy, the design range for the factor of safety must be 1.30 to 1.50 or greater.

The results of the slope stability assessment completed for the slope sections and considering the proposed retaining walls, houses and fill indicate factors of safety in excess of 1.5 for all three of the analyzed cross sections, at which medium depth to deep rotational failures would cause the loss of the structure.

In conclusion, the findings of our slope stability assessment do not show an aggravation of existing slope instabilities or future slope instabilities due to the proposed structures. As well, there is an adequate factor of safety against rotational slope failures that could adversely affect the stability of the proposed structures.

Some maintenance and minor slope repairs should be expected over the life span of the structures, especially along the upper portion of the slope. The placed fill should be vegetated as soon as possible after placement.

Englobe should be contacted if the design of the proposed structures changes (i.e. size, location, or proposed footing depths) in order to provide updated recommendations on slope stability.

We trust that this information is complete and suitable for your present requirements. If you have any questions or require further information, please do not hesitate to contact our office.

Yours very truly,

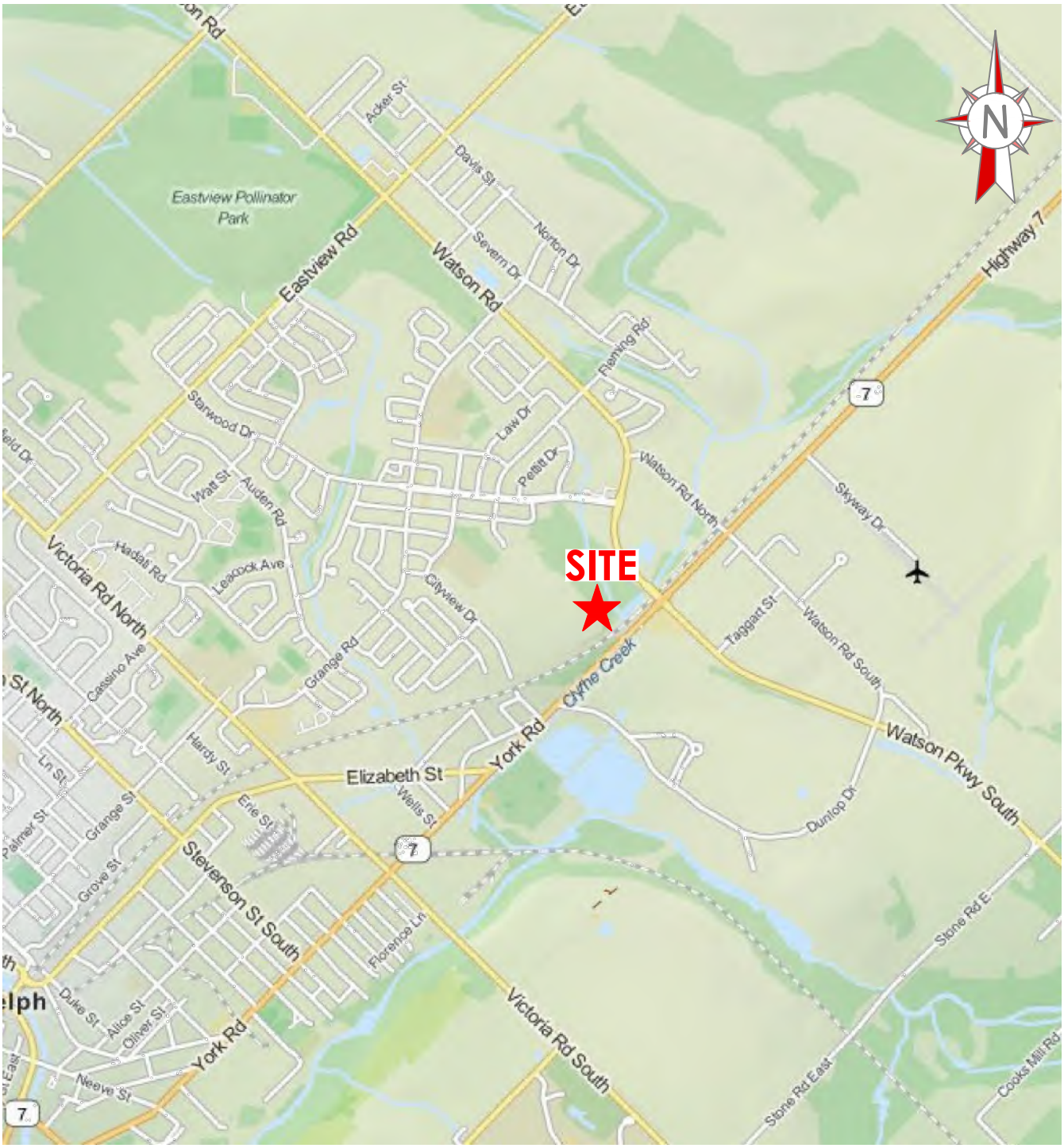


Dan Gonser EIT
Geotechnical Department

J.B. England, P.Eng.
Senior Geotechnical Engineer

jw

Encl. Drawing 1 – Site Plan
Encl. Drawing 2 – Site Plan
Encl. Drawing 3 – Cross-Section A-A'
Encl. NEA – Drawing 2 – Site Plan
Encl. NEA – Boreholes BH104 to BH106



NOTES :
1-REFERENCES : © OpenStreetMap contributors (2016).

0 250 500 750 1000 m
SCALE 1:25000

10 cm
0 1 2 3 4 5

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Project

Cityview Ridge Subdivision
Slope Stability Assessment

Guelph, Ontario

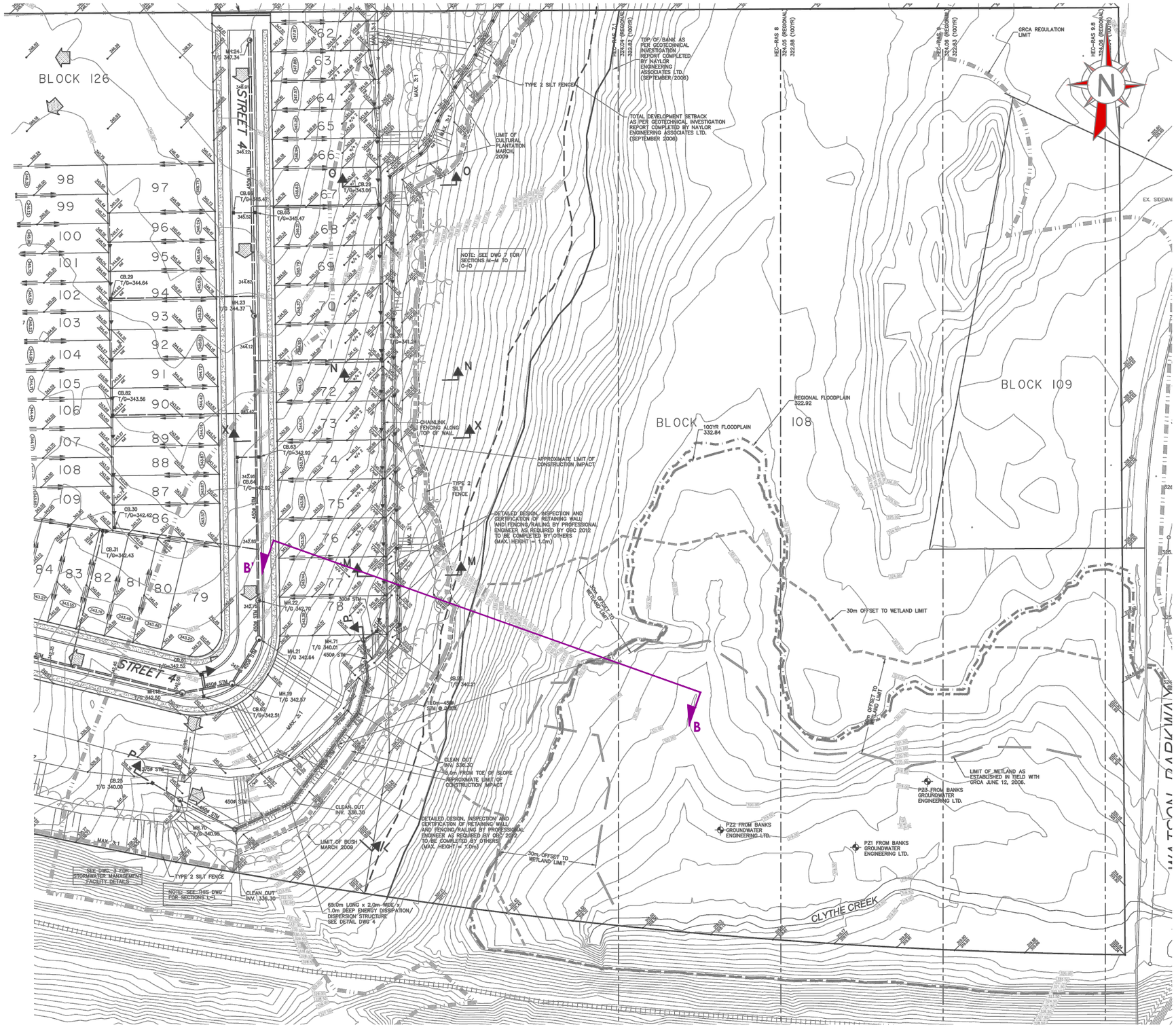
Title

LOCATION PLAN

Englobe Corp.
353, Bridge Street East
Kitchener (Ontario) N2K 2Y5
Telephone : 519.741.1313
Fax : 519.741.5422

Prepared	K. Ashe	Discipline	GEOTECHNICAL	Project manager	D. Gonser
Drawn	K. Ashe	Scale	1 : 25000	Sequence no.	01 of 03
Checked	D. Gonser	Date	2015-02-04		

M. dept.	Project	Disc.	Dwg no.	Rev.
160	P-0009857-0-01-100	GE	001	00



LEGEND :

B B' CROSS SECTION

0 10 20 30 40 50 m

SCALE 1:1250

NOTES :

1-REFERENCES : GAMSBY AND MANNEROW ENGINEERS, Carson Reid Homes Cityview Ridge, Preliminary Grading and Drainage Plan, Project Number 105-172, Drawing Number 2, Revised March 30, 2015.

2-Drawing scale may be distorted due to file conversion and/or copying. Measurements taken from the drawing must be verified in the field.

Project

Cityview Ridge Subdivision
Slope Stability Assessment

Guelph, Ontario

Title

SITE PLAN

Englobe Corp.
353, Bridge Street East
Kitchener (Ontario) N2K 2Y5
Telephone : 519.741.1313
Fax : 519.741.5422

Prepared	K. Ashe	Discipline	GEOTECHNICAL
Drawn	K. Ashe	Scale	1:1250
Checked	D. Gonser	Date	2016-02-04

Project manager: D. Gonser

Sequence no.: 02 of 03

M. dept.	Project	Disc.	Dwg no.	Rev.
160	P-0009857-0-01-100	GE	002	00

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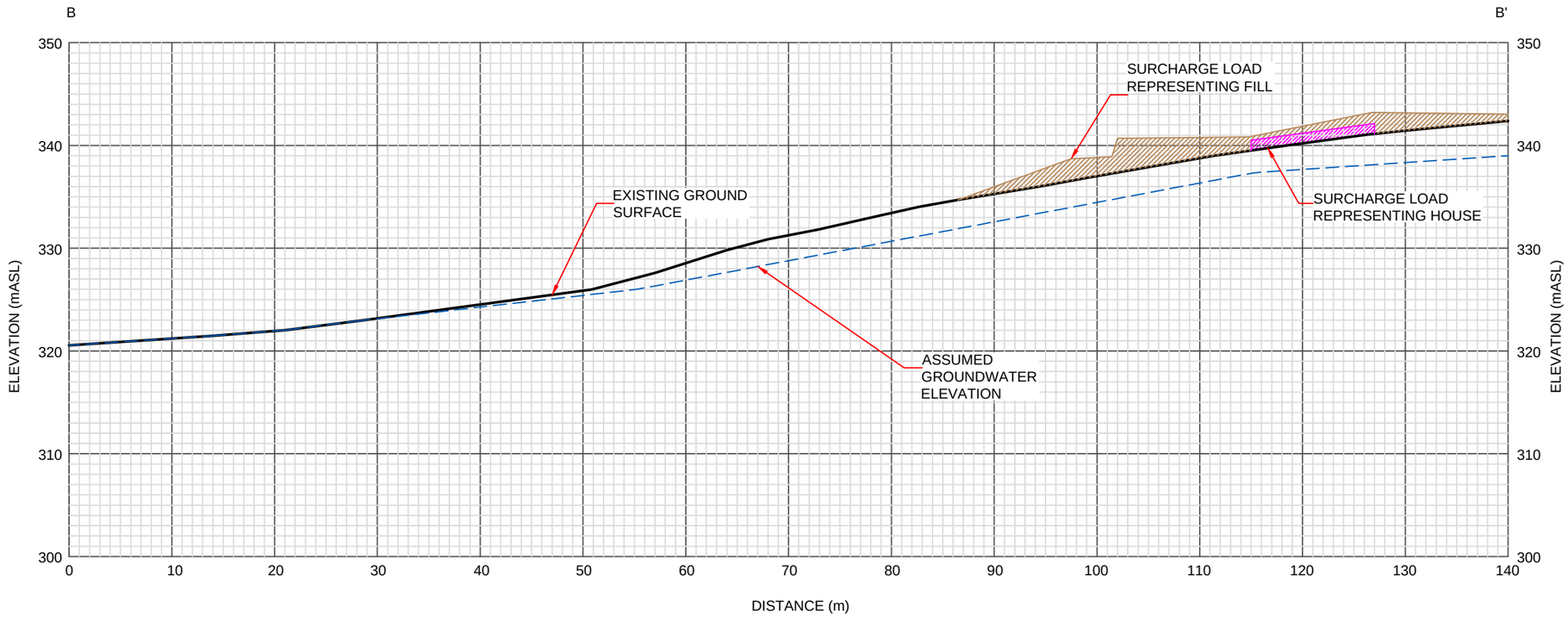

NOTES :

1-Drawing scale may be distorted due to file conversion and/or copying. Measurements taken from the drawing must be verified in the field.

0 5 10 15 m

SCALE 1:500

Project

Cityview Ridge Subdivision
Slope Stability Assessment

Guelph, Ontario

Title

CROSS SECTION B - B'

Englobe Corp.
353, Bridge Street East
Kitchener (Ontario) N2K 2Y5
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Fax : 519.741.5422

Prepared	K. Ashe	Discipline	GEOTECHNICAL
Drawn	K. Ashe	Scale	1 : 500
Checked	D. Gonser	Date	2016-02-04

Project manager: D. Gonser
Sequence no.: 03 of 03

M. dept.	Project	Disc.	Dwg no.	Rev.
160	P-0009857-0-01-100	GE	003	00

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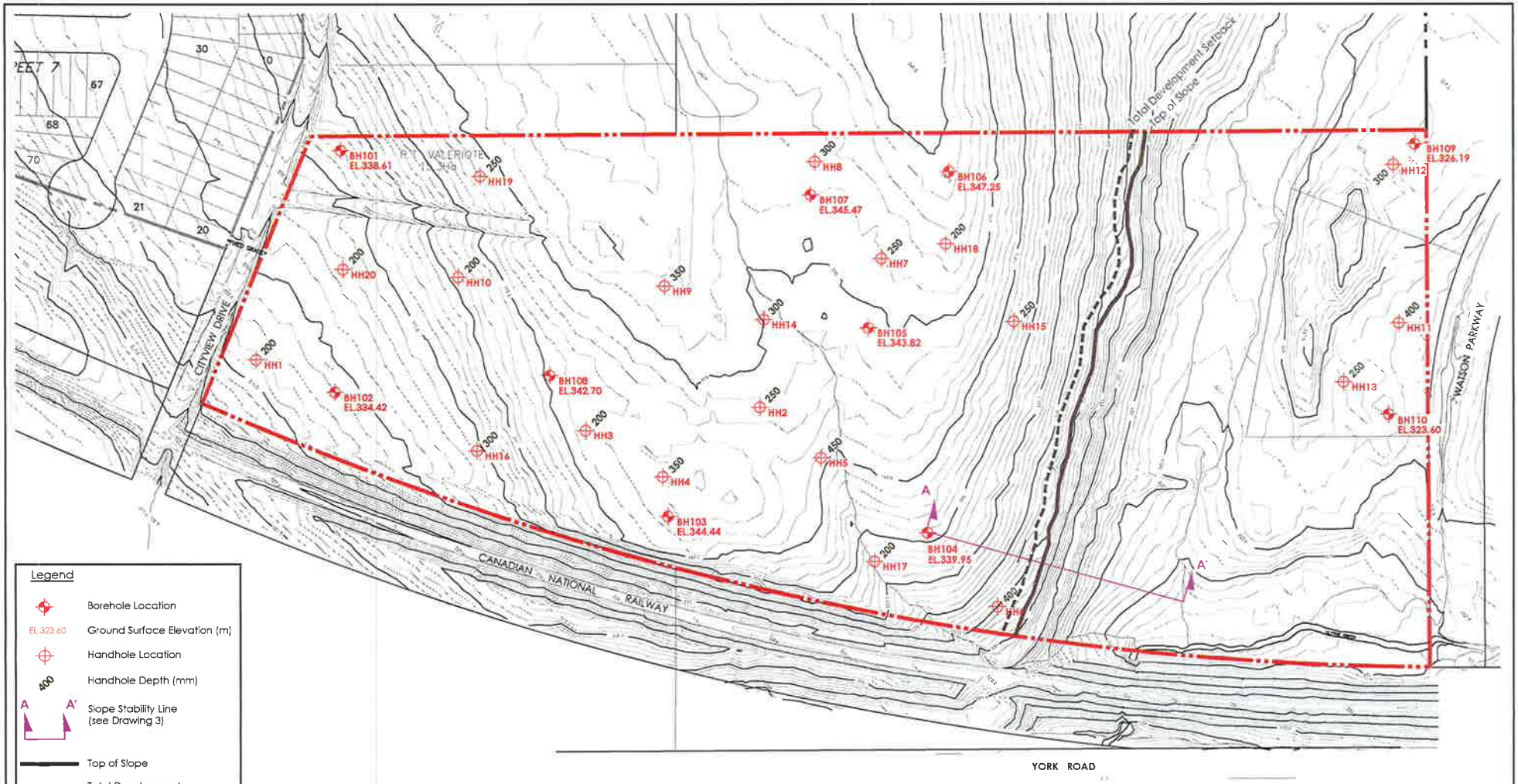


Legend

- Borehole Location
- EL.323.60 Ground Surface Elevation (m)
- Handhole Location
- 400 Handhole Depth (mm)
- A A' Slope Stability Line (see Drawing 3)
- Top of Slope
- Total Development Setback Line

Drawing Reference: Base drawing provided by City of Guelph.

Note:
Locations of site features in this drawing are approximate based on available information. Exact locations must be verified in the field.

No.	Revisions	Date
0	Report Issued	Sept. 2006
1	Report Revised	Jan. 2012
2		
3		

NORTH

Naylor Engineering Associates Ltd
CONSULTING ENGINEERS

P.T. Valeriote Subdivision
Cityview Drive
Guelph, Ontario

SITE PLAN

Date	Scale	Job No.	Drawing No.
Sept. 2006	1:2000	0353G4	2

F:\0353\0353G4\0353G4_02.dwg
August 31, 2006 (SR)

Naylor Engineering Associates Ltd
CONSULTING ENGINEERS

Borehole Number: 104

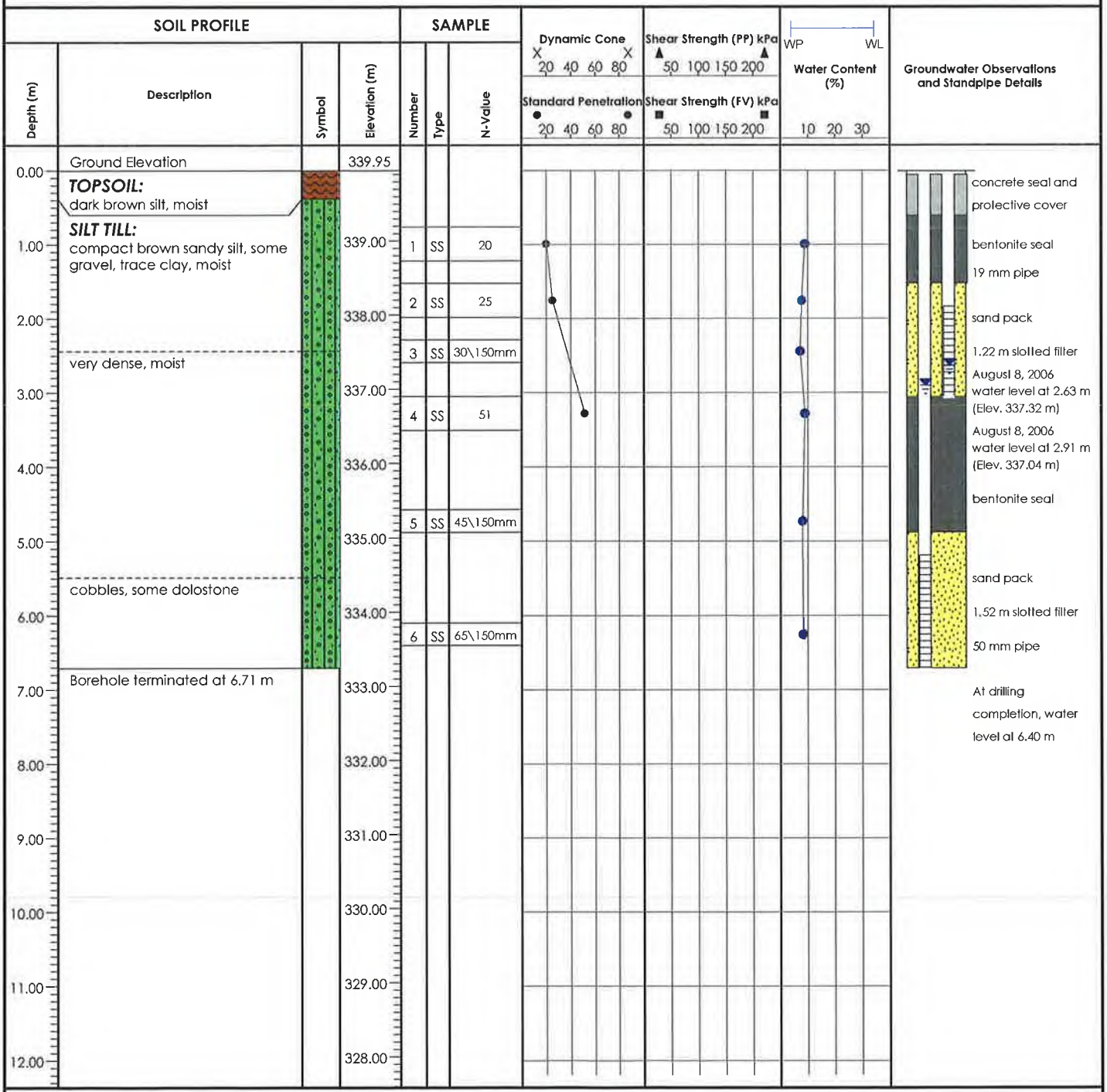
Ground Elevation: *339.95 m*

Project: *P.T. Valeriote Subdivision*

Job No.: *0353G4*

Location: *Cityview Drive, Guelph, Ontario*

Drill Date: *July 31, 2006*



Reviewed by: *DN*

Drill Method: *Solid Stem Auger*

Notes:

Field Tech.: *RM*

Sheet: *1 of 1*

Drafted by: *DC(01a)*

Naylor Engineering Associates Ltd
CONSULTING ENGINEERS

Borehole Number: 105

Ground Elevation: *343.82 m*

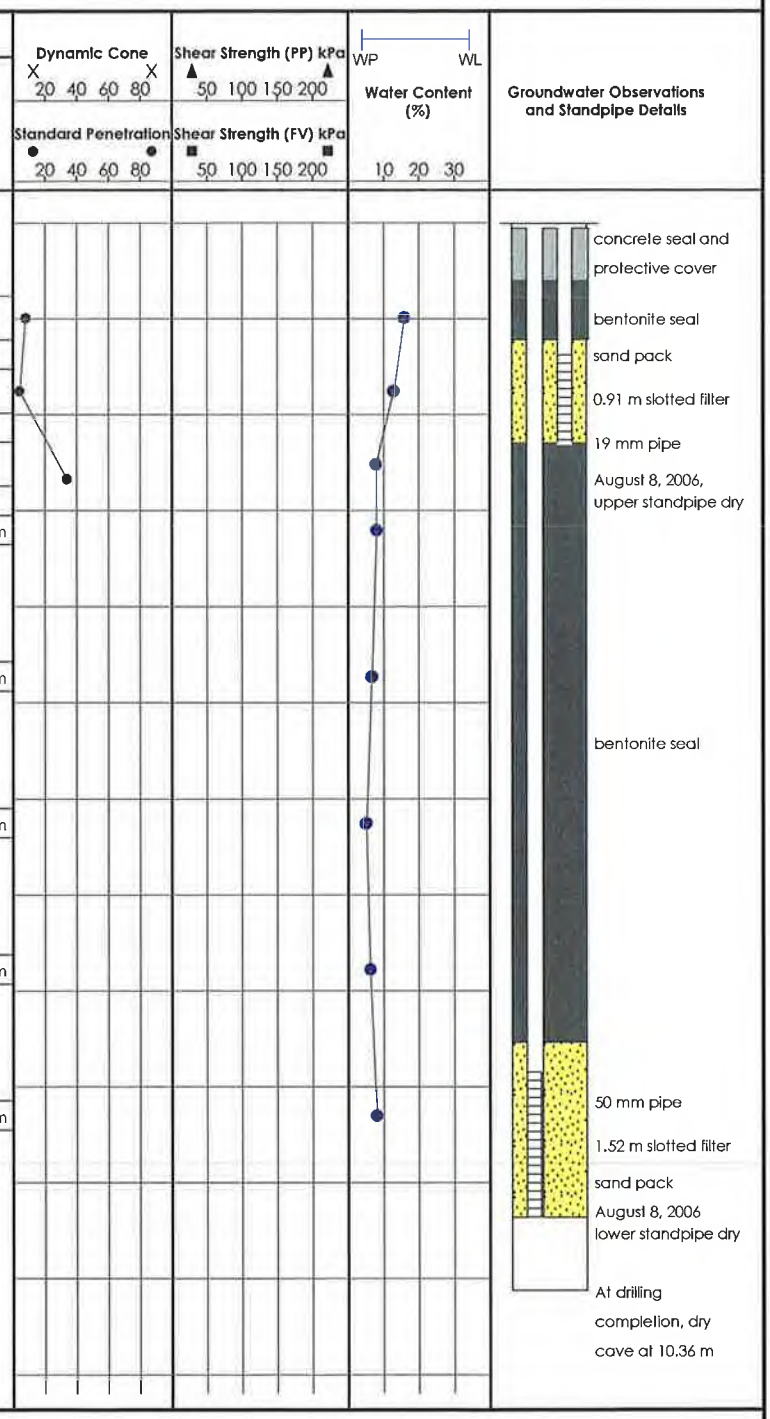
Project: *P.T. Valeriote Subdivision*

Location: *Cityview Drive, Guelph, Ontario*

Job No.: *0353G4*

Drill Date: *July 31, 2006*

Depth (m)	Description	Elevation (m)	Number	Type	N-Value
	Ground Elevation	343.82			
0.00	***TOPSOIL:*** dark brown silt, moist				
1.00	***SILT TILL:*** loose brown silt, some sand, trace clay and gravel, very moist	343.00	1	SS	8
2.00		342.00	2	SS	4
	dense to very dense brown sandy silt		3	SS	34
3.00		341.00	4	SS	50\150mm
4.00		340.00			
	some cobbles				
	grey, moist	339.00	5	SS	55\150mm
5.00					
6.00		338.00	6	SS	70\150mm
7.00		337.00			
8.00		336.00	7	SS	70\150mm
9.00		335.00	8	SS	60\150mm
10.00		334.00			
11.00	augering on bedrock or boulder	333.00			
	Borehole terminated at 11.13 m upon auger refusal on bedrock or boulder	332.00			
12.00					



Reviewed by: *DN*

Drill Method: *Solid Stem Auger*

Notes: *Bulk sample taken from 1.22 to 2.13 m.*

Field Tech.: *RM*

Sheet: *1 of 1*

Drafted by: *DC(01a)*

Naylor Engineering Associates Ltd.
CONSULTING ENGINEERS

Borehole Number: 106

Ground Elevation: *347.25 m*

Project: *P.T. Valeriote Subdivision*

Job No.: *0353G4*

Location: *Cityview Drive, Guelph, Ontario*

Drill Date: *August 2, 2006*

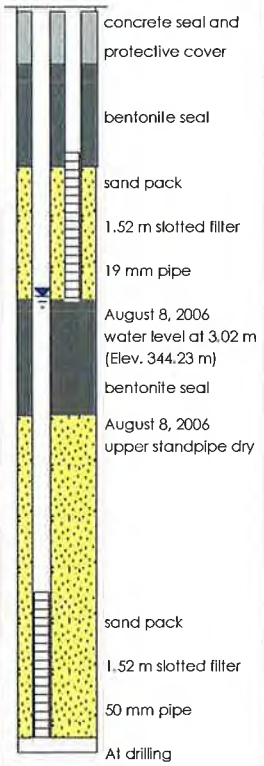
Depth (m)	Description	Elevation (m)	Sample Number	Sample Type	N-Value
0.00	Ground Elevation	347.25			
	TOPSOIL: dark brown silt, moist				
1.00	***SILT TILL:*** compact brown sandy silt, some gravel, trace clay, moist	346.00	1	SS	19
	some cobbles		2	SS	23
2.00	very moist	345.00	3	SS	25
3.00	dense to very dense, moist	344.00	4	SS	50
4.00		343.00			
5.00			5	SS	*
		342.00			
6.00		341.00	6	SS	40\150mm
7.00		340.00	7	SS	40\150mm
8.00	Borehole terminated at 7.77 m	339.00			
9.00		338.00			
10.00		337.00			
11.00		336.00			
12.00		335.00			

Dynamic Cone / Standard Penetration: 20 40 60 80

Shear Strength (PP) kPa / Shear Strength (FV) kPa: 50 100 150 200

Water Content (%): WP WL; 10 20 30

Groundwater Observations and Standpipe Details



Reviewed by: *DN*

Drill Method: *Solid Stem Auger*

Notes: *Bulk sample taken from 1.52 to 3.05 m. *Sampler bouncing on gravel.*

Field Tech.: *RM*

Sheet: *1 of 1*

Drafted by: *DC(01a)*

March 1, 2019

Cityview Ridge Developments Inc.
c/o GM BluePlan Engineering Limited
330 Trillium Drive, Unit D
Kitchener, Ontario N2E 3J2
Attention: Ms. Angela Kroetsch, P.Eng.

Subject: **Slope Stability Assessment of South-Facing Slope**
Cityview Ridge Subdivision
Cityview Drive
Guelph, Ontario
Our ref.: 160-P-0009857-0-01-100-GE-L-0002-00

Ms. Angela Kroetsch:

Englobe Corp. (Englobe) is pleased to provide this letter report for the slope stability assessment completed for the proposed Cityview Ridge Subdivision on Cityview Drive, Guelph. The initial work for this investigation was authorized by Mr. Carson Reid of Cityview Ridge Developments Inc. on January 15, 2018 with additional analyses authorized on February 6, 2019.

The site being investigated comprises the area of the proposed stormwater management (SWM) facility, and adjacent rail corridor to the south of the site. The SWM facility construction will include the placement of fill near the top of the slope towards the east side of the site and cutting of the native soils towards the west side of the site.

The purpose of this slope stability assessment is to analyze the impact of the proposed development on the stability of the existing south slope at the site. Reference is made to Englobe letter 160-P-0009857-0-02-101-L-0001-0B dated April 4, 2018 for findings related to the east slope.

General Information

The subject site is located on Cityview Drive, Guelph Ontario and the area being investigated is located at the south side of the site, near the top of a slope. A rail line is located at the base of the south slope.

Naylor Engineering Associates Ltd. (NEA) previously completed a geotechnical investigation and slope stability assessment at the subject site including drilling of ten boreholes (Boreholes BH101 to BH110) to depths of 5.6 to 11.1 m for the general area of the proposed development. Based on the findings of this investigation, it is assumed that the existing slopes are comprised of native non-cohesive glacial silt till.

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Groundwater was found to occur in saturated seams at variable depths within the silt till deposit. A slope stability analysis was carried out in the southeast portion of the site and the results of the slope stability analysis found that the slope had a factor of safety (FS) of greater than 1.5. We refer the reader to the geotechnical investigation for further information (NEA, Geotechnical Investigation, P.T. Valeriote Subdivision, Cityview Drive, Guelph, Ontario. 0353G4.R01_Rev. February 2012). The relevant borehole logs of the previous investigation are illustrated on Drawing 1 appended to this letter. Englobe recommends that a supplementary borehole investigation be conducted specifically for the purpose of slope stability assessment.

The proposed SWM facility will have a pond bottom at Elevation 339.35 m with a permanent pool water level at Elevation 339.75 m and a design regional storm event water level at Elevation 340.32 m. It is understood that the pond will be constructed with a clay liner to Elevation 340.64 m. It is assumed that the clay liner will be designed and constructed in a manner that the storm water management pond will not increase the moisture content of the underlying soil, causing excessive forces and reducing strength of the soil. Toward the west and central portions of the SWM facility, the existing grades are above the proposed finished grades and material will be cut for construction of the facility. Toward the east portion of the SWM facility, the existing grade is near the proposed pond base and material will placed to construct the berms along the outside of the pond. Based on conversation with GM BluePlan Engineering Limited (GMBP), it is understood that surplus onsite material (silt till) will be reused for construction of the SWM facility.

(Gamsby and Mannerow Engineers, Carson Reid Homes, Cityview Ridge, Project Number 105-172, Preliminary Site Grading and Drainage Plan [Drawings 1 & 2], Stormwater Pond Plan and Sections [Drawing 4), Stormwater Pond Cross-Sections [Drawing 5], and Trail Plan and Sections [Drawing 8], Revised June 6, 2017).

Slope Inspection

Englobe completed a site visit on January 20, 2018 to inspect the existing slope conditions. The slope inspection was carried out based on the guidance provided in the Ontario Ministry of Natural Resources (MNR) document: *Technical Guide, River & Stream Systems: Erosion Hazard Limit* and slope ratings for the south slope was produced in accordance with Table 4.2 of the MNR document. Based on the results of the slope inspection the south slope had a rating of 35 points, indicating Moderate Potential for slope instability.

Slope Stability Assessment

Cross-Section C-C’ through F-F’ were created based on topographic data provided by Gamsby and Mannerow Engineers and the location of the sections are shown on our Drawing 1– Site Plan – South Side. The cross-sections were created to represent worst case scenarios, where the slopes were the steepest and the proposed additional loading was greatest.

Following the GRCA policy, the design range for the FS must be 1.3 to 1.5 or greater. As per our meeting with GMBP on February 4, 2019, the proposed conditions for Cross-Sections C-C' to F-F' were analyzed for a minimum FS of 1.3 and a minimum FS of 1.5 to illustrate the required setback requirements for each FS. Englobe notes that an additional slope inspection during the Spring as well as additional borehole investigation including the installation of monitoring wells near the slope section at SWM facility is recommended if a FS of 1.3 is considered for use in the site plan design. The additional information collected would be analyzed in order to refine the geotechnical model for the cross-sections under discussion. It is further noted that Englobe is not able to comment if CN will permit a FS of 1.3.

The information from the existing boreholes and cross-sections were used for computer analyses of the slope stability using the Slope/W Program (Morgenstern-Price Method). The soil parameters used in this analysis have been estimated based on the information from the existing boreholes, site laboratory testing, local experience, and available literature correlations and are provided in Table 1.

Table 1: Soil Parameters

SOIL MATERIAL	UNIT WEIGHT (kN/m^3)	ANGLE OF INTERNAL FRICTION (°)	COHESION (kPa)
Silt Till, loose	22	32	0
Silt Till, compact	22-23	32	0
Silt Till, dense to very dense	23.3	35	0

Standard Proctor moisture-density testing carried out during the previously referenced NEA indicated that if the soil was compacted to 100% standard Proctor maximum dry density (SPMDD) at the approximate optimum moisture content, the bulk unit weight of the material would be in the range of 22 to 23.3 kN/m^3 and such, this range of unit weights were selected in the analysis.

Based on the gradation analyses carried out on samples of the glacial till during the NEA investigation, the material was found to comprise sand and silt with trace to some gravel, and traces of clay. Typically soils containing trace amounts of clay do not exhibit reliable and consistent cohesive strength, therefore, no cohesion was applied in the analyses.

The angle of internal frictions that were used in the analyses are based on the measured standard penetration testing (SPT) N-values obtained during the NEA investigation. The relative density of the glacial till soils, based on the SPT N-values was found to range from loose to very dense, and increased with depth. The soil layers modelled in the analysis were based on the relative densities as determined by the N-values. The angle of internal frictions that were utilized for each soil layer are based on local experience and laboratory testing performed on projects with similar soil conditions as well as published correlations summarized in the publication *Performance and use of the Standard Penetration Test in Geotechnical Engineering Practice* (McGregor, and Duncan, Centre for Geotechnical Practice and Research, Virginia Polytechnic Institute and State University, October 1998).

Suspected bedrock was encountered but was not proven by coring during the NEA investigation. Based on local area knowledge, bedrock outcrops are present to the south of the site in the area between the railroad tracks, York Road, and Cityview Drive South. Based on available bedrock mapping and water well records, it is anticipated that the bedrock surface is located at depths in excess of 20 m below ground surface to the north of the site. Based on the available data, bedrock is suspected to slope downwards towards the north but reliable data to determine the bedrock elevation on the site is not available and as such the soil was conservatively assumed to be continuous to Elevation 300 m.

The following additional assumptions have been made to assess the possible impact of the proposed structures on the slope stability at the subject site:

- Grades of the site will be raised (where applicable) with well compacted subgrade or structural fill utilizing the onsite glacial till. The fill is placed in 300 mm thick lifts and compacted to 95% SPMDD (subgrade fill) or 98% SPMDD (structural fill for residential buildings and below retaining walls) at a minimum.
- The proposed fill materials were conservatively assumed to exhibit a surcharge load of 23.3 kN/m^3 based on a compaction of 100% SPMDD.
- The assumed groundwater depth along the south-facing slope was modelled under consideration of the groundwater monitoring data provided by GMBP on February 5, 2019 (105-172 Updated_Water_Level_Data_Feb.2019.pdf). The provided groundwater data indicates fluctuations in the groundwater levels across the site with the seasonal high generally recorded during the Spring and localized water elevations near or above the ground surface. For the purpose of this preliminary analysis for the south-facing slopes the recorded high groundwater levels were considered. A supplementary borehole investigation with monitoring wells is recommended, to confirm the assumptions made for the slope stability assessment. It is further recommended that a slope inspection is completed during the Spring, 2019 to identify possible seepage zones within the slope.

A slope stability analysis was carried out on four representative cross-sections to identify critical slip surfaces and potential failure types using computer software (GeoStudio SLOPE/W – Morgenstern-Price Method). The various failures analyzed included shallow slumping type failure of the slope surface, medium depth rotational failures, and deep rotational failures. At each cross-section location, the existing and proposed conditions were modelled to determine the impact of the proposed development on the slope stability. The GeoStudio SLOPE/W results are summarized below in Table 2.

Table 2: Cross-Section Summary

CROSS-SECTION	EXISTING MINIMUM FS	MINIMUM FS UNDER PROPOSED CONDITIONS	STABLE SLOPE SETBACK* FOR FS OF 1.3	STABLE SLOPE SETBACK* FOR FS OF 1.5	EROSION SETBACK
Cross-Section C	1.32	1.32	N/A	9.5 m	N/A
Cross- Section D	1.02	1.20	5.9 m	12.1 m	N/A
Cross- Section E	1.05	1.06	9.1 m	14.1 m	N/A
Cross- Section F	1.33	1.33	N/A	4.6 m	N/A

Note: * Stable Slope Setback refers to setback from proposed top of slope.

The results of the slope stability assessment completed for slope sections CC, DD, EE, and FF, on the south side of the site, indicate the existing minimum FS are below 1.5 and/or 1.3, and therefore a stable slope setback should be applied as per Table 2. In addition to the stable slope setback, the GRCA policy recommends an access allowance ranging from 6 to 15 m and a 6 m access allowance setback is considered suitable for this site. It is noted that as long as access for maintenance to the slopes is provided this access allowance may be excluded from the total development setback. An erosion setback allowance was not considered in the analysis as no watercourse is present near the toe of the existing slope.

The top of slope and development setback lines for FS of 1.5 and 1.3 are shown on the attached Drawing 1. As portions of the proposed development are located beyond the stable slope and development setback limits for a FS of 1.5, the development will need to be modified and the slope should be re-analyzed under the actual proposed conditions when they are finalized. Alternatively, the results for a FS of 1.3 may be used for the site plan of the proposed development provided additional borehole investigation including monitoring wells and site inspection are being completed.

We trust that this information is complete and suitable for your present requirements. If you have any questions or require further information, please do not hesitate to contact our office.

Yours very truly,



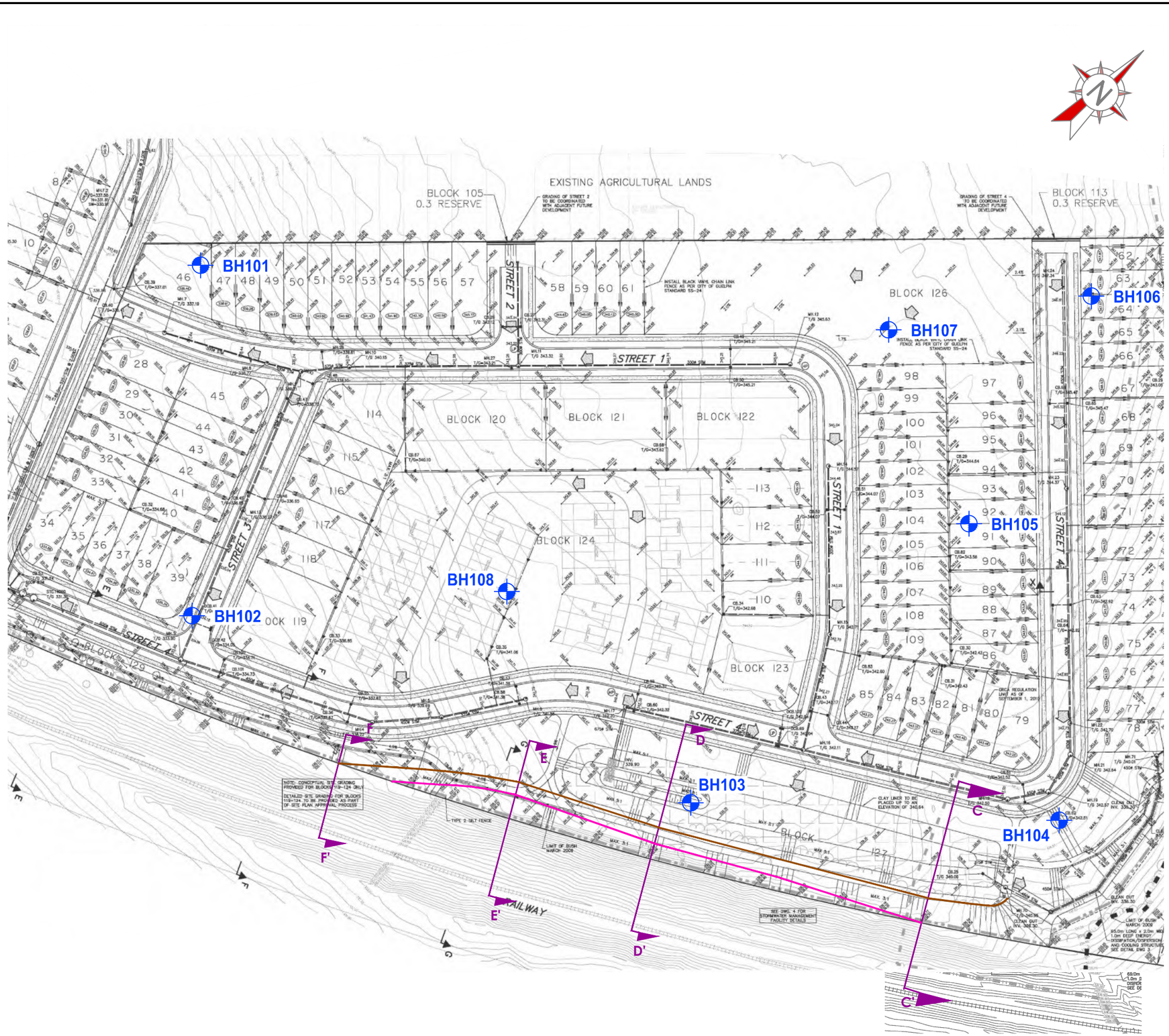
Karen Thrams, Dipl.-Ing., M.Eng, P.Eng.
Geotechnical Engineer



Devi Tulasi, PE, P.Eng.
Director, Geotechnical Engineer

jw

Drawing 1 – Site Plan – South Side



LEGEND :

- MONITORING WELL LOCATION (Previous NEA Investigation, Project No.0353G4, 2006)
- CROSS SECTION
- STABLE SLOPE SETBACK FOR FS=1.3
- STABLE SLOPE SETBACK FOR FS=1.5

0 10 20 30 40 50 m

SCALE 1:1500

NOTES :

1-REFERENCES : GAMSBY AND MANNEROW ENGINEERS, Carson Reid Homes Cityview Ridge, Preliminary Grading and Drainage Plan, Project Number 105-172, Drawing Number 1, Revised June 22, 2017.

2-Drawing scale may be distorted due to file conversion and/or copying. Measurements taken from the drawing must be verified in the field.

Project

Cityview Ridge Subdivision
Slope Stability Assessment

Guelph, Ontario

Title

SOUTH SIDE

Englobe Corp.
353, Bridge Street East
Kitchener (Ontario) N2K 2Y5
Telephone : 519.741.1313
Fax : 519.741.5422

Prepared	E.Ciochon	Discipline	GEOTECHNICAL
Drawn	E.Ciochon	Scale	1:1500
Checked	K.Thrams	Date	2019-02-26

Project manager: K.Thrams

Sequence no.: 01 of 01

M. dept.	Project	Disc.	Dwg no.	Rev.
160	P-0009857-0-02-101	GE	001	00

G:\160\P0009857\Z4_CAD\101\P-0009857-0-02-101_DWG001_L002.DWG

December 14, 2020

Cityview Ridge Developments Inc.
c/o GM BluePlan Engineering Limited
330 Trillium Drive, Unit D
Kitchener, Ontario N2E 3J2
Attention: Ms. Angela Kroetsch, P.Eng.

Subject: **Slope Stability Assessment of East-Facing Slope**
Cityview Ridge Subdivision
Cityview Drive
Guelph, Ontario
Our ref.: 160-P-0009857-0-01-100-GE-L-0001-00

Ms. Angela Kroetsch:

Englobe Corp. (Englobe) is pleased to provide this letter report for the slope stability assessment completed for the proposed Cityview Ridge Subdivision on Cityview Drive, Guelph (Location Plan, Drawing 1). The work for this investigation was authorized by Mr. Carson Reid of Cityview Ridge Developments Inc. on January 15, 2018 with additional analyses authorized on February 6, 2019.

The areas being investigated comprise Lots 62 to 78 along the east side of the proposed development. It is understood that a proposed stormwater management (SWM) facility, and adjacent rail corridor are located to the south of the site. Based on preliminary site grading plan, it is understood that the proposed development will involve the placement of fill and construction of retaining walls and a walking trail along the rear of the above-mentioned lots. In addition, the SWM facility construction will include the placement of fill near the top of the slope towards the east side of the site and cutting of the native soils towards the west side of the site.

The purpose of this slope stability assessment is to analyze the impact of the proposed development on the stability of the existing slope at the east side of the site near Lots 62 to 78 (i.e. Cross Sections OO', BB' and XX' as shown in Drawing 2 of attached appendices).

Reference is made to Englobe letter 160-P-0009857-0-01-100-GE-L-0002-00 dated March 01, 2019 for slope stability findings related to the south slope on this site.

General Information

The subject site is located on Cityview Drive, in Guelph Ontario and the area being investigated is located at the east site of the site, near the top of a slope. It is understood that protected natural heritage features (Clythe Creek and a Grand River Conservation Authority (GRCA) regulated wetland) are located at the base of the east slope and a rail line is located at the base of the south slope.

Naylor Engineering Associates Ltd. (NEA) previously completed a geotechnical investigation and slope stability assessment at the subject site including drilling of ten boreholes (Boreholes BH101 to BH110) to depths of 5.6 to 11.1 m for the general area of the proposed development. Based on the findings of this investigation, it is assumed that the existing slopes are comprised of native non-cohesive glacial silt till. It is recommended that a supplementary borehole investigation be conducted specifically for the purpose of slope stability assessment. Groundwater was found to occur in saturated seams at variable depths within the silt till deposit. A slope stability analysis was carried out in the southeast portion of the site and the results of the slope stability analysis found that the slope had a factor of safety of greater than 1.5. We refer the reader to the geotechnical investigation for further information (NEA, Geotechnical Investigation, P.T. Valeriote Subdivision, Cityview Drive, Guelph, Ontario. 0353G4.R01_Rev. February 2012). The relevant borehole logs of the previous investigation and site plan (NEA – Drawing 2 – Site Plan) illustrating the borehole locations have been appended to this letter.

In 2016, Englobe completed further slope stability analyses on the east side slope near Lots 62 to 78 to assess the proposed placement of fill, construction of retaining walls, and construction of a walking trail. The results of the analyses conducted on the east side slope found that the slopes remained stable under the proposed development loading conditions (Englobe Corp., Cityview Ridge Subdivision, Slope Stability Assessment – Lots 62 – 78, Guelph, Ontario, 160-P-0009857-0-01-100-GE-L-0001-01, February 2016).

It is understood that proposed development includes retaining walls, swales, houses, a walking trail, SWM facility, and fill placement near the top of the slope. The proposed retaining walls will traverse along the east side of Lots 72 to 78 and Lot 67, along the east side of the walking trail behind Lots 77 and 78 and along the east side of the walking trail between lot 78 and the SWM facility.

It is further understood that grades at the rear of Lots 75 to 78 are to be raised by up to 3.5 m with final grades near Elevation 340.5 to 341.0 m. The fill will be partially retained by the retaining walls, beyond which it is to be sloped to the east at an inclination of 3 horizontal to 1 vertical, then blend into the existing grades. The thickness of the fill decreases toward the north, and along Lots 68 to 72, the proposed elevation at the rear of the lots is close to or below the existing grades.

The proposed SWM facility will have a pond bottom at Elevation 339.35 m with a permanent pool water level at Elevation 339.75 m and a design regional storm event water level at Elevation 340.32 m. It is understood that the pond will be constructed with a clay liner to Elevation 340.64 m. It is assumed that the clay liner will be designed and constructed in a manner that the storm water management pond will not increase the moisture content of the underlying soil, causing excessive forces and reducing strength of the soil. Toward the west and central portions of the SWM facility, the existing grades are above the proposed finished grades and material will be cut for construction of the facility. Toward the east portion of the SWM facility, the existing grade is near the proposed pond base and material will placed to construct the berms along the outside of the pond. Based on conversation with GM BluePlan Engineering (GMBP), it is understood that surplus onsite material (silt till) will be reused for construction of the SWM facility.

(Gamsby and Mannerow Engineers, Carson Reid Homes, Cityview Ridge, Project Number 105-172, Preliminary Site Grading and Drainage Plan [Drawings 1 and 2], Stormwater Pond Plan and Sections [Drawing 4), Stormwater Pond Cross-Sections [Drawing 5], and Trail Plan and Sections [Drawing 8], Revised June 6, 2017).

Slope Inspection

Englobe completed a site visit on January 20, 2018 to inspect the existing slope conditions. The slope inspections were carried out based on the guidance provided in the Ontario Ministry of Natural Resources (MNR) document: *Technical Guide, River & Stream Systems: Erosion Hazard Limit* and slope ratings for the east slope was produced in accordance with Table 4.2 of the MNR document. The slope inspection rating chart is attached to this letter and show that the east slope had a rating of 25 points, indicating Slight Potential.

Slope Stability Assessment

For the slope stability analyses, Cross-Sections X-X and O-O were used from the provided topographic plan whereas, the Cross-Section B-B' was created based on topographic data provided by Gamsby and Mannerow Engineers. The locations of the sections are shown on our Drawing 2, Site Plan. These cross sections were created to represent worst case scenarios, where the slopes were the steepest and the proposed additional loading was greatest.

Following the GRCA policy, the design range for the factor of safety (FOS) must be 1.3 to 1.5 or greater. Considering the potential for loss of life or significant injury in the event of slope failure, Englobe recommends that a factor of safety of 1.5 should be targeted as the design factor of safety.

The information from the boreholes and cross-sections were used for computer analyses of the slope stability using the Slope/W Program (Morgenstern-Price Method). The soil parameters used in this analysis have been estimated based on the information from the existing boreholes, site laboratory testing, local experience, and available literature correlations and are provided in Table 1.

Table 1: Soil Parameters

SOIL MATERIAL	UNIT WEIGHT (kN/m^3)	ANGLE OF INTERNAL FRICTION (°)	COHESION (kPa)
Silt Till, loose	22	32	0
Silt Till, compact	22-23	32-33	0
Silt Till, dense to very dense	23.3	35	0

Standard Proctor moisture-density testing carried out during the previously referenced NEA indicated that if the soil was compacted to 100% standard Proctor maximum dry density (SPMDD) at the approximate optimum moisture content, the bulk unit weight of the material would be in the range of 22 to 23.3 kN/m3 and such, this range of unit weights were selected in the analysis.

Based on the gradation analyses carried out on samples of the glacial till during the NEA investigation, the material was found to comprise sand and silt with trace to some gravel, and traces of clay. Typically soils containing trace amounts of clay do not exhibit reliable and consistent cohesive strength, therefore, no cohesion was applied in the analyses.

The angle of internal frictions that were used in the analyses are based on the measured standard penetration testing (SPT) N-values obtained during the NEA investigation. The relative density of the glacial till soils, based on the SPT N-values was found to range from loose to very dense, and increased with depth. The soil layers modelled in the analysis were based on the relative densities as determined by the N-values. The angle of internal frictions that were utilized for each soil layer are based on local experience and laboratory testing performed on projects with similar soil conditions as well as published correlations summarized in the publication *Performance and use of the Standard Penetration Test in Geotechnical Engineering Practice* (McGregor, and Duncan, Centre for Geotechnical Practice and Research, Virginia Polytechnic Institute and State University, October 1998).

Suspected bedrock was encountered but was not proven by coring during the NEA investigation. Based on local area knowledge, bedrock outcrops are present to the south of the site in the area between the railroad tracks, York Road, and Cityview Drive South. Based on available bedrock mapping and water well records, it is anticipated that the bedrock surface is located at depths exceeding 20 m below ground surface to the north of the site. Based on the available data, bedrock is suspected to slope downwards towards the north but reliable data to determine the bedrock elevation on the site is not available and as such the soil was conservatively assumed to be continuous to Elevation 300 m.

The following additional assumptions have been made in order to assess the possible impact of the proposed structures on the slope stability at the subject site:

- Residential foundations will be designed as per the previous NEA geotechnical report and the Ontario Building Code and were modelled to exhibit a surcharge load equivalent to 75 kPa.
- The proposed retaining wall will be adequately designed for sliding and overturning.
- Grades of the site will be raised (where applicable) with well compacted subgrade or structural fill utilizing the onsite glacial till. The fill is placed in 300 mm thick lifts and compacted to 95% SPMDD (general subgrade fill) or 98% SPMDD (structural fill for residential buildings and below retaining walls) at a minimum.
- The proposed fill materials were conservatively assumed to exhibit a surcharge load of 23.3 kN/m^3 based on a compaction of 100% SPMDD.
- The assumed groundwater depth was modelled at the top of the slope to be approximately 0.5 m higher than the groundwater level encountered in the closest relevant NEA monitoring well for each cross section. It is recommended supplementary borehole investigation with monitoring wells, provide current information for the slope stability assessment. For the east side slope, the groundwater was modelled to be at ground surface where the slope met the GRCA 100-year floodplain.

A slope stability analysis was carried out on three cross sections (O-O', X-X' and B-B')for a number of potential failure types using computer software (GeoStudio SLOPE/W – Morgenstern-Price Method). The various failures analyzed included shallow slumping type failure of the slope surface, medium depth rotational failures, and deep rotational failures. At each cross-section location, the existing and proposed conditions were modelled to determine the impact of the proposed development on the slope stability. The GeoStudio SLOPE/W print outs for each analyzed scenario are attached as Slope Figures 1 to 6 and the results are summarized below, and in Table 2.

Table 2: Cross Section Summary

CROSS SECTION	EXISTING MINIMUM FACTOR OF SAFETY	MINIMUM FACTOR OF SAFETY UNDER PROPOSED CONDITIONS	STABLE SLOPE SETBACK FOR FACTOR OF SAFETY OF 1.5	EROSION SETBACK	ACCESS ALLOWANCE SETBACK	TOTAL DEVELOPMENT SETBACK FROM TOP OF SLOPE
Cross Section B-B'	>1.5	>1.5	N/A	1.0 m	6.0 m	7.0 m
Cross Section O-O'	>1.5	>1.5	N/A	1.0 m	6.0 m	7.0 m
Cross Section X-X'	>1.5	>1.5	N/A	1.0 m	6.0 m	7.0 m

The results of the slope stability assessment completed for the slope sections on the east side of the site and considering the proposed retaining walls, houses and fill indicate FOS in excess of 1.5 for all three of the analyzed cross sections on the east side of the site. The slope setbacks applied during the aforementioned NEA investigation, as shown on the attached Drawing 2, are appropriate for the given conditions.

The top of slope and development setback lines are shown on the attached Drawings 2. As portions of the proposed development are located beyond the stable slope and development setback limits, the development will need to be modified and the slope should be analyzed under the actual proposed conditions when they are finalized.

The protected natural heritage features (Clythe Creek and the associated wetlands) are located beyond the toe of the east side slope. As the calculated factor of safety of the slope on the east side is greater than 1.5 under the proposed development conditions, there is a low potential for these areas to be impacted by slope failure.

Retaining Wall Design and Construction Considerations

The construction of the proposed retaining walls and trail along the east side of the site should be feasible with the following considerations. The design of the retaining walls should be performed by a licensed structural engineer. The retaining wall must be designed to resist the lateral earth pressures. For calculating the lateral earth pressure for walls, an active earth pressure coefficient (Ka) of 0.36, an at-rest earth pressure coefficient (Ko) of 0.53 and a soil unit weight of 19 to 21 kN/m3 may be used. An

appropriate safety factor should be employed and recommendations of Section 24 of Canadian Foundation Engineering Manual should be followed.

We recommend that the backfill for the wall comprise clean free-draining granular material such as OPSS.MUNI 1010 Granular B Type 1. The soils encountered on-site are not considered suitable for reuse as retaining wall backfill. The backfill should be placed in thin lifts and compacted to 95% standard Proctor maximum dry density (SPMDD). Over-compaction should be avoided since this may cause excessive lateral earth pressures against the retaining walls. It is recommended that backfilling operations be inspected in order to approve the backfill materials and ensure the proper degree of compaction is being achieved.

Subdrains should be installed behind the retaining wall foundations. The subdrains should comprise minimum 150 mm diameter perforated pipes with filter sock and sand bedding (OPSS Concrete Sand). The subdrains must drain by gravity to a frost free outlet.

The slope behind the retaining wall should be graded with an inclination of 3.0 horizontal to 1.0 vertical or flatter and the soil considered as surcharge in the retaining wall design. The finished slopes should be topsoiled and vegetated as soon as possible after construction to minimize surface erosion. The minimum topsoil thickness should be 100 mm. Some routine maintenance of the slope surfaces may be required to address minor long-term weathering and erosion.

To reduce surface runoff over the retaining wall and down the slope it is recommended that surface runoff be diverted behind the retaining wall and lead to a positive outlet.

We trust that this information is complete and suitable for your present requirements. If you have any questions or require further information, please do not hesitate to contact our office.

Yours very truly,

Puneet Verma, P.Eng.
Geotechnical Engineer

Ala Abu Obeid, M.Sc., P.Eng., PMP
Senior Geotechnical Engineer

Encl.	Drawing 1 – Location Plan
Encl.	Drawing 2 – Site Plan – East Side
Encl.	Slope Figures 1 to 6 – GeoStudio printouts
Encl.	Slope Stability Rating Chart – East Side Slope
Encl.	NEA – Drawing 2 – Site Plan
Encl.	NEA – Figures 1 to 3 – Lab Testing Results
Encl.	NEA – Boreholes BH101 to BH108





Statement of Limitations

The geotechnical recommendations provided in this report are applicable only to the project described in the text and then only if constructed substantially in accordance with the details stated in this report. Since all details of the design may not be known at the time of report preparation, we recommend that we be retained during the final design stage to verify that the geotechnical recommendations have been correctly interpreted in the design. Also, if any further clarification and/or elaboration are needed concerning the geotechnical aspects of the project, Englobe should be contacted. We recommend that we be retained during construction to confirm that the subsurface conditions do not deviate materially from those encountered in the test holes and to ensure that our recommendations are properly understood.

The geotechnical recommendations provided in this report are intended for the use of the owner and its retained designer. They are not intended as specifications or instructions to contractors. Any use which a contractor makes of this report, or decisions made based on it, are the responsibility of the contractor. The contractor must also accept the responsibility for means and methods of construction, seek additional information if required, and draw their own conclusions as to how the subsurface conditions may affect their work. Englobe accepts no responsibility and denies any liability whatsoever for any damages arising from improper or unauthorized use of the report or parts thereof.

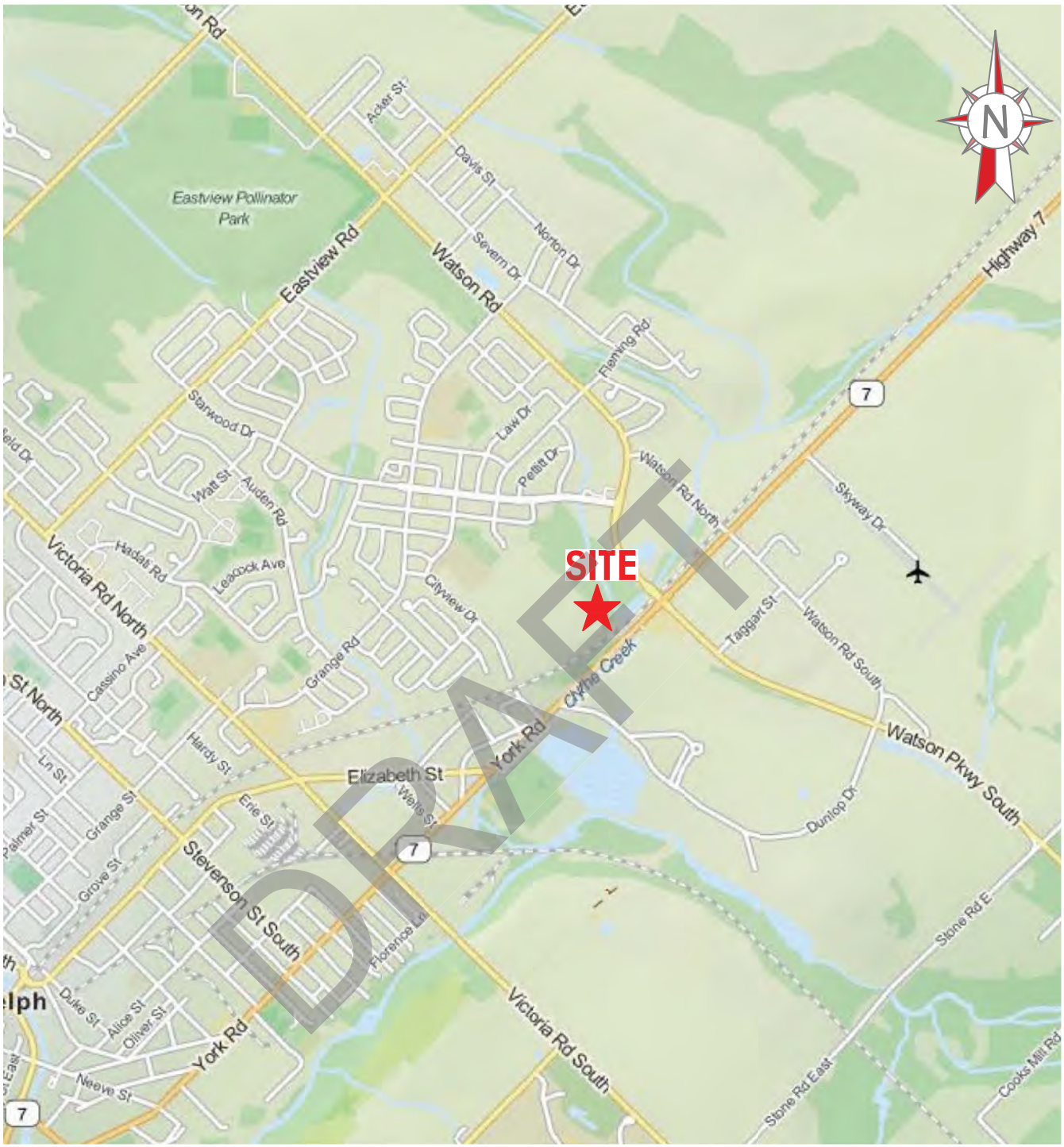
It should be noted that the soil boundaries indicated on the borehole log are inferred from noncontinuous sampling and observations during drilling and should not be interpreted as exact planes of geological change. These boundaries are intended to reflect approximate transition zones for the purpose of geotechnical design. Also, the subsoil and groundwater conditions have been determined at the borehole locations only.

It is further noted that, depending on the time of year the field work was completed, water levels should be expected to vary, perhaps significantly from those observed at the time of this investigation.

It is important to note that the geotechnical investigation involves a limited sampling of the site gathered at specific test hole locations and the conclusions in this report are based on this information gathered. The subsurface geotechnical, hydrogeological, environmental and geologic conditions between and beyond the test holes will differ from those encountered at the test holes. Also, such conditions are not uniform and can vary over time. Should subsurface conditions be encountered which differ materially from those indicated at the test holes, we request that we be notified in order to assess the additional information and determine whether or not changes should be made as a result of the conditions.

The Englobe recommendations are contingent upon provision of a consistently competent, stable subgrade, which is properly drained and free of soft spots and objectionable materials such as organics.

All construction works should only be completed during periods of favourable weather. The need for continuous construction supervision by a qualified, experienced technician, and quality control testing during construction projects cannot be over-emphasized. All materials and construction services required should be in accordance with Ontario Provincial Standard Specifications.



NOTES :
1-REFERENCES : © OpenStreetMap contributors (2018).

0 250 500 750 1000 m
SCALE 1:25000

Project

Cityview Ridge Subdivision
Slope Stability Assessment

Guelph, Ontario

Title

LOCATION PLAN

Englobe Corp.
353, Bridge Street East
Kitchener (Ontario) N2K 2Y5
Telephone : 519.741.1313
Fax : 519.741.5422

Prepared	E.Ciochon	Discipline	GEOTECHNICAL	Project manager	D. Gonser
Drawn	E.Ciochon	Scale	1 : 25000	Sequence no.	01 of 03
Checked	D. Gonser	Date	2018-01-23		

M. dept.	Project	Disc.	Dwg no.	Rev.
160	P-0009857-0-02-101	GE	001	00

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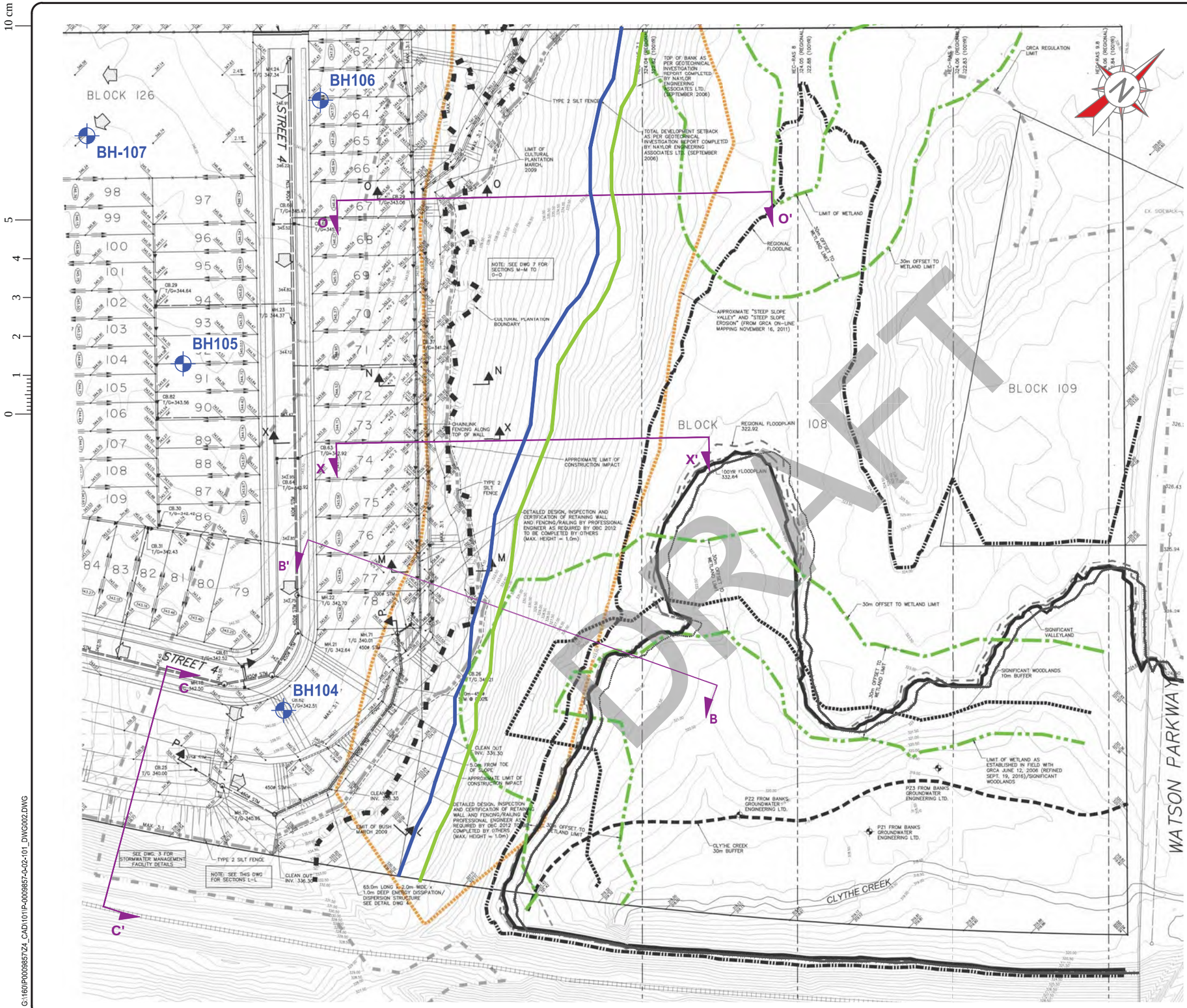

LEGEND :

- MONITORING WELL LOCATION (Previous NEA Investigation, Project No.0353G4, 2006)
- B B' CROSS SECTION
- TOTAL DEVELOPMENT SETBACK
- TOP OF SLOPE

0 10 20 30 40 50 m

SCALE 1:1250

NOTES :

1-REFERENCES : GAMSBY AND MANNEROW ENGINEERS, Carson Reid Homes Cityview Ridge, Preliminary Grading and Drainage Plan, Project Number 105-172, Drawing Number 2, Revised June 22, 2017.

2-Drawing scale may be distorted due to file conversion and/or copying. Measurements taken from the drawing must be verified in the field.

Project

Cityview Ridge Subdivision Slope Stability Assessment

Guelph, Ontario

Title

SITE PLAN

Englobe Corp.
353, Bridge Street East
Kitchener (Ontario) N2K 2Y5
Telephone : 519.741.1313
Fax : 519.741.5422

Prepared	E.Ciochon	Discipline	GEOTECHNICAL
Drawn	E.Ciochon	Scale	1:1250
Checked	D. Gonser	Date	2018-01-22
Project manager	D. Gonser	Sequence no.	02 of 03

M. dept.	Project	Disc.	Dwg no.	Rev.
160	P-0009857-0-02-101	GE	002	00

10 cm 0 1 2 3 4 5

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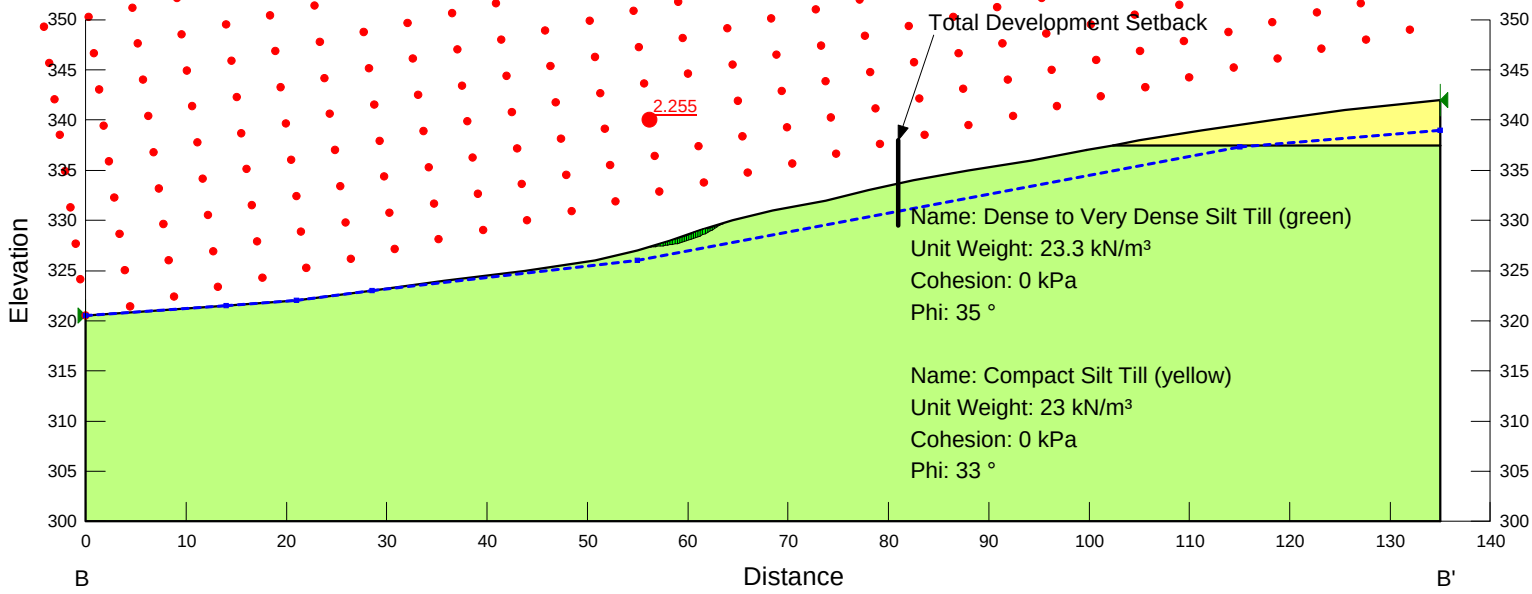
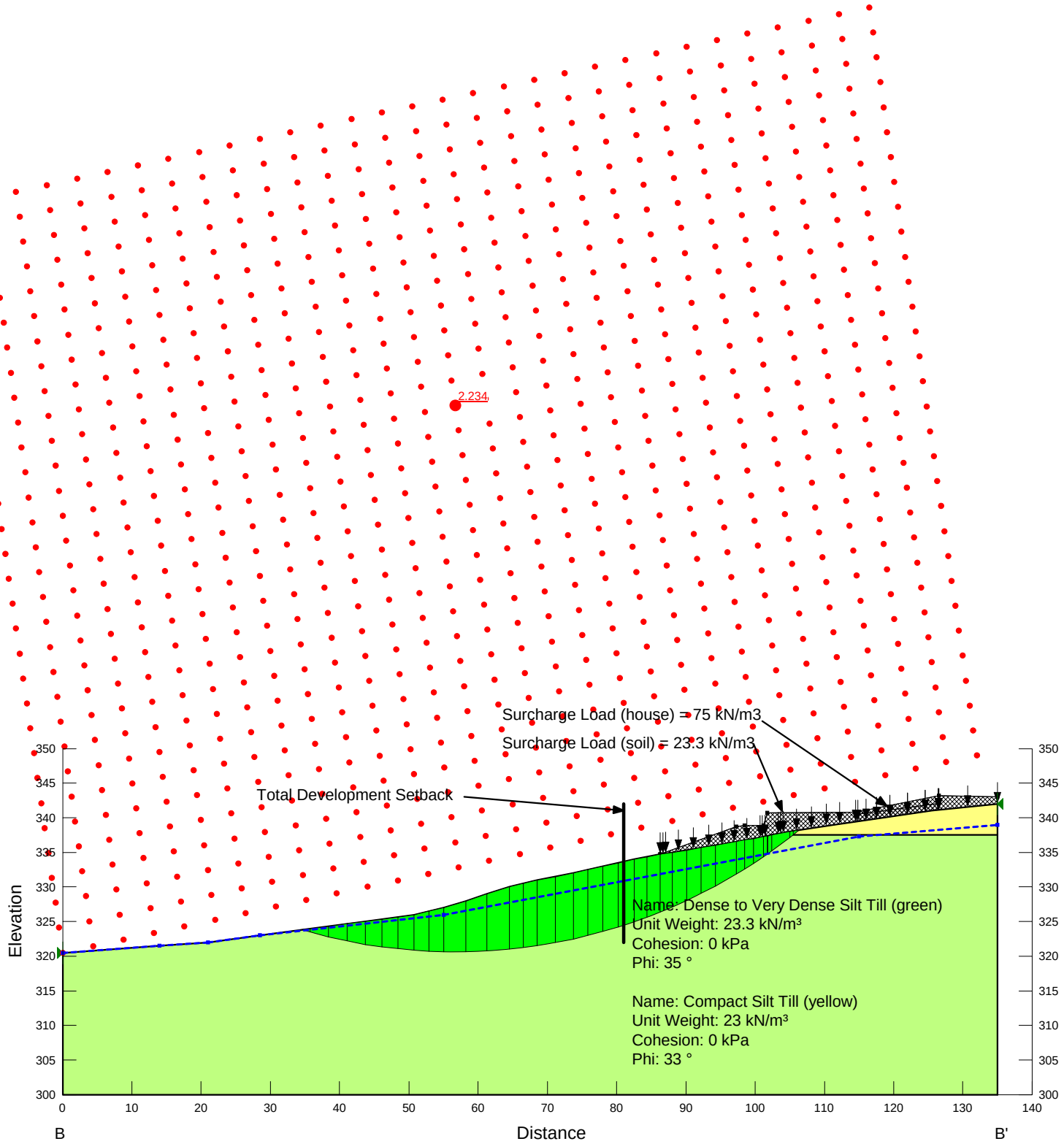
Slope Figure 1: Cross Section BB – Existing Conditions
Cityview Ridge Subdivision
Guelph, Ontario
160-P-0009857-0-02-101-GE-L-0001



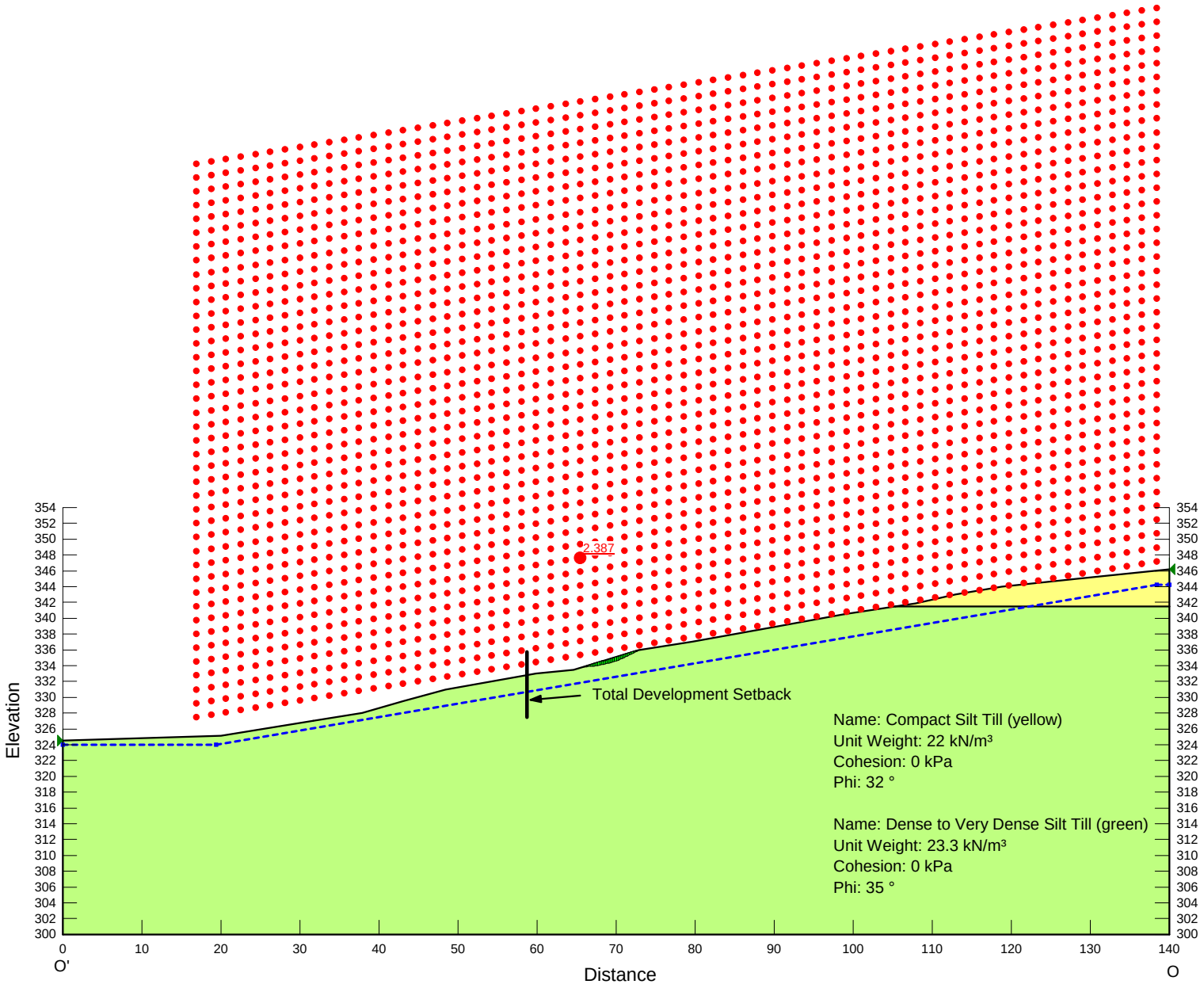
Englobe

Slope Figure 2: Cross Section BB – Proposed Conditions
Cityview Ridge Subdivision
Guelph, Ontario
160-P-0009857-0-02-101-GE-L-0001

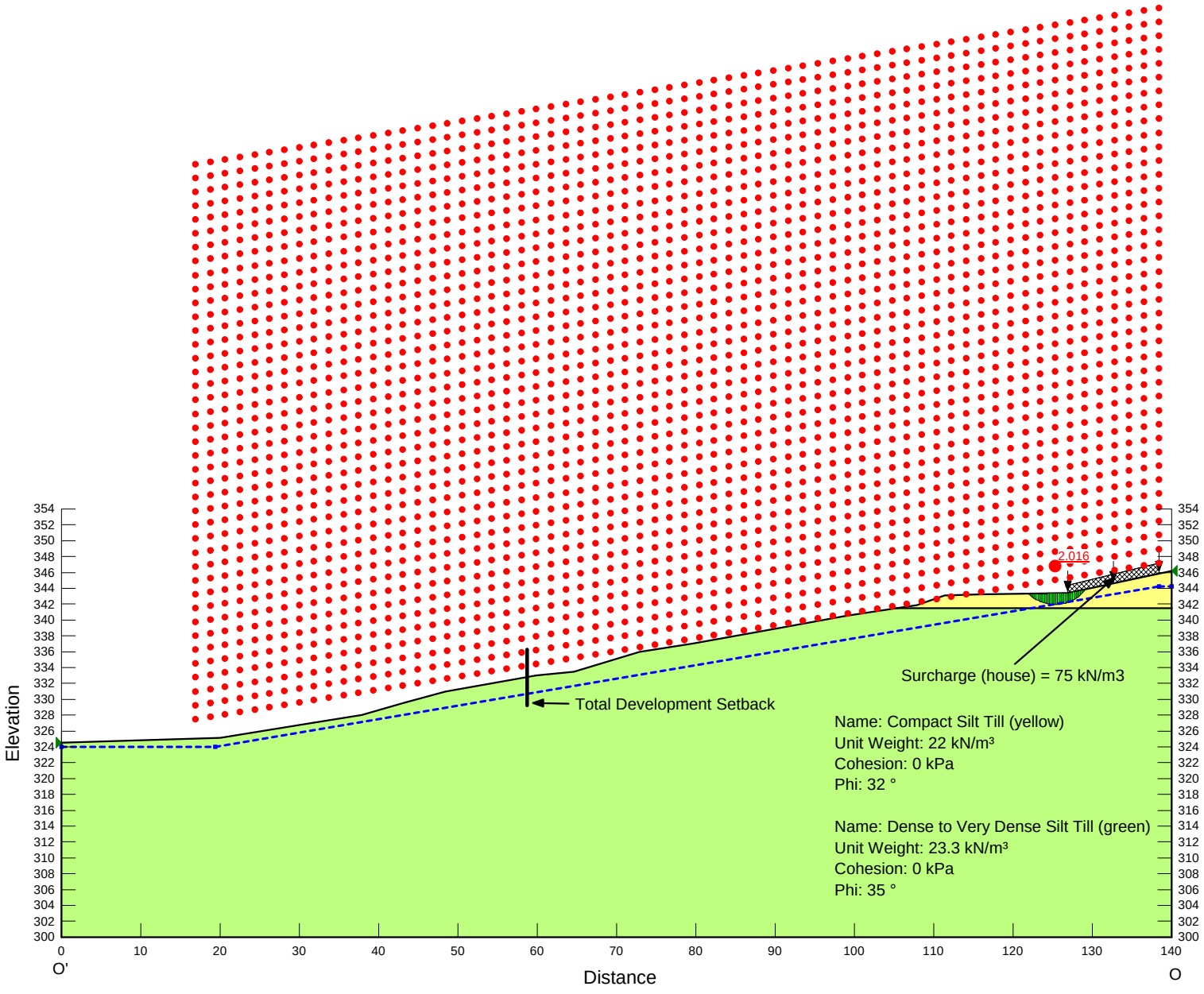


Englobe

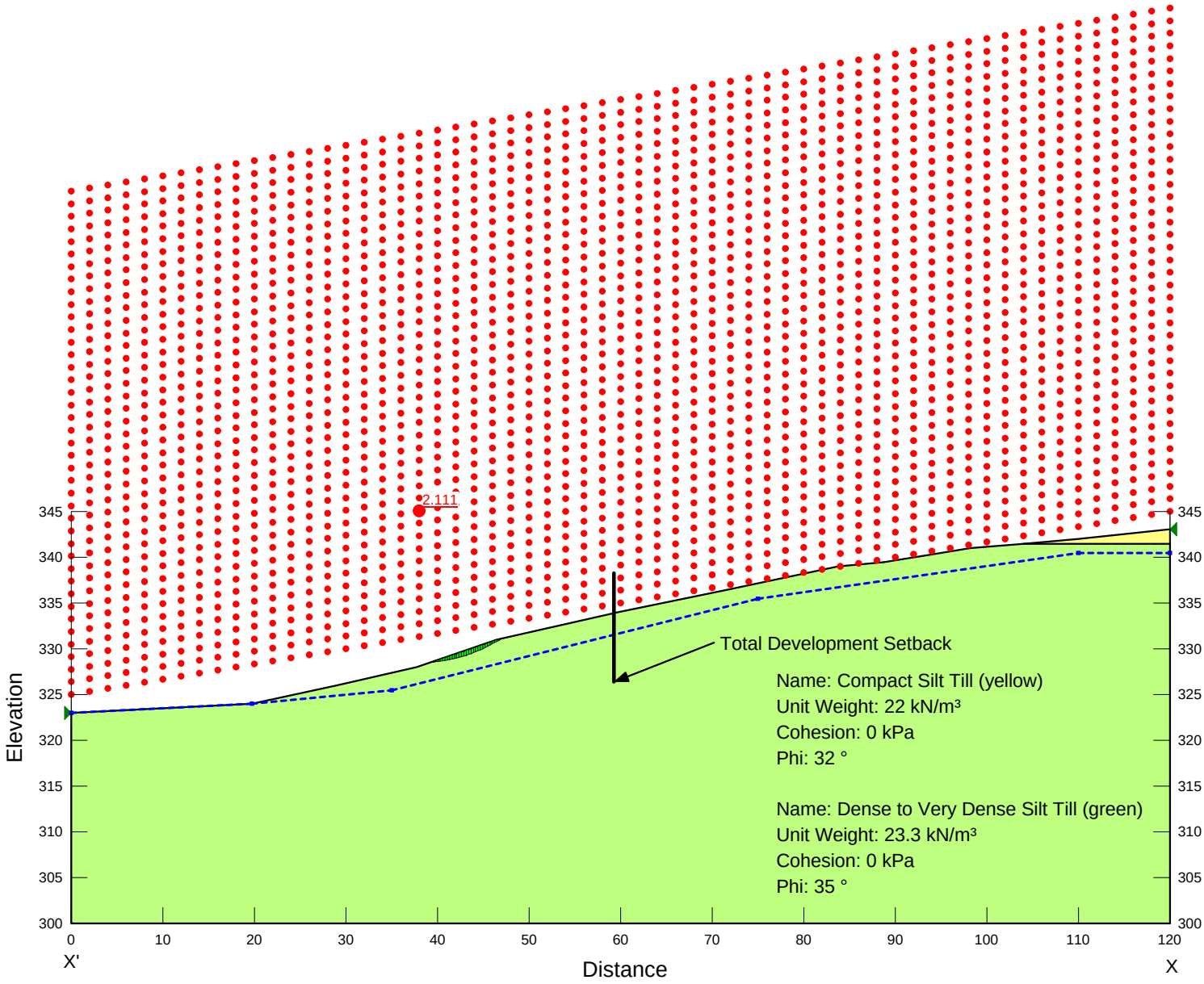
Slope Figure 11: Cross Section OO – Existing Conditions
Cityview Ridge Subdivision
Guelph, Ontario
160-P-0009857-0-02-101-GE-L-0001



Slope Figure 12: Cross Section OO – Proposed Conditions
Cityview Ridge Subdivision
Guelph, Ontario
160-P-0009857-0-02-101-GE-L-0001

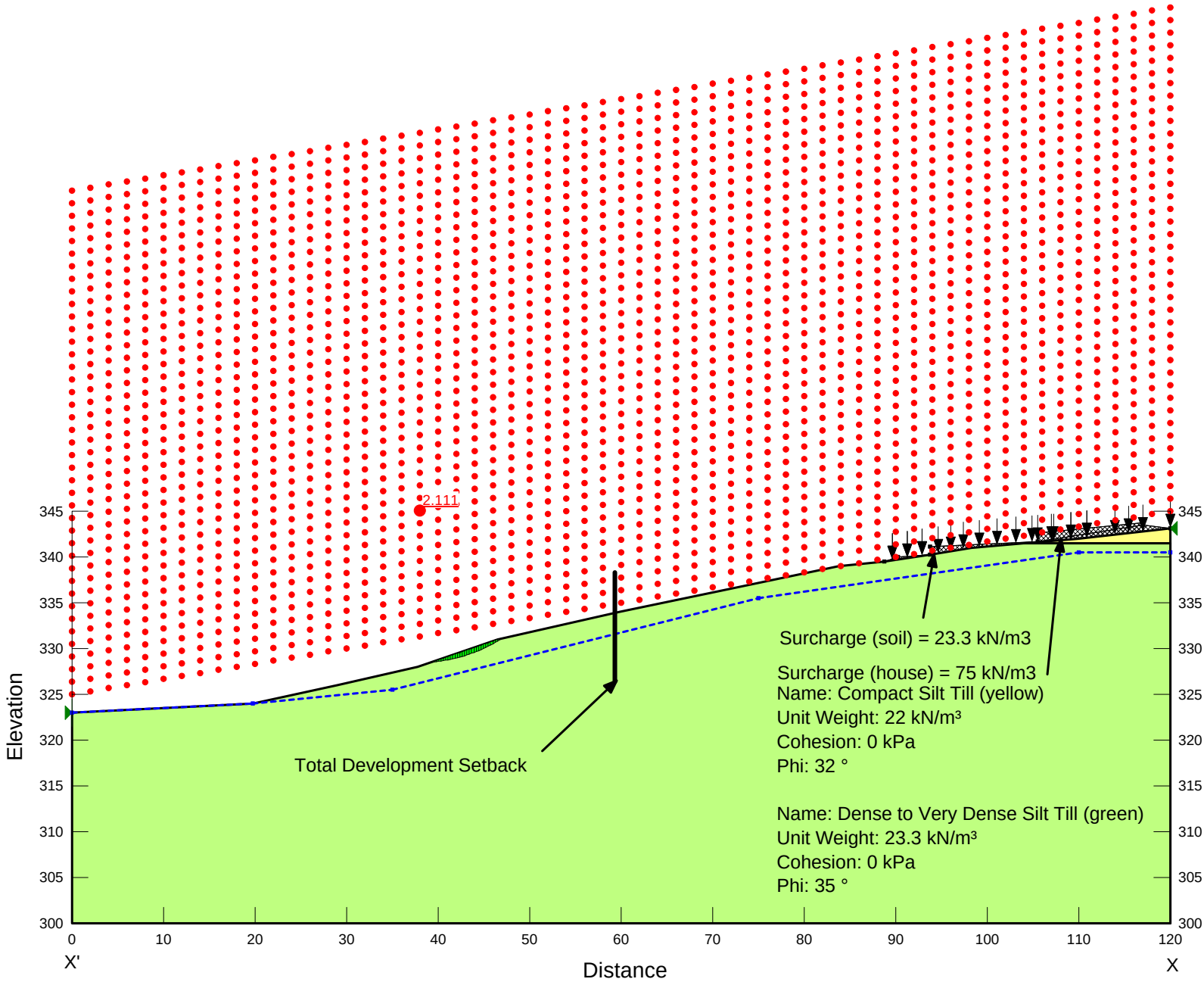


Slope Figure 13: Cross Section XX – Existing Conditions
Cityview Ridge Subdivision
Guelph, Ontario
160-P-0009857-0-02-101-GE-L-0001



Englobe

Slope Figure 14: Cross Section XX – Proposed Conditions
Cityview Ridge Subdivision
Guelph, Ontario
160-P-0009857-0-02-101-GE-L-0001



Englobe

SLOPE STABILITY RATING CHART

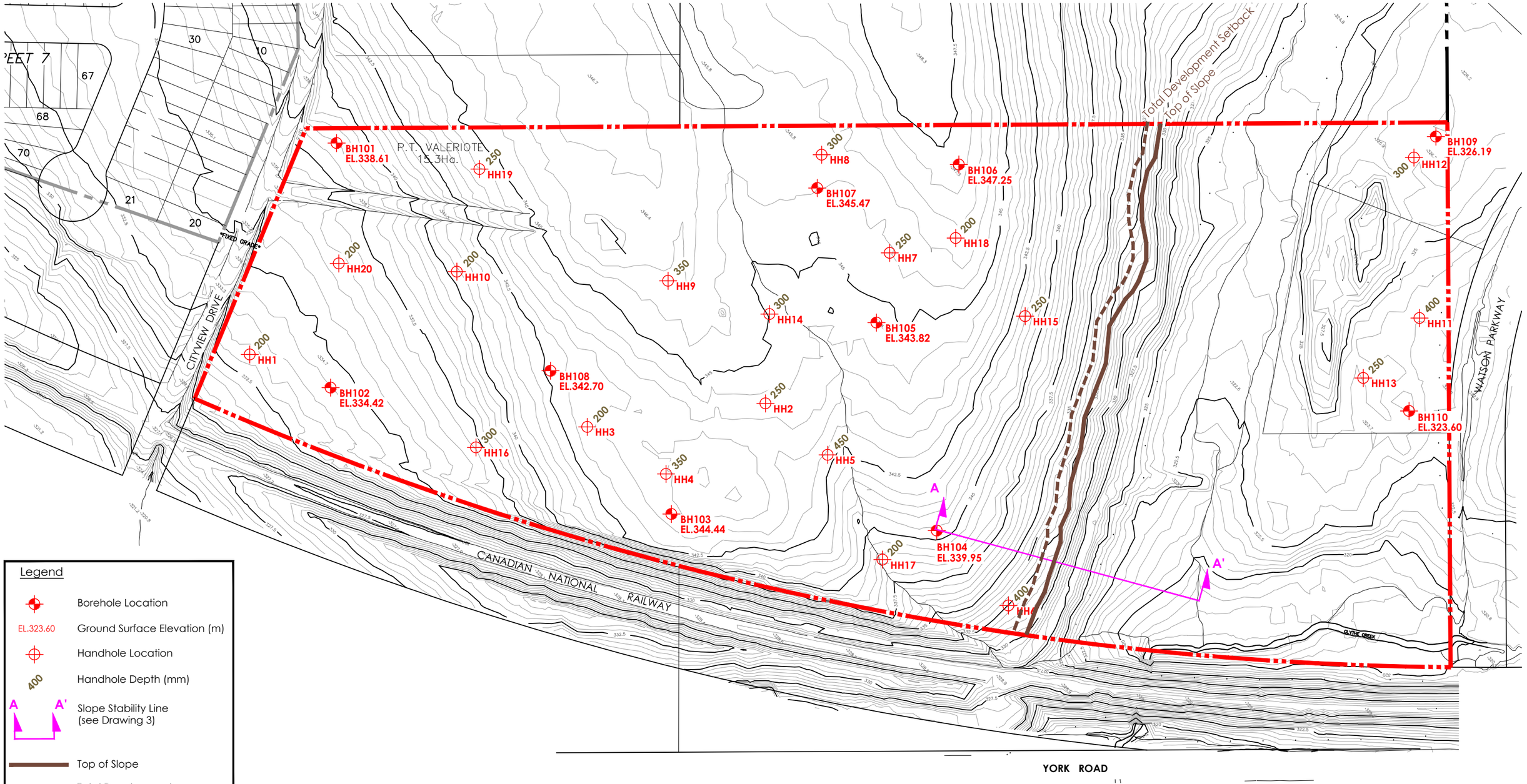
East Side Slope

Site Location:	Cityview Ridge Development	**Project No.:**	P-0009857-0-02-101
Client:	Carson Reid Homes	**Inspection Date:**	January 20, 2018
Inspected By:	D.Gonser	**Weather:**	Sun & Cloud, 5 degrees

1. SLOPE INCLINATION			
Degrees:	*Horizontal : Vertical*		
a) 18 or less	3 : 1 or flatter	0	
b) 18 – 26	2 : 1 to more than 3 : 1	6	
c) more than 26	steeper than 2 : 1	16	0
2. SOIL STRATIGRAPHY			
a) Shale, Limestone, Granite (Bedrock)		0	
b) Sand, Gravel		6	
c) Glacial Till		9	
d) Clay, Silt		12	
e) Fill		16	
f) Leda Clay		24	9
3. SEEPAGE FROM SLOPE FACE			
a) None or near bottom only		0	
b) Near mid-slope only		6	
c) Near crest only or from several levels		12	0
4. SLOPE HEIGHT			
a) 2.0 m or less		0	
b) 2.1 to 5.0 m		2	
c) 5.1 to 10.0 m		4	
d) more than 10.0 m		8	8
5. VEGETATION COVER ON SLOPE FACE			
a) Well vegetated, heavy shrubs or forested with mature trees		0	
b) Light vegetation, mostly grass, weeds, occasional trees, shrubs		4	
c) No vegetation, bare		8	0
6. TABLE LAND DRAINAGE			
a) Table land flat, no apparent drainage over slope		0	
b) Minor drainage over slope, no active erosion		2	
c) Drainage over slope, active erosion, gullies		4	2
7. PROXIMITY OF WATERCOURSE TO SLOPE TOE			
a) 15 m or more from slope toe		0	
b) less than 15 m from slope toe		6	6
8. PREVIOUS LANDSLIDE ACTIVITY			
a) No		0	
b) Yes		6	0
SLOPE INSTABILITY RATING VALUES INVESTIGATION RATING SUMMARY		**TOTAL**	25

Reference: Ministry of Natural Resources, Technical Guide River & Stream Systems: Erosion Hazard Limit, Table 4.2

Englobe



Legend

- Borehole Location
- EL.323.60 — Ground Surface Elevation (m)
- Handhole Location
- 400 — Handhole Depth (mm)
- A A' — Slope Stability Line (see Drawing 3)
- Top of Slope
- Total Development Setback Line

Drawing Reference: Base drawing provided by City of Guelph.

Note:
Locations of site features in this drawing are approximate based on available information. Exact locations must be verified in the field.

No.	Revisions	Date
0	**Report Issued**	**Sept. 2006**
1	**Report Revised**	**Jan. 2012**
2		
3		

NORTH

Naylor Engineering Associates Ltd.
CONSULTING ENGINEERS

P.T. Valeriote Subdivision
Cityview Drive
Guelph, Ontario

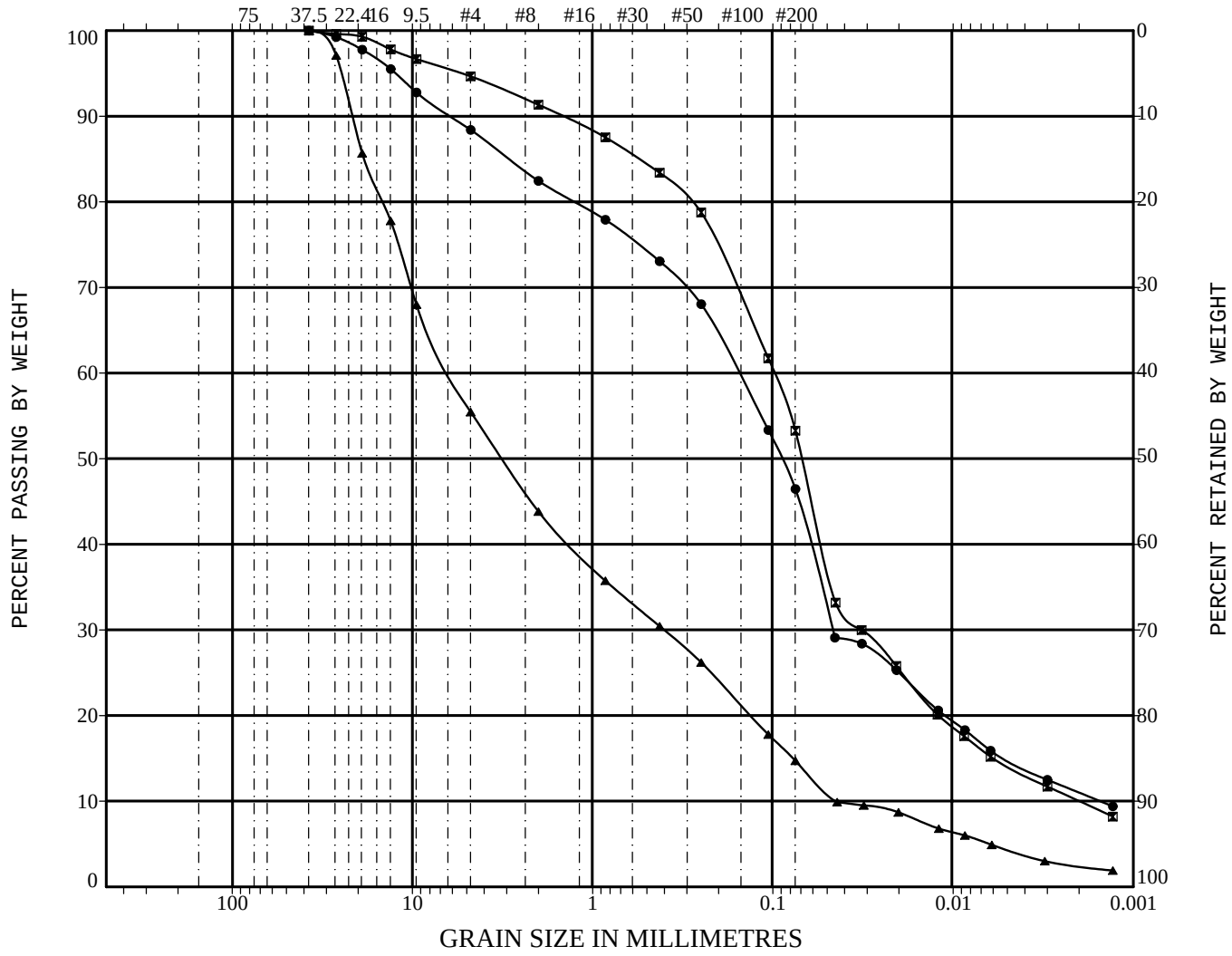
SITE PLAN

Date	Scale	Job No.	Drawing No.
Sept. 2006	**1:2000**	**0353G4**	**2**

F:\0353\0353G4\0353G4_02.dwg
August 31, 2006 (SR)

UNIFIED SOIL CLASSIFICATION

COBBLES	*GRAVEL*		*SAND*			*SILT OR CLAY*
	COARSE	FINE	COARSE	MEDIUM	FINE	
U.S. SIEVE SIZE IN MILLIMETRES			U.S. STANDARD SIEVE No.			HYDROMETER



PROJECT P.T. Valeriote Subdivision

LOCATION Cityview Drive, Guelph, Ontario JOB NO. 0353G4

CURVE ID	BOREHOLE/ TEST PIT	SAMPLE NO.	DEPTH (m)	SOIL DESCRIPTION
●	BH101	BS	1.85-3.05	SILT TILL: SILT and SAND, some Gravel, trace Clay
⊠	BH105	BS	1.22-2.13	SILT TILL: SAND and SILT, trace Gravel and Clay
▲	BH110	Sa2	5.00-6.50	SAND AND GRAVEL, some Silt

REMARKS

Naylor Engineering Associates Ltd.
CONSULTING ENGINEERS

Figure No. 1

FIGURE NO. 2

Naylor Engineering Associates
CONSULTING ENGINEERS

LABORATORY PROCTOR MOISTURE–DENSITY TEST

PROJECT: P.T. Valeriote Subdivision

LOCATION: Cityview Drive, Guelph, Ontario — JOB NO.: 0353G4

BOREHOLE NO.: BH105 — DATE TESTED: August 21, 2006

SAMPLE DEPTH: 1.22 – 2.13 — TESTED BY: WF

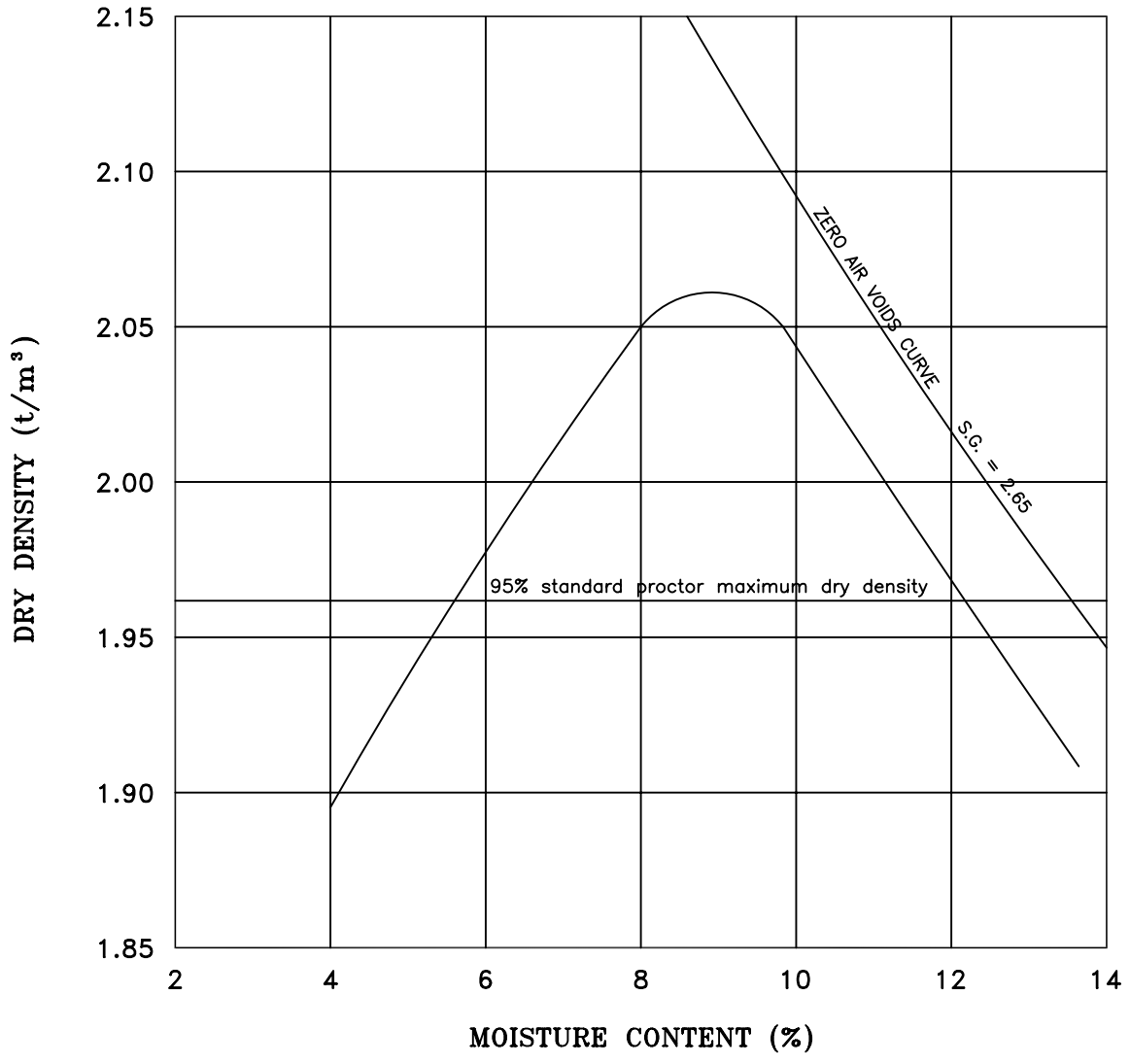
SOIL TYPE: SILT TILL — MOISTURE CONTENT: 14.9%

REMARKS:

STANDARD PROCTOR – ASTM D698–91
METHOD – A ☑ B ☐ C ☐ D ☐
MODIFIED PROCTOR – ASTM D1557–91
METHOD – A ☐ B ☐ C ☐ D ☐

MAXIMUM DRY DENSITY: 2.065 t/m³

OPTIMUM MOISTURE: 9.0%



F:\0353\0353G4\0353G4_Figure 1.dwg
August 25, 2006 (GRL)

FIGURE NO. 3

Naylor Engineering Associates
CONSULTING ENGINEERS

LABORATORY PROCTOR MOISTURE-DENSITY TEST

PROJECT P.T. Valeriote Subdivision

LOCATION Cityview Drive, Guelph, Ontario JOB NO. 0353G4

BOREHOLE NO. BH106 DATE TESTED August 21, 2006

SAMPLE DEPTH 1.52 - 3.05m TESTED BY KJ

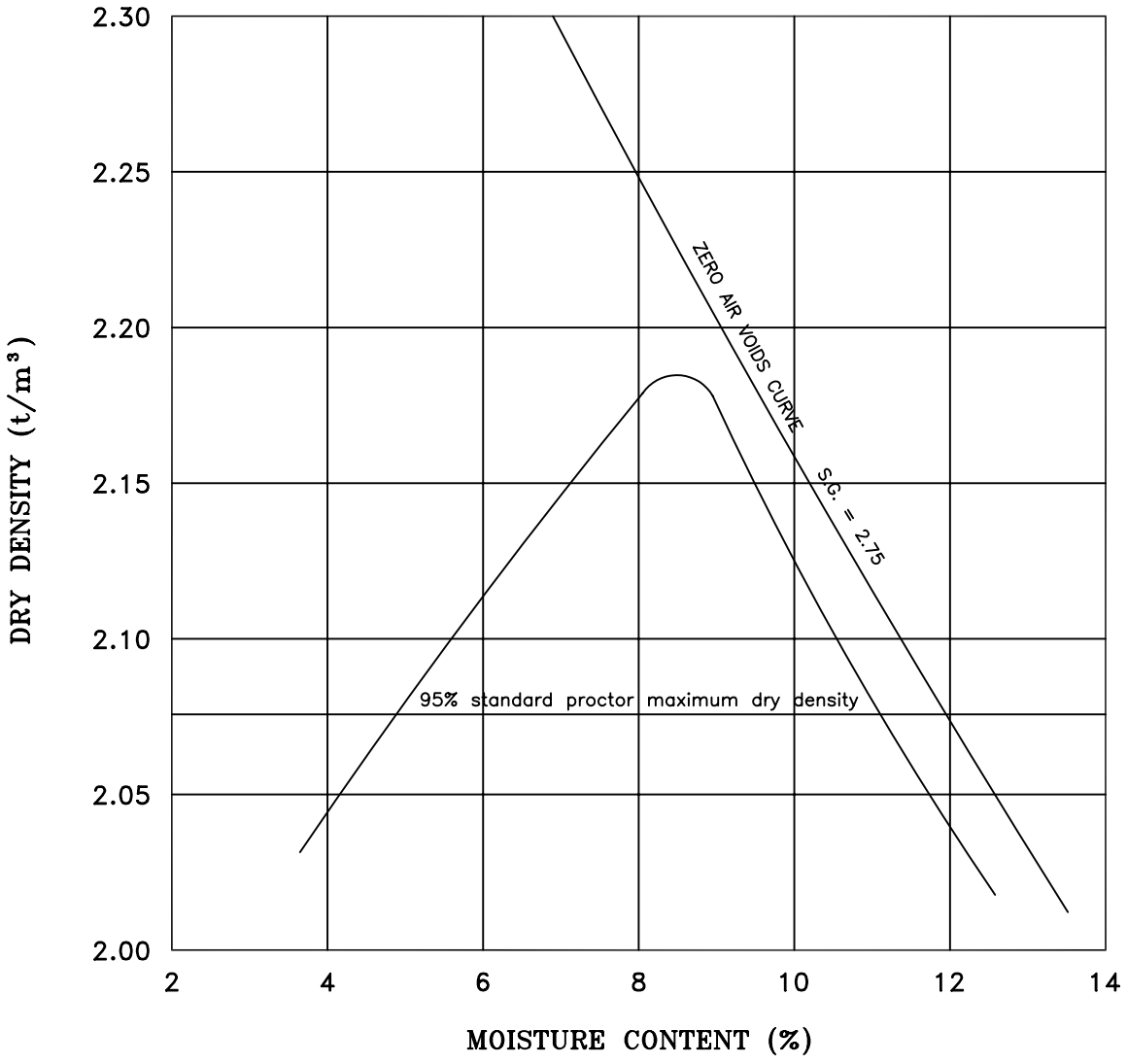
SOIL TYPE SILT TILL MOISTURE CONTENT 8.7%

REMARKS

STANDARD PROCTOR - ASTM D698-91
METHOD - A ☐ B ☐ C ☑ D ☐
MODIFIED PROCTOR - ASTM D1557-91
METHOD - A ☐ B ☐ C ☐ D ☐

MAXIMUM DRY DENSITY 2.185 t/m³

OPTIMUM MOISTURE 8.7%



F:\0353\0353G4\0353G4_Figure 2.dwg
August 28, 2006 (GRL)

Naylor Engineering Associates Ltd.
CONSULTING ENGINEERS

Borehole Number: 101

Ground Elevation: ***338.61 m***

Project: ***P.T. Valeriote Subdivision***

Job No.: ***0353G4***

Location: ***Cityview Drive, Guelph, Ontario***

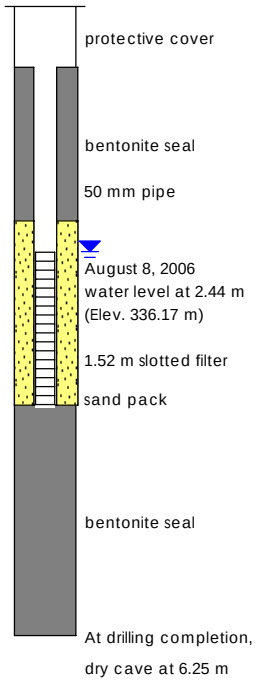
Drill Date: ***August 2, 2006***

Depth (m)	Description	Symbol	Elevation (m)	Number	Type	N-Value
	Ground Elevation		338.61			
0.00	***TOPSOIL:*** dark brown silt, moist					
1.00	***SILT TILL:*** compact brown sandy silt, some gravel, moist		338.00	1	SS	25
2.00			337.00	2	SS	14
	very moist					
3.00			336.00	3	SS	16
	dense to very dense, moist					
4.00			335.00	4	SS	35
5.00			334.00	5	SS	45\150mm
6.00			333.00	6	SS	50\150mm
	Borehole terminated at 6.25 m		332.00			
7.00			331.00			
8.00			330.00			
9.00			329.00			
10.00			328.00			
11.00			327.00			
12.00						

Dynamic Cone / Standard Penetration: 20 40 60 80

Shear Strength (PP) kPa / Shear Strength (FV) kPa: 50 100 150 200

Water Content (%): WP WL; 10 20 30



Reviewed by: ***DN***

Drill Method: ***Solid Stem Auger***

Notes: ***Bulk sample taken from 1.83 to 3.05 m.***

Field Tech.: ***RM***

Sheet: ***1 of 1***

Drafted by: ***DC(01a)***

Naylor Engineering Associates Ltd.
CONSULTING ENGINEERS

Borehole Number: 102

Ground Elevation: *334.42 m*

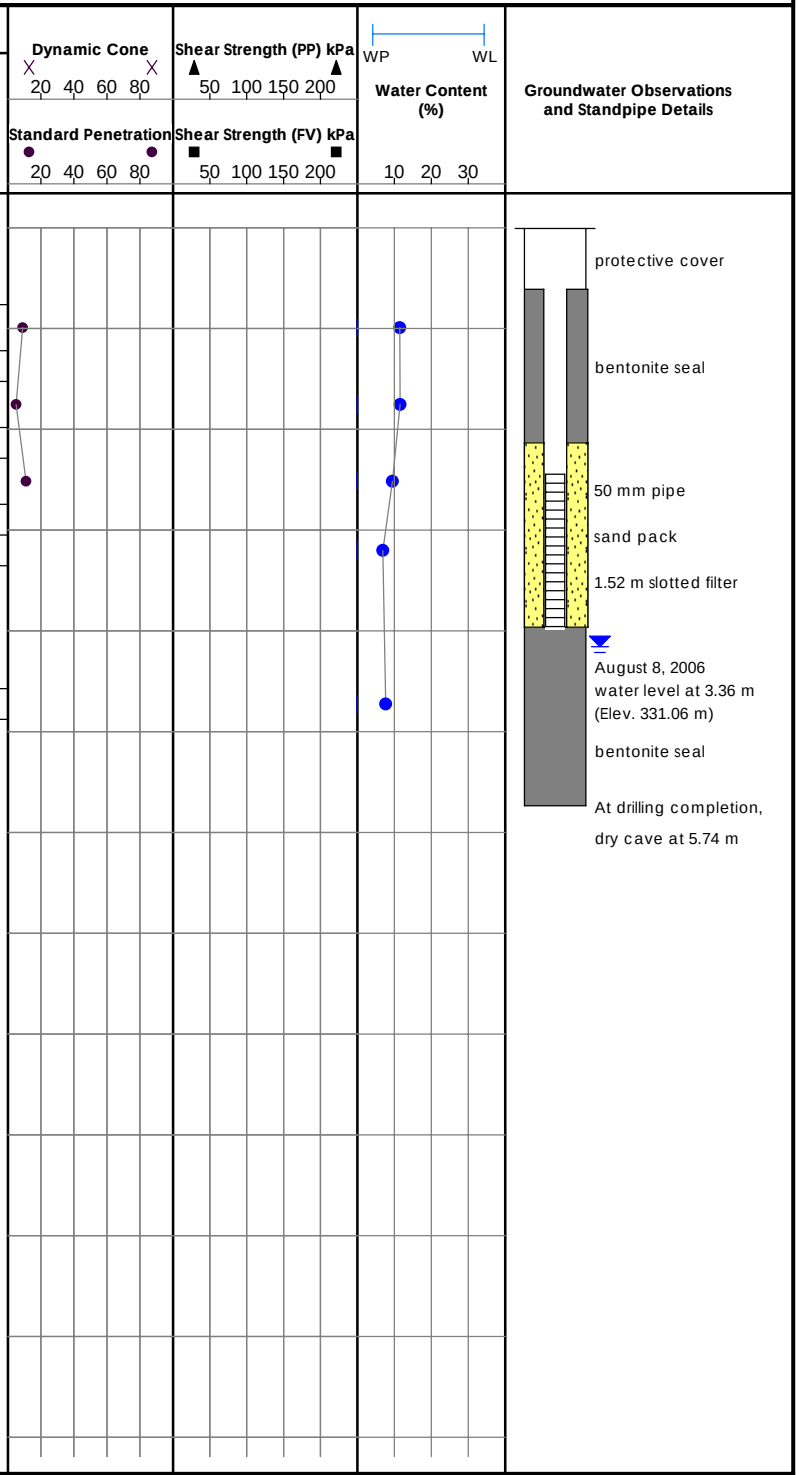
Project: *P.T. Valeriote Subdivision*

Location: *Cityview Drive, Guelph, Ontario*

Job No.: *0353G4*

Drill Date: *August 2, 2006*

Depth (m)	Description	Elevation (m)	Number	Type	N-Value
	Ground Elevation	334.42			
0.00	***TOPSOIL:*** dark brown silt, moist				
1.00	***SILT TILL:*** loose brown sandy silt, some gravel, trace clay, very moist	333.00	1	SS	9
2.00		332.00	2	SS	5
	compact, very moist		3	SS	11
3.00	very dense, moist	331.00	4	SS	50\150mm
4.00		330.00			
5.00		329.00	5	SS	45\150mm
6.00	augering on weathered bedrock or boulder Borehole terminated at 5.74 m upon auger refusal on bedrock or boulder	328.00			
7.00		327.00			
8.00		326.00			
9.00		325.00			
10.00		324.00			
11.00		323.00			
12.00					



Reviewed by: *DN*

Drill Method: *Solid Stem Auger*

Notes:

Field Tech.: *RM*

Sheet: *1 of 1*

Drafted by: *DC(01a)*

Naylor Engineering Associates Ltd.
CONSULTING ENGINEERS

Borehole Number: 103

Ground Elevation: ***344.44 m***

Project: ***P.T. Valeriote Subdivision***

Job No.: ***0353G4***

Location: ***Cityview Drive, Guelph, Ontario***

Drill Date: ***July 31, 2006***

Depth (m)	Description	Elevation (m)	Number	Type	N-Value
	Ground Elevation	344.44			
0.00	***TOPSOIL:*** dark brown silt, moist				
1.00	***SILT TILL:*** loose rusty brown silt, some sand, trace clay and gravel, trace tree roots, moist to very moist	343.00	1	SS	5
2.00			2	SS	6
3.00	dense to very dense brown sandy silt, some gravel, trace clay, moist	342.00	3	SS	*
4.00		341.00	4	SS	55\150mm
5.00		340.00	5	SS	45\150mm
6.00	grey, moist	339.00	6	SS	60\150mm
7.00		338.00	7	SS	75\150mm
8.00	Borehole terminated at 7.92 m	337.00			
9.00		336.00			
10.00		335.00			
11.00		334.00			
12.00		333.00			

Dynamic Cone / Standard Penetration: 20 40 60 80

Shear Strength (PP) kPa / Shear Strength (FV) kPa: 50 100 150 200

Water Content (%): WP WL; 10 20 30

Groundwater Observations and Standpipe Details

- concrete seal and protective cover
- bentonite seal
- sand pack
- 0.76 m slotted filter
- 19 mm pipe
- August 8, 2006, upper standpipe dry
- bentonite seal
- August 8, 2006 water level at 3.80 m (Elev. 340.64 m)
- 50 mm pipe
- sand pack
- 1.52 m slotted filter
- At drilling completion, dry cave at 7.62 m

Reviewed by: ***DN***

Drill Method: ***Solid Stem Auger***

Notes: **** Sampler driving on gravel.***

Field Tech.: ***RM***

Sheet: ***1 of 1***

Drafted by: ***DC(01a)***

Naylor Engineering Associates Ltd.
CONSULTING ENGINEERS

Borehole Number: 104

Ground Elevation: ***339.95 m***

Project: ***P.T. Valeriote Subdivision***

Job No.: ***0353G4***

Location: ***Cityview Drive, Guelph, Ontario***

Drill Date: ***July 31, 2006***

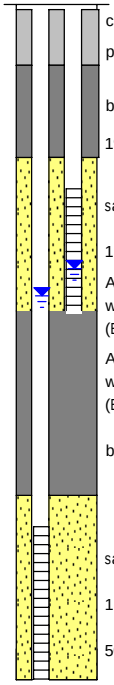
Depth (m)	Description	Symbol	Elevation (m)	Number	Type	N-Value
0.00	Ground Elevation		339.95			
	TOPSOIL: dark brown silt, moist					
1.00	***SILT TILL:*** compact brown sandy silt, some gravel, trace clay, moist		339.00	1	SS	20
2.00			338.00	2	SS	25
	very dense, moist			3	SS	30\150mm
3.00			337.00	4	SS	51
4.00			336.00			
5.00			335.00	5	SS	45\150mm
	cobbles, some dolostone					
6.00			334.00	6	SS	65\150mm
7.00	Borehole terminated at 6.71 m		333.00			
8.00			332.00			
9.00			331.00			
10.00			330.00			
11.00			329.00			
12.00			328.00			

Dynamic Cone / Standard Penetration: 20 40 60 80

Shear Strength (PP) kPa / Shear Strength (FV) kPa: 50 100 150 200

Water Content (%): WP WL; 10 20 30

Groundwater Observations and Standpipe Details



At drilling completion, water level at 6.40 m

Reviewed by: ***DN***

Drill Method: ***Solid Stem Auger***

Notes:

Field Tech.: ***RM***

Sheet: ***1 of 1***

Drafted by: ***DC(01a)***

Naylor Engineering Associates Ltd.
CONSULTING ENGINEERS

Borehole Number: 105

Ground Elevation: *343.82 m*

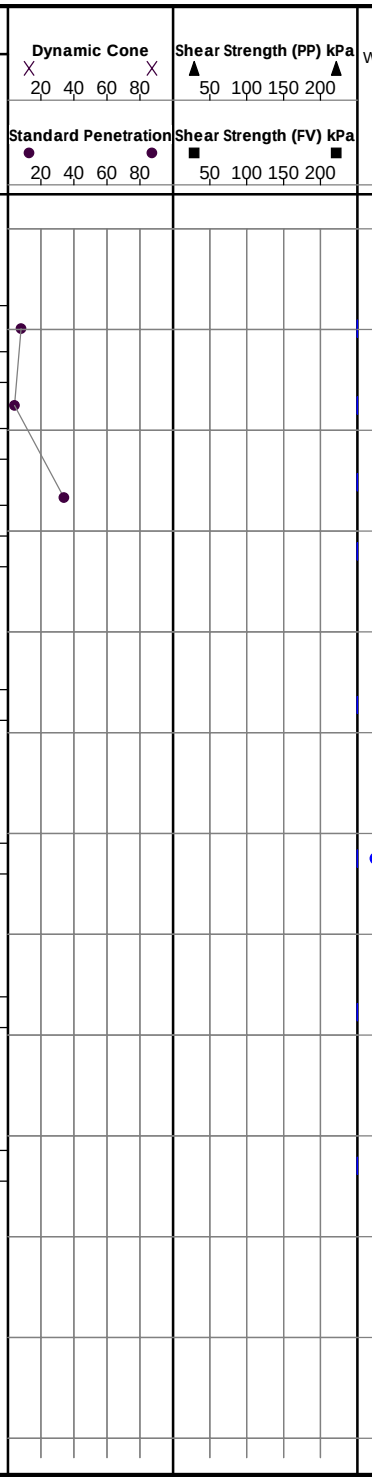
Project: *P.T. Valeriote Subdivision*

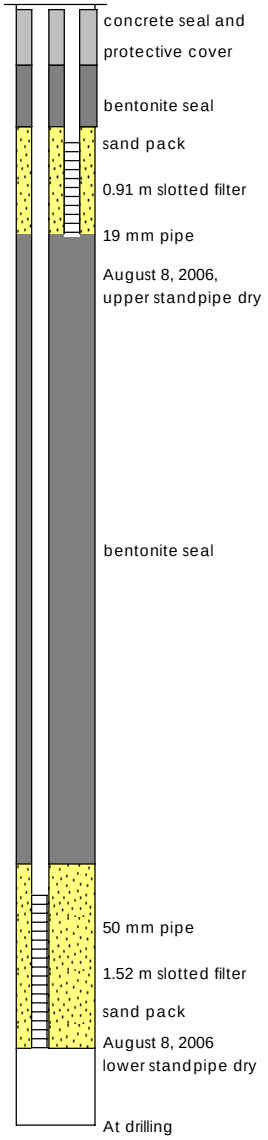
Job No.: *0353G4*

Location: *Cityview Drive, Guelph, Ontario*

Drill Date: *July 31, 2006*

Depth (m)	Description	Elevation (m)	Number	Type	N-Value
0.00	Ground Elevation	343.82			
	TOPSOIL: dark brown silt, moist				
1.00	***SILT TILL:*** loose brown silt, some sand, trace clay and gravel, very moist	343.00	1	SS	8
2.00		342.00	2	SS	4
	dense to very dense brown sandy silt		3	SS	34
3.00		341.00	4	SS	50\150mm
4.00		340.00			
	some cobbles				
	grey, moist		5	SS	55\150mm
5.00		339.00			
6.00		338.00	6	SS	70\150mm
7.00		337.00			
8.00		336.00	7	SS	70\150mm
9.00		335.00			
			8	SS	60\150mm
10.00		334.00			
11.00	augering on bedrock or boulder	333.00			
	Borehole terminated at 11.13 m upon auger refusal on bedrock or boulder				
12.00		332.00			





Reviewed by: *DN*

Drill Method: *Solid Stem Auger*

Notes: *Bulk sample taken from 1.22 to 2.13 m.*

Field Tech.: *RM*

Sheet: *1 of 1*

Drafted by: *DC(01a)*

Naylor Engineering Associates Ltd.
CONSULTING ENGINEERS

Borehole Number: 106

Ground Elevation: ***347.25 m***

Project: ***P.T. Valeriote Subdivision***

Job No.: ***0353G4***

Location: ***Cityview Drive, Guelph, Ontario***

Drill Date: ***August 2, 2006***

Depth (m)	Description	Elevation (m)	Number	Type	N-Value
	Ground Elevation	347.25			
0.00	***TOPSOIL:*** dark brown silt, moist				
1.00	***SILT TILL:*** compact brown sandy silt, some gravel, trace clay, moist	346.00	1	SS	19
	some cobbles		2	SS	23
2.00	very moist	345.00	3	SS	25
3.00	dense to very dense, moist	344.00	4	SS	50
4.00		343.00			
5.00		342.00	5	SS	*
6.00		341.00	6	SS	40\150mm
7.00		340.00	7	SS	40\150mm
8.00	Borehole terminated at 7.77 m	339.00			
9.00		338.00			
10.00		337.00			
11.00		336.00			
12.00		335.00			

Dynamic Cone / Standard Penetration: 20 40 60 80

Shear Strength (PP) kPa / Shear Strength (FV) kPa: 50 100 150 200

Water Content (%): WP WL; 10 20 30

Groundwater Observations and Standpipe Details

- concrete seal and protective cover
- bentonite seal
- sand pack
- 1.52 m slotted filter
- 19 mm pipe
- August 8, 2006 water level at 3.02 m (Elev. 344.23 m)
- bentonite seal
- August 8, 2006 upper standpipe dry
- sand pack
- 1.52 m slotted filter
- 50 mm pipe
- At drilling completion, dry
- cave at 10.36 m

Reviewed by: ***DN***

Drill Method: ***Solid Stem Auger***

Notes: ***Bulk sample taken from 1.52 to 3.05 m. *Sampler bouncing on gravel.***

Field Tech.: ***RM***

Sheet: ***1 of 1***

Drafted by: ***DC(01a)***

Naylor Engineering Associates Ltd.
CONSULTING ENGINEERS

Borehole Number: 107

Ground Elevation: *345.47 m*

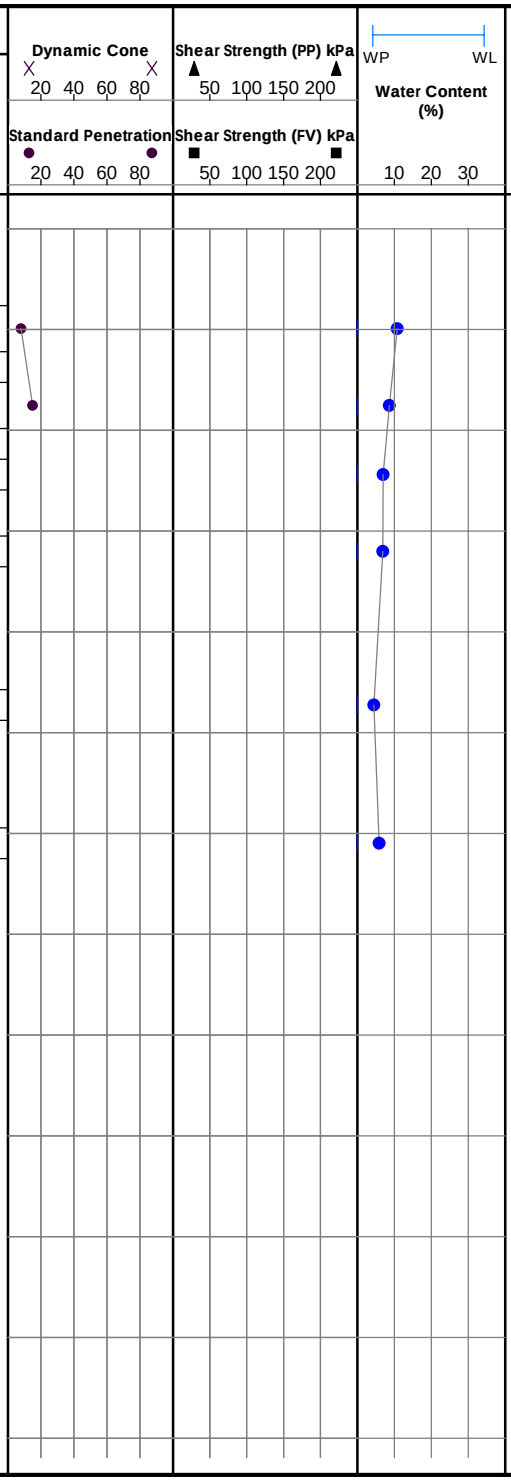
Project: *P.T. Valeriote Subdivision*

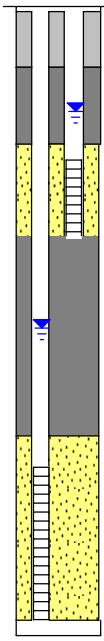
Job No.: *0353G4*

Location: *Cityview Drive, Guelph, Ontario*

Drill Date: *July 31, 2006*

Depth (m)	Description	Elevation (m)	Number	Type	N-Value
0.00	Ground Elevation	345.47			
0.00	***TOPSOIL:*** dark brown silt, moist				
1.00	***SILT TILL:*** loose brown silt, some sand, trace clay, very moist		1	SS	8
	compact	344.00			
			2	SS	15
2.00	compact to very dense brown sandy silt, some gravel				
		343.00	3	SS	35\150mm
3.00					
			4	SS	50\150mm
	grey, moist	342.00			
4.00					
		341.00	5	SS	*
5.00					
		340.00			
6.00			6	SS	60\150mm
	Borehole terminated at 6.25 m	339.00			
7.00					
		338.00			
8.00					
		337.00			
9.00					
		336.00			
10.00					
		335.00			
11.00					
		334.00			
12.00					





Groundwater Observations and Standpipe Details

concrete seal and protective cover

bentonite seal

sand pack

0.76 m slotted filter

19 mm pipe

bentonite seal

sand pack

1.52 m slotted filter

50 mm pipe

At drilling completion, dry cave at 6.10 m

August 8, 2006
water level in upper standpipe at 1.05 m (Elev. 344.42 m)
water level in lower standpipe at 3.20 m (Elev. 342.27 m)

Reviewed by: *DN*

Drill Method: *Solid Stem Auger*

Notes: * *Sampler bouncing on gravel.*

Field Tech.: *RM*

Sheet: *1 of 1*

Drafted by: *DC(01a)*

Naylor Engineering Associates Ltd.
CONSULTING ENGINEERS

Borehole Number: 108

Ground Elevation: *342.70 m*

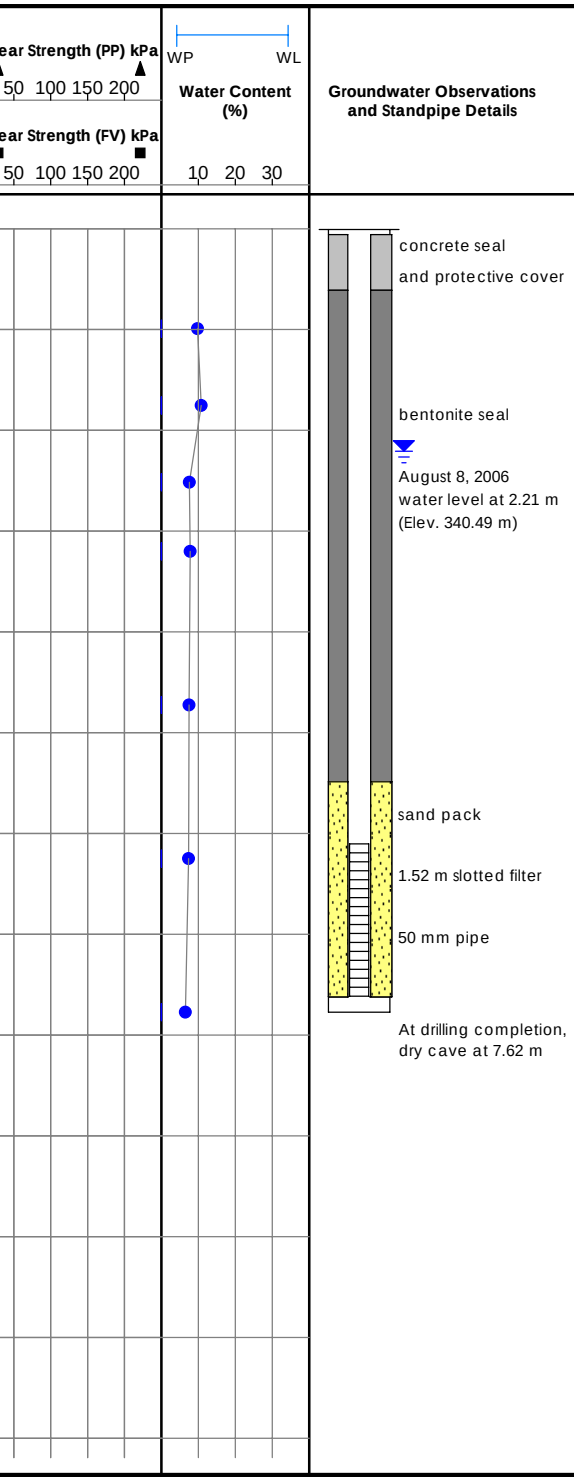
Project: *P.T. Valeriote Subdivision*

Job No.: *0353G4*

Location: *Cityview Drive, Guelph, Ontario*

Drill Date: *July 31, 2006*

Depth (m)	Description	Elevation (m)	Number	Type	N-Value
0.00	Ground Elevation	342.70			
	TOPSOIL: dark brown silt, moist				
	SILT TILL: compact brown silt, some sand, gravel and clay, moist	342.00	1	SS	19
1.00					
		341.00	2	SS	24
2.00	dense to very dense, trace clay, moist				
		340.00	3	SS	31
3.00	some cobbles				
		339.00	4	SS	45\150mm
4.00	grey, moist				
		338.00	5	SS	45\125mm
5.00					
		337.00			
6.00			6	SS	58\150mm
		336.00			
7.00					
		335.00	7	SS	65\150mm
8.00	Borehole terminated at 7.77 m				
		334.00			
9.00					
		333.00			
10.00					
		332.00			
11.00					
		331.00			
12.00					



Reviewed by: *DN*

Drill Method: *Solid Stem Auger*

Notes: *Bulk sample taken from 1.52 to 3.05 m.*

Field Tech.: *RM*

Sheet: *1 of 1*

Drafted by: *DC(01a)*

May 31, 2023

Reference No. G4704-23-5

Carson Reid Homes
195 Hanlon Creek Boulevard, Unit 100
Guelph, Ontario
N1C 0A1

Attention: Mr. Carson Reid
Via Email carson@carsonreidhomes.com

RE: Slope Stability Assessment
Cityview Ridge Subdivision
Watson Parkway and York Road
Guelph, ON
GMBP Ref. 105172 – Cityview Ridge Subdivision – SWMP Outlet Slope Stability

Dear Mr. Reid,

JLP Services Inc. (JLP) was retained by GM BluePlan Engineering Limited on behalf of Carson Reid Homes to evaluate the slope stability of the post-development slope downstream of the proposed storm water management facility.

The purpose of this slope stability assessment is to provide geotechnical comments pertaining to the potential impacts of the proposed overland flow route from the storm water management facility over the slope with the inclusion of the energy dissipation and cooling structures to the natural slope downstream.

It is our understanding that the proposed storm water management pond (SWMP) has a perimeter berm with maximum height of about 2.4m high. The side slope of the SWMP is 3H:1V on the valley side and 5H:1V on the pond side. The crest of the perimeter berm near the spillway will be at Elevation 341.41m and the crest of the spillway is at Elevation 340.95m. The bottom of the pond will be at Elevation 339.35m and the bottom of the forebay will be at Elevation 338.35m. The permanent pool level in the SWMP will be at Elevation 339.65m and the regional storm level will be up to Elevation 340.83m. Any water storage higher than the permanent pool level will discharge through a storm outlet to a system of cooling trenches and a linear energy dissipation and dispersion trench downstream of the SWMP towards the natural heritage system (NHS) at the northeast corner of the site. Questions have been raised by the Grand River

Geotechnical & Environmental Consultants

Conservation Authority (GVCA) and the City of Guelph (CofG) towards the stability of the slope and the potential for erosion down the slope of the proposed SWMP outlet.

This slope stability assessment is based on information pertaining to the design of the proposed storm water management facility with the energy dissipation and cooling structures, the existing and post-construction site grades of the slope and the previous slope stability assessments provided in the following documents:

1. Draft Preliminary Engineering Plan for Cityview Ridge Subdivision, City of Guelph, Drawing Nos. 1 to 15, Project No. 105172, dated August 30, 2021, by GM BluePlan Engineering Limited.
2. Report titled "Geotechnical Investigation, P.T. Valeriote Subdivision, Cityview Drive, Guelph, Ontario, Ref.: 0353G4.R01_Rev., dated February 2012, prepared by Naylor Engineering Associates Ltd.
3. Report titled "Technical Memorandum (Draft), Hydrogeological Investigation, Environmental Impact Study, Proposed Cityview Ridge Development, City of Guelph", Ref. BGE.52.091, dated November 17, 2014, prepared by Banks Groundwater Engineering Limited.
4. Report titled "Slope Stability Assessment of South-Facing Slope, Cityview Ridge Subdivision, Cityview Drive, Guelph, Ontario, Ref.: 160-P-0009857-0-01-100-GE-L-00202-00, dated March 1, 2019, prepared by Englobe Corporation.
5. Report titled "Slope Stability Assessment of East-Facing Slope, Cityview Ridge Subdivision, Cityview Drive, Guelph, Ontario, Ref.: 160-P-0009857-0-01-100-GE-L-0001-00, dated December 14, 2020, prepared by Englobe Corporation.

The slope profile used in the slope stability assessment is the cross-section from the storm water management pond (SWMP) through the outlet system, including the cooling trench structure and the linear energy dissipation and dispersion trench, to the natural slope and creek downstream. The location of the cross-section, Section A-A,B-B, in relation to the proposed SWMP, outlet structures and the natural slope downstream is shown on Enclosure 1.

Considerations have also been given to the slope profiles with phreatic surface in steady state condition where the water level in the SWMP is at the permanent pool level and with phreatic surface in most critical condition where the discharge from the SWMP is constantly flowing over and saturating the natural slope downstream of the linear energy dissipation and dispersion trench towards the creek. The slope profiles with respective phreatic surfaces are shown on Enclosures 2 and 3.

The soil profile was based on the log of Borehole 104 which is closest to the location of the proposed SWMP outlet system, which indicates that the site consists of a surficial topsoil layer overlying a deposit of silt till in generally compact to very dense state of compactness. The groundwater level was at about

2.6 metres below grade, approximately Elevation 337.3m, at the time of the geotechnical investigation in August 2006.

No laboratory testing on soil strength properties were carried out in the original geotechnical investigation. Therefore, the soil strength parameters used in the slope stability assessment were based on the soil parameters used in the previous slope stability assessments in 2019 and 2020 by Englobe and our experience with similar types of soil.

The soil parameters used in the slope stability analyses are listed in Table 1 below:

Table 1: Estimated Soil Properties for Slope Stability Analysis

Soil Material	Unit Weight of Soil (kN/m^3)	Angle of Internal Friction (°)	Cohesion (kPa)
Fill, sandy silt, trace to some gravel, compacted	22	32	0
Silt Till, compact to very dense	22	35	0

The slope stability analyses were carried out using the commercially available slope stability modelling software SLIDE Version 5. This is a two-dimensional limit equilibrium slope stability analysis program which calculates the Factor of Safety (FOS) against circular failure of slope configurations using the assumed soil strength and groundwater level parameters. The FOS is the factor by which the soil strength must be reduced in order to bring the slope into a state of limit equilibrium (or imminent failure) along a given slip surface. The Bishops's Modified Method was used in the analysis. A uniformly distributed load of 12 kN/m^2 was applied to the access road on the crest of the perimeter berm of the proposed SWMP to simulate the effects of vehicular load.

The results of the slope stability analyses are shown on Enclosures 4 to 11 and summarized in Table 2 below.

Considering the proposed SWMP is operating with water level at the permanent pool level and the seepage through the perimeter berm to the slope downstream of the pond is at steady-state condition, the slope profile of the proposed SWMP, including the outlet system with the cooling trench and the linear energy dissipation and dispersion trench, and the natural slope downstream to the creek is considered to be stable with calculated Factors of Safety (FOS) between 1.64 and 2.05 for surface, shallow and/or deep-seated failures. The lower FOSs are related to shallow and deep-seated failures at the lower portion of the slope profile close to the creek where the slope is somewhat steeper than 3H:1V.

Table 2: Slope Stability Analyses Results for Section A-A,B-B

Profile Section, Water Level and Failure Type	Calculated Minimum Factors of Safety	
	Static	Enclosure No.
Section A-A – Proposed Slope, Water Level at Steady State, Surface Failure	1.86	4
Section A-A – Proposed Slope, Water Level at Steady State, Shallow Failure	2.05	5
Section B-B – Existing Slope, Water Level at Steady State, Surface Failure	1.70	6
Section B-B – Existing Slope, Water Level at Steady State, Deep-Seated Failure	1.64	7
Section A-A – Proposed Slope, Water Level at Slope Surface, Shallow Failure	1.63	8
Section A-A – Proposed Slope, Water Level at Slope Surface, Deep-Seated Failure	1.71	9
Section B-B – Existing Slope, Water Level at Slope Surface, Surface Failure	1.08	10
Section B-B – Existing Slope, Water Level at Slope Surface, Shallow Failure	1.17	11

Considering the most critical condition in which the proposed SWMP is operating with water level perpetually higher than the permanent pool level and free water is constantly discharged through the outlet system onto the surface of the slope downstream of the linear energy dissipation and dispersion trench with phreatic surface at the slope surface saturating the soil profile below, the slope profile of the proposed SWMP, including the outlet system with the cooling trench and the linear energy dissipation and dispersion trench, and the natural slope downstream to the creek is considered to be stable with calculated FOSs reduced to 1.63 and 1.71 for shallow and deep-seated failures in the upper portion of the slope profile close to the proposed SWMP and outlet system and FOSs reduced to 1.08 and 1.17 for surface and shallow failures in the lower portion of the slope profile close to the creek.

Based on the results of the slope stability assessment, it is our opinion that the proposed soil profile downstream of the storm water management pond outlet system over the slope is considered to be stable. The proposed slope profile is stable even under the most critical condition, worst case scenario which has a very low probability of occurring, when the discharge over the slope is persistent and the soil below is fully saturated.

It should be noted that the lower portion of the slope profile is natural and undisturbed by the proposed development. The vegetation on the existing slope aids in the slope stability against surface and shallow failures by increasing the effective cohesion within the surficial soils. The vegetation on the existing slope should, therefore, be maintained. The disturbed ground surface during construction should be sodded or seeded to protect from erosion as soon as possible after construction. Erosion protection over the side slope of the proposed SWMP and outlet structures should consist of topsoil and surface vegetation secured by natural or synthetic erosion control products to establish growth and to minimize potential for soil erosion.

It is recommended that a monitoring plan of the slope profile along the proposed storm water discharge route, including the perimeter berm, outlet structures, distribution systems and the surficial soil and vegetation, be established as part of the operation manual for the proposed SWMP. The monitoring plan may include periodic inspection and evaluation of the integrity of the components of the outlet structures and distribution systems in terms of seepage paths, piping and erosion of backfill, and of the integrity of the slope profile downstream of the SWMP to the creek in terms of surface erosion paths, loss of topsoil and vegetation and accumulation of sediment and debris. The periodic inspection and evaluation may be carried out at a higher frequency, such as quarterly, during the first two years of operation of the SWMP and then reduced to yearly thereafter. The implementation of the monitoring plan will ensure early detection of potential issues during the operation of the SWMP.

Trust that this report meets your requirements and is satisfactory to you. Should you have any questions, please do not hesitate to contact this office.

Yours very truly,

JLP SERVICES INC.

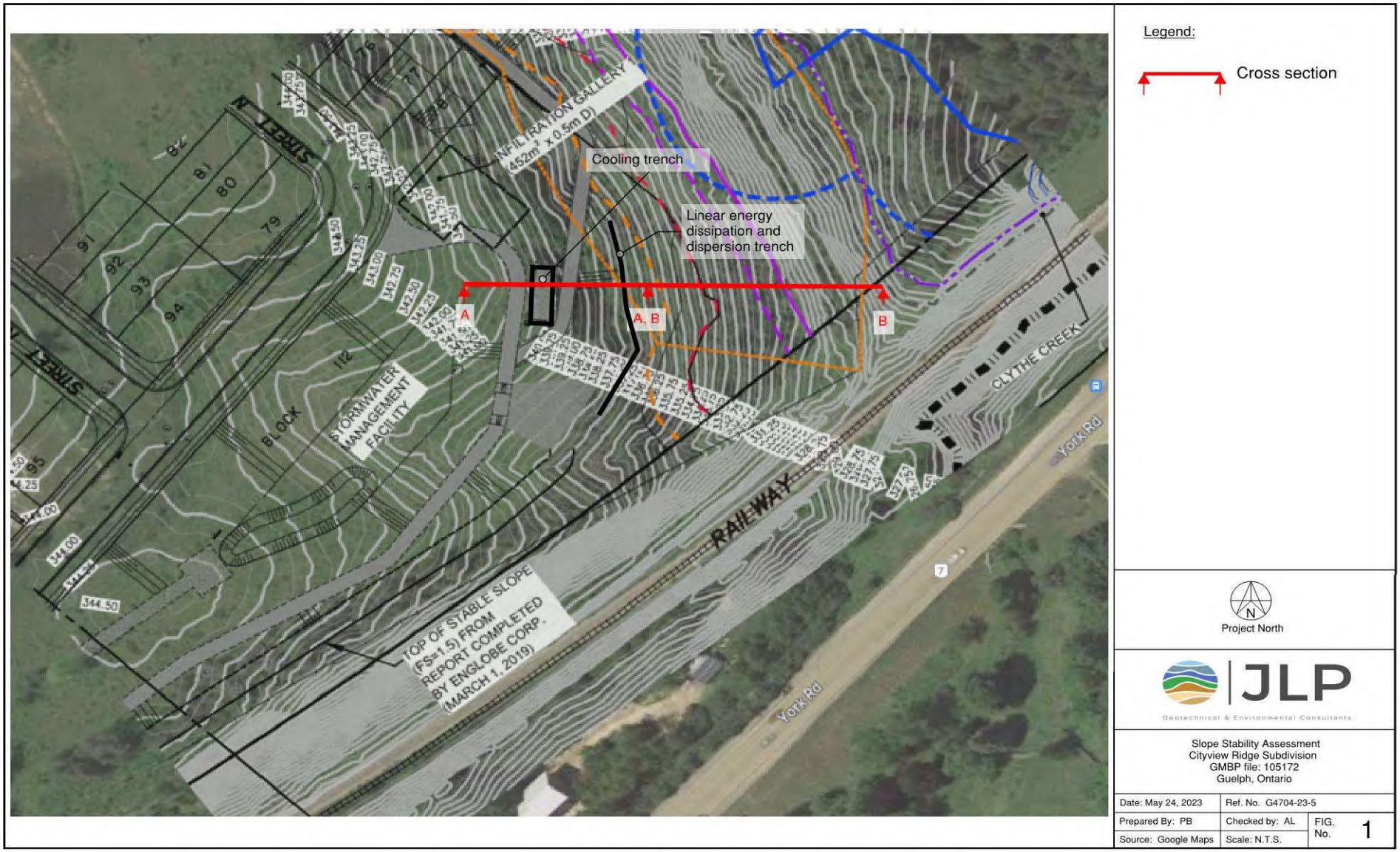


Alexander Lee, M. Sc. (Eng.), P.Eng.
Senior Geotechnical Engineer

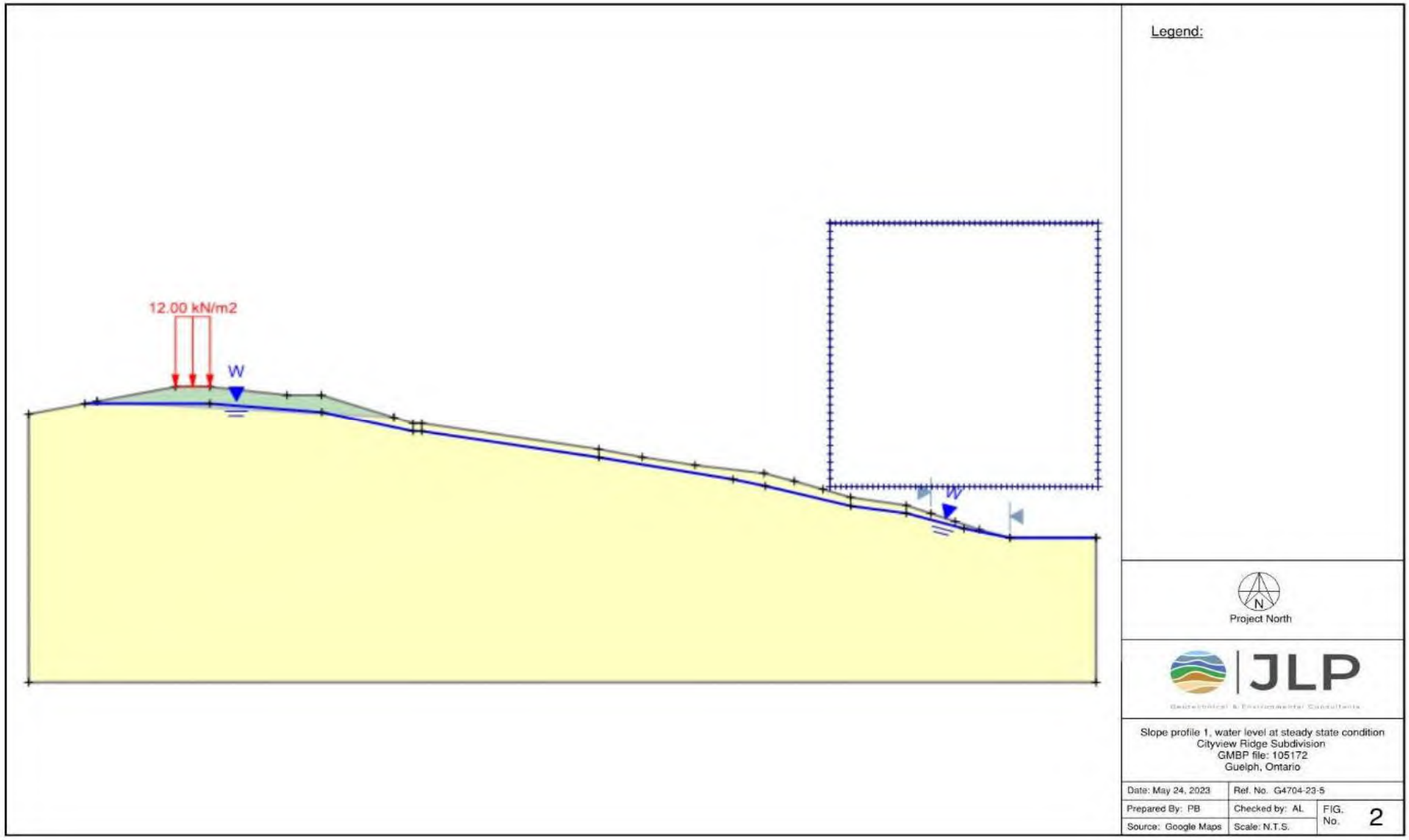
J. Broad, B.A.
General Manager, Geotechnical Services

cc: GM BluePlan Engineering Limited – Attn: Angela Kroetsch (angela.kroetsch@gmblueplan.ca)

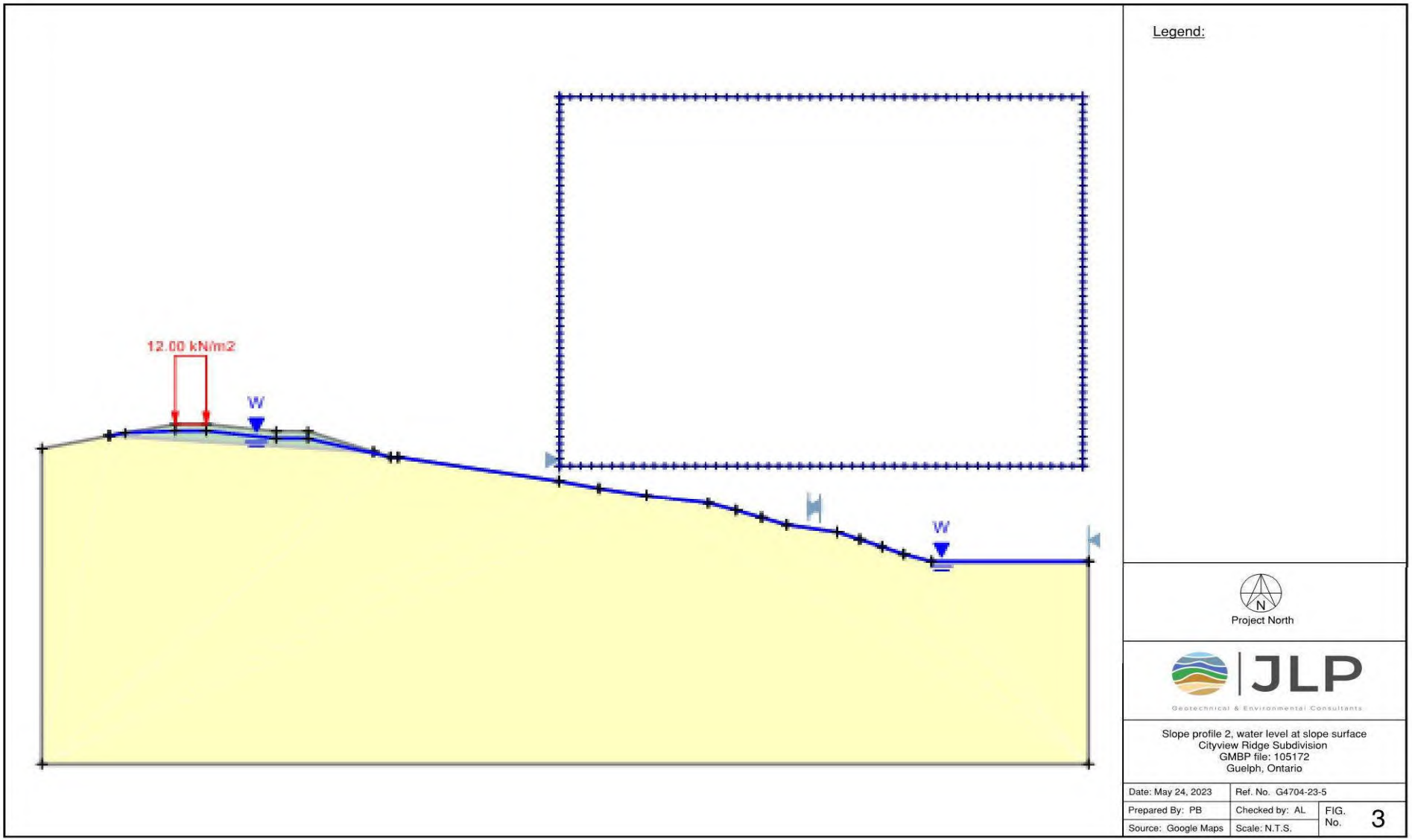
Enclosures



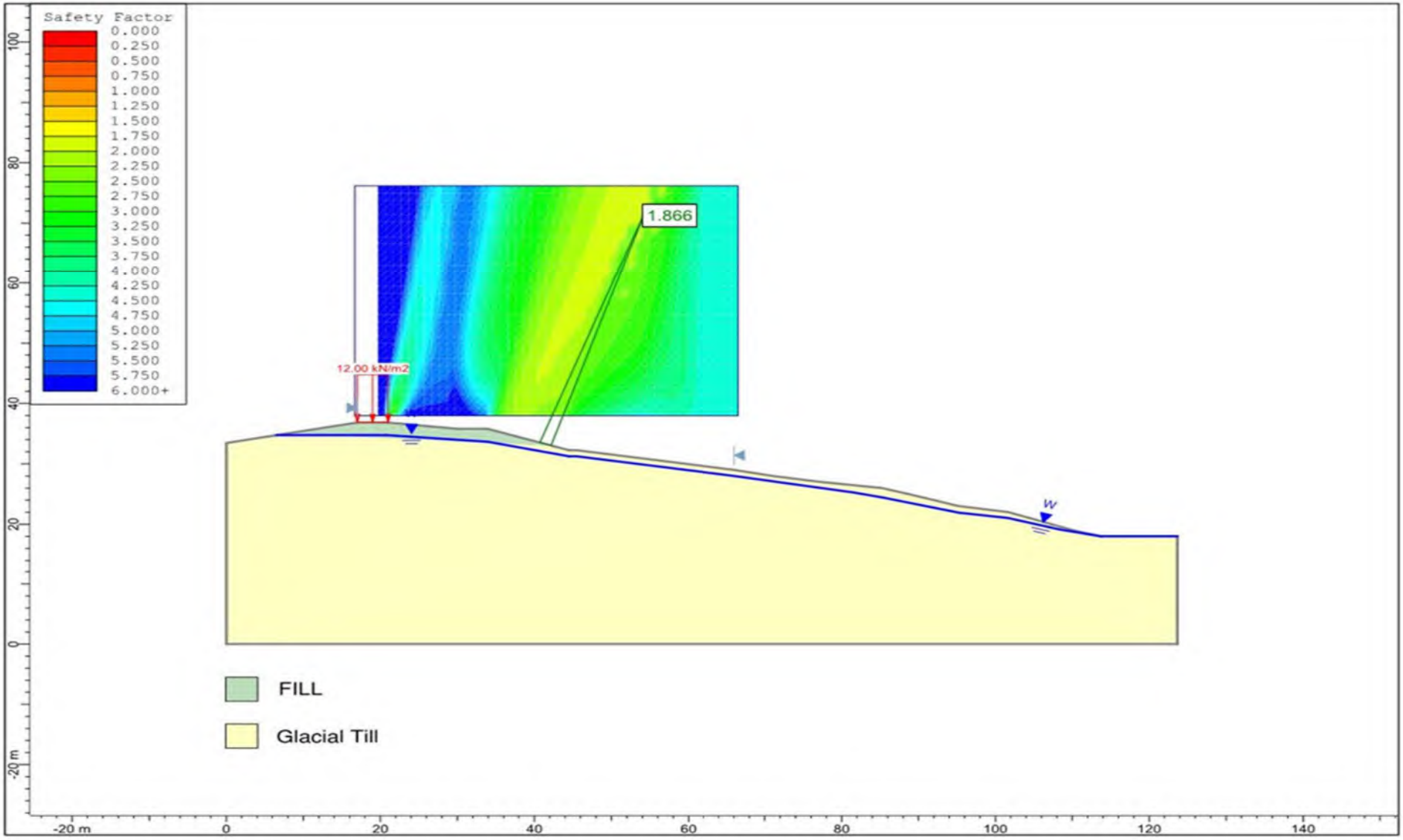
Enclosure 1: Site Plan with Cross-Section A-A and B-B for Slope Stability Analysis



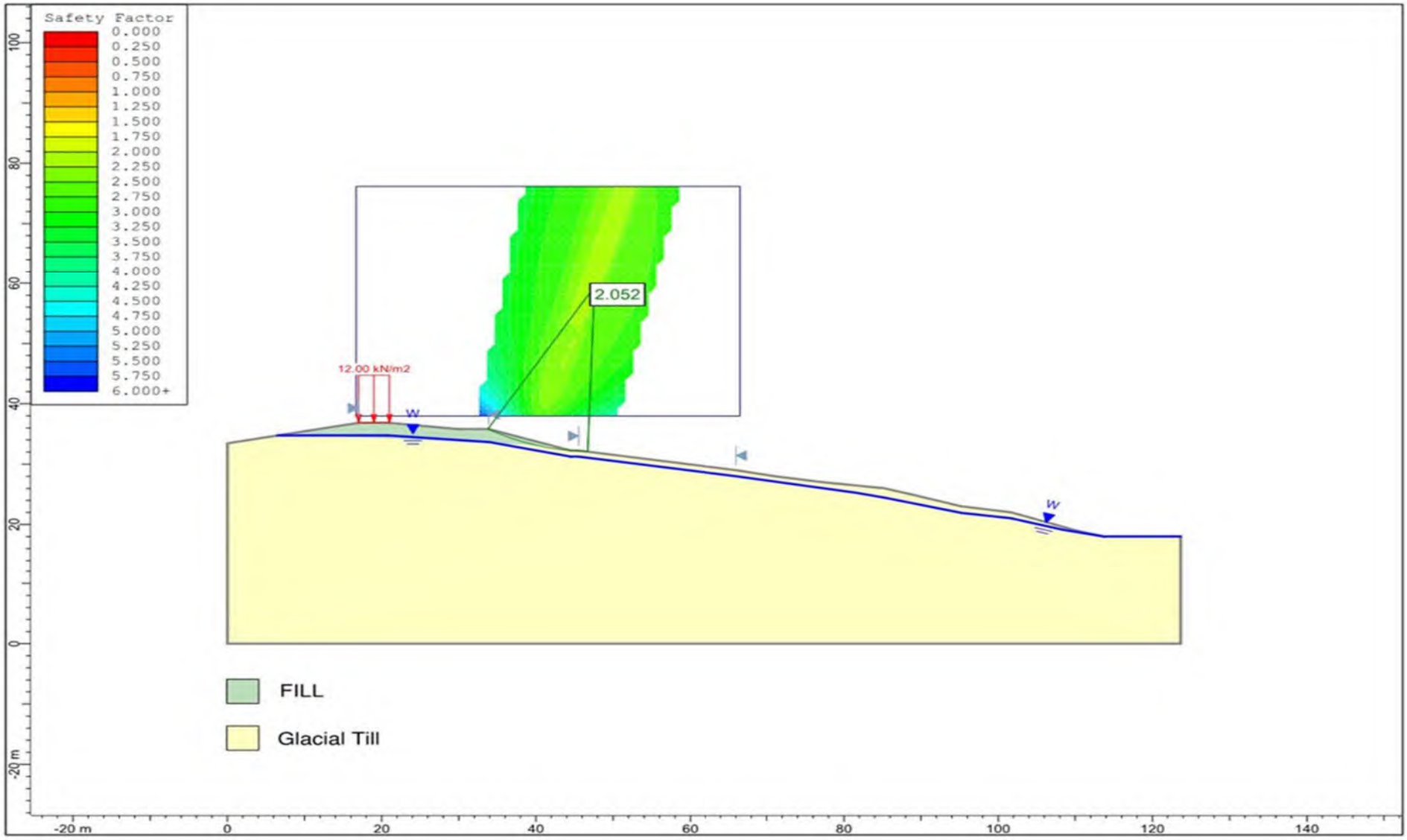
Enclosure 2: Slope Profile 1 – Water level at Steady State Condition



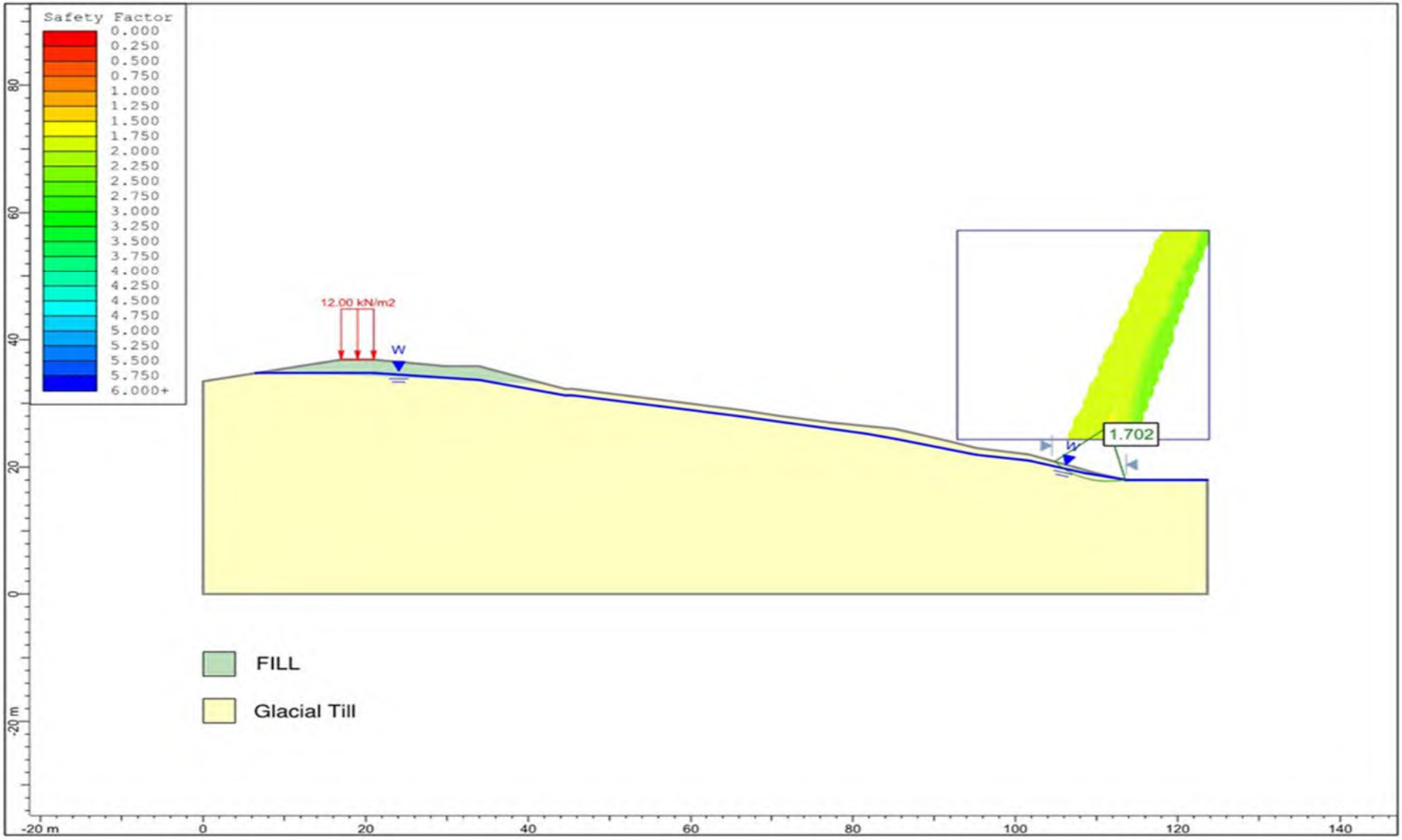
Enclosure 3: Slope Profile 2 – Water Level at Slope Surface



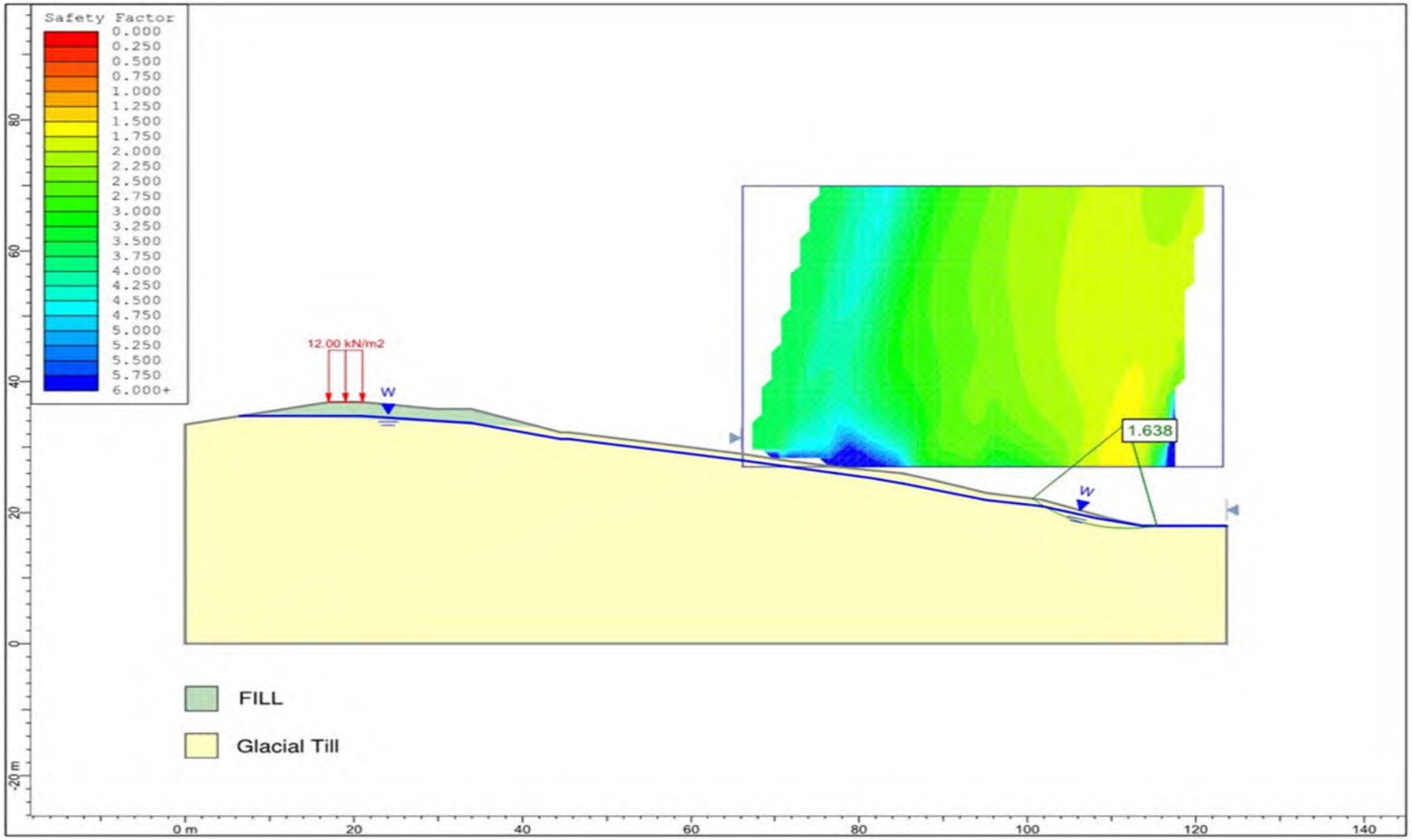
Enclosure 4 – Proposed Slope, Water Level at Steady State, Section A-A, Surface Failure, FOS = 1.866



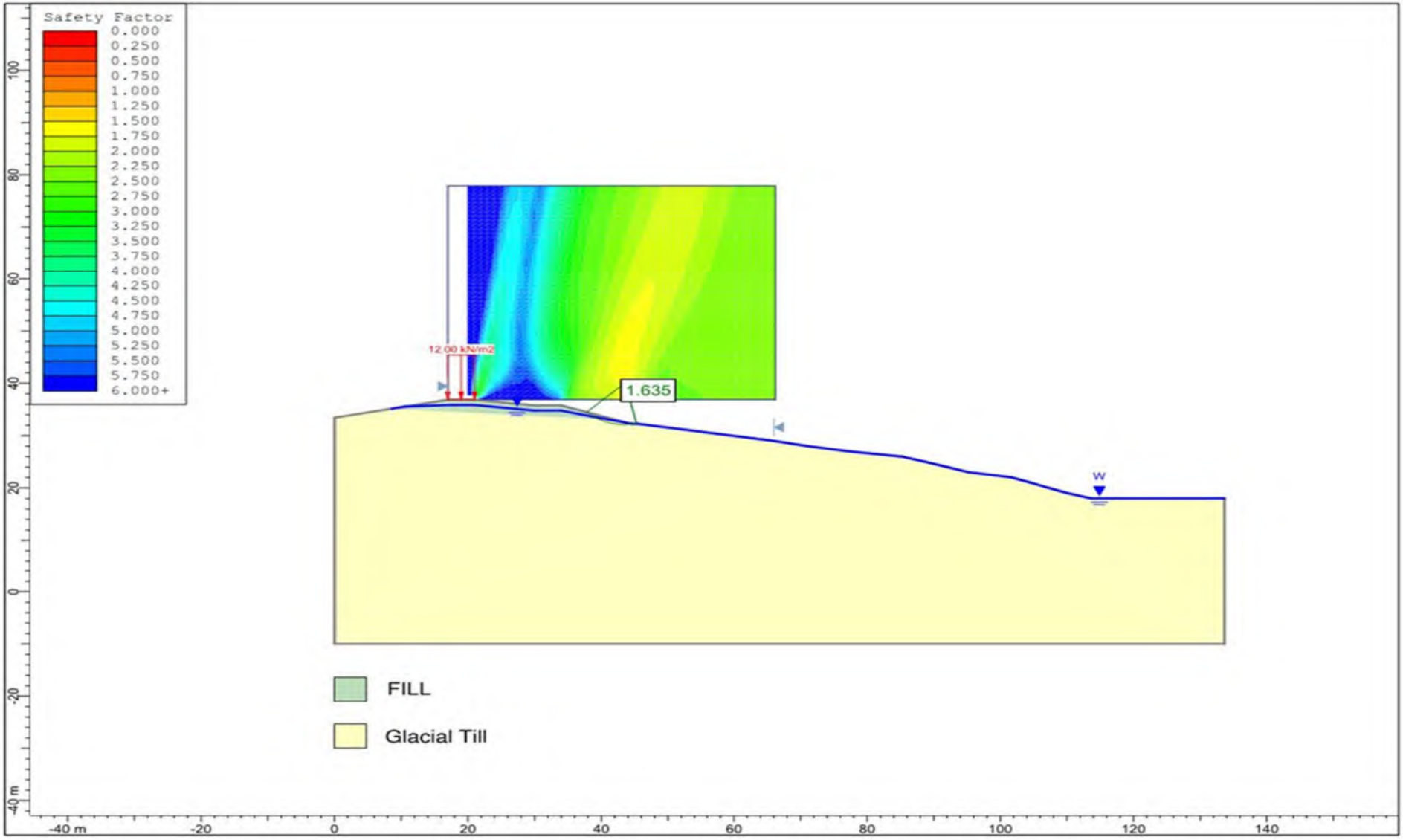
Enclosure 5 – Proposed Slope, Water Level at Steady State, Section A-A, Shallow Failure, FOS = 2.052



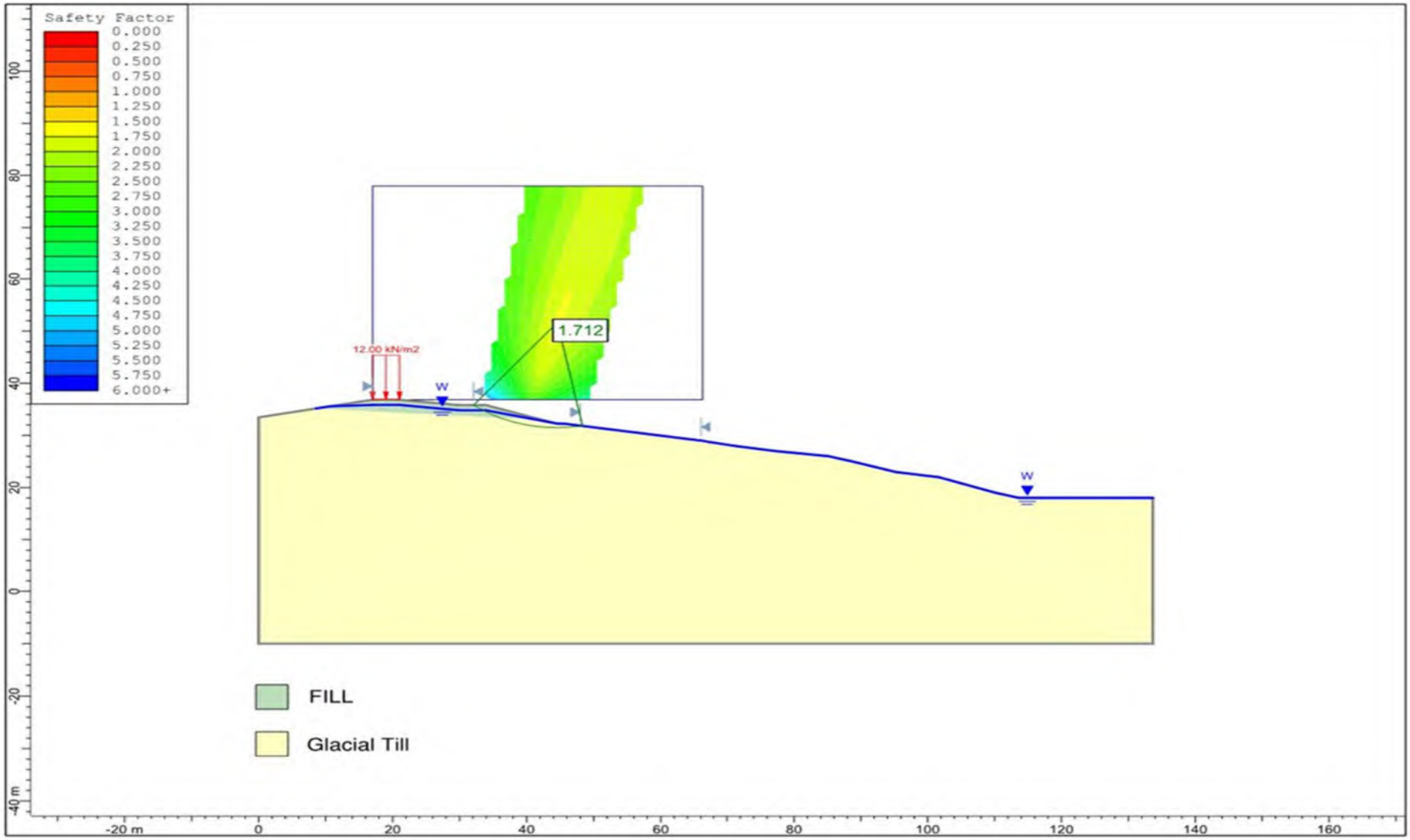
Enclosure 6 – Existing Slope, Water Level at Steady State, Section B-B, Shallow Failure, FOS = 1.702



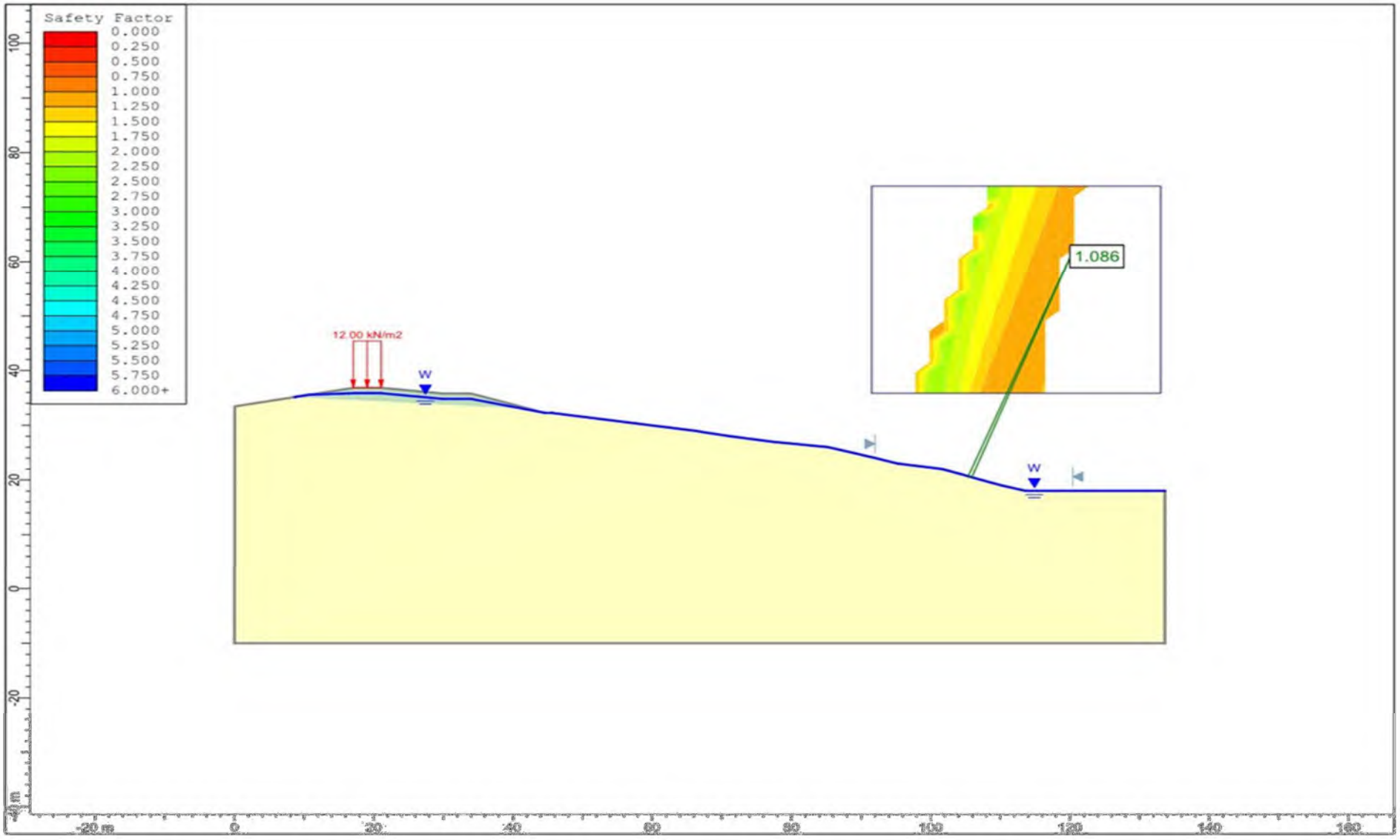
Enclosure 7 – Existing Slope, Water Level at Steady State, Section B-B, Deep-Seated Failure, FOS = 1.638



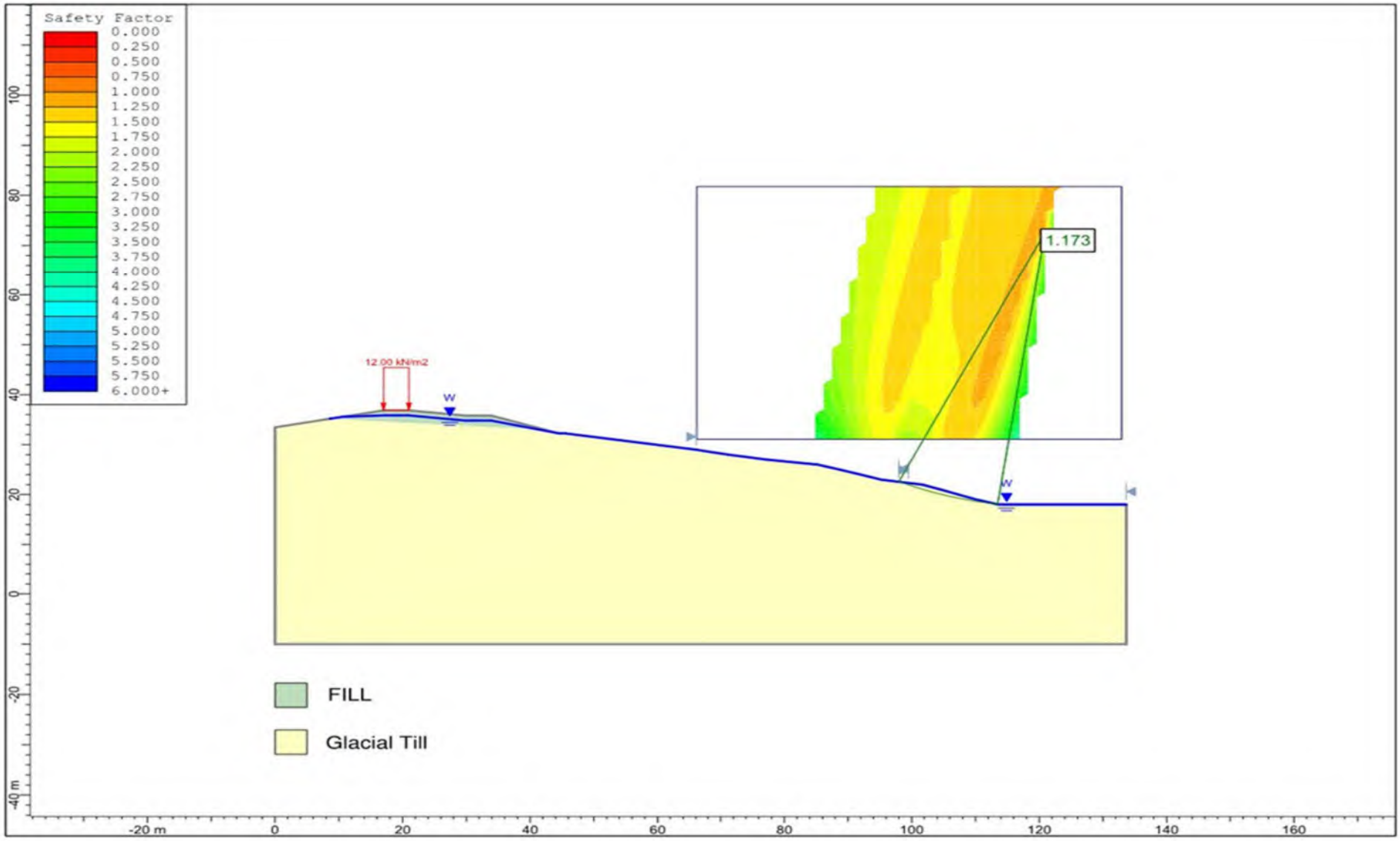
Enclosure 8 – Proposed Slope, Water Level at Slope Surface, Section A-A, Shallow Failure, FOS = 1.635



Enclosure 9 – Proposed Slope, Water Level at Slope Surface, Section A-A, Deep-Seated Failure, FOS = 1.712



Enclosure 10 – Existing Slope, Water Level at Slope Surface, Section B-B, Surface Failure, FOS = 1.086



Enclosure 11 – Existing Slope, Water Level at Slope Surface, Section B-B, Shallow Failure, FOS = 1.173

APPENDIX D:

GUELPH PERMEAMETER TESTING, CMT ENGINEERING, 2020

CMT Engineering Inc.
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October 23, 2020 20-513.R01

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

Attention: Mr. Patrick Grier, P.Eng.

Dear Sir:

Re: Insitu Permeability Testing
Cityview Ridge Subdivision
Cityview Drive North
Guelph, Ontario

The services of CMT Engineering Inc. (CMT Inc.) were retained by Mr. Patrick Grier, P.Eng. of GM BluePlan Engineering Limited to conduct insitu permeability testing for infiltration galleries for the proposed residential development to be constructed at a site near Cityview Drive North in Guelph, Ontario. The location of the site is shown on Drawing 1.

It is understood that the owner is proposing to construct a new residential subdivision. Currently, infiltration of individual lot stormwater is proposed through the installation of on-site infiltration galleries. As such, CMT Engineering Inc. conducted insitu permeability testing at the locations of the proposed infiltration galleries using the Guelph Permeameter Testing method conducted as per Appendix C of the Low Impact Development Stormwater Management Planning and Design Guide (LIDSWMP).

The subject site is currently vacant. It is apparent that the site has been utilized as a borrow pit since the topographic survey was completed in 2009 (based on the date on the Preliminary Grading and Drainage Plan). A review of historical aerial photography indicates that the earth borrow took place sometime between 2009 and 2013. There is currently a berm throughout the site. There are various areas of undisturbed soils with large trees throughout the site as well as areas of ponded water and cattails. A geotechnical investigation was completed at this site in 2006 by Naylor Engineering Associates Ltd. (NEAL). The information provided in the geotechnical report indicates that the site of the proposed development comprises predominantly

compact to very dense silt till overlying presumed bedrock. The silt till was evident in the exposed slopes throughout the borrow areas of the site.

Field Work

CMT Engineering Inc. conducted a field investigation to determine the estimated infiltration rates at the proposed infiltration gallery locations. The investigation was conducted on September 30 and October 1, 2020 and was comprised of eighteen (18) insitu Guelph Permeameter Constant Head borehole infiltration tests (in accordance with ASTM D5126 Section 4.1.6) conducted by employees of CMT Engineering Inc. A minimum of two (2) boreholes were advanced at the test locations to allow for one exploration borehole and lower test and one borehole for the upper permeameter testing, utilizing a Geoprobe 7822DT drillrig operated by CMT Drilling Inc. staff. Three (3) boreholes were advanced at the Permeameter test location #2 due to saturated soils being encountered at an elevation higher than the second test elevation. The boreholes were advanced utilizing the macro core (MC5) direct push continuous soil sampling methodology. At Permeameter test location #9, the 6.1 m (20.0 ft) borehole was advanced utilizing hollow stem augers to achieve the required testing depth.

The layout of the testing locations and ground surface elevations at the test locations was completed by others prior to the field investigation. The locations and ground surface elevations of the permeameter tests are shown on Drawing 2.

Appendix C of the LIDSWMP recommends that at least one infiltration test should be conducted at the bottom elevation of the proposed infiltration gallery, plus one additional test at every soil horizon encountered within 1.5 m below the bottom elevation (a minimum of two tests per infiltration gallery). The infiltration galleries require a minimum of 1.2 m depth of cover for frost protection and it is understood that the infiltration galleries are not to exceed 0.6 m (2.0 ft) in thickness; therefore, one insitu permeability test will be required at a depth of approximately 1.8 m (6.0 ft) below the design finished grade elevation and a second insitu permeability test will be required at a depth of approximately 3.3 m (10.8 ft) below the design finished grade elevation.

Appendix C of the LIDSWMP also recommends that one test pit should be advanced for an infiltration gallery with a footprint of less than 50 m^2, two test pits for infiltration galleries with footprints between 50 m^2 and 900 m^2, a minimum of one additional test pit for each additional 450 m^2 of infiltration gallery footprint, and two soil borings may be conducted for every test pit. The additional borings/test pits are to ensure the same soil units that were tested in the infiltration testing extend to the extents of the infiltration gallery.

Subsoil Conditions

The soils encountered in the boreholes are described briefly below and a more detailed stratigraphic description is provided on the borehole logs attached. The following paragraphs have been simplified into terms of major soil strata. The soil boundaries indicated have been inferred from non-continuous samples and observations of sampling and drilling resistance and typically represent transitions from one soil type to another rather than exact planes of geological change. Further, the subsurface conditions are anticipated to vary between and beyond the borehole locations.

Topsoil

Loose, dark brown topsoil was encountered at the ground surface in all boreholes with the exception of Borehole 6. The thickness of the topsoil at the borehole locations was observed to range from approximately 150 mm to 910 mm (average 265 mm). The topsoil was generally considered to be in a moist state. Materials designated as topsoil in this report were classified based solely on visual and textural evidence. Testing of organic content or for other nutrients was not carried out.

Peat

Very loose, dark brown peat was encountered at the surface of Borehole 6. The peat was observed to be approximately 50 mm in thickness and was considered to be in a moist state. Materials designated as topsoil in this report were classified based solely on visual and textural evidence.

Silty Sand

Loose, brown silty sand, was encountered underlying the topsoil in Borehole 1. The silty sand was observed to be approximately 310 mm in thickness and was considered to be in a moist state.

Silt Till

Loose to dense, brown to grey silt till with occasional large gravel was encountered underlying the silty sand in Borehole 1; underlying the topsoil in Boreholes 2, 3, 4, 5, 7, 8 and 9; and underlying the peat in Borehole 6. The silt till was considered to be moist to wet, with moisture contents ranging from about 3.1% to 9.5% (average 7.5%).

Groundwater

No accumulated groundwater was encountered upon completion of the boreholes. Groundwater conditions are generally dependent on the weather conditions, amount of precipitation, site grading and other measures in place to control surface water drainage, as well as the time of year, and can fluctuate significantly in elevation over time.

Testing and Results

The test holes varied in diameter from between approximately 5.7 cm (2.25 in, used at 17 test locations) to approximately 8.3 cm (3.25 in, used at 1 test location) and extended to depths between 0.46 m (1.5 ft) to 6.1 m (20.0 ft) below the existing ground surface elevations at the test

locations. Constant head permeability testing was conducted using a constant head setting of 10 cm.

Based on information gathered from the permeameter testing and borehole data, the following table presents the estimated field saturated hydraulic conductivity, estimated infiltration rates with no safety factors applied, test locations, permeameter test location number, and approximate elevations of the tests:

Test Location	Permeameter Test Location Number	Approximate Elevation of Upper Test [m]	Approximate Elevation of Lower Test [m]	Top Test Estimated Field Saturated Hydraulic Conductivity Kfs [cm/sec]	Bottom Test Estimated Field Saturated Hydraulic Conductivity Kfs [cm/sec]	Top Test Estimated Infiltration Rate - No Safety Factor Applied [mm/hour]	Bottom Test Estimated Infiltration Rate - No Safety Factor Applied [mm/hour]
Lot 20	1	331.01	329.49	8.1×10^{-06}	4.0×10^{-06}	26	18
Lot 6	2	336.49**	335.27**	1.0×10^{-04}	2.8×10^{-07}	50	2
Lot 36, 44, 45	3	331.59	330.06	2.8×10^{-06}	8.1×10^{-06}	15	26
Lot 109,110	4	337.01	335.41	1.3×10^{-05}	6.9×10^{-06}	30	23
Lot 105	5	341.91	340.34	$<1.3 \times 10^{-07}$	1.2×10^{-05}	<0.5	30
Lot 85,86,95,96	6	342.54	340.86	$<1.6 \times 10^{-07}$	3.2×10^{-06}	<0.8	16
Lot 78	7	338.68*	337.31*	8.1×10^{-06}	1.6×10^{-06}	26	13
Lot 66	8	343.30*	341.93*	7.3×10^{-06}	1.6×10^{-06}	24	13
Lot 54	9	337.76	336.18	7.8×10^{-06}	4.6×10^{-05}	25	38

***Note: Testing elevations lowered due to the bottom of infiltration gallery being above the existing ground surface elevations.**
****Note: Testing elevations raised due to wet and/or swelling or caving soil conditions encountered in the borehole.**

In order to determine the design infiltration rate, the ratio of the infiltration rates at the proposed bottom of the infiltration gallery and the infiltration rate of the least permeable soil horizon within 1.5 m below the proposed bottom elevation of the BMP is calculated. As per LIDSWMP, the applicable safety factor from Table C2 is applied to the infiltration rate at the proposed base of the infiltration gallery.

The following table provides the ratio of infiltration rates, safety correction factor, and design infiltration rate for each proposed infiltration gallery location:

Test Location	Permeameter Number	Ratio of Top/Bottom Test Infiltration Rates	Safety Factor	Design Infiltration Rate [mm/hour]
Lot 20	1	1.44	3.5	7
Lot 6	2	20.83	8.5	5
Lot 36, 44, 45	3	0.60	2.5	6
Lot 109,110	4	1.28	3.5	8
Lot 105	5	<0.02	2.5	<0.2

Test Location	Permeameter Number	Ratio of Top/Bottom Test Infiltration Rates	Safety Factor	Design Infiltration Rate [mm/hour]
Lots 85, 86, 95, 96	6	<0.05	2.5	<0.3
Lot 78	7	1.96	3.5	7
Lot 66	8	1.85	3.5	7
Lot 54	9	0.67	2.5	10

It is required that inspections of the infiltration gallery bases be conducted prior to backfilling to confirm that the soils encountered within the excavation are consistent with the soils encountered in the boreholes.

CMT Inc. recommends that each infiltration gallery be designed with an overflow that has positive drainage to a storm sewer or other suitable outlet and that each downspout entering the infiltration gallery have a strainer/leaf deflector as well as a rainwater leader overflow outlet just above grade that is equipped with a splash pad to direct water away from the foundation. Regular maintenance of the downspout strainer/leaf deflector is required to ensure continuous operation and reduce the potential for the accumulation of sediment that can impede the functionality of the infiltration gallery.

It is important to emphasize that a soil investigation is, in fact, a random sampling of a site and the comments are based on the results obtained at the test locations only. It is therefore assumed that these results are representative of the subsoil conditions across the site. Should any conditions at the site be encountered which differ from those found at the test locations, we request that we be notified immediately in order to permit a reassessment of our recommendations.

We trust that this information meets your present requirements and we thank you for allowing us to undertake this project for you. Should you have any questions, please do not hesitate to contact our office at your convenience.

Yours truly,

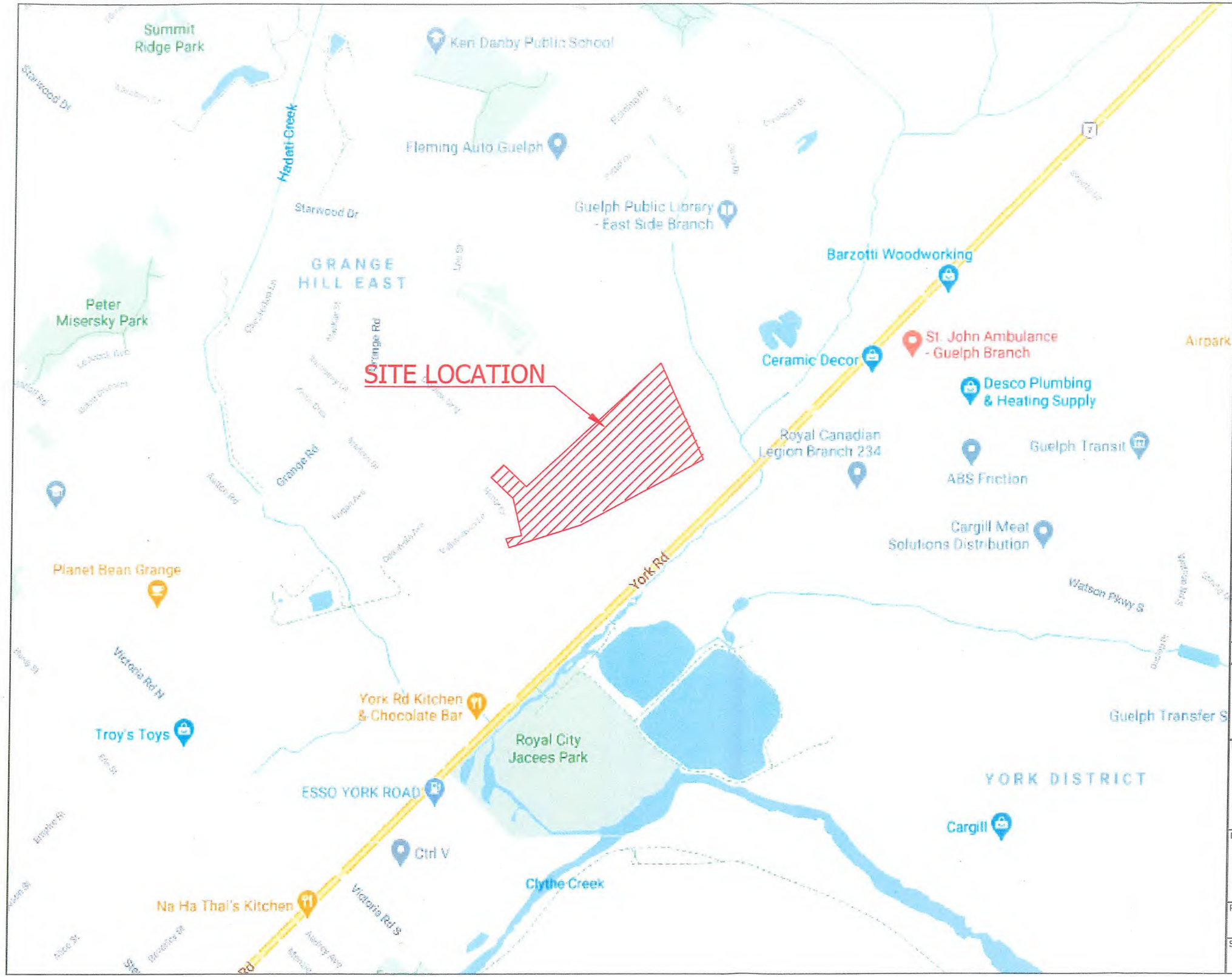


Weston Morlock, M.Eng., EIT

Nathan Chortos, P.Eng.

ks

Attachments: Drawing 1 - Site Location Map
Drawing 2 - Site Plan Showing Permeameter Test Locations
Borehole Logs



NOTES:

1. BASE MAP PROVIDED BY GOOGLE MAPS

N

NO.	DESCRIPTION	DATE

REVISIONS

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

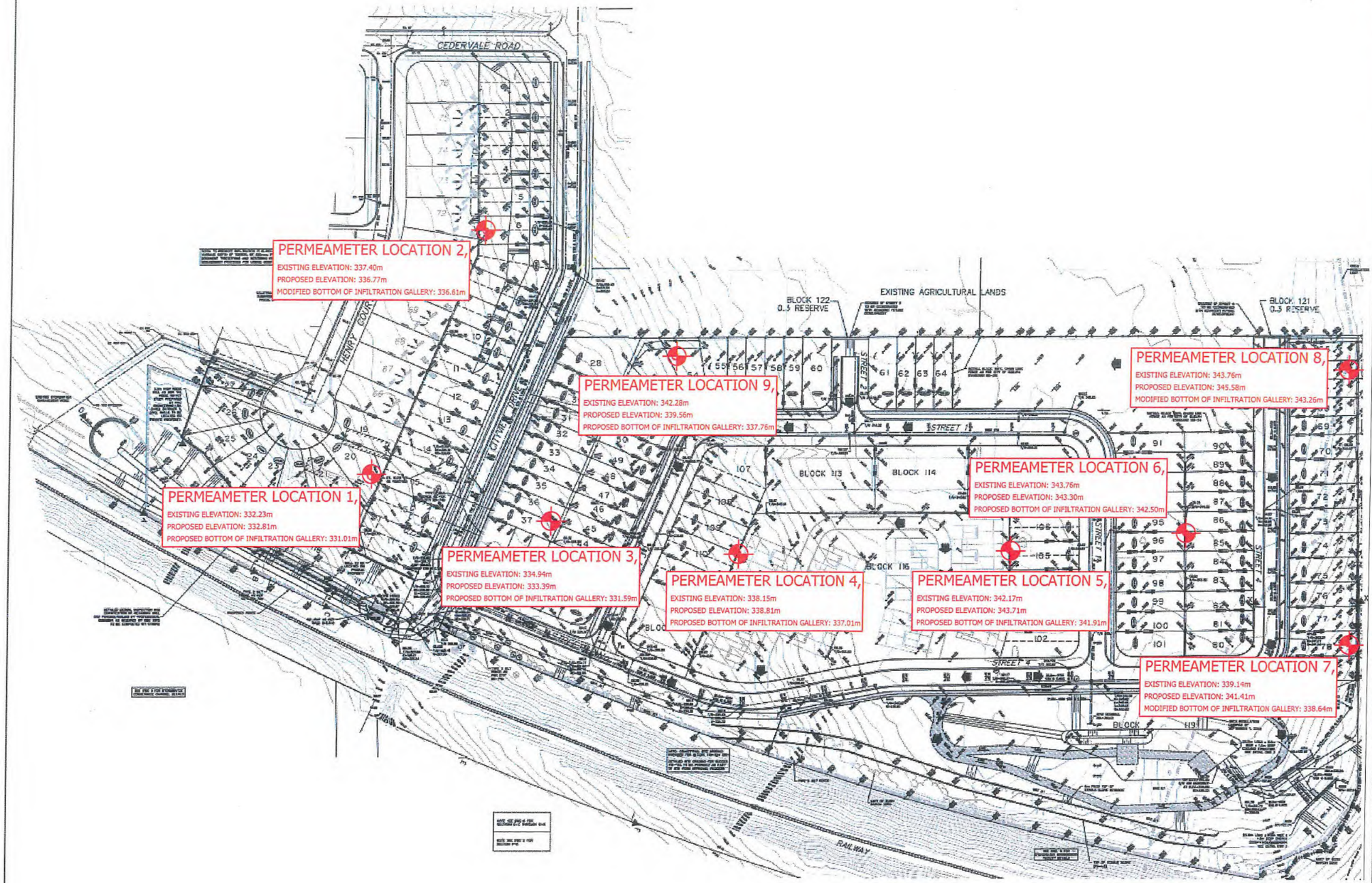
PROJECT:

INSITU PERMEABILITY TESTING
Cityview Ridge Subdivision
Guelph, Ontario

DRAWING TITLE:

SITE LOCATION MAP

PROJECT NO.:	DATE:
20-513	October 23, 2020
SCALE:	DRAWING NO.
N.T.S.	1



NOTES:

1. This drawing is for information purposes only. Locations and sizes of existing and proposed features are approximate only, and should not be used for construction.

LEGEND

CMT PERMEAMETER TEST LOCATION

NO.	DESCRIPTION	DATE

REVISIONS

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

PROJECT:

INSITU PERMEABILITY TESTING
Cityview Ridge Subdivision
Guelph, Ontario

DRAWING TITLE:

PLAN VIEW SHOWING
PERMEAMETER TEST LOCATIONS

PROJECT NO.:	DATE:
20-513	October 23, 2020
SCALE:	DRAWING NO.
N.T.S	2

CMT Engineering Inc.
1011 Industrial Crescent, Unit 1
St. Clements, Ontario, N0B 2M0
Telephone: 519 699 5775
Fax: 519 699 4664

BOREHOLE NUMBER PERMEAMETER 1

PROJECT: Insitu Permeability Testing
PROJECT ADDRESS: Cityview Ridge Subdivision
PROJECT NUMBER: 20-513
PROJECT LOCATION: Guelph, Ontario
DRILLING DATE: 20-10-1
GROUND ELEVATION: 332.23 m
DRILLING CONTRACTOR: CMT Drilling Inc.
LOGGED BY: W. Morlock
DRILLING EQUIPMENT: Geoprobe 7822DT
SAMPLING METHOD: MC5

DEPTH (m)	GRAPHIC LOG	MATERIAL DESCRIPTION	Depth, Elevation (m)	SAMPLE TYPE NUMBER	RECOVERY %	BLOW COUNTS (N VALUE)
		Loose, dark brown, gravelly topsoil, moist	0.00, 332.23			
		Loose, brown, silty sand, moist	0.15, 332.08			
1		Compact, brown, silt till, moist	0.46, 331.77	MC5 1	100	
		Approximate proposed bottom of infiltration gallery elevation	1.22, 331.01			
2				MC5 2	100	

SPT N VALUE: 10, 20, 30, 40
POCKET PENETROMETER (kPa): 90, 180, 270, 360
MOISTURE CONTENT (%): 12, 24, 36, 48
3.1
8.5

Bottom of borehole at 2.72 m, Elevation 329.51 m.

No accumulated groundwater or caving encountered upon borehole completion.

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St. Clements, Ontario, N0B 2M0
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Fax: 519 699 4664

BOREHOLE NUMBER PERMEAMETER 2

PROJECT: Insitu Permeability Testing
PROJECT ADDRESS: Cityview Ridge Subdivision
PROJECT LOCATION: Guelph, Ontario
PROJECT NUMBER: 20-513
DRILLING DATE: 20-10-1
GROUND ELEVATION: 337.40 m
DRILLING CONTRACTOR: CMT Drilling Inc.
LOGGED BY: W. Morlock
DRILLING EQUIPMENT: Geoprobe 7822DT
SAMPLING METHOD: MC5

DEPTH (m)	GRAPHIC LOG	MATERIAL DESCRIPTION	Depth, Elevation (m)	SAMPLE TYPE NUMBER	RECOVERY %	BLOW COUNTS (N VALUE)
		Loose, dark brown, topsoil, moist	0.00, 337.40	MC5 1	100	
1		Approximate modified proposed bottom of infiltration gallery elevation	0.79, 336.61			
		Loose, brown, silt till, moist	0.91, 336.49			
2		becoming wet	2.43, 334.97	MC5 2	100	
3						

SPT N VALUE: 10, 20, 30, 40
POCKET PENETROMETER (kPa): 90, 180, 270, 360
MOISTURE CONTENT (%): 12, 24, 36, 48

8.6
9

Bottom of borehole at 3.93 m, Elevation 333.47 m.

Dry cave encountered at about 2.44 m (8 ft.) below the ground surface (approximate elevation 334.96 m).

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1011 Industrial Crescent, Unit 1
St. Clements, Ontario, N0B 2M0
Telephone: 519 699 5775
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BOREHOLE NUMBER PERMEAMETER 3

PROJECT: Insitu Permeability Testing
PROJECT ADDRESS: Cityview Ridge Subdivision
PROJECT LOCATION: Guelph, Ontario
PROJECT NUMBER: 20-513
DRILLING DATE: 20-10-1
GROUND ELEVATION: 334.94 m
DRILLING CONTRACTOR: CMT Drilling Inc.
LOGGED BY: W. Morlock
DRILLING EQUIPMENT: Geoprobe 7822DT
SAMPLING METHOD: MC5

DEPTH (m)	GRAPHIC LOG	MATERIAL DESCRIPTION	Depth, Elevation (m)	SAMPLE TYPE NUMBER	RECOVERY %	BLOW COUNTS (N VALUE)
0		Loose, dark brown, topsoil, moist	0.00, 334.94			
		Compact, brown, silt till, moist	0.15, 334.79	MC5 1	100	
1						
2				MC5 2	100	
3						
		Approximate proposed bottom of infiltration gallery elevation	3.35, 331.59	MC5 3	100	
4						

SPT N VALUE: 10 20 30 40
POCKET PENETROMETER (kPa): 90 180 270 360
MOISTURE CONTENT (%): 12 24 36 48

8.4
8.5
9.5

Bottom of borehole at 4.88 m, Elevation 330.06 m.

No accumulated groundwater or caving encountered upon borehole completion.

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BOREHOLE NUMBER PERMEAMETER 4

PROJECT: Insitu Permeability Testing
PROJECT ADDRESS: Cityview Ridge Subdivision
PROJECT NUMBER: 20-513
PROJECT LOCATION: Guelph, Ontario
DRILLING DATE: 20-9-30
GROUND ELEVATION: 338.15 m
DRILLING CONTRACTOR: CMT Drilling Inc.
LOGGED BY: W. Morlock
DRILLING EQUIPMENT: Geoprobe 7822DT
SAMPLING METHOD: MC5

DEPTH (m)	GRAPHIC LOG	MATERIAL DESCRIPTION	Depth, Elevation (m)	SAMPLE TYPE NUMBER	RECOVERY %	BLOW COUNTS (N VALUE)
		Loose, dark brown, topsoil, moist	0.00, 338.15			
		Dense, brown, silt till with some large gravel, moist	0.15, 338.00	MC5 1	100	
1		Approximate proposed bottom of infiltration gallery elevation	1.14, 337.01			
2				MC5 2	100	

SPT N VALUE: 10, 20, 30, 40
POCKET PENETROMETER (kPa): 90, 180, 270, 360
MOISTURE CONTENT (%): 12, 24, 36, 48

4.7
8.2

Bottom of borehole at 2.74 m, Elevation 335.41 m.

No accumulated groundwater or caving encountered upon borehole completion.

CMT Engineering Inc.
1011 Industrial Crescent, Unit 1
St. Clements, Ontario, N0B 2M0
Telephone: 519 699 5775
Fax: 519 699 4664

BOREHOLE NUMBER PERMEAMETER 5

PROJECT: Insitu Permeability Testing
PROJECT ADDRESS: Cityview Ridge Subdivision
PROJECT LOCATION: Guelph, Ontario
PROJECT NUMBER: 20-513
DRILLING DATE: 20-9-30
GROUND ELEVATION: 342.17 m
DRILLING CONTRACTOR: CMT Drilling Inc.
LOGGED BY: W. Morlock
DRILLING EQUIPMENT: Geoprobe 7822DT
SAMPLING METHOD: MC5

DEPTH (m)	GRAPHIC LOG	MATERIAL DESCRIPTION	Depth, Elevation (m)	SAMPLE TYPE NUMBER	RECOVERY %	BLOW COUNTS (N VALUE)
		Loose, dark brown, topsoil, moist	0.00, 342.17			
		Dense, brown, silt till, moist	0.15, 342.02			
		Approximate proposed bottom of infiltration gallery elevation	0.26, 341.91			
1				MC5 1	100	
		becoming grey with some larger gravel	1.52, 340.65	MC5 2	100	

SPT N VALUE: 10, 20, 30, 40
POCKET PENETROMETER (kPa): 90, 180, 270, 360
MOISTURE CONTENT (%): 12, 24, 36, 48
5.7
8.4

Bottom of borehole at 1.83 m, Elevation 340.34 m.

No accumulated groundwater or caving encountered upon borehole completion.

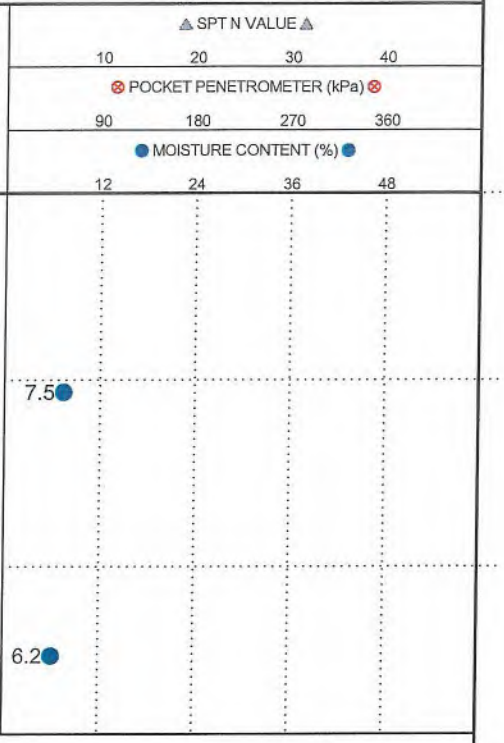
CMT Engineering Inc.
1011 Industrial Crescent, Unit 1
St. Clements, Ontario, N0B 2M0
Telephone: 519 699 5775
Fax: 519 699 4664

BOREHOLE NUMBER PERMEAMETER 6

PROJECT: Insitu Permeability Testing
PROJECT ADDRESS: Cityview Ridge Subdivision
PROJECT NUMBER: 20-513
PROJECT LOCATION: Guelph, Ontario
DRILLING DATE: 20-9-30
GROUND ELEVATION: 343.76 m
DRILLING CONTRACTOR: CMT Drilling Inc.
LOGGED BY: W. Morlock
DRILLING EQUIPMENT: Geoprobe 7822DT
SAMPLING METHOD: MC5

DEPTH (m)	GRAPHIC LOG	MATERIAL DESCRIPTION	Depth, Elevation (m)	SAMPLE TYPE NUMBER	RECOVERY %	BLOW COUNTS (N VALUE)
		Very loose, dark brown, peat, moist	0.00, 343.76			
		Compact, brown, silt till, wet	0.05, 343.71			
		becoming moist with occasional large gravels encountered	0.46, 343.30	MC5 1	100	
1						
		Approximate proposed bottom of infiltration gallery elevation	1.26, 342.50			
		becoming very dense	1.52, 342.24			
2				MC5 1	100	
		becoming grey	2.77, 340.99			
		Bottom of borehole at 2.90 m, Elevation 340.86 m.				

No accumulated groundwater or caving encountered upon borehole completion.



CMT Engineering Inc.
1011 Industrial Crescent, Unit 1
St. Clements, Ontario, N0B 2M0
Telephone: 519 699 5775
Fax: 519 699 4664

BOREHOLE NUMBER PERMEAMETER 7

PROJECT: Insitu Permeability Testing
PROJECT ADDRESS: Cityview Ridge Subdivision
PROJECT NUMBER: 20-513
PROJECT LOCATION: Guelph, Ontario
DRILLING DATE: 20-9-30
GROUND ELEVATION: 339.14 m
DRILLING CONTRACTOR: CMT Drilling Inc.
LOGGED BY: W. Morlock
DRILLING EQUIPMENT: Geoprobe 7822DT
SAMPLING METHOD: MC5

DEPTH (m)	GRAPHIC LOG	MATERIAL DESCRIPTION	Depth, Elevation (m)	SAMPLE TYPE NUMBER	RECOVERY %	BLOW COUNTS (N VALUE)
		Loose, dark brown, topsoil, moist	0.00, 339.14			
		Compact, brown, silt till with occasional large gravel, moist	0.20, 338.94			
		Approximate modified proposed bottom of infiltration gallery elevation	0.50, 338.64	MC5 1	66	
1				MC5 2	100	

SPT N VALUE: 10, 20, 30, 40
POCKET PENETROMETER (kPa): 90, 180, 270, 360
MOISTURE CONTENT (%): 12, 24, 36, 48

8.6
8.9

Bottom of borehole at 1.83 m, Elevation 337.31 m.

No accumulated groundwater or caving encountered upon borehole completion.

CMT Engineering Inc.
1011 Industrial Crescent, Unit 1
St. Clements, Ontario, N0B 2M0
Telephone: 519 699 5775
Fax: 519 699 4664

BOREHOLE NUMBER PERMEAMETER 8

PROJECT: Insitu Permeability Testing
PROJECT ADDRESS: Cityview Ridge Subdivision
PROJECT LOCATION: Guelph, Ontario
PROJECT NUMBER: 20-513
DRILLING DATE: 20-9-30
GROUND ELEVATION: 343.76 m
DRILLING CONTRACTOR: CMT Drilling Inc.
LOGGED BY: W. Morlock
DRILLING EQUIPMENT: Geoprobe 7822DT
SAMPLING METHOD: MC5

DEPTH (m)	GRAPHIC LOG	MATERIAL DESCRIPTION	Depth, Elevation (m)	SAMPLE TYPE NUMBER	RECOVERY %	BLOW COUNTS (N VALUE)
		Loose, dark brown, gravelly topsoil, moist	0.00, 343.76			
		Compact, brown, silt till with some large gravel, moist	0.23, 343.53			
		Approximate modified proposed bottom of infiltration gallery elevation	0.50, 343.26	MC5 1	85	
1				MC5 2	100	

SPT N VALUE: 10, 20, 30, 40
POCKET PENETROMETER (kPa): 90, 180, 270, 360
MOISTURE CONTENT (%): 12, 24, 36, 48
7.1
9

Bottom of borehole at 1.83 m, Elevation 341.93 m.

No accumulated groundwater or caving encountered upon borehole completion.

CMT Engineering Inc.
1011 Industrial Crescent, Unit 1
St. Clements, Ontario, N0B 2M0
Telephone: 519 699 5775
Fax: 519 699 4664

BOREHOLE NUMBER PERMEAMETER 9

PROJECT: Insitu Permeability Testing
PROJECT ADDRESS: Cityview Ridge Subdivision
PROJECT NUMBER: 20-513
PROJECT LOCATION: Guelph, Ontario
DRILLING DATE: 20-10-1
GROUND ELEVATION: 342.28 m
DRILLING CONTRACTOR: CMT Drilling Inc.
LOGGED BY: W. Morlock
DRILLING EQUIPMENT: Geoprobe 7822DT
SAMPLING METHOD: Auger/MC5

DEPTH (m)	GRAPHIC LOG	MATERIAL DESCRIPTION	Depth, Elevation (m)	SAMPLE TYPE NUMBER	RECOVERY %	BLOW COUNTS (N VALUE)
		Loose, dark brown, topsoil, moist	0.00, 342.28			
		Compact, brown, silt till, moist	0.18, 342.10	MC5 1	100	
1						
2				MC5 2	49	
3						
4				MC5 3	100	
		Approximate proposed bottom of infiltration gallery elevation	4.52, 337.76			
5				MC5 4	100	
6						

SPT N VALUE: 10, 20, 30, 40
POCKET PENETROMETER (kPa): 90, 180, 270, 360
MOISTURE CONTENT (%): 12, 24, 36, 48

5.4
9.4
7.5
5.9

Bottom of borehole at 6.10 m, Elevation 336.18 m.

No accumulated groundwater or caving encountered upon borehole completion.

APPENDIX E:

HYDROGEOLOGICAL INVESTIGATION,
BANKS GROUNDWATER ENGINEERING LIMITED, 2014

Technical Memorandum (DRAFT)

Banks Groundwater Engineering Limited
940 Watson Road South, RR 1 Puslinch, Ontario N0B 2J0
519.829.4808 www.banksgroundwater.ca

17 November 2014

To: Carson Reid – Cityview Ridge Developments Inc.

Copies: Angela Kroetsch – GM BluePlan Engineering Limited
Mirek Sharp – North-South Environmental Inc.
Nancy Shoemaker – Black, Shoemaker, Robinson & Donaldson Limited

From: Bill Banks

Re: Hydrogeological Investigation
Environmental Impact Study
Proposed Cityview Ridge Development, City of Guelph

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1 Introduction

This Technical Memorandum presents the updated results of a hydrogeological investigation completed for this proposed development. The site is located immediately northwest of the intersection of York Road and Watson Parkway, adjacent to Cityview Drive, and north of the Canadian National Railway, in the City of Guelph.

The results of the hydrogeological investigation have been updated to include additional groundwater monitoring conducted on-site from December 2012 to October 2014. This investigation was also completed to support pre- and post-development water balance calculations, by providing estimates of current on-site infiltration of precipitation and groundwater discharge to an on-site wetland and adjacent creek. The results and the interpretation of hydrogeological conditions are provided for inclusion or reference in an Environmental Impact Study (EIS) for this proposed development. The hydrogeological investigation included the following tasks:

- Review of available information including: draft site plan, previous geotechnical investigation data, published geology maps and reports, City of Guelph groundwater study reports, aerial photography, wetland mapping and analyses, and stormwater management plans
- Site reconnaissance
- Initial installation of shallow piezometers in 2009 at three locations adjacent to an on-site wetland and creek, and the subsequent installation in 2012 of shallow piezometers at one additional location adjacent to the on-site wetland
- Initial short-term monitoring of groundwater levels in 2009 to determine hydraulic gradients and evaluate groundwater flows to the on-site wetland and adjacent creek
- Subsequent longer-term monitoring of groundwater levels in shallow piezometers to assess seasonal variations in groundwater discharge to the on-site wetland and adjacent creek
- Monitoring of groundwater levels in existing on-site monitoring wells
- Analysis of the results of the background review, groundwater monitoring and the local hydrogeological conditions

- Analysis of groundwater levels to establish depths to water table, directions and rates of groundwater flow, the need for stormwater management systems, and the interaction of groundwater and the wetland
- Consideration and evaluation of source water protection related to City of Guelph municipal wells.

Presented below is a summary of the geology and hydrogeology of the area in which the site is located, followed by the results of the groundwater monitoring, and analysis of groundwater recharge and discharge in relation to the wetland.

2 Surficial Geology

The study site is situated within the Guelph Drumlin Fields physiographic region, as defined by Chapman and Putnam (1984). The Guelph Drumlin Field consists of a series of northwest-southeast trending drumlins that are regionally situated to the northwest of the Paris Moraine. The drumlins are characterized by a series of elongated oval-shaped hills. The topography of the local area is dominated by three closely-spaced drumlins. The proposed residential development area of the site is located on the southern end of the middle drumlin. The eastern part of the site encompasses the slope of the drumlin and lower lying areas. Multiple residential development is proposed for the easternmost part of the site adjacent to Watson Parkway North.

The drumlins in the Guelph Drumlin Field are comprised of a sandy facies (up to 40 percent sand) of the Port Stanley Till, which is typically a silt to sandy silt till (Karrow, 1968, 1987). Overburden thickness is more than 30 m at the highest elevation of the drumlins. The overburden deposits in the lower areas comprise a series of terraced deposits of glacial outwash (sand and gravel) and lacustrine (sand) materials. The overburden thins to less than 4 m in the lower-lying areas. Wetland areas are generally found associated with the glacial outwash deposits within these lower lying areas. A wetland occurs in the south-eastern area of the site at the base of the drumlin, and is interpreted to drain to the adjacent Clythe Creek.

The results of a previous geotechnical investigation of this site, which included drilling and soil sampling at 10 locations on-site, confirmed the shallow soils on the drumlin comprise a sandy silt till and the shallow soils in the eastern part of the site comprise sand and gravel (Naylor Engineering Associates, 2006).

3 Overburden Hydrogeology

Groundwater occurs within the bedrock formations and overburden deposits throughout the region and flows horizontally and vertically under hydraulic gradients. The rate of groundwater flow is dependent on the hydraulic conductivity of the deposits and formations, as well as the magnitude of the local and regional hydraulic gradients. The rate of groundwater flow is typically very slow relative to the flow of surface water in creeks, streams, and rivers.

Groundwater flow in the local area is interpreted to be southerly towards discharge to the Eramosa River, which is about 700 metres south of the site. A component of localized groundwater flow on-site is expected to be south-easterly towards discharge to the wetland and Clythe Creek.

Drumlins comprising a silt to sandy silt glacial till typically have limited intergranular porosity and hydraulic conductivity. These deposits do not transmit water readily and will likely act to limit the flow of groundwater. The logs of the eight boreholes drilled on the drumlin indicate the sandy silt till increased in density with depth, with borehole depths ranging from 5.7 to 11.1 metres. Given the characteristics of the drumlin at this site it is interpreted that a limited amount of precipitation infiltrates in the upland portion and to a lesser extent along the slopes. This infiltration would recharge the local groundwater system, but it is expected that most of this shallow groundwater would flow towards the sand and gravel deposits situated around the southerly and easterly base

of the drumlin. Infiltration in the area of the sand and gravel surficial deposits would be significantly greater. Groundwater flow in the sand and gravel deposits on-site is interpreted to be southerly towards discharge to the wetland and Clythe Creek. Groundwater seeps (i.e. surface discharge areas) were observed at several locations up-gradient of the wetland.

4 Groundwater Monitoring

4.1 Wetland Piezometers (2009)

To confirm the occurrence of groundwater flow and discharge to the wetland located in the southeast area of the site, shallow piezometers were installed at two locations (Refer to Plates 1 and 2). Shallow piezometers were also installed at a third location to determine if shallow groundwater discharge was occurring adjacent to Clythe Creek along the southern boundary of the site (Refer to Plate 3). The locations were selected during a site reconnaissance in early May 2009, when the groundwater seeps were visible and the area upgradient of the wetland was saturated.

At each site the piezometers were installed in pairs, with one set at a shallow depth (about 0.5 m) and another at an intermediate depth (about 1.1 m), to provide for measurement of the vertical hydraulic gradient at various times. Groundwater levels were measured in each piezometer and recorded relative to adjacent ground surface on three occasions: 13 and 25 May, and 4 June 2009.



Plate 1: Piezometer Station 1



Plate 2: Piezometer Station 2

On each occasion the monitoring at Stations 1 and 2 confirmed groundwater discharge conditions adjacent to the wetland and upgradient. Confirmation of local groundwater discharge to the wetland is based on the observation of groundwater seeps along the upgradient slope on the north edge of the wetland on each monitoring occasion. Shallow groundwater flow to the wetland is also confirmed by the groundwater levels in piezometers that were observed at or just above ground surface. On these three monitoring occasions a downward gradient was observed, as the groundwater level in the intermediate piezometer was below the adjacent groundwater level in the shallow piezometer.

This initial short-term monitoring indicated that the upgradient groundwater seeps, combined with shallow groundwater flow along the fringe of the wetland are important in terms of maintaining water levels in the wetland. These observations demonstrated the wetland's dependence on groundwater flow during this brief monitoring period.



Plate 3: Piezometer Station 3

The third pair of shallow piezometers located along the southern edge of the site, just west of the Clythe Creek culvert under the railway, indicated groundwater was at a depth of 1.2 m on 13 May, but declined below the intermediate piezometer soon after. The shallow piezometer was dry on each occasion. The monitoring confirmed there was no shallow groundwater discharge at this location on these occasions. It is considered possible that groundwater is discharging directly to Clythe Creek in this area.

These monitoring results confirmed that the shallow groundwater system was discharging to the wetland along the base of the drumlin during the mid- to late-spring 2009 monitoring period. It is expected that these conditions occur each spring; however, due to the limited period of monitoring it was uncertain if these discharge conditions continue during drier seasonal periods.

4.2 Wetland Piezometers (2012 - 2014)

In recognition of the need for seasonal monitoring of groundwater levels and discharge to the wetland, a second period of monitoring was initiated in December 2012. Prior to the start of this monitoring, another pair of shallow piezometers was installed at a third location that was at the edge of the wetland and downgradient of a groundwater seep area. Plate 4 is a photograph of Station 4 in December 2012. The groundwater discharge in this area is visible where the warmer groundwater is melting the recently-fallen snow. The approximate locations of the three piezometer stations are shown in the appended Figure 1.



Plate 4: Piezometer Station 4

Groundwater levels were then measured and recorded in piezometers at Stations 1, 2 and 4 on 14 December 2012. The groundwater in piezometers is typically frozen in January and February, and therefore was not measured during these months in 2013. Monitoring resumed on 15 March 2013 and continued on a monthly basis until 12 December 2013. During 2014 monitoring occurred in April, July and October. The groundwater monitoring data and discharge observations for 2009 and 2012 to 2014 are summarized in the appended Table 1.

Groundwater level monitoring and discharge observations from December 2012 to October 2014 confirmed that groundwater levels in the shallow piezometers were close to, and on some occasions above, ground surface. This confirmed that groundwater was flowing toward and discharging into the wetland on all monitoring occasions. Without continuous monitoring it cannot be concluded that discharge was constant; however, observations made during months with below-average precipitation during 2013 (i.e. March, May, August, September, November and December) confirmed discharge was occurring during "drier" periods. The quarterly monitoring events in 2014 occurred during months of above-average total precipitation, thus resulting in higher groundwater levels and flow conditions.

4.3 Monitoring Wells

Groundwater levels were also measured in each of the 10 on-site monitoring wells on 13 May 2009, for the purpose of assessing horizontal and vertical flow directions. At five locations pairs of monitoring wells were installed in the same borehole to provide for measurement of the vertical hydraulic gradient at various times. Groundwater elevations were representative of spring levels, with depths to groundwater ranging from 0.5 to 1.6 metres below ground surface in the seven shallow monitors (i.e. completed at depths less than 4.0 m). Groundwater levels ranged from 0.5 to 6.8 metres below ground surface in the eight deeper monitors. The lowest groundwater elevation occurred in the central part of the site in the deepest monitor, which is completed at a depth of about 10 metres at the crest of the southern slope of the drumlin.

Groundwater elevations in the shallow monitors confirm groundwater flow directions are radial from the top of the drumlin towards the base (i.e. ranging from southwest to east). A comparison of shallow and deeper groundwater elevations indicates a downward hydraulic gradient in the drumlin, as would be expected.

5 Groundwater Recharge and Discharge

Based on a review of local geology and hydrogeology and the results of the shallow groundwater monitoring, it is evident that there is limited groundwater recharge on the drumlin that dominates much of the site. It is interpreted that the rate of groundwater recharge and flow is more significant in the lower-lying, eastern part of the site, where the outwash sand and gravel deposit occurs at surface. The limited amount of groundwater that discharges along the eastern base of the drumlin likely flows through the outwash deposit, eventually discharging into the on-site wetland. It is further interpreted that a portion of the surface water runoff from up the slope and on the top of the drumlin also flows to the wetland.

The average annual precipitation has been estimated from an averaging of precipitation normals from meteorological stations in Guelph and the surrounding area, for the period 1981 to 2010. The average annual precipitation, for the area in which the study site is located, is estimated to be about 925 mm. It has also been estimated that the average annual evapotranspiration for this area is about 555 mm; however, evapotranspiration rates across a site will vary in relation to the depth to water table, soil texture, topography, extent of vegetation cover, and type of vegetation. Based on the results of research conducted in other parts of the Eramosa River and Speed River subwatersheds, estimates of evapotranspiration rates can be made for this site. It is estimated that evapotranspiration rates on the drumlin will average about 555 mm/year, whereas in the well-drained outwash sand and gravel deposit the rate is estimated to be about 495 mm/year. The net water available for infiltration and surface runoff is 370 mm on the drumlin and 430 mm in the sand and gravel area, on an annual average basis.

For the purpose of estimating recharge to the groundwater system, on and adjacent to the drumlin, that maintains discharge to the wetland, it is estimated that the average annual groundwater recharge on the drumlin under current conditions is 180 mm. The remaining 190 mm is the average annual surface runoff. These estimates are based on previous analyses completed for developments in Guelph where drumlins exist. The average annual rate of recharge in the eastern sand and gravel area is estimated to be as high as 380 mm, with the remaining 50 mm allocated to surface runoff.

The total area of the subject lands comprises 17.682 ha. However, a total area of 18.28 ha has been used for the purposes of a water budget, which includes the southern section of Cityview Drive. Reference should be made to the site description and maps included in the Preliminary Servicing and Stormwater Management Report (Gamsby and Mannerow Limited, 2012). The western and central parts of the development site (i.e. on top of the drumlins and on the western slope, which includes Catchments 10 and 20 of the existing conditions drainage area) represents an area of 11.80 ha. Accounting for no infiltration on a 0.56 ha impervious area within this part of the site, the average annual rate of recharge on this part of the site under existing conditions is estimated to be 20 230 m^3/year. It is interpreted that the recharge in this part of the site maintains local groundwater levels and groundwater flow in the overburden deposits in a southerly direction from the site.

The eastern 6.48 ha of the site (i.e. Catchment 30 of the existing conditions drainage area) comprises an area of about 2.1 ha along the eastern slope of the drumlin and about 4.38 ha in the sand and gravel outwash deposit area. Accounting for these areas and the differences in surficial soil types and slopes, the average annual rate of recharge in the eastern part of the site is estimated to be 20 420 m^3/year. It is interpreted that much of the recharge occurring in the eastern part of the site would maintain the shallow groundwater discharging to the wetland and Clythe Creek. The net total recharge for the site under existing conditions is therefore estimated to be about 40 650 m^3/year.

Surface water runoff onsite under existing conditions is estimated to be about 31 600 m^3/year, of which 25 420 m^3/year occurs in the western and central parts of the site (i.e. Catchments 10 and 20), and 6 180 m^3/year occurs in the eastern part of the site (i.e. Catchment 30).

It is anticipated that a monthly water budget under existing conditions will be requested by the City of Guelph at a later stage in the review/approval process. This will provide a comparison of pre- and post-development monthly and annual rates of recharge and runoff, that will be based on the stormwater management systems proposed for this site.

6 Stormwater Management

It is understood that stormwater management facilities will be designed to manage surface water runoff in the developed areas of the site (i.e. post-development catchments 100, 201, and 202). Based on the proposed development plan, groundwater recharge and surface water runoff on the eastern slope of the drumlin and within the eastern part of the site are expected to remain unchanged following development. The multiple residential development within a 0.68 ha area of the north-eastern part of the site will require separate stormwater management facilities designed to maintain the current rate of groundwater recharge in this area that will contribute to discharge to the wetland located on-site and to Clythe Creek.

The remaining part of the eastern low-lying area is to remain in the current natural state and it is expected that stormwater management in this area is not required. It can therefore be concluded that surface water runoff and shallow groundwater flow in the undeveloped area will continue to contribute to the maintenance of the wetland and flow in Clythe Creek.

7 Future Groundwater Monitoring

An on-site groundwater monitoring program is recommended to assess changes in groundwater elevations and quality during and following development of the site, as well as to assess the performance of the stormwater management facilities. The locations for groundwater monitoring would be established during preparation of the Environmental Implementation Report for review and consideration by City of Guelph staff.

Initially, groundwater levels should be monitored on a quarterly basis at a minimum in all available on-site monitoring wells before and, where possible, during grading of the site. The preferred monitoring periods would be January, April, July and October. Groundwater samples should be collected each spring and analyzed for general chemical parameters. Similar to other local sites, monitoring of groundwater levels and quality should continue for a period of up to two years following 75 percent completion of the development.

A review of the Ontario Ministry of the Environment on-line well record information service indicates there are (or were) several private water supply wells located in the vicinity of the site. The records for wells in this local area indicate each well has been completed in, and derives its' water supply from, the underlying bedrock aquifer. The records indicate the overburden in this area ranges in thickness from less than 10 m to more than 30 m, and wells are completed at depths ranging from about 20 m to more than 60 m below ground surface. If any of these wells are currently in use, the quantity and quality of water obtained from each well should not be affected by the proposed development, as groundwater flow in the overburden beneath the site is to the south and southeast. It is also noted that a number of water supply wells have been decommissioned and presumably residents are now obtaining their water from the municipal supply system.

If concerns are expressed by well owners regarding the potential for changes in quality and/or quantity of their water supply, baseline testing could be conducted before grading begins on the development site. This would provide background data that could be referenced in the event a well owner indicates they believe their water supply has been affected either during, or following,

development in this area. Municipal water supply is available to all local residences and businesses within this part of the City of Guelph. If it were confirmed that the water quality and/or quantity available from a private well was detrimentally affected by local land development, a municipal water supply could be readily provided.

8 Source Water Protection

The Grand River Source Protection Area Approved Assessment Report (Lake Erie Region Source Protection Committee, 2012) includes mapping of Wellhead Protection Areas (WHPA) and Groundwater Vulnerability for the City of Guelph Municipal Well System. There are currently several municipal wells in the northeast part of Guelph and the mapping indicates part of the proposed residential development site is located within the WHPA-B zone (i.e. 2-year time-of-travel capture zone) for one or more of these wells. The Groundwater Vulnerability mapping indicates the site is located in an area with a vulnerability score that ranges from a value of 6 (i.e. medium) to a value of 10 (i.e. the highest value). It is therefore apparent that there may be source water protection implications related to this proposed development.

Proposed Source Protection Policies have been developed by the City of Guelph and submitted for approval by the Ontario Ministry of the Environment. Once approved (likely in 2015), the requirements of these policies can be expected to apply to this site. Various measures may be required to manage the risk of potential threats to groundwater quality, such as on-going educational measures directed at residents regarding the Province's ban on the use of cosmetic pesticides.

9 Summary

On the basis of an assessment of current site conditions, the net total average annual, pre-development, groundwater recharge for the site is estimated to be about 40 650 m^3/year. It is estimated that the average annual rate of recharge to the groundwater system in the western and central parts of the site, comprising an area of 11.80 ha (i.e. Catchments 10 and 20), is 20 230 m^3/year. It is also estimated that the average annual rate of recharge to the groundwater system in the eastern 6.48 ha of the site, including part of the eastern slope of the drumlin (i.e. Catchment 30), is 20 420 m^3/year.

It is interpreted that much of the recharge in the eastern area currently maintains the shallow groundwater discharging to the wetland and Clythe Creek occurring in the south-eastern part of the site. Under the proposed development, only a limited area along the top of the eastern slope of the drumlin will be developed for residential use and most of this area will comprise rear yards. Groundwater recharge along most of the eastern slope of the drumlin is expected to remain unchanged. Groundwater recharge within the remaining eastern part of the site should also remain unchanged as much of this area will not be developed.

The proposed multiple residential lands within a 0.68 ha area of the north-eastern part of the site will require stormwater management facilities designed to maintain the current rate of groundwater recharge in this area. Groundwater discharge to the wetland located on-site and to Clythe Creek should therefore continue to be maintained following the proposed development of this site. It is anticipated that a monthly water budget under existing conditions will be requested by the City of Guelph at a later stage in the review/approval process. This will provide a comparison of pre- and post-development monthly and annual rates of recharge and runoff, that will be based on the stormwater management systems proposed for this site.

An on-site groundwater monitoring program is recommended to assess any changes in groundwater elevations and quality during and following development of the site, as well as to assess the performance of the stormwater management facilities. The locations for groundwater

monitoring would be established during preparation of the Environmental Implementation Report for review and consideration by City of Guelph staff.

There may be several private water supply wells located in the vicinity of the site. If concerns are expressed by well owners regarding the potential for changes in quality and/or quantity of their water supply, baseline testing could be conducted before grading begins on the development site. This would provide background data that could be referenced in the event a well owner indicates they believe their water supply has been affected either during, or following, development in this area. Municipal water supply is available to all local residences and businesses within this part of the City of Guelph.

Based on recent Source Water Protection mapping for the City of Guelph municipal well system, it is apparent that there may be source water protection implications related to this proposed development. Once Source Protection Policies are approved in the coming year, various measures may be required to manage the risk of potential threats to groundwater quality, and these will be explored as part of the detailed Environmental Implementation Report.

10 References

Chapman, L. J. and D.F. Putnam. 1984. The Physiography of Southern Ontario. Ontario Geological Survey.

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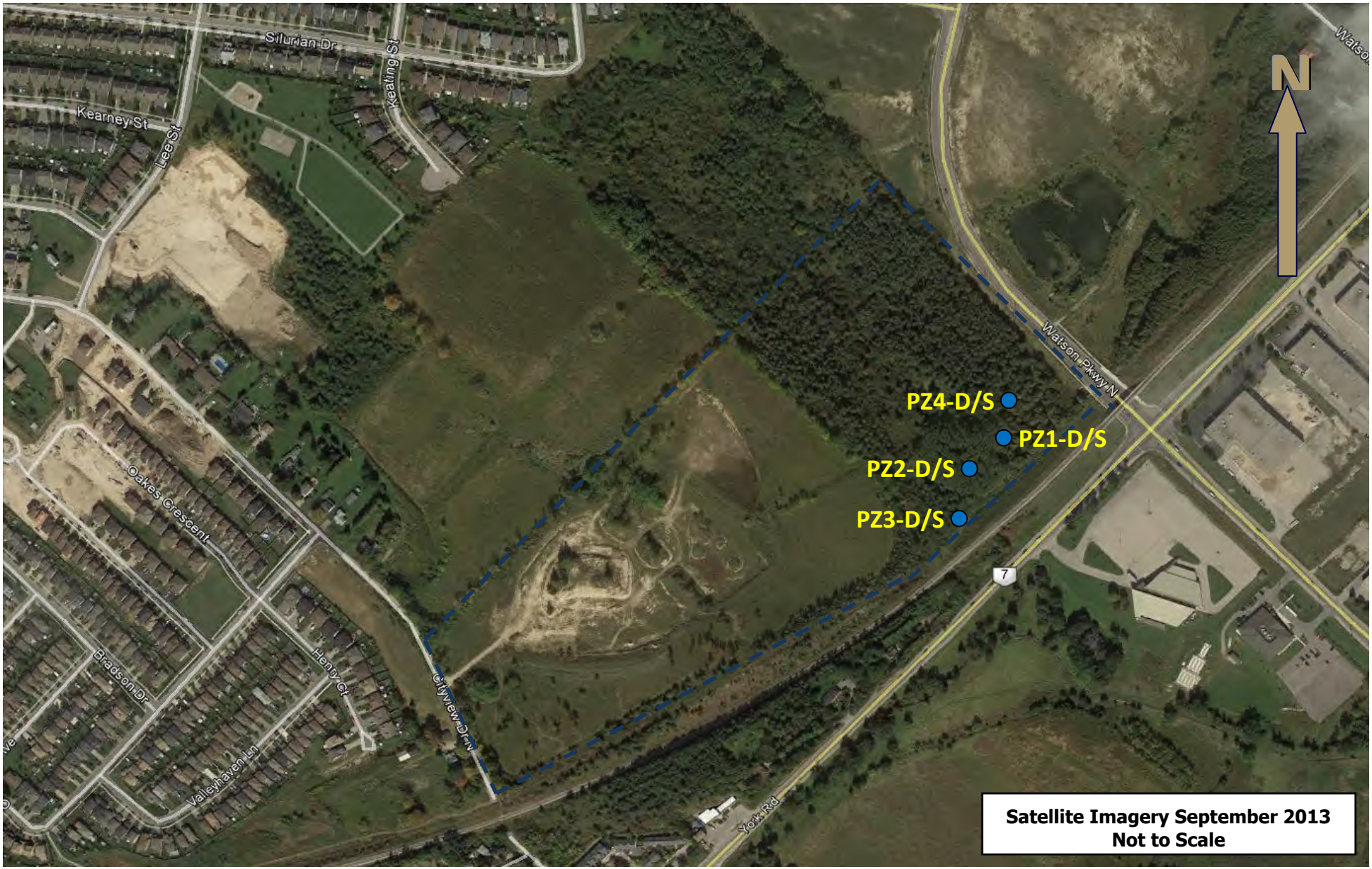
Respectfully submitted,
Banks Groundwater Engineering Limited

final version to be signed by:

William D. Banks, P.Eng.
Principal Hydrogeologist



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Hydrogeological Investigation
Environmental Impact Study
Proposed Cityview Ridge Development
City of Guelph

Piezometer Locations

Figure 1

Table 1: Groundwater Levels Measured (metres below ground level*)

Date	PZ1-D	PZ1-S	PZ2-D	PZ2-S	PZ3-D	PZ3-S	PZ4-D	PZ4-S	Groundwater Discharge Observations
13-May-09	0.03	0.08	0.90	0.01	0.95	dry	-	-	low to moderate flow from seeps
25-May-09	0.01	-0.01	0.75	0.02	1.10	dry	-	-	low to moderate flow from seeps
04-Jun-09	0.01	-0.01	0.69	0.05	dry	dry	-	-	low to moderate flow from seeps
14-Dec-12	0.04	0.07	0.26	0.10	-	-	-0.07	-0.04	low to moderate flow from seeps
15-Mar-13	0.00	0.02	0.24	0.06	-	-	-0.11	-0.04	higher flows from seeps
26-Apr-13	0.00	0.02	0.23	0.06	-	-	-0.10	-0.04	higher flows from seeps
15-May-13	0.01	0.01	0.23	0.06	-	-	-0.09	-0.03	moderate flow from seeps
11-Jun-13	0.01	0.00	0.23	0.07	-	-	-0.08	-0.03	low to moderate flow from seeps
11-Jul-13	0.00	0.00	0.22	0.08	-	-	-0.09	-0.03	higher flows from seeps
09-Aug-13	0.00	0.00	0.22	0.04	-	-	-0.08	-0.02	low to moderate flow from seeps
09-Sep-13	0.01	0.00	0.20	0.06	-	-	-0.06	-0.02	lower flow from seeps
08-Oct-13	0.01	-0.01	0.20	0.05	-	-	-0.07	-0.02	lower flow from seeps
14-Nov-13	0.00	-0.02	0.20	0.06	-	-	-0.06	-0.02	low to moderate flow from seeps
12-Dec-13	0.01	-0.01	0.21	0.06	-	-	-0.06	-0.02	low to moderate flow from seeps
30-Apr-14	0.02	0.04	0.19	0.04	-	-	-0.09	-0.02	higher flows from seeps
16-Jul-14	0.03	0.04	0.18	0.08	-	-	-0.06	-0.01	very low flow from seeps
23-Oct-14	0.02	0.03	0.18	0.05	-	-	-0.07	-0.01	moderate flow from seeps

* negative values indicate groundwater above ground level

APPENDIX F:

WATER BALANCE CALCULATIONS

Cityview Ridge Subdivision
City of Guelph
Monthly Water Balance (Thornthwaite and Mather Method)
Date: April 2023

EXISTING CONDITIONS

							Percent of Total Area		
Contributing Catchments:	10, 20 & 30	Soil Type: Guelph Loam - 76% Till; 24% Sand and Gravel	Impervous Area =	0.56	ha	3%	Runoff Factor =	0.45
Contributing Area =	18.28 ha	Vegetation: Shallow-rooted unkept vegetation	Pervious Till Area =	13.34	ha	73%	Evapotranspiration	
Percent Impervious =	3%	Root Zone Depth = 0.50m	Pervious S&G Area =	4.38	ha	24%	Factor for Impervious	
		Soil Moisture Retention Capacity = 75mm	Total Area =	18.28	ha	100%	Surfaces =	0.36

Month	Daily Average Temperature	Monthly Heat Index (I)	Unadjusted Daily Potential Evapotranspiration	Correction Factors	Adjusted Potential Evapotranspiration (PE)	Average Precipitation (P)	P-PE	Accum. Pot. Water Loss	Storage (ST)	ΔS	Pervious ET	Actual Evapotrans-piration (AE)	Pervious ET - Actual ET	Moisture Deficit (D)	Moisture Surplus (S)	Water Runoff (RO)	Snow Melt Runoff	Total Recharge and Runoff	Actual Runoff	Runoff Volume	Recharge Volume
	(°C)		(mm)		(mm)	(mm)	(mm)	(mm)	(mm)	(mm)		(mm)		(mm)	(mm)	(mm)	(mm)	(mm)	(mm)	(m^3)	(m^3)
Jan	-6.0	0.0	0.0	24.3	0.0	66.5	66.5		211.2	0.0	0.0	0.0	0.0	0.0	0.0	8.4	0.0	8.4	3.8	698	841
Feb	-5.0	0.0	0.0	24.6	0.0	57.6	57.6		268.8	0.0	0.0	0.0	0.0	0.0	0.0	4.2	0.0	4.2	1.9	349	421
Mar	-0.5	0.0	0.0	30.6	0.0	61.1	61.1		329.9	0.0	0.0	0.0	0.0	0.0	0.0	2.1	0.0	2.1	1.0	175	210
Apr	6.5	1.5	1.0	33.6	33.6	76.6	43.0		75.0	0.0	33.6	32.9	0.7	0.7	43.7	23.0	25.5	48.5	22.0	4,022	4,847
May	12.9	4.2	2.1	37.8	79.4	85.8	6.4		75.0	0.0	79.4	77.8	1.6	1.6	8.0	15.5	114.7	130.2	59.0	10,794	13,008
Jun	18.2	7.1	3.0	38.4	115.2	78.0	-37.2	-37.2	44.8	-30.2	108.2	106.1	2.1	9.1	2.1	8.8	57.4	66.2	30.0	5,485	6,610
Jul	20.8	8.7	3.5	38.7	135.5	89.8	-45.7	-82.9	23.1	-21.7	111.5	109.3	2.2	26.1	2.2	5.5	28.7	34.2	15.5	2,833	3,414
Aug	19.8	8.0	3.3	36.0	118.8	86.7	-32.1	-115.0	15.0	-8.1	94.8	92.9	1.9	25.9	1.9	3.7	14.3	18.0	8.2	1,494	1,800
Sep	15.4	5.5	2.5	31.2	78.0	87.5	9.5		24.5	9.5	78.0	76.5	1.5	1.5	1.5	2.6	7.5	10.1	4.6	838	1,009
Oct	9.0	2.4	1.4	28.5	39.9	74.3	34.4		58.9	34.4	39.9	39.1	0.8	0.8	0.8	1.7	3.9	5.6	2.5	464	559
Nov	3.1	0.5	0.4	24.3	9.7	91.3	81.6		75.0	16.1	9.7	9.5	0.2	0.2	65.7	33.7	2.0	35.7	16.2	2,958	3,565
Dec	-2.7	0.0	0.0	23.1	0.0	69.7	69.7		144.7	0.0	0.0	0.0	0.0	0.0	0.0	16.8	1.1	17.9	8.1	1,487	1,792
Total		**37.9**				**924.9**	**314.9**					**544.2**	**10.9**	**65.8**	**125.8**	**126.1**	**255.1**	**381.1**	**172.8**	**31,596**	**38,076**

POST-DEVELOPMENT CONDITIONS
Includes Infiltration Gallery 1
Infiltration Gallery 2 - Assuming Dry Year

							Percent of Total Area		
Contributing Catchments:	B2c, 201, 202 & 300	Soil Type: Guelph Loam - 76% Till; 24% Sand and Gravel	Impervous Area =	7.49	ha	41%	Runoff Factor =	0.73
Contributing Area =	18.28 ha	Vegetation: Urban lawns	Pervious Till Area =	6.41	ha	35%	Evapotranspiration	
Percent Impervious =	41.0%	Root Zone Depth = 0.5m	Pervious S&G Area =	4.38	ha	24%	Factor for Impervious	
		Soil Moisture Retention Capacity = 75mm	Total Area =	18.28	ha	100%	Surfaces =	0.36

Month	Daily Average Temperature	Monthly Heat Index	Unadjusted Daily Potential Evapotranspiration	Correction Factors	Adjusted Potential Evapotranspiration	Average Precipitation	P-PE	Accum. Pot. Water Loss	Storage	ΔS	Pervious ET	Actual Evapotrans-piration	Pervious ET - Actual ET	Moisture Deficit	Moisture Surplus	Water Runoff	Snow Melt Runoff	Total Recharge & Runoff	Actual Runoff	Runoff Volume	Recharge Volume	Enhanced Recharge Volume	Remaining Runoff Volume
	(°C)		(mm)		(mm)	(mm)	(mm)	(mm)	(mm)	(mm)		(mm)		(mm)	(mm)	(mm)	(mm)	(mm)	(mm)	(m^3)	(m^3)	(m^3)	(m^3)
Jan	-6.0	0.0	0.0	24.3	0.0	66.5	66.5		211.2	0.0	0.0	0.0	0.0	0.0	0.0	10.6	0.0	10.6	7.7	1,416	528	265	1,151
Feb	-5.0	0.0	0.0	24.6	0.0	57.6	57.6		268.8	0.0	0.0	0.0	0.0	0.0	0.0	5.3	0.0	5.3	3.9	708	264	132	576
Mar	-0.5	0.0	0.0	30.6	0.0	61.1	61.1		329.9	0.0	0.0	0.0	0.0	0.0	0.0	2.7	0.0	2.7	1.9	354	132	66	288
Apr	6.5	1.5	1.0	33.6	33.6	76.6	43.0		75.0	0.0	33.6	24.8	8.8	8.8	51.8	27.4	25.5	52.8	38.5	7,038	2,623	1,171	5,867
May	12.9	4.2	2.1	37.8	79.4	85.8	6.4		75.0	0.0	79.4	58.6	20.8	20.8	27.2	27.3	114.7	142.0	103.5	18,911	7,048	3,162	15,750
Jun	18.2	7.1	3.0	38.4	115.2	78.0	-37.2	-37.2	44.8	-30.2	108.2	79.8	28.4	35.4	28.4	27.8	57.4	85.2	62.1	11,346	4,229	2,146	9,200
Jul	20.8	8.7	3.5	38.7	135.5	89.8	-45.7	-82.9	23.1	-21.7	111.5	82.2	29.3	53.2	29.3	28.6	28.7	57.2	41.7	7,621	2,840	1,655	5,966
Aug	19.8	8.0	3.3	36.0	118.8	86.7	-32.1	-115.0	15.0	-8.1	94.8	69.9	24.9	48.9	24.9	26.7	14.3	41.1	29.9	5,467	2,037	1,322	4,145
Sep	15.4	5.5	2.5	31.2	78.0	87.5	9.5		24.5	9.5	78.0	57.5	20.5	20.5	20.5	23.6	7.5	31.1	22.6	4,140	1,543	1,075	3,065
Oct	9.0	2.4	1.4	28.5	39.9	74.3	34.4		58.9	34.4	39.9	29.4	10.5	10.5	10.5	17.0	3.9	20.9	15.2	2,787	1,039	749	2,038
Nov	3.1	0.5	0.4	24.3	9.7	91.3	81.6		75.0	16.1	9.7	7.2	2.6	2.6	68.0	42.5	2.0	44.5	32.4	5,930	2,210	1,099	4,831
Dec	-2.7	0.0	0.0	23.1	0.0	69.7	69.7		144.7	0.0	0.0	0.0	0.0	0.0	0.0	21.3	1.1	22.4	16.3	2,978	1,110	552	2,427
Total		**37.9**				**924.9**	**314.9**					**409.4**	**145.7**	**200.6**	**260.6**	**260.8**	**255.1**	**515.9**	**375.8**	**68,697**	**25,602**	**13,393**	**55,304**
																				Total Recharge (m^3)		**38,996**	
																			% Change from Pre-Development			**2%**	**75%**

Notes: Precipitation and Temperature data from Environment Canada Climate Normals 1971-200 for the Guelph Arboretum
Monthly water balance strategy as outlined in the document *Instructions and Tables for Computing Potential Evapotranspiration and the Water Balance (Thornthwaite and Mather, 1957)*
Evaporation Factor for Impervious Surfaces = Average Annual Evapotranspiration for Impervious Surfaces (200mm/year) / Average Annual Evapotranspiration for Pervious Till Surfaces (555mm/year) = 0.36
Runoff Factor = [(Impervious Percentage of Site x Average Annual Runoff for Impervious Surfaces (725mm/year)) + (Pervious Till Percentage of Site x Average Annual Runoff for Pervious Till Surfaces (190 mm/year)) + (Pervious Sand & Gravel Percentage of Site x Average Annual Runoff for Pervious S & G Surfaces (50 mm/year)] / Total Annual Recharge & Runoff

Cityview Ridge Subdivision
City of Guelph
Monthly Water Balance (Thornthwaite and Mather Method)
Date: April 2023

POST-DEVELOPMENT CONDITIONS
Includes Infiltration Gallery 1
Infiltration Gallery 2 - No Infiltration During Spring Melt (March to July)

Contributing Catchments:	B2c, 201, 202 & 300	Soil Type: Guelph Loam - 76% Till; 24% Sand and Gravel	Impervous Area =	7.49	ha	41%	Runoff Factor =	0.73
Contributing Area =	18.28 ha	Vegetation: Urban lawns	Pervious Till Area =	6.41	ha	35%	Evapotranspiration	
Percent Impervious =	41.0%	Root Zone Depth = 0.5m	Pervious S&G Area =	4.38	ha	24%	Factor for Impervious	
		Soil Moisture Retention Capacity = 75mm	Total Area =	18.28	ha	100%	Surfaces =	0.36

Month	Daily Average Temperature	Monthly Heat Index	Unadjusted Daily Potential Evapotranspiration	Correction Factors	Adjusted Potential Evapotranspiration	Average Precipitation	P-PE	Accum. Pot. Water Loss	Storage	ΔS	Pervious ET	Actual Evapotrans-piration	Pervious ET - Actual ET	Moisture Deficit	Moisture Surplus	Water Runoff	Snow Melt Runoff	Total Recharge & Runoff	Actual Runoff	Runoff Volume	Recharge Volume	Enhanced Recharge Volume	Remaining Runoff Volume
	(°C)		(mm)		(mm)	(mm)	(mm)	(mm)	(mm)	(mm)		(mm)		(mm)	(mm)	(mm)	(mm)	(mm)	(mm)	(m^3)	(m^3)	(m^3)	(m^3)
Jan	-6.0	0.0	0.0	24.3	0.0	66.5	66.5		211.2	0.0	0.0	0.0	0.0	0.0	0.0	10.6	0.0	10.6	7.7	1,416	528	265	1,151
Feb	-5.0	0.0	0.0	24.6	0.0	57.6	57.6		268.8	0.0	0.0	0.0	0.0	0.0	0.0	5.3	0.0	5.3	3.9	708	264	132	576
Mar	-0.5	0.0	0.0	30.6	0.0	61.1	61.1		329.9	0.0	0.0	0.0	0.0	0.0	0.0	2.7	0.0	2.7	1.9	354	132	46	308
Apr	6.5	1.5	1.0	33.6	33.6	76.6	43.0		75.0	0.0	33.6	24.8	8.8	8.8	51.8	27.4	25.5	52.8	38.5	7,038	2,623	827	6,211
May	12.9	4.2	2.1	37.8	79.4	85.8	6.4		75.0	0.0	79.4	58.6	20.8	20.8	27.2	27.3	114.7	142.0	103.5	18,911	7,048	2,231	16,680
Jun	18.2	7.1	3.0	38.4	115.2	78.0	-37.2	-37.2	44.8	-30.2	108.2	79.8	28.4	35.4	28.4	27.8	57.4	85.2	62.1	11,346	4,229	1,479	9,867
Jul	20.8	8.7	3.5	38.7	135.5	89.8	-45.7	-82.9	23.1	-21.7	111.5	82.2	29.3	53.2	29.3	28.6	28.7	57.2	41.7	7,621	2,840	1,114	6,507
Aug	19.8	8.0	3.3	36.0	118.8	86.7	-32.1	-115.0	15.0	-8.1	94.8	69.9	24.9	48.9	24.9	26.7	14.3	41.1	29.9	5,467	2,037	1,322	4,145
Sep	15.4	5.5	2.5	31.2	78.0	87.5	9.5		24.5	9.5	78.0	57.5	20.5	20.5	20.5	23.6	7.5	31.1	22.6	4,140	1,543	1,075	3,065
Oct	9.0	2.4	1.4	28.5	39.9	74.3	34.4		58.9	34.4	39.9	29.4	10.5	10.5	10.5	17.0	3.9	20.9	15.2	2,787	1,039	749	2,038
Nov	3.1	0.5	0.4	24.3	9.7	91.3	81.6		75.0	16.1	9.7	7.2	2.6	2.6	68.0	42.5	2.0	44.5	32.4	5,930	2,210	1,099	4,831
Dec	-2.7	0.0	0.0	23.1	0.0	69.7	69.7		144.7	0.0	0.0	0.0	0.0	0.0	0.0	21.3	1.1	22.4	16.3	2,978	1,110	552	2,427
Total		**37.9**				**924.9**	**314.9**					**409.4**	**145.7**	**200.6**	**260.6**	**260.8**	**255.1**	**515.9**	**375.8**	**68,697**	**25,602**	**10,891**	**57,806**
																				Total Recharge (m^3)		**36,493**	
																				% Change from Pre-Development		**-4%**	**83%**

POST-DEVELOPMENT CONDITIONS
Includes Infiltration Gallery 1
Infiltration Gallery 2 Not Included

Contributing Catchments:	B2c, 201, 202 & 300	Soil Type: Guelph Loam - 76% Till; 24% Sand and Gravel	Impervous Area =	7.49	ha	41%	Runoff Factor =	0.73
Contributing Area =	18.28 ha	Vegetation: Urban lawns	Pervious Till Area =	6.41	ha	35%	Evapotranspiration	
Percent Impervious =	41.0%	Root Zone Depth = 0.5m	Pervious S&G Area =	4.38	ha	24%	Factor for Impervious	
		Soil Moisture Retention Capacity = 75mm	Total Area =	18.28	ha	100%	Surfaces =	0.36

Month	Daily Average Temperature	Monthly Heat Index	Unadjusted Daily Potential Evapotranspiration	Correction Factors	Adjusted Potential Evapotranspiration	Average Precipitation	P-PE	Accum. Pot. Water Loss	Storage	ΔS	Pervious ET	Actual Evapotrans-piration	Pervious ET - Actual ET	Moisture Deficit	Moisture Surplus	Water Runoff	Snow Melt Runoff	Total Recharge & Runoff	Actual Runoff	Runoff Volume	Recharge Volume	Enhanced Recharge Volume	Remaining Runoff Volume
	(°C)		(mm)		(mm)	(mm)	(mm)	(mm)	(mm)	(mm)		(mm)		(mm)	(mm)	(mm)	(mm)	(mm)	(mm)	(m^3)	(m^3)	(m^3)	(m^3)
Jan	-6.0	0.0	0.0	24.3	0.0	66.5	66.5		211.2	0.0	0.0	0.0	0.0	0.0	0.0	10.6	0.0	10.6	7.7	1,416	528	183	1,233
Feb	-5.0	0.0	0.0	24.6	0.0	57.6	57.6		268.8	0.0	0.0	0.0	0.0	0.0	0.0	5.3	0.0	5.3	3.9	708	264	91	617
Mar	-0.5	0.0	0.0	30.6	0.0	61.1	61.1		329.9	0.0	0.0	0.0	0.0	0.0	0.0	2.7	0.0	2.7	1.9	354	132	46	308
Apr	6.5	1.5	1.0	33.6	33.6	76.6	43.0		75.0	0.0	33.6	24.8	8.8	8.8	51.8	27.4	25.5	52.8	38.5	7,038	2,623	827	6,211
May	12.9	4.2	2.1	37.8	79.4	85.8	6.4		75.0	0.0	79.4	58.6	20.8	20.8	27.2	27.3	114.7	142.0	103.5	18,911	7,048	2,231	16,680
Jun	18.2	7.1	3.0	38.4	115.2	78.0	-37.2	-37.2	44.8	-30.2	108.2	79.8	28.4	35.4	28.4	27.8	57.4	85.2	62.1	11,346	4,229	1,479	9,867
Jul	20.8	8.7	3.5	38.7	135.5	89.8	-45.7	-82.9	23.1	-21.7	111.5	82.2	29.3	53.2	29.3	28.6	28.7	57.2	41.7	7,621	2,840	1,114	6,507
Aug	19.8	8.0	3.3	36.0	118.8	86.7	-32.1	-115.0	15.0	-8.1	94.8	69.9	24.9	48.9	24.9	26.7	14.3	41.1	29.9	5,467	2,037	876	4,591
Sep	15.4	5.5	2.5	31.2	78.0	87.5	9.5		24.5	9.5	78.0	57.5	20.5	20.5	20.5	23.6	7.5	31.1	22.6	4,140	1,543	705	3,436
Oct	9.0	2.4	1.4	28.5	39.9	74.3	34.4		58.9	34.4	39.9	29.4	10.5	10.5	10.5	17.0	3.9	20.9	15.2	2,787	1,039	489	2,299
Nov	3.1	0.5	0.4	24.3	9.7	91.3	81.6		75.0	16.1	9.7	7.2	2.6	2.6	68.0	42.5	2.0	44.5	32.4	5,930	2,210	760	5,170
Dec	-2.7	0.0	0.0	23.1	0.0	69.7	69.7		144.7	0.0	0.0	0.0	0.0	0.0	0.0	21.3	1.1	22.4	16.3	2,978	1,110	382	2,597
Total		**37.9**				**924.9**	**314.9**					**409.4**	**145.7**	**200.6**	**260.6**	**260.8**	**255.1**	**515.9**	**375.8**	**68,697**	**25,602**	**9,182**	**59,515**
																				Total Recharge (m^3)		**34,785**	
																				% Change from Pre-Development		**-9%**	**88%**

Notes: Precipitation and Temperature data from Environment Canada Climate Normals 1971-200 for the Guelph Arboretum
Monthly water balance strategy as outlined in the document *Instructions and Tables for Computing Potential Evapotranspiration and the Water Balance (Thornthwaite and Mather, 1957)*
Evaporation Factor for Impervious Surfaces = Average Annual Evapotranspiration for Impervious Surfaces (200mm/year) / Average Annual Evapotranspiration for Pervious Till Surfaces (555mm/year) = 0.36
Runoff Factor = [(Impervious Percentage of Site x Average Annual Runoff for Impervious Surfaces (725mm/year)) + (Pervious Till Percentage of Site x Average Annual Runoff for Pervious Till Surfaces (190 mm/year)) + (Pervious Sand & Gravel Percentage of Site x Average Annual Runoff for Pervious S & G Surfaces (50 mm/year)] / Total Annual Recharge & Runoff

PARK BLOCK
Total Runoff (mm) Calculation used for Enhanced Infiltration Design

Contributing Area = 1.270 ha
Percent Impervious = 50.0%

Soil Type: Guelph Loam - Till
Vegetation: Urban lawns
Root Zone Depth = 0.5m
Soil Moisture Retention Capacity = 75mm

			Percent of Total Area
Impervous Area =	0.64	ha	50%
Pervious Till Area =	0.64	ha	50%
Pervious S&G Area =	0	ha	0%
Total Area =	1.270	ha	100%

Runoff Factor = 0.84
Evapotranspiration Factor for Impervious Surfaces = 0.36

Includes 0.49 ha park runoff from upstream development draining to subject lands. This runoff will be captured by the third pipe collector and will be conveyed to Infiltration Gallery 2.

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)
Jan	-6.0	0.0	0.0	24.3	0.0	66.5	66.5		211.2	0.0	0.0	0.0	0.0	0.0	0.0	11.2	0.0	11.2	9.3
Feb	-5.0	0.0	0.0	24.6	0.0	57.6	57.6		268.8	0.0	0.0	0.0	0.0	0.0	0.0	5.6	0.0	5.6	4.7
Mar	-0.5	0.0	0.0	30.6	0.0	61.1	61.1		329.9	0.0	0.0	0.0	0.0	0.0	0.0	2.8	0.0	2.8	2.3
Apr	6.5	1.5	1.0	33.6	33.6	76.6	43.0		75.0	0.0	33.6	22.8	10.8	10.8	53.8	28.3	25.5	53.8	45.0
May	12.9	4.2	2.1	37.8	79.4	85.8	6.4		75.0	0.0	79.4	54.0	25.4	25.4	31.8	30.1	114.7	144.8	120.9
Jun	18.2	7.1	3.0	38.4	115.2	78.0	-37.2	-37.2	44.8	-30.2	108.2	73.6	34.6	41.6	34.6	32.3	57.4	89.7	74.9
Jul	20.8	8.7	3.5	38.7	135.5	89.8	-45.7	-82.9	23.1	-21.7	111.5	75.8	35.7	59.6	35.7	34.0	28.7	62.7	52.4
Aug	19.8	8.0	3.3	36.0	118.8	86.7	-32.1	-115.0	15.0	-8.1	94.8	64.5	30.3	54.3	30.3	32.2	14.3	46.5	38.9
Sep	15.4	5.5	2.5	31.2	78.0	87.5	9.5		24.5	9.5	78.0	53.0	25.0	25.0	25.0	28.6	7.5	36.1	30.1
Oct	9.0	2.4	1.4	28.5	39.9	74.3	34.4		58.9	34.4	39.9	27.1	12.8	12.8	12.8	20.7	3.9	24.6	20.5
Nov	3.1	0.5	0.4	24.3	9.7	91.3	81.6		75.0	16.1	9.7	6.6	3.1	3.1	68.6	44.6	2.0	46.6	38.9
Dec	-2.7	0.0	0.0	23.1	0.0	69.7	69.7		144.7	0.0	0.0	0.0	0.0	0.0	0.0	22.3	1.1	23.4	19.6
Total		**37.9**				**924.9**	**314.9**					**377.5**	**177.6**	**232.6**	**292.5**	**292.6**	**255.1**	**547.7**	**457.5**

Notes: Precipitation and Temperature data from Environment Canada Climate Normals 1971-200 for the Guelph Arboretum
Monthly water balance strategy as outlined in the document *Instructions and Tables for Computing Potential Evapotranspiration and the Water Balance (Thornthwaite and Mather, 1957)*

Evaporation Factor for Impervious Surfaces = Average Annual Evapotranspiration for Impervious Surfaces (200mm/year) / Average Annual Evapotranspiration for Pervious Till Surfaces (555mm/year) = 0.36
Runoff Factor = [(Impervious Percentage of Site x Average Annual Runoff for Impervious Surfaces (725mm/year)) + (Pervious Till Percentage of Site x Average Annual Runoff for Pervious Till Surfaces (190 mm/year)) + (Pervious Sand & Gravel Percentage of Site x Average Annual Runoff for Pervious S & G Surfaces (50 mm/year)] / Total Annual Recharge & Runoff

Cityview Ridge Subdivision
City of Guelph
Monthly Water Balance (Thornthwaite and Mather Method)
Date: April 2023

ROOFTOP (100% IMPERVIOUS)
Total Runoff (mm) Calculation used for Enhanced Infiltration Design

Soil Type: Guelph Loam - Till
Vegetation: Urban lawns
Percent Impervious = 100.0%
Root Zone Depth = 0.5m
Soil Moisture Retention Capacity = 75mm

Runoff Factor = 1.00
Evapotranspiration Factor for Impervious Surfaces = 0.36

Month	Daily Average Temperature	Monthly Heat Index	Unadjusted Daily Potential Evapotranspiration	Correction Factors	Adjusted Potential Evapotranspiration	Average Precipitation	P-PE	Accum. Pot. Water Loss	Storage	ΔS	Pervious ET	Actual Evapotrans-piration	Pervious ET - Actual ET	Moisture Deficit	Moisture Surplus	Water Runoff	Snow Melt Runoff	Total Recharge & Runoff	Actual Runoff
	(°C)		(mm)		(mm)	(mm)	(mm)	(mm)	(mm)	(mm)		(mm)		(mm)	(mm)	(mm)	(mm)	(mm)	(mm)
Jan	-6.0	0.0	0.0	24.3	0.0	66.5	66.5		211.2	0.0	0.0	0.0	0.0	0.0	0.0	14.1	0.0	14.1	14.1
Feb	-5.0	0.0	0.0	24.6	0.0	57.6	57.6		268.8	0.0	0.0	0.0	0.0	0.0	0.0	7.0	0.0	7.0	7.0
Mar	-0.5	0.0	0.0	30.6	0.0	61.1	61.1		329.9	0.0	0.0	0.0	0.0	0.0	0.0	3.5	0.0	3.5	3.5
Apr	6.5	1.5	1.0	33.6	33.6	76.6	43.0		75.0	0.0	33.6	12.1	21.5	21.5	64.5	33.7	25.5	59.2	59.2
May	12.9	4.2	2.1	37.8	79.4	85.8	6.4		75.0	0.0	79.4	28.6	50.8	50.8	57.2	45.5	114.7	160.2	160.3
Jun	18.2	7.1	3.0	38.4	115.2	78.0	-37.2	-37.2	44.8	-30.2	108.2	39.0	69.2	76.2	69.2	57.4	57.4	114.7	114.8
Jul	20.8	8.7	3.5	38.7	135.5	89.8	-45.7	-82.9	23.1	-21.7	111.5	40.1	71.4	95.3	71.4	64.4	28.7	93.0	93.1
Aug	19.8	8.0	3.3	36.0	118.8	86.7	-32.1	-115.0	15.0	-8.1	94.8	34.1	60.7	84.7	60.7	62.5	14.3	76.9	76.9
Sep	15.4	5.5	2.5	31.2	78.0	87.5	9.5		24.5	9.5	78.0	28.1	49.9	49.9	49.9	56.2	7.5	63.7	63.8
Oct	9.0	2.4	1.4	28.5	39.9	74.3	34.4		58.9	34.4	39.9	14.4	25.5	25.5	25.5	40.9	3.9	44.8	44.8
Nov	3.1	0.5	0.4	24.3	9.7	91.3	81.6		75.0	16.1	9.7	3.5	6.2	6.2	71.7	56.3	2.0	58.3	58.3
Dec	-2.7	0.0	0.0	23.1	0.0	69.7	69.7		144.7	0.0	0.0	0.0	0.0	0.0	0.0	28.1	1.1	29.2	29.3
Total		**37.9**				**924.9**	**314.9**					**199.8**	**355.3**	**410.2**	**470.2**	**469.5**	**255.1**	**724.6**	**725.0**

Actual runoff adjusted to reflect 725 mm/year average impervious runoff (rooftop)

Notes: Precipitation and Temperature data from Environment Canada Climate Normals 1971-200 for the Guelph Arboretum
Monthly water balance strategy as outlined in the document *Instructions and Tables for Computing Potential Evapotranspiration and the Water Balance (Thornthwaite and Mather, 1957)*
Evaporation Factor for Impervious Surfaces = Average Annual Evapotranspiration for Impervious Surfaces (200mm/year) / Average Annual Evapotranspiration for Pervious Till Surfaces (555mm/year) = 0.36
Runoff Factor = [(Impervious Percentage of Site x Average Annual Runoff for Impervious Surfaces (725mm/year)) + (Pervious Till Percentage of Site x Average Annual Runoff for Pervious Till Surfaces (190 mm/year)) + (Pervious Sand & Gravel Percentage of Site x Average Annual Runoff for Pervious S & G Surfaces (50 mm/year)] / Total Annual Recharge & Runoff

Cityview Ridge Subdivision
City of Guelph
Clean Water Collector System Drainage Area

Lot/Block	Frontage	Depth	Min. Exterior Side Yard Setback	Min. Side Yard Setback	Min. Front Yard Setback	Min. Rear Yard Setback	Max. Rooftop Length	Max. Rooftop Width	Max. Rooftop Area Infiltrated
	(m)	(m)	(m)	(m)	(m)	(m)	(m^2)	(m^2)	(m^2)
Clean Water Collector (CWC) to Infiltration Gallery 1									
64 (single family)	9.0	32.0	-	0.6	6	7.5	18.5	7.8	144
65 (single family)	9.0	32.0	-	0.6	6	7.5	18.5	7.8	144
66 (single family)	9.0	32.0	-	0.6	6	7.5	18.5	7.8	144
67 (single family)	9.0	32.0	-	0.6	6	7.5	18.5	7.8	144
68 (single family)	9.0	32.0	-	0.6	6	7.5	18.5	7.8	144
69 (single family)	12.0	32.0	-	1.2	6	7.5	18.5	9.6	178
70 (single family)	12.0	32.0	-	1.2	6	7.5	18.5	9.6	178
71 (single family)	12.0	32.0	-	1.2	6	7.5	18.5	9.6	178
72 (single family)	12.0	32.0	-	1.2	6	7.5	18.5	9.6	178
73 (single family)	12.0	32.0	-	1.2	6	7.5	18.5	9.6	178
74 (single family)	12.0	32.0	-	1.2	6	7.5	18.5	9.6	178
75 (single family)	12.0	32.0	-	1.2	6	7.5	18.5	9.6	178
76 (single family)	12.0	32.0	-	1.2	6	7.5	18.5	9.6	178
77 (single family)	12.0	32.0	-	1.2	6	7.5	18.5	9.6	178
78 (single family)	12.0	32.0	-	1.2	6	7.5	18.5	9.6	178
79 (single family)	14.4	32.0	4.5	1.5	6	7.5	18.5	8.4	155
80 (single family)	9.0	32.0	-	0.6	6	7.5	18.5	7.8	144
81 (single family)	9.0	32.0	-	0.6	6	7.5	18.5	7.8	144
82 (single family)	9.0	32.0	-	0.6	6	7.5	18.5	7.8	144
83 (single family)	9.0	32.0	-	0.6	6	7.5	18.5	7.8	144
84 (single family)	9.0	32.0	-	0.6	6	7.5	18.5	7.8	144
85 (single family)	9.0	32.0	-	0.6	6	7.5	18.5	7.8	144
86 (single family)	9.0	32.0	-	0.6	6	7.5	18.5	7.8	144
87 (single family)	9.0	32.0	-	0.6	6	7.5	18.5	7.8	144
88 (single family)	9.0	32.0	-	0.6	6	7.5	18.5	7.8	144
89 (single family)	9.0	32.0	-	0.6	6	7.5	18.5	7.8	144
90 (single family)	9.0	32.0	-	0.6	6	7.5	18.5	7.8	144
91 (single family)	9.0	32.0	-	0.6	6	7.5	18.5	7.8	144
92 (single family)	9.0	32.0	-	0.6	6	7.5	18.5	7.8	144
93 (single family)	9.0	32.0	-	0.6	6	7.5	18.5	7.8	144
94 (single family)	14.4	32.0	4.5	1.2	6	7.5	18.5	8.7	161
95 (semi-detached)	15.2	33.0	4.5	1.2	6	7.5	19.5	9.5	185
96 (semi-detached)	13.0	33.0	-	1.2	6	7.5	19.5	10.6	207
97 (semi-detached)	13.0	33.0	-	1.2	6	7.5	19.5	10.6	207
98 (semi-detached)	13.0	33.0	-	1.2	6	7.5	19.5	10.6	207
99 (semi-detached)	13.0	33.0	-	1.2	6	7.5	19.5	10.6	207
107 (townhome)*	53.1	32.0	4.5	1.5	6	7.5	18.5	44.1	408
Total CWC to Infiltration Gallery 1									**6,254**

Cityview Ridge Subdivision
City of Guelph
Clean Water Collector System Drainage Area

Lot/Block	Frontage	Depth	Min. Exterior Side Yard Setback	Min. Side Yard Setback	Min. Front Yard Setback	Min. Rear Yard Setback	Max. Rooftop Length	Max. Rooftop Width	Max. Rooftop Area Infiltrated
	(m)	(m)	(m)	(m)	(m)	(m)	(m^2)	(m^2)	(m^2)
Clean Water Collector (CWC) to Gallery 2									
38 (single family)	14.5	32.9	4.5	1.2	6	7.5	19.4	8.8	171
39 (single family)	9.0	32.9	-	1.2	6	7.5	19.4	6.6	128
40 (single family)	9.0	33.0	-	1.2	6	7.5	19.5	6.6	129
41 (single family)	9.0	33.0	-	1.2	6	7.5	19.5	6.6	129
42 (single family)	9.0	32.9	-	1.2	6	7.5	19.4	6.6	128
43 (single family)	14.3	32.9	4.5	1.2	6	7.5	19.4	8.6	167
44 (single family)	9.0	32.0	-	0.6	6	7.5	18.5	7.8	144
45 (single family)	9.0	32.0	-	0.6	6	7.5	18.5	7.8	144
46 (single family)	9.0	32.0	-	0.6	6	7.5	18.5	7.8	144
47 (single family)	9.0	32.0	-	0.6	6	7.5	18.5	7.8	144
48 (single family)	9.0	32.0	-	0.6	6	7.5	18.5	7.8	144
49 (single family)	9.0	32.0	-	0.6	6	7.5	18.5	7.8	144
50 (single family)	9.0	32.0	-	0.6	6	7.5	18.5	7.8	144
51 (single family)	9.0	32.0	-	0.6	6	7.5	18.5	7.8	144
52 (single family)	9.0	32.5	-	0.6	6	7.5	19	7.8	148
53 (single family)	9.0	37.5	-	0.6	6	7.5	24	7.8	187
54 (single family)	9.0	34.0	-	0.6	6	7.5	20.5	7.8	160
55 (single family)	9.1	34.0	-	0.6	6	7.5	20.5	7.9	162
56 (single family)	9.0	34.0	-	0.6	6	7.5	20.5	7.8	160
57 (single family)	9.0	34.0	-	0.6	6	7.5	20.5	7.8	160
58 (single family)	9.0	34.0	-	0.6	6	7.5	20.5	7.8	160
59 (single family)	9.0	34.0	-	0.6	6	7.5	20.5	7.8	160
60 (single family)	14.0	34.0	4.5	1.2	6	7.5	20.5	8.3	170
61 (single family)	12.6	34.0	4.5	1.2	6	7.5	20.5	6.9	141
62 (single family)	11.0	34.0	-	0.6	6	7.5	20.5	9.77	200
63 (single family)	11.0	34.0	-	0.6	6	7.5	20.5	9.77	200
100 (semi-detached)	16.6	33.0	4.5	1.2	6	7.5	19.5	10.9	213
101 (semi-detached)	13.7	33.0	-	1.2	6	7.5	19.5	11.3	220
102 (semi-detached)	13.7	33.0	-	1.2	6	7.5	19.5	11.3	220
103 (semi-detached)	13.7	33.0	-	1.2	6	7.5	19.5	11.3	220
104 (semi-detached)	13.7	33.0	-	1.2	6	7.5	19.5	11.3	220
105 (townhome)*	33.2	33.0	4.5	1.5	6	7.5	19.5	27.2	265
106 (townhome)*	53.0	32.0	-	1.5	6	7.5	18.5	47	435
Total CWC to Infiltration Gallery 2									**5,808**

Notes:
1. Clean Water Collection (CWC) will collect runoff from proposed rooftops
2. * For street fronting townhome blocks, the Clean Water Collection system will only colelct the front half of the rooftop (50% of roof area)

3. Setbacks obtained from City of Guelph Zoning By-law

Enhanced Infiltration Structure - Clean Water Collection System to Infiltration Gallery 1

Located in easterly portion of the stormwater management block

Structure Length = Irregular shape
Structure Width =
Structure Depth = 0.50 m

Gallery Footprint = 452 m^2

Volume of Stone = 226.00 cu m
Stone Porosity = 0.33
Storage Volume of Stone = 75.33 cu m

Draindown time calculated using the BMP Sizing equation from the Low Impact Development Stormwater Management Planning and Design Guide

$d_{rmax} = i * t_s / V_r$

d_{rmax} = depth of stone = 500.00 mm
i = infiltration fate for native soils = 7.00 mm/hr
V_r = void space ratio for aggregate used = 0.33
t_s = time to drain, solve for t_s

$t_s = d_{rmax} * V_r / i$ = 23.57 hours or 0.98 day draindown period

Building Rooftops

Contributing Area 0.625 ha Rooftop Areas draining to Clean Water Collection System
Recharge Time 23.57 hours / 0.98 days
Recharge Volume Potential 75.33 m^3

Month	Total Runoff (mm)	No. of days	Max Potential Recharge (m^3)	Available Recharge (m^3)	Enhanced Recharge (m^3)
Jan	14.1	31	2,378	88	88
Feb	7.0	28	2,148	44	44
Mar	3.5	31	2,378	22	22
Apr	59.2	30	2,301	370	370
May	160.3	31	2,378	1,002	1,002
Jun	114.8	30	2,301	718	718
Jul	93.1	31	2,378	582	582
Aug	76.9	31	2,378	481	481
Sep	63.8	30	2,301	399	399
Oct	44.8	31	2,378	280	280
Nov	58.3	30	2,301	365	365
Dec	29.3	31	2,378	183	183
Total	**725.0**	**365**	**27,997**	**4,534**	**4,534**

Park Block

Contributing Area 1.016 ha

Park area draining to Clean Water Collection System (Assumes that 80% of the total park area can be infiltrated). Includes 0.49ha park area from adjacent development which drains to subject lands.

Recharge Time 23.57 hours / 0.98 days

Recharge Volume Potential 75.33 m^3

Month	Total Runoff (mm)	No. of days	Max Potential Recharge (m^3)	Available Recharge (m^3)	Enhanced Recharge (m^3)
Jan	9.3	31	2,378	95	95
Feb	4.7	28	2,148	47	47
Mar	2.3	31	2,378	24	24
Apr	45.0	30	2,301	457	457
May	120.9	31	2,378	1,229	1,229
Jun	74.9	30	2,301	761	761
Jul	52.4	31	2,378	532	532
Aug	38.9	31	2,378	395	395
Sep	30.1	30	2,301	306	306
Oct	20.5	31	2,378	208	208
Nov	38.9	30	2,301	396	396
Dec	19.6	31	2,378	199	199
Total	**457.5**	**365**	**27,997**	**4,648**	**4,648**

Combine runoff from park block and building rooftops

Month	Max Potential Recharge (m^3)	Available Recharge (m^3)	Enhanced Recharge (m^3)
Jan	2,378	183	183
Feb	2,148	91	91
Mar	2,378	46	46
Apr	2,301	827	827
May	2,378	2,231	2,231
Jun	2,301	1,479	1,479
Jul	2,378	1,114	1,114
Aug	2,378	876	876
Sep	2,301	705	705
Oct	2,378	489	489
Nov	2,301	760	760
Dec	2,378	382	382
Total	**27,997**	**9,182**	**9,182**

Enhanced Infiltration Structure - Clean Water Collection System to Gallery 2

Located in open space area south of Street 1

Structure Length =	40.00	m	Gallery Footprint =	280	m^2
Structure Width =	7.00	m			
Structure Depth =	0.50	m			
Area of Stone =	3.50	sq m	Volume of Stone =	140.00	cu m
			Stone Porosity =	0.33	
			Storage Volume of Stone =	**46.67**	**cu m**

Draindown time calculated using the BMP Sizing equation from the Low Impact Development Stormwater Management Planning and Design Guide

$d_{rmax} = i * t_s / V_r$

d_{rmax} = depth of stone =	500.00	mm
i = infiltration fate for native soils =	6.00	mm/hr
V_r = void space ratio for aggregate used =	0.33	
t_s = time to drain, solve for t_s		

$t_s = d_{rmax} * V_r / i$ = 27.5 hours or 1.15 day draindown period

Contributing Area	0.581	ha	Rooftop Areas draining to Clean Water Collection System	
Recharge Time	27.50	hours	/	1.15 days
Recharge Volume Potential	46.67	m^3		

Month	Total Runoff (mm)	No. of days	Max Potential Recharge (m^3)	Available Recharge (m^3)	Enhanced Recharge Potential (Dry Year) (m^3)	Enhanced Recharge - No Infiltration During Spring Melt* (m^3)
Jan	14.1	31	1,263	82	82	82
Feb	7.0	28	1,140	41	41	41
Mar	3.5	31	1,263	20	20	0
Apr	59.2	30	1,222	344	344	0
May	160.3	31	1,263	931	931	0
Jun	114.8	30	1,222	667	667	0
Jul	93.1	31	1,263	541	541	0
Aug	76.9	31	1,263	447	447	447
Sep	63.8	30	1,222	370	370	370
Oct	44.8	31	1,263	260	260	260
Nov	58.3	30	1,222	339	339	339
Dec	29.3	31	1,263	170	170	170
Total	**725.0**	**365**	**14,865**	**4,211**	**4,211**	**1,709**

* Assumes no infiltration during periods of the year when the groundwater level readings are close to ground surface. Months March to July are excluded from the infiltration calculations.

APPENDIX G:

OIL/GRIT SEPARATOR SIZING CALCULATIONS

Cityview Ridge Subdivision
City of Guelph
Our File: 105-172

Existing Quality Facility No. 2 - Oil/Grit Separator Drainage Areas

OGS 1

	Area (ha)	% Impervious (I)
Part of Catchment B2c (Cityview Ridge Subdivision)	4.33	70%

OGS 2 (No upstream treatment)

	Area (ha)	% Impervious (I)
Catchment B2a Cityview Estates Subdivision (Stantec Report 2016, Catchments 206 and 207)	6.15	62%
Subtract Park Block (drains to Catchment 201 per Walterfedy Drawings)	-0.49	40%
Catchment B2a William C Winegard Public School (Gamsby and Mannerow 2013, Catchment 202)	1.78	14%
Catchment B2a William C Winegard Public School (Gamsby and Mannerow 2013, Catchment 201)	0.28	10%
Sub-Total B2a Upstream of Cityview Dr.	**7.72**	**50%**
Ex. properties along Cityview Drive	2.01	60%
Cityview Drive B2c	1.64	70%
Total	**11.37**	**55%**

Note: Catchment B2a upstream of Cityview Drive will require quality control treatment to achieve a minimum of 50% total suspended solid reduction

OGS 2 (Upstream treatment) - Used in Analysis

	Area (ha)	% Impervious (I)
Sub-Total B2a Upstream of Cityview Dr.	**7.72**	**25%**
Ex. properties along Cityview Drive B2a	2.01	60%
Cityview Drive B2c	1.64	70%
Total	**11.37**	**38%**

Note: It is assumed that upstream quality control treatment to a minimum 50% total suspended solid removal will be provided in the for Catchment B2a, upstream of Cityview Drive

APPENDIX H:

COOLING TRENCH CALCULATIONS

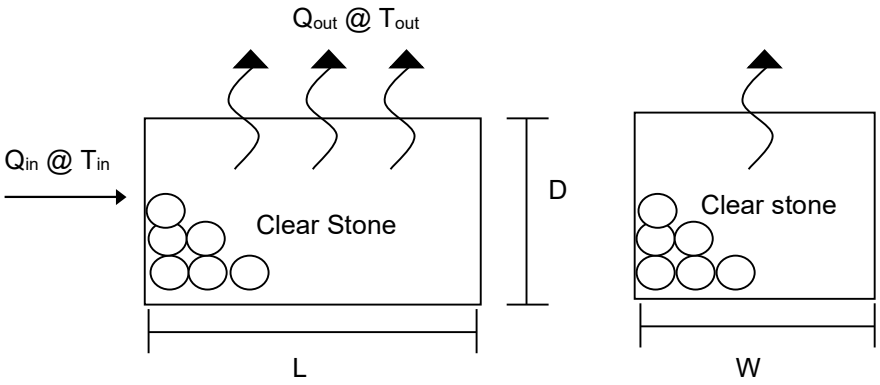
Cityview Ridge Subdivision
City of Guelph
File No.: 105172

Cooling Trench Sample Calculations

Assumptions:

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

Schematic:



Design Variables:

Q = flowrate through trench (m^3/s)
= 0.022m^3/s for 2 year design storm event.

T_{in} = temperature of fluid at inlet (K)
= 36°C
= 309 K

T_{out} = temperature of fluid at outlet (K)
= 24°C
= 297 K

T_{avg} = average temperature of inflow and outflow (K)
= 30°C
= 303 K

T_{stone} = average temperature of clear stone (K)
= 21°C
= 294 K

L = length of trench (m)
= 15 m

W = width of trench (m)
= 4.0 m

D = depth of trench (m)
= 2.0 m

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

Physical Properties:

μ = dynamic viscosity
= 0.798 $x10^{-3}$ kg/m s water @ 303 K
(Table A-9, p. 918, Çengal, Ghajar, 5th Edition)

ρ = fluid density
= 996.0 kg/m^3 for water at 303K
(Table A-9, p. 918, Çengal, Ghajar, 5th Edition)

P_r = Prandtl number
= 5.42 for water @ 303K
(Table A-9, p. 918, Çengal, Ghajar, 5th Edition)

k = Thermal Conductivity of Water
= 0.615 W/m K for water at 303K
(Table A-9, p. 918, Çengal, Ghajar, 5th Edition)

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

Analysis:

Calculate the Reynolds number using the following equation:

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

Where:

V = velocity of water (m/s)

D = stone diameter (m)

ν = kinematic viscosity (m^2/s)

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

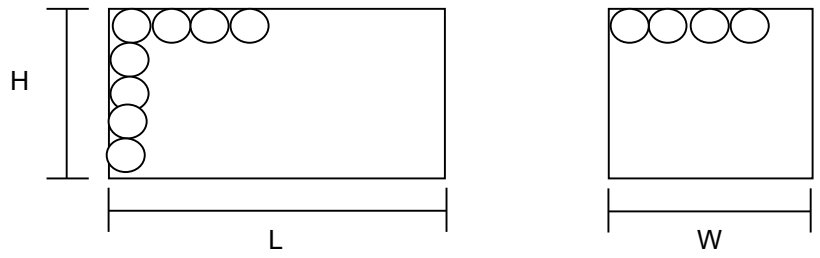
Where:

Q = Flow rate (m^3/s)

Av = Void area in the cross section of the cooling trench (m^2)

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

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



$$As = (\pi \; x \; 0.01^2) \; x \; \left(\frac{2}{0.02} \; x \; \frac{4}{0.02}\right)$$
$$A = 6.28m^2$$

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

$$Av = (H \; x \; W) - \text{As}$$
$$Av = (2 \; x \; 4) - 6.28$$
$$Av = 1.72m^2$$

Step 3: Calculate the velocity using equation 2.

$$V = \frac{0.022}{1.72}$$
$$V = 0.013m/s$$

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

$$\nu = \frac{\mu}{\rho} \qquad \text{Eq. 4}$$

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

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

Step 5: Calculate the Reynolds number using Equation 1:

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

$$Re = \frac{0.013\ x\ 0.02}{8.01\text{x}10^{-7}}$$

$$Re = 320$$

Step 6: Calculate the Nusselt number

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

For 4,000<Re<40,000 $Nu = 0.193Re^{0.466}Pr^{1/3}$ Eq. 6

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

As Re = 320, use Equation 5.

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

$$Nu = 0.683(320)^{0.466}(5.42)^{1/3}$$

$$Nu = 17.6$$

Step 7: Calculate the heat transfer coefficient.

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

Where:

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

D = stone diameter (m)

Nu = Nusselt Number

$$hs = \frac{0.615}{0.02}(17.6)$$

$$hs = 542.38\ W/m^2K$$

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

$q_r = Q\rho C_p(T_{in} - T_{out})$ Eq. 7

$q_r = 0.022(996)(810)(309 - 297)$

$q_r = 212{,}985$ W

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

$q_a = h_s A_s(T_{avg} - T_{stone})$ Eq. 8

Where:

h_s = Heat transfer coefficient (W/m K)

A = Surface area of clear stone particles (m^2)

$$A = (\pi\ x\ D^2)\ x\ \left(\frac{L}{D}\ x\ \frac{H}{D}\ x\ \frac{W}{D}\right)$$

$$A = \pi\ x\ \left(\frac{LHW}{D}\right)$$
$$A = \pi\ x\ \left(\frac{15\ x\ 4\ x\ 2}{0.02}\right)$$
$$A = 18{,}850m^2$$

$$q_a = \ h_s A_s \left(T_{avg} - T_{stone}\right)$$
$$q_a = (542.38)(18{,}850)(303 - 294)$$
$$q_a = 92{,}013{,}376\ W$$

Therefore, the available heat transfer rate to reduce the temperature of water to 297 K (24°C) from 309K (36°C) is 92,013,376 W.

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

$$SF = \frac{\mathrm{qa} - \mathrm{qr}}{\mathrm{qr}} \qquad \text{Eq. 9}$$
$$SF = \frac{92{,}013{,}376 - 212{,}985}{212{,}985}$$
$$SF = 43{,}102\%$$

Therefore the Safety Factor for the cooling trench is 43,102% for the 2-year design storm event based on the assumptions used in the calculations.

Therefore, since the available heat transfer rate (q_a) of 92,013,376 W is greater than the required heat transfer rate (q_r) of 212,985 W, we conclude that a cooling trench 15m long by 4m wide by 2m deep, constructed with 0.020m diameter clear stone, has the ability to reduce the temperature of the inflow from 309 K (36°C) to 297 K (24°C).

105172 - Cityview Ridge Subdivision
Cooling Trench Sizing Calculations

Knowns:

Q 25mm =	0.008	m^3/s
Q 2yr =	0.022	m^3/s
Q 5yr =	0.055	m^3/s
Q 25yr =	0.114	m^3/s
Q 100yr =	0.149	m^3/s
Q Regional =	0.180	m^3/s
v=	8.01E-07	
Pr =	5.42	
k=	0.615	
Cross Sectional Void Space	1.72	m^2
Rho =	996	kg/m^3
Cp =	810	J/kg·K

Assumptions:

Tin =	36	°C
=	309	K
Tout =	24	°C
=	297	K
Tavg =	30	°C
=	303	K
Tstone =	21	°C
=	294	K
L =	15	m
W =	4	m
D =	2	m
Diam. =	0.02	m

Storm	V (m/s)	Re	Nu	h_s J/m²·K·s	As m^2	qr (J/s)	qa (J/s)	SF (%)
25mm	0.005	116	11.0	338.52	18,850	77,449	57,427,767	74049%
2 Year	0.013	320	17.6	542.38	18,850	212,985	92,013,376	43102%
5 Year	0.032	800	27.0	831.28	18,850	532,462	141,023,344	26385%
25 Year	0.066	1,658	38.0	1167.50	18,850	1,103,648	198,061,314	17846%
100 Year	0.087	2,167	43.0	1322.64	18,850	1,442,487	224,381,371	15455%
Regional	0.105	2,618	47.0	1444.43	18,850	1,742,602	245,041,128	13962%

APPENDIX I:

PRE-DEVELOPMENT STORMWATER MANAGEMENT ANALYSIS
MIDUSS OUTPUT FILES FOR THE CITYVIEW RIDGE SUBDIVISION

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"            1   Equal length"
"            2   Horton equation"
"           10   Catchment 10 - To Hadati Creek"
"        8.000   % Impervious"
"        7.020   Total Area"
"       45.000   Flow length"
"        2.000   Overland Slope"
"        6.458   Pervious Area"
"       45.000   Pervious length"
"        2.000   Pervious slope"
"        0.562   Impervious Area"
"       45.000   Impervious length"
"        2.000   Impervious slope"
"        0.250   Pervious Manning 'n'"
"       75.000   Pervious Max.infiltration"
"       12.500   Pervious Min.infiltration"
"        0.250   Pervious Lag constant (hours)"
"        5.000   Pervious Depression storage"
"        0.015   Impervious Manning 'n'"
"        0.000   Impervious Max.infiltration"
"        0.000   Impervious Min.infiltration"
"        0.050   Impervious Lag constant (hours)"
"        1.500   Impervious Depression storage"
"                     0.130     0.000     0.000     0.000 c.m/sec"
```

```
"             Catchment 10           Pervious   Impervious Total Area "
"             Surface Area           6.458      0.562      7.020      hectare"
"             Time of concentration  33.141     2.730      15.686     minutes"
"             Time to Centroid       104.165    89.669     95.845     minutes"
"             Rainfall depth         34.259     34.259     34.259     mm"
"             Rainfall volume        2212.55    192.40     2404.95    c.m"
"             Rainfall losses        32.178     2.027      29.766     mm"
"             Runoff depth           2.080      32.231     4.492      mm"
"             Runoff volume          134.36     181.01     315.37     c.m"
"             Runoff coefficient     0.061      0.941      0.131      "
"             Maximum flow           0.070      0.127      0.130      c.m/sec"
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"                    0.130     0.130     0.130     0.000"
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"             Hydrograph volume          315.373    c.m"
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"            1   Equal length"
"            2   Horton equation"
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"        2.000   Pervious slope"
"        0.000   Impervious Area"
"       45.000   Impervious length"
"        2.000   Impervious slope"
"        0.250   Pervious Manning 'n'"
"       75.000   Pervious Max.infiltration"
"       12.500   Pervious Min.infiltration"
"        0.250   Pervious Lag constant (hours)"
"        5.000   Pervious Depression storage"
"        0.015   Impervious Manning 'n'"
"        0.000   Impervious Max.infiltration"
"        0.000   Impervious Min.infiltration"
```

```
"        0.050   Impervious Lag constant (hours)"
"        1.500   Impervious Depression storage"
"                     0.052     0.000     0.130     0.130 c.m/sec"
"             Catchment 20           Pervious   Impervious Total Area "
"             Surface Area           4.780      0.000      4.780      hectare"
"             Time of concentration  33.141     2.730      33.141     minutes"
"             Time to Centroid       104.165    89.669     104.165    minutes"
"             Rainfall depth         34.259     34.259     34.259     mm"
"             Rainfall volume        1637.56    0.00       1637.56    c.m"
"             Rainfall losses        32.178     2.027      32.178     mm"
"             Runoff depth           2.080      32.231     2.080      mm"
"             Runoff volume          99.44      0.00       99.45      c.m"
"             Runoff coefficient     0.061      0.000      0.061      "
"             Maximum flow           0.052      0.000      0.052      c.m/sec"
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"        0.052   Current peak flow    c.m/sec"
"        0.065   Manning 'n'"
"           0.   Cross-section type: 0=trapezoidal; 1=general"
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"        0.000   Left bank slope"
"        0.000   Right bank slope"
"        1.000   Channel depth    metre"
"       18.000   Gradient   %"
"             Depth of flow                0.003    metre"
"             Velocity                     0.147    m/sec"
"             Channel capacity           676.783    c.m/sec"
"             Critical depth               0.003    metre"
" 53          ROUTE    Channel Route 50"
"        50.00      Channel Route 50 Reach length   ( metre)"
"        0.500   X-factor <= 0.5"
"      255.437   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"
"      150.000   Routing time step   ( seconds)"
"            1   No. of sub-reaches"
"             Peak outflow                 0.050    c.m/sec"
"                     0.052     0.052     0.050     0.130 c.m/sec"
" 40          HYDROGRAPH Next link "
"            5   Next link "
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"            1   Triangular SCS"
"            1   Equal length"
"            2   Horton equation"
"           30   Catchment 30 - To Clythe Creek"
```

```
"        0.000   % Impervious"
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"        2.000   Overland Slope"
"        6.480   Pervious Area"
"       45.000   Pervious length"
"        2.000   Pervious slope"
"        0.000   Impervious Area"
"       45.000   Impervious length"
"        2.000   Impervious slope"
"        0.250   Pervious Manning 'n'"
"       75.000   Pervious Max.infiltration"
"       12.500   Pervious Min.infiltration"
"        0.250   Pervious Lag constant (hours)"
"        5.000   Pervious Depression storage"
"        0.015   Impervious Manning 'n'"
"        0.000   Impervious Max.infiltration"
"        0.000   Impervious Min.infiltration"
"        0.050   Impervious Lag constant (hours)"
"        1.500   Impervious Depression storage"
"                    0.070     0.050     0.050     0.130 c.m/sec"
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"             Surface Area           6.480      0.000      6.480      hectare"
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"             Time to Centroid       104.165    89.669     104.165    minutes"
"             Rainfall depth         34.259     34.259     34.259     mm"
"             Rainfall volume        2219.95    0.00       2219.95    c.m"
"             Rainfall losses        32.178     2.027      32.178     mm"
"             Runoff depth           2.080      32.231     2.080      mm"
"             Runoff volume          134.81     0.00       134.81     c.m"
"             Runoff coefficient     0.061      0.000      0.061      "
"             Maximum flow           0.070      0.000      0.070      c.m/sec"
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"            6   Combine "
"            1   Node #"
"                Total Discharge"
"             Maximum flow                 0.202    c.m/sec"
"             Hydrograph volume          549.634    c.m"
"                    0.070     0.114     0.114     0.202"
" 40          HYDROGRAPH   Confluence    1"
"            7   Confluence "
"            1   Node #"
"                Total Discharge"
"             Maximum flow                 0.202    c.m/sec"
```

```
"             Hydrograph volume           549.634    c.m"
"                     0.070     0.202     0.114     0.000"
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"            3   Runoff Totals on EXIT"
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"             Total Impervious area                    0.562    hectare"
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" 19          EXIT"
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"            1   Equal length"
"            2   Horton equation"
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"        7.020   Total Area"
"       45.000   Flow length"
"        2.000   Overland Slope"
"        6.458   Pervious Area"
"       45.000   Pervious length"
"        2.000   Pervious slope"
"        0.562   Impervious Area"
"       45.000   Impervious length"
"        2.000   Impervious slope"
"        0.250   Pervious Manning 'n'"
"       75.000   Pervious Max.infiltration"
"       12.500   Pervious Min.infiltration"
"        0.250   Pervious Lag constant (hours)"
"        5.000   Pervious Depression storage"
"        0.015   Impervious Manning 'n'"
"        0.000   Impervious Max.infiltration"
"        0.000   Impervious Min.infiltration"
"        0.050   Impervious Lag constant (hours)"
"        1.500   Impervious Depression storage"
"                     0.492     0.000     0.000     0.000 c.m/sec"
```

```
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"             Surface Area           6.458      0.562      7.020      hectare"
"             Time of concentration  17.999     2.478      13.949     minutes"
"             Time to Centroid       95.777     87.611     93.646     minutes"
"             Rainfall depth         47.240     47.240     47.240     mm"
"             Rainfall volume        3050.94    265.30     3316.24    c.m"
"             Rainfall losses        36.173     2.305      33.464     mm"
"             Runoff depth           11.067     44.935     13.776     mm"
"             Runoff volume          714.73     252.35     967.09     c.m"
"             Runoff coefficient     0.234      0.951      0.292      "
"             Maximum flow           0.447      0.174      0.492      c.m/sec"
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"            4   Add Runoff "
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" 40          HYDROGRAPH Copy to Outflow"
"            8   Copy to Outflow"
"                    0.492     0.492     0.492     0.000"
" 40          HYDROGRAPH   Combine    1"
"            6   Combine "
"            1   Node #"
"                Total Discharge"
"             Maximum flow                 0.492    c.m/sec"
"             Hydrograph volume          967.087    c.m"
"                    0.492     0.492     0.492     0.492"
" 40          HYDROGRAPH Start - New Tributary"
"            2   Start - New Tributary"
"                    0.492     0.000     0.492     0.492"
" 33          CATCHMENT 20"
"            1   Triangular SCS"
"            1   Equal length"
"            2   Horton equation"
"           20   Catchment 20 - To Clythe Creeek"
"        0.000   % Impervious"
"        4.780   Total Area"
"       45.000   Flow length"
"        2.000   Overland Slope"
"        4.780   Pervious Area"
"       45.000   Pervious length"
"        2.000   Pervious slope"
"        0.000   Impervious Area"
"       45.000   Impervious length"
"        2.000   Impervious slope"
"        0.250   Pervious Manning 'n'"
"       75.000   Pervious Max.infiltration"
"       12.500   Pervious Min.infiltration"
"        0.250   Pervious Lag constant (hours)"
"        5.000   Pervious Depression storage"
"        0.015   Impervious Manning 'n'"
"        0.000   Impervious Max.infiltration"
"        0.000   Impervious Min.infiltration"
```

```
"        0.050   Impervious Lag constant (hours)"
"        1.500   Impervious Depression storage"
"                     0.331     0.000     0.492     0.492 c.m/sec"
"             Catchment 20           Pervious   Impervious Total Area "
"             Surface Area           4.780      0.000      4.780      hectare"
"             Time of concentration  17.999     2.478      17.999     minutes"
"             Time to Centroid       95.777     87.611     95.777     minutes"
"             Rainfall depth         47.240     47.240     47.240     mm"
"             Rainfall volume        2258.06    0.00       2258.07    c.m"
"             Rainfall losses        36.173     2.305      36.173     mm"
"             Runoff depth           11.067     44.935     11.067     mm"
"             Runoff volume          528.99     0.00       528.99     c.m"
"             Runoff coefficient     0.234      0.000      0.234      "
"             Maximum flow           0.331      0.000      0.331      c.m/sec"
" 40          HYDROGRAPH Add Runoff "
"            4   Add Runoff "
"                     0.331     0.331     0.492     0.492"
" 52          CHANNEL DESIGN"
"        0.331   Current peak flow    c.m/sec"
"        0.065   Manning 'n'"
"           0.   Cross-section type: 0=trapezoidal; 1=general"
"      105.000   Basewidth    metre"
"        0.000   Left bank slope"
"        0.000   Right bank slope"
"        1.000   Channel depth    metre"
"       18.000   Gradient   %"
"             Depth of flow                0.010    metre"
"             Velocity                     0.308    m/sec"
"             Channel capacity           676.783    c.m/sec"
"             Critical depth               0.010    metre"
" 53          ROUTE    Channel Route 50"
"        50.00      Channel Route 50 Reach length   ( metre)"
"        0.500   X-factor <= 0.5"
"      121.836   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                 0.318    c.m/sec"
"                     0.331     0.331     0.318     0.492 c.m/sec"
" 40          HYDROGRAPH Next link "
"            5   Next link "
"                     0.331     0.318     0.318     0.492"
" 33          CATCHMENT 30"
"            1   Triangular SCS"
"            1   Equal length"
"            2   Horton equation"
"           30   Catchment 30 - To Clythe Creek"
```

```
"        0.000   % Impervious"
"        6.480   Total Area"
"       45.000   Flow length"
"        2.000   Overland Slope"
"        6.480   Pervious Area"
"       45.000   Pervious length"
"        2.000   Pervious slope"
"        0.000   Impervious Area"
"       45.000   Impervious length"
"        2.000   Impervious slope"
"        0.250   Pervious Manning 'n'"
"       75.000   Pervious Max.infiltration"
"       12.500   Pervious Min.infiltration"
"        0.250   Pervious Lag constant (hours)"
"        5.000   Pervious Depression storage"
"        0.015   Impervious Manning 'n'"
"        0.000   Impervious Max.infiltration"
"        0.000   Impervious Min.infiltration"
"        0.050   Impervious Lag constant (hours)"
"        1.500   Impervious Depression storage"
"                    0.448     0.318     0.318     0.492 c.m/sec"
"             Catchment 30           Pervious   Impervious Total Area "
"             Surface Area           6.480      0.000      6.480      hectare"
"             Time of concentration  17.999     2.478      17.999     minutes"
"             Time to Centroid       95.777     87.611     95.777     minutes"
"             Rainfall depth         47.240     47.240     47.240     mm"
"             Rainfall volume        3061.14    0.00       3061.14    c.m"
"             Rainfall losses        36.173     2.305      36.173     mm"
"             Runoff depth           11.067     44.935     11.067     mm"
"             Runoff volume          717.12     0.00       717.12     c.m"
"             Runoff coefficient     0.234      0.000      0.234      "
"             Maximum flow           0.448      0.000      0.448      c.m/sec"
" 40          HYDROGRAPH Add Runoff "
"            4   Add Runoff "
"                    0.448     0.766     0.318     0.492"
" 40          HYDROGRAPH Copy to Outflow"
"            8   Copy to Outflow"
"                    0.448     0.766     0.766     0.492"
" 40          HYDROGRAPH   Combine    1"
"            6   Combine "
"            1   Node #"
"                Total Discharge"
"             Maximum flow                 1.258    c.m/sec"
"             Hydrograph volume         2213.202    c.m"
"                    0.448     0.766     0.766     1.258"
" 40          HYDROGRAPH   Confluence    1"
"            7   Confluence "
"            1   Node #"
"                Total Discharge"
"             Maximum flow                 1.258    c.m/sec"
```

```
"             Hydrograph volume          2213.202    c.m"
"                     0.448     1.258     0.766     0.000"
" 38          START/RE-START TOTALS 1"
"            3   Runoff Totals on EXIT"
"             Total Catchment area                    18.280    hectare"
"             Total Impervious area                    0.562    hectare"
"             Total % impervious                       3.072"
" 19          EXIT"
```

```
"                MIDUSS Output ------------------------------------------------>"
"                MIDUSS version                          Version 2.25  rev. 473"
"                MIDUSS created                       Sunday, February 07, 2010"
"           10   Units used:                                          ie METRIC"
"                Job folder:            C:\Users\szaga\Documents\MIDUSS\105172"
"                Output filename:                    105172 Ex Cond 25year.out"
"                Licensee name:                                           gmbp"
"                Company                                                     "
"                Date & Time last used:                4/28/2023 at 5:03:45 PM"
" 31          TIME PARAMETERS"
"        5.000   Time Step"
"      180.000   Max. Storm length"
"     1500.000   Max. Hydrograph"
" 32          STORM Chicago storm"
"            1   Chicago storm"
"     3158.000   Coefficient A"
"       15.000   Constant B"
"        0.936   Exponent C"
"        0.400   Fraction R"
"      180.000   Duration"
"        1.000   Time step multiplier"
"             Maximum intensity          191.271    mm/hr"
"             Total depth                 68.087    mm"
"            6   025hyd   Hydrograph extension used in this file"
" 33          CATCHMENT 10"
"            1   Triangular SCS"
"            1   Equal length"
"            2   Horton equation"
"           10   Catchment 10 - To Hadati Creek"
"        8.000   % Impervious"
"        7.020   Total Area"
"       45.000   Flow length"
"        2.000   Overland Slope"
"        6.458   Pervious Area"
"       45.000   Pervious length"
"        2.000   Pervious slope"
"        0.562   Impervious Area"
"       45.000   Impervious length"
"        2.000   Impervious slope"
"        0.250   Pervious Manning 'n'"
"       75.000   Pervious Max.infiltration"
"       12.500   Pervious Min.infiltration"
"        0.250   Pervious Lag constant (hours)"
"        5.000   Pervious Depression storage"
"        0.015   Impervious Manning 'n'"
"        0.000   Impervious Max.infiltration"
"        0.000   Impervious Min.infiltration"
"        0.050   Impervious Lag constant (hours)"
"        1.500   Impervious Depression storage"
"                     1.334     0.000     0.000     0.000 c.m/sec"
```

```
"             Catchment 10           Pervious   Impervious Total Area "
"             Surface Area           6.458      0.562      7.020      hectare"
"             Time of concentration  12.547     2.183      10.799     minutes"
"             Time to Centroid       93.833     86.046     92.520     minutes"
"             Rainfall depth         68.087     68.087     68.087     mm"
"             Rainfall volume        4397.30    382.37     4779.67    c.m"
"             Rainfall losses        39.975     2.507      36.978     mm"
"             Runoff depth           28.111     65.580     31.109     mm"
"             Runoff volume          1815.54    368.30     2183.84    c.m"
"             Runoff coefficient     0.413      0.963      0.457      "
"             Maximum flow           1.214      0.248      1.334      c.m/sec"
" 40          HYDROGRAPH Add Runoff "
"            4   Add Runoff "
"                    1.334     1.334     0.000     0.000"
" 40          HYDROGRAPH Copy to Outflow"
"            8   Copy to Outflow"
"                    1.334     1.334     1.334     0.000"
" 40          HYDROGRAPH   Combine    1"
"            6   Combine "
"            1   Node #"
"                Total Discharge"
"             Maximum flow                 1.334    c.m/sec"
"             Hydrograph volume          2183.837    c.m"
"                    1.334     1.334     1.334     1.334"
" 40          HYDROGRAPH Start - New Tributary"
"            2   Start - New Tributary"
"                    1.334     0.000     1.334     1.334"
" 33          CATCHMENT 20"
"            1   Triangular SCS"
"            1   Equal length"
"            2   Horton equation"
"           20   Catchment 20 - To Clythe Creeek"
"         0.000   % Impervious"
"         4.780   Total Area"
"        45.000   Flow length"
"         2.000   Overland Slope"
"         4.780   Pervious Area"
"        45.000   Pervious length"
"         2.000   Pervious slope"
"         0.000   Impervious Area"
"        45.000   Impervious length"
"         2.000   Impervious slope"
"         0.250   Pervious Manning 'n'"
"        75.000   Pervious Max.infiltration"
"        12.500   Pervious Min.infiltration"
"         0.250   Pervious Lag constant (hours)"
"         5.000   Pervious Depression storage"
"         0.015   Impervious Manning 'n'"
"         0.000   Impervious Max.infiltration"
"         0.000   Impervious Min.infiltration"
```

```
"        0.050   Impervious Lag constant (hours)"
"        1.500   Impervious Depression storage"
"                     0.899     0.000     1.334     1.334 c.m/sec"
"             Catchment 20           Pervious   Impervious Total Area "
"             Surface Area           4.780      0.000      4.780      hectare"
"             Time of concentration  12.547     2.183      12.547     minutes"
"             Time to Centroid       93.833     86.046     93.833     minutes"
"             Rainfall depth         68.087     68.087     68.087     mm"
"             Rainfall volume        3254.53    0.00       3254.53    c.m"
"             Rainfall losses        39.975     2.507      39.975     mm"
"             Runoff depth           28.111     65.580     28.111     mm"
"             Runoff volume          1343.72    0.00       1343.72    c.m"
"             Runoff coefficient     0.413      0.000      0.413      "
"             Maximum flow           0.899      0.000      0.899      c.m/sec"
" 40          HYDROGRAPH Add Runoff "
"            4   Add Runoff "
"                     0.899     0.899     1.334     1.334"
" 52          CHANNEL DESIGN"
"        0.899   Current peak flow    c.m/sec"
"        0.065   Manning 'n'"
"           0.   Cross-section type: 0=trapezoidal; 1=general"
"      105.000   Basewidth    metre"
"        0.000   Left bank slope"
"        0.000   Right bank slope"
"        1.000   Channel depth    metre"
"       18.000   Gradient   %"
"             Depth of flow                0.019    metre"
"             Velocity                     0.459    m/sec"
"             Channel capacity           676.783    c.m/sec"
"             Critical depth               0.020    metre"
" 53          ROUTE    Channel Route 50"
"        50.00      Channel Route 50 Reach length   ( metre)"
"        0.499   X-factor <= 0.5"
"       81.702   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                 0.871    c.m/sec"
"                     0.899     0.899     0.871     1.334 c.m/sec"
" 40          HYDROGRAPH Next link "
"            5   Next link "
"                     0.899     0.871     0.871     1.334"
" 33          CATCHMENT 30"
"            1   Triangular SCS"
"            1   Equal length"
"            2   Horton equation"
"           30   Catchment 30 - To Clythe Creek"
```

```
"        0.000   % Impervious"
"        6.480   Total Area"
"       45.000   Flow length"
"        2.000   Overland Slope"
"        6.480   Pervious Area"
"       45.000   Pervious length"
"        2.000   Pervious slope"
"        0.000   Impervious Area"
"       45.000   Impervious length"
"        2.000   Impervious slope"
"        0.250   Pervious Manning 'n'"
"       75.000   Pervious Max.infiltration"
"       12.500   Pervious Min.infiltration"
"        0.250   Pervious Lag constant (hours)"
"        5.000   Pervious Depression storage"
"        0.015   Impervious Manning 'n'"
"        0.000   Impervious Max.infiltration"
"        0.000   Impervious Min.infiltration"
"        0.050   Impervious Lag constant (hours)"
"        1.500   Impervious Depression storage"
"                    1.218     0.871     0.871     1.334 c.m/sec"
"             Catchment 30           Pervious   Impervious Total Area "
"             Surface Area           6.480      0.000      6.480      hectare"
"             Time of concentration  12.547     2.183      12.547     minutes"
"             Time to Centroid       93.833     86.046     93.833     minutes"
"             Rainfall depth         68.087     68.087     68.087     mm"
"             Rainfall volume        4412.00    0.00       4412.01    c.m"
"             Rainfall losses        39.975     2.507      39.975     mm"
"             Runoff depth           28.111     65.580     28.111     mm"
"             Runoff volume          1821.61    0.00       1821.62    c.m"
"             Runoff coefficient     0.413      0.000      0.413      "
"             Maximum flow           1.218      0.000      1.218      c.m/sec"
" 40          HYDROGRAPH Add Runoff "
"            4   Add Runoff "
"                    1.218     2.058     0.871     1.334"
" 40          HYDROGRAPH Copy to Outflow"
"            8   Copy to Outflow"
"                    1.218     2.058     2.058     1.334"
" 40          HYDROGRAPH   Combine    1"
"            6   Combine "
"            1   Node #"
"                Total Discharge"
"             Maximum flow                 3.391    c.m/sec"
"             Hydrograph volume         5349.175    c.m"
"                    1.218     2.058     2.058     3.391"
" 40          HYDROGRAPH   Confluence    1"
"            7   Confluence "
"            1   Node #"
"                Total Discharge"
"             Maximum flow                 3.391    c.m/sec"
```

```
"             Hydrograph volume          5349.175    c.m"
"                     1.218     3.391     2.058     0.000"
" 38          START/RE-START TOTALS 1"
"            3   Runoff Totals on EXIT"
"             Total Catchment area                    18.280    hectare"
"             Total Impervious area                    0.562    hectare"
"             Total % impervious                       3.072"
" 19          EXIT"
```

```
"                MIDUSS Output ------------------------------------------------>"
"                MIDUSS version                          Version 2.25  rev. 473"
"                MIDUSS created                       Sunday, February 07, 2010"
"           10   Units used:                                          ie METRIC"
"                Job folder:            C:\Users\szaga\Documents\MIDUSS\105172"
"                Output filename:                    105172 Ex Cond 100year.out"
"                Licensee name:                                            gmbp"
"                Company                                                      "
"                Date & Time last used:                4/28/2023 at 5:04:31 PM"
" 31          TIME PARAMETERS"
"        5.000   Time Step"
"      180.000   Max. Storm length"
"     1500.000   Max. Hydrograph"
" 32          STORM Chicago storm"
"            1   Chicago storm"
"     4688.000   Coefficient A"
"       17.000   Constant B"
"        0.962   Exponent C"
"        0.400   Fraction R"
"      180.000   Duration"
"        1.000   Time step multiplier"
"             Maximum intensity          239.650    mm/hr"
"             Total depth                 87.263    mm"
"            6   100hyd   Hydrograph extension used in this file"
" 33          CATCHMENT 10"
"            1   Triangular SCS"
"            1   Equal length"
"            2   Horton equation"
"           10   Catchment 10 - To Hadati Creek"
"        8.000   % Impervious"
"        7.020   Total Area"
"       45.000   Flow length"
"        2.000   Overland Slope"
"        6.458   Pervious Area"
"       45.000   Pervious length"
"        2.000   Pervious slope"
"        0.562   Impervious Area"
"       45.000   Impervious length"
"        2.000   Impervious slope"
"        0.250   Pervious Manning 'n'"
"       75.000   Pervious Max.infiltration"
"       12.500   Pervious Min.infiltration"
"        0.250   Pervious Lag constant (hours)"
"        5.000   Pervious Depression storage"
"        0.015   Impervious Manning 'n'"
"        0.000   Impervious Max.infiltration"
"        0.000   Impervious Min.infiltration"
"        0.050   Impervious Lag constant (hours)"
"        1.500   Impervious Depression storage"
"                     2.153     0.000     0.000     0.000 c.m/sec"
```

```
"             Catchment 10           Pervious   Impervious Total Area "
"             Surface Area           6.458      0.562      7.020      hectare"
"             Time of concentration  11.252     1.995      9.956      minutes"
"             Time to Centroid       92.918     85.270     91.848     minutes"
"             Rainfall depth         87.263     87.263     87.263     mm"
"             Rainfall volume        5635.82    490.07     6125.89    c.m"
"             Rainfall losses        42.118     2.747      38.968     mm"
"             Runoff depth           45.146     84.517     48.295     mm"
"             Runoff volume          2915.68    474.65     3390.32    c.m"
"             Runoff coefficient     0.517      0.969      0.553      "
"             Maximum flow           1.997      0.315      2.153      c.m/sec"
" 40          HYDROGRAPH Add Runoff "
"            4   Add Runoff "
"                     2.153     2.153     0.000     0.000"
" 40          HYDROGRAPH Copy to Outflow"
"            8   Copy to Outflow"
"                     2.153     2.153     2.153     0.000"
" 40          HYDROGRAPH   Combine    1"
"            6   Combine "
"            1   Node #"
"                Total Discharge"
"             Maximum flow                 2.153    c.m/sec"
"             Hydrograph volume         3390.325    c.m"
"                     2.153     2.153     2.153     2.153"
" 40          HYDROGRAPH Start - New Tributary"
"            2   Start - New Tributary"
"                     2.153     0.000     2.153     2.153"
" 33          CATCHMENT 20"
"            1   Triangular SCS"
"            1   Equal length"
"            2   Horton equation"
"           20   Catchment 20 - To Clythe Creeek"
"         0.000   % Impervious"
"         4.780   Total Area"
"        45.000   Flow length"
"         2.000   Overland Slope"
"         4.780   Pervious Area"
"        45.000   Pervious length"
"         2.000   Pervious slope"
"         0.000   Impervious Area"
"        45.000   Impervious length"
"         2.000   Impervious slope"
"         0.250   Pervious Manning 'n'"
"        75.000   Pervious Max.infiltration"
"        12.500   Pervious Min.infiltration"
"         0.250   Pervious Lag constant (hours)"
"         5.000   Pervious Depression storage"
"         0.015   Impervious Manning 'n'"
"         0.000   Impervious Max.infiltration"
"         0.000   Impervious Min.infiltration"
```

```
"        0.050   Impervious Lag constant (hours)"
"        1.500   Impervious Depression storage"
"                     1.478     0.000     2.153     2.153 c.m/sec"
"             Catchment 20           Pervious   Impervious Total Area "
"             Surface Area           4.780      0.000      4.780      hectare"
"             Time of concentration  11.252     1.995      11.252     minutes"
"             Time to Centroid       92.918     85.270     92.918     minutes"
"             Rainfall depth         87.263     87.263     87.263     mm"
"             Rainfall volume        4171.19    0.00       4171.19    c.m"
"             Rainfall losses        42.118     2.747      42.118     mm"
"             Runoff depth           45.146     84.517     45.146     mm"
"             Runoff volume          2157.95    0.00       2157.96    c.m"
"             Runoff coefficient     0.517      0.000      0.517      "
"             Maximum flow           1.478      0.000      1.478      c.m/sec"
" 40          HYDROGRAPH Add Runoff "
"            4   Add Runoff "
"                     1.478     1.478     2.153     2.153"
" 52          CHANNEL DESIGN"
"        1.478   Current peak flow    c.m/sec"
"        0.065   Manning 'n'"
"           0.   Cross-section type: 0=trapezoidal; 1=general"
"      105.000   Basewidth    metre"
"        0.000   Left bank slope"
"        0.000   Right bank slope"
"        1.000   Channel depth    metre"
"       18.000   Gradient   %"
"             Depth of flow                0.025    metre"
"             Velocity                     0.560    m/sec"
"             Channel capacity           676.783    c.m/sec"
"             Critical depth               0.027    metre"
" 53          ROUTE    Channel Route 50"
"        50.00      Channel Route 50 Reach length   ( metre)"
"        0.499   X-factor <= 0.5"
"       66.971   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                 1.423    c.m/sec"
"                     1.478     1.478     1.423     2.153 c.m/sec"
" 40          HYDROGRAPH Next link "
"            5   Next link "
"                     1.478     1.423     1.423     2.153"
" 33          CATCHMENT 30"
"            1   Triangular SCS"
"            1   Equal length"
"            2   Horton equation"
"           30   Catchment 30 - To Clythe Creek"
```

```
"        0.000   % Impervious"
"        6.480   Total Area"
"       45.000   Flow length"
"        2.000   Overland Slope"
"        6.480   Pervious Area"
"       45.000   Pervious length"
"        2.000   Pervious slope"
"        0.000   Impervious Area"
"       45.000   Impervious length"
"        2.000   Impervious slope"
"        0.250   Pervious Manning 'n'"
"       75.000   Pervious Max.infiltration"
"       12.500   Pervious Min.infiltration"
"        0.250   Pervious Lag constant (hours)"
"        5.000   Pervious Depression storage"
"        0.015   Impervious Manning 'n'"
"        0.000   Impervious Max.infiltration"
"        0.000   Impervious Min.infiltration"
"        0.050   Impervious Lag constant (hours)"
"        1.500   Impervious Depression storage"
"                    2.004     1.423     1.423     2.153 c.m/sec"
"             Catchment 30           Pervious   Impervious Total Area "
"             Surface Area           6.480      0.000      6.480      hectare"
"             Time of concentration  11.252     1.995      11.252     minutes"
"             Time to Centroid       92.918     85.270     92.918     minutes"
"             Rainfall depth         87.263     87.263     87.263     mm"
"             Rainfall volume        5654.67    0.01       5654.67    c.m"
"             Rainfall losses        42.118     2.747      42.118     mm"
"             Runoff depth           45.146     84.517     45.146     mm"
"             Runoff volume          2925.43    0.01       2925.43    c.m"
"             Runoff coefficient     0.517      0.000      0.517      "
"             Maximum flow           2.004      0.000      2.004      c.m/sec"
" 40          HYDROGRAPH Add Runoff "
"            4   Add Runoff "
"                    2.004     3.427     1.423     2.153"
" 40          HYDROGRAPH Copy to Outflow"
"            8   Copy to Outflow"
"                    2.004     3.427     3.427     2.153"
" 40          HYDROGRAPH   Combine    1"
"            6   Combine "
"            1   Node #"
"                Total Discharge"
"             Maximum flow                 5.580    c.m/sec"
"             Hydrograph volume         8473.716    c.m"
"                    2.004     3.427     3.427     5.580"
" 40          HYDROGRAPH   Confluence    1"
"            7   Confluence "
"            1   Node #"
"                Total Discharge"
"             Maximum flow                 5.580    c.m/sec"
```

```
"             Hydrograph volume          8473.716    c.m"
"                     2.004     5.580     3.427     0.000"
" 38          START/RE-START TOTALS 1"
"            3   Runoff Totals on EXIT"
"             Total Catchment area                    18.280    hectare"
"             Total Impervious area                    0.562    hectare"
"             Total % impervious                       3.072"
" 19          EXIT"
```

```
"                MIDUSS Output ------------------------------------------------>"
"                MIDUSS version                          Version 2.25  rev. 473"
"                MIDUSS created                       Sunday, February 07, 2010"
"           10   Units used:                                          ie METRIC"
"                Job folder:            C:\Users\szaga\Documents\MIDUSS\105172"
"                Output filename:                  105172 Ex Cond Regional.out"
"                Licensee name:                                            gmbp"
"                Company                                                      "
"                Date & Time last used:                4/28/2023 at 5:05:40 PM"
" 31          TIME PARAMETERS"
"       60.000   Time Step"
"     2880.000   Max. Storm length"
"     3600.000   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     2.206     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                 285.180    mm"
"            6   001hyd   Hydrograph extension used in this file"
" 33          CATCHMENT 10"
"            1   Triangular SCS"
"            1   Equal length"
"            2   Horton equation"
"           10   Catchment 10 - To Hadati Creek"
"        8.000   % Impervious"
"        7.020   Total Area"
"       45.000   Flow length"
"        2.000   Overland Slope"
"        6.458   Pervious Area"
"       45.000   Pervious length"
"        2.000   Pervious slope"
"        0.562   Impervious Area"
"       45.000   Impervious length"
"        2.000   Impervious slope"
"        0.250   Pervious Manning 'n'"
"       75.000   Pervious Max.infiltration"
"       12.500   Pervious Min.infiltration"
"        0.250   Pervious Lag constant (hours)"
"        5.000   Pervious Depression storage"
```

```
"        0.015   Impervious Manning 'n'"
"        0.000   Impervious Max.infiltration"
"        0.000   Impervious Min.infiltration"
"        0.050   Impervious Lag constant (hours)"
"        1.500   Impervious Depression storage"
"                     0.587     0.000     0.000     0.000 c.m/sec"
"             Catchment 10           Pervious   Impervious Total Area "
"             Surface Area           6.458      0.562      7.020      hectare"
"             Time of concentration  21.969     3.647      18.018     minutes"
"             Time to Centroid       2780.245   2236.863   2663.074   minutes"
"             Rainfall depth         285.180    285.180    285.180    mm"
"             Rainfall volume        1.8418     0.1602     2.0020     ha-m"
"             Rainfall losses        207.172    38.558     193.683    mm"
"             Runoff depth           78.008     246.622    91.497     mm"
"             Runoff volume          5038.08    1385.03    6423.11    c.m"
"             Runoff coefficient     0.274      0.865      0.321      "
"             Maximum flow           0.537      0.071      0.587      c.m/sec"
" 40          HYDROGRAPH Add Runoff "
"            4   Add Runoff "
"                     0.587     0.587     0.000     0.000"
" 40          HYDROGRAPH Copy to Outflow"
"            8   Copy to Outflow"
"                     0.587     0.587     0.587     0.000"
" 40          HYDROGRAPH   Combine    1"
"            6   Combine "
"            1   Node #"
"                Total Discharge"
"             Maximum flow                  0.587    c.m/sec"
"             Hydrograph volume          6423.105    c.m"
"                     0.587     0.587     0.587     0.587"
" 40          HYDROGRAPH Start - New Tributary"
"            2   Start - New Tributary"
"                     0.587     0.000     0.587     0.587"
" 33          CATCHMENT 20"
"            1   Triangular SCS"
"            1   Equal length"
"            2   Horton equation"
"           20   Catchment 20 - To Clythe Creeek"
"        0.000   % Impervious"
"        4.780   Total Area"
"       45.000   Flow length"
"        2.000   Overland Slope"
"        4.780   Pervious Area"
"       45.000   Pervious length"
"        2.000   Pervious slope"
"        0.000   Impervious Area"
"       45.000   Impervious length"
"        2.000   Impervious slope"
"        0.250   Pervious Manning 'n'"
"       75.000   Pervious Max.infiltration"
```

```
"       12.500   Pervious Min.infiltration"
"        0.250   Pervious Lag constant (hours)"
"        5.000   Pervious Depression storage"
"        0.015   Impervious Manning 'n'"
"        0.000   Impervious Max.infiltration"
"        0.000   Impervious Min.infiltration"
"        0.050   Impervious Lag constant (hours)"
"        1.500   Impervious Depression storage"
"                     0.397     0.000     0.587     0.587 c.m/sec"
"             Catchment 20           Pervious   Impervious Total Area "
"             Surface Area           4.780      0.000      4.780      hectare"
"             Time of concentration  21.969     3.647      21.969     minutes"
"             Time to Centroid       2780.245   2236.863   2780.243   minutes"
"             Rainfall depth         285.180    285.180    285.180    mm"
"             Rainfall volume        1.3632     0.0000     1.3632     ha-m"
"             Rainfall losses        207.172    38.558     207.172    mm"
"             Runoff depth           78.008     246.622    78.008     mm"
"             Runoff volume          3728.78    0.01       3728.80    c.m"
"             Runoff coefficient     0.274      0.000      0.274      "
"             Maximum flow           0.397      0.000      0.397      c.m/sec"
" 40          HYDROGRAPH Add Runoff "
"            4   Add Runoff "
"                     0.397     0.397     0.587     0.587"
" 52          CHANNEL DESIGN"
"        0.397   Current peak flow    c.m/sec"
"        0.065   Manning 'n'"
"           0.   Cross-section type: 0=trapezoidal; 1=general"
"      105.000   Basewidth    metre"
"        0.000   Left bank slope"
"        0.000   Right bank slope"
"        1.000   Channel depth    metre"
"       18.000   Gradient   %"
"             Depth of flow                 0.011    metre"
"             Velocity                      0.331    m/sec"
"             Channel capacity            676.783    c.m/sec"
"             Critical depth                0.011    metre"
" 53          ROUTE    Channel Route 50"
"        50.00      Channel Route 50 Reach length   ( metre)"
"        0.500   X-factor <= 0.5"
"      113.291   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"
"      112.500   Routing time step   ( seconds)"
"            1   No. of sub-reaches"
"             Peak outflow                  0.396    c.m/sec"
"                     0.397     0.397     0.396     0.587 c.m/sec"
" 40          HYDROGRAPH Next link "
"            5   Next link "
```

```
"                    0.397     0.396     0.396     0.587"
" 33          CATCHMENT 30"
"            1   Triangular SCS"
"            1   Equal length"
"            2   Horton equation"
"           30   Catchment 30 - To Clythe Creek"
"        0.000   % Impervious"
"        6.480   Total Area"
"       45.000   Flow length"
"        2.000   Overland Slope"
"        6.480   Pervious Area"
"       45.000   Pervious length"
"        2.000   Pervious slope"
"        0.000   Impervious Area"
"       45.000   Impervious length"
"        2.000   Impervious slope"
"        0.250   Pervious Manning 'n'"
"       75.000   Pervious Max.infiltration"
"       12.500   Pervious Min.infiltration"
"        0.250   Pervious Lag constant (hours)"
"        5.000   Pervious Depression storage"
"        0.015   Impervious Manning 'n'"
"        0.000   Impervious Max.infiltration"
"        0.000   Impervious Min.infiltration"
"        0.050   Impervious Lag constant (hours)"
"        1.500   Impervious Depression storage"
"                    0.538     0.396     0.396     0.587 c.m/sec"
"             Catchment 30           Pervious   Impervious Total Area "
"             Surface Area           6.480      0.000      6.480      hectare"
"             Time of concentration  21.969     3.647      21.969     minutes"
"             Time to Centroid       2780.244   2236.863   2780.243   minutes"
"             Rainfall depth         285.180    285.180    285.180    mm"
"             Rainfall volume        1.8480     0.0000     1.8480     ha-m"
"             Rainfall losses        207.172    38.558     207.172    mm"
"             Runoff depth           78.008     246.622    78.008     mm"
"             Runoff volume          5054.92    0.02       5054.94    c.m"
"             Runoff coefficient     0.274      0.000      0.274      "
"             Maximum flow           0.538      0.000      0.538      c.m/sec"
" 40          HYDROGRAPH Add Runoff "
"            4   Add Runoff "
"                    0.538     0.934     0.396     0.587"
" 40          HYDROGRAPH Copy to Outflow"
"            8   Copy to Outflow"
"                    0.538     0.934     0.934     0.587"
" 40          HYDROGRAPH   Combine    1"
"            6   Combine "
"            1   Node #"
"                Total Discharge"
"             Maximum flow                 1.521    c.m/sec"
"             Hydrograph volume        15206.840    c.m"
```

```
"                    0.538     0.934     0.934     1.521"
" 40          HYDROGRAPH   Confluence    1"
"            7   Confluence "
"            1   Node #"
"                Total Discharge"
"             Maximum flow                  1.521    c.m/sec"
"             Hydrograph volume         15206.838    c.m"
"                    0.538     1.521     0.934     0.000"
" 38          START/RE-START TOTALS 1"
"            3   Runoff Totals on EXIT"
"             Total Catchment area                      18.280    hectare"
"             Total Impervious area                      0.562    hectare"
"             Total % impervious                         3.072"
" 19          EXIT"
```

APPENDIX J:

POST-DEVELOPMENT STORMWATER MANAGEMENT ANALYSIS

STORMWATER MANAGEMENT SYSTEM CALCULATIONS

.POST-DEVELOPMENT CONTROLLED CONDITIONS MIDUSS MODELING OUTPUT FILES (WESTERN PORTION OF CITYVIEW RIDGE SUBDIVISION – TO CLYTHE CREEK)

HADATI CREEK WATERSHED SCHEMATIC (POST-DEVELOPMENT – INCLUDING CITYVIEW RIDGE)

HADATI CREEK STORMWATER MANAGEMENT ANALYSIS (POST-DEVELOPMENT – INCLUDING CITYVIEW RIDGE)

Cityview Ridge Subdivision
City of Guelph
Our File: 105-172

Post-Development Percent Impervious Calculation

Catchment B2c	**6.95 ha**		
Land Use	**Area**	**% Impervious**	**W/T %**
Lots 1-18, 102-111 (semi-detached)	1.13	70%	11%
Lots 19-27, 29-37, 39-42, 44-59, 62-63 (single <12m frontage)	1.48	65%	14%
Lots 28, 38, 43, 60, 61 (single 12-18m frontage)	0.26	60%	2%
Blocks 105 and 106 (on-street townhomes)	0.29	80%	3%
Block 108 - (cluster townhomes)	1.19	80%	14%
Block 110 (Walkway)	0.03	80%	0.4%
Block 111 (SWM)	0.52	50%	4%
Part Block 112 (SWM)	0.22	20%	1%
Roads	1.65	80%	19%
Open Space/Trail	0.18	50%	1.3%
Total	**6.95**	**70%**	**70%**

Catchment 201	**3.63 ha**		
Land Use	**Area**	**% Impervious**	**W/T %**
Lots 64-68, 80-93 (single <12m frontage)	0.63	65%	11%
Lots 69-79 and 94 (single 12-18m frontage)	0.13	60%	2%
Block 110 (Walkway)	0.03	80%	1%
Block 107 (on-street townhomes)	0.16	80%	3%
Part Block 109 (park)	0.78	50%	11%
Part Block 112 (SWM)	0.91	50%	13%
Roads	1.00	80%	22%
Total	**3.63**	**63%**	**63%**

Catchment 202	**0.81 ha**		
Land Use	**Area**	**% Impervious**	**W/T %**
Rear Yards Lots 64-78 (no roof)	0.41	20%	7%
Part Block 119 (SWM)	0.81	20%	13%
Total	**1.22**	**20%**	**20%**

Catchment 300	**6.48 ha**		
Land Use	**Area**	**% Impervious**	**W/T %**
Open Space	6.48	2%	2%
Total	**6.48**	**2%**	**2%**

Total Post-Development	
Area (ha)	18.28
Percent Impervious	41%
Impervious Area (ha)	7.48

Therefore the 18.28ha site at 42% imperviousness is used in the water balance calculations

Cityview Ridge Subdivision
City of Guelph
Our File: 105-172

Catchment B2a Percent Impervious Calculation

Catchment B2a	**9.73 ha**		
Site	**Area**	**% Impervious**	**Impervious Area**
Cityview Estates Subdivision (Stantec Report 2016, Catchments 206 and 207)	6.15	62%	3.81
Subtract Park Block (drains to Catchment 201 per Walterfedy Drawings)	-0.49	40%	-0.20
William C Winegard Public School (Gamsby and Mannerow 2013, Catchment 202)	1.78	14%	0.25
William C Winegard Public School (Gamsby and Mannerow 2013, Catchment 201)	0.28	10%	0.03
Ex. properties along Cityview Drive	2.01	60%	1.21
Total	**9.73**	**52%**	**5.10**

Notes:

1. Cityview Estates Subdivision drainage area and percent imperviousness obtained from the Final Stormwater Management Report, Cityview Estates Subdivision prepared by Stantec Consulting Limited, dated August 12, 2016,

2. Cityview Estates Subdivision Phase 2 design information obtained from the engineering plans prepared by Walterfedy, dated May 20, 2022.

3. William C Winegard Public School drainage information obtained from the Stormwater Management Design Report Lee Street Public School prepared by Gamsby and Mannerow Limited, dated February 2013.

Cityview Ridge Subdivision
City of Guelph
Our File: 105-172

Existing Catchment B2b Percent Impervious Calculation

Catchment B2b **5.97 ha**

Site	Area	% Impervious	Impervious Area
Single Detached (<12m frontage)	3.72	65%	2.42
Semi-Detached	0.90	70%	0.63
Dry Quality Pond	1.35	0%	0.00
Total	**5.97**	**51%**	**3.05**

Notes:

1. Lot information and catchment limits obtained from the Martini Valeriote Subdivision Stormwater Management Design Report by Gamsby and Mannerow Limited dated 2004.

Cityview Ridge Subdivision
City of Guelph
Our File: 105-172

Existing Quality Facility No. 2 Drainage Areas

Original Drainage Area per the Martini Valeriote Subdivision 2004

Area =	29.6	ha	
% Impervious (I) =	42%		
C =	0.494		C=0.2+0.7*I
A*C =	**14.622**		

Revised Drainage Areas

	Area (ha)	% Impervious (I)	
Catchment B2a	9.73	52%	
Catchment B2b	5.97	51%	
Catchment B2c	6.95	70%	
Total	**22.65**	**57%**	
C =	0.601		C=0.2+0.7*I
A*C =	**13.613**		

Cityview Ridge Subdivision
City of Guelph
Our File: 105172
March 2023

Catchment 201 - Proposed Stormwater Management Facility

STORAGE VOLUME CALCULATIONS

Elevation (m)	Depth (m)	Surface Area (m^2)	Permanent Pool Volume (m^3)	Accumulated Perm. Pool Volume (m^3)	Incremental Storage Volume (m^3)	Accum. Inc. Storage Volume (m^3)	
339.35	**0.00**	**1,467.9**	**0.0**	**0.0**			**Bottom of Pond**
339.45	0.10	1,567.6	151.8	151.8			
339.55	0.20	1,681.9	162.5	314.2			
339.65	**0.30**	**1,803.7**	**174.3**	**488.5**	**0.0**	**0.0**	**Top of Permanent Pool**
339.75	0.40	1,928.7			186.6	186.6	
339.85	0.50	2,056.8			199.3	385.9	
339.95	**0.60**	**2,188.0**			**212.2**	**598.1**	**Orifice No.2**
340.05	0.70	2,311.6			225.0	823.1	
340.15	0.80	2,440.2			237.6	1,060.7	
340.25	0.90	2,572.7			250.6	1,311.4	
340.35	1.00	2,708.8			264.1	1,575.4	
340.45	1.10	2,848.8			277.9	1,853.3	
340.55	1.20	2,992.6			292.1	2,145.4	
340.65	1.30	3,140.4			306.7	2,452.0	
340.75	1.40	3,292.0			321.6	2,773.6	
340.85	1.50	3,447.6			337.0	3,110.6	
340.95	**1.60**	**3,618.6**			**353.3**	**3,463.9**	**Weir Elevation**
341.05	1.70	3,791.2			370.5	3,834.4	
341.15	1.80	3,956.6			387.4	4,221.8	
341.25	1.90	4,125.3			404.1	4,625.9	
341.35	2.00	4,297.6			421.1	5,047.0	
341.45	**2.10**	**4,478.6**			**438.8**	**5,485.9**	**Top of Bank**

Cityview Ridge Subdivision
City of Guelph
Our File: 105172
March 2023

Catchment 201 - Proposed Stormwater Management Facility (continued)

ORIFICE No.1			ORIFICE No.2		
INV =	339.65	m	INV =	339.95	m
Q =	0.025	m^3/s	Q =	0.218	m^3/s
Cd =	0.6		Cd =	0.6	
H =	1.753	m	H =	1.350	m
2g =	19.62		2g =	19.62	
A =	0.007	m^2	A =	0.071	m^2
D =	0.095	m	D =	0.300	m

Overflow Weir

Elev	d1	h	H	2g	L	Q
m	m	m	m		m	m^3/s
340.95	1.30	1.30	0.00	19.62	10.00	0.000
341.05	1.40	1.30	0.10	19.62	10.00	0.437
341.15	1.50	1.30	0.20	19.62	10.00	1.256
341.25	1.60	1.30	0.30	19.62	10.00	2.341
341.35	1.70	1.30	0.40	19.62	10.00	3.653
341.45	1.80	1.30	0.50	19.62	10.00	5.167

STAGE/STORAGE/DISCHARGE TABLE

Elevation (m)	Stage (m)	Storage (m^3)	Orifice No.1 (m^3/s)	Orifice No.2 (m^3/s)	Weir (m^3/s)	Discharge (m^3/s)	
339.65	**0.00**	**0.0**	**0.000**	**0.000**	**0.000**	**0.000**	**Top of Permanent Pool**
339.75	0.10	186.6	0.004	0.000	0.000	0.004	
339.85	0.20	385.9	0.007	0.000	0.000	0.007	
339.95	**0.30**	**598.1**	**0.009**	**0.000**	**0.000**	**0.009**	**Orifice No.2**
340.05	0.40	823.1	0.011	0.021	0.000	0.032	
340.15	0.50	1,060.7	0.013	0.042	0.000	0.055	
340.25	0.60	1,311.4	0.014	0.073	0.000	0.087	
340.35	0.70	1,575.4	0.015	0.094	0.000	0.109	
340.45	0.80	1,853.3	0.016	0.111	0.000	0.127	
340.55	0.90	2,145.4	0.017	0.126	0.000	0.143	
340.65	1.00	2,452.0	0.018	0.139	0.000	0.158	
340.75	1.10	2,773.6	0.019	0.151	0.000	0.171	
340.85	1.20	3,110.6	0.020	0.163	0.000	0.183	
340.95	**1.30**	**3,463.9**	**0.021**	**0.173**	**0.000**	**0.194**	**Weir Elevation**
341.05	1.40	3,834.4	0.022	0.183	0.437	0.642	
341.15	1.50	4,221.8	0.023	0.192	1.256	1.471	
341.25	1.60	4,625.9	0.023	0.201	2.341	2.566	
341.35	1.70	5,047.0	0.024	0.210	3.653	3.887	
341.45	**1.80**	**5,485.9**	**0.025**	**0.218**	**5.167**	**5.410**	**Top of Bank**

Cityview Ridge Subdivision City of Guelph
Our File: 105172
March 2023

Catchment 202 - Linear Dispersion Trench

STORAGE VOLUME TABLE

Depth (m)	Surface Area Storage (m^2)	Surface Area - Pipe (m^2)	Increm. Storage (m^3)	Total Storage (m^3)	
0.00	**36.67**	**0.00**	**0.00**	**0.00**	**Bottom of Stone**
0.10	36.67	0.00	3.67	3.67	
0.15	**36.67**	**0.00**	**1.83**	**5.50**	**Bottom of Dispersion Pipe**
0.25	36.63	0.03	5.41	10.91	
0.35	36.63	0.03	5.41	16.33	
0.45	36.63	0.03	5.41	21.74	
0.55	36.63	0.03	5.41	27.15	
0.60	**36.63**	**0.03**	**3.58**	**30.73**	**Top of Dispersion Pipe**
0.70	36.67	0.00	3.67	34.40	
0.80	36.67	0.00	3.67	38.07	
0.90	36.67	0.00	3.67	41.73	
1.00	**36.67**	**0.00**	**3.67**	**45.40**	**Top of Stone/Overflow**
1.01	36.68	0.00	0.37	45.77	
1.10	36.77	0.00	3.30	49.07	
1.20	36.87	0.00	3.68	52.75	

Cityview Ridge Subdivision City of Guelph
Our File: 105172
March 2023

Catchment 202 - Linear Dispersion Trench (continued)

BOTTOM			SIDES		
L(dw) =	55.00	m	L(dw) =	55.00	m
W(dw) =	2.00	m			
D(dw) =	1.00	m	D(dw) =	1.00	m
A(c) =	110.0	m^2	A(c) =	110.0	sq m (both sides)
K =	0.00E+00	cm/s			

Overflow Weir

Elev	d1	h	H	2g	L	Q
m	m	m	m		m	m^3/s
1.00	1.00	1.00	0.00	19.62	55.00	0.000
1.01	1.01	1.00	0.01	19.62	55.00	0.075
1.10	1.10	1.00	0.10	19.62	55.00	2.414
1.20	1.20	1.00	0.20	19.62	55.00	6.968

STORAGE VOLUME TABLE

Stage (m)	Storage (m^3)	Infiltration Discharge (m^3/s)	Overflow Weir Discharge (m^3/s)	Total Discharge (m^3/s)	
0.00	**0.0**	**0.00000**	**0.000**	**0.00000**	**Bottom of Stone**
0.10	3.7	0.00000	0.000	0.00000	
0.15	**5.5**	**0.00000**	**0.000**	**0.00000**	**Bottom of Dispersion Pipe**
0.25	10.9	0.00000	0.000	0.00000	
0.35	16.3	0.00000	0.000	0.00000	
0.45	21.7	0.00000	0.000	0.00000	
0.55	27.2	0.00000	0.000	0.00000	
0.60	**30.7**	**0.00000**	**0.000**	**0.00000**	**Top of Dispersion Pipe**
0.70	34.4	0.00000	0.000	0.00000	
0.80	38.1	0.00000	0.000	0.00000	
0.90	41.7	0.00000	0.000	0.00000	
1.00	**45.4**	**0.00000**	**0.000**	**0.00000**	**Top of Stone/Overflow**
1.01	45.8	0.00000	0.075	0.07478	
1.10	49.1	0.00000	2.414	2.41428	
1.20	52.8	0.00000	6.968	6.96826	

Cityview Ridge Subdivision
City of Guelph
Our File: 105172
March 2023

Flow Check - Cooling Trench

	Stormwater Management Pond				Cooling Trench Orifice Flow (4-pipes)		
Flow			**Depth**				
Q 25mm =	0.008	m^3/s	H 25mm =	0.27 m	Q 25mm =	0.083	m^3/s
Q 2yr =	0.022	m^3/s	H 2yr =	0.36 m	Q 2yr =	0.100	m^3/s
Q 5yr =	0.055	m^3/s	H 5yr =	0.50 m	Q 5yr =	0.122	m^3/s
Q 25yr =	0.114	m^3/s	H 25yr =	0.73 m	Q 25yr =	0.152	m^3/s
Q 100yr =	0.149	m^3/s	H 100yr =	0.94 m	Q 100yr =	0.175	m^3/s
Regional =	0.180	m^3/s	H Regional =	1.18 m	Q Regional =	0.197	m^3/s

Orifice Flow Typical Calculation

Q =	0.015	m^3/s
Cd =	0.6	
H =	0.105	m
2g =	19.62	
A =	0.018	m^2
D =	0.150	m

Therefore four (4) - 150mm diameter perforated distribution pipes can convey the flows from the pond

Assumes that distribution pipe act as an orifice
Assmues hydraulic head pushing on the orifice equals flow depth from pond (conservative estimate as the bottom collection pipe will be deeper than the top distribution pipe)
Assumes that there will be four (4) distribution pipes and four (4) collector pipes

Flow Check - Linear Dispersion Trench
Check that Linear Dispersion Trench can convey Major Flow events from the Stormwater Management Pond

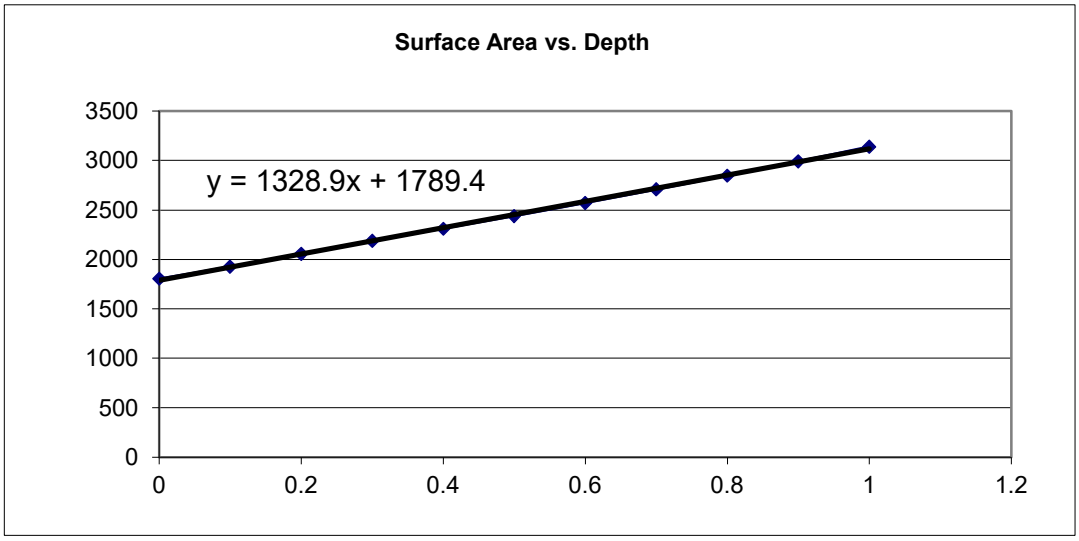
Orifice Flow

Q =	0.334	m^3/s
Cd =	0.6	
H =	0.625	m
2g =	19.62	
A =	0.159	m^2
D =	0.450	m

Therefore a 450mm diameter perforated distribution pipe can convey the flows from the stormwater management pond.

Assumes that distribution pipe act as an orifice
Assumes 1.0m deep trench, 450mm diameter pipe invert is 0.15m higher than the trench bottom

Cityview Ridge Subdivision
City of Guelph
File No: 105172
Stormwater Management Facility Extended Detention Drawdown



Drain Down Calculations

$$t = \frac{0.66C_2h^{1.5} + 2C_3h^{0.5}}{2.75A_o}$$

Modelled extended detention volume :	524
Required extended detention volume ponding depth:	0.265

Extended Detention Orifice Sizing

Given: d = 0.095 m

A_o = 0.007 m

C_2 = 1328.9

C_3 = 1789.4

h = 0.265 - (0.095/2)

= 0.217 m

Solve for t

$$t = \frac{0.66C_2h^{1.5} + 2C_3h^{0.5}}{2.75A_o}$$

t = 90183

t = 1503

t = 25.1

Cityview Ridge Subdivision
City of Guelph
File No: 105172

Catchment 201
Proposed Stormwater Management Facility
Forebay

Forebay Length =	40.0	m	(Dist)
Forebay Top Width =	10.0	m	
Active Forebay Depth =	1.0	m	(d)
Active Forebay Bottom Width =	4.0	m	
Approximate Forebay Volume =	280	m^3	
Length Width Ratio =	4.0	:1	(r)
25 mm Storm Peak Flowrate =	0.008	m^3/s	(Q25mm)
5 Year Storm Inflow Rate =	0.793	m^3/s	(Q5)
Desired Forebay Velocity =	0.500	m/s	(Vf)
Desired Settling Velocity (recommended) =	0.0003	m/s	(Vs)

Settling Length

Dist = ((r x Q25mm)/Vs)^.5 =	10.3	m	25mm

Forebay length (40 m) exceeds the settling length (10.3 m).

Dispersion Length

Dist = (8 x Q5)/(d x Vf) =	12.7	m	5 Year

Forebay length (40 m) exceeds dispersion length (12.7 m).

Flow Velocity in Forebay

Cross-sectional Area =	7	m^2	
Cross-sectional Area (With Permanent Pool) =	10.45	m^2	A
Q5 =	0.793	m^3/s	
Velocity = Q5/A =	0.08	m/s	5 Year

The average flow velocity through the forebay meets the allowable velocity of 0.15 m/s.

Cityview Ridge Subdivision City of Guelph
Our File: 105172
March 2023

Catchment B2a: Existing Stormwater Quality Pond No. 2

Stage Storage Discharge Calculations

Elevation (m)	Stage (m)	Surface Area (m^2)	Incremental Storage Volume (m^3)	Accumulated Storage Volume (m^3)	
321.50	0.00	5,688.0	0.00	0.00	Pond Bottom
321.60	0.10	5,900.0	579.40	579.40	
321.70	0.20	6,110.0	600.50	1,179.90	
321.80	0.30	6,323.0	621.65	1,801.55	
321.90	0.40	6,537.0	643.00	2,444.55	
322.00	0.50	6,752.0	664.45	3,109.00	
322.10	0.60	6,967.0	685.95	3,794.95	
322.20	0.70	7,184.0	707.55	4,502.50	Weir
322.30	0.80	7,401.0	729.25	5,231.75	
322.40	0.90	7,619.0	751.00	5,982.75	
322.50	1.00	7,839.0	772.90	6,755.65	Overflow

Cityview Ridge Subdivision City of Guelph
Our File: 105172
March 2023

Catchment B2a: Existing Stormwater Quality Pond No. 2 (continued)

OUTLET #1
300 mm diameter orifice (pipe inv. = 319.55)

Q =	0.303	m^3/s
Cd =	0.6	
H =	2.60	m
2g =	19.62	
A =	0.071	m^2
D =	0.300	m
D/2	0.150	

OVERFLOW WEIR

d1 =	1.00	m
h =	0.70	m
H =	0.30	m
2g =	19.62	
L =	30.00	m
Q =	7.251	m^3/s

Stage/Storage/Discharge Table

Elevation (m)	Stage (m)	Storage (m^3)	Outlet #1 1050 mm dia. pipe (m^3/s)	Overflow Weir (m^3/s)	Total Discharge (m^3/s)	
321.50	0.00	0.00	0.000	0.000	0.000	Pond Bottom
321.60	0.10	579.40	0.259	0.000	0.259	
321.70	0.20	1,179.90	0.266	0.000	0.266	
321.80	0.30	1,801.55	0.272	0.000	0.272	
321.90	0.40	2,444.55	0.279	0.000	0.279	
322.00	0.50	3,109.00	0.285	0.000	0.285	
322.10	0.60	3,794.95	0.291	0.000	0.291	
322.20	0.70	4,502.50	0.297	0.000	0.297	Weir
322.30	0.80	5,231.75	0.303	1.329	1.632	
322.40	0.90	5,982.75	0.309	3.860	4.168	
322.50	1.00	6,755.65	0.314	7.251	7.566	Overflow

Cityview Ridge Subdivision
City of Guelph
File No: 105172

Catchment B2c
Forebay Design

Forebay Length =	60.0	m	(Dist)
Forebay Top Width =	20.0	m	
Active Forebay Depth =	1.00	m	(d)
Active Forebay Bottom Width =	3.0	m	
Approximate Forebay Volume =	690	m^3	
Length Width Ratio =	3.0	:1	(r)
25 mm Storm Peak Flowrate =	0.268	m^3/s	(Q25mm)
5 Year Storm Inflow Rate =	2.78	m^3/s	(Q5)
Desired Forebay Velocity =	0.500	m/s	(Vf)
Desired Settling Velocity (recommended) =	0.0003	m/s	(Vs)

Settling Length

Dist = ((r x Q25mm)/Vs)^.5 =	51.8	m	25mm

Forebay length (60 m) is less than settling length (51.8 m).

Dispersion Length

Dist = (8 x Q5)/(d x Vf) =	44.5	m	5 Year

Forebay length (60 m) is less than dispersion length (44.5 m).

Flow Velocity in Forebay

Cross-sectional Area =	11.5	m^2	
Cross-sectional Area (With Permanent Pool) =	17.95	m^2	A
Q5 =	2.780	m^3/s	
Velocity = Q5/A =	0.15	m/s	5 Year

The average flow velocity through the forebay meets the allowable velocity of 0.15 m/s.

```
"                MIDUSS Output ----------------------------------------------->"
"                MIDUSS version                          Version 2.25  rev. 473"
"                MIDUSS created                       Sunday, February 07, 2010"
"           10   Units used:                                          ie METRIC"
"                Job folder:            C:\Users\szaga\Documents\MIDUSS\105172"
"                Output filename:                          105172_POST_25mm.out"
"                Licensee name:                                            gmbp"
"                Company                                                      "
"                Date & Time last used:                5/2/2023 at 11:29:10 AM"
" 31          TIME PARAMETERS"
"        5.000   Time Step"
"      240.000   Max. Storm length"
"     3600.000   Max. Hydrograph"
" 32          STORM Chicago storm"
"            1   Chicago storm"
"     1581.200   Coefficient A"
"       13.000   Constant B"
"        1.000   Exponent C"
"        0.400   Fraction R"
"      240.000   Duration"
"        1.000   Time step multiplier"
"             Maximum intensity            84.723    mm/hr"
"             Total depth                  24.999    mm"
"            8   00025hyd   Hydrograph extension used in this file"
" 33          CATCHMENT 400"
"            1   Triangular SCS"
"            1   Equal length"
"            2   Horton equation"
"          400   Catchment 400 - External Park"
"       50.000   % Impervious"
"        0.490   Total Area"
"       33.000   Flow length"
"        2.000   Overland Slope"
"        0.245   Pervious Area"
"       33.000   Pervious length"
"        2.000   Pervious slope"
"        0.245   Impervious Area"
"       33.000   Impervious length"
"        2.000   Impervious slope"
"        0.250   Pervious Manning 'n'"
"       75.000   Pervious Max.infiltration"
"       12.500   Pervious Min.infiltration"
"        0.250   Pervious Lag constant (hours)"
"        5.000   Pervious Depression storage"
"        0.015   Impervious Manning 'n'"
"        0.000   Impervious Max.infiltration"
"        0.000   Impervious Min.infiltration"
"        0.050   Impervious Lag constant (hours)"
"        1.500   Impervious Depression storage"
"                     0.049     0.000     0.000     0.000 c.m/sec"
```

```
"             Catchment 400          Pervious   Impervious Total Area "
"             Surface Area           0.245      0.245      0.490      hectare"
"             Time of concentration      ---    2.510      2.510      minutes"
"             Time to Centroid       0.000      111.134    111.134    minutes"
"             Rainfall depth         24.999     24.999     24.999     mm"
"             Rainfall volume        61.25      61.25      122.50     c.m"
"             Rainfall losses        24.999     1.929      13.464     mm"
"             Runoff depth           0.000      23.070     11.535     mm"
"             Runoff volume          0.00       56.52      56.52      c.m"
"             Runoff coefficient     0.000      0.923      0.461      "
"             Maximum flow           0.000      0.049      0.049      c.m/sec"
" 40          HYDROGRAPH Add Runoff "
"            4   Add Runoff "
"                     0.049     0.049     0.000     0.000"
" 33          CATCHMENT 201"
"            1   Triangular SCS"
"            1   Equal length"
"            2   Horton equation"
"          201   Catchment 201 - To Clythe Creeek"
"       63.000   % Impervious"
"        3.630   Total Area"
"       50.000   Flow length"
"        2.000   Overland Slope"
"        1.343   Pervious Area"
"       50.000   Pervious length"
"        2.000   Pervious slope"
"        2.287   Impervious Area"
"       50.000   Impervious length"
"        2.000   Impervious slope"
"        0.250   Pervious Manning 'n'"
"       75.000   Pervious Max.infiltration"
"       12.500   Pervious Min.infiltration"
"        0.250   Pervious Lag constant (hours)"
"        5.000   Pervious Depression storage"
"        0.015   Impervious Manning 'n'"
"        0.000   Impervious Max.infiltration"
"        0.000   Impervious Min.infiltration"
"        0.050   Impervious Lag constant (hours)"
"        1.500   Impervious Depression storage"
"                     0.439     0.049     0.000     0.000 c.m/sec"
"             Catchment 201          Pervious   Impervious Total Area "
"             Surface Area           1.343      2.287      3.630      hectare"
"             Time of concentration      ---    3.221      3.221      minutes"
"             Time to Centroid       0.000      112.195    112.195    minutes"
"             Rainfall depth         24.999     24.999     24.999     mm"
"             Rainfall volume        335.76     571.71     907.47     c.m"
"             Rainfall losses        24.999     1.999      10.509     mm"
"             Runoff depth           0.000      23.000     14.490     mm"
"             Runoff volume          0.00       525.99     525.99     c.m"
"             Runoff coefficient     0.000      0.920      0.580      "
```

```
"             Maximum flow           0.000      0.439      0.439      c.m/sec"
" 40          HYDROGRAPH Add Runoff "
"            4   Add Runoff "
"                     0.439     0.489     0.000     0.000"
" 54          POND DESIGN"
"         0.489   Current peak flow    c.m/sec"
"         0.171   Target outflow    c.m/sec"
"         582.5   Hydrograph volume    c.m"
"           19.   Number of stages"
"         0.000   Minimum water level    metre"
"         3.000   Maximum water level    metre"
"         0.000   Starting water level    metre"
"             0   Keep Design Data: 1 = True; 0 = False"
"                   Level Discharge    Volume"
"                 339.650     0.000     0.000"
"                 339.750   0.00400   186.600"
"                 339.850   0.00700   385.900"
"                 339.950   0.00900   598.100"
"                 340.050   0.03200   823.100"
"                 340.150   0.05500  1060.700"
"                 340.250   0.08700  1311.400"
"                 340.350    0.1090  1575.400"
"                 340.450    0.1270  1853.300"
"                 340.550    0.1430  2145.400"
"                 340.650    0.1580  2452.000"
"                 340.750    0.1710  2773.600"
"                 340.850    0.1830  3110.600"
"                 340.950    0.1940  3463.900"
"                 341.050    0.6420  3834.400"
"                 341.150     1.471  4221.800"
"                 341.250     2.566  4625.900"
"                 341.350     3.887  5047.000"
"                 341.450     5.410  5485.900"
"             Peak outflow                  0.008    c.m/sec"
"             Maximum level               339.915    metre"
"             Maximum storage             523.771    c.m"
"             Centroidal lag               15.776   hours"
"                  0.439     0.489     0.008     0.000 c.m/sec"
" 40          HYDROGRAPH Next link "
"            5   Next link "
"                     0.439     0.008     0.008     0.000"
" 33          CATCHMENT 202"
"            1   Triangular SCS"
"            1   Equal length"
"            2   Horton equation"
"          202   Catchment 202"
"       20.000   % Impervious"
"        1.220   Total Area"
"       15.000   Flow length"
"        2.000   Overland Slope"
```

```
"        0.976   Pervious Area"
"       15.000   Pervious length"
"        2.000   Pervious slope"
"        0.244   Impervious Area"
"       15.000   Impervious length"
"        2.000   Impervious slope"
"        0.250   Pervious Manning 'n'"
"       75.000   Pervious Max.infiltration"
"       12.500   Pervious Min.infiltration"
"        0.250   Pervious Lag constant (hours)"
"        5.000   Pervious Depression storage"
"        0.015   Impervious Manning 'n'"
"        0.000   Impervious Max.infiltration"
"        0.000   Impervious Min.infiltration"
"        0.050   Impervious Lag constant (hours)"
"        1.500   Impervious Depression storage"
"                    0.051     0.008     0.008     0.000 c.m/sec"
"             Catchment 202          Pervious   Impervious Total Area "
"             Surface Area           0.976      0.244      1.220      hectare"
"             Time of concentration      ---    1.564      1.564      minutes"
"             Time to Centroid       0.000      109.787    109.787    minutes"
"             Rainfall depth         24.999     24.999     24.999     mm"
"             Rainfall volume        243.99     61.00      304.99     c.m"
"             Rainfall losses        24.999     1.808      20.361     mm"
"             Runoff depth           0.000      23.191     4.638      mm"
"             Runoff volume          0.00       56.59      56.59      c.m"
"             Runoff coefficient     0.000      0.928      0.186      "
"             Maximum flow           0.000      0.051      0.051      c.m/sec"
" 40          HYDROGRAPH Add Runoff "
"            4   Add Runoff "
"                    0.051     0.055     0.008     0.000"
" 54          POND DESIGN"
"        0.055   Current peak flow    c.m/sec"
"        0.171   Target outflow    c.m/sec"
"        631.2   Hydrograph volume    c.m"
"          15.   Number of stages"
"        0.000   Minimum water level    metre"
"        3.000   Maximum water level    metre"
"        0.000   Starting water level    metre"
"            0   Keep Design Data: 1 = True; 0 = False"
"                  Level Discharge    Volume"
"                  0.000     0.000     0.000"
"                 0.1000  1.01E-05     3.670"
"                 0.1500  2.01E-05     5.500"
"                 0.2500  3.01E-05    10.910"
"                 0.3500  4.01E-05    16.330"
"                 0.4500  5.01E-05    21.740"
"                 0.5500  6.01E-05    27.150"
"                 0.6000  7.01E-05    30.730"
"                 0.7000  8.01E-05    34.400"
```

```
"                0.8000  9.01E-05    38.070"
"                0.9000   0.00010    41.730"
"                 1.000   0.00011    45.400"
"                 1.010   0.07478    45.770"
"                 1.100     2.414    49.070"
"                 1.200     6.968    52.750"
"            Peak outflow                  0.018    c.m/sec"
"            Maximum level                 1.003    metre"
"            Maximum storage              45.516    c.m"
"            Centroidal lag               23.042   hours"
"                 0.051     0.055     0.018     0.000 c.m/sec"
" 40         HYDROGRAPH Next link "
"           5   Next link "
"                    0.051     0.018     0.018     0.000"
" 52         CHANNEL DESIGN"
"       0.018   Current peak flow    c.m/sec"
"       0.065   Manning 'n'"
"          0.   Cross-section type: 0=trapezoidal; 1=general"
"      55.000   Basewidth    metre"
"       0.000   Left bank slope"
"       0.000   Right bank slope"
"       1.000   Channel depth    metre"
"      18.000   Gradient   %"
"            Depth of flow                 0.003    metre"
"            Velocity                      0.124    m/sec"
"            Channel capacity            350.545    c.m/sec"
"            Critical depth                0.002    metre"
" 53         ROUTE    Channel Route 50"
"       50.00      Channel Route 50 Reach length   ( metre)"
"       0.500   X-factor <= 0.5"
"     150.737   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"
"     300.000   Routing time step   ( seconds)"
"           2   No. of sub-reaches"
"            Peak outflow                  0.018    c.m/sec"
"                    0.051     0.018     0.018     0.000 c.m/sec"
" 40         HYDROGRAPH Next link "
"           5   Next link "
"                    0.051     0.018     0.018     0.000"
" 33         CATCHMENT 300"
"           1   Triangular SCS"
"           1   Equal length"
"           2   Horton equation"
"         300   Catchment 300 - To Clythe Creek"
"       2.000   % Impervious"
"       6.480   Total Area"
"      45.000   Flow length"
```

```
"        2.000   Overland Slope"
"        6.350   Pervious Area"
"       45.000   Pervious length"
"        2.000   Pervious slope"
"        0.130   Impervious Area"
"       45.000   Impervious length"
"        2.000   Impervious slope"
"        0.250   Pervious Manning 'n'"
"       75.000   Pervious Max.infiltration"
"       12.500   Pervious Min.infiltration"
"        0.250   Pervious Lag constant (hours)"
"        5.000   Pervious Depression storage"
"        0.015   Impervious Manning 'n'"
"        0.000   Impervious Max.infiltration"
"        0.000   Impervious Min.infiltration"
"        0.050   Impervious Lag constant (hours)"
"        1.500   Impervious Depression storage"
"                    0.025     0.018     0.018     0.000 c.m/sec"
"             Catchment 300          Pervious   Impervious Total Area "
"             Surface Area           6.350      0.130      6.480      hectare"
"             Time of concentration      ---    3.023      3.023      minutes"
"             Time to Centroid       0.000      111.915    111.915    minutes"
"             Rainfall depth         24.999     24.999     24.999     mm"
"             Rainfall volume        1587.55    32.40      1619.95    c.m"
"             Rainfall losses        24.999     2.018      24.540     mm"
"             Runoff depth           0.000      22.981     0.460      mm"
"             Runoff volume          0.00       29.78      29.78      c.m"
"             Runoff coefficient     0.000      0.919      0.018      "
"             Maximum flow           0.000      0.025      0.025      c.m/sec"
" 40          HYDROGRAPH Add Runoff "
"            4   Add Runoff "
"                    0.025     0.025     0.018     0.000"
" 38          START/RE-START TOTALS 300"
"            3   Runoff Totals on EXIT"
"             Total Catchment area                    11.820    hectare"
"             Total Impervious area                    2.905    hectare"
"             Total % impervious                      24.581"
" 19          EXIT"
```

```
"                MIDUSS Output ------------------------------------------------>"
"                MIDUSS version                          Version 2.25  rev. 473"
"                MIDUSS created                       Sunday, February 07, 2010"
"           10   Units used:                                          ie METRIC"
"                Job folder:            C:\Users\szaga\Documents\MIDUSS\105172"
"                Output filename:                            105172_POST_2YR.out"
"                Licensee name:                                             gmbp"
"                Company                                                       "
"                Date & Time last used:                5/2/2023 at 11:27:58 AM"
" 31          TIME PARAMETERS"
"        5.000   Time Step"
"      180.000   Max. Storm length"
"     1500.000   Max. Hydrograph"
" 32          STORM Chicago storm"
"            1   Chicago storm"
"      743.000   Coefficient A"
"        6.000   Constant B"
"        0.799   Exponent C"
"        0.400   Fraction R"
"      180.000   Duration"
"        1.000   Time step multiplier"
"             Maximum intensity          109.374    mm/hr"
"             Total depth                 34.259    mm"
"            6   002hyd   Hydrograph extension used in this file"
" 33          CATCHMENT 400"
"            1   Triangular SCS"
"            1   Equal length"
"            2   Horton equation"
"          400   Catchment 400 - External Park"
"       50.000   % Impervious"
"        0.490   Total Area"
"       33.000   Flow length"
"        2.000   Overland Slope"
"        0.245   Pervious Area"
"       33.000   Pervious length"
"        2.000   Pervious slope"
"        0.245   Impervious Area"
"       33.000   Impervious length"
"        2.000   Impervious slope"
"        0.250   Pervious Manning 'n'"
"       75.000   Pervious Max.infiltration"
"       12.500   Pervious Min.infiltration"
"        0.250   Pervious Lag constant (hours)"
"        5.000   Pervious Depression storage"
"        0.015   Impervious Manning 'n'"
"        0.000   Impervious Max.infiltration"
"        0.000   Impervious Min.infiltration"
"        0.050   Impervious Lag constant (hours)"
"        1.500   Impervious Depression storage"
"                     0.058     0.000     0.000     0.000 c.m/sec"
```

```
"             Catchment 400          Pervious   Impervious Total Area "
"             Surface Area           0.245      0.245      0.490      hectare"
"             Time of concentration  27.514     2.266      3.796      minutes"
"             Time to Centroid       99.779     88.927     89.585     minutes"
"             Rainfall depth         34.259     34.259     34.259     mm"
"             Rainfall volume        83.93      83.93      167.87     c.m"
"             Rainfall losses        32.179     2.002      17.090     mm"
"             Runoff depth           2.080      32.257     17.168     mm"
"             Runoff volume          5.10       79.03      84.12      c.m"
"             Runoff coefficient     0.061      0.942      0.501      "
"             Maximum flow           0.003      0.058      0.058      c.m/sec"
" 40          HYDROGRAPH Add Runoff "
"            4   Add Runoff "
"                     0.058     0.058     0.000     0.000"
" 33          CATCHMENT 201"
"            1   Triangular SCS"
"            1   Equal length"
"            2   Horton equation"
"          201   Catchment 201 - To Clythe Creeek"
"       63.000   % Impervious"
"        3.630   Total Area"
"       50.000   Flow length"
"        2.000   Overland Slope"
"        1.343   Pervious Area"
"       50.000   Pervious length"
"        2.000   Pervious slope"
"        2.287   Impervious Area"
"       50.000   Impervious length"
"        2.000   Impervious slope"
"        0.250   Pervious Manning 'n'"
"       75.000   Pervious Max.infiltration"
"       12.500   Pervious Min.infiltration"
"        0.250   Pervious Lag constant (hours)"
"        5.000   Pervious Depression storage"
"        0.015   Impervious Manning 'n'"
"        0.000   Impervious Max.infiltration"
"        0.000   Impervious Min.infiltration"
"        0.050   Impervious Lag constant (hours)"
"        1.500   Impervious Depression storage"
"                     0.510     0.058     0.000     0.000 c.m/sec"
"             Catchment 201          Pervious   Impervious Total Area "
"             Surface Area           1.343      2.287      3.630      hectare"
"             Time of concentration  35.304     2.908      4.090      minutes"
"             Time to Centroid       105.817    89.932     90.511     minutes"
"             Rainfall depth         34.259     34.259     34.259     mm"
"             Rainfall volume        460.13     783.46     1243.59    c.m"
"             Rainfall losses        32.179     1.993      13.162     mm"
"             Runoff depth           2.080      32.266     21.097     mm"
"             Runoff volume          27.93      737.89     765.82     c.m"
"             Runoff coefficient     0.061      0.942      0.616      "
```

```
"             Maximum flow           0.013      0.510      0.510      c.m/sec"
" 40          HYDROGRAPH Add Runoff "
"            4   Add Runoff "
"                     0.510     0.568     0.000     0.000"
" 54          POND DESIGN"
"         0.568   Current peak flow    c.m/sec"
"         0.171   Target outflow    c.m/sec"
"         849.9   Hydrograph volume    c.m"
"           19.   Number of stages"
"         0.000   Minimum water level    metre"
"         3.000   Maximum water level    metre"
"         0.000   Starting water level    metre"
"             0   Keep Design Data: 1 = True; 0 = False"
"                   Level Discharge    Volume"
"                 339.650     0.000     0.000"
"                 339.750   0.00400   186.600"
"                 339.850   0.00700   385.900"
"                 339.950   0.00900   598.100"
"                 340.050   0.03200   823.100"
"                 340.150   0.05500  1060.700"
"                 340.250   0.08700  1311.400"
"                 340.350    0.1090  1575.400"
"                 340.450    0.1270  1853.300"
"                 340.550    0.1430  2145.400"
"                 340.650    0.1580  2452.000"
"                 340.750    0.1710  2773.600"
"                 340.850    0.1830  3110.600"
"                 340.950    0.1940  3463.900"
"                 341.050    0.6420  3834.400"
"                 341.150     1.471  4221.800"
"                 341.250     2.566  4625.900"
"                 341.350     3.887  5047.000"
"                 341.450     5.410  5485.900"
"             Peak outflow                  0.022    c.m/sec"
"             Maximum level               340.007    metre"
"             Maximum storage             725.781    c.m"
"             Centroidal lag               14.529   hours"
"                  0.510     0.568     0.022     0.000 c.m/sec"
" 40          HYDROGRAPH Next link "
"            5   Next link "
"                     0.510     0.022     0.022     0.000"
" 33          CATCHMENT 202"
"            1   Triangular SCS"
"            1   Equal length"
"            2   Horton equation"
"          202   Catchment 202"
"       20.000   % Impervious"
"        1.220   Total Area"
"       15.000   Flow length"
"        2.000   Overland Slope"
```

```
"        0.976   Pervious Area"
"       15.000   Pervious length"
"        2.000   Pervious slope"
"        0.244   Impervious Area"
"       15.000   Impervious length"
"        2.000   Impervious slope"
"        0.250   Pervious Manning 'n'"
"       75.000   Pervious Max.infiltration"
"       12.500   Pervious Min.infiltration"
"        0.250   Pervious Lag constant (hours)"
"        5.000   Pervious Depression storage"
"        0.015   Impervious Manning 'n'"
"        0.000   Impervious Max.infiltration"
"        0.000   Impervious Min.infiltration"
"        0.050   Impervious Lag constant (hours)"
"        1.500   Impervious Depression storage"
"                     0.063     0.022     0.022     0.000 c.m/sec"
"             Catchment 202          Pervious   Impervious Total Area "
"             Surface Area           0.976      0.244      1.220      hectare"
"             Time of concentration  17.143     1.412      4.638      minutes"
"             Time to Centroid       91.703     87.627     88.463     minutes"
"             Rainfall depth         34.259     34.259     34.259     mm"
"             Rainfall volume        334.36     83.59      417.95     c.m"
"             Rainfall losses        32.183     2.069      26.160     mm"
"             Runoff depth           2.076      32.189     8.099      mm"
"             Runoff volume          20.26      78.54      98.80      c.m"
"             Runoff coefficient     0.061      0.940      0.236      "
"             Maximum flow           0.017      0.062      0.063      c.m/sec"
" 40          HYDROGRAPH Add Runoff "
"            4   Add Runoff "
"                     0.063     0.068     0.022     0.000"
" 54          POND DESIGN"
"        0.068   Current peak flow    c.m/sec"
"        0.171   Target outflow    c.m/sec"
"        785.2   Hydrograph volume    c.m"
"          15.   Number of stages"
"        0.000   Minimum water level    metre"
"        3.000   Maximum water level    metre"
"        0.000   Starting water level    metre"
"            0   Keep Design Data: 1 = True; 0 = False"
"                  Level Discharge    Volume"
"                  0.000     0.000     0.000"
"                 0.1000  1.01E-05     3.670"
"                 0.1500  2.01E-05     5.500"
"                 0.2500  3.01E-05    10.910"
"                 0.3500  4.01E-05    16.330"
"                 0.4500  5.01E-05    21.740"
"                 0.5500  6.01E-05    27.150"
"                 0.6000  7.01E-05    30.730"
"                 0.7000  8.01E-05    34.400"
```

```
"                0.8000  9.01E-05    38.070"
"                0.9000   0.00010    41.730"
"                 1.000   0.00011    45.400"
"                 1.010   0.07478    45.770"
"                 1.100     2.414    49.070"
"                 1.200     6.968    52.750"
"            Peak outflow                  0.054    c.m/sec"
"            Maximum level                 1.007    metre"
"            Maximum storage              45.669    c.m"
"            Centroidal lag               10.215   hours"
"                 0.063     0.068     0.054     0.000 c.m/sec"
" 40         HYDROGRAPH Next link "
"           5   Next link "
"                    0.063     0.054     0.054     0.000"
" 52         CHANNEL DESIGN"
"        0.054   Current peak flow    c.m/sec"
"        0.065   Manning 'n'"
"           0.   Cross-section type: 0=trapezoidal; 1=general"
"       55.000   Basewidth    metre"
"        0.000   Left bank slope"
"        0.000   Right bank slope"
"        1.000   Channel depth    metre"
"       18.000   Gradient   %"
"            Depth of flow                 0.005    metre"
"            Velocity                      0.193    m/sec"
"            Channel capacity            350.545    c.m/sec"
"            Critical depth                0.005    metre"
" 53         ROUTE    Channel Route 50"
"        50.00      Channel Route 50 Reach length   ( metre)"
"        0.500   X-factor <= 0.5"
"      194.275   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"
"      150.000   Routing time step   ( seconds)"
"            1   No. of sub-reaches"
"            Peak outflow                  0.049    c.m/sec"
"                    0.063     0.054     0.049     0.000 c.m/sec"
" 40         HYDROGRAPH Next link "
"           5   Next link "
"                    0.063     0.049     0.049     0.000"
" 33         CATCHMENT 300"
"           1   Triangular SCS"
"           1   Equal length"
"           2   Horton equation"
"         300   Catchment 300 - To Clythe Creek"
"        2.000   % Impervious"
"        6.480   Total Area"
"       45.000   Flow length"
```

```
"        2.000   Overland Slope"
"        6.350   Pervious Area"
"       45.000   Pervious length"
"        2.000   Pervious slope"
"        0.130   Impervious Area"
"       45.000   Impervious length"
"        2.000   Impervious slope"
"        0.250   Pervious Manning 'n'"
"       75.000   Pervious Max.infiltration"
"       12.500   Pervious Min.infiltration"
"        0.250   Pervious Lag constant (hours)"
"        5.000   Pervious Depression storage"
"        0.015   Impervious Manning 'n'"
"        0.000   Impervious Max.infiltration"
"        0.000   Impervious Min.infiltration"
"        0.050   Impervious Lag constant (hours)"
"        1.500   Impervious Depression storage"
"                     0.073     0.049     0.049     0.000 c.m/sec"
"             Catchment 300          Pervious   Impervious Total Area "
"             Surface Area           6.350      0.130      6.480      hectare"
"             Time of concentration  33.141     2.730      25.836     minutes"
"             Time to Centroid       104.165    89.669     100.683    minutes"
"             Rainfall depth         34.259     34.259     34.259     mm"
"             Rainfall volume        2175.56    44.40      2219.96    c.m"
"             Rainfall losses        32.178     2.027      31.575     mm"
"             Runoff depth           2.080      32.231     2.683      mm"
"             Runoff volume          132.12     41.77      173.89     c.m"
"             Runoff coefficient     0.061      0.941      0.078      "
"             Maximum flow           0.069      0.029      0.073      c.m/sec"
" 40          HYDROGRAPH Add Runoff "
"            4   Add Runoff "
"                     0.073     0.104     0.049     0.000"
" 38          START/RE-START TOTALS 300"
"            3   Runoff Totals on EXIT"
"             Total Catchment area                    11.820    hectare"
"             Total Impervious area                    2.905    hectare"
"             Total % impervious                      24.581"
" 19          EXIT"
```

```
"                MIDUSS Output ------------------------------------------------>"
"                MIDUSS version                          Version 2.25  rev. 473"
"                MIDUSS created                       Sunday, February 07, 2010"
"           10   Units used:                                          ie METRIC"
"                Job folder:            C:\Users\szaga\Documents\MIDUSS\105172"
"                Output filename:                            105172_POST_5YR.out"
"                Licensee name:                                             gmbp"
"                Company                                                       "
"                Date & Time last used:                5/2/2023 at 11:28:35 AM"
" 31          TIME PARAMETERS"
"        5.000   Time Step"
"      180.000   Max. Storm length"
"     1500.000   Max. Hydrograph"
" 32          STORM Chicago storm"
"            1   Chicago storm"
"     1593.000   Coefficient A"
"       11.000   Constant B"
"        0.879   Exponent C"
"        0.400   Fraction R"
"      180.000   Duration"
"        1.000   Time step multiplier"
"             Maximum intensity          139.250    mm/hr"
"             Total depth                 47.240    mm"
"            6   005hyd   Hydrograph extension used in this file"
" 33          CATCHMENT 400"
"            1   Triangular SCS"
"            1   Equal length"
"            2   Horton equation"
"          400   Catchment 400 - External Park"
"       50.000   % Impervious"
"        0.490   Total Area"
"       33.000   Flow length"
"        2.000   Overland Slope"
"        0.245   Pervious Area"
"       33.000   Pervious length"
"        2.000   Pervious slope"
"        0.245   Impervious Area"
"       33.000   Impervious length"
"        2.000   Impervious slope"
"        0.250   Pervious Manning 'n'"
"       75.000   Pervious Max.infiltration"
"       12.500   Pervious Min.infiltration"
"        0.250   Pervious Lag constant (hours)"
"        5.000   Pervious Depression storage"
"        0.015   Impervious Manning 'n'"
"        0.000   Impervious Max.infiltration"
"        0.000   Impervious Min.infiltration"
"        0.050   Impervious Lag constant (hours)"
"        1.500   Impervious Depression storage"
"                     0.081     0.000     0.000     0.000 c.m/sec"
```

```
"             Catchment 400          Pervious   Impervious Total Area "
"             Surface Area           0.245      0.245      0.490      hectare"
"             Time of concentration  14.943     2.058      4.598      minutes"
"             Time to Centroid       93.003     86.962     88.152     minutes"
"             Rainfall depth         47.240     47.240     47.240     mm"
"             Rainfall volume        115.74     115.74     231.48     c.m"
"             Rainfall losses        36.169     2.149      19.159     mm"
"             Runoff depth           11.071     45.091     28.081     mm"
"             Runoff volume          27.12      110.47     137.60     c.m"
"             Runoff coefficient     0.234      0.955      0.594      "
"             Maximum flow           0.019      0.078      0.081      c.m/sec"
" 40          HYDROGRAPH Add Runoff "
"            4   Add Runoff "
"                     0.081     0.081     0.000     0.000"
" 33          CATCHMENT 201"
"            1   Triangular SCS"
"            1   Equal length"
"            2   Horton equation"
"          201   Catchment 201 - To Clythe Creeek"
"       63.000   % Impervious"
"        3.630   Total Area"
"       50.000   Flow length"
"        2.000   Overland Slope"
"        1.343   Pervious Area"
"       50.000   Pervious length"
"        2.000   Pervious slope"
"        2.287   Impervious Area"
"       50.000   Impervious length"
"        2.000   Impervious slope"
"        0.250   Pervious Manning 'n'"
"       75.000   Pervious Max.infiltration"
"       12.500   Pervious Min.infiltration"
"        0.250   Pervious Lag constant (hours)"
"        5.000   Pervious Depression storage"
"        0.015   Impervious Manning 'n'"
"        0.000   Impervious Max.infiltration"
"        0.000   Impervious Min.infiltration"
"        0.050   Impervious Lag constant (hours)"
"        1.500   Impervious Depression storage"
"                     0.712     0.081     0.000     0.000 c.m/sec"
"             Catchment 201          Pervious   Impervious Total Area "
"             Surface Area           1.343      2.287      3.630      hectare"
"             Time of concentration  19.174     2.640      4.729      minutes"
"             Time to Centroid       96.822     87.870     89.001     minutes"
"             Rainfall depth         47.240     47.240     47.240     mm"
"             Rainfall volume        634.48     1080.33    1714.81    c.m"
"             Rainfall losses        36.212     2.454      14.944     mm"
"             Runoff depth           11.028     44.786     32.295     mm"
"             Runoff volume          148.12     1024.20    1172.32    c.m"
"             Runoff coefficient     0.233      0.948      0.684      "
```

```
"             Maximum flow           0.089      0.700      0.712      c.m/sec"
" 40          HYDROGRAPH Add Runoff "
"            4   Add Runoff "
"                     0.712     0.793     0.000     0.000"
" 54          POND DESIGN"
"         0.793   Current peak flow    c.m/sec"
"         0.171   Target outflow    c.m/sec"
"        1309.9   Hydrograph volume    c.m"
"           19.   Number of stages"
"         0.000   Minimum water level    metre"
"         3.000   Maximum water level    metre"
"         0.000   Starting water level    metre"
"             0   Keep Design Data: 1 = True; 0 = False"
"                   Level Discharge    Volume"
"                 339.650     0.000     0.000"
"                 339.750   0.00400   186.600"
"                 339.850   0.00700   385.900"
"                 339.950   0.00900   598.100"
"                 340.050   0.03200   823.100"
"                 340.150   0.05500  1060.700"
"                 340.250   0.08700  1311.400"
"                 340.350    0.1090  1575.400"
"                 340.450    0.1270  1853.300"
"                 340.550    0.1430  2145.400"
"                 340.650    0.1580  2452.000"
"                 340.750    0.1710  2773.600"
"                 340.850    0.1830  3110.600"
"                 340.950    0.1940  3463.900"
"                 341.050    0.6420  3834.400"
"                 341.150     1.471  4221.800"
"                 341.250     2.566  4625.900"
"                 341.350     3.887  5047.000"
"                 341.450     5.410  5485.900"
"              Peak outflow                  0.055    c.m/sec"
"              Maximum level               340.150    metre"
"              Maximum storage            1060.243    c.m"
"              Centroidal lag               11.691   hours"
"                   0.712     0.793     0.055     0.000 c.m/sec"
" 40          HYDROGRAPH Next link "
"            5   Next link "
"                     0.712     0.055     0.055     0.000"
" 33          CATCHMENT 202"
"            1   Triangular SCS"
"            1   Equal length"
"            2   Horton equation"
"          202   Catchment 202"
"        20.000   % Impervious"
"         1.220   Total Area"
"        15.000   Flow length"
"         2.000   Overland Slope"
```

```
"        0.976   Pervious Area"
"       15.000   Pervious length"
"        2.000   Pervious slope"
"        0.244   Impervious Area"
"       15.000   Impervious length"
"        2.000   Impervious slope"
"        0.250   Pervious Manning 'n'"
"       75.000   Pervious Max.infiltration"
"       12.500   Pervious Min.infiltration"
"        0.250   Pervious Lag constant (hours)"
"        5.000   Pervious Depression storage"
"        0.015   Impervious Manning 'n'"
"        0.000   Impervious Max.infiltration"
"        0.000   Impervious Min.infiltration"
"        0.050   Impervious Lag constant (hours)"
"        1.500   Impervious Depression storage"
"                     0.140     0.055     0.055     0.000 c.m/sec"
"             Catchment 202          Pervious   Impervious Total Area "
"             Surface Area           0.976      0.244      1.220      hectare"
"             Time of concentration  9.311      1.282      5.260      minutes"
"             Time to Centroid       87.735     85.869     86.794     minutes"
"             Rainfall depth         47.240     47.240     47.240     mm"
"             Rainfall volume        461.06     115.27     576.33     c.m"
"             Rainfall losses        36.224     2.381      29.456     mm"
"             Runoff depth           11.016     44.859     17.784     mm"
"             Runoff volume          107.51     109.46     216.97     c.m"
"             Runoff coefficient     0.233      0.950      0.376      "
"             Maximum flow           0.098      0.082      0.140      c.m/sec"
" 40          HYDROGRAPH Add Runoff "
"            4   Add Runoff "
"                     0.140     0.154     0.055     0.000"
" 54          POND DESIGN"
"        0.154   Current peak flow    c.m/sec"
"        0.171   Target outflow    c.m/sec"
"       1333.7   Hydrograph volume    c.m"
"          15.   Number of stages"
"        0.000   Minimum water level    metre"
"        3.000   Maximum water level    metre"
"        0.000   Starting water level    metre"
"            0   Keep Design Data: 1 = True; 0 = False"
"                  Level Discharge    Volume"
"                  0.000     0.000     0.000"
"                 0.1000  1.01E-05     3.670"
"                 0.1500  2.01E-05     5.500"
"                 0.2500  3.01E-05    10.910"
"                 0.3500  4.01E-05    16.330"
"                 0.4500  5.01E-05    21.740"
"                 0.5500  6.01E-05    27.150"
"                 0.6000  7.01E-05    30.730"
"                 0.7000  8.01E-05    34.400"
```

```
"                0.8000  9.01E-05    38.070"
"                0.9000   0.00010    41.730"
"                 1.000   0.00011    45.400"
"                 1.010   0.07478    45.770"
"                 1.100     2.414    49.070"
"                 1.200     6.968    52.750"
"            Peak outflow                  0.154    c.m/sec"
"            Maximum level                 1.013    metre"
"            Maximum storage              45.882    c.m"
"            Centroidal lag                7.393   hours"
"                 0.140     0.154     0.154     0.000 c.m/sec"
" 40         HYDROGRAPH Next link "
"           5   Next link "
"                    0.140     0.154     0.154     0.000"
" 52         CHANNEL DESIGN"
"       0.154   Current peak flow    c.m/sec"
"       0.065   Manning 'n'"
"          0.   Cross-section type: 0=trapezoidal; 1=general"
"      55.000   Basewidth    metre"
"       0.000   Left bank slope"
"       0.000   Right bank slope"
"       1.000   Channel depth    metre"
"      18.000   Gradient   %"
"            Depth of flow                 0.010    metre"
"            Velocity                      0.294    m/sec"
"            Channel capacity            350.545    c.m/sec"
"            Critical depth                0.009    metre"
" 53         ROUTE    Channel Route 50"
"       50.00      Channel Route 50 Reach length   ( metre)"
"       0.500   X-factor <= 0.5"
"     127.760   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                  0.152    c.m/sec"
"                    0.140     0.154     0.152     0.000 c.m/sec"
" 40         HYDROGRAPH Next link "
"           5   Next link "
"                    0.140     0.152     0.152     0.000"
" 33         CATCHMENT 300"
"           1   Triangular SCS"
"           1   Equal length"
"           2   Horton equation"
"         300   Catchment 300 - To Clythe Creek"
"       2.000   % Impervious"
"       6.480   Total Area"
"      45.000   Flow length"
```

```
"        2.000   Overland Slope"
"        6.350   Pervious Area"
"       45.000   Pervious length"
"        2.000   Pervious slope"
"        0.130   Impervious Area"
"       45.000   Impervious length"
"        2.000   Impervious slope"
"        0.250   Pervious Manning 'n'"
"       75.000   Pervious Max.infiltration"
"       12.500   Pervious Min.infiltration"
"        0.250   Pervious Lag constant (hours)"
"        5.000   Pervious Depression storage"
"        0.015   Impervious Manning 'n'"
"        0.000   Impervious Max.infiltration"
"        0.000   Impervious Min.infiltration"
"        0.050   Impervious Lag constant (hours)"
"        1.500   Impervious Depression storage"
"                     0.450     0.152     0.152     0.000 c.m/sec"
"             Catchment 300          Pervious   Impervious Total Area "
"             Surface Area           6.350      0.130      6.480      hectare"
"             Time of concentration  17.999     2.478      16.812     minutes"
"             Time to Centroid       95.777     87.611     95.152     minutes"
"             Rainfall depth         47.240     47.240     47.240     mm"
"             Rainfall volume        2999.92    61.22      3061.14    c.m"
"             Rainfall losses        36.173     2.305      35.496     mm"
"             Runoff depth           11.067     44.935     11.744     mm"
"             Runoff volume          702.78     58.24      761.02     c.m"
"             Runoff coefficient     0.234      0.951      0.249      "
"             Maximum flow           0.439      0.040      0.450      c.m/sec"
" 40          HYDROGRAPH Add Runoff "
"            4   Add Runoff "
"                     0.450     0.587     0.152     0.000"
" 38          START/RE-START TOTALS 300"
"            3   Runoff Totals on EXIT"
"             Total Catchment area                    11.820    hectare"
"             Total Impervious area                    2.905    hectare"
"             Total % impervious                      24.581"
" 19          EXIT"
```

```
"                MIDUSS Output ------------------------------------------------>"
"                MIDUSS version                          Version 2.25  rev. 473"
"                MIDUSS created                       Sunday, February 07, 2010"
"           10   Units used:                                          ie METRIC"
"                Job folder:            C:\Users\szaga\Documents\MIDUSS\105172"
"                Output filename:                          105172_POST_25YR.out"
"                Licensee name:                                            gmbp"
"                Company                                                      "
"                Date & Time last used:                 5/2/2023 at 11:29:47 AM"
" 31          TIME PARAMETERS"
"        5.000   Time Step"
"      180.000   Max. Storm length"
"     1500.000   Max. Hydrograph"
" 32          STORM Chicago storm"
"            1   Chicago storm"
"     3158.000   Coefficient A"
"       15.000   Constant B"
"        0.936   Exponent C"
"        0.400   Fraction R"
"      180.000   Duration"
"        1.000   Time step multiplier"
"             Maximum intensity           191.271    mm/hr"
"             Total depth                  68.087    mm"
"            6   025hyd   Hydrograph extension used in this file"
" 33          CATCHMENT 400"
"            1   Triangular SCS"
"            1   Equal length"
"            2   Horton equation"
"          400   Catchment 400 - External Park"
"       50.000   % Impervious"
"        0.490   Total Area"
"       33.000   Flow length"
"        2.000   Overland Slope"
"        0.245   Pervious Area"
"       33.000   Pervious length"
"        2.000   Pervious slope"
"        0.245   Impervious Area"
"       33.000   Impervious length"
"        2.000   Impervious slope"
"        0.250   Pervious Manning 'n'"
"       75.000   Pervious Max.infiltration"
"       12.500   Pervious Min.infiltration"
"        0.250   Pervious Lag constant (hours)"
"        5.000   Pervious Depression storage"
"        0.015   Impervious Manning 'n'"
"        0.000   Impervious Max.infiltration"
"        0.000   Impervious Min.infiltration"
"        0.050   Impervious Lag constant (hours)"
"        1.500   Impervious Depression storage"
"                     0.133     0.000     0.000     0.000 c.m/sec"
```

```
"             Catchment 400          Pervious   Impervious Total Area "
"             Surface Area           0.245      0.245      0.490      hectare"
"             Time of concentration  10.416     1.812      4.390      minutes"
"             Time to Centroid       91.556     85.521     87.329     minutes"
"             Rainfall depth         68.087     68.087     68.087     mm"
"             Rainfall volume        166.81     166.81     333.62     c.m"
"             Rainfall losses        39.978     2.364      21.171     mm"
"             Runoff depth           28.109     65.722     46.915     mm"
"             Runoff volume          68.87      161.02     229.89     c.m"
"             Runoff coefficient     0.413      0.965      0.689      "
"             Maximum flow           0.051      0.111      0.133      c.m/sec"
" 40          HYDROGRAPH Add Runoff "
"            4   Add Runoff "
"                     0.133     0.133     0.000     0.000"
" 33          CATCHMENT 201"
"            1   Triangular SCS"
"            1   Equal length"
"            2   Horton equation"
"          201   Catchment 201 - To Clythe Creeek"
"       63.000   % Impervious"
"        3.630   Total Area"
"       50.000   Flow length"
"        2.000   Overland Slope"
"        1.343   Pervious Area"
"       50.000   Pervious length"
"        2.000   Pervious slope"
"        2.287   Impervious Area"
"       50.000   Impervious length"
"        2.000   Impervious slope"
"        0.250   Pervious Manning 'n'"
"       75.000   Pervious Max.infiltration"
"       12.500   Pervious Min.infiltration"
"        0.250   Pervious Lag constant (hours)"
"        5.000   Pervious Depression storage"
"        0.015   Impervious Manning 'n'"
"        0.000   Impervious Max.infiltration"
"        0.000   Impervious Min.infiltration"
"        0.050   Impervious Lag constant (hours)"
"        1.500   Impervious Depression storage"
"                     1.055     0.133     0.000     0.000 c.m/sec"
"             Catchment 201          Pervious   Impervious Total Area "
"             Surface Area           1.343      2.287      3.630      hectare"
"             Time of concentration  13.366     2.325      4.551      minutes"
"             Time to Centroid       94.724     86.253     87.961     minutes"
"             Rainfall depth         68.087     68.087     68.087     mm"
"             Rainfall volume        914.47     1557.07    2471.54    c.m"
"             Rainfall losses        39.942     2.621      16.430     mm"
"             Runoff depth           28.145     65.465     51.657     mm"
"             Runoff volume          378.01     1497.12    1875.13    c.m"
"             Runoff coefficient     0.413      0.961      0.759      "
```

```
"             Maximum flow           0.252      1.003      1.055      c.m/sec"
" 40          HYDROGRAPH Add Runoff "
"            4   Add Runoff "
"                     1.055     1.180     0.000     0.000"
" 54          POND DESIGN"
"         1.180   Current peak flow    c.m/sec"
"         0.171   Target outflow    c.m/sec"
"       2105.0   Hydrograph volume    c.m"
"          19.   Number of stages"
"         0.000   Minimum water level    metre"
"         3.000   Maximum water level    metre"
"         0.000   Starting water level    metre"
"            0   Keep Design Data: 1 = True; 0 = False"
"                  Level Discharge    Volume"
"                339.650     0.000     0.000"
"                339.750   0.00400   186.600"
"                339.850   0.00700   385.900"
"                339.950   0.00900   598.100"
"                340.050   0.03200   823.100"
"                340.150   0.05500  1060.700"
"                340.250   0.08700  1311.400"
"                340.350    0.1090  1575.400"
"                340.450    0.1270  1853.300"
"                340.550    0.1430  2145.400"
"                340.650    0.1580  2452.000"
"                340.750    0.1710  2773.600"
"                340.850    0.1830  3110.600"
"                340.950    0.1940  3463.900"
"                341.050    0.6420  3834.400"
"                341.150     1.471  4221.800"
"                341.250     2.566  4625.900"
"                341.350     3.887  5047.000"
"                341.450     5.410  5485.900"
"             Peak outflow                  0.114    c.m/sec"
"             Maximum level               340.379    metre"
"             Maximum storage            1655.341    c.m"
"             Centroidal lag                9.231   hours"
"                  1.055     1.180     0.114     0.000 c.m/sec"
" 40          HYDROGRAPH Next link "
"            5   Next link "
"                     1.055     0.114     0.114     0.000"
" 33          CATCHMENT 202"
"            1   Triangular SCS"
"            1   Equal length"
"            2   Horton equation"
"          202   Catchment 202"
"       20.000   % Impervious"
"         1.220   Total Area"
"       15.000   Flow length"
"         2.000   Overland Slope"
```

```
"        0.976   Pervious Area"
"       15.000   Pervious length"
"        2.000   Pervious slope"
"        0.244   Impervious Area"
"       15.000   Impervious length"
"        2.000   Impervious slope"
"        0.250   Pervious Manning 'n'"
"       75.000   Pervious Max.infiltration"
"       12.500   Pervious Min.infiltration"
"        0.250   Pervious Lag constant (hours)"
"        5.000   Pervious Depression storage"
"        0.015   Impervious Manning 'n'"
"        0.000   Impervious Max.infiltration"
"        0.000   Impervious Min.infiltration"
"        0.050   Impervious Lag constant (hours)"
"        1.500   Impervious Depression storage"
"                     0.350     0.114     0.114     0.000 c.m/sec"
"             Catchment 202          Pervious   Impervious Total Area "
"             Surface Area           0.976      0.244      1.220      hectare"
"             Time of concentration  6.490      1.129      4.520      minutes"
"             Time to Centroid       87.446     84.615     86.405     minutes"
"             Rainfall depth         68.087     68.087     68.087     mm"
"             Rainfall volume        664.52     166.13     830.66     c.m"
"             Rainfall losses        40.152     3.154      32.752     mm"
"             Runoff depth           27.935     64.933     35.334     mm"
"             Runoff volume          272.64     158.44     431.08     c.m"
"             Runoff coefficient     0.410      0.954      0.519      "
"             Maximum flow           0.273      0.114      0.350      c.m/sec"
" 40          HYDROGRAPH Add Runoff "
"            4   Add Runoff "
"                     0.350     0.389     0.114     0.000"
" 54          POND DESIGN"
"        0.389   Current peak flow    c.m/sec"
"        0.171   Target outflow    c.m/sec"
"       2316.4   Hydrograph volume    c.m"
"          15.   Number of stages"
"        0.000   Minimum water level    metre"
"        3.000   Maximum water level    metre"
"        0.000   Starting water level    metre"
"            0   Keep Design Data: 1 = True; 0 = False"
"                  Level Discharge    Volume"
"                  0.000     0.000     0.000"
"                 0.1000  1.01E-05     3.670"
"                 0.1500  2.01E-05     5.500"
"                 0.2500  3.01E-05    10.910"
"                 0.3500  4.01E-05    16.330"
"                 0.4500  5.01E-05    21.740"
"                 0.5500  6.01E-05    27.150"
"                 0.6000  7.01E-05    30.730"
"                 0.7000  8.01E-05    34.400"
```

```
"                0.8000  9.01E-05    38.070"
"                0.9000   0.00010    41.730"
"                 1.000   0.00011    45.400"
"                 1.010   0.07478    45.770"
"                 1.100     2.414    49.070"
"                 1.200     6.968    52.750"
"            Peak outflow                  0.388    c.m/sec"
"            Maximum level                 1.022    metre"
"            Maximum storage              46.213    c.m"
"            Centroidal lag                5.936   hours"
"                 0.350     0.389     0.388     0.000 c.m/sec"
" 40         HYDROGRAPH Next link "
"           5   Next link "
"                    0.350     0.388     0.388     0.000"
" 52         CHANNEL DESIGN"
"        0.388   Current peak flow    c.m/sec"
"        0.065   Manning 'n'"
"           0.   Cross-section type: 0=trapezoidal; 1=general"
"       55.000   Basewidth    metre"
"        0.000   Left bank slope"
"        0.000   Right bank slope"
"        1.000   Channel depth    metre"
"       18.000   Gradient   %"
"            Depth of flow                 0.017    metre"
"            Velocity                      0.425    m/sec"
"            Channel capacity            350.545    c.m/sec"
"            Critical depth                0.017    metre"
" 53         ROUTE    Channel Route 50"
"        50.00      Channel Route 50 Reach length   ( metre)"
"        0.499   X-factor <= 0.5"
"       88.291   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                  0.354    c.m/sec"
"                    0.350     0.388     0.354     0.000 c.m/sec"
" 40         HYDROGRAPH Next link "
"           5   Next link "
"                    0.350     0.354     0.354     0.000"
" 33         CATCHMENT 300"
"           1   Triangular SCS"
"           1   Equal length"
"           2   Horton equation"
"         300   Catchment 300 - To Clythe Creek"
"        2.000   % Impervious"
"        6.480   Total Area"
"       45.000   Flow length"
```

```
"        2.000   Overland Slope"
"        6.350   Pervious Area"
"       45.000   Pervious length"
"        2.000   Pervious slope"
"        0.130   Impervious Area"
"       45.000   Impervious length"
"        2.000   Impervious slope"
"        0.250   Pervious Manning 'n'"
"       75.000   Pervious Max.infiltration"
"       12.500   Pervious Min.infiltration"
"        0.250   Pervious Lag constant (hours)"
"        5.000   Pervious Depression storage"
"        0.015   Impervious Manning 'n'"
"        0.000   Impervious Max.infiltration"
"        0.000   Impervious Min.infiltration"
"        0.050   Impervious Lag constant (hours)"
"        1.500   Impervious Depression storage"
"                    1.221     0.354     0.354     0.000 c.m/sec"
"             Catchment 300          Pervious   Impervious Total Area "
"             Surface Area           6.350      0.130      6.480      hectare"
"             Time of concentration  12.547     2.183      12.076     minutes"
"             Time to Centroid       93.833     86.046     93.479     minutes"
"             Rainfall depth         68.087     68.087     68.087     mm"
"             Rainfall volume        4323.77    88.24      4412.01    c.m"
"             Rainfall losses        39.975     2.507      39.226     mm"
"             Runoff depth           28.111     65.580     28.861     mm"
"             Runoff volume          1785.18    84.99      1870.17    c.m"
"             Runoff coefficient     0.413      0.963      0.424      "
"             Maximum flow           1.194      0.057      1.221      c.m/sec"
" 40          HYDROGRAPH Add Runoff "
"            4   Add Runoff "
"                    1.221     1.576     0.354     0.000"
" 38          START/RE-START TOTALS 300"
"            3   Runoff Totals on EXIT"
"             Total Catchment area                    11.820    hectare"
"             Total Impervious area                    2.905    hectare"
"             Total % impervious                      24.581"
" 19          EXIT"
```

```
"                MIDUSS Output ----------------------------------------------->"
"                MIDUSS version                          Version 2.25  rev. 473"
"                MIDUSS created                       Sunday, February 07, 2010"
"           10   Units used:                                          ie METRIC"
"                Job folder:            C:\Users\szaga\Documents\MIDUSS\105172"
"                Output filename:                        105172_POST_100YR.out"
"                Licensee name:                                            gmbp"
"                Company                                                      "
"                Date & Time last used:                5/2/2023 at 11:25:06 AM"
" 31          TIME PARAMETERS"
"        5.000   Time Step"
"      180.000   Max. Storm length"
"     1500.000   Max. Hydrograph"
" 32          STORM Chicago storm"
"            1   Chicago storm"
"     4688.000   Coefficient A"
"       17.000   Constant B"
"        0.962   Exponent C"
"        0.400   Fraction R"
"      180.000   Duration"
"        1.000   Time step multiplier"
"             Maximum intensity          239.650    mm/hr"
"             Total depth                 87.263    mm"
"            6   100hyd   Hydrograph extension used in this file"
" 33          CATCHMENT 400"
"            1   Triangular SCS"
"            1   Equal length"
"            2   Horton equation"
"          400   Catchment 400 - External Park"
"       50.000   % Impervious"
"        0.490   Total Area"
"       33.000   Flow length"
"        2.000   Overland Slope"
"        0.245   Pervious Area"
"       33.000   Pervious length"
"        2.000   Pervious slope"
"        0.245   Impervious Area"
"       33.000   Impervious length"
"        2.000   Impervious slope"
"        0.250   Pervious Manning 'n'"
"       75.000   Pervious Max.infiltration"
"       12.500   Pervious Min.infiltration"
"        0.250   Pervious Lag constant (hours)"
"        5.000   Pervious Depression storage"
"        0.015   Impervious Manning 'n'"
"        0.000   Impervious Max.infiltration"
"        0.000   Impervious Min.infiltration"
"        0.050   Impervious Lag constant (hours)"
"        1.500   Impervious Depression storage"
"                     0.189     0.000     0.000     0.000 c.m/sec"
```

```
"             Catchment 400          Pervious   Impervious Total Area "
"             Surface Area           0.245      0.245      0.490      hectare"
"             Time of concentration  9.341      1.656      4.322      minutes"
"             Time to Centroid       90.818     84.819     86.900     minutes"
"             Rainfall depth         87.263     87.263     87.263     mm"
"             Rainfall volume        213.80     213.80     427.59     c.m"
"             Rainfall losses        42.300     2.622      22.461     mm"
"             Runoff depth           44.964     84.642     64.803     mm"
"             Runoff volume          110.16     207.37     317.53     c.m"
"             Runoff coefficient     0.515      0.970      0.743      "
"             Maximum flow           0.082      0.141      0.189      c.m/sec"
" 40          HYDROGRAPH Add Runoff "
"            4   Add Runoff "
"                     0.189     0.189     0.000     0.000"
" 33          CATCHMENT 201"
"            1   Triangular SCS"
"            1   Equal length"
"            2   Horton equation"
"          201   Catchment 201 - To Clythe Creeek"
"       63.000   % Impervious"
"        3.630   Total Area"
"       50.000   Flow length"
"        2.000   Overland Slope"
"        1.343   Pervious Area"
"       50.000   Pervious length"
"        2.000   Pervious slope"
"        2.287   Impervious Area"
"       50.000   Impervious length"
"        2.000   Impervious slope"
"        0.250   Pervious Manning 'n'"
"       75.000   Pervious Max.infiltration"
"       12.500   Pervious Min.infiltration"
"        0.250   Pervious Lag constant (hours)"
"        5.000   Pervious Depression storage"
"        0.015   Impervious Manning 'n'"
"        0.000   Impervious Max.infiltration"
"        0.000   Impervious Min.infiltration"
"        0.050   Impervious Lag constant (hours)"
"        1.500   Impervious Depression storage"
"                     1.399     0.189     0.000     0.000 c.m/sec"
"             Catchment 201          Pervious   Impervious Total Area "
"             Surface Area           1.343      2.287      3.630      hectare"
"             Time of concentration  11.986     2.125      4.480      minutes"
"             Time to Centroid       93.719     85.475     87.444     minutes"
"             Rainfall depth         87.263     87.263     87.263     mm"
"             Rainfall volume        1172.04    1995.63    3167.66    c.m"
"             Rainfall losses        42.145     2.810      17.364     mm"
"             Runoff depth           45.119     84.454     69.900     mm"
"             Runoff volume          605.99     1931.37    2537.36    c.m"
"             Runoff coefficient     0.517      0.968      0.801      "
```

```
"             Maximum flow           0.401      1.272      1.399      c.m/sec"
" 40          HYDROGRAPH Add Runoff "
"            4   Add Runoff "
"                     1.399     1.588     0.000     0.000"
" 54          POND DESIGN"
"         1.588   Current peak flow    c.m/sec"
"         0.171   Target outflow    c.m/sec"
"       2854.9   Hydrograph volume    c.m"
"          19.   Number of stages"
"         0.000   Minimum water level    metre"
"         3.000   Maximum water level    metre"
"         0.000   Starting water level    metre"
"            0   Keep Design Data: 1 = True; 0 = False"
"                  Level Discharge    Volume"
"                339.650     0.000     0.000"
"                339.750   0.00400   186.600"
"                339.850   0.00700   385.900"
"                339.950   0.00900   598.100"
"                340.050   0.03200   823.100"
"                340.150   0.05500  1060.700"
"                340.250   0.08700  1311.400"
"                340.350    0.1090  1575.400"
"                340.450    0.1270  1853.300"
"                340.550    0.1430  2145.400"
"                340.650    0.1580  2452.000"
"                340.750    0.1710  2773.600"
"                340.850    0.1830  3110.600"
"                340.950    0.1940  3463.900"
"                341.050    0.6420  3834.400"
"                341.150     1.471  4221.800"
"                341.250     2.566  4625.900"
"                341.350     3.887  5047.000"
"                341.450     5.410  5485.900"
"             Peak outflow                  0.149    c.m/sec"
"             Maximum level               340.587    metre"
"             Maximum storage            2259.548    c.m"
"             Centroidal lag                8.254   hours"
"                  1.399     1.588     0.149     0.000 c.m/sec"
" 40          HYDROGRAPH Next link "
"            5   Next link "
"                     1.399     0.149     0.149     0.000"
" 33          CATCHMENT 202"
"            1   Triangular SCS"
"            1   Equal length"
"            2   Horton equation"
"          202   Catchment 202"
"       20.000   % Impervious"
"         1.220   Total Area"
"       15.000   Flow length"
"         2.000   Overland Slope"
```

```
"        0.976   Pervious Area"
"       15.000   Pervious length"
"        2.000   Pervious slope"
"        0.244   Impervious Area"
"       15.000   Impervious length"
"        2.000   Impervious slope"
"        0.250   Pervious Manning 'n'"
"       75.000   Pervious Max.infiltration"
"       12.500   Pervious Min.infiltration"
"        0.250   Pervious Lag constant (hours)"
"        5.000   Pervious Depression storage"
"        0.015   Impervious Manning 'n'"
"        0.000   Impervious Max.infiltration"
"        0.000   Impervious Min.infiltration"
"        0.050   Impervious Lag constant (hours)"
"        1.500   Impervious Depression storage"
"                     0.504     0.149     0.149     0.000 c.m/sec"
"             Catchment 202          Pervious   Impervious Total Area "
"             Surface Area           0.976      0.244      1.220      hectare"
"             Time of concentration  5.820      1.032      4.303      minutes"
"             Time to Centroid       87.061     84.019     86.098     minutes"
"             Rainfall depth         87.263     87.263     87.263     mm"
"             Rainfall volume        851.69     212.92     1064.61    c.m"
"             Rainfall losses        42.428     4.101      34.763     mm"
"             Runoff depth           44.835     83.163     52.501     mm"
"             Runoff volume          437.59     202.92     640.51     c.m"
"             Runoff coefficient     0.514      0.953      0.602      "
"             Maximum flow           0.407      0.144      0.504      c.m/sec"
" 40          HYDROGRAPH Add Runoff "
"            4   Add Runoff "
"                     0.504     0.576     0.149     0.000"
" 54          POND DESIGN"
"        0.576   Current peak flow    c.m/sec"
"        0.171   Target outflow    c.m/sec"
"       3255.3   Hydrograph volume    c.m"
"          15.   Number of stages"
"        0.000   Minimum water level    metre"
"        3.000   Maximum water level    metre"
"        0.000   Starting water level    metre"
"            0   Keep Design Data: 1 = True; 0 = False"
"                  Level Discharge    Volume"
"                  0.000     0.000     0.000"
"                 0.1000  1.00E-07     3.670"
"                 0.1500  1.00E-07     5.500"
"                 0.2500  1.00E-07    10.910"
"                 0.3500  1.00E-07    16.330"
"                 0.4500  1.00E-07    21.740"
"                 0.5500  1.00E-07    27.150"
"                 0.6000  1.00E-07    30.730"
"                 0.7000  1.00E-07    34.400"
```

```
"                0.8000  1.00E-07    38.070"
"                0.9000  1.00E-07    41.730"
"                 1.000  1.00E-07    45.400"
"                 1.010   0.07478    45.770"
"                 1.100     2.414    49.070"
"                 1.200     6.968    52.750"
"            Peak outflow                  0.575    c.m/sec"
"            Maximum level                 1.029    metre"
"            Maximum storage              46.476    c.m"
"            Centroidal lag                5.285   hours"
"                 0.504     0.576     0.575     0.000 c.m/sec"
" 40         HYDROGRAPH Next link "
"           5   Next link "
"                    0.504     0.575     0.575     0.000"
" 52         CHANNEL DESIGN"
"        0.575   Current peak flow    c.m/sec"
"        0.065   Manning 'n'"
"           0.   Cross-section type: 0=trapezoidal; 1=general"
"       55.000   Basewidth    metre"
"        0.000   Left bank slope"
"        0.000   Right bank slope"
"        1.000   Channel depth    metre"
"       18.000   Gradient   %"
"            Depth of flow                 0.021    metre"
"            Velocity                      0.497    m/sec"
"            Channel capacity            350.545    c.m/sec"
"            Critical depth                0.022    metre"
" 53         ROUTE    Channel Route 50"
"        50.00      Channel Route 50 Reach length   ( metre)"
"        0.499   X-factor <= 0.5"
"       75.441   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                  0.525    c.m/sec"
"                    0.504     0.575     0.525     0.000 c.m/sec"
" 40         HYDROGRAPH Next link "
"           5   Next link "
"                    0.504     0.525     0.525     0.000"
" 33         CATCHMENT 300"
"           1   Triangular SCS"
"           1   Equal length"
"           2   Horton equation"
"         300   Catchment 300 - To Clythe Creek"
"        2.000   % Impervious"
"        6.480   Total Area"
"       45.000   Flow length"
```

```
"        2.000   Overland Slope"
"        6.350   Pervious Area"
"       45.000   Pervious length"
"        2.000   Pervious slope"
"        0.130   Impervious Area"
"       45.000   Impervious length"
"        2.000   Impervious slope"
"        0.250   Pervious Manning 'n'"
"       75.000   Pervious Max.infiltration"
"       12.500   Pervious Min.infiltration"
"        0.250   Pervious Lag constant (hours)"
"        5.000   Pervious Depression storage"
"        0.015   Impervious Manning 'n'"
"        0.000   Impervious Max.infiltration"
"        0.000   Impervious Min.infiltration"
"        0.050   Impervious Lag constant (hours)"
"        1.500   Impervious Depression storage"
"                    2.000     0.525     0.525     0.000 c.m/sec"
"             Catchment 300          Pervious   Impervious Total Area "
"             Surface Area           6.350      0.130      6.480      hectare"
"             Time of concentration  11.252     1.995      10.911     minutes"
"             Time to Centroid       92.918     85.270     92.637     minutes"
"             Rainfall depth         87.263     87.263     87.263     mm"
"             Rainfall volume        5541.58    113.09     5654.67    c.m"
"             Rainfall losses        42.118     2.747      41.330     mm"
"             Runoff depth           45.146     84.517     45.933     mm"
"             Runoff volume          2866.92    109.53     2976.46    c.m"
"             Runoff coefficient     0.517      0.969      0.526      "
"             Maximum flow           1.964      0.073      2.000      c.m/sec"
" 40          HYDROGRAPH Add Runoff "
"            4   Add Runoff "
"                    2.000     2.525     0.525     0.000"
" 38          START/RE-START TOTALS 300"
"            3   Runoff Totals on EXIT"
"             Total Catchment area                    11.820    hectare"
"             Total Impervious area                    2.905    hectare"
"             Total % impervious                      24.581"
" 19          EXIT"
```

```
"                MIDUSS Output ----------------------------------------------->"
"                MIDUSS version                          Version 2.25  rev. 473"
"                MIDUSS created                       Sunday, February 07, 2010"
"           10   Units used:                                          ie METRIC"
"                Job folder:            C:\Users\szaga\Documents\MIDUSS\105172"
"                Output filename:                           105172_POST_REG.out"
"                Licensee name:                                            gmbp"
"                Company                                                      "
"                Date & Time last used:                5/2/2023 at 11:30:23 AM"
" 31          TIME PARAMETERS"
"       60.000   Time Step"
"     2880.000   Max. Storm length"
"     3600.000   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     2.206     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                 285.180    mm"
"            6   001hyd   Hydrograph extension used in this file"
" 33          CATCHMENT 400"
"            1   Triangular SCS"
"            1   Equal length"
"            2   Horton equation"
"          400   Catchment 400 - External Park"
"       50.000   % Impervious"
"        0.490   Total Area"
"       33.000   Flow length"
"        2.000   Overland Slope"
"        0.245   Pervious Area"
"       33.000   Pervious length"
"        2.000   Pervious slope"
"        0.245   Impervious Area"
"       33.000   Impervious length"
"        2.000   Impervious slope"
"        0.250   Pervious Manning 'n'"
"       75.000   Pervious Max.infiltration"
"       12.500   Pervious Min.infiltration"
"        0.250   Pervious Lag constant (hours)"
"        5.000   Pervious Depression storage"
```

```
"        0.015   Impervious Manning 'n'"
"        0.000   Impervious Max.infiltration"
"        0.000   Impervious Min.infiltration"
"        0.050   Impervious Lag constant (hours)"
"        1.500   Impervious Depression storage"
"                     0.050     0.000     0.000     0.000 c.m/sec"
"             Catchment 400          Pervious   Impervious Total Area "
"             Surface Area           0.245      0.245      0.490      hectare"
"             Time of concentration  18.239     3.028      6.681      minutes"
"             Time to Centroid       2776.286   2247.731   2374.662   minutes"
"             Rainfall depth         285.180    285.180    285.180    mm"
"             Rainfall volume        698.69     698.69     1397.38    c.m"
"             Rainfall losses        207.495    39.376     123.436    mm"
"             Runoff depth           77.685     245.804    161.744    mm"
"             Runoff volume          190.33     602.22     792.55     c.m"
"             Runoff coefficient     0.272      0.862      0.567      "
"             Maximum flow           0.020      0.031      0.050      c.m/sec"
" 40          HYDROGRAPH Add Runoff "
"            4   Add Runoff "
"                     0.050     0.050     0.000     0.000"
" 33          CATCHMENT 201"
"            1   Triangular SCS"
"            1   Equal length"
"            2   Horton equation"
"          201   Catchment 201 - To Clythe Creeek"
"       63.000   % Impervious"
"        3.630   Total Area"
"       50.000   Flow length"
"        2.000   Overland Slope"
"        1.343   Pervious Area"
"       50.000   Pervious length"
"        2.000   Pervious slope"
"        2.287   Impervious Area"
"       50.000   Impervious length"
"        2.000   Impervious slope"
"        0.250   Pervious Manning 'n'"
"       75.000   Pervious Max.infiltration"
"       12.500   Pervious Min.infiltration"
"        0.250   Pervious Lag constant (hours)"
"        5.000   Pervious Depression storage"
"        0.015   Impervious Manning 'n'"
"        0.000   Impervious Max.infiltration"
"        0.000   Impervious Min.infiltration"
"        0.050   Impervious Lag constant (hours)"
"        1.500   Impervious Depression storage"
"                     0.383     0.050     0.000     0.000 c.m/sec"
"             Catchment 201          Pervious   Impervious Total Area "
"             Surface Area           1.343      2.287      3.630      hectare"
"             Time of concentration  23.403     3.885      6.930      minutes"
"             Time to Centroid       2781.632   2234.914   2320.197   minutes"
```

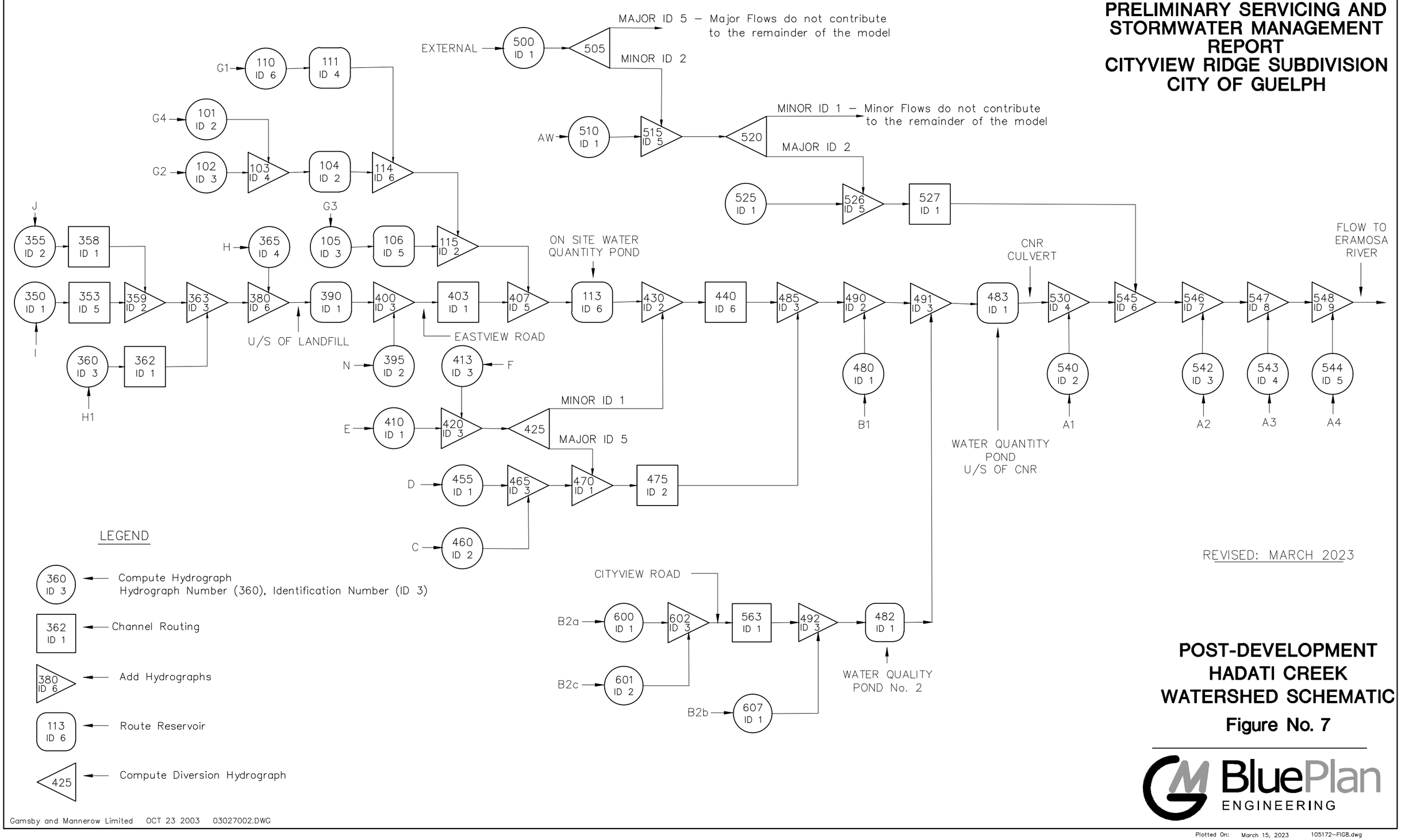
```
"             Rainfall depth         285.180    285.180    285.180    mm"
"             Rainfall volume        0.3830     0.6522     1.0352     ha-m"
"             Rainfall losses        207.253    37.554     100.343    mm"
"             Runoff depth           77.927     247.626    184.837    mm"
"             Runoff volume          1046.64    5662.95    6709.60    c.m"
"             Runoff coefficient     0.273      0.868      0.648      "
"             Maximum flow           0.113      0.289      0.383      c.m/sec"
" 40          HYDROGRAPH Add Runoff "
"            4   Add Runoff "
"                     0.383     0.433     0.000     0.000"
" 54          POND DESIGN"
"        0.433   Current peak flow    c.m/sec"
"        0.171   Target outflow    c.m/sec"
"       7502.1   Hydrograph volume    c.m"
"          19.   Number of stages"
"        0.000   Minimum water level    metre"
"        3.000   Maximum water level    metre"
"        0.000   Starting water level    metre"
"            0   Keep Design Data: 1 = True; 0 = False"
"                  Level Discharge    Volume"
"                339.650     0.000     0.000"
"                339.750   0.00400   186.600"
"                339.850   0.00700   385.900"
"                339.950   0.00900   598.100"
"                340.050   0.03200   823.100"
"                340.150   0.05500  1060.700"
"                340.250   0.08700  1311.400"
"                340.350    0.1090  1575.400"
"                340.450    0.1270  1853.300"
"                340.550    0.1430  2145.400"
"                340.650    0.1580  2452.000"
"                340.750    0.1710  2773.600"
"                340.850    0.1830  3110.600"
"                340.950    0.1940  3463.900"
"                341.050    0.6420  3834.400"
"                341.150     1.471  4221.800"
"                341.250     2.566  4625.900"
"                341.350     3.887  5047.000"
"                341.450     5.410  5485.900"
"             Peak outflow                  0.180    c.m/sec"
"             Maximum level               340.831    metre"
"             Maximum storage            3046.650    c.m"
"             Centroidal lag               45.673   hours"
"                  0.383     0.433     0.180     0.000 c.m/sec"
" 40          HYDROGRAPH Next link "
"            5   Next link "
"                     0.383     0.180     0.180     0.000"
" 33          CATCHMENT 202"
"            1   Triangular SCS"
"            1   Equal length"
```

```
"            2   Horton equation"
"          202   Catchment 202"
"       20.000   % Impervious"
"        1.220   Total Area"
"       15.000   Flow length"
"        2.000   Overland Slope"
"        0.976   Pervious Area"
"       15.000   Pervious length"
"        2.000   Pervious slope"
"        0.244   Impervious Area"
"       15.000   Impervious length"
"        2.000   Impervious slope"
"        0.250   Pervious Manning 'n'"
"       75.000   Pervious Max.infiltration"
"       12.500   Pervious Min.infiltration"
"        0.250   Pervious Lag constant (hours)"
"        5.000   Pervious Depression storage"
"        0.015   Impervious Manning 'n'"
"        0.000   Impervious Max.infiltration"
"        0.000   Impervious Min.infiltration"
"        0.050   Impervious Lag constant (hours)"
"        1.500   Impervious Depression storage"
"                     0.116     0.180     0.180     0.000 c.m/sec"
"             Catchment 202          Pervious   Impervious Total Area "
"             Surface Area           0.976      0.244      1.220      hectare"
"             Time of concentration  11.364     1.887      7.080      minutes"
"             Time to Centroid       2766.532   2277.420   2545.441   minutes"
"             Rainfall depth         285.180    285.180    285.180    mm"
"             Rainfall volume        2783.36    695.84     3479.20    c.m"
"             Rainfall losses        211.278    41.332     177.289    mm"
"             Runoff depth           73.902     243.848    107.891    mm"
"             Runoff volume          721.28     594.99     1316.27    c.m"
"             Runoff coefficient     0.259      0.855      0.378      "
"             Maximum flow           0.084      0.032      0.116      c.m/sec"
" 40          HYDROGRAPH Add Runoff "
"            4   Add Runoff "
"                     0.116     0.263     0.180     0.000"
" 54          POND DESIGN"
"        0.263   Current peak flow    c.m/sec"
"        0.171   Target outflow    c.m/sec"
"       8304.4   Hydrograph volume    c.m"
"          15.   Number of stages"
"        0.000   Minimum water level    metre"
"        3.000   Maximum water level    metre"
"        0.000   Starting water level    metre"
"            0   Keep Design Data: 1 = True; 0 = False"
"                  Level Discharge    Volume"
"                  0.000     0.000     0.000"
"                 0.1000  1.01E-05     3.670"
"                 0.1500  2.01E-05     5.500"
```

```
"                0.2500  3.01E-05    10.910"
"                0.3500  4.01E-05    16.330"
"                0.4500  5.01E-05    21.740"
"                0.5500  6.01E-05    27.150"
"                0.6000  7.01E-05    30.730"
"                0.7000  8.01E-05    34.400"
"                0.8000  9.01E-05    38.070"
"                0.9000   0.00010    41.730"
"                 1.000   0.00011    45.400"
"                 1.010   0.07478    45.770"
"                 1.100     2.414    49.070"
"                 1.200     6.968    52.750"
"             Peak outflow                  0.263    c.m/sec"
"             Maximum level                 1.017    metre"
"             Maximum storage              46.035    c.m"
"             Centroidal lag               43.880   hours"
"                  0.116     0.263     0.263     0.000 c.m/sec"
" 40          HYDROGRAPH Next link "
"            5   Next link "
"                     0.116     0.263     0.263     0.000"
" 52          CHANNEL DESIGN"
"        0.263   Current peak flow    c.m/sec"
"        0.065   Manning 'n'"
"           0.   Cross-section type: 0=trapezoidal; 1=general"
"       55.000   Basewidth    metre"
"        0.000   Left bank slope"
"        0.000   Right bank slope"
"        1.000   Channel depth    metre"
"       18.000   Gradient   %"
"             Depth of flow                 0.013    metre"
"             Velocity                      0.364    m/sec"
"             Channel capacity            350.545    c.m/sec"
"             Critical depth                0.013    metre"
" 53          ROUTE    Channel Route 50"
"        50.00      Channel Route 50 Reach length   ( metre)"
"        0.500   X-factor <= 0.5"
"      103.144   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"
"      102.857   Routing time step   ( seconds)"
"            1   No. of sub-reaches"
"             Peak outflow                  0.262    c.m/sec"
"                     0.116     0.263     0.262     0.000 c.m/sec"
" 40          HYDROGRAPH Next link "
"            5   Next link "
"                     0.116     0.262     0.262     0.000"
" 33          CATCHMENT 300"
"            1   Triangular SCS"
```

```
"            1   Equal length"
"            2   Horton equation"
"          300   Catchment 300 - To Clythe Creek"
"        2.000   % Impervious"
"        6.480   Total Area"
"       45.000   Flow length"
"        2.000   Overland Slope"
"        6.350   Pervious Area"
"       45.000   Pervious length"
"        2.000   Pervious slope"
"        0.130   Impervious Area"
"       45.000   Impervious length"
"        2.000   Impervious slope"
"        0.250   Pervious Manning 'n'"
"       75.000   Pervious Max.infiltration"
"       12.500   Pervious Min.infiltration"
"        0.250   Pervious Lag constant (hours)"
"        5.000   Pervious Depression storage"
"        0.015   Impervious Manning 'n'"
"        0.000   Impervious Max.infiltration"
"        0.000   Impervious Min.infiltration"
"        0.050   Impervious Lag constant (hours)"
"        1.500   Impervious Depression storage"
"                     0.539     0.262     0.262     0.000 c.m/sec"
"             Catchment 300          Pervious   Impervious Total Area "
"             Surface Area           6.350      0.130      6.480      hectare"
"             Time of concentration  21.969     3.647      20.859     minutes"
"             Time to Centroid       2780.245   2236.863   2747.310   minutes"
"             Rainfall depth         285.180    285.180    285.180    mm"
"             Rainfall volume        1.8110     0.0370     1.8480     ha-m"
"             Rainfall losses        207.172    38.558     203.800    mm"
"             Runoff depth           78.008     246.622    81.380     mm"
"             Runoff volume          4953.83    319.62     5273.45    c.m"
"             Runoff coefficient     0.274      0.865      0.285      "
"             Maximum flow           0.528      0.016      0.539      c.m/sec"
" 40          HYDROGRAPH Add Runoff "
"            4   Add Runoff "
"                     0.539     0.802     0.262     0.000"
" 38          START/RE-START TOTALS 300"
"            3   Runoff Totals on EXIT"
"             Total Catchment area                    11.820    hectare"
"             Total Impervious area                    2.905    hectare"
"             Total % impervious                      24.581"
" 19          EXIT"
```

PRELIMINARY SERVICING AND STORMWATER MANAGEMENT REPORT
CITYVIEW RIDGE SUBDIVISION
CITY OF GUELPH



LEGEND

- 360 ID 3 ← Compute Hydrograph. Hydrograph Number (360), Identification Number (ID 3)
- 362 ID 1 ← Channel Routing
- 380 ID 6 ← Add Hydrographs
- 113 ID 6 ← Route Reservoir
- 425 ← Compute Diversion Hydrograph

REVISED: MARCH 2023

POST-DEVELOPMENT HADATI CREEK WATERSHED SCHEMATIC

Figure No. 7

BluePlan ENGINEERING

Gamsby and Mannerow Limited OCT 23 2003 03027002.DWG

Plotted On: March 15, 2023 105172-FIG8.dwg

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================================================================================
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       V    V   I    SSSSS  U   U    A    L              (v 6.2.2007)
       V    V   I    SS     U   U   A A   L
        V  V    I     SS    U   U  AAAAA  L
        V  V    I      SS   U   U  A   A  L
         VV     I    SSSSS  UUUUU  A   A  LLLLL

        OOO   TTTTT  TTTTT  H   H  Y   Y  M   M   OOO    TM
       O   O    T      T    H   H   Y Y   MM MM  O   O
       O   O    T      T    H   H    Y    M   M  O   O
        OOO     T      T    H   H    Y    M   M   OOO
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                  *****  D E T A I L E D   O U T P U T *****


  Input   filename: C:\Program Files (x86)\Visual OTTHYMO 6.2\VO2\voin.dat

  Output  filename:
C:\Users\szaga\AppData\Local\Civica\VH5\755e78af-23fe-400e-9cfe-54285a1c407c\c139af3
2-e708-4538-ba6b-185f3f495d26\scenar
  Summary filename:
C:\Users\szaga\AppData\Local\Civica\VH5\755e78af-23fe-400e-9cfe-54285a1c407c\c139af3
2-e708-4538-ba6b-185f3f495d26\scenar


DATE: 02/17/2023                          TIME: 03:33:48

USER:



COMMENTS: _____________________________________________________________


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  ********************************************
  ** SIMULATION : Hadati Creek Watershed - Post **
  ********************************************


--------------------
|    READ STORM    |    Filename: C:\Users\szaga\AppD
|                  |              ata\Local\Temp\
```

| | 3ddd6580-52dc-4449-bccd-814fa38467d3\3fb2578a
| Ptotal= 25.00 mm | Comments: 25 mm - 4 hour - 10 Minute Time Step

TIME hrs	RAIN mm/hr	TIME hrs	RAIN mm/hr	TIME hrs	RAIN mm/hr	TIME hrs	RAIN mm/hr
0.00	0.53	1.00	17.57	2.00	2.95	3.00	0.76
0.17	0.71	1.17	61.55	2.17	2.19	3.17	0.65
0.33	0.99	1.33	24.02	2.33	1.69	3.33	0.57
0.50	1.51	1.50	11.16	2.50	1.34	3.50	0.49
0.67	2.57	1.67	6.44	2.67	1.09	3.67	0.44
0.83	5.31	1.83	4.20	2.83	0.90	3.83	0.38

| CALIB |
| STANDHYD (0544)| Area (ha)= 1.13
|ID= 1 DT= 5.0 min | Total Imp(%)= 80.00 Dir. Conn.(%)= 79.00

		IMPERVIOUS	PERVIOUS (i)
Surface Area	(ha)=	0.90	0.23
Dep. Storage	(mm)=	1.50	5.00
Average Slope	(%)=	0.55	0.55
Length	(m)=	50.00	40.00
Mannings n	=	0.013	0.300

NOTE: RAINFALL WAS TRANSFORMED TO 5.0 MIN. TIME STEP.

---- TRANSFORMED HYETOGRAPH ----

TIME hrs	RAIN mm/hr	TIME hrs	RAIN mm/hr	TIME hrs	RAIN mm/hr	TIME hrs	RAIN mm/hr
0.083	0.53	1.083	17.57	2.083	2.95	3.08	0.76
0.167	0.53	1.167	17.57	2.167	2.95	3.17	0.76
0.250	0.71	1.250	61.55	2.250	2.19	3.25	0.65
0.333	0.71	1.333	61.55	2.333	2.19	3.33	0.65
0.417	0.99	1.417	24.02	2.417	1.69	3.42	0.57
0.500	0.99	1.500	24.02	2.500	1.69	3.50	0.57
0.583	1.51	1.583	11.16	2.583	1.34	3.58	0.49
0.667	1.51	1.667	11.16	2.667	1.34	3.67	0.49
0.750	2.57	1.750	6.44	2.750	1.09	3.75	0.44
0.833	2.57	1.833	6.44	2.833	1.09	3.83	0.44
0.917	5.31	1.917	4.20	2.917	0.90	3.92	0.38
1.000	5.31	2.000	4.20	3.000	0.90	4.00	0.38

Max.Eff.Inten.(mm/hr)=		61.55	0.00
	over (min)	5.00	325.00
Storage Coeff. (min)=		2.45 (ii)	320.46 (ii)
Unit Hyd. Tpeak (min)=		5.00	325.00
Unit Hyd. peak (cms)=		0.30	0.00

			TOTALS
PEAK FLOW (cms)=	0.15	0.00	0.151 (iii)
TIME TO PEAK (hrs)=	1.33	0.00	1.33
RUNOFF VOLUME (mm)=	23.50	0.00	18.56
TOTAL RAINFALL (mm)=	25.00	25.00	25.00
RUNOFF COEFFICIENT =	0.94	0.00	0.74

***** WARNING: STORAGE COEFF. IS SMALLER THAN TIME STEP!
***** WARNING: THE PERVIOUS AREA HAS NO FLOW .

(i) HORTONS EQUATION SELECTED FOR PERVIOUS LOSSES:
Fo (mm/hr)= 75.00 K (1/hr)= 4.14
Fc (mm/hr)= 12.50 Cum.Inf. (mm)= 0.00
(ii) TIME STEP (DT) SHOULD BE SMALLER OR EQUAL
THAN THE STORAGE COEFFICIENT.
(iii) PEAK FLOW DOES NOT INCLUDE BASEFLOW IF ANY.

CALIB	
STANDHYD (0543)	Area (ha)= 14.99
ID= 1 DT= 5.0 min	Total Imp(%)= 80.00 Dir. Conn.(%)= 79.00

		IMPERVIOUS	PERVIOUS (i)
Surface Area	(ha)=	11.99	3.00
Dep. Storage	(mm)=	1.50	5.00
Average Slope	(%)=	0.55	0.55
Length	(m)=	200.00	40.00
Mannings n	=	0.013	0.300

NOTE: RAINFALL WAS TRANSFORMED TO 5.0 MIN. TIME STEP.

---- TRANSFORMED HYETOGRAPH ----

TIME hrs	RAIN mm/hr	TIME hrs	RAIN mm/hr	TIME hrs	RAIN mm/hr	TIME hrs	RAIN mm/hr
0.083	0.53	1.083	17.57	2.083	2.95	3.08	0.76
0.167	0.53	1.167	17.57	2.167	2.95	3.17	0.76
0.250	0.71	1.250	61.55	2.250	2.19	3.25	0.65
0.333	0.71	1.333	61.55	2.333	2.19	3.33	0.65
0.417	0.99	1.417	24.02	2.417	1.69	3.42	0.57
0.500	0.99	1.500	24.02	2.500	1.69	3.50	0.57
0.583	1.51	1.583	11.16	2.583	1.34	3.58	0.49
0.667	1.51	1.667	11.16	2.667	1.34	3.67	0.49
0.750	2.57	1.750	6.44	2.750	1.09	3.75	0.44
0.833	2.57	1.833	6.44	2.833	1.09	3.83	0.44
0.917	5.31	1.917	4.20	2.917	0.90	3.92	0.38
1.000	5.31	2.000	4.20	3.000	0.90	4.00	0.38

Max.Eff.Inten.(mm/hr)=	61.55	0.00

```
               over (min)        5.00       325.00
     Storage Coeff.  (min)=       5.63 (ii)  323.64 (ii)
     Unit Hyd. Tpeak (min)=       5.00       325.00
     Unit Hyd. peak  (cms)=       0.20         0.00
                                                      *TOTALS*
     PEAK FLOW       (cms)=       1.77         0.00          1.767 (iii)
     TIME TO PEAK    (hrs)=       1.33         0.00           1.33
     RUNOFF VOLUME    (mm)=      23.50         0.00          18.56
     TOTAL RAINFALL   (mm)=      25.00        25.00          25.00
     RUNOFF COEFFICIENT   =       0.94         0.00           0.74

***** WARNING: THE PERVIOUS AREA HAS NO FLOW .

       (i) HORTONS EQUATION SELECTED FOR PERVIOUS LOSSES:
            Fo   (mm/hr)= 75.00           K  (1/hr)=  4.14
            Fc   (mm/hr)= 12.50     Cum.Inf.   (mm)=  0.00
      (ii) TIME STEP (DT) SHOULD BE SMALLER OR EQUAL
           THAN THE STORAGE COEFFICIENT.
     (iii) PEAK FLOW DOES NOT INCLUDE BASEFLOW IF ANY.

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--------------------
| CALIB            |
| STANDHYD (  0542)|   Area    (ha)=  25.25
|ID= 1 DT= 5.0 min |   Total Imp(%)=  80.00   Dir. Conn.(%)=  79.00
--------------------
                           IMPERVIOUS    PERVIOUS (i)
     Surface Area     (ha)=      20.20         5.05
     Dep. Storage     (mm)=       1.50         5.00
     Average Slope     (%)=       0.55         0.55
     Length            (m)=     350.00        40.00
     Mannings n           =      0.013        0.300

         NOTE:  RAINFALL WAS TRANSFORMED TO   5.0 MIN. TIME STEP.


                          ---- TRANSFORMED HYETOGRAPH ----
               TIME    RAIN |  TIME    RAIN |'  TIME    RAIN |  TIME    RAIN
                hrs   mm/hr |   hrs   mm/hr |'   hrs   mm/hr |   hrs   mm/hr
              0.083    0.53 | 1.083   17.57 | 2.083    2.95 |  3.08    0.76
              0.167    0.53 | 1.167   17.57 | 2.167    2.95 |  3.17    0.76
              0.250    0.71 | 1.250   61.55 | 2.250    2.19 |  3.25    0.65
              0.333    0.71 | 1.333   61.55 | 2.333    2.19 |  3.33    0.65
              0.417    0.99 | 1.417   24.02 | 2.417    1.69 |  3.42    0.57
              0.500    0.99 | 1.500   24.02 | 2.500    1.69 |  3.50    0.57
              0.583    1.51 | 1.583   11.16 | 2.583    1.34 |  3.58    0.49
              0.667    1.51 | 1.667   11.16 | 2.667    1.34 |  3.67    0.49
              0.750    2.57 | 1.750    6.44 | 2.750    1.09 |  3.75    0.44
              0.833    2.57 | 1.833    6.44 | 2.833    1.09 |  3.83    0.44
              0.917    5.31 | 1.917    4.20 | 2.917    0.90 |  3.92    0.38
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                1.000    5.31 | 2.000    4.20 | 3.000    0.90 |  4.00    0.38

     Max.Eff.Inten.(mm/hr)=      61.55         0.00
               over (min)        10.00       330.00
     Storage Coeff.  (min)=       7.87 (ii)  325.88 (ii)
     Unit Hyd. Tpeak (min)=      10.00       330.00
     Unit Hyd. peak  (cms)=       0.13         0.00
                                                        *TOTALS*
     PEAK FLOW       (cms)=       2.41         0.00          2.408 (iii)
     TIME TO PEAK    (hrs)=       1.42         0.00           1.42
     RUNOFF VOLUME    (mm)=      23.50         0.00          18.56
     TOTAL RAINFALL   (mm)=      25.00        25.00          25.00
     RUNOFF COEFFICIENT   =       0.94         0.00           0.74

***** WARNING: THE PERVIOUS AREA HAS NO FLOW .

       (i) HORTONS EQUATION SELECTED FOR PERVIOUS LOSSES:
            Fo   (mm/hr)= 75.00          K  (1/hr)=  4.14
            Fc   (mm/hr)= 12.50     Cum.Inf.   (mm)=  0.00
      (ii) TIME STEP (DT) SHOULD BE SMALLER OR EQUAL
           THAN THE STORAGE COEFFICIENT.
     (iii) PEAK FLOW DOES NOT INCLUDE BASEFLOW IF ANY.

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--------------------
| STORE HYD(  0525)|   AREA       (ha)=   0.00
| ID= 1 DT=****min |   QPEAK     (cms)=   2.00
--------------------   TPEAK     (hrs)=  24.00
                       VOLUME     (mm)=*******

  TIME    FLOW |  TIME    FLOW |  TIME    FLOW |'  TIME    FLOW |  TIME    FLOW
   hrs     cms |   hrs     cms |   hrs     cms |'   hrs     cms |   hrs     cms
  0.00    1.00 | 24.00    2.00 |
--------------------------------------------------------------------------------
--------------------
| CALIB            |
| STANDHYD (  0510)|   Area    (ha)=  16.00
|ID= 1 DT= 5.0 min |   Total Imp(%)=  80.00   Dir. Conn.(%)=  79.00
--------------------
                              IMPERVIOUS    PERVIOUS (i)
     Surface Area     (ha)=      12.80         3.20
     Dep. Storage     (mm)=       1.50         5.00
     Average Slope     (%)=       0.50         0.25
     Length            (m)=     400.00        40.00
     Mannings n             =      0.013        0.300

         NOTE:  RAINFALL WAS TRANSFORMED TO   5.0 MIN. TIME STEP.


                              ---- TRANSFORMED HYETOGRAPH ----
```

TIME hrs	RAIN mm/hr	TIME hrs	RAIN mm/hr	TIME hrs	RAIN mm/hr	TIME hrs	RAIN mm/hr
0.083	0.53	1.083	17.57	2.083	2.95	3.08	0.76
0.167	0.53	1.167	17.57	2.167	2.95	3.17	0.76
0.250	0.71	1.250	61.55	2.250	2.19	3.25	0.65
0.333	0.71	1.333	61.55	2.333	2.19	3.33	0.65
0.417	0.99	1.417	24.02	2.417	1.69	3.42	0.57
0.500	0.99	1.500	24.02	2.500	1.69	3.50	0.57
0.583	1.51	1.583	11.16	2.583	1.34	3.58	0.49
0.667	1.51	1.667	11.16	2.667	1.34	3.67	0.49
0.750	2.57	1.750	6.44	2.750	1.09	3.75	0.44
0.833	2.57	1.833	6.44	2.833	1.09	3.83	0.44
0.917	5.31	1.917	4.20	2.917	0.90	3.92	0.38
1.000	5.31	2.000	4.20	3.000	0.90	4.00	0.38

Max.Eff.Inten.(mm/hr)=	61.55	0.00		
over (min)	10.00	415.00		
Storage Coeff. (min)=	8.77 (ii)	411.65 (ii)		
Unit Hyd. Tpeak (min)=	10.00	415.00		
Unit Hyd. peak (cms)=	0.12	0.00		
			TOTALS	
PEAK FLOW (cms)=	1.48	0.00	1.475 (iii)	
TIME TO PEAK (hrs)=	1.42	0.00	1.42	
RUNOFF VOLUME (mm)=	23.50	0.00	18.56	
TOTAL RAINFALL (mm)=	25.00	25.00	25.00	
RUNOFF COEFFICIENT =	0.94	0.00	0.74	

***** WARNING: THE PERVIOUS AREA HAS NO FLOW .

(i) HORTONS EQUATION SELECTED FOR PERVIOUS LOSSES:
Fo (mm/hr)= 75.00 K (1/hr)= 4.14
Fc (mm/hr)= 12.50 Cum.Inf. (mm)= 0.00
(ii) TIME STEP (DT) SHOULD BE SMALLER OR EQUAL
THAN THE STORAGE COEFFICIENT.
(iii) PEAK FLOW DOES NOT INCLUDE BASEFLOW IF ANY.

CALIB
STANDHYD (0500)
ID= 1 DT= 5.0 min

Area (ha)= 244.00
Total Imp(%)= 46.00 Dir. Conn.(%)= 26.00

		IMPERVIOUS	PERVIOUS (i)
Surface Area	(ha)=	112.24	131.76
Dep. Storage	(mm)=	1.50	5.00
Average Slope	(%)=	0.80	0.80
Length	(m)=	1275.00	40.00
Mannings n	=	0.013	0.300

NOTE: RAINFALL WAS TRANSFORMED TO 5.0 MIN. TIME STEP.

---- TRANSFORMED HYETOGRAPH ----

TIME hrs	RAIN mm/hr	TIME hrs	RAIN mm/hr	TIME hrs	RAIN mm/hr	TIME hrs	RAIN mm/hr
0.083	0.53	1.083	17.57	2.083	2.95	3.08	0.76
0.167	0.53	1.167	17.57	2.167	2.95	3.17	0.76
0.250	0.71	1.250	61.55	2.250	2.19	3.25	0.65
0.333	0.71	1.333	61.55	2.333	2.19	3.33	0.65
0.417	0.99	1.417	24.02	2.417	1.69	3.42	0.57
0.500	0.99	1.500	24.02	2.500	1.69	3.50	0.57
0.583	1.51	1.583	11.16	2.583	1.34	3.58	0.49
0.667	1.51	1.667	11.16	2.667	1.34	3.67	0.49
0.750	2.57	1.750	6.44	2.750	1.09	3.75	0.44
0.833	2.57	1.833	6.44	2.833	1.09	3.83	0.44
0.917	5.31	1.917	4.20	2.917	0.90	3.92	0.38
1.000	5.31	2.000	4.20	3.000	0.90	4.00	0.38

			TOTALS
Max.Eff.Inten.(mm/hr)=	42.79	5.28	
over (min)	20.00	55.00	
Storage Coeff. (min)=	17.67 (ii)	51.28 (ii)	
Unit Hyd. Tpeak (min)=	20.00	55.00	
Unit Hyd. peak (cms)=	0.06	0.02	
PEAK FLOW (cms)=	5.07	0.82	5.342 (iii)
TIME TO PEAK (hrs)=	1.58	2.17	1.58
RUNOFF VOLUME (mm)=	23.50	2.25	7.77
TOTAL RAINFALL (mm)=	25.00	25.00	25.00
RUNOFF COEFFICIENT =	0.94	0.09	0.31

(i) HORTONS EQUATION SELECTED FOR PERVIOUS LOSSES:
Fo (mm/hr)= 75.00 K (1/hr)= 4.14
Fc (mm/hr)= 12.50 Cum.Inf. (mm)= 0.00
(ii) TIME STEP (DT) SHOULD BE SMALLER OR EQUAL
THAN THE STORAGE COEFFICIENT.
(iii) PEAK FLOW DOES NOT INCLUDE BASEFLOW IF ANY.

DUHYD (0505)
Inlet Cap.= 9.000
#of Inlets= 1
Total(cms)= 9.0

	AREA (ha)	QPEAK (cms)	TPEAK (hrs)	R.V. (mm)
TOTAL HYD.(ID= 1):	244.00	5.34	1.58	7.77
MAJOR SYS.(ID= 2):	0.00	0.00	0.00	0.00
MINOR SYS.(ID= 3):	244.00	5.34	1.58	7.77

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

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

--------------------
| ADD HYD  (  0515)|
|   1 +  2 =  3    |          AREA    QPEAK    TPEAK     R.V.
--------------------          (ha)    (cms)    (hrs)     (mm)
        ID1= 1 (  0505):   244.00   5.342     1.58     7.77
      + ID2= 2 (  0510):    16.00   1.475     1.42    18.56
        ====================================================
        ID = 3 (  0515):   260.00   6.307     1.58     8.44

     NOTE:  PEAK FLOWS DO NOT INCLUDE BASEFLOWS IF ANY.
------------------------------------------------------------------------------
--------------------
| DUHYD    (  0520)|
| Inlet Cap.= 3.050|
| #of Inlets=     1|
| Total(cms)=   3.0|      AREA     QPEAK     TPEAK    R.V.
--------------------      (ha)     (cms)     (hrs)    (mm)
     TOTAL HYD.(ID= 1): 260.00      6.31      1.58    8.44
     ====================================================
     MAJOR SYS.(ID= 2):  59.59      3.26      1.58    8.44
     MINOR SYS.(ID= 3): 200.41      3.05      1.33    8.44

     NOTE:  PEAK FLOWS DO NOT INCLUDE BASEFLOWS IF ANY.

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

--------------------
| ADD HYD  (  0526)|
|   1 +  2 =  3    |          AREA    QPEAK    TPEAK     R.V.
--------------------          (ha)    (cms)    (hrs)     (mm)
        ID1= 1 (  0520):    59.59   3.257     1.58     8.44
      + ID2= 2 (  0525):     0.00   2.000    24.00  *******
        ====================================================
        ID = 3 (  0526):    59.59   4.323     1.58   225.65

     NOTE:  PEAK FLOWS DO NOT INCLUDE BASEFLOWS IF ANY.
------------------------------------------------------------------------------
--------------------
| ROUTE CHN(  0527)|
| IN= 2---> OUT= 1 |     Routing time step (min)'=  5.00
--------------------
               <------ DATA FOR SECTION (   1.1) ------>
               Distance      Elevation       Manning
                 100.00        313.20        0.0500
                 140.00        312.40    0.0500 /0.0300  Main Channel
                 140.50        310.80        0.0300      Main Channel
```

141.50	310.80	0.0300	Main Channel
142.00	312.40	0.0300 /0.0500	Main Channel
160.00	313.20	0.0500	

<-------------------- TRAVEL TIME TABLE ---------------------->

DEPTH (m)	ELEV (m)	VOLUME (cu.m.)	FLOW RATE (cms)	VELOCITY (m/s)	TRAV.TIME (min)
0.12	310.92	.575E+02	0.1	0.40	18.86
0.25	311.05	.119E+03	0.2	0.57	13.13
0.37	311.17	.185E+03	0.3	0.69	10.87
0.49	311.29	.256E+03	0.4	0.78	9.61
0.62	311.42	.330E+03	0.6	0.86	8.77
0.74	311.54	.409E+03	0.8	0.92	8.17
0.86	311.66	.492E+03	1.1	0.97	7.70
0.98	311.78	.579E+03	1.3	1.02	7.32
1.11	311.91	.671E+03	1.6	1.07	7.01
1.23	312.03	.767E+03	1.9	1.11	6.74
1.35	312.15	.867E+03	2.2	1.15	6.50
1.48	312.28	.971E+03	2.6	1.19	6.29
1.60	312.40	.108E+04	2.9	1.23	6.11
1.73	312.53	.149E+04	3.6	1.10	6.85
1.87	312.67	.248E+04	4.9	0.88	8.52
2.00	312.80	.405E+04	6.9	0.77	9.74
2.13	312.93	.620E+04	10.1	0.73	10.21
2.27	313.07	.893E+04	14.6	0.74	10.17
2.40	313.20	.122E+05	20.7	0.76	9.85

		<---- hydrograph ---->			<-pipe / channel->	
	AREA (ha)	QPEAK (cms)	TPEAK (hrs)	R.V. (mm)	MAX DEPTH (m)	MAX VEL (m/s)
INFLOW : ID= 2 (0526)	59.59	4.32	1.58	225.65	1.81	0.96
OUTFLOW: ID= 1 (0527)	59.59	3.71	1.67	225.40	1.74	1.08

CALIB STANDHYD (0540) ID= 1 DT= 5.0 min	Area (ha)= 4.63 Total Imp(%)= 80.00 Dir. Conn.(%)= 79.00

		IMPERVIOUS	PERVIOUS (i)
Surface Area	(ha)=	3.70	0.93
Dep. Storage	(mm)=	1.50	5.00
Average Slope	(%)=	0.55	0.55
Length	(m)=	150.00	40.00
Mannings n	=	0.013	0.300

NOTE: RAINFALL WAS TRANSFORMED TO 5.0 MIN. TIME STEP.

---- TRANSFORMED HYETOGRAPH ----

TIME hrs	RAIN mm/hr	TIME hrs	RAIN mm/hr	TIME hrs	RAIN mm/hr	TIME hrs	RAIN mm/hr
0.083	0.53	1.083	17.57	2.083	2.95	3.08	0.76
0.167	0.53	1.167	17.57	2.167	2.95	3.17	0.76
0.250	0.71	1.250	61.55	2.250	2.19	3.25	0.65
0.333	0.71	1.333	61.55	2.333	2.19	3.33	0.65
0.417	0.99	1.417	24.02	2.417	1.69	3.42	0.57
0.500	0.99	1.500	24.02	2.500	1.69	3.50	0.57
0.583	1.51	1.583	11.16	2.583	1.34	3.58	0.49
0.667	1.51	1.667	11.16	2.667	1.34	3.67	0.49
0.750	2.57	1.750	6.44	2.750	1.09	3.75	0.44
0.833	2.57	1.833	6.44	2.833	1.09	3.83	0.44
0.917	5.31	1.917	4.20	2.917	0.90	3.92	0.38
1.000	5.31	2.000	4.20	3.000	0.90	4.00	0.38

Max.Eff.Inten.(mm/hr)=	61.55	0.00		
over (min)	5.00	325.00		
Storage Coeff. (min)=	4.73 (ii)	322.74 (ii)		
Unit Hyd. Tpeak (min)=	5.00	325.00		
Unit Hyd. peak (cms)=	0.22	0.00		
			TOTALS	
PEAK FLOW (cms)=	0.57	0.00	0.569 (iii)	
TIME TO PEAK (hrs)=	1.33	0.00	1.33	
RUNOFF VOLUME (mm)=	23.50	0.00	18.56	
TOTAL RAINFALL (mm)=	25.00	25.00	25.00	
RUNOFF COEFFICIENT =	0.94	0.00	0.74	

***** WARNING: STORAGE COEFF. IS SMALLER THAN TIME STEP!
***** WARNING: THE PERVIOUS AREA HAS NO FLOW .

(i) HORTONS EQUATION SELECTED FOR PERVIOUS LOSSES:
Fo (mm/hr)= 75.00 K (1/hr)= 4.14
Fc (mm/hr)= 12.50 Cum.Inf. (mm)= 0.00
(ii) TIME STEP (DT) SHOULD BE SMALLER OR EQUAL
THAN THE STORAGE COEFFICIENT.
(iii) PEAK FLOW DOES NOT INCLUDE BASEFLOW IF ANY.

CALIB STANDHYD (0600) ID= 1 DT= 5.0 min	Area (ha)= 9.73 Total Imp(%)= 52.00 Dir. Conn.(%)= 35.00

		IMPERVIOUS	PERVIOUS (i)
Surface Area	(ha)=	5.06	4.67
Dep. Storage	(mm)=	1.50	5.00
Average Slope	(%)=	2.00	2.00
Length	(m)=	254.69	33.00

Mannings n = 0.013 0.300

NOTE: RAINFALL WAS TRANSFORMED TO 5.0 MIN. TIME STEP.

---- TRANSFORMED HYETOGRAPH ----

TIME hrs	RAIN mm/hr	TIME hrs	RAIN mm/hr	TIME hrs	RAIN mm/hr	TIME hrs	RAIN mm/hr
0.083	0.53	1.083	17.57	2.083	2.95	3.08	0.76
0.167	0.53	1.167	17.57	2.167	2.95	3.17	0.76
0.250	0.71	1.250	61.55	2.250	2.19	3.25	0.65
0.333	0.71	1.333	61.55	2.333	2.19	3.33	0.65
0.417	0.99	1.417	24.02	2.417	1.69	3.42	0.57
0.500	0.99	1.500	24.02	2.500	1.69	3.50	0.57
0.583	1.51	1.583	11.16	2.583	1.34	3.58	0.49
0.667	1.51	1.667	11.16	2.667	1.34	3.67	0.49
0.750	2.57	1.750	6.44	2.750	1.09	3.75	0.44
0.833	2.57	1.833	6.44	2.833	1.09	3.83	0.44
0.917	5.31	1.917	4.20	2.917	0.90	3.92	0.38
1.000	5.31	2.000	4.20	3.000	0.90	4.00	0.38

Max.Eff.Inten.(mm/hr)=	61.55	8.41		
over (min)	5.00	25.00		
Storage Coeff. (min)=	4.42 (ii)	23.30 (ii)		
Unit Hyd. Tpeak (min)=	5.00	25.00		
Unit Hyd. peak (cms)=	0.23	0.05		
			TOTALS	
PEAK FLOW (cms)=	0.54	0.05	0.546 (iii)	
TIME TO PEAK (hrs)=	1.33	1.67	1.33	
RUNOFF VOLUME (mm)=	23.50	2.07	9.57	
TOTAL RAINFALL (mm)=	25.00	25.00	25.00	
RUNOFF COEFFICIENT =	0.94	0.08	0.38	

***** WARNING: STORAGE COEFF. IS SMALLER THAN TIME STEP!

(i) HORTONS EQUATION SELECTED FOR PERVIOUS LOSSES:
Fo (mm/hr)= 75.00 K (1/hr)= 4.14
Fc (mm/hr)= 12.50 Cum.Inf. (mm)= 0.00
(ii) TIME STEP (DT) SHOULD BE SMALLER OR EQUAL
THAN THE STORAGE COEFFICIENT.
(iii) PEAK FLOW DOES NOT INCLUDE BASEFLOW IF ANY.

CALIB
STANDHYD (0601)
ID= 1 DT= 5.0 min

Area (ha)= 6.95
Total Imp(%)= 70.00 Dir. Conn.(%)= 50.00

	IMPERVIOUS	PERVIOUS (i)
Surface Area (ha)=	4.86	2.09

Dep. Storage	(mm)=	1.50	5.00
Average Slope	(%)=	2.00	2.00
Length	(m)=	215.25	33.00
Mannings n	=	0.013	0.300

NOTE: RAINFALL WAS TRANSFORMED TO 5.0 MIN. TIME STEP.

---- TRANSFORMED HYETOGRAPH ----

TIME hrs	RAIN mm/hr	TIME hrs	RAIN mm/hr	TIME hrs	RAIN mm/hr	TIME hrs	RAIN mm/hr
0.083	0.53	1.083	17.57	2.083	2.95	3.08	0.76
0.167	0.53	1.167	17.57	2.167	2.95	3.17	0.76
0.250	0.71	1.250	61.55	2.250	2.19	3.25	0.65
0.333	0.71	1.333	61.55	2.333	2.19	3.33	0.65
0.417	0.99	1.417	24.02	2.417	1.69	3.42	0.57
0.500	0.99	1.500	24.02	2.500	1.69	3.50	0.57
0.583	1.51	1.583	11.16	2.583	1.34	3.58	0.49
0.667	1.51	1.667	11.16	2.667	1.34	3.67	0.49
0.750	2.57	1.750	6.44	2.750	1.09	3.75	0.44
0.833	2.57	1.833	6.44	2.833	1.09	3.83	0.44
0.917	5.31	1.917	4.20	2.917	0.90	3.92	0.38
1.000	5.31	2.000	4.20	3.000	0.90	4.00	0.38

Max.Eff.Inten.(mm/hr)=	61.55	32.47		
over (min)	5.00	15.00		
Storage Coeff. (min)=	3.99 (ii)	14.99 (ii)		
Unit Hyd. Tpeak (min)=	5.00	15.00		
Unit Hyd. peak (cms)=	0.24	0.08		
			TOTALS	
PEAK FLOW (cms)=	0.56	0.11	0.588 (iii)	
TIME TO PEAK (hrs)=	1.33	1.50	1.33	
RUNOFF VOLUME (mm)=	23.50	4.87	14.18	
TOTAL RAINFALL (mm)=	25.00	25.00	25.00	
RUNOFF COEFFICIENT =	0.94	0.19	0.57	

***** WARNING: STORAGE COEFF. IS SMALLER THAN TIME STEP!

(i) HORTONS EQUATION SELECTED FOR PERVIOUS LOSSES:
Fo (mm/hr)= 75.00 K (1/hr)= 4.14
Fc (mm/hr)= 12.50 Cum.Inf. (mm)= 0.00
(ii) TIME STEP (DT) SHOULD BE SMALLER OR EQUAL
THAN THE STORAGE COEFFICIENT.
(iii) PEAK FLOW DOES NOT INCLUDE BASEFLOW IF ANY.

ADD HYD (0602)				
1 + 2 = 3	AREA	QPEAK	TPEAK	R.V.

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--------------------          (ha)    (cms)    (hrs)     (mm)
        ID1= 1 (  0600):     9.73   0.546     1.33     9.57
      + ID2= 2 (  0601):     6.95   0.588     1.33    14.18
        ================================================
        ID = 3 (  0602):    16.68   1.134     1.33    11.49

     NOTE:  PEAK FLOWS DO NOT INCLUDE BASEFLOWS IF ANY.
------------------------------------------------------------------------------
--------------------
| ROUTE CHN(  0563)|
| IN= 2---> OUT= 1 |     Routing time step (min)'=  5.00
--------------------
               <------ DATA FOR SECTION (   2.2) ------>
               Distance      Elevation       Manning
                   0.00          1.00        0.0350
                   2.00          0.50        0.0350
                   4.00          0.00    0.0350 /0.0350  Main Channel
                   4.50          0.00        0.0350      Main Channel
                   5.00          0.00    0.0350 /0.0350  Main Channel
                   7.00          0.50        0.0350
                   9.00          1.00        0.0350

      <---------------------- TRAVEL TIME TABLE ---------------------->
       DEPTH    ELEV      VOLUME    FLOW RATE    VELOCITY   TRAV.TIME
        (m)      (m)     (cu.m.)      (cms)        (m/s)      (min)
       0.05     0.05    .701E+01       0.0          0.64       2.87
       0.11     0.11    .165E+02       0.1          0.96       1.91
       0.16     0.16    .283E+02       0.3          1.21       1.51
       0.21     0.21    .427E+02       0.6          1.42       1.29
       0.26     0.26    .594E+02       0.9          1.61       1.14
       0.32     0.32    .786E+02       1.3          1.77       1.03
       0.37     0.37    .100E+03       1.8          1.93       0.95
       0.42     0.42    .124E+03       2.3          2.08       0.88
       0.47     0.47    .151E+03       3.0          2.22       0.83
       0.53     0.53    .180E+03       3.8          2.35       0.78
       0.58     0.58    .211E+03       4.8          2.48       0.74
       0.63     0.63    .245E+03       5.8          2.60       0.71
       0.68     0.68    .281E+03       7.0          2.72       0.67
       0.74     0.74    .320E+03       8.2          2.84       0.65
       0.79     0.79    .361E+03       9.7          2.95       0.62
       0.84     0.84    .405E+03      11.3          3.06       0.60
       0.89     0.89    .451E+03      13.0          3.17       0.58
       0.95     0.95    .499E+03      14.8          3.27       0.56
       1.00     1.00    .550E+03      16.9          3.38       0.54

                                    <---- hydrograph ---->   <-pipe / channel->
                              AREA    QPEAK   TPEAK   R.V.   MAX DEPTH  MAX VEL
                              (ha)    (cms)   (hrs)   (mm)      (m)      (m/s)
   INFLOW : ID= 2 (  0602)   16.68     1.13    1.33  11.49      0.30      1.71
   OUTFLOW: ID= 1 (  0563)   16.68     1.18    1.33  11.49      0.30      1.73
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--------------------
| CALIB            |
| STANDHYD (  0607)|   Area    (ha)=   5.97
|ID= 1 DT= 5.0 min |   Total Imp(%)=  51.00   Dir. Conn.(%)=  35.00
--------------------
                             IMPERVIOUS    PERVIOUS (i)
     Surface Area     (ha)=       3.04         2.93
     Dep. Storage     (mm)=       1.50         5.00
     Average Slope     (%)=       2.00         2.00
     Length            (m)=     199.50        33.00
     Mannings n            =      0.013        0.300

         NOTE:  RAINFALL WAS TRANSFORMED TO   5.0 MIN. TIME STEP.


                              ---- TRANSFORMED HYETOGRAPH ----
               TIME    RAIN |  TIME    RAIN |'  TIME    RAIN |  TIME    RAIN
                hrs   mm/hr |   hrs   mm/hr |'   hrs   mm/hr |   hrs   mm/hr
              0.083    0.53 | 1.083   17.57 | 2.083    2.95 |  3.08    0.76
              0.167    0.53 | 1.167   17.57 | 2.167    2.95 |  3.17    0.76
              0.250    0.71 | 1.250   61.55 | 2.250    2.19 |  3.25    0.65
              0.333    0.71 | 1.333   61.55 | 2.333    2.19 |  3.33    0.65
              0.417    0.99 | 1.417   24.02 | 2.417    1.69 |  3.42    0.57
              0.500    0.99 | 1.500   24.02 | 2.500    1.69 |  3.50    0.57
              0.583    1.51 | 1.583   11.16 | 2.583    1.34 |  3.58    0.49
              0.667    1.51 | 1.667   11.16 | 2.667    1.34 |  3.67    0.49
              0.750    2.57 | 1.750    6.44 | 2.750    1.09 |  3.75    0.44
              0.833    2.57 | 1.833    6.44 | 2.833    1.09 |  3.83    0.44
              0.917    5.31 | 1.917    4.20 | 2.917    0.90 |  3.92    0.38
              1.000    5.31 | 2.000    4.20 | 3.000    0.90 |  4.00    0.38

     Max.Eff.Inten.(mm/hr)=      61.55         5.60
               over (min)        5.00        30.00
     Storage Coeff.  (min)=       3.81 (ii)   26.04 (ii)
     Unit Hyd. Tpeak (min)=       5.00        30.00
     Unit Hyd. peak  (cms)=       0.25         0.04
                                                      *TOTALS*
     PEAK FLOW       (cms)=       0.34         0.03          0.341 (iii)
     TIME TO PEAK    (hrs)=       1.33         1.75           1.33
     RUNOFF VOLUME    (mm)=      23.50         1.76           9.37
     TOTAL RAINFALL   (mm)=      25.00        25.00          25.00
     RUNOFF COEFFICIENT   =       0.94         0.07           0.37

***** WARNING: STORAGE COEFF. IS SMALLER THAN TIME STEP!

       (i) HORTONS EQUATION SELECTED FOR PERVIOUS LOSSES:
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```
            Fo   (mm/hr)= 75.00          K  (1/hr)=  4.14
            Fc   (mm/hr)= 12.50     Cum.Inf.   (mm)=  0.00
      (ii) TIME STEP (DT) SHOULD BE SMALLER OR EQUAL
           THAN THE STORAGE COEFFICIENT.
     (iii) PEAK FLOW DOES NOT INCLUDE BASEFLOW IF ANY.

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--------------------
| ADD HYD  (  0492)|
|   1 +  2 =  3    |         AREA    QPEAK    TPEAK     R.V.
--------------------         (ha)    (cms)    (hrs)     (mm)
       ID1= 1 (  0563):    16.68   1.183     1.33    11.49
     + ID2= 2 (  0607):     5.97   0.341     1.33     9.37
       ================================================
       ID = 3 (  0492):    22.65   1.525     1.33    10.93

     NOTE:  PEAK FLOWS DO NOT INCLUDE BASEFLOWS IF ANY.
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--------------------
| RESERVOIR(  0482)|     OVERFLOW IS OFF
| IN= 2---> OUT= 1 |
| DT=  5.0 min     |     OUTFLOW    STORAGE   |  OUTFLOW    STORAGE
--------------------      (cms)     (ha.m.)   |   (cms)     (ha.m.)
                          0.0000     0.0000   |   0.2910      0.3795
                          0.2590     0.0579   |   0.2970      0.4503
                          0.2660     0.1180   |   1.6320      0.5232
                          0.2720     0.1802   |   4.1680      0.5983
                          0.2790     0.2445   |   7.5660      0.6756
                          0.2850     0.3109   |   0.0000      0.0000

                                AREA     QPEAK     TPEAK       R.V.
                                (ha)     (cms)     (hrs)       (mm)
   INFLOW : ID= 2 (  0492)     22.650      1.525      1.33      10.93
   OUTFLOW: ID= 1 (  0482)     22.650      0.268      1.83      10.93

                  PEAK   FLOW   REDUCTION [Qout/Qin](%)= 17.60
                  TIME SHIFT OF PEAK FLOW         (min)= 30.00
                  MAXIMUM  STORAGE   USED       (ha.m.)=  0.1417

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--------------------
| CALIB            |
| STANDHYD (  0480)|   Area    (ha)=  43.10
|ID= 1 DT= 5.0 min |   Total Imp(%)=  42.00   Dir. Conn.(%)=  21.00
--------------------
                             IMPERVIOUS    PERVIOUS (i)
     Surface Area     (ha)=      18.10        25.00
     Dep. Storage     (mm)=       1.50         5.00
     Average Slope     (%)=       2.00         2.00
```

Length (m)=	680.00	40.00	
Mannings n =	0.013	0.300	

NOTE: RAINFALL WAS TRANSFORMED TO 5.0 MIN. TIME STEP.

---- TRANSFORMED HYETOGRAPH ----

TIME hrs	RAIN mm/hr	TIME hrs	RAIN mm/hr	TIME hrs	RAIN mm/hr	TIME hrs	RAIN mm/hr
0.083	0.53	1.083	17.57	2.083	2.95	3.08	0.76
0.167	0.53	1.167	17.57	2.167	2.95	3.17	0.76
0.250	0.71	1.250	61.55	2.250	2.19	3.25	0.65
0.333	0.71	1.333	61.55	2.333	2.19	3.33	0.65
0.417	0.99	1.417	24.02	2.417	1.69	3.42	0.57
0.500	0.99	1.500	24.02	2.500	1.69	3.50	0.57
0.583	1.51	1.583	11.16	2.583	1.34	3.58	0.49
0.667	1.51	1.667	11.16	2.667	1.34	3.67	0.49
0.750	2.57	1.750	6.44	2.750	1.09	3.75	0.44
0.833	2.57	1.833	6.44	2.833	1.09	3.83	0.44
0.917	5.31	1.917	4.20	2.917	0.90	3.92	0.38
1.000	5.31	2.000	4.20	3.000	0.90	4.00	0.38

Max.Eff.Inten.(mm/hr)=	61.55	7.05		
over (min)	10.00	35.00		
Storage Coeff. (min)=	7.96 (ii)	30.70 (ii)		
Unit Hyd. Tpeak (min)=	10.00	35.00		
Unit Hyd. peak (cms)=	0.13	0.04		
			TOTALS	
PEAK FLOW (cms)=	1.09	0.23	1.142 (iii)	
TIME TO PEAK (hrs)=	1.42	1.83	1.42	
RUNOFF VOLUME (mm)=	23.50	2.16	6.64	
TOTAL RAINFALL (mm)=	25.00	25.00	25.00	
RUNOFF COEFFICIENT =	0.94	0.09	0.27	

(i) HORTONS EQUATION SELECTED FOR PERVIOUS LOSSES:
Fo (mm/hr)= 75.00 K (1/hr)= 4.14
Fc (mm/hr)= 12.50 Cum.Inf. (mm)= 0.00
(ii) TIME STEP (DT) SHOULD BE SMALLER OR EQUAL
THAN THE STORAGE COEFFICIENT.
(iii) PEAK FLOW DOES NOT INCLUDE BASEFLOW IF ANY.

CALIB		
STANDHYD (0460)	Area (ha)=	36.00
ID= 1 DT= 5.0 min	Total Imp(%)=	42.00 Dir. Conn.(%)= 21.00

	IMPERVIOUS	PERVIOUS (i)
Surface Area (ha)=	15.12	20.88

Dep. Storage	(mm)=	1.50	5.00
Average Slope	(%)=	2.03	2.03
Length	(m)=	465.00	40.00
Mannings n	=	0.013	0.300

NOTE: RAINFALL WAS TRANSFORMED TO 5.0 MIN. TIME STEP.

---- TRANSFORMED HYETOGRAPH ----

TIME hrs	RAIN mm/hr	TIME hrs	RAIN mm/hr	TIME hrs	RAIN mm/hr	TIME hrs	RAIN mm/hr
0.083	0.53	1.083	17.57	2.083	2.95	3.08	0.76
0.167	0.53	1.167	17.57	2.167	2.95	3.17	0.76
0.250	0.71	1.250	61.55	2.250	2.19	3.25	0.65
0.333	0.71	1.333	61.55	2.333	2.19	3.33	0.65
0.417	0.99	1.417	24.02	2.417	1.69	3.42	0.57
0.500	0.99	1.500	24.02	2.500	1.69	3.50	0.57
0.583	1.51	1.583	11.16	2.583	1.34	3.58	0.49
0.667	1.51	1.667	11.16	2.667	1.34	3.67	0.49
0.750	2.57	1.750	6.44	2.750	1.09	3.75	0.44
0.833	2.57	1.833	6.44	2.833	1.09	3.83	0.44
0.917	5.31	1.917	4.20	2.917	0.90	3.92	0.38
1.000	5.31	2.000	4.20	3.000	0.90	4.00	0.38

Max.Eff.Inten.(mm/hr)=	61.55	7.05		
over (min)	5.00	30.00		
Storage Coeff. (min)=	6.31 (ii)	28.95 (ii)		
Unit Hyd. Tpeak (min)=	5.00	30.00		
Unit Hyd. peak (cms)=	0.19	0.04		
				TOTALS
PEAK FLOW (cms)=	1.09	0.21		1.117 (iii)
TIME TO PEAK (hrs)=	1.33	1.75		1.33
RUNOFF VOLUME (mm)=	23.50	2.16		6.64
TOTAL RAINFALL (mm)=	25.00	25.00		25.00
RUNOFF COEFFICIENT =	0.94	0.09		0.27

(i) HORTONS EQUATION SELECTED FOR PERVIOUS LOSSES:
Fo (mm/hr)= 75.00 K (1/hr)= 4.14
Fc (mm/hr)= 12.50 Cum.Inf. (mm)= 0.00
(ii) TIME STEP (DT) SHOULD BE SMALLER OR EQUAL
THAN THE STORAGE COEFFICIENT.
(iii) PEAK FLOW DOES NOT INCLUDE BASEFLOW IF ANY.

CALIB
STANDHYD (0455)
ID= 1 DT= 5.0 min

Area (ha)= 12.70
Total Imp(%)= 42.00 Dir. Conn.(%)= 21.00

		IMPERVIOUS	PERVIOUS (i)
Surface Area	(ha)=	5.33	7.37
Dep. Storage	(mm)=	1.50	5.00
Average Slope	(%)=	1.71	1.71
Length	(m)=	300.00	40.00
Mannings n	=	0.013	0.300

NOTE: RAINFALL WAS TRANSFORMED TO 5.0 MIN. TIME STEP.

---- TRANSFORMED HYETOGRAPH ----

TIME hrs	RAIN mm/hr	TIME hrs	RAIN mm/hr	TIME hrs	RAIN mm/hr	TIME hrs	RAIN mm/hr
0.083	0.53	1.083	17.57	2.083	2.95	3.08	0.76
0.167	0.53	1.167	17.57	2.167	2.95	3.17	0.76
0.250	0.71	1.250	61.55	2.250	2.19	3.25	0.65
0.333	0.71	1.333	61.55	2.333	2.19	3.33	0.65
0.417	0.99	1.417	24.02	2.417	1.69	3.42	0.57
0.500	0.99	1.500	24.02	2.500	1.69	3.50	0.57
0.583	1.51	1.583	11.16	2.583	1.34	3.58	0.49
0.667	1.51	1.667	11.16	2.667	1.34	3.67	0.49
0.750	2.57	1.750	6.44	2.750	1.09	3.75	0.44
0.833	2.57	1.833	6.44	2.833	1.09	3.83	0.44
0.917	5.31	1.917	4.20	2.917	0.90	3.92	0.38
1.000	5.31	2.000	4.20	3.000	0.90	4.00	0.38

Max.Eff.Inten.(mm/hr)=		61.55	7.05	
over (min)		5.00	30.00	
Storage Coeff. (min)=		5.11 (ii)	28.94 (ii)	
Unit Hyd. Tpeak (min)=		5.00	30.00	
Unit Hyd. peak (cms)=		0.21	0.04	
				TOTALS
PEAK FLOW	(cms)=	0.41	0.07	0.417 (iii)
TIME TO PEAK	(hrs)=	1.33	1.75	1.33
RUNOFF VOLUME	(mm)=	23.50	2.16	6.64
TOTAL RAINFALL	(mm)=	25.00	25.00	25.00
RUNOFF COEFFICIENT	=	0.94	0.09	0.27

(i) HORTONS EQUATION SELECTED FOR PERVIOUS LOSSES:
Fo (mm/hr)= 75.00 K (1/hr)= 4.14
Fc (mm/hr)= 12.50 Cum.Inf. (mm)= 0.00

(ii) TIME STEP (DT) SHOULD BE SMALLER OR EQUAL THAN THE STORAGE COEFFICIENT.

(iii) PEAK FLOW DOES NOT INCLUDE BASEFLOW IF ANY.

ADD HYD (0465)

1 + 2 = 3		AREA (ha)	QPEAK (cms)	TPEAK (hrs)	R.V. (mm)
	ID1= 1 (0455):	12.70	0.417	1.33	6.64
+	ID2= 2 (0460):	36.00	1.117	1.33	6.64
	ID = 3 (0465):	48.70	1.534	1.33	6.64

NOTE: PEAK FLOWS DO NOT INCLUDE BASEFLOWS IF ANY.

CALIB STANDHYD (0410) ID= 1 DT= 5.0 min	Area (ha)= 24.20 Total Imp(%)= 42.00 Dir. Conn.(%)= 21.00

		IMPERVIOUS	PERVIOUS (i)
Surface Area	(ha)=	10.16	14.04
Dep. Storage	(mm)=	1.50	5.00
Average Slope	(%)=	2.00	2.00
Length	(m)=	401.00	40.00
Mannings n	=	0.013	0.300

NOTE: RAINFALL WAS TRANSFORMED TO 5.0 MIN. TIME STEP.

---- TRANSFORMED HYETOGRAPH ----

TIME hrs	RAIN mm/hr	TIME hrs	RAIN mm/hr	TIME hrs	RAIN mm/hr	TIME hrs	RAIN mm/hr
0.083	0.53	1.083	17.57	2.083	2.95	3.08	0.76
0.167	0.53	1.167	17.57	2.167	2.95	3.17	0.76
0.250	0.71	1.250	61.55	2.250	2.19	3.25	0.65
0.333	0.71	1.333	61.55	2.333	2.19	3.33	0.65
0.417	0.99	1.417	24.02	2.417	1.69	3.42	0.57
0.500	0.99	1.500	24.02	2.500	1.69	3.50	0.57
0.583	1.51	1.583	11.16	2.583	1.34	3.58	0.49
0.667	1.51	1.667	11.16	2.667	1.34	3.67	0.49
0.750	2.57	1.750	6.44	2.750	1.09	3.75	0.44
0.833	2.57	1.833	6.44	2.833	1.09	3.83	0.44
0.917	5.31	1.917	4.20	2.917	0.90	3.92	0.38
1.000	5.31	2.000	4.20	3.000	0.90	4.00	0.38

Max.Eff.Inten.	(mm/hr)=	61.55	7.05	
	over (min)	5.00	30.00	
Storage Coeff.	(min)=	5.80 (ii)	28.54 (ii)	
Unit Hyd. Tpeak	(min)=	5.00	30.00	
Unit Hyd. peak	(cms)=	0.20	0.04	
				TOTALS
PEAK FLOW	(cms)=	0.75	0.14	0.770 (iii)
TIME TO PEAK	(hrs)=	1.33	1.75	1.33
RUNOFF VOLUME	(mm)=	23.50	2.16	6.64
TOTAL RAINFALL	(mm)=	25.00	25.00	25.00

```
     RUNOFF COEFFICIENT   =       0.94         0.09          0.27


       (i) HORTONS EQUATION SELECTED FOR PERVIOUS LOSSES:
            Fo   (mm/hr)= 75.00          K  (1/hr)=  4.14
            Fc   (mm/hr)= 12.50     Cum.Inf.   (mm)=  0.00
      (ii) TIME STEP (DT) SHOULD BE SMALLER OR EQUAL
           THAN THE STORAGE COEFFICIENT.
     (iii) PEAK FLOW DOES NOT INCLUDE BASEFLOW IF ANY.

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--------------------
| CALIB            |
| STANDHYD (  0415)|   Area    (ha)=   4.99
|ID= 1 DT= 5.0 min |   Total Imp(%)=  42.00   Dir. Conn.(%)=  21.00
--------------------
                            IMPERVIOUS    PERVIOUS (i)
     Surface Area     (ha)=       2.10         2.89
     Dep. Storage     (mm)=       1.50         5.00
     Average Slope     (%)=       2.86         2.86
     Length            (m)=     185.00        40.00
     Mannings n           =      0.013        0.300

         NOTE:  RAINFALL WAS TRANSFORMED TO   5.0 MIN. TIME STEP.


                              ---- TRANSFORMED HYETOGRAPH ----
               TIME    RAIN |  TIME    RAIN |'  TIME    RAIN |  TIME    RAIN
                hrs   mm/hr |   hrs   mm/hr |'   hrs   mm/hr |   hrs   mm/hr
              0.083    0.53 | 1.083   17.57 | 2.083    2.95 |  3.08    0.76
              0.167    0.53 | 1.167   17.57 | 2.167    2.95 |  3.17    0.76
              0.250    0.71 | 1.250   61.55 | 2.250    2.19 |  3.25    0.65
              0.333    0.71 | 1.333   61.55 | 2.333    2.19 |  3.33    0.65
              0.417    0.99 | 1.417   24.02 | 2.417    1.69 |  3.42    0.57
              0.500    0.99 | 1.500   24.02 | 2.500    1.69 |  3.50    0.57
              0.583    1.51 | 1.583   11.16 | 2.583    1.34 |  3.58    0.49
              0.667    1.51 | 1.667   11.16 | 2.667    1.34 |  3.67    0.49
              0.750    2.57 | 1.750    6.44 | 2.750    1.09 |  3.75    0.44
              0.833    2.57 | 1.833    6.44 | 2.833    1.09 |  3.83    0.44
              0.917    5.31 | 1.917    4.20 | 2.917    0.90 |  3.92    0.38
              1.000    5.31 | 2.000    4.20 | 3.000    0.90 |  4.00    0.38

     Max.Eff.Inten.(mm/hr)=      61.55         8.82
               over (min)        5.00        25.00
     Storage Coeff.  (min)=       3.27 (ii)   21.96 (ii)
     Unit Hyd. Tpeak (min)=       5.00        25.00
     Unit Hyd. peak  (cms)=       0.27         0.05
                                                          *TOTALS*
     PEAK FLOW       (cms)=       0.17         0.04          0.179 (iii)
     TIME TO PEAK    (hrs)=       1.33         1.67           1.33
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```
     RUNOFF VOLUME    (mm)=      23.50         2.16          6.64
     TOTAL RAINFALL   (mm)=      25.00        25.00         25.00
     RUNOFF COEFFICIENT   =       0.94         0.09          0.27

***** WARNING: STORAGE COEFF. IS SMALLER THAN TIME STEP!

       (i) HORTONS EQUATION SELECTED FOR PERVIOUS LOSSES:
            Fo   (mm/hr)= 75.00           K  (1/hr)=  4.14
            Fc   (mm/hr)= 12.50     Cum.Inf.   (mm)=  0.00
      (ii) TIME STEP (DT) SHOULD BE SMALLER OR EQUAL
           THAN THE STORAGE COEFFICIENT.
     (iii) PEAK FLOW DOES NOT INCLUDE BASEFLOW IF ANY.

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--------------------
| ADD HYD  (  0420)|
|   1 +  2 =  3    |         AREA    QPEAK    TPEAK     R.V.
--------------------         (ha)    (cms)    (hrs)     (mm)
       ID1= 1 (  0410):    24.20   0.770     1.33     6.64
     + ID2= 2 (  0415):     4.99   0.179     1.33     6.64
       ================================================
       ID = 3 (  0420):    29.19   0.948     1.33     6.64

     NOTE:  PEAK FLOWS DO NOT INCLUDE BASEFLOWS IF ANY.
--------------------------------------------------------------------------------
--------------------
| DUHYD    (  0425)|
| Inlet Cap.= 1.980|
| #of Inlets=     1|
| Total(cms)=   2.0|      AREA     QPEAK     TPEAK    R.V.
--------------------      (ha)     (cms)     (hrs)    (mm)
     TOTAL HYD.(ID= 1):  29.19      0.95      1.33    6.64
     ================================================
     MAJOR SYS.(ID= 2):   0.00      0.00      0.00    0.00
     MINOR SYS.(ID= 3):  29.19      0.95      1.33    6.64

     NOTE:  PEAK FLOWS DO NOT INCLUDE BASEFLOWS IF ANY.

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--------------------
| ADD HYD  (  0470)|
|   1 +  2 =  3    |         AREA    QPEAK    TPEAK     R.V.
--------------------         (ha)    (cms)    (hrs)     (mm)
*** W A R N I N G :  HYDROGRAPH   0425 <ID= 1> IS DRY.
*** W A R N I N G :  HYDROGRAPH   0470 = HYDROGRAPH 0465
       ID1= 1 (  0425):     0.00   0.000     0.00     0.00
     + ID2= 2 (  0465):    48.70   1.534     1.33     6.64
       ================================================
```

```
        ID = 3 (  0470):    48.70   1.534     1.33     6.64

     NOTE:  PEAK FLOWS DO NOT INCLUDE BASEFLOWS IF ANY.
------------------------------------------------------------------------------
--------------------
| ROUTE CHN(  0475)|
| IN= 2---> OUT= 1 |     Routing time step (min)'=  5.00
--------------------
               <------ DATA FOR SECTION (   1.1) ------>
               Distance      Elevation       Manning
                 100.00        324.60        0.0500
                 115.00        321.60        0.0500
                 120.00        320.80    0.0500 /0.0300  Main Channel
                 122.00        320.80    0.0300 /0.0500  Main Channel
                 138.00        321.60        0.0500
                 148.00        322.30        0.0500
                 154.00        323.10        0.0500
                 164.00        324.60        0.0500

      <---------------------- TRAVEL TIME TABLE ---------------------->
       DEPTH    ELEV      VOLUME    FLOW RATE    VELOCITY   TRAV.TIME
        (m)      (m)     (cu.m.)      (cms)        (m/s)      (min)
       0.20   321.00    .398E+03       0.8          0.84       8.53
       0.40   321.20    .125E+04       3.3          1.13       6.33
       0.60   321.40    .255E+04       8.1          1.36       5.27
       0.80   321.60    .430E+04      15.6          1.56       4.59
       1.00   321.80    .644E+04      26.8          1.79       4.01
       1.20   322.00    .892E+04      41.2          1.99       3.61
       1.40   322.20    .117E+05      59.3          2.17       3.30
       1.60   322.40    .148E+05      81.9          2.37       3.02
       1.80   322.60    .182E+05     109.1          2.58       2.78
       2.00   322.80    .218E+05     140.2          2.77       2.59
       2.20   323.00    .256E+05     175.3          2.95       2.43
       2.40   323.20    .296E+05     214.7          3.12       2.29
       2.60   323.40    .338E+05     258.6          3.29       2.18
       2.80   323.60    .382E+05     306.7          3.46       2.07
       3.00   323.80    .428E+05     359.1          3.61       1.98
       3.20   324.00    .476E+05     416.0          3.76       1.91
       3.40   324.20    .526E+05     477.5          3.91       1.83
       3.60   324.40    .578E+05     543.5          4.05       1.77
       3.80   324.60    .632E+05     614.3          4.18       1.71

                                    <---- hydrograph ---->   <-pipe / channel->
                              AREA    QPEAK   TPEAK   R.V.   MAX DEPTH  MAX VEL
                              (ha)    (cms)   (hrs)   (mm)      (m)      (m/s)
   INFLOW : ID= 2 (  0470)   48.70     1.53    1.33   6.64      0.26      0.91
   OUTFLOW: ID= 1 (  0475)   48.70     1.10    1.42   6.64      0.23      0.87
```

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--------------------
| CALIB            |
| STANDHYD (  0105)|   Area    (ha)=  51.32
|ID= 1 DT= 5.0 min |   Total Imp(%)=  42.00   Dir. Conn.(%)=  21.00
--------------------
                             IMPERVIOUS    PERVIOUS (i)
     Surface Area     (ha)=      21.55        29.77
     Dep. Storage     (mm)=       1.50         5.00
     Average Slope     (%)=       2.00         2.00
     Length            (m)=     550.00        40.00
     Mannings n           =      0.013        0.300

         NOTE:  RAINFALL WAS TRANSFORMED TO   5.0 MIN. TIME STEP.


                            ---- TRANSFORMED HYETOGRAPH ----
               TIME    RAIN |  TIME    RAIN |'  TIME    RAIN |  TIME    RAIN
                hrs   mm/hr |   hrs   mm/hr |'   hrs   mm/hr |   hrs   mm/hr
              0.083    0.53 | 1.083   17.57 | 2.083    2.95 |  3.08    0.76
              0.167    0.53 | 1.167   17.57 | 2.167    2.95 |  3.17    0.76
              0.250    0.71 | 1.250   61.55 | 2.250    2.19 |  3.25    0.65
              0.333    0.71 | 1.333   61.55 | 2.333    2.19 |  3.33    0.65
              0.417    0.99 | 1.417   24.02 | 2.417    1.69 |  3.42    0.57
              0.500    0.99 | 1.500   24.02 | 2.500    1.69 |  3.50    0.57
              0.583    1.51 | 1.583   11.16 | 2.583    1.34 |  3.58    0.49
              0.667    1.51 | 1.667   11.16 | 2.667    1.34 |  3.67    0.49
              0.750    2.57 | 1.750    6.44 | 2.750    1.09 |  3.75    0.44
              0.833    2.57 | 1.833    6.44 | 2.833    1.09 |  3.83    0.44
              0.917    5.31 | 1.917    4.20 | 2.917    0.90 |  3.92    0.38
              1.000    5.31 | 2.000    4.20 | 3.000    0.90 |  4.00    0.38

     Max.Eff.Inten.(mm/hr)=      61.55         7.05
               over (min)        5.00        30.00
     Storage Coeff.  (min)=      7.01 (ii)   29.75 (ii)
     Unit Hyd. Tpeak (min)=      5.00        30.00
     Unit Hyd. peak  (cms)=      0.17         0.04
                                                        *TOTALS*
     PEAK FLOW       (cms)=      1.50         0.30         1.538 (iii)
     TIME TO PEAK    (hrs)=      1.33         1.75          1.33
     RUNOFF VOLUME    (mm)=     23.50         2.16          6.64
     TOTAL RAINFALL   (mm)=     25.00        25.00         25.00
     RUNOFF COEFFICIENT   =      0.94         0.09          0.27


       (i) HORTONS EQUATION SELECTED FOR PERVIOUS LOSSES:
            Fo   (mm/hr)= 75.00          K  (1/hr)=  4.14
            Fc   (mm/hr)= 12.50     Cum.Inf.   (mm)=  0.00
      (ii) TIME STEP (DT) SHOULD BE SMALLER OR EQUAL
           THAN THE STORAGE COEFFICIENT.
```

(iii) PEAK FLOW DOES NOT INCLUDE BASEFLOW IF ANY.

RESERVOIR(0106) / IN= 2---> OUT= 1 / DT= 5.0 min	OVERFLOW IS OFF			
	OUTFLOW (cms)	STORAGE (ha.m.)	OUTFLOW (cms)	STORAGE (ha.m.)
	0.0000	0.0000	0.5000	0.4000
	0.0100	0.0100	6.6000	0.8000
	0.0260	0.2300	0.0000	0.0000

	AREA (ha)	QPEAK (cms)	TPEAK (hrs)	R.V. (mm)
INFLOW : ID= 2 (0105)	51.320	1.538	1.33	6.64
OUTFLOW: ID= 1 (0106)	51.320	0.155	2.42	6.63

PEAK FLOW REDUCTION [Qout/Qin](%)= 10.08
TIME SHIFT OF PEAK FLOW (min)= 65.00
MAXIMUM STORAGE USED (ha.m.)= 0.2763

CALIB STANDHYD (0110) / ID= 1 DT= 5.0 min	Area (ha)= 19.00		
	Total Imp(%)= 42.00	Dir. Conn.(%)= 21.00	
	IMPERVIOUS	PERVIOUS (i)	
Surface Area (ha)=	7.98	11.02	
Dep. Storage (mm)=	1.50	5.00	
Average Slope (%)=	2.00	2.00	
Length (m)=	365.00	40.00	
Mannings n =	0.013	0.300	

NOTE: RAINFALL WAS TRANSFORMED TO 5.0 MIN. TIME STEP.

---- TRANSFORMED HYETOGRAPH ----

TIME hrs	RAIN mm/hr	TIME hrs	RAIN mm/hr	TIME hrs	RAIN mm/hr	TIME hrs	RAIN mm/hr
0.083	0.53	1.083	17.57	2.083	2.95	3.08	0.76
0.167	0.53	1.167	17.57	2.167	2.95	3.17	0.76
0.250	0.71	1.250	61.55	2.250	2.19	3.25	0.65
0.333	0.71	1.333	61.55	2.333	2.19	3.33	0.65
0.417	0.99	1.417	24.02	2.417	1.69	3.42	0.57
0.500	0.99	1.500	24.02	2.500	1.69	3.50	0.57
0.583	1.51	1.583	11.16	2.583	1.34	3.58	0.49
0.667	1.51	1.667	11.16	2.667	1.34	3.67	0.49
0.750	2.57	1.750	6.44	2.750	1.09	3.75	0.44
0.833	2.57	1.833	6.44	2.833	1.09	3.83	0.44

```
              0.917    5.31 | 1.917    4.20 | 2.917    0.90 |  3.92    0.38
              1.000    5.31 | 2.000    4.20 | 3.000    0.90 |  4.00    0.38

    Max.Eff.Inten.(mm/hr)=      61.55         7.05
              over (min)         5.00        30.00
    Storage Coeff.  (min)=       5.48 (ii)   28.22 (ii)
    Unit Hyd. Tpeak (min)=       5.00        30.00
    Unit Hyd. peak  (cms)=       0.20         0.04
                                                        *TOTALS*
    PEAK FLOW       (cms)=       0.60         0.11          0.614 (iii)
    TIME TO PEAK    (hrs)=       1.33         1.75           1.33
    RUNOFF VOLUME    (mm)=      23.50         2.16           6.64
    TOTAL RAINFALL   (mm)=      25.00        25.00          25.00
    RUNOFF COEFFICIENT   =       0.94         0.09           0.27


      (i) HORTONS EQUATION SELECTED FOR PERVIOUS LOSSES:
           Fo   (mm/hr)= 75.00          K  (1/hr)=  4.14
           Fc   (mm/hr)= 12.50     Cum.Inf.   (mm)=  0.00
     (ii) TIME STEP (DT) SHOULD BE SMALLER OR EQUAL
          THAN THE STORAGE COEFFICIENT.
    (iii) PEAK FLOW DOES NOT INCLUDE BASEFLOW IF ANY.

--------------------------------------------------------------------------------
--------------------
| RESERVOIR(  0111)|     OVERFLOW IS OFF
| IN= 2---> OUT= 1 |
| DT=  5.0 min     |     OUTFLOW    STORAGE   |  OUTFLOW    STORAGE
--------------------      (cms)     (ha.m.)   |   (cms)     (ha.m.)
                          0.0000     0.0000   |   1.0000      1.0000
                          0.0100     0.0100   |  20.0000      1.1000
                          0.0120     0.1000   |   0.0000      0.0000

                                 AREA     QPEAK     TPEAK       R.V.
                                 (ha)     (cms)     (hrs)       (mm)
   INFLOW : ID= 2 (  0110)     19.000      0.614      1.33       6.64
   OUTFLOW: ID= 1 (  0111)     19.000      0.024      2.92       6.63

                  PEAK   FLOW   REDUCTION [Qout/Qin](%)=  3.93
                  TIME SHIFT OF PEAK FLOW         (min)= 95.00
                  MAXIMUM  STORAGE   USED       (ha.m.)=  0.1111

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--------------------
| CALIB            |
| STANDHYD (  0102)|   Area    (ha)=  14.32
|ID= 1 DT= 5.0 min |   Total Imp(%)=  42.00   Dir. Conn.(%)=  21.00
--------------------
                               IMPERVIOUS    PERVIOUS (i)
     Surface Area     (ha)=       6.01         8.31
```

Dep. Storage	(mm)=	1.50	5.00
Average Slope	(%)=	2.00	2.00
Length	(m)=	287.00	40.00
Mannings n	=	0.013	0.300

NOTE: RAINFALL WAS TRANSFORMED TO 5.0 MIN. TIME STEP.

---- TRANSFORMED HYETOGRAPH ----

TIME hrs	RAIN mm/hr	TIME hrs	RAIN mm/hr	TIME hrs	RAIN mm/hr	TIME hrs	RAIN mm/hr
0.083	0.53	1.083	17.57	2.083	2.95	3.08	0.76
0.167	0.53	1.167	17.57	2.167	2.95	3.17	0.76
0.250	0.71	1.250	61.55	2.250	2.19	3.25	0.65
0.333	0.71	1.333	61.55	2.333	2.19	3.33	0.65
0.417	0.99	1.417	24.02	2.417	1.69	3.42	0.57
0.500	0.99	1.500	24.02	2.500	1.69	3.50	0.57
0.583	1.51	1.583	11.16	2.583	1.34	3.58	0.49
0.667	1.51	1.667	11.16	2.667	1.34	3.67	0.49
0.750	2.57	1.750	6.44	2.750	1.09	3.75	0.44
0.833	2.57	1.833	6.44	2.833	1.09	3.83	0.44
0.917	5.31	1.917	4.20	2.917	0.90	3.92	0.38
1.000	5.31	2.000	4.20	3.000	0.90	4.00	0.38

Max.Eff.Inten.(mm/hr)=	61.55	7.05		
over (min)	5.00	30.00		
Storage Coeff. (min)=	4.74 (ii)	27.48 (ii)		
Unit Hyd. Tpeak (min)=	5.00	30.00		
Unit Hyd. peak (cms)=	0.22	0.04		
				TOTALS
PEAK FLOW (cms)=	0.47	0.09		0.479 (iii)
TIME TO PEAK (hrs)=	1.33	1.75		1.33
RUNOFF VOLUME (mm)=	23.50	2.16		6.64
TOTAL RAINFALL (mm)=	25.00	25.00		25.00
RUNOFF COEFFICIENT =	0.94	0.09		0.27

***** WARNING: STORAGE COEFF. IS SMALLER THAN TIME STEP!

(i) HORTONS EQUATION SELECTED FOR PERVIOUS LOSSES:
Fo (mm/hr)= 75.00 K (1/hr)= 4.14
Fc (mm/hr)= 12.50 Cum.Inf. (mm)= 0.00

(ii) TIME STEP (DT) SHOULD BE SMALLER OR EQUAL
THAN THE STORAGE COEFFICIENT.

(iii) PEAK FLOW DOES NOT INCLUDE BASEFLOW IF ANY.

CALIB	
STANDHYD (0101)	Area (ha)= 16.32
ID= 1 DT= 5.0 min	Total Imp(%)= 42.00 Dir. Conn.(%)= 21.00

		IMPERVIOUS	PERVIOUS (i)
Surface Area	(ha)=	6.85	9.47
Dep. Storage	(mm)=	1.50	5.00
Average Slope	(%)=	2.00	2.00
Length	(m)=	309.00	40.00
Mannings n	=	0.013	0.300

NOTE: RAINFALL WAS TRANSFORMED TO 5.0 MIN. TIME STEP.

---- TRANSFORMED HYETOGRAPH ----

TIME hrs	RAIN mm/hr	TIME hrs	RAIN mm/hr	TIME hrs	RAIN mm/hr	TIME hrs	RAIN mm/hr
0.083	0.53	1.083	17.57	2.083	2.95	3.08	0.76
0.167	0.53	1.167	17.57	2.167	2.95	3.17	0.76
0.250	0.71	1.250	61.55	2.250	2.19	3.25	0.65
0.333	0.71	1.333	61.55	2.333	2.19	3.33	0.65
0.417	0.99	1.417	24.02	2.417	1.69	3.42	0.57
0.500	0.99	1.500	24.02	2.500	1.69	3.50	0.57
0.583	1.51	1.583	11.16	2.583	1.34	3.58	0.49
0.667	1.51	1.667	11.16	2.667	1.34	3.67	0.49
0.750	2.57	1.750	6.44	2.750	1.09	3.75	0.44
0.833	2.57	1.833	6.44	2.833	1.09	3.83	0.44
0.917	5.31	1.917	4.20	2.917	0.90	3.92	0.38
1.000	5.31	2.000	4.20	3.000	0.90	4.00	0.38

Max.Eff.Inten.	(mm/hr)=	61.55	7.05	
over	(min)	5.00	30.00	
Storage Coeff.	(min)=	4.96 (ii)	27.70 (ii)	
Unit Hyd. Tpeak	(min)=	5.00	30.00	
Unit Hyd. peak	(cms)=	0.22	0.04	
				TOTALS
PEAK FLOW	(cms)=	0.53	0.10	0.540 (iii)
TIME TO PEAK	(hrs)=	1.33	1.75	1.33
RUNOFF VOLUME	(mm)=	23.50	2.16	6.64
TOTAL RAINFALL	(mm)=	25.00	25.00	25.00
RUNOFF COEFFICIENT	=	0.94	0.09	0.27

***** WARNING: STORAGE COEFF. IS SMALLER THAN TIME STEP!

(i) HORTONS EQUATION SELECTED FOR PERVIOUS LOSSES:
Fo (mm/hr)= 75.00 K (1/hr)= 4.14
Fc (mm/hr)= 12.50 Cum.Inf. (mm)= 0.00

(ii) TIME STEP (DT) SHOULD BE SMALLER OR EQUAL
THAN THE STORAGE COEFFICIENT.

(iii) PEAK FLOW DOES NOT INCLUDE BASEFLOW IF ANY.

```
--------------------
| ADD HYD  (  0103)|
|   1 +  2 =  3    |          AREA    QPEAK    TPEAK     R.V.
--------------------          (ha)    (cms)    (hrs)     (mm)
        ID1= 1 (  0101):    16.32   0.540     1.33     6.64
      + ID2= 2 (  0102):    14.32   0.479     1.33     6.64
        ================================================
        ID = 3 (  0103):    30.64   1.019     1.33     6.64

     NOTE:  PEAK FLOWS DO NOT INCLUDE BASEFLOWS IF ANY.
--------------------------------------------------------------------------------
--------------------
| RESERVOIR(  0104)|     OVERFLOW IS OFF
| IN= 2---> OUT= 1 |
| DT=  5.0 min     |     OUTFLOW    STORAGE   |  OUTFLOW    STORAGE
--------------------      (cms)     (ha.m.)   |   (cms)     (ha.m.)
                          0.0000     0.0000   |   1.0000      0.5000
                          0.0100     0.0100   |  10.0000      0.6000
                          0.0150     0.1332   |   0.0000      0.0000

                                    AREA     QPEAK     TPEAK       R.V.
                                    (ha)     (cms)     (hrs)       (mm)
   INFLOW : ID= 2 (  0103)     30.640      1.019      1.33       6.64
   OUTFLOW: ID= 1 (  0104)     30.640      0.097      2.33       6.63

                  PEAK   FLOW   REDUCTION [Qout/Qin](%)=  9.52
                  TIME SHIFT OF PEAK FLOW         (min)= 60.00
                  MAXIMUM  STORAGE   USED       (ha.m.)=  0.1639

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

--------------------
| ADD HYD  (  0114)|
|   1 +  2 =  3    |          AREA    QPEAK    TPEAK     R.V.
--------------------          (ha)    (cms)    (hrs)     (mm)
        ID1= 1 (  0104):    30.64   0.097     2.33     6.63
      + ID2= 2 (  0111):    19.00   0.024     2.92     6.63
        ================================================
        ID = 3 (  0114):    49.64   0.118     2.42     6.63

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

--------------------
| ADD HYD  (  0115)|
|   1 +  2 =  3    |          AREA    QPEAK    TPEAK     R.V.
--------------------          (ha)    (cms)    (hrs)     (mm)
        ID1= 1 (  0106):    51.32   0.155     2.42     6.63
      + ID2= 2 (  0114):    49.64   0.118     2.42     6.63
        ================================================
```

```
        ID = 3 (  0115):   100.96   0.273     2.42     6.63

     NOTE:  PEAK FLOWS DO NOT INCLUDE BASEFLOWS IF ANY.
--------------------------------------------------------------------------------
--------------------
| CALIB            |
| STANDHYD (  0395)|   Area    (ha)=  51.20
|ID= 1 DT= 5.0 min |   Total Imp(%)=  10.00   Dir. Conn.(%)=   5.00
--------------------
                             IMPERVIOUS    PERVIOUS (i)
     Surface Area     (ha)=       5.12        46.08
     Dep. Storage     (mm)=       1.50         5.00
     Average Slope     (%)=       2.00         2.00
     Length            (m)=     900.00        40.00
     Mannings n            =      0.013        0.300

         NOTE:  RAINFALL WAS TRANSFORMED TO   5.0 MIN. TIME STEP.


                              ---- TRANSFORMED HYETOGRAPH ----
               TIME    RAIN |  TIME    RAIN |'  TIME    RAIN |  TIME    RAIN
                hrs   mm/hr |   hrs   mm/hr |'   hrs   mm/hr |   hrs   mm/hr
              0.083    0.53 | 1.083   17.57 | 2.083    2.95 |  3.08    0.76
              0.167    0.53 | 1.167   17.57 | 2.167    2.95 |  3.17    0.76
              0.250    0.71 | 1.250   61.55 | 2.250    2.19 |  3.25    0.65
              0.333    0.71 | 1.333   61.55 | 2.333    2.19 |  3.33    0.65
              0.417    0.99 | 1.417   24.02 | 2.417    1.69 |  3.42    0.57
              0.500    0.99 | 1.500   24.02 | 2.500    1.69 |  3.50    0.57
              0.583    1.51 | 1.583   11.16 | 2.583    1.34 |  3.58    0.49
              0.667    1.51 | 1.667   11.16 | 2.667    1.34 |  3.67    0.49
              0.750    2.57 | 1.750    6.44 | 2.750    1.09 |  3.75    0.44
              0.833    2.57 | 1.833    6.44 | 2.833    1.09 |  3.83    0.44
              0.917    5.31 | 1.917    4.20 | 2.917    0.90 |  3.92    0.38
              1.000    5.31 | 2.000    4.20 | 3.000    0.90 |  4.00    0.38

     Max.Eff.Inten.(mm/hr)=      61.55         0.00
               over (min)        10.00       230.00
     Storage Coeff.  (min)=       9.42 (ii)  225.31 (ii)
     Unit Hyd. Tpeak (min)=      10.00       230.00
     Unit Hyd. peak  (cms)=       0.12         0.00
                                                        *TOTALS*
     PEAK FLOW       (cms)=       0.29         0.00          0.292 (iii)
     TIME TO PEAK    (hrs)=       1.42         0.00           1.42
     RUNOFF VOLUME    (mm)=      23.50         0.00           1.17
     TOTAL RAINFALL   (mm)=      25.00        25.00          25.00
     RUNOFF COEFFICIENT   =       0.94         0.00           0.05

***** WARNING:FOR AREAS WITH IMPERVIOUS RATIOS BELOW 20%
              YOU SHOULD CONSIDER SPLITTING THE AREA.
***** WARNING: THE PERVIOUS AREA HAS NO FLOW .
```

(i) HORTONS EQUATION SELECTED FOR PERVIOUS LOSSES:
Fo (mm/hr)= 75.00 K (1/hr)= 4.14
Fc (mm/hr)= 12.50 Cum.Inf. (mm)= 0.00
(ii) TIME STEP (DT) SHOULD BE SMALLER OR EQUAL
THAN THE STORAGE COEFFICIENT.
(iii) PEAK FLOW DOES NOT INCLUDE BASEFLOW IF ANY.

CALIB	
STANDHYD (0365)	Area (ha)= 117.50
ID= 1 DT= 5.0 min	Total Imp(%)= 42.00 Dir. Conn.(%)= 21.00

		IMPERVIOUS	PERVIOUS (i)
Surface Area	(ha)=	49.35	68.15
Dep. Storage	(mm)=	1.50	5.00
Average Slope	(%)=	2.00	2.00
Length	(m)=	885.00	40.00
Mannings n	=	0.013	0.300

NOTE: RAINFALL WAS TRANSFORMED TO 5.0 MIN. TIME STEP.

---- TRANSFORMED HYETOGRAPH ----

TIME hrs	RAIN mm/hr	TIME hrs	RAIN mm/hr	TIME hrs	RAIN mm/hr	TIME hrs	RAIN mm/hr
0.083	0.53	1.083	17.57	2.083	2.95	3.08	0.76
0.167	0.53	1.167	17.57	2.167	2.95	3.17	0.76
0.250	0.71	1.250	61.55	2.250	2.19	3.25	0.65
0.333	0.71	1.333	61.55	2.333	2.19	3.33	0.65
0.417	0.99	1.417	24.02	2.417	1.69	3.42	0.57
0.500	0.99	1.500	24.02	2.500	1.69	3.50	0.57
0.583	1.51	1.583	11.16	2.583	1.34	3.58	0.49
0.667	1.51	1.667	11.16	2.667	1.34	3.67	0.49
0.750	2.57	1.750	6.44	2.750	1.09	3.75	0.44
0.833	2.57	1.833	6.44	2.833	1.09	3.83	0.44
0.917	5.31	1.917	4.20	2.917	0.90	3.92	0.38
1.000	5.31	2.000	4.20	3.000	0.90	4.00	0.38

Max.Eff.Inten.	(mm/hr)=	61.55	7.05	
	over (min)	10.00	35.00	
Storage Coeff.	(min)=	9.32 (ii)	32.06 (ii)	
Unit Hyd. Tpeak	(min)=	10.00	35.00	
Unit Hyd. peak	(cms)=	0.12	0.03	
				TOTALS
PEAK FLOW	(cms)=	2.82	0.62	2.960 (iii)
TIME TO PEAK	(hrs)=	1.42	1.83	1.42
RUNOFF VOLUME	(mm)=	23.50	2.16	6.64
TOTAL RAINFALL	(mm)=	25.00	25.00	25.00

```
     RUNOFF COEFFICIENT   =       0.94         0.09           0.27


       (i) HORTONS EQUATION SELECTED FOR PERVIOUS LOSSES:
            Fo   (mm/hr)= 75.00           K  (1/hr)=  4.14
            Fc   (mm/hr)= 12.50     Cum.Inf.   (mm)=  0.00
      (ii) TIME STEP (DT) SHOULD BE SMALLER OR EQUAL
           THAN THE STORAGE COEFFICIENT.
     (iii) PEAK FLOW DOES NOT INCLUDE BASEFLOW IF ANY.

--------------------------------------------------------------------------------
--------------------
| CALIB            |
| STANDHYD (  0360)|   Area    (ha)=  30.00
|ID= 1 DT= 5.0 min |   Total Imp(%)=  37.00   Dir. Conn.(%)=  19.00
--------------------
                              IMPERVIOUS    PERVIOUS (i)
     Surface Area     (ha)=      11.10        18.90
     Dep. Storage     (mm)=       1.50         5.00
     Average Slope     (%)=       2.00         2.00
     Length            (m)=     447.00        40.00
     Mannings n           =      0.013        0.300

         NOTE:  RAINFALL WAS TRANSFORMED TO   5.0 MIN. TIME STEP.


                              ---- TRANSFORMED HYETOGRAPH ----
               TIME    RAIN |  TIME    RAIN |'  TIME    RAIN |  TIME    RAIN
                hrs   mm/hr |   hrs   mm/hr |'   hrs   mm/hr |   hrs   mm/hr
              0.083    0.53 | 1.083   17.57 | 2.083    2.95 |  3.08    0.76
              0.167    0.53 | 1.167   17.57 | 2.167    2.95 |  3.17    0.76
              0.250    0.71 | 1.250   61.55 | 2.250    2.19 |  3.25    0.65
              0.333    0.71 | 1.333   61.55 | 2.333    2.19 |  3.33    0.65
              0.417    0.99 | 1.417   24.02 | 2.417    1.69 |  3.42    0.57
              0.500    0.99 | 1.500   24.02 | 2.500    1.69 |  3.50    0.57
              0.583    1.51 | 1.583   11.16 | 2.583    1.34 |  3.58    0.49
              0.667    1.51 | 1.667   11.16 | 2.667    1.34 |  3.67    0.49
              0.750    2.57 | 1.750    6.44 | 2.750    1.09 |  3.75    0.44
              0.833    2.57 | 1.833    6.44 | 2.833    1.09 |  3.83    0.44
              0.917    5.31 | 1.917    4.20 | 2.917    0.90 |  3.92    0.38
              1.000    5.31 | 2.000    4.20 | 3.000    0.90 |  4.00    0.38

     Max.Eff.Inten.(mm/hr)=      61.55         2.81
               over (min)        5.00        40.00
     Storage Coeff.  (min)=      6.19 (ii)   39.07 (ii)
     Unit Hyd. Tpeak (min)=      5.00        40.00
     Unit Hyd. peak  (cms)=      0.19         0.03
                                                        *TOTALS*
     PEAK FLOW       (cms)=      0.83         0.08          0.834 (iii)
     TIME TO PEAK    (hrs)=      1.33         1.92           1.33
```

```
     RUNOFF VOLUME    (mm)=      23.50         1.27          5.50
     TOTAL RAINFALL   (mm)=      25.00        25.00         25.00
     RUNOFF COEFFICIENT   =       0.94         0.05          0.22

***** WARNING:FOR AREAS WITH IMPERVIOUS RATIOS BELOW 20%
              YOU SHOULD CONSIDER SPLITTING THE AREA.

       (i) HORTONS EQUATION SELECTED FOR PERVIOUS LOSSES:
            Fo   (mm/hr)= 75.00           K  (1/hr)=  4.14
            Fc   (mm/hr)= 12.50     Cum.Inf.   (mm)=  0.00
      (ii) TIME STEP (DT) SHOULD BE SMALLER OR EQUAL
           THAN THE STORAGE COEFFICIENT.
     (iii) PEAK FLOW DOES NOT INCLUDE BASEFLOW IF ANY.

--------------------------------------------------------------------------------
--------------------
| ROUTE CHN(  0362)|
| IN= 2---> OUT= 1 |     Routing time step (min)'=  5.00
--------------------
               <------ DATA FOR SECTION (   1.1) ------>
               Distance      Elevation       Manning
                   0.00          0.40        0.0300
                   5.50          0.15    0.0300 /0.0150  Main Channel
                   5.51          0.00        0.0150      Main Channel
                  10.00          0.09        0.0150      Main Channel
                  14.49          0.00        0.0150      Main Channel
                  14.50          0.15    0.0150 /0.0300  Main Channel
                  20.00          0.40        0.0300

      <--------------------- TRAVEL TIME TABLE ---------------------->
       DEPTH    ELEV      VOLUME    FLOW RATE    VELOCITY   TRAV.TIME
        (m)      (m)     (cu.m.)      (cms)        (m/s)      (min)
       0.02     0.02    .176E+02       0.0          0.21      80.52
       0.04     0.04    .702E+02       0.0          0.33      50.72
       0.06     0.06    .158E+03       0.1          0.43      38.71
       0.08     0.08    .281E+03       0.1          0.52      31.95
       0.09     0.09    .438E+03       0.3          0.62      26.84
       0.11     0.11    .607E+03       0.5          0.77      21.66
       0.13     0.13    .776E+03       0.7          0.90      18.45
       0.15     0.15    .944E+03       1.0          1.03      16.22
       0.17     0.17    .116E+04       1.3          1.16      14.36
       0.20     0.20    .140E+04       1.8          1.27      13.13
       0.22     0.22    .166E+04       2.3          1.36      12.24
       0.24     0.24    .194E+04       2.8          1.44      11.58
       0.26     0.26    .225E+04       3.4          1.51      11.05
       0.29     0.29    .258E+04       4.0          1.57      10.63
       0.31     0.31    .293E+04       4.8          1.62      10.27
       0.33     0.33    .331E+04       5.5          1.67       9.97
       0.35     0.35    .371E+04       6.4          1.72       9.71
       0.38     0.38    .413E+04       7.3          1.76       9.48
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      0.40     0.40    .457E+04       8.2          1.80       9.28

                                    <---- hydrograph ---->   <-pipe / channel->
                             AREA    QPEAK   TPEAK   R.V.   MAX DEPTH  MAX VEL
                             (ha)    (cms)   (hrs)   (mm)      (m)      (m/s)
   INFLOW : ID= 2 (  0360)   30.00     0.83    1.33   5.50      0.14      0.96
   OUTFLOW: ID= 1 (  0362)   30.00     0.41    1.50   5.48      0.11      0.71



--------------------------------------------------------------------------------
--------------------
| CALIB            |
| STANDHYD (  0350)|   Area    (ha)=  16.30
|ID= 1 DT= 5.0 min |   Total Imp(%)=  42.00   Dir. Conn.(%)=  21.00
--------------------
                             IMPERVIOUS    PERVIOUS (i)
     Surface Area     (ha)=       6.85         9.45
     Dep. Storage     (mm)=       1.50         5.00
     Average Slope     (%)=       1.00         1.00
     Length            (m)=     330.00        40.00
     Mannings n             =     0.013        0.300

         NOTE:  RAINFALL WAS TRANSFORMED TO   5.0 MIN. TIME STEP.


                              ---- TRANSFORMED HYETOGRAPH ----
               TIME    RAIN |  TIME    RAIN |'  TIME    RAIN |  TIME    RAIN
                hrs   mm/hr |   hrs   mm/hr |'   hrs   mm/hr |   hrs   mm/hr
              0.083    0.53 | 1.083   17.57 | 2.083    2.95 |  3.08    0.76
              0.167    0.53 | 1.167   17.57 | 2.167    2.95 |  3.17    0.76
              0.250    0.71 | 1.250   61.55 | 2.250    2.19 |  3.25    0.65
              0.333    0.71 | 1.333   61.55 | 2.333    2.19 |  3.33    0.65
              0.417    0.99 | 1.417   24.02 | 2.417    1.69 |  3.42    0.57
              0.500    0.99 | 1.500   24.02 | 2.500    1.69 |  3.50    0.57
              0.583    1.51 | 1.583   11.16 | 2.583    1.34 |  3.58    0.49
              0.667    1.51 | 1.667   11.16 | 2.667    1.34 |  3.67    0.49
              0.750    2.57 | 1.750    6.44 | 2.750    1.09 |  3.75    0.44
              0.833    2.57 | 1.833    6.44 | 2.833    1.09 |  3.83    0.44
              0.917    5.31 | 1.917    4.20 | 2.917    0.90 |  3.92    0.38
              1.000    5.31 | 2.000    4.20 | 3.000    0.90 |  4.00    0.38

     Max.Eff.Inten.(mm/hr)=      61.55         5.04
               over (min)         5.00        40.00
     Storage Coeff.  (min)=       6.35 (ii)   38.38 (ii)
     Unit Hyd. Tpeak (min)=       5.00        40.00
     Unit Hyd. peak  (cms)=       0.19         0.03
                                                          *TOTALS*
     PEAK FLOW       (cms)=       0.49         0.07          0.499 (iii)
     TIME TO PEAK    (hrs)=       1.33         1.92           1.33
```

```
     RUNOFF VOLUME    (mm)=      23.50         2.16          6.64
     TOTAL RAINFALL   (mm)=      25.00        25.00         25.00
     RUNOFF COEFFICIENT   =       0.94         0.09          0.27


       (i) HORTONS EQUATION SELECTED FOR PERVIOUS LOSSES:
            Fo   (mm/hr)= 75.00           K  (1/hr)=  4.14
            Fc   (mm/hr)= 12.50     Cum.Inf.   (mm)=  0.00
      (ii) TIME STEP (DT) SHOULD BE SMALLER OR EQUAL
           THAN THE STORAGE COEFFICIENT.
     (iii) PEAK FLOW DOES NOT INCLUDE BASEFLOW IF ANY.

--------------------------------------------------------------------------------
--------------------
| ROUTE CHN(  0353)|
| IN= 2---> OUT= 1 |     Routing time step (min)'=  5.00
--------------------
               <------ DATA FOR SECTION (   1.1) ------>
               Distance      Elevation       Manning
                   0.00          0.26        0.0300
                   5.50          0.15    0.0300 /0.0150  Main Channel
                   5.51          0.00        0.0150      Main Channel
                  10.00          0.09        0.0150      Main Channel
                  14.49          0.00        0.0150      Main Channel
                  14.50          0.15    0.0150 /0.0300  Main Channel
                  20.00          0.26        0.0300

      <---------------------- TRAVEL TIME TABLE ---------------------->
       DEPTH    ELEV      VOLUME    FLOW RATE    VELOCITY   TRAV.TIME
        (m)      (m)     (cu.m.)      (cms)        (m/s)      (min)
       0.01     0.01    .929E+01       0.0          0.17      99.56
       0.03     0.03    .372E+02       0.0          0.27      62.72
       0.04     0.04    .836E+02       0.0          0.35      47.86
       0.05     0.05    .149E+03       0.1          0.42      39.51
       0.07     0.07    .232E+03       0.1          0.49      34.05
       0.08     0.08    .334E+03       0.2          0.55      30.15
       0.10     0.10    .454E+03       0.3          0.64      26.24
       0.11     0.11    .576E+03       0.4          0.74      22.41
       0.12     0.12    .699E+03       0.6          0.84      19.75
       0.14     0.14    .822E+03       0.8          0.94      17.76
       0.15     0.15    .944E+03       1.0          1.03      16.22
       0.16     0.16    .108E+04       1.2          1.11      15.07
       0.18     0.18    .123E+04       1.4          1.17      14.28
       0.19     0.19    .140E+04       1.7          1.21      13.72
       0.20     0.20    .159E+04       2.0          1.25      13.31
       0.22     0.22    .180E+04       2.3          1.28      13.01
       0.23     0.23    .203E+04       2.6          1.31      12.76
       0.25     0.25    .227E+04       3.0          1.33      12.57
       0.26     0.26    .254E+04       3.4          1.34      12.41
```

		<---- hydrograph ---->			<-pipe / channel->	
	AREA	QPEAK	TPEAK	R.V.	MAX DEPTH	MAX VEL
	(ha)	(cms)	(hrs)	(mm)	(m)	(m/s)
INFLOW : ID= 2 (0350)	16.30	0.50	1.33	6.64	0.12	0.78
OUTFLOW: ID= 1 (0353)	16.30	0.22	1.58	6.60	0.09	0.57

CALIB STANDHYD (0355) ID= 1 DT= 5.0 min	Area (ha)= 12.30 Total Imp(%)= 42.00 Dir. Conn.(%)= 21.00

		IMPERVIOUS	PERVIOUS (i)
Surface Area	(ha)=	5.17	7.13
Dep. Storage	(mm)=	1.50	5.00
Average Slope	(%)=	1.60	1.60
Length	(m)=	286.00	40.00
Mannings n	=	0.013	0.300

NOTE: RAINFALL WAS TRANSFORMED TO 5.0 MIN. TIME STEP.

---- TRANSFORMED HYETOGRAPH ----

TIME hrs	RAIN mm/hr	TIME hrs	RAIN mm/hr	TIME hrs	RAIN mm/hr	TIME hrs	RAIN mm/hr
0.083	0.53	1.083	17.57	2.083	2.95	3.08	0.76
0.167	0.53	1.167	17.57	2.167	2.95	3.17	0.76
0.250	0.71	1.250	61.55	2.250	2.19	3.25	0.65
0.333	0.71	1.333	61.55	2.333	2.19	3.33	0.65
0.417	0.99	1.417	24.02	2.417	1.69	3.42	0.57
0.500	0.99	1.500	24.02	2.500	1.69	3.50	0.57
0.583	1.51	1.583	11.16	2.583	1.34	3.58	0.49
0.667	1.51	1.667	11.16	2.667	1.34	3.67	0.49
0.750	2.57	1.750	6.44	2.750	1.09	3.75	0.44
0.833	2.57	1.833	6.44	2.833	1.09	3.83	0.44
0.917	5.31	1.917	4.20	2.917	0.90	3.92	0.38
1.000	5.31	2.000	4.20	3.000	0.90	4.00	0.38

Max.Eff.Inten.	(mm/hr)=	61.55	7.05	
	over (min)	5.00	30.00	
Storage Coeff.	(min)=	5.06 (ii)	29.38 (ii)	
Unit Hyd. Tpeak	(min)=	5.00	30.00	
Unit Hyd. peak	(cms)=	0.21	0.04	
				TOTALS
PEAK FLOW	(cms)=	0.40	0.07	0.405 (iii)
TIME TO PEAK	(hrs)=	1.33	1.75	1.33
RUNOFF VOLUME	(mm)=	23.50	2.16	6.64
TOTAL RAINFALL	(mm)=	25.00	25.00	25.00

```
     RUNOFF COEFFICIENT   =       0.94         0.09          0.27


       (i) HORTONS EQUATION SELECTED FOR PERVIOUS LOSSES:
            Fo   (mm/hr)= 75.00          K  (1/hr)=  4.14
            Fc   (mm/hr)= 12.50     Cum.Inf.   (mm)=  0.00
      (ii) TIME STEP (DT) SHOULD BE SMALLER OR EQUAL
           THAN THE STORAGE COEFFICIENT.
     (iii) PEAK FLOW DOES NOT INCLUDE BASEFLOW IF ANY.

--------------------------------------------------------------------------------
--------------------
| ROUTE CHN(  0358)|
| IN= 2---> OUT= 1 |     Routing time step (min)'=  5.00
--------------------
               <------ DATA FOR SECTION (   1.1) ------>
               Distance      Elevation       Manning
                   0.00          0.26        0.0300
                   5.50          0.15    0.0300 /0.0150  Main Channel
                   5.51          0.00        0.0150      Main Channel
                  10.00          0.09        0.0150      Main Channel
                  14.49          0.00        0.0150      Main Channel
                  14.50          0.15    0.0150 /0.0300  Main Channel
                  20.00          0.26        0.0300

      <---------------------- TRAVEL TIME TABLE ---------------------->
       DEPTH    ELEV      VOLUME    FLOW RATE    VELOCITY   TRAV.TIME
        (m)      (m)     (cu.m.)      (cms)        (m/s)      (min)
       0.01     0.01    .102E+02       0.0          0.17     109.52
       0.03     0.03    .409E+02       0.0          0.27      68.99
       0.04     0.04    .920E+02       0.0          0.35      52.65
       0.05     0.05    .163E+03       0.1          0.42      43.46
       0.07     0.07    .255E+03       0.1          0.49      37.45
       0.08     0.08    .368E+03       0.2          0.55      33.17
       0.10     0.10    .499E+03       0.3          0.64      28.86
       0.11     0.11    .634E+03       0.4          0.74      24.66
       0.12     0.12    .769E+03       0.6          0.84      21.72
       0.14     0.14    .904E+03       0.8          0.94      19.54
       0.15     0.15    .104E+04       1.0          1.03      17.84
       0.16     0.16    .119E+04       1.2          1.11      16.57
       0.18     0.18    .135E+04       1.4          1.17      15.71
       0.19     0.19    .154E+04       1.7          1.21      15.10
       0.20     0.20    .175E+04       2.0          1.25      14.65
       0.22     0.22    .198E+04       2.3          1.28      14.31
       0.23     0.23    .223E+04       2.6          1.31      14.04
       0.25     0.25    .250E+04       3.0          1.33      13.82
       0.26     0.26    .279E+04       3.4          1.34      13.65

                                    <---- hydrograph ---->   <-pipe / channel->
                              AREA    QPEAK   TPEAK   R.V.   MAX DEPTH  MAX VEL
```

	(ha)	(cms)	(hrs)	(mm)	(m)	(m/s)
INFLOW : ID= 2 (0355)	12.30	0.40	1.33	6.64	0.11	0.72
OUTFLOW: ID= 1 (0358)	12.30	0.15	1.58	6.59	0.08	0.52

ADD HYD (0359)				
1 + 2 = 3	AREA (ha)	QPEAK (cms)	TPEAK (hrs)	R.V. (mm)
ID1= 1 (0353):	16.30	0.216	1.58	6.60
+ ID2= 2 (0358):	12.30	0.153	1.58	6.59
ID = 3 (0359):	28.60	0.369	1.58	6.60

NOTE: PEAK FLOWS DO NOT INCLUDE BASEFLOWS IF ANY.

ADD HYD (0363)				
1 + 2 = 3	AREA (ha)	QPEAK (cms)	TPEAK (hrs)	R.V. (mm)
ID1= 1 (0359):	28.60	0.369	1.58	6.60
+ ID2= 2 (0362):	30.00	0.406	1.50	5.48
ID = 3 (0363):	58.60	0.769	1.50	6.03

NOTE: PEAK FLOWS DO NOT INCLUDE BASEFLOWS IF ANY.

ADD HYD (0380)				
1 + 2 = 3	AREA (ha)	QPEAK (cms)	TPEAK (hrs)	R.V. (mm)
ID1= 1 (0363):	58.60	0.769	1.50	6.03
+ ID2= 2 (0365):	117.50	2.960	1.42	6.64
ID = 3 (0380):	176.10	3.653	1.42	6.44

NOTE: PEAK FLOWS DO NOT INCLUDE BASEFLOWS IF ANY.

RESERVOIR(0390)	OVERFLOW IS OFF			
IN= 2---> OUT= 1				
DT= 5.0 min	OUTFLOW (cms)	STORAGE (ha.m.)	OUTFLOW (cms)	STORAGE (ha.m.)
	0.0000	0.0000	1.3100	1.6000
	0.7700	0.2870	1.8600	23.2300

```
                          1.2600     0.9680   |   0.0000      0.0000

                                  AREA     QPEAK     TPEAK       R.V.
                                  (ha)     (cms)     (hrs)       (mm)
   INFLOW : ID= 2 (  0380)    176.100      3.653      1.42       6.44
   OUTFLOW: ID= 1 (  0390)    176.100      0.982      2.25       6.43

                    PEAK   FLOW   REDUCTION [Qout/Qin](%)= 26.88
                    TIME SHIFT OF PEAK FLOW         (min)= 50.00
                    MAXIMUM  STORAGE   USED       (ha.m.)=  0.5820

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

--------------------
| ADD HYD  (  0400)|
|   1 +  2 =  3    |         AREA    QPEAK    TPEAK     R.V.
--------------------         (ha)    (cms)    (hrs)     (mm)
        ID1= 1 (  0390):   176.10   0.982     2.25     6.43
      + ID2= 2 (  0395):    51.20   0.292     1.42     1.17
        ================================================
        ID = 3 (  0400):   227.30   1.022     1.58     5.25

     NOTE:  PEAK FLOWS DO NOT INCLUDE BASEFLOWS IF ANY.
--------------------------------------------------------------------------------
--------------------
| ROUTE CHN(  0403)|
| IN= 2---> OUT= 1 |     Routing time step (min)'=  5.00
--------------------
               <------ DATA FOR SECTION (   1.1) ------>
               Distance      Elevation       Manning
                 100.00        338.30        0.0500
                 110.00        336.80        0.0500
                 135.00        336.00        0.0300      Main Channel
                 142.00        335.30        0.0500
                 148.00        335.30        0.0500
                 156.00        336.00        0.0500
                 165.00        338.30        0.0500

      <--------------------- TRAVEL TIME TABLE ---------------------->
       DEPTH    ELEV      VOLUME    FLOW RATE    VELOCITY   TRAV.TIME
        (m)      (m)     (cu.m.)      (cms)        (m/s)      (min)
       0.16   335.46    .231E+04       0.9          0.71      44.52
       0.32   335.62    .563E+04       3.2          1.09      29.11
       0.47   335.77    .997E+04       7.3          1.39      22.72
       0.63   335.93    .153E+05      13.4          1.66      19.04
       0.79   336.09    .218E+05      22.7          1.97      16.04
       0.95   336.25    .299E+05      35.3          2.25      14.10
       1.11   336.41    .396E+05      51.2          2.46      12.89
       1.26   336.56    .510E+05      70.7          2.63      12.02
       1.42   336.72    .641E+05      94.1          2.79      11.35
```

1.58	336.88	.787E+05	122.4	2.96	10.71
1.74	337.04	.939E+05	155.6	3.15	10.06
1.89	337.19	.110E+06	192.8	3.34	9.48
2.05	337.35	.126E+06	233.9	3.53	8.97
2.21	337.51	.143E+06	278.9	3.71	8.53
2.37	337.67	.160E+06	327.7	3.89	8.13
2.53	337.83	.178E+06	380.3	4.07	7.79
2.68	337.98	.196E+06	436.7	4.23	7.48
2.84	338.14	.215E+06	496.9	4.40	7.20
3.00	338.30	.234E+06	561.0	4.56	6.95

		<---- hydrograph ---->			<-pipe / channel->	
	AREA	QPEAK	TPEAK	R.V.	MAX DEPTH	MAX VEL
	(ha)	(cms)	(hrs)	(mm)	(m)	(m/s)
INFLOW : ID= 2 (0400)	227.30	1.02	1.58	5.25	0.17	0.73
OUTFLOW: ID= 1 (0403)	227.30	0.88	3.17	5.25	0.16	0.71

ADD HYD (0407)				
1 + 2 = 3	AREA	QPEAK	TPEAK	R.V.
	(ha)	(cms)	(hrs)	(mm)
ID1= 1 (0115):	100.96	0.273	2.42	6.63
+ ID2= 2 (0403):	227.30	0.881	3.17	5.25
ID = 3 (0407):	328.26	1.112	2.83	5.67

NOTE: PEAK FLOWS DO NOT INCLUDE BASEFLOWS IF ANY.

RESERVOIR(0113) / IN= 2---> OUT= 1 / DT= 5.0 min	OVERFLOW IS OFF			
	OUTFLOW	STORAGE	OUTFLOW	STORAGE
	(cms)	(ha.m.)	(cms)	(ha.m.)
	0.0000	0.0000	1.6000	6.4000
	1.1000	2.9000	9.1000	10.0000
	1.3000	4.3000	12.0000	20.0000

	AREA	QPEAK	TPEAK	R.V.
	(ha)	(cms)	(hrs)	(mm)
INFLOW : ID= 2 (0407)	328.260	1.112	2.83	5.67
OUTFLOW: ID= 1 (0113)	328.260	0.354	5.83	5.67

PEAK FLOW REDUCTION [Qout/Qin](%)= 31.88
TIME SHIFT OF PEAK FLOW (min)=180.00
MAXIMUM STORAGE USED (ha.m.)= 0.9343

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

--------------------
| ADD HYD  (  0430)|
|   1 +  2 =  3    |          AREA    QPEAK    TPEAK     R.V.
--------------------          (ha)    (cms)    (hrs)     (mm)
       ID1= 1 (  0113):   328.26   0.354     5.83     5.67
     + ID2= 2 (  0425):    29.19   0.948     1.33     6.64
       ================================================
       ID = 3 (  0430):   357.45   0.951     1.33     5.75

     NOTE:  PEAK FLOWS DO NOT INCLUDE BASEFLOWS IF ANY.
--------------------------------------------------------------------------------
--------------------
| ROUTE CHN(  0440)|
| IN= 2---> OUT= 1 |     Routing time step (min)'=  5.00
--------------------
               <------ DATA FOR SECTION (   1.1) ------>
               Distance      Elevation       Manning
                 100.00        325.40        0.0600
                 120.00        324.60        0.0600
                 126.00        323.90        0.0600
                 130.00        323.00        0.0600
                 140.00        322.30    0.0600 /0.0300  Main Channel
                 142.00        322.30    0.0300 /0.0600  Main Channel
                 150.00        323.90        0.0600
                 155.00        324.60        0.0600
                 160.00        325.40        0.0600

      <--------------------- TRAVEL TIME TABLE ---------------------->
       DEPTH    ELEV      VOLUME    FLOW RATE    VELOCITY   TRAV.TIME
        (m)      (m)     (cu.m.)      (cms)        (m/s)      (min)
       0.16   322.46    .233E+03       0.6          0.96       6.96
       0.33   322.63    .672E+03       2.1          1.26       5.27
       0.49   322.79    .132E+04       4.9          1.48       4.51
       0.65   322.95    .216E+04       9.0          1.66       4.03
       0.82   323.12    .319E+04      14.9          1.87       3.57
       0.98   323.28    .433E+04      22.5          2.08       3.21
       1.14   323.44    .556E+04      31.6          2.27       2.93
       1.31   323.61    .689E+04      42.3          2.45       2.72
       1.47   323.77    .833E+04      54.6          2.62       2.54
       1.63   323.93    .987E+04      68.3          2.77       2.41
       1.79   324.09    .115E+05      82.8          2.87       2.33
       1.96   324.26    .134E+05      99.2          2.96       2.25
       2.12   324.42    .154E+05     117.9          3.06       2.18
       2.28   324.58    .176E+05     138.8          3.15       2.11
       2.45   324.75    .200E+05     157.4          3.14       2.12
       2.61   324.91    .228E+05     179.6          3.15       2.11
       2.77   325.07    .259E+05     205.8          3.18       2.09
       2.94   325.24    .293E+05     236.1          3.23       2.07
```

```
       3.10   325.40    .330E+05     270.6          3.28       2.03

                                    <---- hydrograph ---->   <-pipe / channel->
                             AREA    QPEAK   TPEAK   R.V.   MAX DEPTH  MAX VEL
                             (ha)    (cms)   (hrs)   (mm)      (m)      (m/s)
   INFLOW : ID= 2 (  0430)  357.45     0.95    1.33   5.75      0.20      1.02
   OUTFLOW: ID= 1 (  0440)  357.45     0.72    1.42   5.75      0.18      0.98



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

--------------------
| ADD HYD  (  0485)|
|   1 +  2 =  3    |         AREA    QPEAK    TPEAK     R.V.
--------------------         (ha)    (cms)    (hrs)     (mm)
       ID1= 1 (  0440):   357.45   0.720     1.42     5.75
     + ID2= 2 (  0475):    48.70   1.101     1.42     6.64
       ================================================
       ID = 3 (  0485):   406.15   1.820     1.42     5.86

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

--------------------
| ADD HYD  (  0490)|
|   1 +  2 =  3    |         AREA    QPEAK    TPEAK     R.V.
--------------------         (ha)    (cms)    (hrs)     (mm)
       ID1= 1 (  0480):    43.10   1.142     1.42     6.64
     + ID2= 2 (  0485):   406.15   1.820     1.42     5.86
       ================================================
       ID = 3 (  0490):   449.25   2.962     1.42     5.93

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

--------------------
| ADD HYD  (  0491)|
|   1 +  2 =  3    |         AREA    QPEAK    TPEAK     R.V.
--------------------         (ha)    (cms)    (hrs)     (mm)
       ID1= 1 (  0482):    22.65   0.268     1.83    10.93
     + ID2= 2 (  0490):   449.25   2.962     1.42     5.93
       ================================================
       ID = 3 (  0491):   471.90   3.225     1.42     6.17

     NOTE:  PEAK FLOWS DO NOT INCLUDE BASEFLOWS IF ANY.
--------------------------------------------------------------------------------
--------------------
| RESERVOIR(  0483)|     OVERFLOW IS OFF
| IN= 2---> OUT= 1 |
```

DT= 5.0 min	OUTFLOW (cms)	STORAGE (ha.m.)	OUTFLOW (cms)	STORAGE (ha.m.)
	0.0000	0.0000	7.0800	2.4860
	0.2760	0.0600	8.1000	3.3240
	1.2000	0.3400	9.7980	4.6420
	2.0400	0.6182	10.4940	7.4397
	2.6400	1.1630	11.6850	10.3000
	3.1200	1.7070	12.3480	11.4000

	AREA (ha)	QPEAK (cms)	TPEAK (hrs)	R.V. (mm)
INFLOW : ID= 2 (0491)	471.900	3.225	1.42	6.17
OUTFLOW: ID= 1 (0483)	471.900	1.376	2.00	6.17

PEAK FLOW REDUCTION [Qout/Qin](%)= 42.65
TIME SHIFT OF PEAK FLOW (min)= 35.00
MAXIMUM STORAGE USED (ha.m.)= 0.3986

ADD HYD (0530)		AREA (ha)	QPEAK (cms)	TPEAK (hrs)	R.V. (mm)
1 + 2 = 3	ID1= 1 (0483):	471.90	1.376	2.00	6.17
	+ ID2= 2 (0540):	4.63	0.569	1.33	18.56
	ID = 3 (0530):	476.53	1.422	2.00	6.29

NOTE: PEAK FLOWS DO NOT INCLUDE BASEFLOWS IF ANY.

ADD HYD (0545)		AREA (ha)	QPEAK (cms)	TPEAK (hrs)	R.V. (mm)
1 + 2 = 3	ID1= 1 (0527):	59.59	3.713	1.67	225.40
	+ ID2= 2 (0530):	476.53	1.422	2.00	6.29
	ID = 3 (0545):	536.12	5.047	1.67	30.65

NOTE: PEAK FLOWS DO NOT INCLUDE BASEFLOWS IF ANY.

ADD HYD (0546)		AREA (ha)	QPEAK (cms)	TPEAK (hrs)	R.V. (mm)
1 + 2 = 3	ID1= 1 (0542):	25.25	2.408	1.42	18.56
	+ ID2= 2 (0545):	536.12	5.047	1.67	30.65

```
        ================================================
        ID = 3 (  0546):   561.37   6.276     1.58    30.10

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

--------------------
| ADD HYD  (  0547)|
|   1 +  2 =  3    |         AREA    QPEAK    TPEAK     R.V.
--------------------         (ha)    (cms)    (hrs)     (mm)
        ID1= 1 (  0543):    14.99   1.767     1.33    18.56
      + ID2= 2 (  0546):   561.37   6.276     1.58    30.10
        ================================================
        ID = 3 (  0547):   576.36   7.132     1.50    29.80

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

--------------------
| ADD HYD  (  0548)|
|   1 +  2 =  3    |         AREA    QPEAK    TPEAK     R.V.
--------------------         (ha)    (cms)    (hrs)     (mm)
        ID1= 1 (  0544):     1.13   0.151     1.33    18.56
      + ID2= 2 (  0547):   576.36   7.132     1.50    29.80
        ================================================
        ID = 3 (  0548):   577.49   7.193     1.50    29.78

     NOTE:  PEAK FLOWS DO NOT INCLUDE BASEFLOWS IF ANY.
--------------------------------------------------------------------------------
--------------------
| ROUTE CHN(  0564)|
| IN= 2---> OUT= 1 |     Routing time step (min)'=  5.00
--------------------
               <------ DATA FOR SECTION (   1.1) ------>
               Distance      Elevation       Manning
                   0.00        101.50        0.0500
                   1.00        100.70        0.0500
                   1.50        100.55    0.0500 /0.0300  Main Channel
                   2.00         99.50        0.0300      Main Channel
                   3.50         99.60        0.0300      Main Channel
                   4.50        100.65    0.0300 /0.0500  Main Channel
                   6.00        101.45        0.0500

      <--------------------- TRAVEL TIME TABLE ---------------------->
       DEPTH    ELEV      VOLUME    FLOW RATE    VELOCITY   TRAV.TIME
        (m)      (m)     (cu.m.)      (cms)        (m/s)      (min)
       0.10    99.60    .353E+02       0.0          0.19      43.69
       0.19    99.69    .112E+03       0.1          0.37      22.76
       0.29    99.79    .195E+03       0.2          0.49      17.03
       0.38    99.88    .285E+03       0.3          0.59      14.23
```

0.48	99.98	.381E+03	0.5	0.67	12.51
0.57	100.07	.484E+03	0.7	0.74	11.32
0.67	100.17	.594E+03	0.9	0.80	10.43
0.76	100.26	.710E+03	1.2	0.86	9.74
0.86	100.36	.832E+03	1.5	0.91	9.18
0.95	100.45	.961E+03	1.8	0.96	8.72
1.05	100.55	.110E+04	2.2	1.00	8.32
1.16	100.66	.127E+04	2.7	1.07	7.80
1.28	100.78	.148E+04	3.4	1.14	7.31
1.39	100.89	.170E+04	4.1	1.20	6.94
1.50	101.00	.195E+04	4.9	1.25	6.65
1.61	101.11	.221E+04	5.8	1.30	6.41
1.72	101.22	.250E+04	6.7	1.34	6.22
1.84	101.34	.280E+04	7.7	1.38	6.04
1.95	101.45	.313E+04	8.8	1.41	5.90

**** WARNING: INFLOW HYDROGRAPH IS DRY!!

```
       V    V   I    SSSSS  U   U    A    L              (v 6.2.2007)
       V    V   I    SS     U   U   A A   L
        V  V    I     SS    U   U  AAAAA  L
        V  V    I      SS   U   U  A   A  L
         VV     I    SSSSS  UUUUU  A   A  LLLLL

        OOO   TTTTT  TTTTT  H   H  Y   Y  M   M   OOO    TM
       O   O    T      T    H   H   Y Y   MM MM  O   O
       O   O    T      T    H   H    Y    M   M  O   O
        OOO     T      T    H   H    Y    M   M   OOO
```

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***** D E T A I L E D O U T P U T *****

Input filename: C:\Program Files (x86)\Visual OTTHYMO 6.2\VO2\voin.dat

Output filename:
C:\Users\szaga\AppData\Local\Civica\VH5\755e78af-23fe-400e-9cfe-54285a1c407c\0862a5f8-aa27-446b-85d0-c69710bb803a\scenar
Summary filename:
C:\Users\szaga\AppData\Local\Civica\VH5\755e78af-23fe-400e-9cfe-54285a1c407c\0862a5f8-aa27-446b-85d0-c69710bb803a\scenar

DATE: 02/17/2023 TIME: 03:33:49

USER:

COMMENTS: _____

****
** SIMULATION : Hadati Creek Watershed - Post **
****

READ STORM	Filename: C:\Users\szaga\AppData\Local\Temp\3ddd6580-52dc-4449-bccd-814fa38467d3\e68c19d1
Ptotal= 53.41 mm	Comments: 5 year SCS Type II 12hour design storm

TIME hrs	RAIN mm/hr	TIME hrs	RAIN mm/hr	TIME hrs	RAIN mm/hr	TIME hrs	RAIN mm/hr
0.00	1.34	3.00	2.14	6.00	9.61	9.00	1.87
0.25	1.34	3.25	2.14	6.25	9.61	9.25	1.87
0.50	1.34	3.50	2.14	6.50	4.27	9.50	1.87
0.75	1.34	3.75	2.14	6.75	4.27	9.75	1.87
1.00	1.34	4.00	3.20	7.00	3.20	10.00	1.07
1.25	1.34	4.25	3.20	7.25	3.20	10.25	1.07
1.50	1.34	4.50	4.27	7.50	3.20	10.50	1.07
1.75	1.34	4.75	4.27	7.75	3.20	10.75	1.07
2.00	1.60	5.00	6.41	8.00	1.87	11.00	1.07
2.25	1.60	5.25	6.41	8.25	1.87	11.25	1.07
2.50	1.60	5.50	25.64	8.50	1.87	11.50	1.07
2.75	1.60	5.75	70.50	8.75	1.87	11.75	1.07

CALIB STANDHYD (0544) ID= 1 DT= 5.0 min	Area (ha)= 1.13 Total Imp(%)= 80.00 Dir. Conn.(%)= 79.00

		IMPERVIOUS	PERVIOUS (i)
Surface Area	(ha)=	0.90	0.23
Dep. Storage	(mm)=	1.50	5.00
Average Slope	(%)=	0.55	0.55
Length	(m)=	50.00	40.00

Mannings n = 0.013 0.300

NOTE: RAINFALL WAS TRANSFORMED TO 5.0 MIN. TIME STEP.

---- TRANSFORMED HYETOGRAPH ----

TIME hrs	RAIN mm/hr	TIME hrs	RAIN mm/hr	TIME hrs	RAIN mm/hr	TIME hrs	RAIN mm/hr
0.083	1.34	3.083	2.14	6.083	9.61	9.08	1.87
0.167	1.34	3.167	2.14	6.167	9.61	9.17	1.87
0.250	1.34	3.250	2.14	6.250	9.61	9.25	1.87
0.333	1.34	3.333	2.14	6.333	9.61	9.33	1.87
0.417	1.34	3.417	2.14	6.417	9.61	9.42	1.87
0.500	1.34	3.500	2.14	6.500	9.61	9.50	1.87
0.583	1.34	3.583	2.14	6.583	4.27	9.58	1.87
0.667	1.34	3.667	2.14	6.667	4.27	9.67	1.87
0.750	1.34	3.750	2.14	6.750	4.27	9.75	1.87
0.833	1.33	3.833	2.14	6.833	4.27	9.83	1.87
0.917	1.34	3.917	2.14	6.917	4.27	9.92	1.87
1.000	1.34	4.000	2.14	7.000	4.27	10.00	1.87
1.083	1.33	4.083	3.20	7.083	3.20	10.08	1.07
1.167	1.34	4.167	3.20	7.167	3.20	10.17	1.07
1.250	1.34	4.250	3.20	7.250	3.21	10.25	1.07
1.333	1.34	4.333	3.21	7.333	3.20	10.33	1.07
1.417	1.34	4.417	3.20	7.417	3.20	10.42	1.07
1.500	1.34	4.500	3.20	7.500	3.21	10.50	1.07
1.583	1.34	4.583	4.27	7.583	3.20	10.58	1.07
1.667	1.34	4.667	4.27	7.667	3.20	10.67	1.07
1.750	1.34	4.750	4.27	7.750	3.21	10.75	1.07
1.833	1.34	4.833	4.27	7.833	3.20	10.83	1.07
1.917	1.34	4.917	4.27	7.917	3.20	10.92	1.07
2.000	1.34	5.000	4.27	8.000	3.20	11.00	1.07
2.083	1.60	5.083	6.41	8.083	1.87	11.08	1.07
2.167	1.60	5.167	6.41	8.167	1.87	11.17	1.07
2.250	1.60	5.250	6.41	8.250	1.87	11.25	1.07
2.333	1.60	5.333	6.41	8.333	1.87	11.33	1.07
2.417	1.60	5.417	6.41	8.417	1.87	11.42	1.07
2.500	1.60	5.500	6.41	8.500	1.87	11.50	1.07
2.583	1.60	5.583	25.64	8.583	1.87	11.58	1.07
2.667	1.60	5.667	25.64	8.667	1.87	11.67	1.07
2.750	1.60	5.750	25.64	8.750	1.87	11.75	1.07
2.833	1.60	5.833	70.50	8.833	1.87	11.83	1.07
2.917	1.60	5.917	70.50	8.917	1.87	11.92	1.07
3.000	1.60	6.000	70.50	9.000	1.87	12.00	1.07

Max.Eff.Inten.(mm/hr)= 70.50 30.06
over (min) 5.00 25.00
Storage Coeff. (min)= 2.32 (ii) 21.08 (ii)
Unit Hyd. Tpeak (min)= 5.00 25.00
Unit Hyd. peak (cms)= 0.30 0.05

				TOTALS
PEAK FLOW	(cms)=	0.17	0.01	0.178 (iii)
TIME TO PEAK	(hrs)=	6.00	6.25	6.00
RUNOFF VOLUME	(mm)=	51.91	9.54	43.01
TOTAL RAINFALL	(mm)=	53.41	53.41	53.41
RUNOFF COEFFICIENT	=	0.97	0.18	0.81

***** WARNING: STORAGE COEFF. IS SMALLER THAN TIME STEP!

(i) HORTONS EQUATION SELECTED FOR PERVIOUS LOSSES:
Fo (mm/hr)= 75.00 K (1/hr)= 4.14
Fc (mm/hr)= 12.50 Cum.Inf. (mm)= 0.00
(ii) TIME STEP (DT) SHOULD BE SMALLER OR EQUAL
THAN THE STORAGE COEFFICIENT.
(iii) PEAK FLOW DOES NOT INCLUDE BASEFLOW IF ANY.

CALIB
STANDHYD (0543)
ID= 1 DT= 5.0 min

Area (ha)= 14.99
Total Imp(%)= 80.00 Dir. Conn.(%)= 79.00

		IMPERVIOUS	PERVIOUS (i)
Surface Area	(ha)=	11.99	3.00
Dep. Storage	(mm)=	1.50	5.00
Average Slope	(%)=	0.55	0.55
Length	(m)=	200.00	40.00
Mannings n	=	0.013	0.300

NOTE: RAINFALL WAS TRANSFORMED TO 5.0 MIN. TIME STEP.

---- TRANSFORMED HYETOGRAPH ----

TIME hrs	RAIN mm/hr	TIME hrs	RAIN mm/hr	TIME hrs	RAIN mm/hr	TIME hrs	RAIN mm/hr
0.083	1.34	3.083	2.14	6.083	9.61	9.08	1.87
0.167	1.34	3.167	2.14	6.167	9.61	9.17	1.87
0.250	1.34	3.250	2.14	6.250	9.61	9.25	1.87
0.333	1.34	3.333	2.14	6.333	9.61	9.33	1.87
0.417	1.34	3.417	2.14	6.417	9.61	9.42	1.87
0.500	1.34	3.500	2.14	6.500	9.61	9.50	1.87
0.583	1.34	3.583	2.14	6.583	4.27	9.58	1.87
0.667	1.34	3.667	2.14	6.667	4.27	9.67	1.87
0.750	1.34	3.750	2.14	6.750	4.27	9.75	1.87
0.833	1.33	3.833	2.14	6.833	4.27	9.83	1.87
0.917	1.34	3.917	2.14	6.917	4.27	9.92	1.87
1.000	1.34	4.000	2.14	7.000	4.27	10.00	1.87
1.083	1.33	4.083	3.20	7.083	3.20	10.08	1.07
1.167	1.34	4.167	3.20	7.167	3.20	10.17	1.07
1.250	1.34	4.250	3.20	7.250	3.21	10.25	1.07

1.333	1.34	4.333	3.21	7.333	3.20	10.33	1.07
1.417	1.34	4.417	3.20	7.417	3.20	10.42	1.07
1.500	1.34	4.500	3.20	7.500	3.21	10.50	1.07
1.583	1.34	4.583	4.27	7.583	3.20	10.58	1.07
1.667	1.34	4.667	4.27	7.667	3.20	10.67	1.07
1.750	1.34	4.750	4.27	7.750	3.21	10.75	1.07
1.833	1.34	4.833	4.27	7.833	3.20	10.83	1.07
1.917	1.34	4.917	4.27	7.917	3.20	10.92	1.07
2.000	1.34	5.000	4.27	8.000	3.20	11.00	1.07
2.083	1.60	5.083	6.41	8.083	1.87	11.08	1.07
2.167	1.60	5.167	6.41	8.167	1.87	11.17	1.07
2.250	1.60	5.250	6.41	8.250	1.87	11.25	1.07
2.333	1.60	5.333	6.41	8.333	1.87	11.33	1.07
2.417	1.60	5.417	6.41	8.417	1.87	11.42	1.07
2.500	1.60	5.500	6.41	8.500	1.87	11.50	1.07
2.583	1.60	5.583	25.64	8.583	1.87	11.58	1.07
2.667	1.60	5.667	25.64	8.667	1.87	11.67	1.07
2.750	1.60	5.750	25.64	8.750	1.87	11.75	1.07
2.833	1.60	5.833	70.50	8.833	1.87	11.83	1.07
2.917	1.60	5.917	70.50	8.917	1.87	11.92	1.07
3.000	1.60	6.000	70.50	9.000	1.87	12.00	1.07

Max.Eff.Inten.(mm/hr)=	70.50	30.06		
over (min)	5.00	25.00		
Storage Coeff. (min)=	5.33 (ii)	24.09 (ii)		
Unit Hyd. Tpeak (min)=	5.00	25.00		
Unit Hyd. peak (cms)=	0.21	0.05		
			TOTALS	
PEAK FLOW (cms)=	2.23	0.12	2.271 (iii)	
TIME TO PEAK (hrs)=	6.00	6.33	6.00	
RUNOFF VOLUME (mm)=	51.91	9.54	43.01	
TOTAL RAINFALL (mm)=	53.41	53.41	53.41	
RUNOFF COEFFICIENT =	0.97	0.18	0.81	

(i) HORTONS EQUATION SELECTED FOR PERVIOUS LOSSES:
Fo (mm/hr)= 75.00 K (1/hr)= 4.14
Fc (mm/hr)= 12.50 Cum.Inf. (mm)= 0.00
(ii) TIME STEP (DT) SHOULD BE SMALLER OR EQUAL
THAN THE STORAGE COEFFICIENT.
(iii) PEAK FLOW DOES NOT INCLUDE BASEFLOW IF ANY.

CALIB
STANDHYD (0542)
ID= 1 DT= 5.0 min

Area (ha)= 25.25
Total Imp(%)= 80.00 Dir. Conn.(%)= 79.00

	IMPERVIOUS	PERVIOUS (i)
Surface Area (ha)=	20.20	5.05

Dep. Storage	(mm)=	1.50	5.00
Average Slope	(%)=	0.55	0.55
Length	(m)=	350.00	40.00
Mannings n	=	0.013	0.300

NOTE: RAINFALL WAS TRANSFORMED TO 5.0 MIN. TIME STEP.

---- TRANSFORMED HYETOGRAPH ----

TIME hrs	RAIN mm/hr	TIME hrs	RAIN mm/hr	TIME hrs	RAIN mm/hr	TIME hrs	RAIN mm/hr
0.083	1.34	3.083	2.14	6.083	9.61	9.08	1.87
0.167	1.34	3.167	2.14	6.167	9.61	9.17	1.87
0.250	1.34	3.250	2.14	6.250	9.61	9.25	1.87
0.333	1.34	3.333	2.14	6.333	9.61	9.33	1.87
0.417	1.34	3.417	2.14	6.417	9.61	9.42	1.87
0.500	1.34	3.500	2.14	6.500	9.61	9.50	1.87
0.583	1.34	3.583	2.14	6.583	4.27	9.58	1.87
0.667	1.34	3.667	2.14	6.667	4.27	9.67	1.87
0.750	1.34	3.750	2.14	6.750	4.27	9.75	1.87
0.833	1.33	3.833	2.14	6.833	4.27	9.83	1.87
0.917	1.34	3.917	2.14	6.917	4.27	9.92	1.87
1.000	1.34	4.000	2.14	7.000	4.27	10.00	1.87
1.083	1.33	4.083	3.20	7.083	3.20	10.08	1.07
1.167	1.34	4.167	3.20	7.167	3.20	10.17	1.07
1.250	1.34	4.250	3.20	7.250	3.21	10.25	1.07
1.333	1.34	4.333	3.21	7.333	3.20	10.33	1.07
1.417	1.34	4.417	3.20	7.417	3.20	10.42	1.07
1.500	1.34	4.500	3.20	7.500	3.21	10.50	1.07
1.583	1.34	4.583	4.27	7.583	3.20	10.58	1.07
1.667	1.34	4.667	4.27	7.667	3.20	10.67	1.07
1.750	1.34	4.750	4.27	7.750	3.21	10.75	1.07
1.833	1.34	4.833	4.27	7.833	3.20	10.83	1.07
1.917	1.34	4.917	4.27	7.917	3.20	10.92	1.07
2.000	1.34	5.000	4.27	8.000	3.20	11.00	1.07
2.083	1.60	5.083	6.41	8.083	1.87	11.08	1.07
2.167	1.60	5.167	6.41	8.167	1.87	11.17	1.07
2.250	1.60	5.250	6.41	8.250	1.87	11.25	1.07
2.333	1.60	5.333	6.41	8.333	1.87	11.33	1.07
2.417	1.60	5.417	6.41	8.417	1.87	11.42	1.07
2.500	1.60	5.500	6.41	8.500	1.87	11.50	1.07
2.583	1.60	5.583	25.64	8.583	1.87	11.58	1.07
2.667	1.60	5.667	25.64	8.667	1.87	11.67	1.07
2.750	1.60	5.750	25.64	8.750	1.87	11.75	1.07
2.833	1.60	5.833	70.50	8.833	1.87	11.83	1.07
2.917	1.60	5.917	70.50	8.917	1.87	11.92	1.07
3.000	1.60	6.000	70.50	9.000	1.87	12.00	1.07

Max.Eff.Inten.(mm/hr)=		70.50	30.06
	over (min)	5.00	30.00

```
     Storage Coeff.  (min)=       7.45 (ii)   26.21 (ii)
     Unit Hyd. Tpeak (min)=       5.00        30.00
     Unit Hyd. peak  (cms)=       0.17         0.04
                                                          *TOTALS*
     PEAK FLOW       (cms)=       3.56         0.19          3.608 (iii)
     TIME TO PEAK    (hrs)=       6.00         6.33           6.00
     RUNOFF VOLUME    (mm)=      51.91         9.54          43.01
     TOTAL RAINFALL   (mm)=      53.41        53.41          53.41
     RUNOFF COEFFICIENT   =       0.97         0.18           0.81


       (i) HORTONS EQUATION SELECTED FOR PERVIOUS LOSSES:
            Fo   (mm/hr)= 75.00           K  (1/hr)=  4.14
            Fc   (mm/hr)= 12.50     Cum.Inf.   (mm)=  0.00
      (ii) TIME STEP (DT) SHOULD BE SMALLER OR EQUAL
           THAN THE STORAGE COEFFICIENT.
     (iii) PEAK FLOW DOES NOT INCLUDE BASEFLOW IF ANY.

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--------------------
| STORE HYD(  0525)|   AREA       (ha)=   0.00
| ID= 1 DT=****min |   QPEAK     (cms)=   2.00
--------------------   TPEAK     (hrs)=  24.00
                       VOLUME     (mm)=*******

  TIME    FLOW |  TIME    FLOW |  TIME    FLOW |'  TIME    FLOW |  TIME    FLOW
   hrs     cms |   hrs     cms |   hrs     cms |'   hrs     cms |   hrs     cms
  0.00    1.00 | 24.00    2.00 |
--------------------------------------------------------------------------------
--------------------
| CALIB            |
| STANDHYD (  0510)|   Area    (ha)=  16.00
|ID= 1 DT= 5.0 min |   Total Imp(%)=  80.00   Dir. Conn.(%)=  79.00
--------------------
                              IMPERVIOUS    PERVIOUS (i)
     Surface Area     (ha)=      12.80         3.20
     Dep. Storage     (mm)=       1.50         5.00
     Average Slope     (%)=       0.50         0.25
     Length            (m)=     400.00        40.00
     Mannings n           =      0.013        0.300

         NOTE:  RAINFALL WAS TRANSFORMED TO   5.0 MIN. TIME STEP.


                              ---- TRANSFORMED HYETOGRAPH ----
                TIME    RAIN |  TIME    RAIN |'  TIME    RAIN |  TIME    RAIN
                 hrs   mm/hr |   hrs   mm/hr |'   hrs   mm/hr |   hrs   mm/hr
               0.083    1.34 | 3.083    2.14 | 6.083    9.61 |  9.08    1.87
               0.167    1.34 | 3.167    2.14 | 6.167    9.61 |  9.17    1.87
               0.250    1.34 | 3.250    2.14 | 6.250    9.61 |  9.25    1.87
```

0.333	1.34	3.333	2.14	6.333	9.61	9.33	1.87
0.417	1.34	3.417	2.14	6.417	9.61	9.42	1.87
0.500	1.34	3.500	2.14	6.500	9.61	9.50	1.87
0.583	1.34	3.583	2.14	6.583	4.27	9.58	1.87
0.667	1.34	3.667	2.14	6.667	4.27	9.67	1.87
0.750	1.34	3.750	2.14	6.750	4.27	9.75	1.87
0.833	1.33	3.833	2.14	6.833	4.27	9.83	1.87
0.917	1.34	3.917	2.14	6.917	4.27	9.92	1.87
1.000	1.34	4.000	2.14	7.000	4.27	10.00	1.87
1.083	1.33	4.083	3.20	7.083	3.20	10.08	1.07
1.167	1.34	4.167	3.20	7.167	3.20	10.17	1.07
1.250	1.34	4.250	3.20	7.250	3.21	10.25	1.07
1.333	1.34	4.333	3.21	7.333	3.20	10.33	1.07
1.417	1.34	4.417	3.20	7.417	3.20	10.42	1.07
1.500	1.34	4.500	3.20	7.500	3.21	10.50	1.07
1.583	1.34	4.583	4.27	7.583	3.20	10.58	1.07
1.667	1.34	4.667	4.27	7.667	3.20	10.67	1.07
1.750	1.34	4.750	4.27	7.750	3.21	10.75	1.07
1.833	1.34	4.833	4.27	7.833	3.20	10.83	1.07
1.917	1.34	4.917	4.27	7.917	3.20	10.92	1.07
2.000	1.34	5.000	4.27	8.000	3.20	11.00	1.07
2.083	1.60	5.083	6.41	8.083	1.87	11.08	1.07
2.167	1.60	5.167	6.41	8.167	1.87	11.17	1.07
2.250	1.60	5.250	6.41	8.250	1.87	11.25	1.07
2.333	1.60	5.333	6.41	8.333	1.87	11.33	1.07
2.417	1.60	5.417	6.41	8.417	1.87	11.42	1.07
2.500	1.60	5.500	6.41	8.500	1.87	11.50	1.07
2.583	1.60	5.583	25.64	8.583	1.87	11.58	1.07
2.667	1.60	5.667	25.64	8.667	1.87	11.67	1.07
2.750	1.60	5.750	25.64	8.750	1.87	11.75	1.07
2.833	1.60	5.833	70.50	8.833	1.87	11.83	1.07
2.917	1.60	5.917	70.50	8.917	1.87	11.92	1.07
3.000	1.60	6.000	70.50	9.000	1.87	12.00	1.07

Max.Eff.Inten.(mm/hr)=	70.50	20.04	
over (min)	10.00	40.00	
Storage Coeff. (min)=	8.31 (ii)	36.26 (ii)	
Unit Hyd. Tpeak (min)=	10.00	40.00	
Unit Hyd. peak (cms)=	0.13	0.03	
			TOTALS
PEAK FLOW (cms)=	2.06	0.09	2.081 (iii)
TIME TO PEAK (hrs)=	6.00	6.50	6.00
RUNOFF VOLUME (mm)=	51.91	9.54	43.01
TOTAL RAINFALL (mm)=	53.41	53.41	53.41
RUNOFF COEFFICIENT =	0.97	0.18	0.81

(i) HORTONS EQUATION SELECTED FOR PERVIOUS LOSSES:
Fo (mm/hr)= 75.00 K (1/hr)= 4.14
Fc (mm/hr)= 12.50 Cum.Inf. (mm)= 0.00

(ii) TIME STEP (DT) SHOULD BE SMALLER OR EQUAL
THAN THE STORAGE COEFFICIENT.
(iii) PEAK FLOW DOES NOT INCLUDE BASEFLOW IF ANY.

CALIB STANDHYD (0500) ID= 1 DT= 5.0 min	Area (ha)= 244.00 Total Imp(%)= 46.00 Dir. Conn.(%)= 26.00

		IMPERVIOUS	PERVIOUS (i)
Surface Area	(ha)=	112.24	131.76
Dep. Storage	(mm)=	1.50	5.00
Average Slope	(%)=	0.80	0.80
Length	(m)=	1275.00	40.00
Mannings n	=	0.013	0.300

NOTE: RAINFALL WAS TRANSFORMED TO 5.0 MIN. TIME STEP.

---- TRANSFORMED HYETOGRAPH ----

TIME hrs	RAIN mm/hr	TIME hrs	RAIN mm/hr	TIME hrs	RAIN mm/hr	TIME hrs	RAIN mm/hr
0.083	1.34	3.083	2.14	6.083	9.61	9.08	1.87
0.167	1.34	3.167	2.14	6.167	9.61	9.17	1.87
0.250	1.34	3.250	2.14	6.250	9.61	9.25	1.87
0.333	1.34	3.333	2.14	6.333	9.61	9.33	1.87
0.417	1.34	3.417	2.14	6.417	9.61	9.42	1.87
0.500	1.34	3.500	2.14	6.500	9.61	9.50	1.87
0.583	1.34	3.583	2.14	6.583	4.27	9.58	1.87
0.667	1.34	3.667	2.14	6.667	4.27	9.67	1.87
0.750	1.34	3.750	2.14	6.750	4.27	9.75	1.87
0.833	1.33	3.833	2.14	6.833	4.27	9.83	1.87
0.917	1.34	3.917	2.14	6.917	4.27	9.92	1.87
1.000	1.34	4.000	2.14	7.000	4.27	10.00	1.87
1.083	1.33	4.083	3.20	7.083	3.20	10.08	1.07
1.167	1.34	4.167	3.20	7.167	3.20	10.17	1.07
1.250	1.34	4.250	3.20	7.250	3.21	10.25	1.07
1.333	1.34	4.333	3.21	7.333	3.20	10.33	1.07
1.417	1.34	4.417	3.20	7.417	3.20	10.42	1.07
1.500	1.34	4.500	3.20	7.500	3.21	10.50	1.07
1.583	1.34	4.583	4.27	7.583	3.20	10.58	1.07
1.667	1.34	4.667	4.27	7.667	3.20	10.67	1.07
1.750	1.34	4.750	4.27	7.750	3.21	10.75	1.07
1.833	1.34	4.833	4.27	7.833	3.20	10.83	1.07
1.917	1.34	4.917	4.27	7.917	3.20	10.92	1.07
2.000	1.34	5.000	4.27	8.000	3.20	11.00	1.07
2.083	1.60	5.083	6.41	8.083	1.87	11.08	1.07
2.167	1.60	5.167	6.41	8.167	1.87	11.17	1.07
2.250	1.60	5.250	6.41	8.250	1.87	11.25	1.07

```
               2.333    1.60 | 5.333    6.41 | 8.333    1.87 | 11.33    1.07
               2.417    1.60 | 5.417    6.41 | 8.417    1.87 | 11.42    1.07
               2.500    1.60 | 5.500    6.41 | 8.500    1.87 | 11.50    1.07
               2.583    1.60 | 5.583   25.64 | 8.583    1.87 | 11.58    1.07
               2.667    1.60 | 5.667   25.64 | 8.667    1.87 | 11.67    1.07
               2.750    1.60 | 5.750   25.64 | 8.750    1.87 | 11.75    1.07
               2.833    1.60 | 5.833   70.50 | 8.833    1.87 | 11.83    1.07
               2.917    1.60 | 5.917   70.50 | 8.917    1.87 | 11.92    1.07
               3.000    1.60 | 6.000   70.50 | 9.000    1.87 | 12.00    1.07

     Max.Eff.Inten.(mm/hr)=      70.50        78.43
               over (min)        15.00        30.00
     Storage Coeff.  (min)=      14.47 (ii)   25.89 (ii)
     Unit Hyd. Tpeak (min)=      15.00        30.00
     Unit Hyd. peak  (cms)=       0.08         0.04
                                                          *TOTALS*
     PEAK FLOW       (cms)=       8.08         9.34         14.467 (iii)
     TIME TO PEAK    (hrs)=       6.08         6.33           6.25
     RUNOFF VOLUME    (mm)=      51.91        14.36          24.12
     TOTAL RAINFALL   (mm)=      53.41        53.41          53.41
     RUNOFF COEFFICIENT   =       0.97         0.27           0.45


       (i) HORTONS EQUATION SELECTED FOR PERVIOUS LOSSES:
            Fo   (mm/hr)= 75.00           K  (1/hr)=  4.14
            Fc   (mm/hr)= 12.50     Cum.Inf.   (mm)=  0.00
      (ii) TIME STEP (DT) SHOULD BE SMALLER OR EQUAL
           THAN THE STORAGE COEFFICIENT.
     (iii) PEAK FLOW DOES NOT INCLUDE BASEFLOW IF ANY.

--------------------------------------------------------------------------------
--------------------
| DUHYD    (  0505)|
| Inlet Cap.= 9.000|
| #of Inlets=     1|
| Total(cms)=   9.0|      AREA     QPEAK     TPEAK    R.V.
--------------------      (ha)     (cms)     (hrs)    (mm)
     TOTAL HYD.(ID= 1): 244.00     14.47      6.25   24.12
     ==================================================
     MAJOR SYS.(ID= 2):  33.53      5.47      6.25   24.12
     MINOR SYS.(ID= 3): 210.47      9.00      6.00   24.12

     NOTE:  PEAK FLOWS DO NOT INCLUDE BASEFLOWS IF ANY.

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

--------------------
| ADD HYD  (  0515)|
|   1 +  2 =  3    |         AREA    QPEAK    TPEAK     R.V.
--------------------         (ha)    (cms)    (hrs)     (mm)
```

```
        ID1= 1 (  0505):   210.47   9.000     6.00    24.12
      + ID2= 2 (  0510):    16.00   2.081     6.00    43.01
        ================================================
        ID = 3 (  0515):   226.47  11.081     6.00    25.46

     NOTE:  PEAK FLOWS DO NOT INCLUDE BASEFLOWS IF ANY.
--------------------------------------------------------------------------------
--------------------
| DUHYD    (  0520)|
| Inlet Cap.= 3.050|
| #of Inlets=     1|
| Total(cms)=   3.0|      AREA     QPEAK     TPEAK    R.V.
--------------------      (ha)     (cms)     (hrs)    (mm)
     TOTAL HYD.(ID= 1): 226.47     11.08      6.00   25.46
     ================================================
     MAJOR SYS.(ID= 2):  88.87      8.03      6.00   25.46
     MINOR SYS.(ID= 3): 137.60      3.05      5.75   25.46

     NOTE:  PEAK FLOWS DO NOT INCLUDE BASEFLOWS IF ANY.

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--------------------
| ADD HYD  (  0526)|
|   1 +  2 =  3    |         AREA    QPEAK    TPEAK     R.V.
--------------------         (ha)    (cms)    (hrs)     (mm)
        ID1= 1 (  0520):    88.87   8.031     6.00    25.46
      + ID2= 2 (  0525):     0.00   2.000    24.00  *******
        ================================================
        ID = 3 (  0526):    88.87   9.281     6.00   171.12

     NOTE:  PEAK FLOWS DO NOT INCLUDE BASEFLOWS IF ANY.
--------------------------------------------------------------------------------
--------------------
| ROUTE CHN(  0527)|
| IN= 2---> OUT= 1 |     Routing time step (min)'=  5.00
--------------------
               <------ DATA FOR SECTION (   1.1) ------>
               Distance      Elevation       Manning
                 100.00        313.20        0.0500
                 140.00        312.40    0.0500 /0.0300  Main Channel
                 140.50        310.80        0.0300      Main Channel
                 141.50        310.80        0.0300      Main Channel
                 142.00        312.40    0.0300 /0.0500  Main Channel
                 160.00        313.20        0.0500

      <---------------------- TRAVEL TIME TABLE ---------------------->
       DEPTH    ELEV      VOLUME    FLOW RATE    VELOCITY   TRAV.TIME
        (m)      (m)     (cu.m.)      (cms)        (m/s)      (min)
       0.12   310.92    .575E+02       0.1          0.40      18.86
```

0.25	311.05	.119E+03	0.2	0.57	13.13
0.37	311.17	.185E+03	0.3	0.69	10.87
0.49	311.29	.256E+03	0.4	0.78	9.61
0.62	311.42	.330E+03	0.6	0.86	8.77
0.74	311.54	.409E+03	0.8	0.92	8.17
0.86	311.66	.492E+03	1.1	0.97	7.70
0.98	311.78	.579E+03	1.3	1.02	7.32
1.11	311.91	.671E+03	1.6	1.07	7.01
1.23	312.03	.767E+03	1.9	1.11	6.74
1.35	312.15	.867E+03	2.2	1.15	6.50
1.48	312.28	.971E+03	2.6	1.19	6.29
1.60	312.40	.108E+04	2.9	1.23	6.11
1.73	312.53	.149E+04	3.6	1.10	6.85
1.87	312.67	.248E+04	4.9	0.88	8.52
2.00	312.80	.405E+04	6.9	0.77	9.74
2.13	312.93	.620E+04	10.1	0.73	10.21
2.27	313.07	.893E+04	14.6	0.74	10.17
2.40	313.20	.122E+05	20.7	0.76	9.85

		<---- hydrograph ---->			<-pipe / channel->	
	AREA	QPEAK	TPEAK	R.V.	MAX DEPTH	MAX VEL
	(ha)	(cms)	(hrs)	(mm)	(m)	(m/s)
INFLOW : ID= 2 (0526)	88.87	9.28	6.00	171.12	2.10	0.74
OUTFLOW: ID= 1 (0527)	88.87	7.72	6.50	170.96	2.03	0.76

CALIB STANDHYD (0540) ID= 1 DT= 5.0 min	Area (ha)= 4.63 Total Imp(%)= 80.00 Dir. Conn.(%)= 79.00

		IMPERVIOUS	PERVIOUS (i)
Surface Area	(ha)=	3.70	0.93
Dep. Storage	(mm)=	1.50	5.00
Average Slope	(%)=	0.55	0.55
Length	(m)=	150.00	40.00
Mannings n	=	0.013	0.300

NOTE: RAINFALL WAS TRANSFORMED TO 5.0 MIN. TIME STEP.

---- TRANSFORMED HYETOGRAPH ----

TIME hrs	RAIN mm/hr	TIME hrs	RAIN mm/hr	TIME hrs	RAIN mm/hr	TIME hrs	RAIN mm/hr
0.083	1.34	3.083	2.14	6.083	9.61	9.08	1.87
0.167	1.34	3.167	2.14	6.167	9.61	9.17	1.87
0.250	1.34	3.250	2.14	6.250	9.61	9.25	1.87
0.333	1.34	3.333	2.14	6.333	9.61	9.33	1.87

0.417	1.34	3.417	2.14	6.417	9.61	9.42	1.87
0.500	1.34	3.500	2.14	6.500	9.61	9.50	1.87
0.583	1.34	3.583	2.14	6.583	4.27	9.58	1.87
0.667	1.34	3.667	2.14	6.667	4.27	9.67	1.87
0.750	1.34	3.750	2.14	6.750	4.27	9.75	1.87
0.833	1.33	3.833	2.14	6.833	4.27	9.83	1.87
0.917	1.34	3.917	2.14	6.917	4.27	9.92	1.87
1.000	1.34	4.000	2.14	7.000	4.27	10.00	1.87
1.083	1.33	4.083	3.20	7.083	3.20	10.08	1.07
1.167	1.34	4.167	3.20	7.167	3.20	10.17	1.07
1.250	1.34	4.250	3.20	7.250	3.21	10.25	1.07
1.333	1.34	4.333	3.21	7.333	3.20	10.33	1.07
1.417	1.34	4.417	3.20	7.417	3.20	10.42	1.07
1.500	1.34	4.500	3.20	7.500	3.21	10.50	1.07
1.583	1.34	4.583	4.27	7.583	3.20	10.58	1.07
1.667	1.34	4.667	4.27	7.667	3.20	10.67	1.07
1.750	1.34	4.750	4.27	7.750	3.21	10.75	1.07
1.833	1.34	4.833	4.27	7.833	3.20	10.83	1.07
1.917	1.34	4.917	4.27	7.917	3.20	10.92	1.07
2.000	1.34	5.000	4.27	8.000	3.20	11.00	1.07
2.083	1.60	5.083	6.41	8.083	1.87	11.08	1.07
2.167	1.60	5.167	6.41	8.167	1.87	11.17	1.07
2.250	1.60	5.250	6.41	8.250	1.87	11.25	1.07
2.333	1.60	5.333	6.41	8.333	1.87	11.33	1.07
2.417	1.60	5.417	6.41	8.417	1.87	11.42	1.07
2.500	1.60	5.500	6.41	8.500	1.87	11.50	1.07
2.583	1.60	5.583	25.64	8.583	1.87	11.58	1.07
2.667	1.60	5.667	25.64	8.667	1.87	11.67	1.07
2.750	1.60	5.750	25.64	8.750	1.87	11.75	1.07
2.833	1.60	5.833	70.50	8.833	1.87	11.83	1.07
2.917	1.60	5.917	70.50	8.917	1.87	11.92	1.07
3.000	1.60	6.000	70.50	9.000	1.87	12.00	1.07

Max.Eff.Inten.(mm/hr)=	70.50	30.06	
over (min)	5.00	25.00	
Storage Coeff. (min)=	4.48 (ii)	23.24 (ii)	
Unit Hyd. Tpeak (min)=	5.00	25.00	
Unit Hyd. peak (cms)=	0.23	0.05	
			TOTALS
PEAK FLOW (cms)=	0.70	0.04	0.713 (iii)
TIME TO PEAK (hrs)=	6.00	6.25	6.00
RUNOFF VOLUME (mm)=	51.91	9.54	43.01
TOTAL RAINFALL (mm)=	53.41	53.41	53.41
RUNOFF COEFFICIENT =	0.97	0.18	0.81

***** WARNING: STORAGE COEFF. IS SMALLER THAN TIME STEP!

(i) HORTONS EQUATION SELECTED FOR PERVIOUS LOSSES:
Fo (mm/hr)= 75.00 K (1/hr)= 4.14
Fc (mm/hr)= 12.50 Cum.Inf. (mm)= 0.00

(ii) TIME STEP (DT) SHOULD BE SMALLER OR EQUAL
THAN THE STORAGE COEFFICIENT.
(iii) PEAK FLOW DOES NOT INCLUDE BASEFLOW IF ANY.

CALIB		
STANDHYD (0600)	Area (ha)= 9.73	
ID= 1 DT= 5.0 min	Total Imp(%)= 52.00	Dir. Conn.(%)= 35.00

		IMPERVIOUS	PERVIOUS (i)
Surface Area	(ha)=	5.06	4.67
Dep. Storage	(mm)=	1.50	5.00
Average Slope	(%)=	2.00	2.00
Length	(m)=	254.69	33.00
Mannings n	=	0.013	0.300

NOTE: RAINFALL WAS TRANSFORMED TO 5.0 MIN. TIME STEP.

---- TRANSFORMED HYETOGRAPH ----

TIME hrs	RAIN mm/hr	TIME hrs	RAIN mm/hr	TIME hrs	RAIN mm/hr	TIME hrs	RAIN mm/hr
0.083	1.34	3.083	2.14	6.083	9.61	9.08	1.87
0.167	1.34	3.167	2.14	6.167	9.61	9.17	1.87
0.250	1.34	3.250	2.14	6.250	9.61	9.25	1.87
0.333	1.34	3.333	2.14	6.333	9.61	9.33	1.87
0.417	1.34	3.417	2.14	6.417	9.61	9.42	1.87
0.500	1.34	3.500	2.14	6.500	9.61	9.50	1.87
0.583	1.34	3.583	2.14	6.583	4.27	9.58	1.87
0.667	1.34	3.667	2.14	6.667	4.27	9.67	1.87
0.750	1.34	3.750	2.14	6.750	4.27	9.75	1.87
0.833	1.33	3.833	2.14	6.833	4.27	9.83	1.87
0.917	1.34	3.917	2.14	6.917	4.27	9.92	1.87
1.000	1.34	4.000	2.14	7.000	4.27	10.00	1.87
1.083	1.33	4.083	3.20	7.083	3.20	10.08	1.07
1.167	1.34	4.167	3.20	7.167	3.20	10.17	1.07
1.250	1.34	4.250	3.20	7.250	3.21	10.25	1.07
1.333	1.34	4.333	3.21	7.333	3.20	10.33	1.07
1.417	1.34	4.417	3.20	7.417	3.20	10.42	1.07
1.500	1.34	4.500	3.20	7.500	3.21	10.50	1.07
1.583	1.34	4.583	4.27	7.583	3.20	10.58	1.07
1.667	1.34	4.667	4.27	7.667	3.20	10.67	1.07
1.750	1.34	4.750	4.27	7.750	3.21	10.75	1.07
1.833	1.34	4.833	4.27	7.833	3.20	10.83	1.07
1.917	1.34	4.917	4.27	7.917	3.20	10.92	1.07
2.000	1.34	5.000	4.27	8.000	3.20	11.00	1.07
2.083	1.60	5.083	6.41	8.083	1.87	11.08	1.07
2.167	1.60	5.167	6.41	8.167	1.87	11.17	1.07
2.250	1.60	5.250	6.41	8.250	1.87	11.25	1.07

```
               2.333    1.60 | 5.333    6.41 | 8.333    1.87 | 11.33    1.07
               2.417    1.60 | 5.417    6.41 | 8.417    1.87 | 11.42    1.07
               2.500    1.60 | 5.500    6.41 | 8.500    1.87 | 11.50    1.07
               2.583    1.60 | 5.583   25.64 | 8.583    1.87 | 11.58    1.07
               2.667    1.60 | 5.667   25.64 | 8.667    1.87 | 11.67    1.07
               2.750    1.60 | 5.750   25.64 | 8.750    1.87 | 11.75    1.07
               2.833    1.60 | 5.833   70.50 | 8.833    1.87 | 11.83    1.07
               2.917    1.60 | 5.917   70.50 | 8.917    1.87 | 11.92    1.07
               3.000    1.60 | 6.000   70.50 | 9.000    1.87 | 12.00    1.07

     Max.Eff.Inten.(mm/hr)=      70.50        81.11
               over (min)         5.00        15.00
     Storage Coeff.  (min)=       4.18 (ii)   11.81 (ii)
     Unit Hyd. Tpeak (min)=       5.00        15.00
     Unit Hyd. peak  (cms)=       0.24         0.09
                                                          *TOTALS*
     PEAK FLOW       (cms)=       0.66         0.60          1.149 (iii)
     TIME TO PEAK    (hrs)=       6.00         6.08           6.00
     RUNOFF VOLUME    (mm)=      51.91        14.13          27.35
     TOTAL RAINFALL   (mm)=      53.41        53.41          53.41
     RUNOFF COEFFICIENT   =       0.97         0.26           0.51

***** WARNING: STORAGE COEFF. IS SMALLER THAN TIME STEP!

       (i) HORTONS EQUATION SELECTED FOR PERVIOUS LOSSES:
            Fo   (mm/hr)= 75.00           K  (1/hr)=  4.14
            Fc   (mm/hr)= 12.50     Cum.Inf.   (mm)=  0.00
      (ii) TIME STEP (DT) SHOULD BE SMALLER OR EQUAL
           THAN THE STORAGE COEFFICIENT.
     (iii) PEAK FLOW DOES NOT INCLUDE BASEFLOW IF ANY.

--------------------------------------------------------------------------------
--------------------
| CALIB            |
| STANDHYD (  0601)|   Area    (ha)=   6.95
|ID= 1 DT= 5.0 min |   Total Imp(%)=  70.00   Dir. Conn.(%)=  50.00
--------------------
                              IMPERVIOUS    PERVIOUS (i)
     Surface Area     (ha)=       4.86         2.09
     Dep. Storage     (mm)=       1.50         5.00
     Average Slope     (%)=       2.00         2.00
     Length            (m)=     215.25        33.00
     Mannings n             =      0.013        0.300

         NOTE:  RAINFALL WAS TRANSFORMED TO   5.0 MIN. TIME STEP.


                              ---- TRANSFORMED HYETOGRAPH ----
                TIME    RAIN |  TIME    RAIN |'  TIME    RAIN |  TIME    RAIN
                 hrs   mm/hr |   hrs   mm/hr |'   hrs   mm/hr |   hrs   mm/hr
```

0.083	1.34	3.083	2.14	6.083	9.61	9.08	1.87
0.167	1.34	3.167	2.14	6.167	9.61	9.17	1.87
0.250	1.34	3.250	2.14	6.250	9.61	9.25	1.87
0.333	1.34	3.333	2.14	6.333	9.61	9.33	1.87
0.417	1.34	3.417	2.14	6.417	9.61	9.42	1.87
0.500	1.34	3.500	2.14	6.500	9.61	9.50	1.87
0.583	1.34	3.583	2.14	6.583	4.27	9.58	1.87
0.667	1.34	3.667	2.14	6.667	4.27	9.67	1.87
0.750	1.34	3.750	2.14	6.750	4.27	9.75	1.87
0.833	1.33	3.833	2.14	6.833	4.27	9.83	1.87
0.917	1.34	3.917	2.14	6.917	4.27	9.92	1.87
1.000	1.34	4.000	2.14	7.000	4.27	10.00	1.87
1.083	1.33	4.083	3.20	7.083	3.20	10.08	1.07
1.167	1.34	4.167	3.20	7.167	3.20	10.17	1.07
1.250	1.34	4.250	3.20	7.250	3.21	10.25	1.07
1.333	1.34	4.333	3.21	7.333	3.20	10.33	1.07
1.417	1.34	4.417	3.20	7.417	3.20	10.42	1.07
1.500	1.34	4.500	3.20	7.500	3.21	10.50	1.07
1.583	1.34	4.583	4.27	7.583	3.20	10.58	1.07
1.667	1.34	4.667	4.27	7.667	3.20	10.67	1.07
1.750	1.34	4.750	4.27	7.750	3.21	10.75	1.07
1.833	1.34	4.833	4.27	7.833	3.20	10.83	1.07
1.917	1.34	4.917	4.27	7.917	3.20	10.92	1.07
2.000	1.34	5.000	4.27	8.000	3.20	11.00	1.07
2.083	1.60	5.083	6.41	8.083	1.87	11.08	1.07
2.167	1.60	5.167	6.41	8.167	1.87	11.17	1.07
2.250	1.60	5.250	6.41	8.250	1.87	11.25	1.07
2.333	1.60	5.333	6.41	8.333	1.87	11.33	1.07
2.417	1.60	5.417	6.41	8.417	1.87	11.42	1.07
2.500	1.60	5.500	6.41	8.500	1.87	11.50	1.07
2.583	1.60	5.583	25.64	8.583	1.87	11.58	1.07
2.667	1.60	5.667	25.64	8.667	1.87	11.67	1.07
2.750	1.60	5.750	25.64	8.750	1.87	11.75	1.07
2.833	1.60	5.833	70.50	8.833	1.87	11.83	1.07
2.917	1.60	5.917	70.50	8.917	1.87	11.92	1.07
3.000	1.60	6.000	70.50	9.000	1.87	12.00	1.07

Max.Eff.Inten.(mm/hr)=	70.50	104.24	
over (min)	5.00	15.00	
Storage Coeff. (min)=	3.78 (ii)	10.68 (ii)	
Unit Hyd. Tpeak (min)=	5.00	15.00	
Unit Hyd. peak (cms)=	0.25	0.09	
			TOTALS
PEAK FLOW (cms)=	0.67	0.39	1.023 (iii)
TIME TO PEAK (hrs)=	6.00	6.08	6.00
RUNOFF VOLUME (mm)=	51.91	17.75	34.83
TOTAL RAINFALL (mm)=	53.41	53.41	53.41
RUNOFF COEFFICIENT =	0.97	0.33	0.65

***** WARNING: STORAGE COEFF. IS SMALLER THAN TIME STEP!

```
       (i) HORTONS EQUATION SELECTED FOR PERVIOUS LOSSES:
            Fo   (mm/hr)= 75.00          K  (1/hr)=  4.14
            Fc   (mm/hr)= 12.50     Cum.Inf.   (mm)=  0.00
      (ii) TIME STEP (DT) SHOULD BE SMALLER OR EQUAL
           THAN THE STORAGE COEFFICIENT.
     (iii) PEAK FLOW DOES NOT INCLUDE BASEFLOW IF ANY.

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--------------------
| ADD HYD  (  0602)|
|   1 +  2 =  3    |         AREA    QPEAK    TPEAK     R.V.
--------------------         (ha)    (cms)    (hrs)     (mm)
        ID1= 1 (  0600):     9.73   1.149     6.00    27.35
      + ID2= 2 (  0601):     6.95   1.023     6.00    34.83
        ================================================
        ID = 3 (  0602):    16.68   2.172     6.00    30.47

     NOTE:  PEAK FLOWS DO NOT INCLUDE BASEFLOWS IF ANY.
--------------------------------------------------------------------------------
--------------------
| ROUTE CHN(  0563)|
| IN= 2---> OUT= 1 |     Routing time step (min)'=  5.00
--------------------
               <------ DATA FOR SECTION (   2.2) ------>
               Distance      Elevation       Manning
                   0.00          1.00        0.0350
                   2.00          0.50        0.0350
                   4.00          0.00    0.0350 /0.0350  Main Channel
                   4.50          0.00        0.0350      Main Channel
                   5.00          0.00    0.0350 /0.0350  Main Channel
                   7.00          0.50        0.0350
                   9.00          1.00        0.0350

      <---------------------- TRAVEL TIME TABLE ---------------------->
       DEPTH    ELEV      VOLUME    FLOW RATE    VELOCITY   TRAV.TIME
        (m)      (m)     (cu.m.)      (cms)        (m/s)      (min)
       0.05     0.05    .701E+01       0.0          0.64       2.87
       0.11     0.11    .165E+02       0.1          0.96       1.91
       0.16     0.16    .283E+02       0.3          1.21       1.51
       0.21     0.21    .427E+02       0.6          1.42       1.29
       0.26     0.26    .594E+02       0.9          1.61       1.14
       0.32     0.32    .786E+02       1.3          1.77       1.03
       0.37     0.37    .100E+03       1.8          1.93       0.95
       0.42     0.42    .124E+03       2.3          2.08       0.88
       0.47     0.47    .151E+03       3.0          2.22       0.83
       0.53     0.53    .180E+03       3.8          2.35       0.78
       0.58     0.58    .211E+03       4.8          2.48       0.74
       0.63     0.63    .245E+03       5.8          2.60       0.71
```

0.68	0.68	.281E+03	7.0	2.72	0.67
0.74	0.74	.320E+03	8.2	2.84	0.65
0.79	0.79	.361E+03	9.7	2.95	0.62
0.84	0.84	.405E+03	11.3	3.06	0.60
0.89	0.89	.451E+03	13.0	3.17	0.58
0.95	0.95	.499E+03	14.8	3.27	0.56
1.00	1.00	.550E+03	16.9	3.38	0.54

	<---- hydrograph ---->			<-pipe / channel->	
	AREA (ha)	QPEAK (cms)	TPEAK (hrs)	R.V. (mm)	MAX DEPTH (m)	MAX VEL (m/s)
INFLOW : ID= 2 (0602)	16.68	2.17	6.00	30.47	0.41	2.03
OUTFLOW: ID= 1 (0563)	16.68	2.08	6.00	30.47	0.40	2.01

CALIB STANDHYD (0607) ID= 1 DT= 5.0 min	Area (ha)= 5.97 Total Imp(%)= 51.00 Dir. Conn.(%)= 35.00

		IMPERVIOUS	PERVIOUS (i)
Surface Area	(ha)=	3.04	2.93
Dep. Storage	(mm)=	1.50	5.00
Average Slope	(%)=	2.00	2.00
Length	(m)=	199.50	33.00
Mannings n	=	0.013	0.300

NOTE: RAINFALL WAS TRANSFORMED TO 5.0 MIN. TIME STEP.

---- TRANSFORMED HYETOGRAPH ----

TIME hrs	RAIN mm/hr	TIME hrs	RAIN mm/hr	TIME hrs	RAIN mm/hr	TIME hrs	RAIN mm/hr
0.083	1.34	3.083	2.14	6.083	9.61	9.08	1.87
0.167	1.34	3.167	2.14	6.167	9.61	9.17	1.87
0.250	1.34	3.250	2.14	6.250	9.61	9.25	1.87
0.333	1.34	3.333	2.14	6.333	9.61	9.33	1.87
0.417	1.34	3.417	2.14	6.417	9.61	9.42	1.87
0.500	1.34	3.500	2.14	6.500	9.61	9.50	1.87
0.583	1.34	3.583	2.14	6.583	4.27	9.58	1.87
0.667	1.34	3.667	2.14	6.667	4.27	9.67	1.87
0.750	1.34	3.750	2.14	6.750	4.27	9.75	1.87
0.833	1.33	3.833	2.14	6.833	4.27	9.83	1.87
0.917	1.34	3.917	2.14	6.917	4.27	9.92	1.87
1.000	1.34	4.000	2.14	7.000	4.27	10.00	1.87
1.083	1.33	4.083	3.20	7.083	3.20	10.08	1.07
1.167	1.34	4.167	3.20	7.167	3.20	10.17	1.07
1.250	1.34	4.250	3.20	7.250	3.21	10.25	1.07

1.333	1.34	4.333	3.21	7.333	3.20	10.33	1.07
1.417	1.34	4.417	3.20	7.417	3.20	10.42	1.07
1.500	1.34	4.500	3.20	7.500	3.21	10.50	1.07
1.583	1.34	4.583	4.27	7.583	3.20	10.58	1.07
1.667	1.34	4.667	4.27	7.667	3.20	10.67	1.07
1.750	1.34	4.750	4.27	7.750	3.21	10.75	1.07
1.833	1.34	4.833	4.27	7.833	3.20	10.83	1.07
1.917	1.34	4.917	4.27	7.917	3.20	10.92	1.07
2.000	1.34	5.000	4.27	8.000	3.20	11.00	1.07
2.083	1.60	5.083	6.41	8.083	1.87	11.08	1.07
2.167	1.60	5.167	6.41	8.167	1.87	11.17	1.07
2.250	1.60	5.250	6.41	8.250	1.87	11.25	1.07
2.333	1.60	5.333	6.41	8.333	1.87	11.33	1.07
2.417	1.60	5.417	6.41	8.417	1.87	11.42	1.07
2.500	1.60	5.500	6.41	8.500	1.87	11.50	1.07
2.583	1.60	5.583	25.64	8.583	1.87	11.58	1.07
2.667	1.60	5.667	25.64	8.667	1.87	11.67	1.07
2.750	1.60	5.750	25.64	8.750	1.87	11.75	1.07
2.833	1.60	5.833	70.50	8.833	1.87	11.83	1.07
2.917	1.60	5.917	70.50	8.917	1.87	11.92	1.07
3.000	1.60	6.000	70.50	9.000	1.87	12.00	1.07

Max.Eff.Inten.(mm/hr)=	70.50	79.03	
over (min)	5.00	15.00	
Storage Coeff. (min)=	3.61 (ii)	11.32 (ii)	
Unit Hyd. Tpeak (min)=	5.00	15.00	
Unit Hyd. peak (cms)=	0.25	0.09	
			TOTALS
PEAK FLOW (cms)=	0.41	0.37	0.706 (iii)
TIME TO PEAK (hrs)=	6.00	6.08	6.00
RUNOFF VOLUME (mm)=	51.91	13.81	27.14
TOTAL RAINFALL (mm)=	53.41	53.41	53.41
RUNOFF COEFFICIENT =	0.97	0.26	0.51

***** WARNING: STORAGE COEFF. IS SMALLER THAN TIME STEP!

(i) HORTONS EQUATION SELECTED FOR PERVIOUS LOSSES:
Fo (mm/hr)= 75.00 K (1/hr)= 4.14
Fc (mm/hr)= 12.50 Cum.Inf. (mm)= 0.00
(ii) TIME STEP (DT) SHOULD BE SMALLER OR EQUAL
THAN THE STORAGE COEFFICIENT.
(iii) PEAK FLOW DOES NOT INCLUDE BASEFLOW IF ANY.

ADD HYD (0492)				
1 + 2 = 3	AREA (ha)	QPEAK (cms)	TPEAK (hrs)	R.V. (mm)
ID1= 1 (0563):	16.68	2.078	6.00	30.47

```
      + ID2= 2 (  0607):     5.97   0.706     6.00    27.14
        ================================================
        ID = 3 (  0492):    22.65   2.784     6.00    29.59

     NOTE:  PEAK FLOWS DO NOT INCLUDE BASEFLOWS IF ANY.
--------------------------------------------------------------------------------
--------------------
| RESERVOIR(  0482)|     OVERFLOW IS OFF
| IN= 2---> OUT= 1 |
| DT=  5.0 min     |     OUTFLOW    STORAGE   |  OUTFLOW    STORAGE
--------------------      (cms)     (ha.m.)   |   (cms)     (ha.m.)
                          0.0000     0.0000   |   0.2910      0.3795
                          0.2590     0.0579   |   0.2970      0.4503
                          0.2660     0.1180   |   1.6320      0.5232
                          0.2720     0.1802   |   4.1680      0.5983
                          0.2790     0.2445   |   7.5660      0.6756
                          0.2850     0.3109   |   0.0000      0.0000

                                AREA     QPEAK     TPEAK       R.V.
                                (ha)     (cms)     (hrs)       (mm)
   INFLOW : ID= 2 (  0492)     22.650      2.784      6.00      29.59
   OUTFLOW: ID= 1 (  0482)     22.650      0.291      6.58      29.59

                  PEAK   FLOW   REDUCTION [Qout/Qin](%)= 10.46
                  TIME SHIFT OF PEAK FLOW         (min)= 35.00
                  MAXIMUM  STORAGE   USED       (ha.m.)=  0.3841

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--------------------
| CALIB            |
| STANDHYD (  0480)|   Area    (ha)=  43.10
|ID= 1 DT= 5.0 min |   Total Imp(%)=  42.00   Dir. Conn.(%)=  21.00
--------------------
                             IMPERVIOUS    PERVIOUS (i)
     Surface Area     (ha)=      18.10        25.00
     Dep. Storage     (mm)=       1.50         5.00
     Average Slope     (%)=       2.00         2.00
     Length            (m)=     680.00        40.00
     Mannings n             =      0.013        0.300

         NOTE:  RAINFALL WAS TRANSFORMED TO   5.0 MIN. TIME STEP.


                              ---- TRANSFORMED HYETOGRAPH ----
               TIME     RAIN |  TIME     RAIN |'  TIME     RAIN |  TIME     RAIN
                hrs    mm/hr |   hrs    mm/hr |'   hrs    mm/hr |   hrs    mm/hr
              0.083     1.34 | 3.083     2.14 | 6.083     9.61 |  9.08     1.87
              0.167     1.34 | 3.167     2.14 | 6.167     9.61 |  9.17     1.87
              0.250     1.34 | 3.250     2.14 | 6.250     9.61 |  9.25     1.87
              0.333     1.34 | 3.333     2.14 | 6.333     9.61 |  9.33     1.87
```

0.417	1.34	3.417	2.14	6.417	9.61	9.42	1.87
0.500	1.34	3.500	2.14	6.500	9.61	9.50	1.87
0.583	1.34	3.583	2.14	6.583	4.27	9.58	1.87
0.667	1.34	3.667	2.14	6.667	4.27	9.67	1.87
0.750	1.34	3.750	2.14	6.750	4.27	9.75	1.87
0.833	1.33	3.833	2.14	6.833	4.27	9.83	1.87
0.917	1.34	3.917	2.14	6.917	4.27	9.92	1.87
1.000	1.34	4.000	2.14	7.000	4.27	10.00	1.87
1.083	1.33	4.083	3.20	7.083	3.20	10.08	1.07
1.167	1.34	4.167	3.20	7.167	3.20	10.17	1.07
1.250	1.34	4.250	3.20	7.250	3.21	10.25	1.07
1.333	1.34	4.333	3.21	7.333	3.20	10.33	1.07
1.417	1.34	4.417	3.20	7.417	3.20	10.42	1.07
1.500	1.34	4.500	3.20	7.500	3.21	10.50	1.07
1.583	1.34	4.583	4.27	7.583	3.20	10.58	1.07
1.667	1.34	4.667	4.27	7.667	3.20	10.67	1.07
1.750	1.34	4.750	4.27	7.750	3.21	10.75	1.07
1.833	1.34	4.833	4.27	7.833	3.20	10.83	1.07
1.917	1.34	4.917	4.27	7.917	3.20	10.92	1.07
2.000	1.34	5.000	4.27	8.000	3.20	11.00	1.07
2.083	1.60	5.083	6.41	8.083	1.87	11.08	1.07
2.167	1.60	5.167	6.41	8.167	1.87	11.17	1.07
2.250	1.60	5.250	6.41	8.250	1.87	11.25	1.07
2.333	1.60	5.333	6.41	8.333	1.87	11.33	1.07
2.417	1.60	5.417	6.41	8.417	1.87	11.42	1.07
2.500	1.60	5.500	6.41	8.500	1.87	11.50	1.07
2.583	1.60	5.583	25.64	8.583	1.87	11.58	1.07
2.667	1.60	5.667	25.64	8.667	1.87	11.67	1.07
2.750	1.60	5.750	25.64	8.750	1.87	11.75	1.07
2.833	1.60	5.833	70.50	8.833	1.87	11.83	1.07
2.917	1.60	5.917	70.50	8.917	1.87	11.92	1.07
3.000	1.60	6.000	70.50	9.000	1.87	12.00	1.07

Max.Eff.Inten.(mm/hr)=	70.50	81.70	
over (min)	10.00	20.00	
Storage Coeff. (min)=	7.54 (ii)	16.07 (ii)	
Unit Hyd. Tpeak (min)=	10.00	20.00	
Unit Hyd. peak (cms)=	0.13	0.06	
			TOTALS
PEAK FLOW (cms)=	1.52	2.56	3.608 (iii)
TIME TO PEAK (hrs)=	6.00	6.17	6.08
RUNOFF VOLUME (mm)=	51.91	14.24	22.15
TOTAL RAINFALL (mm)=	53.41	53.41	53.41
RUNOFF COEFFICIENT =	0.97	0.27	0.41

(i) HORTONS EQUATION SELECTED FOR PERVIOUS LOSSES:
Fo (mm/hr)= 75.00 K (1/hr)= 4.14
Fc (mm/hr)= 12.50 Cum.Inf. (mm)= 0.00
(ii) TIME STEP (DT) SHOULD BE SMALLER OR EQUAL

THAN THE STORAGE COEFFICIENT.
(iii) PEAK FLOW DOES NOT INCLUDE BASEFLOW IF ANY.

CALIB	
STANDHYD (0460)	Area (ha)= 36.00
ID= 1 DT= 5.0 min	Total Imp(%)= 42.00 Dir. Conn.(%)= 21.00

		IMPERVIOUS	PERVIOUS (i)
Surface Area	(ha)=	15.12	20.88
Dep. Storage	(mm)=	1.50	5.00
Average Slope	(%)=	2.03	2.03
Length	(m)=	465.00	40.00
Mannings n	=	0.013	0.300

NOTE: RAINFALL WAS TRANSFORMED TO 5.0 MIN. TIME STEP.

---- TRANSFORMED HYETOGRAPH ----

TIME hrs	RAIN mm/hr	TIME hrs	RAIN mm/hr	TIME hrs	RAIN mm/hr	TIME hrs	RAIN mm/hr
0.083	1.34	3.083	2.14	6.083	9.61	9.08	1.87
0.167	1.34	3.167	2.14	6.167	9.61	9.17	1.87
0.250	1.34	3.250	2.14	6.250	9.61	9.25	1.87
0.333	1.34	3.333	2.14	6.333	9.61	9.33	1.87
0.417	1.34	3.417	2.14	6.417	9.61	9.42	1.87
0.500	1.34	3.500	2.14	6.500	9.61	9.50	1.87
0.583	1.34	3.583	2.14	6.583	4.27	9.58	1.87
0.667	1.34	3.667	2.14	6.667	4.27	9.67	1.87
0.750	1.34	3.750	2.14	6.750	4.27	9.75	1.87
0.833	1.33	3.833	2.14	6.833	4.27	9.83	1.87
0.917	1.34	3.917	2.14	6.917	4.27	9.92	1.87
1.000	1.34	4.000	2.14	7.000	4.27	10.00	1.87
1.083	1.33	4.083	3.20	7.083	3.20	10.08	1.07
1.167	1.34	4.167	3.20	7.167	3.20	10.17	1.07
1.250	1.34	4.250	3.20	7.250	3.21	10.25	1.07
1.333	1.34	4.333	3.21	7.333	3.20	10.33	1.07
1.417	1.34	4.417	3.20	7.417	3.20	10.42	1.07
1.500	1.34	4.500	3.20	7.500	3.21	10.50	1.07
1.583	1.34	4.583	4.27	7.583	3.20	10.58	1.07
1.667	1.34	4.667	4.27	7.667	3.20	10.67	1.07
1.750	1.34	4.750	4.27	7.750	3.21	10.75	1.07
1.833	1.34	4.833	4.27	7.833	3.20	10.83	1.07
1.917	1.34	4.917	4.27	7.917	3.20	10.92	1.07
2.000	1.34	5.000	4.27	8.000	3.20	11.00	1.07
2.083	1.60	5.083	6.41	8.083	1.87	11.08	1.07
2.167	1.60	5.167	6.41	8.167	1.87	11.17	1.07
2.250	1.60	5.250	6.41	8.250	1.87	11.25	1.07
2.333	1.60	5.333	6.41	8.333	1.87	11.33	1.07

2.417	1.60	5.417	6.41	8.417	1.87	11.42	1.07
2.500	1.60	5.500	6.41	8.500	1.87	11.50	1.07
2.583	1.60	5.583	25.64	8.583	1.87	11.58	1.07
2.667	1.60	5.667	25.64	8.667	1.87	11.67	1.07
2.750	1.60	5.750	25.64	8.750	1.87	11.75	1.07
2.833	1.60	5.833	70.50	8.833	1.87	11.83	1.07
2.917	1.60	5.917	70.50	8.917	1.87	11.92	1.07
3.000	1.60	6.000	70.50	9.000	1.87	12.00	1.07

Max.Eff.Inten.(mm/hr)=	70.50	81.70	
over (min)	5.00	15.00	
Storage Coeff. (min)=	5.97 (ii)	14.47 (ii)	
Unit Hyd. Tpeak (min)=	5.00	15.00	
Unit Hyd. peak (cms)=	0.19	0.08	
			TOTALS
PEAK FLOW (cms)=	1.40	2.42	3.376 (iii)
TIME TO PEAK (hrs)=	6.00	6.08	6.00
RUNOFF VOLUME (mm)=	51.91	14.24	22.15
TOTAL RAINFALL (mm)=	53.41	53.41	53.41
RUNOFF COEFFICIENT =	0.97	0.27	0.41

(i) HORTONS EQUATION SELECTED FOR PERVIOUS LOSSES:
Fo (mm/hr)= 75.00 K (1/hr)= 4.14
Fc (mm/hr)= 12.50 Cum.Inf. (mm)= 0.00
(ii) TIME STEP (DT) SHOULD BE SMALLER OR EQUAL
THAN THE STORAGE COEFFICIENT.
(iii) PEAK FLOW DOES NOT INCLUDE BASEFLOW IF ANY.

CALIB
STANDHYD (0455)
ID= 1 DT= 5.0 min

Area (ha)= 12.70
Total Imp(%)= 42.00 Dir. Conn.(%)= 21.00

		IMPERVIOUS	PERVIOUS (i)
Surface Area (ha)=		5.33	7.37
Dep. Storage (mm)=		1.50	5.00
Average Slope (%)=		1.71	1.71
Length (m)=		300.00	40.00
Mannings n =		0.013	0.300

NOTE: RAINFALL WAS TRANSFORMED TO 5.0 MIN. TIME STEP.

---- TRANSFORMED HYETOGRAPH ----

TIME hrs	RAIN mm/hr	TIME hrs	RAIN mm/hr	TIME hrs	RAIN mm/hr	TIME hrs	RAIN mm/hr
0.083	1.34	3.083	2.14	6.083	9.61	9.08	1.87
0.167	1.34	3.167	2.14	6.167	9.61	9.17	1.87

0.250	1.34	3.250	2.14	6.250	9.61	9.25	1.87
0.333	1.34	3.333	2.14	6.333	9.61	9.33	1.87
0.417	1.34	3.417	2.14	6.417	9.61	9.42	1.87
0.500	1.34	3.500	2.14	6.500	9.61	9.50	1.87
0.583	1.34	3.583	2.14	6.583	4.27	9.58	1.87
0.667	1.34	3.667	2.14	6.667	4.27	9.67	1.87
0.750	1.34	3.750	2.14	6.750	4.27	9.75	1.87
0.833	1.33	3.833	2.14	6.833	4.27	9.83	1.87
0.917	1.34	3.917	2.14	6.917	4.27	9.92	1.87
1.000	1.34	4.000	2.14	7.000	4.27	10.00	1.87
1.083	1.33	4.083	3.20	7.083	3.20	10.08	1.07
1.167	1.34	4.167	3.20	7.167	3.20	10.17	1.07
1.250	1.34	4.250	3.20	7.250	3.21	10.25	1.07
1.333	1.34	4.333	3.21	7.333	3.20	10.33	1.07
1.417	1.34	4.417	3.20	7.417	3.20	10.42	1.07
1.500	1.34	4.500	3.20	7.500	3.21	10.50	1.07
1.583	1.34	4.583	4.27	7.583	3.20	10.58	1.07
1.667	1.34	4.667	4.27	7.667	3.20	10.67	1.07
1.750	1.34	4.750	4.27	7.750	3.21	10.75	1.07
1.833	1.34	4.833	4.27	7.833	3.20	10.83	1.07
1.917	1.34	4.917	4.27	7.917	3.20	10.92	1.07
2.000	1.34	5.000	4.27	8.000	3.20	11.00	1.07
2.083	1.60	5.083	6.41	8.083	1.87	11.08	1.07
2.167	1.60	5.167	6.41	8.167	1.87	11.17	1.07
2.250	1.60	5.250	6.41	8.250	1.87	11.25	1.07
2.333	1.60	5.333	6.41	8.333	1.87	11.33	1.07
2.417	1.60	5.417	6.41	8.417	1.87	11.42	1.07
2.500	1.60	5.500	6.41	8.500	1.87	11.50	1.07
2.583	1.60	5.583	25.64	8.583	1.87	11.58	1.07
2.667	1.60	5.667	25.64	8.667	1.87	11.67	1.07
2.750	1.60	5.750	25.64	8.750	1.87	11.75	1.07
2.833	1.60	5.833	70.50	8.833	1.87	11.83	1.07
2.917	1.60	5.917	70.50	8.917	1.87	11.92	1.07
3.000	1.60	6.000	70.50	9.000	1.87	12.00	1.07

Max.Eff.Inten.(mm/hr)=	70.50	81.70	
over (min)	5.00	15.00	
Storage Coeff. (min)=	4.84 (ii)	13.78 (ii)	
Unit Hyd. Tpeak (min)=	5.00	15.00	
Unit Hyd. peak (cms)=	0.22	0.08	
			TOTALS
PEAK FLOW (cms)=	0.51	0.88	1.226 (iii)
TIME TO PEAK (hrs)=	6.00	6.08	6.00
RUNOFF VOLUME (mm)=	51.91	14.24	22.15
TOTAL RAINFALL (mm)=	53.41	53.41	53.41
RUNOFF COEFFICIENT =	0.97	0.27	0.41

***** WARNING: STORAGE COEFF. IS SMALLER THAN TIME STEP!

(i) HORTONS EQUATION SELECTED FOR PERVIOUS LOSSES:

```
            Fo   (mm/hr)= 75.00          K  (1/hr)=  4.14
            Fc   (mm/hr)= 12.50     Cum.Inf.   (mm)=  0.00
      (ii) TIME STEP (DT) SHOULD BE SMALLER OR EQUAL
           THAN THE STORAGE COEFFICIENT.
     (iii) PEAK FLOW DOES NOT INCLUDE BASEFLOW IF ANY.

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--------------------
| ADD HYD  (  0465)|
|   1 +  2 =  3    |         AREA    QPEAK    TPEAK     R.V.
--------------------         (ha)    (cms)    (hrs)     (mm)
       ID1= 1 (  0455):    12.70   1.226     6.00    22.15
     + ID2= 2 (  0460):    36.00   3.376     6.00    22.15
       ================================================
       ID = 3 (  0465):    48.70   4.602     6.00    22.15

     NOTE:  PEAK FLOWS DO NOT INCLUDE BASEFLOWS IF ANY.
--------------------------------------------------------------------------------
--------------------
| CALIB            |
| STANDHYD (  0410)|   Area    (ha)=  24.20
|ID= 1 DT= 5.0 min |   Total Imp(%)=  42.00   Dir. Conn.(%)=  21.00
--------------------
                            IMPERVIOUS    PERVIOUS (i)
     Surface Area     (ha)=      10.16        14.04
     Dep. Storage     (mm)=       1.50         5.00
     Average Slope     (%)=       2.00         2.00
     Length            (m)=     401.00        40.00
     Mannings n             =      0.013        0.300

         NOTE:  RAINFALL WAS TRANSFORMED TO   5.0 MIN. TIME STEP.


                          ---- TRANSFORMED HYETOGRAPH ----
                TIME    RAIN |  TIME    RAIN |'  TIME    RAIN |  TIME    RAIN
                 hrs   mm/hr |   hrs   mm/hr |'   hrs   mm/hr |   hrs   mm/hr
               0.083    1.34 | 3.083    2.14 | 6.083    9.61 |  9.08    1.87
               0.167    1.34 | 3.167    2.14 | 6.167    9.61 |  9.17    1.87
               0.250    1.34 | 3.250    2.14 | 6.250    9.61 |  9.25    1.87
               0.333    1.34 | 3.333    2.14 | 6.333    9.61 |  9.33    1.87
               0.417    1.34 | 3.417    2.14 | 6.417    9.61 |  9.42    1.87
               0.500    1.34 | 3.500    2.14 | 6.500    9.61 |  9.50    1.87
               0.583    1.34 | 3.583    2.14 | 6.583    4.27 |  9.58    1.87
               0.667    1.34 | 3.667    2.14 | 6.667    4.27 |  9.67    1.87
               0.750    1.34 | 3.750    2.14 | 6.750    4.27 |  9.75    1.87
               0.833    1.33 | 3.833    2.14 | 6.833    4.27 |  9.83    1.87
               0.917    1.34 | 3.917    2.14 | 6.917    4.27 |  9.92    1.87
               1.000    1.34 | 4.000    2.14 | 7.000    4.27 | 10.00    1.87
               1.083    1.33 | 4.083    3.20 | 7.083    3.20 | 10.08    1.07
```

1.167	1.34	4.167	3.20	7.167	3.20	10.17	1.07
1.250	1.34	4.250	3.20	7.250	3.21	10.25	1.07
1.333	1.34	4.333	3.21	7.333	3.20	10.33	1.07
1.417	1.34	4.417	3.20	7.417	3.20	10.42	1.07
1.500	1.34	4.500	3.20	7.500	3.21	10.50	1.07
1.583	1.34	4.583	4.27	7.583	3.20	10.58	1.07
1.667	1.34	4.667	4.27	7.667	3.20	10.67	1.07
1.750	1.34	4.750	4.27	7.750	3.21	10.75	1.07
1.833	1.34	4.833	4.27	7.833	3.20	10.83	1.07
1.917	1.34	4.917	4.27	7.917	3.20	10.92	1.07
2.000	1.34	5.000	4.27	8.000	3.20	11.00	1.07
2.083	1.60	5.083	6.41	8.083	1.87	11.08	1.07
2.167	1.60	5.167	6.41	8.167	1.87	11.17	1.07
2.250	1.60	5.250	6.41	8.250	1.87	11.25	1.07
2.333	1.60	5.333	6.41	8.333	1.87	11.33	1.07
2.417	1.60	5.417	6.41	8.417	1.87	11.42	1.07
2.500	1.60	5.500	6.41	8.500	1.87	11.50	1.07
2.583	1.60	5.583	25.64	8.583	1.87	11.58	1.07
2.667	1.60	5.667	25.64	8.667	1.87	11.67	1.07
2.750	1.60	5.750	25.64	8.750	1.87	11.75	1.07
2.833	1.60	5.833	70.50	8.833	1.87	11.83	1.07
2.917	1.60	5.917	70.50	8.917	1.87	11.92	1.07
3.000	1.60	6.000	70.50	9.000	1.87	12.00	1.07

Max.Eff.Inten.(mm/hr)=	70.50	81.70		
over (min)	5.00	15.00		
Storage Coeff. (min)=	5.49 (ii)	14.03 (ii)		
Unit Hyd. Tpeak (min)=	5.00	15.00		
Unit Hyd. peak (cms)=	0.20	0.08		
			TOTALS	
PEAK FLOW (cms)=	0.95	1.66	2.307 (iii)	
TIME TO PEAK (hrs)=	6.00	6.08	6.00	
RUNOFF VOLUME (mm)=	51.91	14.24	22.15	
TOTAL RAINFALL (mm)=	53.41	53.41	53.41	
RUNOFF COEFFICIENT =	0.97	0.27	0.41	

(i) HORTONS EQUATION SELECTED FOR PERVIOUS LOSSES:
Fo (mm/hr)= 75.00 K (1/hr)= 4.14
Fc (mm/hr)= 12.50 Cum.Inf. (mm)= 0.00
(ii) TIME STEP (DT) SHOULD BE SMALLER OR EQUAL
THAN THE STORAGE COEFFICIENT.
(iii) PEAK FLOW DOES NOT INCLUDE BASEFLOW IF ANY.

CALIB	
STANDHYD (0415)	Area (ha)= 4.99
ID= 1 DT= 5.0 min	Total Imp(%)= 42.00 Dir. Conn.(%)= 21.00

		IMPERVIOUS	PERVIOUS (i)
Surface Area	(ha)=	2.10	2.89
Dep. Storage	(mm)=	1.50	5.00
Average Slope	(%)=	2.86	2.86
Length	(m)=	185.00	40.00
Mannings n	=	0.013	0.300

NOTE: RAINFALL WAS TRANSFORMED TO 5.0 MIN. TIME STEP.

---- TRANSFORMED HYETOGRAPH ----

TIME hrs	RAIN mm/hr	TIME hrs	RAIN mm/hr	TIME hrs	RAIN mm/hr	TIME hrs	RAIN mm/hr
0.083	1.34	3.083	2.14	6.083	9.61	9.08	1.87
0.167	1.34	3.167	2.14	6.167	9.61	9.17	1.87
0.250	1.34	3.250	2.14	6.250	9.61	9.25	1.87
0.333	1.34	3.333	2.14	6.333	9.61	9.33	1.87
0.417	1.34	3.417	2.14	6.417	9.61	9.42	1.87
0.500	1.34	3.500	2.14	6.500	9.61	9.50	1.87
0.583	1.34	3.583	2.14	6.583	4.27	9.58	1.87
0.667	1.34	3.667	2.14	6.667	4.27	9.67	1.87
0.750	1.34	3.750	2.14	6.750	4.27	9.75	1.87
0.833	1.33	3.833	2.14	6.833	4.27	9.83	1.87
0.917	1.34	3.917	2.14	6.917	4.27	9.92	1.87
1.000	1.34	4.000	2.14	7.000	4.27	10.00	1.87
1.083	1.33	4.083	3.20	7.083	3.20	10.08	1.07
1.167	1.34	4.167	3.20	7.167	3.20	10.17	1.07
1.250	1.34	4.250	3.20	7.250	3.21	10.25	1.07
1.333	1.34	4.333	3.21	7.333	3.20	10.33	1.07
1.417	1.34	4.417	3.20	7.417	3.20	10.42	1.07
1.500	1.34	4.500	3.20	7.500	3.21	10.50	1.07
1.583	1.34	4.583	4.27	7.583	3.20	10.58	1.07
1.667	1.34	4.667	4.27	7.667	3.20	10.67	1.07
1.750	1.34	4.750	4.27	7.750	3.21	10.75	1.07
1.833	1.34	4.833	4.27	7.833	3.20	10.83	1.07
1.917	1.34	4.917	4.27	7.917	3.20	10.92	1.07
2.000	1.34	5.000	4.27	8.000	3.20	11.00	1.07
2.083	1.60	5.083	6.41	8.083	1.87	11.08	1.07
2.167	1.60	5.167	6.41	8.167	1.87	11.17	1.07
2.250	1.60	5.250	6.41	8.250	1.87	11.25	1.07
2.333	1.60	5.333	6.41	8.333	1.87	11.33	1.07
2.417	1.60	5.417	6.41	8.417	1.87	11.42	1.07
2.500	1.60	5.500	6.41	8.500	1.87	11.50	1.07
2.583	1.60	5.583	25.64	8.583	1.87	11.58	1.07
2.667	1.60	5.667	25.64	8.667	1.87	11.67	1.07
2.750	1.60	5.750	25.64	8.750	1.87	11.75	1.07
2.833	1.60	5.833	70.50	8.833	1.87	11.83	1.07
2.917	1.60	5.917	70.50	8.917	1.87	11.92	1.07
3.000	1.60	6.000	70.50	9.000	1.87	12.00	1.07

```
     Max.Eff.Inten.(mm/hr)=      70.50        81.70
                over (min)        5.00        15.00
     Storage Coeff.  (min)=       3.10 (ii)   10.77 (ii)
     Unit Hyd. Tpeak (min)=       5.00        15.00
     Unit Hyd. peak  (cms)=       0.27         0.09
                                                          *TOTALS*
     PEAK FLOW       (cms)=       0.20         0.39          0.532 (iii)
     TIME TO PEAK    (hrs)=       6.00         6.08           6.00
     RUNOFF VOLUME    (mm)=      51.91        14.24          22.15
     TOTAL RAINFALL   (mm)=      53.41        53.41          53.41
     RUNOFF COEFFICIENT   =       0.97         0.27           0.41

***** WARNING: STORAGE COEFF. IS SMALLER THAN TIME STEP!

       (i) HORTONS EQUATION SELECTED FOR PERVIOUS LOSSES:
            Fo   (mm/hr)= 75.00           K  (1/hr)=  4.14
            Fc   (mm/hr)= 12.50     Cum.Inf.   (mm)=  0.00
      (ii) TIME STEP (DT) SHOULD BE SMALLER OR EQUAL
           THAN THE STORAGE COEFFICIENT.
     (iii) PEAK FLOW DOES NOT INCLUDE BASEFLOW IF ANY.

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--------------------
| ADD HYD  (  0420)|
|   1 +  2 =  3    |         AREA    QPEAK    TPEAK     R.V.
--------------------         (ha)    (cms)    (hrs)     (mm)
        ID1= 1 (  0410):    24.20   2.307     6.00    22.15
      + ID2= 2 (  0415):     4.99   0.532     6.00    22.15
        ================================================
        ID = 3 (  0420):    29.19   2.839     6.00    22.15

     NOTE:  PEAK FLOWS DO NOT INCLUDE BASEFLOWS IF ANY.
--------------------------------------------------------------------------------
--------------------
| DUHYD    (  0425)|
| Inlet Cap.= 1.980|
| #of Inlets=     1|
| Total(cms)=   2.0|      AREA     QPEAK     TPEAK    R.V.
--------------------      (ha)     (cms)     (hrs)    (mm)
     TOTAL HYD.(ID= 1):  29.19      2.84      6.00   22.15
     ================================================
     MAJOR SYS.(ID= 2):   2.28      0.86      6.00   22.15
     MINOR SYS.(ID= 3):  26.91      1.98      6.00   22.15

     NOTE:  PEAK FLOWS DO NOT INCLUDE BASEFLOWS IF ANY.

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| ADD HYD  (  0470)|
|   1 +  2 =  3    |          AREA    QPEAK    TPEAK     R.V.
--------------------          (ha)    (cms)    (hrs)     (mm)
       ID1= 1 (  0425):     2.28   0.859     6.00    22.15
     + ID2= 2 (  0465):    48.70   4.602     6.00    22.15
       ================================================
       ID = 3 (  0470):    50.98   5.461     6.00    22.15

     NOTE:  PEAK FLOWS DO NOT INCLUDE BASEFLOWS IF ANY.
--------------------------------------------------------------------------------
--------------------
| ROUTE CHN(  0475)|
| IN= 2---> OUT= 1 |     Routing time step (min)'=  5.00
--------------------
               <------ DATA FOR SECTION (   1.1) ------>
               Distance      Elevation       Manning
                 100.00        324.60        0.0500
                 115.00        321.60        0.0500
                 120.00        320.80    0.0500 /0.0300  Main Channel
                 122.00        320.80    0.0300 /0.0500  Main Channel
                 138.00        321.60        0.0500
                 148.00        322.30        0.0500
                 154.00        323.10        0.0500
                 164.00        324.60        0.0500

      <---------------------- TRAVEL TIME TABLE ---------------------->
       DEPTH    ELEV      VOLUME    FLOW RATE    VELOCITY   TRAV.TIME
        (m)      (m)     (cu.m.)      (cms)        (m/s)      (min)
       0.20   321.00    .398E+03       0.8          0.84       8.53
       0.40   321.20    .125E+04       3.3          1.13       6.33
       0.60   321.40    .255E+04       8.1          1.36       5.27
       0.80   321.60    .430E+04      15.6          1.56       4.59
       1.00   321.80    .644E+04      26.8          1.79       4.01
       1.20   322.00    .892E+04      41.2          1.99       3.61
       1.40   322.20    .117E+05      59.3          2.17       3.30
       1.60   322.40    .148E+05      81.9          2.37       3.02
       1.80   322.60    .182E+05     109.1          2.58       2.78
       2.00   322.80    .218E+05     140.2          2.77       2.59
       2.20   323.00    .256E+05     175.3          2.95       2.43
       2.40   323.20    .296E+05     214.7          3.12       2.29
       2.60   323.40    .338E+05     258.6          3.29       2.18
       2.80   323.60    .382E+05     306.7          3.46       2.07
       3.00   323.80    .428E+05     359.1          3.61       1.98
       3.20   324.00    .476E+05     416.0          3.76       1.91
       3.40   324.20    .526E+05     477.5          3.91       1.83
       3.60   324.40    .578E+05     543.5          4.05       1.77
       3.80   324.60    .632E+05     614.3          4.18       1.71

                                    <---- hydrograph ---->   <-pipe / channel->
                              AREA    QPEAK   TPEAK   R.V.   MAX DEPTH  MAX VEL
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		(ha)	(cms)	(hrs)	(mm)	(m)	(m/s)
INFLOW : ID= 2 (	0470)	50.98	5.46	6.00	22.15	0.49	1.23
OUTFLOW: ID= 1 (	0475)	50.98	4.60	6.08	22.15	0.45	1.19

CALIB STANDHYD (0105) ID= 1 DT= 5.0 min	Area (ha)= 51.32 Total Imp(%)= 42.00 Dir. Conn.(%)= 21.00

		IMPERVIOUS	PERVIOUS (i)
Surface Area	(ha)=	21.55	29.77
Dep. Storage	(mm)=	1.50	5.00
Average Slope	(%)=	2.00	2.00
Length	(m)=	550.00	40.00
Mannings n	=	0.013	0.300

NOTE: RAINFALL WAS TRANSFORMED TO 5.0 MIN. TIME STEP.

---- TRANSFORMED HYETOGRAPH ----

TIME hrs	RAIN mm/hr	TIME hrs	RAIN mm/hr	TIME hrs	RAIN mm/hr	TIME hrs	RAIN mm/hr
0.083	1.34	3.083	2.14	6.083	9.61	9.08	1.87
0.167	1.34	3.167	2.14	6.167	9.61	9.17	1.87
0.250	1.34	3.250	2.14	6.250	9.61	9.25	1.87
0.333	1.34	3.333	2.14	6.333	9.61	9.33	1.87
0.417	1.34	3.417	2.14	6.417	9.61	9.42	1.87
0.500	1.34	3.500	2.14	6.500	9.61	9.50	1.87
0.583	1.34	3.583	2.14	6.583	4.27	9.58	1.87
0.667	1.34	3.667	2.14	6.667	4.27	9.67	1.87
0.750	1.34	3.750	2.14	6.750	4.27	9.75	1.87
0.833	1.33	3.833	2.14	6.833	4.27	9.83	1.87
0.917	1.34	3.917	2.14	6.917	4.27	9.92	1.87
1.000	1.34	4.000	2.14	7.000	4.27	10.00	1.87
1.083	1.33	4.083	3.20	7.083	3.20	10.08	1.07
1.167	1.34	4.167	3.20	7.167	3.20	10.17	1.07
1.250	1.34	4.250	3.20	7.250	3.21	10.25	1.07
1.333	1.34	4.333	3.21	7.333	3.20	10.33	1.07
1.417	1.34	4.417	3.20	7.417	3.20	10.42	1.07
1.500	1.34	4.500	3.20	7.500	3.21	10.50	1.07
1.583	1.34	4.583	4.27	7.583	3.20	10.58	1.07
1.667	1.34	4.667	4.27	7.667	3.20	10.67	1.07
1.750	1.34	4.750	4.27	7.750	3.21	10.75	1.07
1.833	1.34	4.833	4.27	7.833	3.20	10.83	1.07
1.917	1.34	4.917	4.27	7.917	3.20	10.92	1.07
2.000	1.34	5.000	4.27	8.000	3.20	11.00	1.07
2.083	1.60	5.083	6.41	8.083	1.87	11.08	1.07

2.167	1.60	5.167	6.41	8.167	1.87	11.17	1.07
2.250	1.60	5.250	6.41	8.250	1.87	11.25	1.07
2.333	1.60	5.333	6.41	8.333	1.87	11.33	1.07
2.417	1.60	5.417	6.41	8.417	1.87	11.42	1.07
2.500	1.60	5.500	6.41	8.500	1.87	11.50	1.07
2.583	1.60	5.583	25.64	8.583	1.87	11.58	1.07
2.667	1.60	5.667	25.64	8.667	1.87	11.67	1.07
2.750	1.60	5.750	25.64	8.750	1.87	11.75	1.07
2.833	1.60	5.833	70.50	8.833	1.87	11.83	1.07
2.917	1.60	5.917	70.50	8.917	1.87	11.92	1.07
3.000	1.60	6.000	70.50	9.000	1.87	12.00	1.07

Max.Eff.Inten.(mm/hr)=	70.50	81.70	
over (min)	5.00	20.00	
Storage Coeff. (min)=	6.64 (ii)	15.17 (ii)	
Unit Hyd. Tpeak (min)=	5.00	20.00	
Unit Hyd. peak (cms)=	0.18	0.07	
			TOTALS
PEAK FLOW (cms)=	1.96	3.14	3.870 (iii)
TIME TO PEAK (hrs)=	6.00	6.17	6.08
RUNOFF VOLUME (mm)=	51.91	14.24	22.15
TOTAL RAINFALL (mm)=	53.41	53.41	53.41
RUNOFF COEFFICIENT =	0.97	0.27	0.41

(i) HORTONS EQUATION SELECTED FOR PERVIOUS LOSSES:
Fo (mm/hr)= 75.00 K (1/hr)= 4.14
Fc (mm/hr)= 12.50 Cum.Inf. (mm)= 0.00
(ii) TIME STEP (DT) SHOULD BE SMALLER OR EQUAL
THAN THE STORAGE COEFFICIENT.
(iii) PEAK FLOW DOES NOT INCLUDE BASEFLOW IF ANY.

RESERVOIR(0106)	OVERFLOW IS OFF			
IN= 2---> OUT= 1				
DT= 5.0 min	OUTFLOW (cms)	STORAGE (ha.m.)	OUTFLOW (cms)	STORAGE (ha.m.)
	0.0000	0.0000	0.5000	0.4000
	0.0100	0.0100	6.6000	0.8000
	0.0260	0.2300	0.0000	0.0000

	AREA (ha)	QPEAK (cms)	TPEAK (hrs)	R.V. (mm)
INFLOW : ID= 2 (0105)	51.320	3.870	6.08	22.15
OUTFLOW: ID= 1 (0106)	51.320	2.731	6.33	22.14

PEAK FLOW REDUCTION [Qout/Qin](%)= 70.57
TIME SHIFT OF PEAK FLOW (min)= 15.00
MAXIMUM STORAGE USED (ha.m.)= 0.5507

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| CALIB            |
| STANDHYD (  0110)|   Area    (ha)=  19.00
|ID= 1 DT= 5.0 min |   Total Imp(%)=  42.00   Dir. Conn.(%)=  21.00
--------------------
                             IMPERVIOUS    PERVIOUS (i)
     Surface Area     (ha)=       7.98         11.02
     Dep. Storage     (mm)=       1.50          5.00
     Average Slope     (%)=       2.00          2.00
     Length            (m)=     365.00         40.00
     Mannings n             =     0.013         0.300

         NOTE:  RAINFALL WAS TRANSFORMED TO   5.0 MIN. TIME STEP.
```

---- TRANSFORMED HYETOGRAPH ----

TIME hrs	RAIN mm/hr	TIME hrs	RAIN mm/hr	TIME hrs	RAIN mm/hr	TIME hrs	RAIN mm/hr
0.083	1.34	3.083	2.14	6.083	9.61	9.08	1.87
0.167	1.34	3.167	2.14	6.167	9.61	9.17	1.87
0.250	1.34	3.250	2.14	6.250	9.61	9.25	1.87
0.333	1.34	3.333	2.14	6.333	9.61	9.33	1.87
0.417	1.34	3.417	2.14	6.417	9.61	9.42	1.87
0.500	1.34	3.500	2.14	6.500	9.61	9.50	1.87
0.583	1.34	3.583	2.14	6.583	4.27	9.58	1.87
0.667	1.34	3.667	2.14	6.667	4.27	9.67	1.87
0.750	1.34	3.750	2.14	6.750	4.27	9.75	1.87
0.833	1.33	3.833	2.14	6.833	4.27	9.83	1.87
0.917	1.34	3.917	2.14	6.917	4.27	9.92	1.87
1.000	1.34	4.000	2.14	7.000	4.27	10.00	1.87
1.083	1.33	4.083	3.20	7.083	3.20	10.08	1.07
1.167	1.34	4.167	3.20	7.167	3.20	10.17	1.07
1.250	1.34	4.250	3.20	7.250	3.21	10.25	1.07
1.333	1.34	4.333	3.21	7.333	3.20	10.33	1.07
1.417	1.34	4.417	3.20	7.417	3.20	10.42	1.07
1.500	1.34	4.500	3.20	7.500	3.21	10.50	1.07
1.583	1.34	4.583	4.27	7.583	3.20	10.58	1.07
1.667	1.34	4.667	4.27	7.667	3.20	10.67	1.07
1.750	1.34	4.750	4.27	7.750	3.21	10.75	1.07
1.833	1.34	4.833	4.27	7.833	3.20	10.83	1.07
1.917	1.34	4.917	4.27	7.917	3.20	10.92	1.07
2.000	1.34	5.000	4.27	8.000	3.20	11.00	1.07
2.083	1.60	5.083	6.41	8.083	1.87	11.08	1.07
2.167	1.60	5.167	6.41	8.167	1.87	11.17	1.07
2.250	1.60	5.250	6.41	8.250	1.87	11.25	1.07
2.333	1.60	5.333	6.41	8.333	1.87	11.33	1.07
2.417	1.60	5.417	6.41	8.417	1.87	11.42	1.07
2.500	1.60	5.500	6.41	8.500	1.87	11.50	1.07

2.583	1.60	5.583	25.64	8.583	1.87	11.58	1.07
2.667	1.60	5.667	25.64	8.667	1.87	11.67	1.07
2.750	1.60	5.750	25.64	8.750	1.87	11.75	1.07
2.833	1.60	5.833	70.50	8.833	1.87	11.83	1.07
2.917	1.60	5.917	70.50	8.917	1.87	11.92	1.07
3.000	1.60	6.000	70.50	9.000	1.87	12.00	1.07

Max.Eff.Inten.(mm/hr)=	70.50	81.70	
over (min)	5.00	15.00	
Storage Coeff. (min)=	5.19 (ii)	13.73 (ii)	
Unit Hyd. Tpeak (min)=	5.00	15.00	
Unit Hyd. peak (cms)=	0.21	0.08	
			TOTALS
PEAK FLOW (cms)=	0.75	1.32	1.831 (iii)
TIME TO PEAK (hrs)=	6.00	6.08	6.00
RUNOFF VOLUME (mm)=	51.91	14.24	22.15
TOTAL RAINFALL (mm)=	53.41	53.41	53.41
RUNOFF COEFFICIENT =	0.97	0.27	0.41

(i) HORTONS EQUATION SELECTED FOR PERVIOUS LOSSES:
Fo (mm/hr)= 75.00 K (1/hr)= 4.14
Fc (mm/hr)= 12.50 Cum.Inf. (mm)= 0.00
(ii) TIME STEP (DT) SHOULD BE SMALLER OR EQUAL
THAN THE STORAGE COEFFICIENT.
(iii) PEAK FLOW DOES NOT INCLUDE BASEFLOW IF ANY.

RESERVOIR(0111) / IN= 2---> OUT= 1 / DT= 5.0 min	OVERFLOW IS OFF			
	OUTFLOW (cms)	STORAGE (ha.m.)	OUTFLOW (cms)	STORAGE (ha.m.)
	0.0000	0.0000	1.0000	1.0000
	0.0100	0.0100	20.0000	1.1000
	0.0120	0.1000	0.0000	0.0000

	AREA (ha)	QPEAK (cms)	TPEAK (hrs)	R.V. (mm)
INFLOW : ID= 2 (0110)	19.000	1.831	6.00	22.15
OUTFLOW: ID= 1 (0111)	19.000	0.238	6.58	22.14

PEAK FLOW REDUCTION [Qout/Qin](%)= 12.98
TIME SHIFT OF PEAK FLOW (min)= 35.00
MAXIMUM STORAGE USED (ha.m.)= 0.3060

CALIB STANDHYD (0102)	Area (ha)= 14.32

|ID= 1 DT= 5.0 min | Total Imp(%)= 42.00 Dir. Conn.(%)= 21.00

		IMPERVIOUS	PERVIOUS (i)
Surface Area	(ha)=	6.01	8.31
Dep. Storage	(mm)=	1.50	5.00
Average Slope	(%)=	2.00	2.00
Length	(m)=	287.00	40.00
Mannings n	=	0.013	0.300

NOTE: RAINFALL WAS TRANSFORMED TO 5.0 MIN. TIME STEP.

---- TRANSFORMED HYETOGRAPH ----

TIME hrs	RAIN mm/hr	TIME hrs	RAIN mm/hr	TIME hrs	RAIN mm/hr	TIME hrs	RAIN mm/hr
0.083	1.34	3.083	2.14	6.083	9.61	9.08	1.87
0.167	1.34	3.167	2.14	6.167	9.61	9.17	1.87
0.250	1.34	3.250	2.14	6.250	9.61	9.25	1.87
0.333	1.34	3.333	2.14	6.333	9.61	9.33	1.87
0.417	1.34	3.417	2.14	6.417	9.61	9.42	1.87
0.500	1.34	3.500	2.14	6.500	9.61	9.50	1.87
0.583	1.34	3.583	2.14	6.583	4.27	9.58	1.87
0.667	1.34	3.667	2.14	6.667	4.27	9.67	1.87
0.750	1.34	3.750	2.14	6.750	4.27	9.75	1.87
0.833	1.33	3.833	2.14	6.833	4.27	9.83	1.87
0.917	1.34	3.917	2.14	6.917	4.27	9.92	1.87
1.000	1.34	4.000	2.14	7.000	4.27	10.00	1.87
1.083	1.33	4.083	3.20	7.083	3.20	10.08	1.07
1.167	1.34	4.167	3.20	7.167	3.20	10.17	1.07
1.250	1.34	4.250	3.20	7.250	3.21	10.25	1.07
1.333	1.34	4.333	3.21	7.333	3.20	10.33	1.07
1.417	1.34	4.417	3.20	7.417	3.20	10.42	1.07
1.500	1.34	4.500	3.20	7.500	3.21	10.50	1.07
1.583	1.34	4.583	4.27	7.583	3.20	10.58	1.07
1.667	1.34	4.667	4.27	7.667	3.20	10.67	1.07
1.750	1.34	4.750	4.27	7.750	3.21	10.75	1.07
1.833	1.34	4.833	4.27	7.833	3.20	10.83	1.07
1.917	1.34	4.917	4.27	7.917	3.20	10.92	1.07
2.000	1.34	5.000	4.27	8.000	3.20	11.00	1.07
2.083	1.60	5.083	6.41	8.083	1.87	11.08	1.07
2.167	1.60	5.167	6.41	8.167	1.87	11.17	1.07
2.250	1.60	5.250	6.41	8.250	1.87	11.25	1.07
2.333	1.60	5.333	6.41	8.333	1.87	11.33	1.07
2.417	1.60	5.417	6.41	8.417	1.87	11.42	1.07
2.500	1.60	5.500	6.41	8.500	1.87	11.50	1.07
2.583	1.60	5.583	25.64	8.583	1.87	11.58	1.07
2.667	1.60	5.667	25.64	8.667	1.87	11.67	1.07
2.750	1.60	5.750	25.64	8.750	1.87	11.75	1.07
2.833	1.60	5.833	70.50	8.833	1.87	11.83	1.07
2.917	1.60	5.917	70.50	8.917	1.87	11.92	1.07

```
              3.000    1.60 | 6.000   70.50 | 9.000    1.87 | 12.00    1.07

     Max.Eff.Inten.(mm/hr)=      70.50        81.70
               over (min)         5.00        15.00
     Storage Coeff.  (min)=       4.49 (ii)   13.03 (ii)
     Unit Hyd. Tpeak (min)=       5.00        15.00
     Unit Hyd. peak  (cms)=       0.23         0.08
                                                        *TOTALS*
     PEAK FLOW       (cms)=       0.58         1.02          1.415 (iii)
     TIME TO PEAK    (hrs)=       6.00         6.08           6.00
     RUNOFF VOLUME    (mm)=      51.91        14.24          22.15
     TOTAL RAINFALL   (mm)=      53.41        53.41          53.41
     RUNOFF COEFFICIENT   =       0.97         0.27           0.41

***** WARNING: STORAGE COEFF. IS SMALLER THAN TIME STEP!

       (i) HORTONS EQUATION SELECTED FOR PERVIOUS LOSSES:
            Fo   (mm/hr)= 75.00          K  (1/hr)=  4.14
            Fc   (mm/hr)= 12.50     Cum.Inf.   (mm)=  0.00
      (ii) TIME STEP (DT) SHOULD BE SMALLER OR EQUAL
           THAN THE STORAGE COEFFICIENT.
     (iii) PEAK FLOW DOES NOT INCLUDE BASEFLOW IF ANY.

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| CALIB            |
| STANDHYD (  0101)|   Area    (ha)=  16.32
|ID= 1 DT= 5.0 min |   Total Imp(%)=  42.00   Dir. Conn.(%)=  21.00
--------------------
                            IMPERVIOUS    PERVIOUS (i)
     Surface Area     (ha)=       6.85         9.47
     Dep. Storage     (mm)=       1.50         5.00
     Average Slope     (%)=       2.00         2.00
     Length            (m)=     309.00        40.00
     Mannings n             =      0.013        0.300

         NOTE:  RAINFALL WAS TRANSFORMED TO   5.0 MIN. TIME STEP.


                          ---- TRANSFORMED HYETOGRAPH ----
               TIME    RAIN |  TIME    RAIN |'  TIME    RAIN |  TIME    RAIN
                hrs   mm/hr |   hrs   mm/hr |'   hrs   mm/hr |   hrs   mm/hr
              0.083    1.34 | 3.083    2.14 | 6.083    9.61 |  9.08    1.87
              0.167    1.34 | 3.167    2.14 | 6.167    9.61 |  9.17    1.87
              0.250    1.34 | 3.250    2.14 | 6.250    9.61 |  9.25    1.87
              0.333    1.34 | 3.333    2.14 | 6.333    9.61 |  9.33    1.87
              0.417    1.34 | 3.417    2.14 | 6.417    9.61 |  9.42    1.87
              0.500    1.34 | 3.500    2.14 | 6.500    9.61 |  9.50    1.87
              0.583    1.34 | 3.583    2.14 | 6.583    4.27 |  9.58    1.87
              0.667    1.34 | 3.667    2.14 | 6.667    4.27 |  9.67    1.87
```

0.750	1.34	3.750	2.14	6.750	4.27	9.75	1.87
0.833	1.33	3.833	2.14	6.833	4.27	9.83	1.87
0.917	1.34	3.917	2.14	6.917	4.27	9.92	1.87
1.000	1.34	4.000	2.14	7.000	4.27	10.00	1.87
1.083	1.33	4.083	3.20	7.083	3.20	10.08	1.07
1.167	1.34	4.167	3.20	7.167	3.20	10.17	1.07
1.250	1.34	4.250	3.20	7.250	3.21	10.25	1.07
1.333	1.34	4.333	3.21	7.333	3.20	10.33	1.07
1.417	1.34	4.417	3.20	7.417	3.20	10.42	1.07
1.500	1.34	4.500	3.20	7.500	3.21	10.50	1.07
1.583	1.34	4.583	4.27	7.583	3.20	10.58	1.07
1.667	1.34	4.667	4.27	7.667	3.20	10.67	1.07
1.750	1.34	4.750	4.27	7.750	3.21	10.75	1.07
1.833	1.34	4.833	4.27	7.833	3.20	10.83	1.07
1.917	1.34	4.917	4.27	7.917	3.20	10.92	1.07
2.000	1.34	5.000	4.27	8.000	3.20	11.00	1.07
2.083	1.60	5.083	6.41	8.083	1.87	11.08	1.07
2.167	1.60	5.167	6.41	8.167	1.87	11.17	1.07
2.250	1.60	5.250	6.41	8.250	1.87	11.25	1.07
2.333	1.60	5.333	6.41	8.333	1.87	11.33	1.07
2.417	1.60	5.417	6.41	8.417	1.87	11.42	1.07
2.500	1.60	5.500	6.41	8.500	1.87	11.50	1.07
2.583	1.60	5.583	25.64	8.583	1.87	11.58	1.07
2.667	1.60	5.667	25.64	8.667	1.87	11.67	1.07
2.750	1.60	5.750	25.64	8.750	1.87	11.75	1.07
2.833	1.60	5.833	70.50	8.833	1.87	11.83	1.07
2.917	1.60	5.917	70.50	8.917	1.87	11.92	1.07
3.000	1.60	6.000	70.50	9.000	1.87	12.00	1.07

Max.Eff.Inten.(mm/hr)=	70.50	81.70	
over (min)	5.00	15.00	
Storage Coeff. (min)=	4.70 (ii)	13.23 (ii)	
Unit Hyd. Tpeak (min)=	5.00	15.00	
Unit Hyd. peak (cms)=	0.22	0.08	
			TOTALS
PEAK FLOW (cms)=	0.65	1.15	1.601 (iii)
TIME TO PEAK (hrs)=	6.00	6.08	6.00
RUNOFF VOLUME (mm)=	51.91	14.24	22.15
TOTAL RAINFALL (mm)=	53.41	53.41	53.41
RUNOFF COEFFICIENT =	0.97	0.27	0.41

***** WARNING: STORAGE COEFF. IS SMALLER THAN TIME STEP!

(i) HORTONS EQUATION SELECTED FOR PERVIOUS LOSSES:
Fo (mm/hr)= 75.00 K (1/hr)= 4.14
Fc (mm/hr)= 12.50 Cum.Inf. (mm)= 0.00

(ii) TIME STEP (DT) SHOULD BE SMALLER OR EQUAL
THAN THE STORAGE COEFFICIENT.

(iii) PEAK FLOW DOES NOT INCLUDE BASEFLOW IF ANY.

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--------------------
| ADD HYD  (  0103)|
|   1 +  2 =  3    |         AREA    QPEAK    TPEAK     R.V.
--------------------         (ha)    (cms)    (hrs)     (mm)
       ID1= 1 (  0101):    16.32   1.601     6.00    22.15
     + ID2= 2 (  0102):    14.32   1.415     6.00    22.15
       ================================================
       ID = 3 (  0103):    30.64   3.016     6.00    22.15

     NOTE:  PEAK FLOWS DO NOT INCLUDE BASEFLOWS IF ANY.
--------------------------------------------------------------------------------
--------------------
| RESERVOIR(  0104)|     OVERFLOW IS OFF
| IN= 2---> OUT= 1 |
| DT=  5.0 min     |     OUTFLOW    STORAGE   |  OUTFLOW    STORAGE
--------------------      (cms)     (ha.m.)   |   (cms)     (ha.m.)
                          0.0000     0.0000   |   1.0000      0.5000
                          0.0100     0.0100   |  10.0000      0.6000
                          0.0150     0.1332   |   0.0000      0.0000

                                AREA     QPEAK     TPEAK       R.V.
                                (ha)     (cms)     (hrs)       (mm)
   INFLOW : ID= 2 (  0103)     30.640      3.016      6.00      22.15
   OUTFLOW: ID= 1 (  0104)     30.640      0.801      6.42      22.14

                  PEAK   FLOW   REDUCTION [Qout/Qin](%)= 26.57
                  TIME SHIFT OF PEAK FLOW         (min)= 25.00
                  MAXIMUM  STORAGE   USED       (ha.m.)=  0.4263

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--------------------
| ADD HYD  (  0114)|
|   1 +  2 =  3    |         AREA    QPEAK    TPEAK     R.V.
--------------------         (ha)    (cms)    (hrs)     (mm)
       ID1= 1 (  0104):    30.64   0.801     6.42    22.14
     + ID2= 2 (  0111):    19.00   0.238     6.58    22.14
       ================================================
       ID = 3 (  0114):    49.64   1.029     6.50    22.14

     NOTE:  PEAK FLOWS DO NOT INCLUDE BASEFLOWS IF ANY.
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--------------------
| ADD HYD  (  0115)|
|   1 +  2 =  3    |         AREA    QPEAK    TPEAK     R.V.
--------------------         (ha)    (cms)    (hrs)     (mm)
       ID1= 1 (  0106):    51.32   2.731     6.33    22.14
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```
      + ID2= 2 (  0114):    49.64   1.029     6.50    22.14
        ================================================
        ID = 3 (  0115):   100.96   3.732     6.33    22.14

     NOTE:  PEAK FLOWS DO NOT INCLUDE BASEFLOWS IF ANY.
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--------------------
| CALIB            |
| STANDHYD (  0395)|   Area    (ha)=  51.20
|ID= 1 DT= 5.0 min |   Total Imp(%)=  10.00   Dir. Conn.(%)=   5.00
--------------------
                            IMPERVIOUS    PERVIOUS (i)
     Surface Area     (ha)=       5.12        46.08
     Dep. Storage     (mm)=       1.50         5.00
     Average Slope     (%)=       2.00         2.00
     Length            (m)=     900.00        40.00
     Mannings n             =      0.013        0.300

         NOTE:  RAINFALL WAS TRANSFORMED TO   5.0 MIN. TIME STEP.
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---- TRANSFORMED HYETOGRAPH ----

TIME hrs	RAIN mm/hr	TIME hrs	RAIN mm/hr	TIME hrs	RAIN mm/hr	TIME hrs	RAIN mm/hr
0.083	1.34	3.083	2.14	6.083	9.61	9.08	1.87
0.167	1.34	3.167	2.14	6.167	9.61	9.17	1.87
0.250	1.34	3.250	2.14	6.250	9.61	9.25	1.87
0.333	1.34	3.333	2.14	6.333	9.61	9.33	1.87
0.417	1.34	3.417	2.14	6.417	9.61	9.42	1.87
0.500	1.34	3.500	2.14	6.500	9.61	9.50	1.87
0.583	1.34	3.583	2.14	6.583	4.27	9.58	1.87
0.667	1.34	3.667	2.14	6.667	4.27	9.67	1.87
0.750	1.34	3.750	2.14	6.750	4.27	9.75	1.87
0.833	1.33	3.833	2.14	6.833	4.27	9.83	1.87
0.917	1.34	3.917	2.14	6.917	4.27	9.92	1.87
1.000	1.34	4.000	2.14	7.000	4.27	10.00	1.87
1.083	1.33	4.083	3.20	7.083	3.20	10.08	1.07
1.167	1.34	4.167	3.20	7.167	3.20	10.17	1.07
1.250	1.34	4.250	3.20	7.250	3.21	10.25	1.07
1.333	1.34	4.333	3.21	7.333	3.20	10.33	1.07
1.417	1.34	4.417	3.20	7.417	3.20	10.42	1.07
1.500	1.34	4.500	3.20	7.500	3.21	10.50	1.07
1.583	1.34	4.583	4.27	7.583	3.20	10.58	1.07
1.667	1.34	4.667	4.27	7.667	3.20	10.67	1.07
1.750	1.34	4.750	4.27	7.750	3.21	10.75	1.07
1.833	1.34	4.833	4.27	7.833	3.20	10.83	1.07
1.917	1.34	4.917	4.27	7.917	3.20	10.92	1.07
2.000	1.34	5.000	4.27	8.000	3.20	11.00	1.07
2.083	1.60	5.083	6.41	8.083	1.87	11.08	1.07
2.167	1.60	5.167	6.41	8.167	1.87	11.17	1.07

2.250	1.60	5.250	6.41	8.250	1.87	11.25	1.07
2.333	1.60	5.333	6.41	8.333	1.87	11.33	1.07
2.417	1.60	5.417	6.41	8.417	1.87	11.42	1.07
2.500	1.60	5.500	6.41	8.500	1.87	11.50	1.07
2.583	1.60	5.583	25.64	8.583	1.87	11.58	1.07
2.667	1.60	5.667	25.64	8.667	1.87	11.67	1.07
2.750	1.60	5.750	25.64	8.750	1.87	11.75	1.07
2.833	1.60	5.833	70.50	8.833	1.87	11.83	1.07
2.917	1.60	5.917	70.50	8.917	1.87	11.92	1.07
3.000	1.60	6.000	70.50	9.000	1.87	12.00	1.07

Max.Eff.Inten.(mm/hr)=	70.50	58.39	
over (min)	10.00	20.00	
Storage Coeff. (min)=	8.92 (ii)	18.68 (ii)	
Unit Hyd. Tpeak (min)=	10.00	20.00	
Unit Hyd. peak (cms)=	0.12	0.06	
			TOTALS
PEAK FLOW (cms)=	0.41	2.36	2.601 (iii)
TIME TO PEAK (hrs)=	6.00	6.25	6.17
RUNOFF VOLUME (mm)=	51.91	9.64	11.75
TOTAL RAINFALL (mm)=	53.41	53.41	53.41
RUNOFF COEFFICIENT =	0.97	0.18	0.22

***** WARNING:FOR AREAS WITH IMPERVIOUS RATIOS BELOW 20%
YOU SHOULD CONSIDER SPLITTING THE AREA.

(i) HORTONS EQUATION SELECTED FOR PERVIOUS LOSSES:
Fo (mm/hr)= 75.00 K (1/hr)= 4.14
Fc (mm/hr)= 12.50 Cum.Inf. (mm)= 0.00
(ii) TIME STEP (DT) SHOULD BE SMALLER OR EQUAL
THAN THE STORAGE COEFFICIENT.
(iii) PEAK FLOW DOES NOT INCLUDE BASEFLOW IF ANY.

CALIB
STANDHYD (0365)
ID= 1 DT= 5.0 min

Area (ha)= 117.50
Total Imp(%)= 42.00 Dir. Conn.(%)= 21.00

		IMPERVIOUS	PERVIOUS (i)
Surface Area	(ha)=	49.35	68.15
Dep. Storage	(mm)=	1.50	5.00
Average Slope	(%)=	2.00	2.00
Length	(m)=	885.00	40.00
Mannings n	=	0.013	0.300

NOTE: RAINFALL WAS TRANSFORMED TO 5.0 MIN. TIME STEP.

---- TRANSFORMED HYETOGRAPH ----

TIME hrs	RAIN mm/hr	TIME hrs	RAIN mm/hr	TIME hrs	RAIN mm/hr	TIME hrs	RAIN mm/hr
0.083	1.34	3.083	2.14	6.083	9.61	9.08	1.87
0.167	1.34	3.167	2.14	6.167	9.61	9.17	1.87
0.250	1.34	3.250	2.14	6.250	9.61	9.25	1.87
0.333	1.34	3.333	2.14	6.333	9.61	9.33	1.87
0.417	1.34	3.417	2.14	6.417	9.61	9.42	1.87
0.500	1.34	3.500	2.14	6.500	9.61	9.50	1.87
0.583	1.34	3.583	2.14	6.583	4.27	9.58	1.87
0.667	1.34	3.667	2.14	6.667	4.27	9.67	1.87
0.750	1.34	3.750	2.14	6.750	4.27	9.75	1.87
0.833	1.33	3.833	2.14	6.833	4.27	9.83	1.87
0.917	1.34	3.917	2.14	6.917	4.27	9.92	1.87
1.000	1.34	4.000	2.14	7.000	4.27	10.00	1.87
1.083	1.33	4.083	3.20	7.083	3.20	10.08	1.07
1.167	1.34	4.167	3.20	7.167	3.20	10.17	1.07
1.250	1.34	4.250	3.20	7.250	3.21	10.25	1.07
1.333	1.34	4.333	3.21	7.333	3.20	10.33	1.07
1.417	1.34	4.417	3.20	7.417	3.20	10.42	1.07
1.500	1.34	4.500	3.20	7.500	3.21	10.50	1.07
1.583	1.34	4.583	4.27	7.583	3.20	10.58	1.07
1.667	1.34	4.667	4.27	7.667	3.20	10.67	1.07
1.750	1.34	4.750	4.27	7.750	3.21	10.75	1.07
1.833	1.34	4.833	4.27	7.833	3.20	10.83	1.07
1.917	1.34	4.917	4.27	7.917	3.20	10.92	1.07
2.000	1.34	5.000	4.27	8.000	3.20	11.00	1.07
2.083	1.60	5.083	6.41	8.083	1.87	11.08	1.07
2.167	1.60	5.167	6.41	8.167	1.87	11.17	1.07
2.250	1.60	5.250	6.41	8.250	1.87	11.25	1.07
2.333	1.60	5.333	6.41	8.333	1.87	11.33	1.07
2.417	1.60	5.417	6.41	8.417	1.87	11.42	1.07
2.500	1.60	5.500	6.41	8.500	1.87	11.50	1.07
2.583	1.60	5.583	25.64	8.583	1.87	11.58	1.07
2.667	1.60	5.667	25.64	8.667	1.87	11.67	1.07
2.750	1.60	5.750	25.64	8.750	1.87	11.75	1.07
2.833	1.60	5.833	70.50	8.833	1.87	11.83	1.07
2.917	1.60	5.917	70.50	8.917	1.87	11.92	1.07
3.000	1.60	6.000	70.50	9.000	1.87	12.00	1.07

Max.Eff.Inten.(mm/hr)=	70.50	81.70	
over (min)	10.00	20.00	
Storage Coeff. (min)=	8.83 (ii)	17.37 (ii)	
Unit Hyd. Tpeak (min)=	10.00	20.00	
Unit Hyd. peak (cms)=	0.12	0.06	
			TOTALS
PEAK FLOW (cms)=	3.95	6.70	9.481 (iii)
TIME TO PEAK (hrs)=	6.00	6.17	6.08
RUNOFF VOLUME (mm)=	51.91	14.24	22.15
TOTAL RAINFALL (mm)=	53.41	53.41	53.41
RUNOFF COEFFICIENT =	0.97	0.27	0.41

(i) HORTONS EQUATION SELECTED FOR PERVIOUS LOSSES:
Fo (mm/hr)= 75.00 K (1/hr)= 4.14
Fc (mm/hr)= 12.50 Cum.Inf. (mm)= 0.00
(ii) TIME STEP (DT) SHOULD BE SMALLER OR EQUAL
THAN THE STORAGE COEFFICIENT.
(iii) PEAK FLOW DOES NOT INCLUDE BASEFLOW IF ANY.

CALIB	
STANDHYD (0360)	Area (ha)= 30.00
ID= 1 DT= 5.0 min	Total Imp(%)= 37.00 Dir. Conn.(%)= 19.00

		IMPERVIOUS	PERVIOUS (i)
Surface Area	(ha)=	11.10	18.90
Dep. Storage	(mm)=	1.50	5.00
Average Slope	(%)=	2.00	2.00
Length	(m)=	447.00	40.00
Mannings n	=	0.013	0.300

NOTE: RAINFALL WAS TRANSFORMED TO 5.0 MIN. TIME STEP.

---- TRANSFORMED HYETOGRAPH ----

TIME hrs	RAIN mm/hr	TIME hrs	RAIN mm/hr	TIME hrs	RAIN mm/hr	TIME hrs	RAIN mm/hr
0.083	1.34	3.083	2.14	6.083	9.61	9.08	1.87
0.167	1.34	3.167	2.14	6.167	9.61	9.17	1.87
0.250	1.34	3.250	2.14	6.250	9.61	9.25	1.87
0.333	1.34	3.333	2.14	6.333	9.61	9.33	1.87
0.417	1.34	3.417	2.14	6.417	9.61	9.42	1.87
0.500	1.34	3.500	2.14	6.500	9.61	9.50	1.87
0.583	1.34	3.583	2.14	6.583	4.27	9.58	1.87
0.667	1.34	3.667	2.14	6.667	4.27	9.67	1.87
0.750	1.34	3.750	2.14	6.750	4.27	9.75	1.87
0.833	1.33	3.833	2.14	6.833	4.27	9.83	1.87
0.917	1.34	3.917	2.14	6.917	4.27	9.92	1.87
1.000	1.34	4.000	2.14	7.000	4.27	10.00	1.87
1.083	1.33	4.083	3.20	7.083	3.20	10.08	1.07
1.167	1.34	4.167	3.20	7.167	3.20	10.17	1.07
1.250	1.34	4.250	3.20	7.250	3.21	10.25	1.07
1.333	1.34	4.333	3.21	7.333	3.20	10.33	1.07
1.417	1.34	4.417	3.20	7.417	3.20	10.42	1.07
1.500	1.34	4.500	3.20	7.500	3.21	10.50	1.07
1.583	1.34	4.583	4.27	7.583	3.20	10.58	1.07
1.667	1.34	4.667	4.27	7.667	3.20	10.67	1.07
1.750	1.34	4.750	4.27	7.750	3.21	10.75	1.07
1.833	1.34	4.833	4.27	7.833	3.20	10.83	1.07

1.917	1.34	4.917	4.27	7.917	3.20	10.92	1.07
2.000	1.34	5.000	4.27	8.000	3.20	11.00	1.07
2.083	1.60	5.083	6.41	8.083	1.87	11.08	1.07
2.167	1.60	5.167	6.41	8.167	1.87	11.17	1.07
2.250	1.60	5.250	6.41	8.250	1.87	11.25	1.07
2.333	1.60	5.333	6.41	8.333	1.87	11.33	1.07
2.417	1.60	5.417	6.41	8.417	1.87	11.42	1.07
2.500	1.60	5.500	6.41	8.500	1.87	11.50	1.07
2.583	1.60	5.583	25.64	8.583	1.87	11.58	1.07
2.667	1.60	5.667	25.64	8.667	1.87	11.67	1.07
2.750	1.60	5.750	25.64	8.750	1.87	11.75	1.07
2.833	1.60	5.833	70.50	8.833	1.87	11.83	1.07
2.917	1.60	5.917	70.50	8.917	1.87	11.92	1.07
3.000	1.60	6.000	70.50	9.000	1.87	12.00	1.07

Max.Eff.Inten.(mm/hr)=	70.50	75.96	
over (min)	5.00	15.00	
Storage Coeff. (min)=	5.86 (ii)	14.65 (ii)	
Unit Hyd. Tpeak (min)=	5.00	15.00	
Unit Hyd. peak (cms)=	0.20	0.08	
			TOTALS
PEAK FLOW (cms)=	1.06	1.94	2.582 (iii)
TIME TO PEAK (hrs)=	6.00	6.08	6.00
RUNOFF VOLUME (mm)=	51.91	13.31	20.64
TOTAL RAINFALL (mm)=	53.41	53.41	53.41
RUNOFF COEFFICIENT =	0.97	0.25	0.39

***** WARNING:FOR AREAS WITH IMPERVIOUS RATIOS BELOW 20%
YOU SHOULD CONSIDER SPLITTING THE AREA.

(i) HORTONS EQUATION SELECTED FOR PERVIOUS LOSSES:
Fo (mm/hr)= 75.00 K (1/hr)= 4.14
Fc (mm/hr)= 12.50 Cum.Inf. (mm)= 0.00
(ii) TIME STEP (DT) SHOULD BE SMALLER OR EQUAL
THAN THE STORAGE COEFFICIENT.
(iii) PEAK FLOW DOES NOT INCLUDE BASEFLOW IF ANY.

ROUTE CHN(0362)	
IN= 2---> OUT= 1	Routing time step (min)'= 5.00

<------ DATA FOR SECTION (1.1) ------>

Distance	Elevation	Manning	
0.00	0.40	0.0300	
5.50	0.15	0.0300 /0.0150	Main Channel
5.51	0.00	0.0150	Main Channel
10.00	0.09	0.0150	Main Channel
14.49	0.00	0.0150	Main Channel
14.50	0.15	0.0150 /0.0300	Main Channel

20.00 0.40 0.0300

<-------------------- TRAVEL TIME TABLE ---------------------->

DEPTH (m)	ELEV (m)	VOLUME (cu.m.)	FLOW RATE (cms)	VELOCITY (m/s)	TRAV.TIME (min)
0.02	0.02	.176E+02	0.0	0.21	80.52
0.04	0.04	.702E+02	0.0	0.33	50.72
0.06	0.06	.158E+03	0.1	0.43	38.71
0.08	0.08	.281E+03	0.1	0.52	31.95
0.09	0.09	.438E+03	0.3	0.62	26.84
0.11	0.11	.607E+03	0.5	0.77	21.66
0.13	0.13	.776E+03	0.7	0.90	18.45
0.15	0.15	.944E+03	1.0	1.03	16.22
0.17	0.17	.116E+04	1.3	1.16	14.36
0.20	0.20	.140E+04	1.8	1.27	13.13
0.22	0.22	.166E+04	2.3	1.36	12.24
0.24	0.24	.194E+04	2.8	1.44	11.58
0.26	0.26	.225E+04	3.4	1.51	11.05
0.29	0.29	.258E+04	4.0	1.57	10.63
0.31	0.31	.293E+04	4.8	1.62	10.27
0.33	0.33	.331E+04	5.5	1.67	9.97
0.35	0.35	.371E+04	6.4	1.72	9.71
0.38	0.38	.413E+04	7.3	1.76	9.48
0.40	0.40	.457E+04	8.2	1.80	9.28

		AREA (ha)	<---- hydrograph ----> QPEAK (cms)	TPEAK (hrs)	R.V. (mm)	<-pipe / channel-> MAX DEPTH (m)	MAX VEL (m/s)
INFLOW : ID= 2 (	0360)	30.00	2.58	6.00	20.64	0.23	1.41
OUTFLOW: ID= 1 (	0362)	30.00	2.01	6.17	20.63	0.21	1.31

CALIB STANDHYD (0350) ID= 1 DT= 5.0 min	Area (ha)= 16.30 Total Imp(%)= 42.00 Dir. Conn.(%)= 21.00

		IMPERVIOUS	PERVIOUS (i)
Surface Area	(ha)=	6.85	9.45
Dep. Storage	(mm)=	1.50	5.00
Average Slope	(%)=	1.00	1.00
Length	(m)=	330.00	40.00
Mannings n	=	0.013	0.300

NOTE: RAINFALL WAS TRANSFORMED TO 5.0 MIN. TIME STEP.

---- TRANSFORMED HYETOGRAPH ----

TIME hrs	RAIN mm/hr	TIME hrs	RAIN mm/hr	TIME hrs	RAIN mm/hr	TIME hrs	RAIN mm/hr
0.083	1.34	3.083	2.14	6.083	9.61	9.08	1.87
0.167	1.34	3.167	2.14	6.167	9.61	9.17	1.87
0.250	1.34	3.250	2.14	6.250	9.61	9.25	1.87
0.333	1.34	3.333	2.14	6.333	9.61	9.33	1.87
0.417	1.34	3.417	2.14	6.417	9.61	9.42	1.87
0.500	1.34	3.500	2.14	6.500	9.61	9.50	1.87
0.583	1.34	3.583	2.14	6.583	4.27	9.58	1.87
0.667	1.34	3.667	2.14	6.667	4.27	9.67	1.87
0.750	1.34	3.750	2.14	6.750	4.27	9.75	1.87
0.833	1.33	3.833	2.14	6.833	4.27	9.83	1.87
0.917	1.34	3.917	2.14	6.917	4.27	9.92	1.87
1.000	1.34	4.000	2.14	7.000	4.27	10.00	1.87
1.083	1.33	4.083	3.20	7.083	3.20	10.08	1.07
1.167	1.34	4.167	3.20	7.167	3.20	10.17	1.07
1.250	1.34	4.250	3.20	7.250	3.21	10.25	1.07
1.333	1.34	4.333	3.21	7.333	3.20	10.33	1.07
1.417	1.34	4.417	3.20	7.417	3.20	10.42	1.07
1.500	1.34	4.500	3.20	7.500	3.21	10.50	1.07
1.583	1.34	4.583	4.27	7.583	3.20	10.58	1.07
1.667	1.34	4.667	4.27	7.667	3.20	10.67	1.07
1.750	1.34	4.750	4.27	7.750	3.21	10.75	1.07
1.833	1.34	4.833	4.27	7.833	3.20	10.83	1.07
1.917	1.34	4.917	4.27	7.917	3.20	10.92	1.07
2.000	1.34	5.000	4.27	8.000	3.20	11.00	1.07
2.083	1.60	5.083	6.41	8.083	1.87	11.08	1.07
2.167	1.60	5.167	6.41	8.167	1.87	11.17	1.07
2.250	1.60	5.250	6.41	8.250	1.87	11.25	1.07
2.333	1.60	5.333	6.41	8.333	1.87	11.33	1.07
2.417	1.60	5.417	6.41	8.417	1.87	11.42	1.07
2.500	1.60	5.500	6.41	8.500	1.87	11.50	1.07
2.583	1.60	5.583	25.64	8.583	1.87	11.58	1.07
2.667	1.60	5.667	25.64	8.667	1.87	11.67	1.07
2.750	1.60	5.750	25.64	8.750	1.87	11.75	1.07
2.833	1.60	5.833	70.50	8.833	1.87	11.83	1.07
2.917	1.60	5.917	70.50	8.917	1.87	11.92	1.07
3.000	1.60	6.000	70.50	9.000	1.87	12.00	1.07

Max.Eff.Inten.(mm/hr)=	70.50	77.46	
over (min)	5.00	20.00	
Storage Coeff. (min)=	6.01 (ii)	16.75 (ii)	
Unit Hyd. Tpeak (min)=	5.00	20.00	
Unit Hyd. peak (cms)=	0.19	0.06	
			TOTALS
PEAK FLOW (cms)=	0.63	0.95	1.186 (iii)
TIME TO PEAK (hrs)=	6.00	6.17	6.00
RUNOFF VOLUME (mm)=	51.91	14.24	22.15
TOTAL RAINFALL (mm)=	53.41	53.41	53.41
RUNOFF COEFFICIENT =	0.97	0.27	0.41

```
       (i) HORTONS EQUATION SELECTED FOR PERVIOUS LOSSES:
            Fo   (mm/hr)= 75.00          K  (1/hr)=  4.14
            Fc   (mm/hr)= 12.50     Cum.Inf.   (mm)=  0.00
      (ii) TIME STEP (DT) SHOULD BE SMALLER OR EQUAL
           THAN THE STORAGE COEFFICIENT.
     (iii) PEAK FLOW DOES NOT INCLUDE BASEFLOW IF ANY.

--------------------------------------------------------------------------------
--------------------
| ROUTE CHN(  0353)|
| IN= 2---> OUT= 1 |     Routing time step (min)'=  5.00
--------------------
               <------ DATA FOR SECTION (   1.1) ------>
               Distance      Elevation       Manning
                   0.00          0.26        0.0300
                   5.50          0.15    0.0300 /0.0150  Main Channel
                   5.51          0.00        0.0150      Main Channel
                  10.00          0.09        0.0150      Main Channel
                  14.49          0.00        0.0150      Main Channel
                  14.50          0.15    0.0150 /0.0300  Main Channel
                  20.00          0.26        0.0300

      <---------------------- TRAVEL TIME TABLE ----------------------->
       DEPTH    ELEV      VOLUME    FLOW RATE    VELOCITY   TRAV.TIME
        (m)      (m)     (cu.m.)      (cms)        (m/s)      (min)
       0.01     0.01    .929E+01       0.0          0.17      99.56
       0.03     0.03    .372E+02       0.0          0.27      62.72
       0.04     0.04    .836E+02       0.0          0.35      47.86
       0.05     0.05    .149E+03       0.1          0.42      39.51
       0.07     0.07    .232E+03       0.1          0.49      34.05
       0.08     0.08    .334E+03       0.2          0.55      30.15
       0.10     0.10    .454E+03       0.3          0.64      26.24
       0.11     0.11    .576E+03       0.4          0.74      22.41
       0.12     0.12    .699E+03       0.6          0.84      19.75
       0.14     0.14    .822E+03       0.8          0.94      17.76
       0.15     0.15    .944E+03       1.0          1.03      16.22
       0.16     0.16    .108E+04       1.2          1.11      15.07
       0.18     0.18    .123E+04       1.4          1.17      14.28
       0.19     0.19    .140E+04       1.7          1.21      13.72
       0.20     0.20    .159E+04       2.0          1.25      13.31
       0.22     0.22    .180E+04       2.3          1.28      13.01
       0.23     0.23    .203E+04       2.6          1.31      12.76
       0.25     0.25    .227E+04       3.0          1.33      12.57
       0.26     0.26    .254E+04       3.4          1.34      12.41

                                  <---- hydrograph ---->   <-pipe / channel->
                            AREA    QPEAK   TPEAK   R.V.   MAX DEPTH  MAX VEL
                            (ha)    (cms)   (hrs)   (mm)      (m)      (m/s)
```

INFLOW : ID= 2 (0350)	16.30	1.19	6.00	22.15	0.16	1.10
OUTFLOW: ID= 1 (0353)	16.30	0.95	6.25	22.11	0.15	1.02

CALIB STANDHYD (0355) ID= 1 DT= 5.0 min	Area (ha)= 12.30 Total Imp(%)= 42.00 Dir. Conn.(%)= 21.00

		IMPERVIOUS	PERVIOUS (i)
Surface Area	(ha)=	5.17	7.13
Dep. Storage	(mm)=	1.50	5.00
Average Slope	(%)=	1.60	1.60
Length	(m)=	286.00	40.00
Mannings n	=	0.013	0.300

NOTE: RAINFALL WAS TRANSFORMED TO 5.0 MIN. TIME STEP.

---- TRANSFORMED HYETOGRAPH ----

TIME hrs	RAIN mm/hr	TIME hrs	RAIN mm/hr	TIME hrs	RAIN mm/hr	TIME hrs	RAIN mm/hr
0.083	1.34	3.083	2.14	6.083	9.61	9.08	1.87
0.167	1.34	3.167	2.14	6.167	9.61	9.17	1.87
0.250	1.34	3.250	2.14	6.250	9.61	9.25	1.87
0.333	1.34	3.333	2.14	6.333	9.61	9.33	1.87
0.417	1.34	3.417	2.14	6.417	9.61	9.42	1.87
0.500	1.34	3.500	2.14	6.500	9.61	9.50	1.87
0.583	1.34	3.583	2.14	6.583	4.27	9.58	1.87
0.667	1.34	3.667	2.14	6.667	4.27	9.67	1.87
0.750	1.34	3.750	2.14	6.750	4.27	9.75	1.87
0.833	1.33	3.833	2.14	6.833	4.27	9.83	1.87
0.917	1.34	3.917	2.14	6.917	4.27	9.92	1.87
1.000	1.34	4.000	2.14	7.000	4.27	10.00	1.87
1.083	1.33	4.083	3.20	7.083	3.20	10.08	1.07
1.167	1.34	4.167	3.20	7.167	3.20	10.17	1.07
1.250	1.34	4.250	3.20	7.250	3.21	10.25	1.07
1.333	1.34	4.333	3.21	7.333	3.20	10.33	1.07
1.417	1.34	4.417	3.20	7.417	3.20	10.42	1.07
1.500	1.34	4.500	3.20	7.500	3.21	10.50	1.07
1.583	1.34	4.583	4.27	7.583	3.20	10.58	1.07
1.667	1.34	4.667	4.27	7.667	3.20	10.67	1.07
1.750	1.34	4.750	4.27	7.750	3.21	10.75	1.07
1.833	1.34	4.833	4.27	7.833	3.20	10.83	1.07
1.917	1.34	4.917	4.27	7.917	3.20	10.92	1.07
2.000	1.34	5.000	4.27	8.000	3.20	11.00	1.07
2.083	1.60	5.083	6.41	8.083	1.87	11.08	1.07
2.167	1.60	5.167	6.41	8.167	1.87	11.17	1.07

```
                2.250    1.60 | 5.250    6.41 | 8.250    1.87 | 11.25    1.07
                2.333    1.60 | 5.333    6.41 | 8.333    1.87 | 11.33    1.07
                2.417    1.60 | 5.417    6.41 | 8.417    1.87 | 11.42    1.07
                2.500    1.60 | 5.500    6.41 | 8.500    1.87 | 11.50    1.07
                2.583    1.60 | 5.583   25.64 | 8.583    1.87 | 11.58    1.07
                2.667    1.60 | 5.667   25.64 | 8.667    1.87 | 11.67    1.07
                2.750    1.60 | 5.750   25.64 | 8.750    1.87 | 11.75    1.07
                2.833    1.60 | 5.833   70.50 | 8.833    1.87 | 11.83    1.07
                2.917    1.60 | 5.917   70.50 | 8.917    1.87 | 11.92    1.07
                3.000    1.60 | 6.000   70.50 | 9.000    1.87 | 12.00    1.07

     Max.Eff.Inten.(mm/hr)=      70.50        81.70
               over (min)         5.00        15.00
     Storage Coeff.  (min)=       4.79 (ii)   13.92 (ii)
     Unit Hyd. Tpeak (min)=       5.00        15.00
     Unit Hyd. peak  (cms)=       0.22         0.08
                                                          *TOTALS*
     PEAK FLOW       (cms)=       0.49         0.85          1.183 (iii)
     TIME TO PEAK    (hrs)=       6.00         6.08           6.00
     RUNOFF VOLUME    (mm)=      51.91        14.24          22.15
     TOTAL RAINFALL   (mm)=      53.41        53.41          53.41
     RUNOFF COEFFICIENT   =       0.97         0.27           0.41

***** WARNING: STORAGE COEFF. IS SMALLER THAN TIME STEP!

       (i) HORTONS EQUATION SELECTED FOR PERVIOUS LOSSES:
            Fo   (mm/hr)= 75.00           K  (1/hr)=  4.14
            Fc   (mm/hr)= 12.50     Cum.Inf.   (mm)=  0.00
      (ii) TIME STEP (DT) SHOULD BE SMALLER OR EQUAL
           THAN THE STORAGE COEFFICIENT.
     (iii) PEAK FLOW DOES NOT INCLUDE BASEFLOW IF ANY.

--------------------------------------------------------------------------------
--------------------
| ROUTE CHN(  0358)|
| IN= 2---> OUT= 1 |     Routing time step (min)'=  5.00
--------------------
               <------ DATA FOR SECTION (   1.1) ------>
               Distance      Elevation       Manning
                   0.00          0.26        0.0300
                   5.50          0.15    0.0300 /0.0150  Main Channel
                   5.51          0.00        0.0150      Main Channel
                  10.00          0.09        0.0150      Main Channel
                  14.49          0.00        0.0150      Main Channel
                  14.50          0.15    0.0150 /0.0300  Main Channel
                  20.00          0.26        0.0300

      <--------------------- TRAVEL TIME TABLE ---------------------->
       DEPTH    ELEV      VOLUME    FLOW RATE    VELOCITY   TRAV.TIME
         (m)      (m)     (cu.m.)      (cms)        (m/s)      (min)
```

0.01	0.01	.102E+02	0.0	0.17	109.52
0.03	0.03	.409E+02	0.0	0.27	68.99
0.04	0.04	.920E+02	0.0	0.35	52.65
0.05	0.05	.163E+03	0.1	0.42	43.46
0.07	0.07	.255E+03	0.1	0.49	37.45
0.08	0.08	.368E+03	0.2	0.55	33.17
0.10	0.10	.499E+03	0.3	0.64	28.86
0.11	0.11	.634E+03	0.4	0.74	24.66
0.12	0.12	.769E+03	0.6	0.84	21.72
0.14	0.14	.904E+03	0.8	0.94	19.54
0.15	0.15	.104E+04	1.0	1.03	17.84
0.16	0.16	.119E+04	1.2	1.11	16.57
0.18	0.18	.135E+04	1.4	1.17	15.71
0.19	0.19	.154E+04	1.7	1.21	15.10
0.20	0.20	.175E+04	2.0	1.25	14.65
0.22	0.22	.198E+04	2.3	1.28	14.31
0.23	0.23	.223E+04	2.6	1.31	14.04
0.25	0.25	.250E+04	3.0	1.33	13.82
0.26	0.26	.279E+04	3.4	1.34	13.65

		<---- hydrograph ---->			<-pipe / channel->	
	AREA	QPEAK	TPEAK	R.V.	MAX DEPTH	MAX VEL
	(ha)	(cms)	(hrs)	(mm)	(m)	(m/s)
INFLOW : ID= 2 (0355)	12.30	1.18	6.00	22.15	0.16	1.10
OUTFLOW: ID= 1 (0358)	12.30	0.74	6.17	22.10	0.13	0.92

ADD HYD (0359)				
1 + 2 = 3	AREA	QPEAK	TPEAK	R.V.
	(ha)	(cms)	(hrs)	(mm)
ID1= 1 (0353):	16.30	0.952	6.25	22.11
+ ID2= 2 (0358):	12.30	0.744	6.17	22.10
ID = 3 (0359):	28.60	1.680	6.25	22.11

NOTE: PEAK FLOWS DO NOT INCLUDE BASEFLOWS IF ANY.

ADD HYD (0363)				
1 + 2 = 3	AREA	QPEAK	TPEAK	R.V.
	(ha)	(cms)	(hrs)	(mm)
ID1= 1 (0359):	28.60	1.680	6.25	22.11
+ ID2= 2 (0362):	30.00	2.013	6.17	20.63
ID = 3 (0363):	58.60	3.649	6.17	21.35

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

--------------------
| ADD HYD  (  0380)|
|   1 +  2 =  3    |         AREA    QPEAK    TPEAK     R.V.
--------------------         (ha)    (cms)    (hrs)     (mm)
       ID1= 1 (  0363):    58.60   3.649     6.17    21.35
     + ID2= 2 (  0365):   117.50   9.481     6.08    22.15
       ================================================
       ID = 3 (  0380):   176.10  12.674     6.17    21.88

     NOTE:  PEAK FLOWS DO NOT INCLUDE BASEFLOWS IF ANY.
--------------------------------------------------------------------------------
--------------------
| RESERVOIR(  0390)|     OVERFLOW IS OFF
| IN= 2---> OUT= 1 |
| DT=  5.0 min     |     OUTFLOW    STORAGE   |  OUTFLOW    STORAGE
--------------------      (cms)     (ha.m.)   |   (cms)     (ha.m.)
                          0.0000     0.0000   |   1.3100      1.6000
                          0.7700     0.2870   |   1.8600     23.2300
                          1.2600     0.9680   |   0.0000      0.0000

                                AREA     QPEAK     TPEAK       R.V.
                                (ha)     (cms)     (hrs)       (mm)
   INFLOW : ID= 2 (  0380)    176.100     12.674      6.17      21.88
   OUTFLOW: ID= 1 (  0390)    176.100      1.333      7.08      21.88

                  PEAK   FLOW   REDUCTION [Qout/Qin](%)= 10.52
                  TIME SHIFT OF PEAK FLOW         (min)= 55.00
                  MAXIMUM  STORAGE   USED       (ha.m.)=  2.5065

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

--------------------
| ADD HYD  (  0400)|
|   1 +  2 =  3    |         AREA    QPEAK    TPEAK     R.V.
--------------------         (ha)    (cms)    (hrs)     (mm)
       ID1= 1 (  0390):   176.10   1.333     7.08    21.88
     + ID2= 2 (  0395):    51.20   2.601     6.17    11.75
       ================================================
       ID = 3 (  0400):   227.30   3.883     6.17    19.60

     NOTE:  PEAK FLOWS DO NOT INCLUDE BASEFLOWS IF ANY.
--------------------------------------------------------------------------------
--------------------
| ROUTE CHN(  0403)|
| IN= 2---> OUT= 1 |     Routing time step (min)'=  5.00
--------------------
```

<-------- DATA FOR SECTION (1.1) ------>

Distance	Elevation	Manning	
100.00	338.30	0.0500	
110.00	336.80	0.0500	
135.00	336.00	0.0300	Main Channel
142.00	335.30	0.0500	
148.00	335.30	0.0500	
156.00	336.00	0.0500	
165.00	338.30	0.0500	

<---------- TRAVEL TIME TABLE ---------->

DEPTH (m)	ELEV (m)	VOLUME (cu.m.)	FLOW RATE (cms)	VELOCITY (m/s)	TRAV.TIME (min)
0.16	335.46	.231E+04	0.9	0.71	44.52
0.32	335.62	.563E+04	3.2	1.09	29.11
0.47	335.77	.997E+04	7.3	1.39	22.72
0.63	335.93	.153E+05	13.4	1.66	19.04
0.79	336.09	.218E+05	22.7	1.97	16.04
0.95	336.25	.299E+05	35.3	2.25	14.10
1.11	336.41	.396E+05	51.2	2.46	12.89
1.26	336.56	.510E+05	70.7	2.63	12.02
1.42	336.72	.641E+05	94.1	2.79	11.35
1.58	336.88	.787E+05	122.4	2.96	10.71
1.74	337.04	.939E+05	155.6	3.15	10.06
1.89	337.19	.110E+06	192.8	3.34	9.48
2.05	337.35	.126E+06	233.9	3.53	8.97
2.21	337.51	.143E+06	278.9	3.71	8.53
2.37	337.67	.160E+06	327.7	3.89	8.13
2.53	337.83	.178E+06	380.3	4.07	7.79
2.68	337.98	.196E+06	436.7	4.23	7.48
2.84	338.14	.215E+06	496.9	4.40	7.20
3.00	338.30	.234E+06	561.0	4.56	6.95

		<---- hydrograph ---->			<-pipe / channel->	
	AREA (ha)	QPEAK (cms)	TPEAK (hrs)	R.V. (mm)	MAX DEPTH (m)	MAX VEL (m/s)
INFLOW : ID= 2 (0400)	227.30	3.88	6.17	19.60	0.34	1.13
OUTFLOW: ID= 1 (0403)	227.30	2.23	6.42	19.60	0.25	0.89

ADD HYD (0407)				
1 + 2 = 3	AREA (ha)	QPEAK (cms)	TPEAK (hrs)	R.V. (mm)
ID1= 1 (0115):	100.96	3.732	6.33	22.14
+ ID2= 2 (0403):	227.30	2.232	6.42	19.60
	==========	==========	==========	==========

```
        ID = 3 (  0407):   328.26   5.857     6.33    20.38

     NOTE:  PEAK FLOWS DO NOT INCLUDE BASEFLOWS IF ANY.
------------------------------------------------------------------------------
--------------------
| RESERVOIR(  0113)|     OVERFLOW IS OFF
| IN= 2---> OUT= 1 |
| DT=  5.0 min     |     OUTFLOW    STORAGE   |  OUTFLOW    STORAGE
--------------------       (cms)     (ha.m.)   |   (cms)     (ha.m.)
                           0.0000     0.0000   |   1.6000      6.4000
                           1.1000     2.9000   |   9.1000     10.0000
                           1.3000     4.3000   |  12.0000     20.0000

                                 AREA     QPEAK     TPEAK       R.V.
                                 (ha)     (cms)     (hrs)       (mm)
   INFLOW : ID= 2 (  0407)    328.260      5.857      6.33      20.38
   OUTFLOW: ID= 1 (  0113)    328.260      1.137     12.67      20.38

                  PEAK   FLOW   REDUCTION [Qout/Qin](%)= 19.42
                  TIME SHIFT OF PEAK FLOW         (min)=380.00
                  MAXIMUM  STORAGE   USED       (ha.m.)=  3.1599

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

--------------------
| ADD HYD  (  0430)|
|   1 +  2 =  3    |         AREA    QPEAK    TPEAK     R.V.
--------------------         (ha)    (cms)    (hrs)     (mm)
        ID1= 1 (  0113):   328.26   1.137    12.67    20.38
      + ID2= 2 (  0425):    26.91   1.980     6.00    22.15
        ================================================
        ID = 3 (  0430):   355.17   2.137     6.17    20.51

     NOTE:  PEAK FLOWS DO NOT INCLUDE BASEFLOWS IF ANY.
------------------------------------------------------------------------------
--------------------
| ROUTE CHN(  0440)|
| IN= 2---> OUT= 1 |     Routing time step (min)'=  5.00
--------------------
               <------ DATA FOR SECTION (   1.1) ------>
               Distance      Elevation       Manning
                 100.00        325.40        0.0600
                 120.00        324.60        0.0600
                 126.00        323.90        0.0600
                 130.00        323.00        0.0600
                 140.00        322.30    0.0600 /0.0300  Main Channel
                 142.00        322.30    0.0300 /0.0600  Main Channel
                 150.00        323.90        0.0600
                 155.00        324.60        0.0600
                 160.00        325.40        0.0600
```

<-------------------- TRAVEL TIME TABLE ---------------------->

DEPTH (m)	ELEV (m)	VOLUME (cu.m.)	FLOW RATE (cms)	VELOCITY (m/s)	TRAV.TIME (min)
0.16	322.46	.233E+03	0.6	0.96	6.96
0.33	322.63	.672E+03	2.1	1.26	5.27
0.49	322.79	.132E+04	4.9	1.48	4.51
0.65	322.95	.216E+04	9.0	1.66	4.03
0.82	323.12	.319E+04	14.9	1.87	3.57
0.98	323.28	.433E+04	22.5	2.08	3.21
1.14	323.44	.556E+04	31.6	2.27	2.93
1.31	323.61	.689E+04	42.3	2.45	2.72
1.47	323.77	.833E+04	54.6	2.62	2.54
1.63	323.93	.987E+04	68.3	2.77	2.41
1.79	324.09	.115E+05	82.8	2.87	2.33
1.96	324.26	.134E+05	99.2	2.96	2.25
2.12	324.42	.154E+05	117.9	3.06	2.18
2.28	324.58	.176E+05	138.8	3.15	2.11
2.45	324.75	.200E+05	157.4	3.14	2.12
2.61	324.91	.228E+05	179.6	3.15	2.11
2.77	325.07	.259E+05	205.8	3.18	2.09
2.94	325.24	.293E+05	236.1	3.23	2.07
3.10	325.40	.330E+05	270.6	3.28	2.03

		<---- hydrograph ---->			<-pipe / channel->	
	AREA (ha)	QPEAK (cms)	TPEAK (hrs)	R.V. (mm)	MAX DEPTH (m)	MAX VEL (m/s)
INFLOW : ID= 2 (0430)	355.17	2.14	6.17	20.51	0.33	1.26
OUTFLOW: ID= 1 (0440)	355.17	2.11	6.17	20.51	0.32	1.26

ADD HYD (0485)					
1 + 2 = 3	AREA (ha)	QPEAK (cms)	TPEAK (hrs)	R.V. (mm)
ID1= 1 (0440):	355.17	2.113	6.17	20.51
+ ID2= 2 (0475):	50.98	4.600	6.08	22.15
ID = 3 (0485):	406.15	6.641	6.08	20.72

NOTE: PEAK FLOWS DO NOT INCLUDE BASEFLOWS IF ANY.

ADD HYD (0490)				
1 + 2 = 3	AREA (ha)	QPEAK (cms)	TPEAK (hrs)	R.V. (mm)

```
        ID1= 1 (  0480):    43.10   3.608     6.08    22.15
      + ID2= 2 (  0485):   406.15   6.641     6.08    20.72
        ================================================
        ID = 3 (  0490):   449.25  10.249     6.08    20.86

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

--------------------
| ADD HYD  (  0491)|
|   1 +  2 =  3    |         AREA    QPEAK    TPEAK     R.V.
--------------------         (ha)    (cms)    (hrs)     (mm)
        ID1= 1 (  0482):    22.65   0.291     6.58    29.59
      + ID2= 2 (  0490):   449.25  10.249     6.08    20.86
        ================================================
        ID = 3 (  0491):   471.90  10.530     6.08    21.28

     NOTE:  PEAK FLOWS DO NOT INCLUDE BASEFLOWS IF ANY.
--------------------------------------------------------------------------------
--------------------
| RESERVOIR(  0483)|     OVERFLOW IS OFF
| IN= 2---> OUT= 1 |
| DT=  5.0 min     |     OUTFLOW    STORAGE   |  OUTFLOW    STORAGE
--------------------      (cms)     (ha.m.)   |   (cms)     (ha.m.)
                          0.0000     0.0000   |   7.0800      2.4860
                          0.2760     0.0600   |   8.1000      3.3240
                          1.2000     0.3400   |   9.7980      4.6420
                          2.0400     0.6182   |  10.4940      7.4397
                          2.6400     1.1630   |  11.6850     10.3000
                          3.1200     1.7070   |  12.3480     11.4000

                                AREA     QPEAK     TPEAK       R.V.
                                (ha)     (cms)     (hrs)       (mm)
   INFLOW : ID= 2 (  0491)    471.900     10.530      6.08      21.28
   OUTFLOW: ID= 1 (  0483)    471.900      2.923      6.67      21.28

                  PEAK   FLOW   REDUCTION [Qout/Qin](%)= 27.76
                  TIME SHIFT OF PEAK FLOW         (min)= 35.00
                  MAXIMUM  STORAGE   USED       (ha.m.)=  1.4861

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

--------------------
| ADD HYD  (  0530)|
|   1 +  2 =  3    |         AREA    QPEAK    TPEAK     R.V.
--------------------         (ha)    (cms)    (hrs)     (mm)
        ID1= 1 (  0483):   471.90   2.923     6.67    21.28
      + ID2= 2 (  0540):     4.63   0.713     6.00    43.01
        ================================================
        ID = 3 (  0530):   476.53   3.019     6.50    21.49
```

NOTE: PEAK FLOWS DO NOT INCLUDE BASEFLOWS IF ANY.

ADD HYD (0545)					
1 + 2 = 3	AREA (ha)	QPEAK (cms)	TPEAK (hrs)	R.V. (mm)
ID1= 1 (0527):	88.87	7.720	6.50	170.96
+ ID2= 2 (0530):	476.53	3.019	6.50	21.49
ID = 3 (0545):	565.40	10.738	6.50	44.98

NOTE: PEAK FLOWS DO NOT INCLUDE BASEFLOWS IF ANY.

ADD HYD (0546)					
1 + 2 = 3	AREA (ha)	QPEAK (cms)	TPEAK (hrs)	R.V. (mm)
ID1= 1 (0542):	25.25	3.608	6.00	43.01
+ ID2= 2 (0545):	565.40	10.738	6.50	44.98
ID = 3 (0546):	590.65	11.509	6.42	44.90

NOTE: PEAK FLOWS DO NOT INCLUDE BASEFLOWS IF ANY.

ADD HYD (0547)					
1 + 2 = 3	AREA (ha)	QPEAK (cms)	TPEAK (hrs)	R.V. (mm)
ID1= 1 (0543):	14.99	2.271	6.00	43.01
+ ID2= 2 (0546):	590.65	11.509	6.42	44.90
ID = 3 (0547):	605.64	13.463	6.00	44.85

NOTE: PEAK FLOWS DO NOT INCLUDE BASEFLOWS IF ANY.

ADD HYD (0548)					
1 + 2 = 3	AREA (ha)	QPEAK (cms)	TPEAK (hrs)	R.V. (mm)
ID1= 1 (0544):	1.13	0.178	6.00	43.01
+ ID2= 2 (0547):	605.64	13.463	6.00	44.85
ID = 3 (0548):	606.77	13.642	6.00	44.85

NOTE: PEAK FLOWS DO NOT INCLUDE BASEFLOWS IF ANY.

```
--------------------------------------------------------------------------------
--------------------
| ROUTE CHN(  0564)|
| IN= 2---> OUT= 1 |     Routing time step (min)'=  5.00
--------------------
               <------ DATA FOR SECTION (   1.1) ------>
               Distance      Elevation       Manning
                   0.00        101.50        0.0500
                   1.00        100.70        0.0500
                   1.50        100.55    0.0500 /0.0300  Main Channel
                   2.00         99.50        0.0300      Main Channel
                   3.50         99.60        0.0300      Main Channel
                   4.50        100.65    0.0300 /0.0500  Main Channel
                   6.00        101.45        0.0500

      <---------------------- TRAVEL TIME TABLE ---------------------->
       DEPTH     ELEV      VOLUME    FLOW RATE    VELOCITY   TRAV.TIME
        (m)       (m)     (cu.m.)      (cms)        (m/s)      (min)
       0.10    99.60    .353E+02       0.0          0.19      43.69
       0.19    99.69    .112E+03       0.1          0.37      22.76
       0.29    99.79    .195E+03       0.2          0.49      17.03
       0.38    99.88    .285E+03       0.3          0.59      14.23
       0.48    99.98    .381E+03       0.5          0.67      12.51
       0.57   100.07    .484E+03       0.7          0.74      11.32
       0.67   100.17    .594E+03       0.9          0.80      10.43
       0.76   100.26    .710E+03       1.2          0.86       9.74
       0.86   100.36    .832E+03       1.5          0.91       9.18
       0.95   100.45    .961E+03       1.8          0.96       8.72
       1.05   100.55    .110E+04       2.2          1.00       8.32
       1.16   100.66    .127E+04       2.7          1.07       7.80
       1.28   100.78    .148E+04       3.4          1.14       7.31
       1.39   100.89    .170E+04       4.1          1.20       6.94
       1.50   101.00    .195E+04       4.9          1.25       6.65
       1.61   101.11    .221E+04       5.8          1.30       6.41
       1.72   101.22    .250E+04       6.7          1.34       6.22
       1.84   101.34    .280E+04       7.7          1.38       6.04
       1.95   101.45    .313E+04       8.8          1.41       5.90

                                    <---- hydrograph ---->   <-pipe / channel->
                              AREA    QPEAK   TPEAK   R.V.   MAX DEPTH  MAX VEL
                              (ha)    (cms)   (hrs)   (mm)      (m)      (m/s)
   INFLOW : ID= 2 (  0505)   33.53     5.47    6.25  24.12      1.58      1.28
   OUTFLOW: ID= 1 (  0564)   33.53     4.91    6.33  24.12      1.50      1.25



--------------------------------------------------------------------------------
================================================================================
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```

```
       V    V   I    SSSSS  U   U    A    L             (v 6.2.2007)
       V    V   I    SS     U   U   A A   L
        V  V    I     SS    U   U  AAAAA  L
        V  V    I      SS   U   U  A   A  L
         VV     I    SSSSS  UUUUU  A   A  LLLLL

        OOO   TTTTT  TTTTT  H   H  Y   Y  M   M   OOO    TM
       O   O    T      T    H   H   Y Y   MM MM  O   O
       O   O    T      T    H   H    Y    M   M  O   O
        OOO     T      T    H   H    Y    M   M   OOO
```

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***** D E T A I L E D O U T P U T *****

Input filename: C:\Program Files (x86)\Visual OTTHYMO 6.2\VO2\voin.dat

Output filename:
C:\Users\szaga\AppData\Local\Civica\VH5\755e78af-23fe-400e-9cfe-54285a1c407c\e340c80f-64f7-45ea-bc3b-82c77d254c8e\scenar
Summary filename:
C:\Users\szaga\AppData\Local\Civica\VH5\755e78af-23fe-400e-9cfe-54285a1c407c\e340c80f-64f7-45ea-bc3b-82c77d254c8e\scenar

DATE: 02/17/2023 TIME: 03:33:49

USER:

COMMENTS: _____

****
** SIMULATION : Hadati Creek Watershed - Post **
****

READ STORM	Filename: C:\Users\szaga\AppData\Local\Temp\3ddd6580-52dc-4449-bccd-814fa38467d3\a5e32573
Ptotal= 73.56 mm	Comments: 25 year SCS Type II 12hr design storm

TIME hrs	RAIN mm/hr	TIME hrs	RAIN mm/hr	TIME hrs	RAIN mm/hr	TIME hrs	RAIN mm/hr
0.00	1.84	3.00	2.94	6.00	13.24	9.00	2.58
0.25	1.84	3.25	2.94	6.25	13.24	9.25	2.58
0.50	1.84	3.50	2.94	6.50	5.89	9.50	2.58
0.75	1.84	3.75	2.94	6.75	5.89	9.75	2.58
1.00	1.84	4.00	4.41	7.00	4.41	10.00	1.47
1.25	1.84	4.25	4.41	7.25	4.41	10.25	1.47
1.50	1.84	4.50	5.89	7.50	4.41	10.50	1.47
1.75	1.84	4.75	5.89	7.75	4.41	10.75	1.47
2.00	2.21	5.00	8.83	8.00	2.58	11.00	1.47
2.25	2.21	5.25	8.83	8.25	2.58	11.25	1.47
2.50	2.21	5.50	35.31	8.50	2.58	11.50	1.47
2.75	2.21	5.75	97.10	8.75	2.58	11.75	1.47

CALIB
STANDHYD (0544)
ID= 1 DT= 5.0 min

Area (ha)= 1.13
Total Imp(%)= 80.00 Dir. Conn.(%)= 79.00

		IMPERVIOUS	PERVIOUS (i)
Surface Area	(ha)=	0.90	0.23
Dep. Storage	(mm)=	1.50	5.00
Average Slope	(%)=	0.55	0.55
Length	(m)=	50.00	40.00
Mannings n	=	0.013	0.300

NOTE: RAINFALL WAS TRANSFORMED TO 5.0 MIN. TIME STEP.

---- TRANSFORMED HYETOGRAPH ----

TIME hrs	RAIN mm/hr	TIME hrs	RAIN mm/hr	TIME hrs	RAIN mm/hr	TIME hrs	RAIN mm/hr
0.083	1.84	3.083	2.94	6.083	13.24	9.08	2.58
0.167	1.84	3.167	2.94	6.167	13.24	9.17	2.58
0.250	1.84	3.250	2.94	6.250	13.24	9.25	2.57
0.333	1.84	3.333	2.94	6.333	13.24	9.33	2.58
0.417	1.84	3.417	2.94	6.417	13.24	9.42	2.58
0.500	1.84	3.500	2.94	6.500	13.24	9.50	2.58
0.583	1.84	3.583	2.94	6.583	5.89	9.58	2.57
0.667	1.84	3.667	2.94	6.667	5.89	9.67	2.58
0.750	1.84	3.750	2.94	6.750	5.89	9.75	2.58
0.833	1.84	3.833	2.94	6.833	5.89	9.83	2.57
0.917	1.84	3.917	2.94	6.917	5.89	9.92	2.58
1.000	1.84	4.000	2.94	7.000	5.88	10.00	2.58
1.083	1.84	4.083	4.41	7.083	4.41	10.08	1.47
1.167	1.84	4.167	4.41	7.167	4.41	10.17	1.47
1.250	1.84	4.250	4.41	7.250	4.41	10.25	1.47

1.333	1.84	4.333	4.41	7.333	4.41	10.33	1.47
1.417	1.84	4.417	4.41	7.417	4.41	10.42	1.47
1.500	1.84	4.500	4.41	7.500	4.41	10.50	1.47
1.583	1.84	4.583	5.88	7.583	4.41	10.58	1.47
1.667	1.84	4.667	5.89	7.667	4.41	10.67	1.47
1.750	1.84	4.750	5.89	7.750	4.41	10.75	1.47
1.833	1.84	4.833	5.89	7.833	4.41	10.83	1.47
1.917	1.84	4.917	5.89	7.917	4.41	10.92	1.47
2.000	1.84	5.000	5.89	8.000	4.41	11.00	1.47
2.083	2.21	5.083	8.83	8.083	2.58	11.08	1.47
2.167	2.21	5.167	8.83	8.167	2.58	11.17	1.47
2.250	2.21	5.250	8.83	8.250	2.57	11.25	1.47
2.333	2.21	5.333	8.83	8.333	2.58	11.33	1.47
2.417	2.21	5.417	8.83	8.417	2.58	11.42	1.47
2.500	2.21	5.500	8.83	8.500	2.57	11.50	1.47
2.583	2.21	5.583	35.31	8.583	2.58	11.58	1.47
2.667	2.21	5.667	35.31	8.667	2.58	11.67	1.47
2.750	2.21	5.750	35.31	8.750	2.57	11.75	1.47
2.833	2.21	5.833	97.10	8.833	2.58	11.83	1.47
2.917	2.21	5.917	97.10	8.917	2.58	11.92	1.47
3.000	2.21	6.000	97.10	9.000	2.57	12.00	1.47

Max.Eff.Inten.(mm/hr)=	97.10	87.19	
over (min)	5.00	15.00	
Storage Coeff. (min)=	2.04 (ii)	14.29 (ii)	
Unit Hyd. Tpeak (min)=	5.00	15.00	
Unit Hyd. peak (cms)=	0.31	0.08	
			TOTALS
PEAK FLOW (cms)=	0.24	0.03	0.266 (iii)
TIME TO PEAK (hrs)=	6.00	6.08	6.00
RUNOFF VOLUME (mm)=	72.06	21.22	61.38
TOTAL RAINFALL (mm)=	73.56	73.56	73.56
RUNOFF COEFFICIENT =	0.98	0.29	0.83

***** WARNING: STORAGE COEFF. IS SMALLER THAN TIME STEP!

(i) HORTONS EQUATION SELECTED FOR PERVIOUS LOSSES:
Fo (mm/hr)= 75.00 K (1/hr)= 4.14
Fc (mm/hr)= 12.50 Cum.Inf. (mm)= 0.00
(ii) TIME STEP (DT) SHOULD BE SMALLER OR EQUAL
THAN THE STORAGE COEFFICIENT.
(iii) PEAK FLOW DOES NOT INCLUDE BASEFLOW IF ANY.

CALIB
STANDHYD (0543)
ID= 1 DT= 5.0 min

Area (ha)= 14.99
Total Imp(%)= 80.00 Dir. Conn.(%)= 79.00

	IMPERVIOUS	PERVIOUS (i)

Surface Area	(ha)=	11.99	3.00
Dep. Storage	(mm)=	1.50	5.00
Average Slope	(%)=	0.55	0.55
Length	(m)=	200.00	40.00
Mannings n	=	0.013	0.300

NOTE: RAINFALL WAS TRANSFORMED TO 5.0 MIN. TIME STEP.

---- TRANSFORMED HYETOGRAPH ----

TIME hrs	RAIN mm/hr	TIME hrs	RAIN mm/hr	TIME hrs	RAIN mm/hr	TIME hrs	RAIN mm/hr
0.083	1.84	3.083	2.94	6.083	13.24	9.08	2.58
0.167	1.84	3.167	2.94	6.167	13.24	9.17	2.58
0.250	1.84	3.250	2.94	6.250	13.24	9.25	2.57
0.333	1.84	3.333	2.94	6.333	13.24	9.33	2.58
0.417	1.84	3.417	2.94	6.417	13.24	9.42	2.58
0.500	1.84	3.500	2.94	6.500	13.24	9.50	2.58
0.583	1.84	3.583	2.94	6.583	5.89	9.58	2.57
0.667	1.84	3.667	2.94	6.667	5.89	9.67	2.58
0.750	1.84	3.750	2.94	6.750	5.89	9.75	2.58
0.833	1.84	3.833	2.94	6.833	5.89	9.83	2.57
0.917	1.84	3.917	2.94	6.917	5.89	9.92	2.58
1.000	1.84	4.000	2.94	7.000	5.88	10.00	2.58
1.083	1.84	4.083	4.41	7.083	4.41	10.08	1.47
1.167	1.84	4.167	4.41	7.167	4.41	10.17	1.47
1.250	1.84	4.250	4.41	7.250	4.41	10.25	1.47
1.333	1.84	4.333	4.41	7.333	4.41	10.33	1.47
1.417	1.84	4.417	4.41	7.417	4.41	10.42	1.47
1.500	1.84	4.500	4.41	7.500	4.41	10.50	1.47
1.583	1.84	4.583	5.88	7.583	4.41	10.58	1.47
1.667	1.84	4.667	5.89	7.667	4.41	10.67	1.47
1.750	1.84	4.750	5.89	7.750	4.41	10.75	1.47
1.833	1.84	4.833	5.89	7.833	4.41	10.83	1.47
1.917	1.84	4.917	5.89	7.917	4.41	10.92	1.47
2.000	1.84	5.000	5.89	8.000	4.41	11.00	1.47
2.083	2.21	5.083	8.83	8.083	2.58	11.08	1.47
2.167	2.21	5.167	8.83	8.167	2.58	11.17	1.47
2.250	2.21	5.250	8.83	8.250	2.57	11.25	1.47
2.333	2.21	5.333	8.83	8.333	2.58	11.33	1.47
2.417	2.21	5.417	8.83	8.417	2.58	11.42	1.47
2.500	2.21	5.500	8.83	8.500	2.57	11.50	1.47
2.583	2.21	5.583	35.31	8.583	2.58	11.58	1.47
2.667	2.21	5.667	35.31	8.667	2.58	11.67	1.47
2.750	2.21	5.750	35.31	8.750	2.57	11.75	1.47
2.833	2.21	5.833	97.10	8.833	2.58	11.83	1.47
2.917	2.21	5.917	97.10	8.917	2.58	11.92	1.47
3.000	2.21	6.000	97.10	9.000	2.57	12.00	1.47

Max.Eff.Inten.(mm/hr)=		97.10	87.19

```
               over (min)        5.00        20.00
     Storage Coeff.  (min)=       4.69 (ii)   16.94 (ii)
     Unit Hyd. Tpeak (min)=       5.00        20.00
     Unit Hyd. peak  (cms)=       0.22         0.06
                                                      *TOTALS*
     PEAK FLOW       (cms)=       3.11         0.34          3.310 (iii)
     TIME TO PEAK    (hrs)=       6.00         6.17           6.00
     RUNOFF VOLUME    (mm)=      72.06        21.22          61.38
     TOTAL RAINFALL   (mm)=      73.56        73.56          73.56
     RUNOFF COEFFICIENT   =       0.98         0.29           0.83

***** WARNING: STORAGE COEFF. IS SMALLER THAN TIME STEP!

       (i) HORTONS EQUATION SELECTED FOR PERVIOUS LOSSES:
            Fo   (mm/hr)= 75.00           K  (1/hr)=  4.14
            Fc   (mm/hr)= 12.50     Cum.Inf.   (mm)=  0.00
      (ii) TIME STEP (DT) SHOULD BE SMALLER OR EQUAL
           THAN THE STORAGE COEFFICIENT.
     (iii) PEAK FLOW DOES NOT INCLUDE BASEFLOW IF ANY.

--------------------------------------------------------------------------------
--------------------
| CALIB            |
| STANDHYD (  0542)|   Area    (ha)=  25.25
|ID= 1 DT= 5.0 min |   Total Imp(%)=  80.00   Dir. Conn.(%)=  79.00
--------------------
                            IMPERVIOUS    PERVIOUS (i)
     Surface Area     (ha)=      20.20         5.05
     Dep. Storage     (mm)=       1.50         5.00
     Average Slope     (%)=       0.55         0.55
     Length            (m)=     350.00        40.00
     Mannings n           =      0.013        0.300

         NOTE:  RAINFALL WAS TRANSFORMED TO   5.0 MIN. TIME STEP.


                          ---- TRANSFORMED HYETOGRAPH ----
      TIME    RAIN |  TIME    RAIN |'  TIME    RAIN |  TIME    RAIN
       hrs   mm/hr |   hrs   mm/hr |'   hrs   mm/hr |   hrs   mm/hr
     0.083    1.84 | 3.083    2.94 | 6.083   13.24 |  9.08    2.58
     0.167    1.84 | 3.167    2.94 | 6.167   13.24 |  9.17    2.58
     0.250    1.84 | 3.250    2.94 | 6.250   13.24 |  9.25    2.57
     0.333    1.84 | 3.333    2.94 | 6.333   13.24 |  9.33    2.58
     0.417    1.84 | 3.417    2.94 | 6.417   13.24 |  9.42    2.58
     0.500    1.84 | 3.500    2.94 | 6.500   13.24 |  9.50    2.58
     0.583    1.84 | 3.583    2.94 | 6.583    5.89 |  9.58    2.57
     0.667    1.84 | 3.667    2.94 | 6.667    5.89 |  9.67    2.58
     0.750    1.84 | 3.750    2.94 | 6.750    5.89 |  9.75    2.58
     0.833    1.84 | 3.833    2.94 | 6.833    5.89 |  9.83    2.57
     0.917    1.84 | 3.917    2.94 | 6.917    5.89 |  9.92    2.58
```

1.000	1.84	4.000	2.94	7.000	5.88	10.00	2.58
1.083	1.84	4.083	4.41	7.083	4.41	10.08	1.47
1.167	1.84	4.167	4.41	7.167	4.41	10.17	1.47
1.250	1.84	4.250	4.41	7.250	4.41	10.25	1.47
1.333	1.84	4.333	4.41	7.333	4.41	10.33	1.47
1.417	1.84	4.417	4.41	7.417	4.41	10.42	1.47
1.500	1.84	4.500	4.41	7.500	4.41	10.50	1.47
1.583	1.84	4.583	5.88	7.583	4.41	10.58	1.47
1.667	1.84	4.667	5.89	7.667	4.41	10.67	1.47
1.750	1.84	4.750	5.89	7.750	4.41	10.75	1.47
1.833	1.84	4.833	5.89	7.833	4.41	10.83	1.47
1.917	1.84	4.917	5.89	7.917	4.41	10.92	1.47
2.000	1.84	5.000	5.89	8.000	4.41	11.00	1.47
2.083	2.21	5.083	8.83	8.083	2.58	11.08	1.47
2.167	2.21	5.167	8.83	8.167	2.58	11.17	1.47
2.250	2.21	5.250	8.83	8.250	2.57	11.25	1.47
2.333	2.21	5.333	8.83	8.333	2.58	11.33	1.47
2.417	2.21	5.417	8.83	8.417	2.58	11.42	1.47
2.500	2.21	5.500	8.83	8.500	2.57	11.50	1.47
2.583	2.21	5.583	35.31	8.583	2.58	11.58	1.47
2.667	2.21	5.667	35.31	8.667	2.58	11.67	1.47
2.750	2.21	5.750	35.31	8.750	2.57	11.75	1.47
2.833	2.21	5.833	97.10	8.833	2.58	11.83	1.47
2.917	2.21	5.917	97.10	8.917	2.58	11.92	1.47
3.000	2.21	6.000	97.10	9.000	2.57	12.00	1.47

Max.Eff.Inten.(mm/hr)=	97.10	87.19	
over (min)	5.00	20.00	
Storage Coeff. (min)=	6.56 (ii)	18.81 (ii)	
Unit Hyd. Tpeak (min)=	5.00	20.00	
Unit Hyd. peak (cms)=	0.18	0.06	
			TOTALS
PEAK FLOW (cms)=	5.02	0.53	5.333 (iii)
TIME TO PEAK (hrs)=	6.00	6.17	6.00
RUNOFF VOLUME (mm)=	72.06	21.22	61.38
TOTAL RAINFALL (mm)=	73.56	73.56	73.56
RUNOFF COEFFICIENT =	0.98	0.29	0.83

(i) HORTONS EQUATION SELECTED FOR PERVIOUS LOSSES:
Fo (mm/hr)= 75.00 K (1/hr)= 4.14
Fc (mm/hr)= 12.50 Cum.Inf. (mm)= 0.00
(ii) TIME STEP (DT) SHOULD BE SMALLER OR EQUAL
THAN THE STORAGE COEFFICIENT.
(iii) PEAK FLOW DOES NOT INCLUDE BASEFLOW IF ANY.

| STORE HYD(0525)| AREA (ha)= 0.00
| ID= 1 DT=****min | QPEAK (cms)= 2.00

```
--------------------   TPEAK     (hrs)=  24.00
                       VOLUME     (mm)=*******

  TIME    FLOW |  TIME    FLOW |  TIME    FLOW |'  TIME    FLOW |  TIME    FLOW
   hrs     cms |   hrs     cms |   hrs     cms |'   hrs     cms |   hrs     cms
  0.00    1.00 | 24.00    2.00 |
--------------------------------------------------------------------------------
--------------------
| CALIB            |
| STANDHYD (  0510)|   Area    (ha)=  16.00
|ID= 1 DT= 5.0 min |   Total Imp(%)=  80.00   Dir. Conn.(%)=  79.00
--------------------
                            IMPERVIOUS    PERVIOUS (i)
     Surface Area     (ha)=      12.80         3.20
     Dep. Storage     (mm)=       1.50         5.00
     Average Slope     (%)=       0.50         0.25
     Length            (m)=     400.00        40.00
     Mannings n           =      0.013        0.300

         NOTE:  RAINFALL WAS TRANSFORMED TO   5.0 MIN. TIME STEP.


                          ---- TRANSFORMED HYETOGRAPH ----
                TIME    RAIN |  TIME    RAIN |'  TIME    RAIN |  TIME    RAIN
                 hrs   mm/hr |   hrs   mm/hr |'   hrs   mm/hr |   hrs   mm/hr
               0.083    1.84 | 3.083    2.94 | 6.083   13.24 |  9.08    2.58
               0.167    1.84 | 3.167    2.94 | 6.167   13.24 |  9.17    2.58
               0.250    1.84 | 3.250    2.94 | 6.250   13.24 |  9.25    2.57
               0.333    1.84 | 3.333    2.94 | 6.333   13.24 |  9.33    2.58
               0.417    1.84 | 3.417    2.94 | 6.417   13.24 |  9.42    2.58
               0.500    1.84 | 3.500    2.94 | 6.500   13.24 |  9.50    2.58
               0.583    1.84 | 3.583    2.94 | 6.583    5.89 |  9.58    2.57
               0.667    1.84 | 3.667    2.94 | 6.667    5.89 |  9.67    2.58
               0.750    1.84 | 3.750    2.94 | 6.750    5.89 |  9.75    2.58
               0.833    1.84 | 3.833    2.94 | 6.833    5.89 |  9.83    2.57
               0.917    1.84 | 3.917    2.94 | 6.917    5.89 |  9.92    2.58
               1.000    1.84 | 4.000    2.94 | 7.000    5.88 | 10.00    2.58
               1.083    1.84 | 4.083    4.41 | 7.083    4.41 | 10.08    1.47
               1.167    1.84 | 4.167    4.41 | 7.167    4.41 | 10.17    1.47
               1.250    1.84 | 4.250    4.41 | 7.250    4.41 | 10.25    1.47
               1.333    1.84 | 4.333    4.41 | 7.333    4.41 | 10.33    1.47
               1.417    1.84 | 4.417    4.41 | 7.417    4.41 | 10.42    1.47
               1.500    1.84 | 4.500    4.41 | 7.500    4.41 | 10.50    1.47
               1.583    1.84 | 4.583    5.88 | 7.583    4.41 | 10.58    1.47
               1.667    1.84 | 4.667    5.89 | 7.667    4.41 | 10.67    1.47
               1.750    1.84 | 4.750    5.89 | 7.750    4.41 | 10.75    1.47
               1.833    1.84 | 4.833    5.89 | 7.833    4.41 | 10.83    1.47
               1.917    1.84 | 4.917    5.89 | 7.917    4.41 | 10.92    1.47
               2.000    1.84 | 5.000    5.89 | 8.000    4.41 | 11.00    1.47
               2.083    2.21 | 5.083    8.83 | 8.083    2.58 | 11.08    1.47
```

2.167	2.21	5.167	8.83	8.167	2.58	11.17	1.47
2.250	2.21	5.250	8.83	8.250	2.57	11.25	1.47
2.333	2.21	5.333	8.83	8.333	2.58	11.33	1.47
2.417	2.21	5.417	8.83	8.417	2.58	11.42	1.47
2.500	2.21	5.500	8.83	8.500	2.57	11.50	1.47
2.583	2.21	5.583	35.31	8.583	2.58	11.58	1.47
2.667	2.21	5.667	35.31	8.667	2.58	11.67	1.47
2.750	2.21	5.750	35.31	8.750	2.57	11.75	1.47
2.833	2.21	5.833	97.10	8.833	2.58	11.83	1.47
2.917	2.21	5.917	97.10	8.917	2.58	11.92	1.47
3.000	2.21	6.000	97.10	9.000	2.57	12.00	1.47

Max.Eff.Inten.(mm/hr)=	97.10	65.53	
over (min)	5.00	25.00	
Storage Coeff. (min)=	7.31 (ii)	24.71 (ii)	
Unit Hyd. Tpeak (min)=	5.00	25.00	
Unit Hyd. peak (cms)=	0.17	0.05	
			TOTALS
PEAK FLOW (cms)=	3.12	0.27	3.239 (iii)
TIME TO PEAK (hrs)=	6.00	6.25	6.00
RUNOFF VOLUME (mm)=	72.06	21.22	61.38
TOTAL RAINFALL (mm)=	73.56	73.56	73.56
RUNOFF COEFFICIENT =	0.98	0.29	0.83

(i) HORTONS EQUATION SELECTED FOR PERVIOUS LOSSES:
Fo (mm/hr)= 75.00 K (1/hr)= 4.14
Fc (mm/hr)= 12.50 Cum.Inf. (mm)= 0.00

(ii) TIME STEP (DT) SHOULD BE SMALLER OR EQUAL
THAN THE STORAGE COEFFICIENT.

(iii) PEAK FLOW DOES NOT INCLUDE BASEFLOW IF ANY.

CALIB
STANDHYD (0500)
ID= 1 DT= 5.0 min

Area (ha)= 244.00
Total Imp(%)= 46.00 Dir. Conn.(%)= 26.00

		IMPERVIOUS	PERVIOUS (i)
Surface Area	(ha)=	112.24	131.76
Dep. Storage	(mm)=	1.50	5.00
Average Slope	(%)=	0.80	0.80
Length	(m)=	1275.00	40.00
Mannings n	=	0.013	0.300

NOTE: RAINFALL WAS TRANSFORMED TO 5.0 MIN. TIME STEP.

---- TRANSFORMED HYETOGRAPH ----

TIME	RAIN	TIME	RAIN	TIME	RAIN	TIME	RAIN

hrs	mm/hr	hrs	mm/hr	hrs	mm/hr	hrs	mm/hr
0.083	1.84	3.083	2.94	6.083	13.24	9.08	2.58
0.167	1.84	3.167	2.94	6.167	13.24	9.17	2.58
0.250	1.84	3.250	2.94	6.250	13.24	9.25	2.57
0.333	1.84	3.333	2.94	6.333	13.24	9.33	2.58
0.417	1.84	3.417	2.94	6.417	13.24	9.42	2.58
0.500	1.84	3.500	2.94	6.500	13.24	9.50	2.58
0.583	1.84	3.583	2.94	6.583	5.89	9.58	2.57
0.667	1.84	3.667	2.94	6.667	5.89	9.67	2.58
0.750	1.84	3.750	2.94	6.750	5.89	9.75	2.58
0.833	1.84	3.833	2.94	6.833	5.89	9.83	2.57
0.917	1.84	3.917	2.94	6.917	5.89	9.92	2.58
1.000	1.84	4.000	2.94	7.000	5.88	10.00	2.58
1.083	1.84	4.083	4.41	7.083	4.41	10.08	1.47
1.167	1.84	4.167	4.41	7.167	4.41	10.17	1.47
1.250	1.84	4.250	4.41	7.250	4.41	10.25	1.47
1.333	1.84	4.333	4.41	7.333	4.41	10.33	1.47
1.417	1.84	4.417	4.41	7.417	4.41	10.42	1.47
1.500	1.84	4.500	4.41	7.500	4.41	10.50	1.47
1.583	1.84	4.583	5.88	7.583	4.41	10.58	1.47
1.667	1.84	4.667	5.89	7.667	4.41	10.67	1.47
1.750	1.84	4.750	5.89	7.750	4.41	10.75	1.47
1.833	1.84	4.833	5.89	7.833	4.41	10.83	1.47
1.917	1.84	4.917	5.89	7.917	4.41	10.92	1.47
2.000	1.84	5.000	5.89	8.000	4.41	11.00	1.47
2.083	2.21	5.083	8.83	8.083	2.58	11.08	1.47
2.167	2.21	5.167	8.83	8.167	2.58	11.17	1.47
2.250	2.21	5.250	8.83	8.250	2.57	11.25	1.47
2.333	2.21	5.333	8.83	8.333	2.58	11.33	1.47
2.417	2.21	5.417	8.83	8.417	2.58	11.42	1.47
2.500	2.21	5.500	8.83	8.500	2.57	11.50	1.47
2.583	2.21	5.583	35.31	8.583	2.58	11.58	1.47
2.667	2.21	5.667	35.31	8.667	2.58	11.67	1.47
2.750	2.21	5.750	35.31	8.750	2.57	11.75	1.47
2.833	2.21	5.833	97.10	8.833	2.58	11.83	1.47
2.917	2.21	5.917	97.10	8.917	2.58	11.92	1.47
3.000	2.21	6.000	97.10	9.000	2.57	12.00	1.47

Max.Eff.Inten.(mm/hr)=	97.10	120.22	
over (min)	15.00	25.00	
Storage Coeff. (min)=	12.73 (ii)	22.36 (ii)	
Unit Hyd. Tpeak (min)=	15.00	25.00	
Unit Hyd. peak (cms)=	0.08	0.05	
			TOTALS
PEAK FLOW (cms)=	11.66	18.11	27.658 (iii)
TIME TO PEAK (hrs)=	6.08	6.25	6.17
RUNOFF VOLUME (mm)=	72.06	26.62	38.44
TOTAL RAINFALL (mm)=	73.56	73.56	73.56
RUNOFF COEFFICIENT =	0.98	0.36	0.52

```
       (i) HORTONS EQUATION SELECTED FOR PERVIOUS LOSSES:
            Fo   (mm/hr)= 75.00          K  (1/hr)=  4.14
            Fc   (mm/hr)= 12.50     Cum.Inf.   (mm)=  0.00
      (ii) TIME STEP (DT) SHOULD BE SMALLER OR EQUAL
           THAN THE STORAGE COEFFICIENT.
     (iii) PEAK FLOW DOES NOT INCLUDE BASEFLOW IF ANY.

--------------------------------------------------------------------------------
--------------------
| DUHYD    (  0505)|
| Inlet Cap.= 9.000|
| #of Inlets=     1|
| Total(cms)=   9.0|      AREA     QPEAK     TPEAK    R.V.
--------------------      (ha)     (cms)     (hrs)    (mm)
     TOTAL HYD.(ID= 1): 244.00     27.66      6.17   38.44
     ================================================
     MAJOR SYS.(ID= 2):  81.12     18.66      6.17   38.44
     MINOR SYS.(ID= 3): 162.88      9.00      5.92   38.44

     NOTE:  PEAK FLOWS DO NOT INCLUDE BASEFLOWS IF ANY.

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

--------------------
| ADD HYD  (  0515)|
|   1 +  2 =  3    |         AREA    QPEAK    TPEAK     R.V.
--------------------          (ha)    (cms)    (hrs)     (mm)
        ID1= 1 (  0505):   162.88   9.000     5.92    38.44
      + ID2= 2 (  0510):    16.00   3.239     6.00    61.38
        ================================================
        ID = 3 (  0515):   178.88  12.239     6.00    40.49

     NOTE:  PEAK FLOWS DO NOT INCLUDE BASEFLOWS IF ANY.
--------------------------------------------------------------------------------
--------------------
| DUHYD    (  0520)|
| Inlet Cap.= 3.050|
| #of Inlets=     1|
| Total(cms)=   3.0|      AREA     QPEAK     TPEAK    R.V.
--------------------      (ha)     (cms)     (hrs)    (mm)
     TOTAL HYD.(ID= 1): 178.88     12.24      6.00   40.49
     ================================================
     MAJOR SYS.(ID= 2):  74.79      9.19      6.00   40.49
     MINOR SYS.(ID= 3): 104.09      3.05      5.67   40.49

     NOTE:  PEAK FLOWS DO NOT INCLUDE BASEFLOWS IF ANY.

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--------------------
| ADD HYD  (  0526)|
|   1 +  2 =  3    |          AREA    QPEAK    TPEAK     R.V.
--------------------          (ha)    (cms)    (hrs)     (mm)
        ID1= 1 (  0520):    74.79   9.189     6.00    40.49
      + ID2= 2 (  0525):     0.00   2.000    24.00  *******
        ================================================
        ID = 3 (  0526):    74.79  10.439     6.00   213.57

     NOTE:  PEAK FLOWS DO NOT INCLUDE BASEFLOWS IF ANY.
--------------------------------------------------------------------------------
--------------------
| ROUTE CHN(  0527)|
| IN= 2---> OUT= 1 |     Routing time step (min)'=  5.00
--------------------
               <------ DATA FOR SECTION (   1.1) ------>
               Distance      Elevation       Manning
                 100.00        313.20        0.0500
                 140.00        312.40    0.0500 /0.0300  Main Channel
                 140.50        310.80        0.0300      Main Channel
                 141.50        310.80        0.0300      Main Channel
                 142.00        312.40    0.0300 /0.0500  Main Channel
                 160.00        313.20        0.0500

      <---------------------- TRAVEL TIME TABLE ---------------------->
       DEPTH    ELEV      VOLUME    FLOW RATE    VELOCITY   TRAV.TIME
        (m)      (m)     (cu.m.)      (cms)        (m/s)      (min)
       0.12   310.92    .575E+02       0.1          0.40      18.86
       0.25   311.05    .119E+03       0.2          0.57      13.13
       0.37   311.17    .185E+03       0.3          0.69      10.87
       0.49   311.29    .256E+03       0.4          0.78       9.61
       0.62   311.42    .330E+03       0.6          0.86       8.77
       0.74   311.54    .409E+03       0.8          0.92       8.17
       0.86   311.66    .492E+03       1.1          0.97       7.70
       0.98   311.78    .579E+03       1.3          1.02       7.32
       1.11   311.91    .671E+03       1.6          1.07       7.01
       1.23   312.03    .767E+03       1.9          1.11       6.74
       1.35   312.15    .867E+03       2.2          1.15       6.50
       1.48   312.28    .971E+03       2.6          1.19       6.29
       1.60   312.40    .108E+04       2.9          1.23       6.11
       1.73   312.53    .149E+04       3.6          1.10       6.85
       1.87   312.67    .248E+04       4.9          0.88       8.52
       2.00   312.80    .405E+04       6.9          0.77       9.74
       2.13   312.93    .620E+04      10.1          0.73      10.21
       2.27   313.07    .893E+04      14.6          0.74      10.17
       2.40   313.20    .122E+05      20.7          0.76       9.85

                                    <---- hydrograph ---->   <-pipe / channel->
                              AREA    QPEAK   TPEAK   R.V.   MAX DEPTH  MAX VEL
                              (ha)    (cms)   (hrs)   (mm)      (m)      (m/s)
```

INFLOW : ID= 2 (0526)	74.79	10.44	6.00	213.57	2.14	0.73
OUTFLOW: ID= 1 (0527)	74.79	8.32	6.25	213.37	2.06	0.75

CALIB STANDHYD (0540) ID= 1 DT= 5.0 min	Area (ha)= 4.63	Total Imp(%)= 80.00	Dir. Conn.(%)= 79.00

		IMPERVIOUS	PERVIOUS (i)
Surface Area	(ha)=	3.70	0.93
Dep. Storage	(mm)=	1.50	5.00
Average Slope	(%)=	0.55	0.55
Length	(m)=	150.00	40.00
Mannings n	=	0.013	0.300

NOTE: RAINFALL WAS TRANSFORMED TO 5.0 MIN. TIME STEP.

---- TRANSFORMED HYETOGRAPH ----

TIME hrs	RAIN mm/hr	TIME hrs	RAIN mm/hr	TIME hrs	RAIN mm/hr	TIME hrs	RAIN mm/hr
0.083	1.84	3.083	2.94	6.083	13.24	9.08	2.58
0.167	1.84	3.167	2.94	6.167	13.24	9.17	2.58
0.250	1.84	3.250	2.94	6.250	13.24	9.25	2.57
0.333	1.84	3.333	2.94	6.333	13.24	9.33	2.58
0.417	1.84	3.417	2.94	6.417	13.24	9.42	2.58
0.500	1.84	3.500	2.94	6.500	13.24	9.50	2.58
0.583	1.84	3.583	2.94	6.583	5.89	9.58	2.57
0.667	1.84	3.667	2.94	6.667	5.89	9.67	2.58
0.750	1.84	3.750	2.94	6.750	5.89	9.75	2.58
0.833	1.84	3.833	2.94	6.833	5.89	9.83	2.57
0.917	1.84	3.917	2.94	6.917	5.89	9.92	2.58
1.000	1.84	4.000	2.94	7.000	5.88	10.00	2.58
1.083	1.84	4.083	4.41	7.083	4.41	10.08	1.47
1.167	1.84	4.167	4.41	7.167	4.41	10.17	1.47
1.250	1.84	4.250	4.41	7.250	4.41	10.25	1.47
1.333	1.84	4.333	4.41	7.333	4.41	10.33	1.47
1.417	1.84	4.417	4.41	7.417	4.41	10.42	1.47
1.500	1.84	4.500	4.41	7.500	4.41	10.50	1.47
1.583	1.84	4.583	5.88	7.583	4.41	10.58	1.47
1.667	1.84	4.667	5.89	7.667	4.41	10.67	1.47
1.750	1.84	4.750	5.89	7.750	4.41	10.75	1.47
1.833	1.84	4.833	5.89	7.833	4.41	10.83	1.47
1.917	1.84	4.917	5.89	7.917	4.41	10.92	1.47
2.000	1.84	5.000	5.89	8.000	4.41	11.00	1.47
2.083	2.21	5.083	8.83	8.083	2.58	11.08	1.47
2.167	2.21	5.167	8.83	8.167	2.58	11.17	1.47

2.250	2.21	5.250	8.83	8.250	2.57	11.25	1.47
2.333	2.21	5.333	8.83	8.333	2.58	11.33	1.47
2.417	2.21	5.417	8.83	8.417	2.58	11.42	1.47
2.500	2.21	5.500	8.83	8.500	2.57	11.50	1.47
2.583	2.21	5.583	35.31	8.583	2.58	11.58	1.47
2.667	2.21	5.667	35.31	8.667	2.58	11.67	1.47
2.750	2.21	5.750	35.31	8.750	2.57	11.75	1.47
2.833	2.21	5.833	97.10	8.833	2.58	11.83	1.47
2.917	2.21	5.917	97.10	8.917	2.58	11.92	1.47
3.000	2.21	6.000	97.10	9.000	2.57	12.00	1.47

Max.Eff.Inten.(mm/hr)=	97.10	87.19	
over (min)	5.00	20.00	
Storage Coeff. (min)=	3.94 (ii)	16.20 (ii)	
Unit Hyd. Tpeak (min)=	5.00	20.00	
Unit Hyd. peak (cms)=	0.24	0.06	
			TOTALS
PEAK FLOW (cms)=	0.97	0.11	1.036 (iii)
TIME TO PEAK (hrs)=	6.00	6.17	6.00
RUNOFF VOLUME (mm)=	72.06	21.22	61.38
TOTAL RAINFALL (mm)=	73.56	73.56	73.56
RUNOFF COEFFICIENT =	0.98	0.29	0.83

***** WARNING: STORAGE COEFF. IS SMALLER THAN TIME STEP!

(i) HORTONS EQUATION SELECTED FOR PERVIOUS LOSSES:
Fo (mm/hr)= 75.00 K (1/hr)= 4.14
Fc (mm/hr)= 12.50 Cum.Inf. (mm)= 0.00
(ii) TIME STEP (DT) SHOULD BE SMALLER OR EQUAL
THAN THE STORAGE COEFFICIENT.
(iii) PEAK FLOW DOES NOT INCLUDE BASEFLOW IF ANY.

CALIB
STANDHYD (0600)
ID= 1 DT= 5.0 min

Area (ha)= 9.73
Total Imp(%)= 52.00 Dir. Conn.(%)= 35.00

		IMPERVIOUS	PERVIOUS (i)
Surface Area	(ha)=	5.06	4.67
Dep. Storage	(mm)=	1.50	5.00
Average Slope	(%)=	2.00	2.00
Length	(m)=	254.69	33.00
Mannings n	=	0.013	0.300

NOTE: RAINFALL WAS TRANSFORMED TO 5.0 MIN. TIME STEP.

---- TRANSFORMED HYETOGRAPH ----

TIME	RAIN	TIME	RAIN	TIME	RAIN	TIME	RAIN

hrs	mm/hr	hrs	mm/hr	hrs	mm/hr	hrs	mm/hr
0.083	1.84	3.083	2.94	6.083	13.24	9.08	2.58
0.167	1.84	3.167	2.94	6.167	13.24	9.17	2.58
0.250	1.84	3.250	2.94	6.250	13.24	9.25	2.57
0.333	1.84	3.333	2.94	6.333	13.24	9.33	2.58
0.417	1.84	3.417	2.94	6.417	13.24	9.42	2.58
0.500	1.84	3.500	2.94	6.500	13.24	9.50	2.58
0.583	1.84	3.583	2.94	6.583	5.89	9.58	2.57
0.667	1.84	3.667	2.94	6.667	5.89	9.67	2.58
0.750	1.84	3.750	2.94	6.750	5.89	9.75	2.58
0.833	1.84	3.833	2.94	6.833	5.89	9.83	2.57
0.917	1.84	3.917	2.94	6.917	5.89	9.92	2.58
1.000	1.84	4.000	2.94	7.000	5.88	10.00	2.58
1.083	1.84	4.083	4.41	7.083	4.41	10.08	1.47
1.167	1.84	4.167	4.41	7.167	4.41	10.17	1.47
1.250	1.84	4.250	4.41	7.250	4.41	10.25	1.47
1.333	1.84	4.333	4.41	7.333	4.41	10.33	1.47
1.417	1.84	4.417	4.41	7.417	4.41	10.42	1.47
1.500	1.84	4.500	4.41	7.500	4.41	10.50	1.47
1.583	1.84	4.583	5.88	7.583	4.41	10.58	1.47
1.667	1.84	4.667	5.89	7.667	4.41	10.67	1.47
1.750	1.84	4.750	5.89	7.750	4.41	10.75	1.47
1.833	1.84	4.833	5.89	7.833	4.41	10.83	1.47
1.917	1.84	4.917	5.89	7.917	4.41	10.92	1.47
2.000	1.84	5.000	5.89	8.000	4.41	11.00	1.47
2.083	2.21	5.083	8.83	8.083	2.58	11.08	1.47
2.167	2.21	5.167	8.83	8.167	2.58	11.17	1.47
2.250	2.21	5.250	8.83	8.250	2.57	11.25	1.47
2.333	2.21	5.333	8.83	8.333	2.58	11.33	1.47
2.417	2.21	5.417	8.83	8.417	2.58	11.42	1.47
2.500	2.21	5.500	8.83	8.500	2.57	11.50	1.47
2.583	2.21	5.583	35.31	8.583	2.58	11.58	1.47
2.667	2.21	5.667	35.31	8.667	2.58	11.67	1.47
2.750	2.21	5.750	35.31	8.750	2.57	11.75	1.47
2.833	2.21	5.833	97.10	8.833	2.58	11.83	1.47
2.917	2.21	5.917	97.10	8.917	2.58	11.92	1.47
3.000	2.21	6.000	97.10	9.000	2.57	12.00	1.47

Max.Eff.Inten.(mm/hr)=	97.10	118.61	
over (min)	5.00	15.00	
Storage Coeff. (min)=	3.68 (ii)	10.23 (ii)	
Unit Hyd. Tpeak (min)=	5.00	15.00	
Unit Hyd. peak (cms)=	0.25	0.09	
			TOTALS
PEAK FLOW (cms)=	0.91	1.04	1.852 (iii)
TIME TO PEAK (hrs)=	6.00	6.08	6.00
RUNOFF VOLUME (mm)=	72.06	26.44	42.41
TOTAL RAINFALL (mm)=	73.56	73.56	73.56
RUNOFF COEFFICIENT =	0.98	0.36	0.58

***** WARNING: STORAGE COEFF. IS SMALLER THAN TIME STEP!

(i) HORTONS EQUATION SELECTED FOR PERVIOUS LOSSES:
Fo (mm/hr)= 75.00 K (1/hr)= 4.14
Fc (mm/hr)= 12.50 Cum.Inf. (mm)= 0.00
(ii) TIME STEP (DT) SHOULD BE SMALLER OR EQUAL
THAN THE STORAGE COEFFICIENT.
(iii) PEAK FLOW DOES NOT INCLUDE BASEFLOW IF ANY.

CALIB	
STANDHYD (0601)	Area (ha)= 6.95
ID= 1 DT= 5.0 min	Total Imp(%)= 70.00 Dir. Conn.(%)= 50.00

		IMPERVIOUS	PERVIOUS (i)
Surface Area	(ha)=	4.86	2.09
Dep. Storage	(mm)=	1.50	5.00
Average Slope	(%)=	2.00	2.00
Length	(m)=	215.25	33.00
Mannings n	=	0.013	0.300

NOTE: RAINFALL WAS TRANSFORMED TO 5.0 MIN. TIME STEP.

---- TRANSFORMED HYETOGRAPH ----

TIME hrs	RAIN mm/hr	TIME hrs	RAIN mm/hr	TIME hrs	RAIN mm/hr	TIME hrs	RAIN mm/hr
0.083	1.84	3.083	2.94	6.083	13.24	9.08	2.58
0.167	1.84	3.167	2.94	6.167	13.24	9.17	2.58
0.250	1.84	3.250	2.94	6.250	13.24	9.25	2.57
0.333	1.84	3.333	2.94	6.333	13.24	9.33	2.58
0.417	1.84	3.417	2.94	6.417	13.24	9.42	2.58
0.500	1.84	3.500	2.94	6.500	13.24	9.50	2.58
0.583	1.84	3.583	2.94	6.583	5.89	9.58	2.57
0.667	1.84	3.667	2.94	6.667	5.89	9.67	2.58
0.750	1.84	3.750	2.94	6.750	5.89	9.75	2.58
0.833	1.84	3.833	2.94	6.833	5.89	9.83	2.57
0.917	1.84	3.917	2.94	6.917	5.89	9.92	2.58
1.000	1.84	4.000	2.94	7.000	5.88	10.00	2.58
1.083	1.84	4.083	4.41	7.083	4.41	10.08	1.47
1.167	1.84	4.167	4.41	7.167	4.41	10.17	1.47
1.250	1.84	4.250	4.41	7.250	4.41	10.25	1.47
1.333	1.84	4.333	4.41	7.333	4.41	10.33	1.47
1.417	1.84	4.417	4.41	7.417	4.41	10.42	1.47
1.500	1.84	4.500	4.41	7.500	4.41	10.50	1.47
1.583	1.84	4.583	5.88	7.583	4.41	10.58	1.47
1.667	1.84	4.667	5.89	7.667	4.41	10.67	1.47
1.750	1.84	4.750	5.89	7.750	4.41	10.75	1.47
1.833	1.84	4.833	5.89	7.833	4.41	10.83	1.47

1.917	1.84	4.917	5.89	7.917	4.41	10.92	1.47
2.000	1.84	5.000	5.89	8.000	4.41	11.00	1.47
2.083	2.21	5.083	8.83	8.083	2.58	11.08	1.47
2.167	2.21	5.167	8.83	8.167	2.58	11.17	1.47
2.250	2.21	5.250	8.83	8.250	2.57	11.25	1.47
2.333	2.21	5.333	8.83	8.333	2.58	11.33	1.47
2.417	2.21	5.417	8.83	8.417	2.58	11.42	1.47
2.500	2.21	5.500	8.83	8.500	2.57	11.50	1.47
2.583	2.21	5.583	35.31	8.583	2.58	11.58	1.47
2.667	2.21	5.667	35.31	8.667	2.58	11.67	1.47
2.750	2.21	5.750	35.31	8.750	2.57	11.75	1.47
2.833	2.21	5.833	97.10	8.833	2.58	11.83	1.47
2.917	2.21	5.917	97.10	8.917	2.58	11.92	1.47
3.000	2.21	6.000	97.10	9.000	2.57	12.00	1.47

			TOTALS
Max.Eff.Inten.(mm/hr)=	97.10	149.26	
over (min)	5.00	10.00	
Storage Coeff. (min)=	3.33 (ii)	9.30 (ii)	
Unit Hyd. Tpeak (min)=	5.00	10.00	
Unit Hyd. peak (cms)=	0.26	0.12	
PEAK FLOW (cms)=	0.93	0.67	1.597 (iii)
TIME TO PEAK (hrs)=	6.00	6.00	6.00
RUNOFF VOLUME (mm)=	72.06	29.44	50.75
TOTAL RAINFALL (mm)=	73.56	73.56	73.56
RUNOFF COEFFICIENT =	0.98	0.40	0.69

***** WARNING: STORAGE COEFF. IS SMALLER THAN TIME STEP!

(i) HORTONS EQUATION SELECTED FOR PERVIOUS LOSSES:
Fo (mm/hr)= 75.00 K (1/hr)= 4.14
Fc (mm/hr)= 12.50 Cum.Inf. (mm)= 0.00
(ii) TIME STEP (DT) SHOULD BE SMALLER OR EQUAL
THAN THE STORAGE COEFFICIENT.
(iii) PEAK FLOW DOES NOT INCLUDE BASEFLOW IF ANY.

ADD HYD (0602)				
1 + 2 = 3	AREA (ha)	QPEAK (cms)	TPEAK (hrs)	R.V. (mm)
ID1= 1 (0600):	9.73	1.852	6.00	42.41
+ ID2= 2 (0601):	6.95	1.597	6.00	50.75
ID = 3 (0602):	16.68	3.450	6.00	45.88

NOTE: PEAK FLOWS DO NOT INCLUDE BASEFLOWS IF ANY.

```
| ROUTE CHN(  0563)|
| IN= 2---> OUT= 1 |     Routing time step (min)'=  5.00
--------------------
               <------ DATA FOR SECTION (   2.2) ------>
               Distance      Elevation       Manning
                   0.00          1.00        0.0350
                   2.00          0.50        0.0350
                   4.00          0.00    0.0350 /0.0350  Main Channel
                   4.50          0.00        0.0350      Main Channel
                   5.00          0.00    0.0350 /0.0350  Main Channel
                   7.00          0.50        0.0350
                   9.00          1.00        0.0350

      <---------------------- TRAVEL TIME TABLE ---------------------->
       DEPTH    ELEV      VOLUME    FLOW RATE    VELOCITY   TRAV.TIME
        (m)      (m)     (cu.m.)      (cms)        (m/s)      (min)
       0.05     0.05    .701E+01       0.0          0.64       2.87
       0.11     0.11    .165E+02       0.1          0.96       1.91
       0.16     0.16    .283E+02       0.3          1.21       1.51
       0.21     0.21    .427E+02       0.6          1.42       1.29
       0.26     0.26    .594E+02       0.9          1.61       1.14
       0.32     0.32    .786E+02       1.3          1.77       1.03
       0.37     0.37    .100E+03       1.8          1.93       0.95
       0.42     0.42    .124E+03       2.3          2.08       0.88
       0.47     0.47    .151E+03       3.0          2.22       0.83
       0.53     0.53    .180E+03       3.8          2.35       0.78
       0.58     0.58    .211E+03       4.8          2.48       0.74
       0.63     0.63    .245E+03       5.8          2.60       0.71
       0.68     0.68    .281E+03       7.0          2.72       0.67
       0.74     0.74    .320E+03       8.2          2.84       0.65
       0.79     0.79    .361E+03       9.7          2.95       0.62
       0.84     0.84    .405E+03      11.3          3.06       0.60
       0.89     0.89    .451E+03      13.0          3.17       0.58
       0.95     0.95    .499E+03      14.8          3.27       0.56
       1.00     1.00    .550E+03      16.9          3.38       0.54

                                    <---- hydrograph ---->   <-pipe / channel->
                               AREA    QPEAK   TPEAK   R.V.   MAX DEPTH  MAX VEL
                               (ha)    (cms)   (hrs)   (mm)      (m)      (m/s)
   INFLOW : ID= 2 (  0602)   16.68     3.45    6.00  45.88      0.50      2.28
   OUTFLOW: ID= 1 (  0563)   16.68     3.34    6.00  45.88      0.49      2.26



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--------------------
| CALIB            |
| STANDHYD (  0607)|   Area    (ha)=   5.97
|ID= 1 DT= 5.0 min |   Total Imp(%)=  51.00   Dir. Conn.(%)=  35.00
--------------------
```

		IMPERVIOUS	PERVIOUS (i)
Surface Area	(ha)=	3.04	2.93
Dep. Storage	(mm)=	1.50	5.00
Average Slope	(%)=	2.00	2.00
Length	(m)=	199.50	33.00
Mannings n	=	0.013	0.300

NOTE: RAINFALL WAS TRANSFORMED TO 5.0 MIN. TIME STEP.

---- TRANSFORMED HYETOGRAPH ----

TIME hrs	RAIN mm/hr	TIME hrs	RAIN mm/hr	TIME hrs	RAIN mm/hr	TIME hrs	RAIN mm/hr
0.083	1.84	3.083	2.94	6.083	13.24	9.08	2.58
0.167	1.84	3.167	2.94	6.167	13.24	9.17	2.58
0.250	1.84	3.250	2.94	6.250	13.24	9.25	2.57
0.333	1.84	3.333	2.94	6.333	13.24	9.33	2.58
0.417	1.84	3.417	2.94	6.417	13.24	9.42	2.58
0.500	1.84	3.500	2.94	6.500	13.24	9.50	2.58
0.583	1.84	3.583	2.94	6.583	5.89	9.58	2.57
0.667	1.84	3.667	2.94	6.667	5.89	9.67	2.58
0.750	1.84	3.750	2.94	6.750	5.89	9.75	2.58
0.833	1.84	3.833	2.94	6.833	5.89	9.83	2.57
0.917	1.84	3.917	2.94	6.917	5.89	9.92	2.58
1.000	1.84	4.000	2.94	7.000	5.88	10.00	2.58
1.083	1.84	4.083	4.41	7.083	4.41	10.08	1.47
1.167	1.84	4.167	4.41	7.167	4.41	10.17	1.47
1.250	1.84	4.250	4.41	7.250	4.41	10.25	1.47
1.333	1.84	4.333	4.41	7.333	4.41	10.33	1.47
1.417	1.84	4.417	4.41	7.417	4.41	10.42	1.47
1.500	1.84	4.500	4.41	7.500	4.41	10.50	1.47
1.583	1.84	4.583	5.88	7.583	4.41	10.58	1.47
1.667	1.84	4.667	5.89	7.667	4.41	10.67	1.47
1.750	1.84	4.750	5.89	7.750	4.41	10.75	1.47
1.833	1.84	4.833	5.89	7.833	4.41	10.83	1.47
1.917	1.84	4.917	5.89	7.917	4.41	10.92	1.47
2.000	1.84	5.000	5.89	8.000	4.41	11.00	1.47
2.083	2.21	5.083	8.83	8.083	2.58	11.08	1.47
2.167	2.21	5.167	8.83	8.167	2.58	11.17	1.47
2.250	2.21	5.250	8.83	8.250	2.57	11.25	1.47
2.333	2.21	5.333	8.83	8.333	2.58	11.33	1.47
2.417	2.21	5.417	8.83	8.417	2.58	11.42	1.47
2.500	2.21	5.500	8.83	8.500	2.57	11.50	1.47
2.583	2.21	5.583	35.31	8.583	2.58	11.58	1.47
2.667	2.21	5.667	35.31	8.667	2.58	11.67	1.47
2.750	2.21	5.750	35.31	8.750	2.57	11.75	1.47
2.833	2.21	5.833	97.10	8.833	2.58	11.83	1.47
2.917	2.21	5.917	97.10	8.917	2.58	11.92	1.47
3.000	2.21	6.000	97.10	9.000	2.57	12.00	1.47

```
     Max.Eff.Inten.(mm/hr)=      97.10       115.87
                over (min)        5.00        10.00
     Storage Coeff.  (min)=       3.18 (ii)    9.79 (ii)
     Unit Hyd. Tpeak (min)=       5.00        10.00
     Unit Hyd. peak  (cms)=       0.27         0.11
                                                          *TOTALS*
     PEAK FLOW       (cms)=       0.56         0.69          1.254 (iii)
     TIME TO PEAK    (hrs)=       6.00         6.00           6.00
     RUNOFF VOLUME    (mm)=      72.06        26.10          42.19
     TOTAL RAINFALL   (mm)=      73.56        73.56          73.56
     RUNOFF COEFFICIENT   =       0.98         0.35           0.57

***** WARNING: STORAGE COEFF. IS SMALLER THAN TIME STEP!

       (i) HORTONS EQUATION SELECTED FOR PERVIOUS LOSSES:
            Fo   (mm/hr)= 75.00           K  (1/hr)=  4.14
            Fc   (mm/hr)= 12.50     Cum.Inf.   (mm)=  0.00
      (ii) TIME STEP (DT) SHOULD BE SMALLER OR EQUAL
           THAN THE STORAGE COEFFICIENT.
     (iii) PEAK FLOW DOES NOT INCLUDE BASEFLOW IF ANY.

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--------------------
| ADD HYD  (  0492)|
|   1 +  2 =  3    |         AREA    QPEAK    TPEAK     R.V.
--------------------         (ha)    (cms)    (hrs)     (mm)
        ID1= 1 (  0563):    16.68   3.343     6.00    45.88
      + ID2= 2 (  0607):     5.97   1.254     6.00    42.19
        ================================================
        ID = 3 (  0492):    22.65   4.597     6.00    44.91

     NOTE:  PEAK FLOWS DO NOT INCLUDE BASEFLOWS IF ANY.
--------------------------------------------------------------------------------
--------------------
| RESERVOIR(  0482)|     OVERFLOW IS OFF
| IN= 2---> OUT= 1 |
| DT=  5.0 min     |     OUTFLOW    STORAGE   |  OUTFLOW    STORAGE
--------------------      (cms)     (ha.m.)   |   (cms)     (ha.m.)
                          0.0000     0.0000   |   0.2910      0.3795
                          0.2590     0.0579   |   0.2970      0.4503
                          0.2660     0.1180   |   1.6320      0.5232
                          0.2720     0.1802   |   4.1680      0.5983
                          0.2790     0.2445   |   7.5660      0.6756
                          0.2850     0.3109   |   0.0000      0.0000

                                 AREA     QPEAK     TPEAK       R.V.
                                 (ha)     (cms)     (hrs)       (mm)
   INFLOW : ID= 2 (  0492)     22.650      4.597      6.00      44.91
   OUTFLOW: ID= 1 (  0482)     22.650      1.561      6.25      44.91
```

PEAK FLOW REDUCTION [Qout/Qin](%)= 33.96
TIME SHIFT OF PEAK FLOW (min)= 15.00
MAXIMUM STORAGE USED (ha.m.)= 0.5194

CALIB	
STANDHYD (0480)	Area (ha)= 43.10
ID= 1 DT= 5.0 min	Total Imp(%)= 42.00 Dir. Conn.(%)= 21.00

		IMPERVIOUS	PERVIOUS (i)
Surface Area	(ha)=	18.10	25.00
Dep. Storage	(mm)=	1.50	5.00
Average Slope	(%)=	2.00	2.00
Length	(m)=	680.00	40.00
Mannings n	=	0.013	0.300

NOTE: RAINFALL WAS TRANSFORMED TO 5.0 MIN. TIME STEP.

---- TRANSFORMED HYETOGRAPH ----

TIME hrs	RAIN mm/hr	TIME hrs	RAIN mm/hr	TIME hrs	RAIN mm/hr	TIME hrs	RAIN mm/hr
0.083	1.84	3.083	2.94	6.083	13.24	9.08	2.58
0.167	1.84	3.167	2.94	6.167	13.24	9.17	2.58
0.250	1.84	3.250	2.94	6.250	13.24	9.25	2.57
0.333	1.84	3.333	2.94	6.333	13.24	9.33	2.58
0.417	1.84	3.417	2.94	6.417	13.24	9.42	2.58
0.500	1.84	3.500	2.94	6.500	13.24	9.50	2.58
0.583	1.84	3.583	2.94	6.583	5.89	9.58	2.57
0.667	1.84	3.667	2.94	6.667	5.89	9.67	2.58
0.750	1.84	3.750	2.94	6.750	5.89	9.75	2.58
0.833	1.84	3.833	2.94	6.833	5.89	9.83	2.57
0.917	1.84	3.917	2.94	6.917	5.89	9.92	2.58
1.000	1.84	4.000	2.94	7.000	5.88	10.00	2.58
1.083	1.84	4.083	4.41	7.083	4.41	10.08	1.47
1.167	1.84	4.167	4.41	7.167	4.41	10.17	1.47
1.250	1.84	4.250	4.41	7.250	4.41	10.25	1.47
1.333	1.84	4.333	4.41	7.333	4.41	10.33	1.47
1.417	1.84	4.417	4.41	7.417	4.41	10.42	1.47
1.500	1.84	4.500	4.41	7.500	4.41	10.50	1.47
1.583	1.84	4.583	5.88	7.583	4.41	10.58	1.47
1.667	1.84	4.667	5.89	7.667	4.41	10.67	1.47
1.750	1.84	4.750	5.89	7.750	4.41	10.75	1.47
1.833	1.84	4.833	5.89	7.833	4.41	10.83	1.47
1.917	1.84	4.917	5.89	7.917	4.41	10.92	1.47
2.000	1.84	5.000	5.89	8.000	4.41	11.00	1.47
2.083	2.21	5.083	8.83	8.083	2.58	11.08	1.47
2.167	2.21	5.167	8.83	8.167	2.58	11.17	1.47

2.250	2.21	5.250	8.83	8.250	2.57	11.25	1.47
2.333	2.21	5.333	8.83	8.333	2.58	11.33	1.47
2.417	2.21	5.417	8.83	8.417	2.58	11.42	1.47
2.500	2.21	5.500	8.83	8.500	2.57	11.50	1.47
2.583	2.21	5.583	35.31	8.583	2.58	11.58	1.47
2.667	2.21	5.667	35.31	8.667	2.58	11.67	1.47
2.750	2.21	5.750	35.31	8.750	2.57	11.75	1.47
2.833	2.21	5.833	97.10	8.833	2.58	11.83	1.47
2.917	2.21	5.917	97.10	8.917	2.58	11.92	1.47
3.000	2.21	6.000	97.10	9.000	2.57	12.00	1.47

Max.Eff.Inten.(mm/hr)=	97.10	119.40	
over (min)	5.00	15.00	
Storage Coeff. (min)=	6.63 (ii)	13.97 (ii)	
Unit Hyd. Tpeak (min)=	5.00	15.00	
Unit Hyd. peak (cms)=	0.18	0.08	
			TOTALS
PEAK FLOW (cms)=	2.27	4.88	6.559 (iii)
TIME TO PEAK (hrs)=	6.00	6.08	6.00
RUNOFF VOLUME (mm)=	72.06	26.53	36.09
TOTAL RAINFALL (mm)=	73.56	73.56	73.56
RUNOFF COEFFICIENT =	0.98	0.36	0.49

(i) HORTONS EQUATION SELECTED FOR PERVIOUS LOSSES:
Fo (mm/hr)= 75.00 K (1/hr)= 4.14
Fc (mm/hr)= 12.50 Cum.Inf. (mm)= 0.00
(ii) TIME STEP (DT) SHOULD BE SMALLER OR EQUAL
THAN THE STORAGE COEFFICIENT.
(iii) PEAK FLOW DOES NOT INCLUDE BASEFLOW IF ANY.

CALIB	
STANDHYD (0460)	Area (ha)= 36.00
ID= 1 DT= 5.0 min	Total Imp(%)= 42.00 Dir. Conn.(%)= 21.00

		IMPERVIOUS	PERVIOUS (i)
Surface Area	(ha)=	15.12	20.88
Dep. Storage	(mm)=	1.50	5.00
Average Slope	(%)=	2.03	2.03
Length	(m)=	465.00	40.00
Mannings n	=	0.013	0.300

NOTE: RAINFALL WAS TRANSFORMED TO 5.0 MIN. TIME STEP.

---- TRANSFORMED HYETOGRAPH ----

TIME	RAIN	TIME	RAIN	TIME	RAIN	TIME	RAIN
hrs	mm/hr	hrs	mm/hr	hrs	mm/hr	hrs	mm/hr

0.083	1.84	3.083	2.94	6.083	13.24	9.08	2.58
0.167	1.84	3.167	2.94	6.167	13.24	9.17	2.58
0.250	1.84	3.250	2.94	6.250	13.24	9.25	2.57
0.333	1.84	3.333	2.94	6.333	13.24	9.33	2.58
0.417	1.84	3.417	2.94	6.417	13.24	9.42	2.58
0.500	1.84	3.500	2.94	6.500	13.24	9.50	2.58
0.583	1.84	3.583	2.94	6.583	5.89	9.58	2.57
0.667	1.84	3.667	2.94	6.667	5.89	9.67	2.58
0.750	1.84	3.750	2.94	6.750	5.89	9.75	2.58
0.833	1.84	3.833	2.94	6.833	5.89	9.83	2.57
0.917	1.84	3.917	2.94	6.917	5.89	9.92	2.58
1.000	1.84	4.000	2.94	7.000	5.88	10.00	2.58
1.083	1.84	4.083	4.41	7.083	4.41	10.08	1.47
1.167	1.84	4.167	4.41	7.167	4.41	10.17	1.47
1.250	1.84	4.250	4.41	7.250	4.41	10.25	1.47
1.333	1.84	4.333	4.41	7.333	4.41	10.33	1.47
1.417	1.84	4.417	4.41	7.417	4.41	10.42	1.47
1.500	1.84	4.500	4.41	7.500	4.41	10.50	1.47
1.583	1.84	4.583	5.88	7.583	4.41	10.58	1.47
1.667	1.84	4.667	5.89	7.667	4.41	10.67	1.47
1.750	1.84	4.750	5.89	7.750	4.41	10.75	1.47
1.833	1.84	4.833	5.89	7.833	4.41	10.83	1.47
1.917	1.84	4.917	5.89	7.917	4.41	10.92	1.47
2.000	1.84	5.000	5.89	8.000	4.41	11.00	1.47
2.083	2.21	5.083	8.83	8.083	2.58	11.08	1.47
2.167	2.21	5.167	8.83	8.167	2.58	11.17	1.47
2.250	2.21	5.250	8.83	8.250	2.57	11.25	1.47
2.333	2.21	5.333	8.83	8.333	2.58	11.33	1.47
2.417	2.21	5.417	8.83	8.417	2.58	11.42	1.47
2.500	2.21	5.500	8.83	8.500	2.57	11.50	1.47
2.583	2.21	5.583	35.31	8.583	2.58	11.58	1.47
2.667	2.21	5.667	35.31	8.667	2.58	11.67	1.47
2.750	2.21	5.750	35.31	8.750	2.57	11.75	1.47
2.833	2.21	5.833	97.10	8.833	2.58	11.83	1.47
2.917	2.21	5.917	97.10	8.917	2.58	11.92	1.47
3.000	2.21	6.000	97.10	9.000	2.57	12.00	1.47

Max.Eff.Inten.(mm/hr)=	97.10	119.40	
over (min)	5.00	15.00	
Storage Coeff. (min)=	5.26 (ii)	12.56 (ii)	
Unit Hyd. Tpeak (min)=	5.00	15.00	
Unit Hyd. peak (cms)=	0.21	0.08	
			TOTALS
PEAK FLOW (cms)=	1.96	4.29	5.772 (iii)
TIME TO PEAK (hrs)=	6.00	6.08	6.00
RUNOFF VOLUME (mm)=	72.06	26.53	36.09
TOTAL RAINFALL (mm)=	73.56	73.56	73.56
RUNOFF COEFFICIENT =	0.98	0.36	0.49

(i) HORTONS EQUATION SELECTED FOR PERVIOUS LOSSES:
Fo (mm/hr)= 75.00 K (1/hr)= 4.14
Fc (mm/hr)= 12.50 Cum.Inf. (mm)= 0.00
(ii) TIME STEP (DT) SHOULD BE SMALLER OR EQUAL
THAN THE STORAGE COEFFICIENT.
(iii) PEAK FLOW DOES NOT INCLUDE BASEFLOW IF ANY.

CALIB	
STANDHYD (0455)	Area (ha)= 12.70
ID= 1 DT= 5.0 min	Total Imp(%)= 42.00 Dir. Conn.(%)= 21.00

		IMPERVIOUS	PERVIOUS (i)
Surface Area	(ha)=	5.33	7.37
Dep. Storage	(mm)=	1.50	5.00
Average Slope	(%)=	1.71	1.71
Length	(m)=	300.00	40.00
Mannings n	=	0.013	0.300

NOTE: RAINFALL WAS TRANSFORMED TO 5.0 MIN. TIME STEP.

---- TRANSFORMED HYETOGRAPH ----

TIME hrs	RAIN mm/hr	TIME hrs	RAIN mm/hr	TIME hrs	RAIN mm/hr	TIME hrs	RAIN mm/hr
0.083	1.84	3.083	2.94	6.083	13.24	9.08	2.58
0.167	1.84	3.167	2.94	6.167	13.24	9.17	2.58
0.250	1.84	3.250	2.94	6.250	13.24	9.25	2.57
0.333	1.84	3.333	2.94	6.333	13.24	9.33	2.58
0.417	1.84	3.417	2.94	6.417	13.24	9.42	2.58
0.500	1.84	3.500	2.94	6.500	13.24	9.50	2.58
0.583	1.84	3.583	2.94	6.583	5.89	9.58	2.57
0.667	1.84	3.667	2.94	6.667	5.89	9.67	2.58
0.750	1.84	3.750	2.94	6.750	5.89	9.75	2.58
0.833	1.84	3.833	2.94	6.833	5.89	9.83	2.57
0.917	1.84	3.917	2.94	6.917	5.89	9.92	2.58
1.000	1.84	4.000	2.94	7.000	5.88	10.00	2.58
1.083	1.84	4.083	4.41	7.083	4.41	10.08	1.47
1.167	1.84	4.167	4.41	7.167	4.41	10.17	1.47
1.250	1.84	4.250	4.41	7.250	4.41	10.25	1.47
1.333	1.84	4.333	4.41	7.333	4.41	10.33	1.47
1.417	1.84	4.417	4.41	7.417	4.41	10.42	1.47
1.500	1.84	4.500	4.41	7.500	4.41	10.50	1.47
1.583	1.84	4.583	5.88	7.583	4.41	10.58	1.47
1.667	1.84	4.667	5.89	7.667	4.41	10.67	1.47
1.750	1.84	4.750	5.89	7.750	4.41	10.75	1.47
1.833	1.84	4.833	5.89	7.833	4.41	10.83	1.47
1.917	1.84	4.917	5.89	7.917	4.41	10.92	1.47
2.000	1.84	5.000	5.89	8.000	4.41	11.00	1.47

```
                2.083    2.21 | 5.083    8.83 | 8.083    2.58 | 11.08    1.47
                2.167    2.21 | 5.167    8.83 | 8.167    2.58 | 11.17    1.47
                2.250    2.21 | 5.250    8.83 | 8.250    2.57 | 11.25    1.47
                2.333    2.21 | 5.333    8.83 | 8.333    2.58 | 11.33    1.47
                2.417    2.21 | 5.417    8.83 | 8.417    2.58 | 11.42    1.47
                2.500    2.21 | 5.500    8.83 | 8.500    2.57 | 11.50    1.47
                2.583    2.21 | 5.583   35.31 | 8.583    2.58 | 11.58    1.47
                2.667    2.21 | 5.667   35.31 | 8.667    2.58 | 11.67    1.47
                2.750    2.21 | 5.750   35.31 | 8.750    2.57 | 11.75    1.47
                2.833    2.21 | 5.833   97.10 | 8.833    2.58 | 11.83    1.47
                2.917    2.21 | 5.917   97.10 | 8.917    2.58 | 11.92    1.47
                3.000    2.21 | 6.000   97.10 | 9.000    2.57 | 12.00    1.47

     Max.Eff.Inten.(mm/hr)=      97.10       119.40
                over (min)        5.00        15.00
     Storage Coeff.  (min)=       4.25 (ii)   11.94 (ii)
     Unit Hyd. Tpeak (min)=       5.00        15.00
     Unit Hyd. peak  (cms)=       0.23         0.09
                                                          *TOTALS*
     PEAK FLOW       (cms)=       0.71         1.55          2.088 (iii)
     TIME TO PEAK    (hrs)=       6.00         6.08           6.00
     RUNOFF VOLUME    (mm)=      72.06        26.53          36.09
     TOTAL RAINFALL   (mm)=      73.56        73.56          73.56
     RUNOFF COEFFICIENT   =       0.98         0.36           0.49

***** WARNING: STORAGE COEFF. IS SMALLER THAN TIME STEP!

       (i) HORTONS EQUATION SELECTED FOR PERVIOUS LOSSES:
            Fo   (mm/hr)= 75.00           K  (1/hr)=  4.14
            Fc   (mm/hr)= 12.50     Cum.Inf.   (mm)=  0.00
      (ii) TIME STEP (DT) SHOULD BE SMALLER OR EQUAL
           THAN THE STORAGE COEFFICIENT.
     (iii) PEAK FLOW DOES NOT INCLUDE BASEFLOW IF ANY.

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--------------------
| ADD HYD  (  0465)|
|   1 +  2 =  3    |         AREA    QPEAK    TPEAK     R.V.
--------------------         (ha)    (cms)    (hrs)     (mm)
        ID1= 1 (  0455):    12.70   2.088     6.00    36.09
      + ID2= 2 (  0460):    36.00   5.772     6.00    36.09
        ================================================
        ID = 3 (  0465):    48.70   7.859     6.00    36.09

     NOTE:  PEAK FLOWS DO NOT INCLUDE BASEFLOWS IF ANY.
--------------------------------------------------------------------------------
--------------------
| CALIB            |
| STANDHYD (  0410)|   Area    (ha)=  24.20
```

|ID= 1 DT= 5.0 min | Total Imp(%)= 42.00 Dir. Conn.(%)= 21.00

		IMPERVIOUS	PERVIOUS (i)
Surface Area	(ha)=	10.16	14.04
Dep. Storage	(mm)=	1.50	5.00
Average Slope	(%)=	2.00	2.00
Length	(m)=	401.00	40.00
Mannings n	=	0.013	0.300

NOTE: RAINFALL WAS TRANSFORMED TO 5.0 MIN. TIME STEP.

---- TRANSFORMED HYETOGRAPH ----

TIME hrs	RAIN mm/hr	TIME hrs	RAIN mm/hr	TIME hrs	RAIN mm/hr	TIME hrs	RAIN mm/hr
0.083	1.84	3.083	2.94	6.083	13.24	9.08	2.58
0.167	1.84	3.167	2.94	6.167	13.24	9.17	2.58
0.250	1.84	3.250	2.94	6.250	13.24	9.25	2.57
0.333	1.84	3.333	2.94	6.333	13.24	9.33	2.58
0.417	1.84	3.417	2.94	6.417	13.24	9.42	2.58
0.500	1.84	3.500	2.94	6.500	13.24	9.50	2.58
0.583	1.84	3.583	2.94	6.583	5.89	9.58	2.57
0.667	1.84	3.667	2.94	6.667	5.89	9.67	2.58
0.750	1.84	3.750	2.94	6.750	5.89	9.75	2.58
0.833	1.84	3.833	2.94	6.833	5.89	9.83	2.57
0.917	1.84	3.917	2.94	6.917	5.89	9.92	2.58
1.000	1.84	4.000	2.94	7.000	5.88	10.00	2.58
1.083	1.84	4.083	4.41	7.083	4.41	10.08	1.47
1.167	1.84	4.167	4.41	7.167	4.41	10.17	1.47
1.250	1.84	4.250	4.41	7.250	4.41	10.25	1.47
1.333	1.84	4.333	4.41	7.333	4.41	10.33	1.47
1.417	1.84	4.417	4.41	7.417	4.41	10.42	1.47
1.500	1.84	4.500	4.41	7.500	4.41	10.50	1.47
1.583	1.84	4.583	5.88	7.583	4.41	10.58	1.47
1.667	1.84	4.667	5.89	7.667	4.41	10.67	1.47
1.750	1.84	4.750	5.89	7.750	4.41	10.75	1.47
1.833	1.84	4.833	5.89	7.833	4.41	10.83	1.47
1.917	1.84	4.917	5.89	7.917	4.41	10.92	1.47
2.000	1.84	5.000	5.89	8.000	4.41	11.00	1.47
2.083	2.21	5.083	8.83	8.083	2.58	11.08	1.47
2.167	2.21	5.167	8.83	8.167	2.58	11.17	1.47
2.250	2.21	5.250	8.83	8.250	2.57	11.25	1.47
2.333	2.21	5.333	8.83	8.333	2.58	11.33	1.47
2.417	2.21	5.417	8.83	8.417	2.58	11.42	1.47
2.500	2.21	5.500	8.83	8.500	2.57	11.50	1.47
2.583	2.21	5.583	35.31	8.583	2.58	11.58	1.47
2.667	2.21	5.667	35.31	8.667	2.58	11.67	1.47
2.750	2.21	5.750	35.31	8.750	2.57	11.75	1.47
2.833	2.21	5.833	97.10	8.833	2.58	11.83	1.47
2.917	2.21	5.917	97.10	8.917	2.58	11.92	1.47

```
              3.000    2.21 | 6.000   97.10 | 9.000    2.57 | 12.00    1.47

     Max.Eff.Inten.(mm/hr)=      97.10       119.40
               over (min)         5.00        15.00
     Storage Coeff.  (min)=       4.83 (ii)   12.17 (ii)
     Unit Hyd. Tpeak (min)=       5.00        15.00
     Unit Hyd. peak  (cms)=       0.22         0.09
                                                          *TOTALS*
     PEAK FLOW       (cms)=       1.33         2.92          3.938 (iii)
     TIME TO PEAK    (hrs)=       6.00         6.08           6.00
     RUNOFF VOLUME    (mm)=      72.06        26.53          36.09
     TOTAL RAINFALL   (mm)=      73.56        73.56          73.56
     RUNOFF COEFFICIENT   =       0.98         0.36           0.49

***** WARNING: STORAGE COEFF. IS SMALLER THAN TIME STEP!

       (i) HORTONS EQUATION SELECTED FOR PERVIOUS LOSSES:
            Fo   (mm/hr)= 75.00          K  (1/hr)=  4.14
            Fc   (mm/hr)= 12.50     Cum.Inf.   (mm)=  0.00
      (ii) TIME STEP (DT) SHOULD BE SMALLER OR EQUAL
           THAN THE STORAGE COEFFICIENT.
     (iii) PEAK FLOW DOES NOT INCLUDE BASEFLOW IF ANY.

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--------------------
| CALIB            |
| STANDHYD (  0415)|   Area    (ha)=   4.99
|ID= 1 DT= 5.0 min |   Total Imp(%)=  42.00   Dir. Conn.(%)=  21.00
--------------------
                            IMPERVIOUS    PERVIOUS (i)
     Surface Area     (ha)=       2.10         2.89
     Dep. Storage     (mm)=       1.50         5.00
     Average Slope     (%)=       2.86         2.86
     Length            (m)=     185.00        40.00
     Mannings n             =      0.013        0.300

         NOTE:  RAINFALL WAS TRANSFORMED TO   5.0 MIN. TIME STEP.


                          ---- TRANSFORMED HYETOGRAPH ----
               TIME    RAIN |  TIME    RAIN |'  TIME    RAIN |  TIME    RAIN
                hrs   mm/hr |   hrs   mm/hr |'   hrs   mm/hr |   hrs   mm/hr
              0.083    1.84 | 3.083    2.94 | 6.083   13.24 |  9.08    2.58
              0.167    1.84 | 3.167    2.94 | 6.167   13.24 |  9.17    2.58
              0.250    1.84 | 3.250    2.94 | 6.250   13.24 |  9.25    2.57
              0.333    1.84 | 3.333    2.94 | 6.333   13.24 |  9.33    2.58
              0.417    1.84 | 3.417    2.94 | 6.417   13.24 |  9.42    2.58
              0.500    1.84 | 3.500    2.94 | 6.500   13.24 |  9.50    2.58
              0.583    1.84 | 3.583    2.94 | 6.583    5.89 |  9.58    2.57
              0.667    1.84 | 3.667    2.94 | 6.667    5.89 |  9.67    2.58
```

0.750	1.84	3.750	2.94	6.750	5.89	9.75	2.58
0.833	1.84	3.833	2.94	6.833	5.89	9.83	2.57
0.917	1.84	3.917	2.94	6.917	5.89	9.92	2.58
1.000	1.84	4.000	2.94	7.000	5.88	10.00	2.58
1.083	1.84	4.083	4.41	7.083	4.41	10.08	1.47
1.167	1.84	4.167	4.41	7.167	4.41	10.17	1.47
1.250	1.84	4.250	4.41	7.250	4.41	10.25	1.47
1.333	1.84	4.333	4.41	7.333	4.41	10.33	1.47
1.417	1.84	4.417	4.41	7.417	4.41	10.42	1.47
1.500	1.84	4.500	4.41	7.500	4.41	10.50	1.47
1.583	1.84	4.583	5.88	7.583	4.41	10.58	1.47
1.667	1.84	4.667	5.89	7.667	4.41	10.67	1.47
1.750	1.84	4.750	5.89	7.750	4.41	10.75	1.47
1.833	1.84	4.833	5.89	7.833	4.41	10.83	1.47
1.917	1.84	4.917	5.89	7.917	4.41	10.92	1.47
2.000	1.84	5.000	5.89	8.000	4.41	11.00	1.47
2.083	2.21	5.083	8.83	8.083	2.58	11.08	1.47
2.167	2.21	5.167	8.83	8.167	2.58	11.17	1.47
2.250	2.21	5.250	8.83	8.250	2.57	11.25	1.47
2.333	2.21	5.333	8.83	8.333	2.58	11.33	1.47
2.417	2.21	5.417	8.83	8.417	2.58	11.42	1.47
2.500	2.21	5.500	8.83	8.500	2.57	11.50	1.47
2.583	2.21	5.583	35.31	8.583	2.58	11.58	1.47
2.667	2.21	5.667	35.31	8.667	2.58	11.67	1.47
2.750	2.21	5.750	35.31	8.750	2.57	11.75	1.47
2.833	2.21	5.833	97.10	8.833	2.58	11.83	1.47
2.917	2.21	5.917	97.10	8.917	2.58	11.92	1.47
3.000	2.21	6.000	97.10	9.000	2.57	12.00	1.47

Max.Eff.Inten.(mm/hr)=	97.10	119.40	
over (min)	5.00	10.00	
Storage Coeff. (min)=	2.73 (ii)	9.32 (ii)	
Unit Hyd. Tpeak (min)=	5.00	10.00	
Unit Hyd. peak (cms)=	0.29	0.12	
			TOTALS
PEAK FLOW (cms)=	0.28	0.73	1.007 (iii)
TIME TO PEAK (hrs)=	6.00	6.00	6.00
RUNOFF VOLUME (mm)=	72.06	26.53	36.09
TOTAL RAINFALL (mm)=	73.56	73.56	73.56
RUNOFF COEFFICIENT =	0.98	0.36	0.49

***** WARNING: STORAGE COEFF. IS SMALLER THAN TIME STEP!

(i) HORTONS EQUATION SELECTED FOR PERVIOUS LOSSES:
Fo (mm/hr)= 75.00 K (1/hr)= 4.14
Fc (mm/hr)= 12.50 Cum.Inf. (mm)= 0.00

(ii) TIME STEP (DT) SHOULD BE SMALLER OR EQUAL
THAN THE STORAGE COEFFICIENT.

(iii) PEAK FLOW DOES NOT INCLUDE BASEFLOW IF ANY.

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--------------------
| ADD HYD  (  0420)|
|   1 +  2 =  3    |         AREA    QPEAK    TPEAK     R.V.
--------------------         (ha)    (cms)    (hrs)     (mm)
       ID1= 1 (  0410):    24.20   3.938     6.00    36.09
     + ID2= 2 (  0415):     4.99   1.007     6.00    36.09
       ================================================
       ID = 3 (  0420):    29.19   4.945     6.00    36.09

     NOTE:  PEAK FLOWS DO NOT INCLUDE BASEFLOWS IF ANY.
--------------------------------------------------------------------------------
--------------------
| DUHYD    (  0425)|
| Inlet Cap.= 1.980|
| #of Inlets=     1|
| Total(cms)=   2.0|      AREA     QPEAK     TPEAK    R.V.
--------------------      (ha)     (cms)     (hrs)    (mm)
     TOTAL HYD.(ID= 1):  29.19      4.94      6.00   36.09
     ================================================
     MAJOR SYS.(ID= 2):   7.51      2.96      6.00   36.09
     MINOR SYS.(ID= 3):  21.68      1.98      5.83   36.09

     NOTE:  PEAK FLOWS DO NOT INCLUDE BASEFLOWS IF ANY.

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--------------------
| ADD HYD  (  0470)|
|   1 +  2 =  3    |         AREA    QPEAK    TPEAK     R.V.
--------------------         (ha)    (cms)    (hrs)     (mm)
       ID1= 1 (  0425):     7.51   2.965     6.00    36.09
     + ID2= 2 (  0465):    48.70   7.859     6.00    36.09
       ================================================
       ID = 3 (  0470):    56.21  10.824     6.00    36.09

     NOTE:  PEAK FLOWS DO NOT INCLUDE BASEFLOWS IF ANY.
--------------------------------------------------------------------------------
--------------------
| ROUTE CHN(  0475)|
| IN= 2---> OUT= 1 |     Routing time step (min)'=  5.00
--------------------
              <------ DATA FOR SECTION (   1.1) ------>
              Distance      Elevation       Manning
                100.00        324.60        0.0500
                115.00        321.60        0.0500
                120.00        320.80    0.0500 /0.0300  Main Channel
                122.00        320.80    0.0300 /0.0500  Main Channel
                138.00        321.60        0.0500
```

148.00	322.30	0.0500
154.00	323.10	0.0500
164.00	324.60	0.0500

<-------------------- TRAVEL TIME TABLE ---------------------->

DEPTH (m)	ELEV (m)	VOLUME (cu.m.)	FLOW RATE (cms)	VELOCITY (m/s)	TRAV.TIME (min)
0.20	321.00	.398E+03	0.8	0.84	8.53
0.40	321.20	.125E+04	3.3	1.13	6.33
0.60	321.40	.255E+04	8.1	1.36	5.27
0.80	321.60	.430E+04	15.6	1.56	4.59
1.00	321.80	.644E+04	26.8	1.79	4.01
1.20	322.00	.892E+04	41.2	1.99	3.61
1.40	322.20	.117E+05	59.3	2.17	3.30
1.60	322.40	.148E+05	81.9	2.37	3.02
1.80	322.60	.182E+05	109.1	2.58	2.78
2.00	322.80	.218E+05	140.2	2.77	2.59
2.20	323.00	.256E+05	175.3	2.95	2.43
2.40	323.20	.296E+05	214.7	3.12	2.29
2.60	323.40	.338E+05	258.6	3.29	2.18
2.80	323.60	.382E+05	306.7	3.46	2.07
3.00	323.80	.428E+05	359.1	3.61	1.98
3.20	324.00	.476E+05	416.0	3.76	1.91
3.40	324.20	.526E+05	477.5	3.91	1.83
3.60	324.40	.578E+05	543.5	4.05	1.77
3.80	324.60	.632E+05	614.3	4.18	1.71

		<---- hydrograph ---->			<-pipe / channel->	
	AREA (ha)	QPEAK (cms)	TPEAK (hrs)	R.V. (mm)	MAX DEPTH (m)	MAX VEL (m/s)
INFLOW : ID= 2 (0470)	56.21	10.82	6.00	36.09	0.67	1.43
OUTFLOW: ID= 1 (0475)	56.21	9.54	6.08	36.09	0.64	1.39

CALIB STANDHYD (0105) | ID= 1 DT= 5.0 min	Area (ha)= 51.32 Total Imp(%)= 42.00 Dir. Conn.(%)= 21.00

		IMPERVIOUS	PERVIOUS (i)
Surface Area	(ha)=	21.55	29.77
Dep. Storage	(mm)=	1.50	5.00
Average Slope	(%)=	2.00	2.00
Length	(m)=	550.00	40.00
Mannings n	=	0.013	0.300

NOTE: RAINFALL WAS TRANSFORMED TO 5.0 MIN. TIME STEP.

---- TRANSFORMED HYETOGRAPH ----

TIME hrs	RAIN mm/hr	TIME hrs	RAIN mm/hr	TIME hrs	RAIN mm/hr	TIME hrs	RAIN mm/hr
0.083	1.84	3.083	2.94	6.083	13.24	9.08	2.58
0.167	1.84	3.167	2.94	6.167	13.24	9.17	2.58
0.250	1.84	3.250	2.94	6.250	13.24	9.25	2.57
0.333	1.84	3.333	2.94	6.333	13.24	9.33	2.58
0.417	1.84	3.417	2.94	6.417	13.24	9.42	2.58
0.500	1.84	3.500	2.94	6.500	13.24	9.50	2.58
0.583	1.84	3.583	2.94	6.583	5.89	9.58	2.57
0.667	1.84	3.667	2.94	6.667	5.89	9.67	2.58
0.750	1.84	3.750	2.94	6.750	5.89	9.75	2.58
0.833	1.84	3.833	2.94	6.833	5.89	9.83	2.57
0.917	1.84	3.917	2.94	6.917	5.89	9.92	2.58
1.000	1.84	4.000	2.94	7.000	5.88	10.00	2.58
1.083	1.84	4.083	4.41	7.083	4.41	10.08	1.47
1.167	1.84	4.167	4.41	7.167	4.41	10.17	1.47
1.250	1.84	4.250	4.41	7.250	4.41	10.25	1.47
1.333	1.84	4.333	4.41	7.333	4.41	10.33	1.47
1.417	1.84	4.417	4.41	7.417	4.41	10.42	1.47
1.500	1.84	4.500	4.41	7.500	4.41	10.50	1.47
1.583	1.84	4.583	5.88	7.583	4.41	10.58	1.47
1.667	1.84	4.667	5.89	7.667	4.41	10.67	1.47
1.750	1.84	4.750	5.89	7.750	4.41	10.75	1.47
1.833	1.84	4.833	5.89	7.833	4.41	10.83	1.47
1.917	1.84	4.917	5.89	7.917	4.41	10.92	1.47
2.000	1.84	5.000	5.89	8.000	4.41	11.00	1.47
2.083	2.21	5.083	8.83	8.083	2.58	11.08	1.47
2.167	2.21	5.167	8.83	8.167	2.58	11.17	1.47
2.250	2.21	5.250	8.83	8.250	2.57	11.25	1.47
2.333	2.21	5.333	8.83	8.333	2.58	11.33	1.47
2.417	2.21	5.417	8.83	8.417	2.58	11.42	1.47
2.500	2.21	5.500	8.83	8.500	2.57	11.50	1.47
2.583	2.21	5.583	35.31	8.583	2.58	11.58	1.47
2.667	2.21	5.667	35.31	8.667	2.58	11.67	1.47
2.750	2.21	5.750	35.31	8.750	2.57	11.75	1.47
2.833	2.21	5.833	97.10	8.833	2.58	11.83	1.47
2.917	2.21	5.917	97.10	8.917	2.58	11.92	1.47
3.000	2.21	6.000	97.10	9.000	2.57	12.00	1.47

Max.Eff.Inten.(mm/hr)=	97.10	119.40	
over (min)	5.00	15.00	
Storage Coeff. (min)=	5.84 (ii)	13.17 (ii)	
Unit Hyd. Tpeak (min)=	5.00	15.00	
Unit Hyd. peak (cms)=	0.20	0.08	
			TOTALS
PEAK FLOW (cms)=	2.76	5.98	8.044 (iii)
TIME TO PEAK (hrs)=	6.00	6.08	6.00
RUNOFF VOLUME (mm)=	72.06	26.53	36.09

```
     TOTAL RAINFALL   (mm)=      73.56        73.56          73.56
     RUNOFF COEFFICIENT   =       0.98         0.36           0.49


       (i) HORTONS EQUATION SELECTED FOR PERVIOUS LOSSES:
            Fo   (mm/hr)= 75.00           K  (1/hr)=  4.14
            Fc   (mm/hr)= 12.50     Cum.Inf.   (mm)=  0.00
      (ii) TIME STEP (DT) SHOULD BE SMALLER OR EQUAL
           THAN THE STORAGE COEFFICIENT.
     (iii) PEAK FLOW DOES NOT INCLUDE BASEFLOW IF ANY.

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--------------------
| RESERVOIR(  0106)|     OVERFLOW IS OFF
| IN= 2---> OUT= 1 |
| DT=  5.0 min     |     OUTFLOW    STORAGE   |  OUTFLOW    STORAGE
--------------------      (cms)     (ha.m.)   |   (cms)     (ha.m.)
                          0.0000     0.0000   |   0.5000      0.4000
                          0.0100     0.0100   |   6.6000      0.8000
                          0.0260     0.2300   |   0.0000      0.0000

                                  AREA     QPEAK     TPEAK       R.V.
                                  (ha)     (cms)     (hrs)       (mm)
   INFLOW : ID= 2 (  0105)     51.320      8.044      6.00      36.09
   OUTFLOW: ID= 1 (  0106)     51.320      5.545      6.17      36.09

                  PEAK   FLOW   REDUCTION [Qout/Qin](%)= 68.94
                  TIME SHIFT OF PEAK FLOW         (min)= 10.00
                  MAXIMUM  STORAGE   USED       (ha.m.)=  0.7419

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--------------------
| CALIB            |
| STANDHYD (  0110)|   Area    (ha)=  19.00
|ID= 1 DT= 5.0 min |   Total Imp(%)=  42.00   Dir. Conn.(%)=  21.00
--------------------
                             IMPERVIOUS    PERVIOUS (i)
     Surface Area     (ha)=       7.98        11.02
     Dep. Storage     (mm)=       1.50         5.00
     Average Slope     (%)=       2.00         2.00
     Length            (m)=     365.00        40.00
     Mannings n           =      0.013        0.300

         NOTE:  RAINFALL WAS TRANSFORMED TO   5.0 MIN. TIME STEP.


                            ---- TRANSFORMED HYETOGRAPH ----
               TIME    RAIN |  TIME    RAIN |'  TIME    RAIN |  TIME    RAIN
                hrs   mm/hr |   hrs   mm/hr |'   hrs   mm/hr |   hrs   mm/hr
              0.083    1.84 | 3.083    2.94 | 6.083   13.24 |  9.08    2.58
```

0.167	1.84	3.167	2.94	6.167	13.24	9.17	2.58
0.250	1.84	3.250	2.94	6.250	13.24	9.25	2.57
0.333	1.84	3.333	2.94	6.333	13.24	9.33	2.58
0.417	1.84	3.417	2.94	6.417	13.24	9.42	2.58
0.500	1.84	3.500	2.94	6.500	13.24	9.50	2.58
0.583	1.84	3.583	2.94	6.583	5.89	9.58	2.57
0.667	1.84	3.667	2.94	6.667	5.89	9.67	2.58
0.750	1.84	3.750	2.94	6.750	5.89	9.75	2.58
0.833	1.84	3.833	2.94	6.833	5.89	9.83	2.57
0.917	1.84	3.917	2.94	6.917	5.89	9.92	2.58
1.000	1.84	4.000	2.94	7.000	5.88	10.00	2.58
1.083	1.84	4.083	4.41	7.083	4.41	10.08	1.47
1.167	1.84	4.167	4.41	7.167	4.41	10.17	1.47
1.250	1.84	4.250	4.41	7.250	4.41	10.25	1.47
1.333	1.84	4.333	4.41	7.333	4.41	10.33	1.47
1.417	1.84	4.417	4.41	7.417	4.41	10.42	1.47
1.500	1.84	4.500	4.41	7.500	4.41	10.50	1.47
1.583	1.84	4.583	5.88	7.583	4.41	10.58	1.47
1.667	1.84	4.667	5.89	7.667	4.41	10.67	1.47
1.750	1.84	4.750	5.89	7.750	4.41	10.75	1.47
1.833	1.84	4.833	5.89	7.833	4.41	10.83	1.47
1.917	1.84	4.917	5.89	7.917	4.41	10.92	1.47
2.000	1.84	5.000	5.89	8.000	4.41	11.00	1.47
2.083	2.21	5.083	8.83	8.083	2.58	11.08	1.47
2.167	2.21	5.167	8.83	8.167	2.58	11.17	1.47
2.250	2.21	5.250	8.83	8.250	2.57	11.25	1.47
2.333	2.21	5.333	8.83	8.333	2.58	11.33	1.47
2.417	2.21	5.417	8.83	8.417	2.58	11.42	1.47
2.500	2.21	5.500	8.83	8.500	2.57	11.50	1.47
2.583	2.21	5.583	35.31	8.583	2.58	11.58	1.47
2.667	2.21	5.667	35.31	8.667	2.58	11.67	1.47
2.750	2.21	5.750	35.31	8.750	2.57	11.75	1.47
2.833	2.21	5.833	97.10	8.833	2.58	11.83	1.47
2.917	2.21	5.917	97.10	8.917	2.58	11.92	1.47
3.000	2.21	6.000	97.10	9.000	2.57	12.00	1.47

Max.Eff.Inten.(mm/hr)=	97.10	119.40	
over (min)	5.00	15.00	
Storage Coeff. (min)=	4.57 (ii)	11.90 (ii)	
Unit Hyd. Tpeak (min)=	5.00	15.00	
Unit Hyd. peak (cms)=	0.23	0.09	
			TOTALS
PEAK FLOW (cms)=	1.05	2.32	3.122 (iii)
TIME TO PEAK (hrs)=	6.00	6.08	6.00
RUNOFF VOLUME (mm)=	72.06	26.53	36.09
TOTAL RAINFALL (mm)=	73.56	73.56	73.56
RUNOFF COEFFICIENT =	0.98	0.36	0.49

***** WARNING: STORAGE COEFF. IS SMALLER THAN TIME STEP!

```
       (i) HORTONS EQUATION SELECTED FOR PERVIOUS LOSSES:
            Fo   (mm/hr)= 75.00          K  (1/hr)=  4.14
            Fc   (mm/hr)= 12.50     Cum.Inf.   (mm)=  0.00
      (ii) TIME STEP (DT) SHOULD BE SMALLER OR EQUAL
           THAN THE STORAGE COEFFICIENT.
     (iii) PEAK FLOW DOES NOT INCLUDE BASEFLOW IF ANY.

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--------------------
| RESERVOIR(  0111)|     OVERFLOW IS OFF
| IN= 2---> OUT= 1 |
| DT=  5.0 min     |     OUTFLOW    STORAGE   |  OUTFLOW    STORAGE
--------------------      (cms)     (ha.m.)   |   (cms)     (ha.m.)
                          0.0000     0.0000   |   1.0000      1.0000
                          0.0100     0.0100   |  20.0000      1.1000
                          0.0120     0.1000   |   0.0000      0.0000

                                    AREA     QPEAK     TPEAK       R.V.
                                    (ha)     (cms)     (hrs)       (mm)
   INFLOW : ID= 2 (  0110)     19.000      3.122      6.00      36.09
   OUTFLOW: ID= 1 (  0111)     19.000      0.447      6.58      36.08

                  PEAK   FLOW   REDUCTION [Qout/Qin](%)= 14.31
                  TIME SHIFT OF PEAK FLOW         (min)= 35.00
                  MAXIMUM  STORAGE   USED       (ha.m.)=  0.4965

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--------------------
| CALIB            |
| STANDHYD (  0102)|   Area    (ha)=  14.32
|ID= 1 DT= 5.0 min |   Total Imp(%)=  42.00   Dir. Conn.(%)=  21.00
--------------------
                             IMPERVIOUS    PERVIOUS (i)
     Surface Area     (ha)=       6.01         8.31
     Dep. Storage     (mm)=       1.50         5.00
     Average Slope     (%)=       2.00         2.00
     Length            (m)=     287.00        40.00
     Mannings n           =      0.013        0.300

         NOTE:  RAINFALL WAS TRANSFORMED TO   5.0 MIN. TIME STEP.


                              ---- TRANSFORMED HYETOGRAPH ----
               TIME    RAIN |  TIME    RAIN |'  TIME    RAIN |  TIME    RAIN
                hrs   mm/hr |   hrs   mm/hr |'   hrs   mm/hr |   hrs   mm/hr
              0.083    1.84 | 3.083    2.94 | 6.083   13.24 |  9.08    2.58
              0.167    1.84 | 3.167    2.94 | 6.167   13.24 |  9.17    2.58
              0.250    1.84 | 3.250    2.94 | 6.250   13.24 |  9.25    2.57
              0.333    1.84 | 3.333    2.94 | 6.333   13.24 |  9.33    2.58
              0.417    1.84 | 3.417    2.94 | 6.417   13.24 |  9.42    2.58
```

0.500	1.84	3.500	2.94	6.500	13.24	9.50	2.58
0.583	1.84	3.583	2.94	6.583	5.89	9.58	2.57
0.667	1.84	3.667	2.94	6.667	5.89	9.67	2.58
0.750	1.84	3.750	2.94	6.750	5.89	9.75	2.58
0.833	1.84	3.833	2.94	6.833	5.89	9.83	2.57
0.917	1.84	3.917	2.94	6.917	5.89	9.92	2.58
1.000	1.84	4.000	2.94	7.000	5.88	10.00	2.58
1.083	1.84	4.083	4.41	7.083	4.41	10.08	1.47
1.167	1.84	4.167	4.41	7.167	4.41	10.17	1.47
1.250	1.84	4.250	4.41	7.250	4.41	10.25	1.47
1.333	1.84	4.333	4.41	7.333	4.41	10.33	1.47
1.417	1.84	4.417	4.41	7.417	4.41	10.42	1.47
1.500	1.84	4.500	4.41	7.500	4.41	10.50	1.47
1.583	1.84	4.583	5.88	7.583	4.41	10.58	1.47
1.667	1.84	4.667	5.89	7.667	4.41	10.67	1.47
1.750	1.84	4.750	5.89	7.750	4.41	10.75	1.47
1.833	1.84	4.833	5.89	7.833	4.41	10.83	1.47
1.917	1.84	4.917	5.89	7.917	4.41	10.92	1.47
2.000	1.84	5.000	5.89	8.000	4.41	11.00	1.47
2.083	2.21	5.083	8.83	8.083	2.58	11.08	1.47
2.167	2.21	5.167	8.83	8.167	2.58	11.17	1.47
2.250	2.21	5.250	8.83	8.250	2.57	11.25	1.47
2.333	2.21	5.333	8.83	8.333	2.58	11.33	1.47
2.417	2.21	5.417	8.83	8.417	2.58	11.42	1.47
2.500	2.21	5.500	8.83	8.500	2.57	11.50	1.47
2.583	2.21	5.583	35.31	8.583	2.58	11.58	1.47
2.667	2.21	5.667	35.31	8.667	2.58	11.67	1.47
2.750	2.21	5.750	35.31	8.750	2.57	11.75	1.47
2.833	2.21	5.833	97.10	8.833	2.58	11.83	1.47
2.917	2.21	5.917	97.10	8.917	2.58	11.92	1.47
3.000	2.21	6.000	97.10	9.000	2.57	12.00	1.47

			TOTALS
Max.Eff.Inten.(mm/hr)=	97.10	119.40	
over (min)	5.00	15.00	
Storage Coeff. (min)=	3.95 (ii)	11.29 (ii)	
Unit Hyd. Tpeak (min)=	5.00	15.00	
Unit Hyd. peak (cms)=	0.24	0.09	
PEAK FLOW (cms)=	0.80	1.79	2.406 (iii)
TIME TO PEAK (hrs)=	6.00	6.08	6.00
RUNOFF VOLUME (mm)=	72.06	26.53	36.09
TOTAL RAINFALL (mm)=	73.56	73.56	73.56
RUNOFF COEFFICIENT =	0.98	0.36	0.49

***** WARNING: STORAGE COEFF. IS SMALLER THAN TIME STEP!

(i) HORTONS EQUATION SELECTED FOR PERVIOUS LOSSES:
Fo (mm/hr)= 75.00 K (1/hr)= 4.14
Fc (mm/hr)= 12.50 Cum.Inf. (mm)= 0.00
(ii) TIME STEP (DT) SHOULD BE SMALLER OR EQUAL

THAN THE STORAGE COEFFICIENT.
(iii) PEAK FLOW DOES NOT INCLUDE BASEFLOW IF ANY.

CALIB	
STANDHYD (0101)	Area (ha)= 16.32
ID= 1 DT= 5.0 min	Total Imp(%)= 42.00 Dir. Conn.(%)= 21.00

		IMPERVIOUS	PERVIOUS (i)
Surface Area	(ha)=	6.85	9.47
Dep. Storage	(mm)=	1.50	5.00
Average Slope	(%)=	2.00	2.00
Length	(m)=	309.00	40.00
Mannings n	=	0.013	0.300

NOTE: RAINFALL WAS TRANSFORMED TO 5.0 MIN. TIME STEP.

---- TRANSFORMED HYETOGRAPH ----

TIME hrs	RAIN mm/hr	TIME hrs	RAIN mm/hr	TIME hrs	RAIN mm/hr	TIME hrs	RAIN mm/hr
0.083	1.84	3.083	2.94	6.083	13.24	9.08	2.58
0.167	1.84	3.167	2.94	6.167	13.24	9.17	2.58
0.250	1.84	3.250	2.94	6.250	13.24	9.25	2.57
0.333	1.84	3.333	2.94	6.333	13.24	9.33	2.58
0.417	1.84	3.417	2.94	6.417	13.24	9.42	2.58
0.500	1.84	3.500	2.94	6.500	13.24	9.50	2.58
0.583	1.84	3.583	2.94	6.583	5.89	9.58	2.57
0.667	1.84	3.667	2.94	6.667	5.89	9.67	2.58
0.750	1.84	3.750	2.94	6.750	5.89	9.75	2.58
0.833	1.84	3.833	2.94	6.833	5.89	9.83	2.57
0.917	1.84	3.917	2.94	6.917	5.89	9.92	2.58
1.000	1.84	4.000	2.94	7.000	5.88	10.00	2.58
1.083	1.84	4.083	4.41	7.083	4.41	10.08	1.47
1.167	1.84	4.167	4.41	7.167	4.41	10.17	1.47
1.250	1.84	4.250	4.41	7.250	4.41	10.25	1.47
1.333	1.84	4.333	4.41	7.333	4.41	10.33	1.47
1.417	1.84	4.417	4.41	7.417	4.41	10.42	1.47
1.500	1.84	4.500	4.41	7.500	4.41	10.50	1.47
1.583	1.84	4.583	5.88	7.583	4.41	10.58	1.47
1.667	1.84	4.667	5.89	7.667	4.41	10.67	1.47
1.750	1.84	4.750	5.89	7.750	4.41	10.75	1.47
1.833	1.84	4.833	5.89	7.833	4.41	10.83	1.47
1.917	1.84	4.917	5.89	7.917	4.41	10.92	1.47
2.000	1.84	5.000	5.89	8.000	4.41	11.00	1.47
2.083	2.21	5.083	8.83	8.083	2.58	11.08	1.47
2.167	2.21	5.167	8.83	8.167	2.58	11.17	1.47
2.250	2.21	5.250	8.83	8.250	2.57	11.25	1.47
2.333	2.21	5.333	8.83	8.333	2.58	11.33	1.47

```
               2.417    2.21 | 5.417    8.83 | 8.417    2.58 | 11.42    1.47
               2.500    2.21 | 5.500    8.83 | 8.500    2.57 | 11.50    1.47
               2.583    2.21 | 5.583   35.31 | 8.583    2.58 | 11.58    1.47
               2.667    2.21 | 5.667   35.31 | 8.667    2.58 | 11.67    1.47
               2.750    2.21 | 5.750   35.31 | 8.750    2.57 | 11.75    1.47
               2.833    2.21 | 5.833   97.10 | 8.833    2.58 | 11.83    1.47
               2.917    2.21 | 5.917   97.10 | 8.917    2.58 | 11.92    1.47
               3.000    2.21 | 6.000   97.10 | 9.000    2.57 | 12.00    1.47

     Max.Eff.Inten.(mm/hr)=      97.10       119.40
               over (min)         5.00        15.00
     Storage Coeff.  (min)=       4.13 (ii)   11.47 (ii)
     Unit Hyd. Tpeak (min)=       5.00        15.00
     Unit Hyd. peak  (cms)=       0.24         0.09
                                                          *TOTALS*
     PEAK FLOW       (cms)=       0.91         2.02          2.725 (iii)
     TIME TO PEAK    (hrs)=       6.00         6.08           6.00
     RUNOFF VOLUME    (mm)=      72.06        26.53          36.09
     TOTAL RAINFALL   (mm)=      73.56        73.56          73.56
     RUNOFF COEFFICIENT   =       0.98         0.36           0.49

***** WARNING: STORAGE COEFF. IS SMALLER THAN TIME STEP!

       (i) HORTONS EQUATION SELECTED FOR PERVIOUS LOSSES:
            Fo   (mm/hr)= 75.00           K  (1/hr)=  4.14
            Fc   (mm/hr)= 12.50     Cum.Inf.   (mm)=  0.00
      (ii) TIME STEP (DT) SHOULD BE SMALLER OR EQUAL
           THAN THE STORAGE COEFFICIENT.
     (iii) PEAK FLOW DOES NOT INCLUDE BASEFLOW IF ANY.

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--------------------
| ADD HYD  (  0103)|
|   1 +  2 =  3    |         AREA    QPEAK    TPEAK     R.V.
--------------------         (ha)    (cms)    (hrs)     (mm)
        ID1= 1 (  0101):    16.32   2.725     6.00    36.09
      + ID2= 2 (  0102):    14.32   2.406     6.00    36.09
        ================================================
        ID = 3 (  0103):    30.64   5.131     6.00    36.09

     NOTE:  PEAK FLOWS DO NOT INCLUDE BASEFLOWS IF ANY.
--------------------------------------------------------------------------------
--------------------
| RESERVOIR(  0104)|     OVERFLOW IS OFF
| IN= 2---> OUT= 1 |
| DT=  5.0 min     |     OUTFLOW    STORAGE   |  OUTFLOW    STORAGE
--------------------      (cms)     (ha.m.)   |   (cms)     (ha.m.)
                          0.0000     0.0000   |   1.0000      0.5000
                          0.0100     0.0100   |  10.0000      0.6000
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                          0.0150     0.1332   |   0.0000      0.0000

                                    AREA     QPEAK     TPEAK       R.V.
                                    (ha)     (cms)     (hrs)       (mm)
   INFLOW : ID= 2 (  0103)     30.640      5.131      6.00      36.09
   OUTFLOW: ID= 1 (  0104)     30.640      4.550      6.17      36.08

                  PEAK   FLOW   REDUCTION [Qout/Qin](%)= 88.67
                  TIME SHIFT OF PEAK FLOW         (min)= 10.00
                  MAXIMUM  STORAGE   USED       (ha.m.)=  0.5514

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--------------------
| ADD HYD  (  0114)|
|   1 +  2 =  3    |         AREA    QPEAK    TPEAK     R.V.
--------------------         (ha)    (cms)    (hrs)     (mm)
        ID1= 1 (  0104):    30.64   4.550     6.17    36.08
      + ID2= 2 (  0111):    19.00   0.447     6.58    36.08
        ================================================
        ID = 3 (  0114):    49.64   4.877     6.17    36.08

     NOTE:  PEAK FLOWS DO NOT INCLUDE BASEFLOWS IF ANY.
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--------------------
| ADD HYD  (  0115)|
|   1 +  2 =  3    |         AREA    QPEAK    TPEAK     R.V.
--------------------         (ha)    (cms)    (hrs)     (mm)
        ID1= 1 (  0106):    51.32   5.545     6.17    36.09
      + ID2= 2 (  0114):    49.64   4.877     6.17    36.08
        ================================================
        ID = 3 (  0115):   100.96  10.422     6.17    36.08

     NOTE:  PEAK FLOWS DO NOT INCLUDE BASEFLOWS IF ANY.
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--------------------
| CALIB            |
| STANDHYD (  0395)|   Area    (ha)=  51.20
|ID= 1 DT= 5.0 min |   Total Imp(%)=  10.00   Dir. Conn.(%)=   5.00
--------------------
                              IMPERVIOUS    PERVIOUS (i)
     Surface Area     (ha)=       5.12        46.08
     Dep. Storage     (mm)=       1.50         5.00
     Average Slope     (%)=       2.00         2.00
     Length            (m)=     900.00        40.00
     Mannings n           =      0.013        0.300

         NOTE:  RAINFALL WAS TRANSFORMED TO   5.0 MIN. TIME STEP.
```

---- TRANSFORMED HYETOGRAPH ----

TIME hrs	RAIN mm/hr	TIME hrs	RAIN mm/hr	TIME hrs	RAIN mm/hr	TIME hrs	RAIN mm/hr
0.083	1.84	3.083	2.94	6.083	13.24	9.08	2.58
0.167	1.84	3.167	2.94	6.167	13.24	9.17	2.58
0.250	1.84	3.250	2.94	6.250	13.24	9.25	2.57
0.333	1.84	3.333	2.94	6.333	13.24	9.33	2.58
0.417	1.84	3.417	2.94	6.417	13.24	9.42	2.58
0.500	1.84	3.500	2.94	6.500	13.24	9.50	2.58
0.583	1.84	3.583	2.94	6.583	5.89	9.58	2.57
0.667	1.84	3.667	2.94	6.667	5.89	9.67	2.58
0.750	1.84	3.750	2.94	6.750	5.89	9.75	2.58
0.833	1.84	3.833	2.94	6.833	5.89	9.83	2.57
0.917	1.84	3.917	2.94	6.917	5.89	9.92	2.58
1.000	1.84	4.000	2.94	7.000	5.88	10.00	2.58
1.083	1.84	4.083	4.41	7.083	4.41	10.08	1.47
1.167	1.84	4.167	4.41	7.167	4.41	10.17	1.47
1.250	1.84	4.250	4.41	7.250	4.41	10.25	1.47
1.333	1.84	4.333	4.41	7.333	4.41	10.33	1.47
1.417	1.84	4.417	4.41	7.417	4.41	10.42	1.47
1.500	1.84	4.500	4.41	7.500	4.41	10.50	1.47
1.583	1.84	4.583	5.88	7.583	4.41	10.58	1.47
1.667	1.84	4.667	5.89	7.667	4.41	10.67	1.47
1.750	1.84	4.750	5.89	7.750	4.41	10.75	1.47
1.833	1.84	4.833	5.89	7.833	4.41	10.83	1.47
1.917	1.84	4.917	5.89	7.917	4.41	10.92	1.47
2.000	1.84	5.000	5.89	8.000	4.41	11.00	1.47
2.083	2.21	5.083	8.83	8.083	2.58	11.08	1.47
2.167	2.21	5.167	8.83	8.167	2.58	11.17	1.47
2.250	2.21	5.250	8.83	8.250	2.57	11.25	1.47
2.333	2.21	5.333	8.83	8.333	2.58	11.33	1.47
2.417	2.21	5.417	8.83	8.417	2.58	11.42	1.47
2.500	2.21	5.500	8.83	8.500	2.57	11.50	1.47
2.583	2.21	5.583	35.31	8.583	2.58	11.58	1.47
2.667	2.21	5.667	35.31	8.667	2.58	11.67	1.47
2.750	2.21	5.750	35.31	8.750	2.57	11.75	1.47
2.833	2.21	5.833	97.10	8.833	2.58	11.83	1.47
2.917	2.21	5.917	97.10	8.917	2.58	11.92	1.47
3.000	2.21	6.000	97.10	9.000	2.57	12.00	1.47

Max.Eff.Inten.(mm/hr)=	97.10	88.55		
over (min)	10.00	20.00		
Storage Coeff. (min)=	7.85 (ii)	16.11 (ii)		
Unit Hyd. Tpeak (min)=	10.00	20.00		
Unit Hyd. peak (cms)=	0.13	0.06		
			TOTALS	
PEAK FLOW (cms)=	0.58	5.35	5.668 (iii)	
TIME TO PEAK (hrs)=	6.00	6.17	6.17	
RUNOFF VOLUME (mm)=	72.06	21.36	23.89	

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     TOTAL RAINFALL   (mm)=      73.56        73.56          73.56
     RUNOFF COEFFICIENT   =       0.98         0.29           0.32

***** WARNING:FOR AREAS WITH IMPERVIOUS RATIOS BELOW 20%
              YOU SHOULD CONSIDER SPLITTING THE AREA.

       (i) HORTONS EQUATION SELECTED FOR PERVIOUS LOSSES:
            Fo   (mm/hr)= 75.00           K  (1/hr)=  4.14
            Fc   (mm/hr)= 12.50     Cum.Inf.   (mm)=  0.00
      (ii) TIME STEP (DT) SHOULD BE SMALLER OR EQUAL
           THAN THE STORAGE COEFFICIENT.
     (iii) PEAK FLOW DOES NOT INCLUDE BASEFLOW IF ANY.

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--------------------
| CALIB            |
| STANDHYD (  0365)|   Area    (ha)= 117.50
|ID= 1 DT= 5.0 min |   Total Imp(%)=  42.00   Dir. Conn.(%)=  21.00
--------------------
                            IMPERVIOUS    PERVIOUS (i)
     Surface Area     (ha)=      49.35        68.15
     Dep. Storage     (mm)=       1.50         5.00
     Average Slope     (%)=       2.00         2.00
     Length            (m)=     885.00        40.00
     Mannings n           =      0.013        0.300

         NOTE:  RAINFALL WAS TRANSFORMED TO   5.0 MIN. TIME STEP.


                         ---- TRANSFORMED HYETOGRAPH ----
      TIME    RAIN |  TIME    RAIN |'  TIME    RAIN |  TIME    RAIN
       hrs   mm/hr |   hrs   mm/hr |'   hrs   mm/hr |   hrs   mm/hr
     0.083    1.84 | 3.083    2.94 | 6.083   13.24 |  9.08    2.58
     0.167    1.84 | 3.167    2.94 | 6.167   13.24 |  9.17    2.58
     0.250    1.84 | 3.250    2.94 | 6.250   13.24 |  9.25    2.57
     0.333    1.84 | 3.333    2.94 | 6.333   13.24 |  9.33    2.58
     0.417    1.84 | 3.417    2.94 | 6.417   13.24 |  9.42    2.58
     0.500    1.84 | 3.500    2.94 | 6.500   13.24 |  9.50    2.58
     0.583    1.84 | 3.583    2.94 | 6.583    5.89 |  9.58    2.57
     0.667    1.84 | 3.667    2.94 | 6.667    5.89 |  9.67    2.58
     0.750    1.84 | 3.750    2.94 | 6.750    5.89 |  9.75    2.58
     0.833    1.84 | 3.833    2.94 | 6.833    5.89 |  9.83    2.57
     0.917    1.84 | 3.917    2.94 | 6.917    5.89 |  9.92    2.58
     1.000    1.84 | 4.000    2.94 | 7.000    5.88 | 10.00    2.58
     1.083    1.84 | 4.083    4.41 | 7.083    4.41 | 10.08    1.47
     1.167    1.84 | 4.167    4.41 | 7.167    4.41 | 10.17    1.47
     1.250    1.84 | 4.250    4.41 | 7.250    4.41 | 10.25    1.47
     1.333    1.84 | 4.333    4.41 | 7.333    4.41 | 10.33    1.47
     1.417    1.84 | 4.417    4.41 | 7.417    4.41 | 10.42    1.47
     1.500    1.84 | 4.500    4.41 | 7.500    4.41 | 10.50    1.47
```

1.583	1.84	4.583	5.88	7.583	4.41	10.58	1.47
1.667	1.84	4.667	5.89	7.667	4.41	10.67	1.47
1.750	1.84	4.750	5.89	7.750	4.41	10.75	1.47
1.833	1.84	4.833	5.89	7.833	4.41	10.83	1.47
1.917	1.84	4.917	5.89	7.917	4.41	10.92	1.47
2.000	1.84	5.000	5.89	8.000	4.41	11.00	1.47
2.083	2.21	5.083	8.83	8.083	2.58	11.08	1.47
2.167	2.21	5.167	8.83	8.167	2.58	11.17	1.47
2.250	2.21	5.250	8.83	8.250	2.57	11.25	1.47
2.333	2.21	5.333	8.83	8.333	2.58	11.33	1.47
2.417	2.21	5.417	8.83	8.417	2.58	11.42	1.47
2.500	2.21	5.500	8.83	8.500	2.57	11.50	1.47
2.583	2.21	5.583	35.31	8.583	2.58	11.58	1.47
2.667	2.21	5.667	35.31	8.667	2.58	11.67	1.47
2.750	2.21	5.750	35.31	8.750	2.57	11.75	1.47
2.833	2.21	5.833	97.10	8.833	2.58	11.83	1.47
2.917	2.21	5.917	97.10	8.917	2.58	11.92	1.47
3.000	2.21	6.000	97.10	9.000	2.57	12.00	1.47

Max.Eff.Inten.(mm/hr)=	97.10	119.40	
over (min)	10.00	20.00	
Storage Coeff. (min)=	7.77 (ii)	15.10 (ii)	
Unit Hyd. Tpeak (min)=	10.00	20.00	
Unit Hyd. peak (cms)=	0.13	0.07	
			TOTALS
PEAK FLOW (cms)=	5.65	11.98	16.238 (iii)
TIME TO PEAK (hrs)=	6.00	6.17	6.08
RUNOFF VOLUME (mm)=	72.06	26.53	36.09
TOTAL RAINFALL (mm)=	73.56	73.56	73.56
RUNOFF COEFFICIENT =	0.98	0.36	0.49

(i) HORTONS EQUATION SELECTED FOR PERVIOUS LOSSES:
Fo (mm/hr)= 75.00 K (1/hr)= 4.14
Fc (mm/hr)= 12.50 Cum.Inf. (mm)= 0.00
(ii) TIME STEP (DT) SHOULD BE SMALLER OR EQUAL
THAN THE STORAGE COEFFICIENT.
(iii) PEAK FLOW DOES NOT INCLUDE BASEFLOW IF ANY.

CALIB
STANDHYD (0360)
ID= 1 DT= 5.0 min

Area (ha)= 30.00
Total Imp(%)= 37.00 Dir. Conn.(%)= 19.00

		IMPERVIOUS	PERVIOUS (i)
Surface Area	(ha)=	11.10	18.90
Dep. Storage	(mm)=	1.50	5.00
Average Slope	(%)=	2.00	2.00
Length	(m)=	447.00	40.00

Mannings n = 0.013 0.300

NOTE: RAINFALL WAS TRANSFORMED TO 5.0 MIN. TIME STEP.

---- TRANSFORMED HYETOGRAPH ----

TIME hrs	RAIN mm/hr	TIME hrs	RAIN mm/hr	TIME hrs	RAIN mm/hr	TIME hrs	RAIN mm/hr
0.083	1.84	3.083	2.94	6.083	13.24	9.08	2.58
0.167	1.84	3.167	2.94	6.167	13.24	9.17	2.58
0.250	1.84	3.250	2.94	6.250	13.24	9.25	2.57
0.333	1.84	3.333	2.94	6.333	13.24	9.33	2.58
0.417	1.84	3.417	2.94	6.417	13.24	9.42	2.58
0.500	1.84	3.500	2.94	6.500	13.24	9.50	2.58
0.583	1.84	3.583	2.94	6.583	5.89	9.58	2.57
0.667	1.84	3.667	2.94	6.667	5.89	9.67	2.58
0.750	1.84	3.750	2.94	6.750	5.89	9.75	2.58
0.833	1.84	3.833	2.94	6.833	5.89	9.83	2.57
0.917	1.84	3.917	2.94	6.917	5.89	9.92	2.58
1.000	1.84	4.000	2.94	7.000	5.88	10.00	2.58
1.083	1.84	4.083	4.41	7.083	4.41	10.08	1.47
1.167	1.84	4.167	4.41	7.167	4.41	10.17	1.47
1.250	1.84	4.250	4.41	7.250	4.41	10.25	1.47
1.333	1.84	4.333	4.41	7.333	4.41	10.33	1.47
1.417	1.84	4.417	4.41	7.417	4.41	10.42	1.47
1.500	1.84	4.500	4.41	7.500	4.41	10.50	1.47
1.583	1.84	4.583	5.88	7.583	4.41	10.58	1.47
1.667	1.84	4.667	5.89	7.667	4.41	10.67	1.47
1.750	1.84	4.750	5.89	7.750	4.41	10.75	1.47
1.833	1.84	4.833	5.89	7.833	4.41	10.83	1.47
1.917	1.84	4.917	5.89	7.917	4.41	10.92	1.47
2.000	1.84	5.000	5.89	8.000	4.41	11.00	1.47
2.083	2.21	5.083	8.83	8.083	2.58	11.08	1.47
2.167	2.21	5.167	8.83	8.167	2.58	11.17	1.47
2.250	2.21	5.250	8.83	8.250	2.57	11.25	1.47
2.333	2.21	5.333	8.83	8.333	2.58	11.33	1.47
2.417	2.21	5.417	8.83	8.417	2.58	11.42	1.47
2.500	2.21	5.500	8.83	8.500	2.57	11.50	1.47
2.583	2.21	5.583	35.31	8.583	2.58	11.58	1.47
2.667	2.21	5.667	35.31	8.667	2.58	11.67	1.47
2.750	2.21	5.750	35.31	8.750	2.57	11.75	1.47
2.833	2.21	5.833	97.10	8.833	2.58	11.83	1.47
2.917	2.21	5.917	97.10	8.917	2.58	11.92	1.47
3.000	2.21	6.000	97.10	9.000	2.57	12.00	1.47

Max.Eff.Inten.(mm/hr)=	97.10	111.81
over (min)	5.00	15.00
Storage Coeff. (min)=	5.16 (ii)	12.69 (ii)
Unit Hyd. Tpeak (min)=	5.00	15.00
Unit Hyd. peak (cms)=	0.21	0.08

				TOTALS
PEAK FLOW	(cms)=	1.48	3.58	4.647 (iii)
TIME TO PEAK	(hrs)=	6.00	6.08	6.00
RUNOFF VOLUME	(mm)=	72.06	25.57	34.40
TOTAL RAINFALL	(mm)=	73.56	73.56	73.56
RUNOFF COEFFICIENT	=	0.98	0.35	0.47

***** WARNING:FOR AREAS WITH IMPERVIOUS RATIOS BELOW 20%
YOU SHOULD CONSIDER SPLITTING THE AREA.

(i) HORTONS EQUATION SELECTED FOR PERVIOUS LOSSES:
Fo (mm/hr)= 75.00 K (1/hr)= 4.14
Fc (mm/hr)= 12.50 Cum.Inf. (mm)= 0.00
(ii) TIME STEP (DT) SHOULD BE SMALLER OR EQUAL
THAN THE STORAGE COEFFICIENT.
(iii) PEAK FLOW DOES NOT INCLUDE BASEFLOW IF ANY.

ROUTE CHN(0362)
IN= 2---> OUT= 1	Routing time step (min)'= 5.00

<------ DATA FOR SECTION (1.1) ------>

Distance	Elevation	Manning	
0.00	0.40	0.0300	
5.50	0.15	0.0300 /0.0150	Main Channel
5.51	0.00	0.0150	Main Channel
10.00	0.09	0.0150	Main Channel
14.49	0.00	0.0150	Main Channel
14.50	0.15	0.0150 /0.0300	Main Channel
20.00	0.40	0.0300	

<---------- TRAVEL TIME TABLE ---------->

DEPTH (m)	ELEV (m)	VOLUME (cu.m.)	FLOW RATE (cms)	VELOCITY (m/s)	TRAV.TIME (min)
0.02	0.02	.176E+02	0.0	0.21	80.52
0.04	0.04	.702E+02	0.0	0.33	50.72
0.06	0.06	.158E+03	0.1	0.43	38.71
0.08	0.08	.281E+03	0.1	0.52	31.95
0.09	0.09	.438E+03	0.3	0.62	26.84
0.11	0.11	.607E+03	0.5	0.77	21.66
0.13	0.13	.776E+03	0.7	0.90	18.45
0.15	0.15	.944E+03	1.0	1.03	16.22
0.17	0.17	.116E+04	1.3	1.16	14.36
0.20	0.20	.140E+04	1.8	1.27	13.13
0.22	0.22	.166E+04	2.3	1.36	12.24
0.24	0.24	.194E+04	2.8	1.44	11.58
0.26	0.26	.225E+04	3.4	1.51	11.05
0.29	0.29	.258E+04	4.0	1.57	10.63
0.31	0.31	.293E+04	4.8	1.62	10.27

0.33	0.33	.331E+04	5.5	1.67	9.97
0.35	0.35	.371E+04	6.4	1.72	9.71
0.38	0.38	.413E+04	7.3	1.76	9.48
0.40	0.40	.457E+04	8.2	1.80	9.28

		<---- hydrograph ---->			<-pipe / channel->	
	AREA	QPEAK	TPEAK	R.V.	MAX DEPTH	MAX VEL
	(ha)	(cms)	(hrs)	(mm)	(m)	(m/s)
INFLOW : ID= 2 (0360)	30.00	4.65	6.00	34.40	0.31	1.61
OUTFLOW: ID= 1 (0362)	30.00	3.64	6.17	34.39	0.27	1.53

CALIB STANDHYD (0350) ID= 1 DT= 5.0 min	Area (ha)= 16.30 Total Imp(%)= 42.00 Dir. Conn.(%)= 21.00

		IMPERVIOUS	PERVIOUS (i)
Surface Area	(ha)=	6.85	9.45
Dep. Storage	(mm)=	1.50	5.00
Average Slope	(%)=	1.00	1.00
Length	(m)=	330.00	40.00
Mannings n	=	0.013	0.300

NOTE: RAINFALL WAS TRANSFORMED TO 5.0 MIN. TIME STEP.

---- TRANSFORMED HYETOGRAPH ----

TIME hrs	RAIN mm/hr	TIME hrs	RAIN mm/hr	TIME hrs	RAIN mm/hr	TIME hrs	RAIN mm/hr
0.083	1.84	3.083	2.94	6.083	13.24	9.08	2.58
0.167	1.84	3.167	2.94	6.167	13.24	9.17	2.58
0.250	1.84	3.250	2.94	6.250	13.24	9.25	2.57
0.333	1.84	3.333	2.94	6.333	13.24	9.33	2.58
0.417	1.84	3.417	2.94	6.417	13.24	9.42	2.58
0.500	1.84	3.500	2.94	6.500	13.24	9.50	2.58
0.583	1.84	3.583	2.94	6.583	5.89	9.58	2.57
0.667	1.84	3.667	2.94	6.667	5.89	9.67	2.58
0.750	1.84	3.750	2.94	6.750	5.89	9.75	2.58
0.833	1.84	3.833	2.94	6.833	5.89	9.83	2.57
0.917	1.84	3.917	2.94	6.917	5.89	9.92	2.58
1.000	1.84	4.000	2.94	7.000	5.88	10.00	2.58
1.083	1.84	4.083	4.41	7.083	4.41	10.08	1.47
1.167	1.84	4.167	4.41	7.167	4.41	10.17	1.47
1.250	1.84	4.250	4.41	7.250	4.41	10.25	1.47
1.333	1.84	4.333	4.41	7.333	4.41	10.33	1.47
1.417	1.84	4.417	4.41	7.417	4.41	10.42	1.47
1.500	1.84	4.500	4.41	7.500	4.41	10.50	1.47

1.583	1.84	4.583	5.88	7.583	4.41	10.58	1.47
1.667	1.84	4.667	5.89	7.667	4.41	10.67	1.47
1.750	1.84	4.750	5.89	7.750	4.41	10.75	1.47
1.833	1.84	4.833	5.89	7.833	4.41	10.83	1.47
1.917	1.84	4.917	5.89	7.917	4.41	10.92	1.47
2.000	1.84	5.000	5.89	8.000	4.41	11.00	1.47
2.083	2.21	5.083	8.83	8.083	2.58	11.08	1.47
2.167	2.21	5.167	8.83	8.167	2.58	11.17	1.47
2.250	2.21	5.250	8.83	8.250	2.57	11.25	1.47
2.333	2.21	5.333	8.83	8.333	2.58	11.33	1.47
2.417	2.21	5.417	8.83	8.417	2.58	11.42	1.47
2.500	2.21	5.500	8.83	8.500	2.57	11.50	1.47
2.583	2.21	5.583	35.31	8.583	2.58	11.58	1.47
2.667	2.21	5.667	35.31	8.667	2.58	11.67	1.47
2.750	2.21	5.750	35.31	8.750	2.57	11.75	1.47
2.833	2.21	5.833	97.10	8.833	2.58	11.83	1.47
2.917	2.21	5.917	97.10	8.917	2.58	11.92	1.47
3.000	2.21	6.000	97.10	9.000	2.57	12.00	1.47

Max.Eff.Inten.(mm/hr)=	97.10	119.40	
over (min)	5.00	15.00	
Storage Coeff. (min)=	5.29 (ii)	14.32 (ii)	
Unit Hyd. Tpeak (min)=	5.00	15.00	
Unit Hyd. peak (cms)=	0.21	0.08	
			TOTALS
PEAK FLOW (cms)=	0.89	1.82	2.485 (iii)
TIME TO PEAK (hrs)=	6.00	6.08	6.00
RUNOFF VOLUME (mm)=	72.06	26.53	36.09
TOTAL RAINFALL (mm)=	73.56	73.56	73.56
RUNOFF COEFFICIENT =	0.98	0.36	0.49

(i) HORTONS EQUATION SELECTED FOR PERVIOUS LOSSES:
Fo (mm/hr)= 75.00 K (1/hr)= 4.14
Fc (mm/hr)= 12.50 Cum.Inf. (mm)= 0.00
(ii) TIME STEP (DT) SHOULD BE SMALLER OR EQUAL
THAN THE STORAGE COEFFICIENT.
(iii) PEAK FLOW DOES NOT INCLUDE BASEFLOW IF ANY.

ROUTE CHN(0353)	
IN= 2---> OUT= 1	Routing time step (min)'= 5.00

<------ DATA FOR SECTION (1.1) ------>

Distance	Elevation	Manning	
0.00	0.26	0.0300	
5.50	0.15	0.0300 /0.0150	Main Channel
5.51	0.00	0.0150	Main Channel
10.00	0.09	0.0150	Main Channel

14.49	0.00	0.0150	Main Channel
14.50	0.15	0.0150 /0.0300	Main Channel
20.00	0.26	0.0300	

<-------------------- TRAVEL TIME TABLE ---------------------->

DEPTH (m)	ELEV (m)	VOLUME (cu.m.)	FLOW RATE (cms)	VELOCITY (m/s)	TRAV.TIME (min)
0.01	0.01	.929E+01	0.0	0.17	99.56
0.03	0.03	.372E+02	0.0	0.27	62.72
0.04	0.04	.836E+02	0.0	0.35	47.86
0.05	0.05	.149E+03	0.1	0.42	39.51
0.07	0.07	.232E+03	0.1	0.49	34.05
0.08	0.08	.334E+03	0.2	0.55	30.15
0.10	0.10	.454E+03	0.3	0.64	26.24
0.11	0.11	.576E+03	0.4	0.74	22.41
0.12	0.12	.699E+03	0.6	0.84	19.75
0.14	0.14	.822E+03	0.8	0.94	17.76
0.15	0.15	.944E+03	1.0	1.03	16.22
0.16	0.16	.108E+04	1.2	1.11	15.07
0.18	0.18	.123E+04	1.4	1.17	14.28
0.19	0.19	.140E+04	1.7	1.21	13.72
0.20	0.20	.159E+04	2.0	1.25	13.31
0.22	0.22	.180E+04	2.3	1.28	13.01
0.23	0.23	.203E+04	2.6	1.31	12.76
0.25	0.25	.227E+04	3.0	1.33	12.57
0.26	0.26	.254E+04	3.4	1.34	12.41

		<---- hydrograph ---->			<-pipe / channel->	
	AREA (ha)	QPEAK (cms)	TPEAK (hrs)	R.V. (mm)	MAX DEPTH (m)	MAX VEL (m/s)
INFLOW : ID= 2 (0350)	16.30	2.49	6.00	36.09	0.23	1.29
OUTFLOW: ID= 1 (0353)	16.30	1.83	6.17	36.06	0.20	1.23

CALIB STANDHYD (0355)	Area (ha)= 12.30		
ID= 1 DT= 5.0 min	Total Imp(%)= 42.00	Dir. Conn.(%)= 21.00	

		IMPERVIOUS	PERVIOUS (i)
Surface Area	(ha)=	5.17	7.13
Dep. Storage	(mm)=	1.50	5.00
Average Slope	(%)=	1.60	1.60
Length	(m)=	286.00	40.00
Mannings n	=	0.013	0.300

NOTE: RAINFALL WAS TRANSFORMED TO 5.0 MIN. TIME STEP.

---- TRANSFORMED HYETOGRAPH ----

TIME hrs	RAIN mm/hr	TIME hrs	RAIN mm/hr	TIME hrs	RAIN mm/hr	TIME hrs	RAIN mm/hr
0.083	1.84	3.083	2.94	6.083	13.24	9.08	2.58
0.167	1.84	3.167	2.94	6.167	13.24	9.17	2.58
0.250	1.84	3.250	2.94	6.250	13.24	9.25	2.57
0.333	1.84	3.333	2.94	6.333	13.24	9.33	2.58
0.417	1.84	3.417	2.94	6.417	13.24	9.42	2.58
0.500	1.84	3.500	2.94	6.500	13.24	9.50	2.58
0.583	1.84	3.583	2.94	6.583	5.89	9.58	2.57
0.667	1.84	3.667	2.94	6.667	5.89	9.67	2.58
0.750	1.84	3.750	2.94	6.750	5.89	9.75	2.58
0.833	1.84	3.833	2.94	6.833	5.89	9.83	2.57
0.917	1.84	3.917	2.94	6.917	5.89	9.92	2.58
1.000	1.84	4.000	2.94	7.000	5.88	10.00	2.58
1.083	1.84	4.083	4.41	7.083	4.41	10.08	1.47
1.167	1.84	4.167	4.41	7.167	4.41	10.17	1.47
1.250	1.84	4.250	4.41	7.250	4.41	10.25	1.47
1.333	1.84	4.333	4.41	7.333	4.41	10.33	1.47
1.417	1.84	4.417	4.41	7.417	4.41	10.42	1.47
1.500	1.84	4.500	4.41	7.500	4.41	10.50	1.47
1.583	1.84	4.583	5.88	7.583	4.41	10.58	1.47
1.667	1.84	4.667	5.89	7.667	4.41	10.67	1.47
1.750	1.84	4.750	5.89	7.750	4.41	10.75	1.47
1.833	1.84	4.833	5.89	7.833	4.41	10.83	1.47
1.917	1.84	4.917	5.89	7.917	4.41	10.92	1.47
2.000	1.84	5.000	5.89	8.000	4.41	11.00	1.47
2.083	2.21	5.083	8.83	8.083	2.58	11.08	1.47
2.167	2.21	5.167	8.83	8.167	2.58	11.17	1.47
2.250	2.21	5.250	8.83	8.250	2.57	11.25	1.47
2.333	2.21	5.333	8.83	8.333	2.58	11.33	1.47
2.417	2.21	5.417	8.83	8.417	2.58	11.42	1.47
2.500	2.21	5.500	8.83	8.500	2.57	11.50	1.47
2.583	2.21	5.583	35.31	8.583	2.58	11.58	1.47
2.667	2.21	5.667	35.31	8.667	2.58	11.67	1.47
2.750	2.21	5.750	35.31	8.750	2.57	11.75	1.47
2.833	2.21	5.833	97.10	8.833	2.58	11.83	1.47
2.917	2.21	5.917	97.10	8.917	2.58	11.92	1.47
3.000	2.21	6.000	97.10	9.000	2.57	12.00	1.47

Max.Eff.Inten.(mm/hr)=	97.10	119.40	
over (min)	5.00	15.00	
Storage Coeff. (min)=	4.22 (ii)	12.06 (ii)	
Unit Hyd. Tpeak (min)=	5.00	15.00	
Unit Hyd. peak (cms)=	0.24	0.09	
			TOTALS
PEAK FLOW (cms)=	0.68	1.49	2.015 (iii)
TIME TO PEAK (hrs)=	6.00	6.08	6.00
RUNOFF VOLUME (mm)=	72.06	26.53	36.09

```
     TOTAL RAINFALL   (mm)=      73.56        73.56          73.56
     RUNOFF COEFFICIENT   =       0.98         0.36           0.49

***** WARNING: STORAGE COEFF. IS SMALLER THAN TIME STEP!

       (i) HORTONS EQUATION SELECTED FOR PERVIOUS LOSSES:
            Fo   (mm/hr)= 75.00           K  (1/hr)=  4.14
            Fc   (mm/hr)= 12.50     Cum.Inf.   (mm)=  0.00
      (ii) TIME STEP (DT) SHOULD BE SMALLER OR EQUAL
           THAN THE STORAGE COEFFICIENT.
     (iii) PEAK FLOW DOES NOT INCLUDE BASEFLOW IF ANY.

--------------------------------------------------------------------------------
--------------------
| ROUTE CHN(  0358)|
| IN= 2---> OUT= 1 |     Routing time step (min)'=  5.00
--------------------
               <------ DATA FOR SECTION (   1.1) ------>
               Distance      Elevation       Manning
                   0.00          0.26        0.0300
                   5.50          0.15    0.0300 /0.0150  Main Channel
                   5.51          0.00        0.0150      Main Channel
                  10.00          0.09        0.0150      Main Channel
                  14.49          0.00        0.0150      Main Channel
                  14.50          0.15    0.0150 /0.0300  Main Channel
                  20.00          0.26        0.0300

      <---------------------- TRAVEL TIME TABLE ---------------------->
       DEPTH    ELEV      VOLUME    FLOW RATE    VELOCITY   TRAV.TIME
        (m)      (m)     (cu.m.)      (cms)        (m/s)      (min)
       0.01     0.01    .102E+02       0.0          0.17     109.52
       0.03     0.03    .409E+02       0.0          0.27      68.99
       0.04     0.04    .920E+02       0.0          0.35      52.65
       0.05     0.05    .163E+03       0.1          0.42      43.46
       0.07     0.07    .255E+03       0.1          0.49      37.45
       0.08     0.08    .368E+03       0.2          0.55      33.17
       0.10     0.10    .499E+03       0.3          0.64      28.86
       0.11     0.11    .634E+03       0.4          0.74      24.66
       0.12     0.12    .769E+03       0.6          0.84      21.72
       0.14     0.14    .904E+03       0.8          0.94      19.54
       0.15     0.15    .104E+04       1.0          1.03      17.84
       0.16     0.16    .119E+04       1.2          1.11      16.57
       0.18     0.18    .135E+04       1.4          1.17      15.71
       0.19     0.19    .154E+04       1.7          1.21      15.10
       0.20     0.20    .175E+04       2.0          1.25      14.65
       0.22     0.22    .198E+04       2.3          1.28      14.31
       0.23     0.23    .223E+04       2.6          1.31      14.04
       0.25     0.25    .250E+04       3.0          1.33      13.82
       0.26     0.26    .279E+04       3.4          1.34      13.65
```

```
                                      <---- hydrograph ---->   <-pipe / channel->
                                AREA    QPEAK   TPEAK   R.V.   MAX DEPTH  MAX VEL
                                (ha)    (cms)   (hrs)   (mm)      (m)      (m/s)
   INFLOW : ID= 2 (  0355)   12.30     2.02    6.00  36.09      0.21      1.25
   OUTFLOW: ID= 1 (  0358)   12.30     1.38    6.17  36.04      0.17      1.15



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

--------------------
| ADD HYD  (  0359)|
|   1 +  2 =  3    |         AREA    QPEAK    TPEAK     R.V.
--------------------         (ha)    (cms)    (hrs)     (mm)
       ID1= 1 (  0353):    16.30   1.826     6.17    36.06
     + ID2= 2 (  0358):    12.30   1.378     6.17    36.04
       ================================================
       ID = 3 (  0359):    28.60   3.204     6.17    36.05

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

--------------------
| ADD HYD  (  0363)|
|   1 +  2 =  3    |         AREA    QPEAK    TPEAK     R.V.
--------------------         (ha)    (cms)    (hrs)     (mm)
       ID1= 1 (  0359):    28.60   3.204     6.17    36.05
     + ID2= 2 (  0362):    30.00   3.642     6.17    34.39
       ================================================
       ID = 3 (  0363):    58.60   6.846     6.17    35.20

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

--------------------
| ADD HYD  (  0380)|
|   1 +  2 =  3    |         AREA    QPEAK    TPEAK     R.V.
--------------------         (ha)    (cms)    (hrs)     (mm)
       ID1= 1 (  0363):    58.60   6.846     6.17    35.20
     + ID2= 2 (  0365):   117.50  16.238     6.08    36.09
       ================================================
       ID = 3 (  0380):   176.10  22.579     6.08    35.79

     NOTE:  PEAK FLOWS DO NOT INCLUDE BASEFLOWS IF ANY.
--------------------------------------------------------------------------------
--------------------
| RESERVOIR(  0390)|     OVERFLOW IS OFF
| IN= 2---> OUT= 1 |
| DT=  5.0 min     |     OUTFLOW    STORAGE   |  OUTFLOW    STORAGE
--------------------      (cms)     (ha.m.)   |   (cms)     (ha.m.)
```

```
                          0.0000     0.0000   |   1.3100      1.6000
                          0.7700     0.2870   |   1.8600     23.2300
                          1.2600     0.9680   |   0.0000      0.0000

                                AREA     QPEAK     TPEAK       R.V.
                                (ha)     (cms)     (hrs)       (mm)
   INFLOW : ID= 2 (  0380)    176.100     22.579      6.08      35.79
   OUTFLOW: ID= 1 (  0390)    176.100      1.387      7.17      35.79

                  PEAK   FLOW   REDUCTION [Qout/Qin](%)=  6.14
                  TIME SHIFT OF PEAK FLOW         (min)= 65.00
                  MAXIMUM  STORAGE   USED       (ha.m.)=  4.6291

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

--------------------
| ADD HYD  (  0400)|
|   1 +  2 =  3    |         AREA    QPEAK    TPEAK     R.V.
--------------------         (ha)    (cms)    (hrs)     (mm)
        ID1= 1 (  0390):   176.10   1.387     7.17    35.79
      + ID2= 2 (  0395):    51.20   5.668     6.17    23.89
        ====================================================
        ID = 3 (  0400):   227.30   6.995     6.17    33.11

     NOTE:  PEAK FLOWS DO NOT INCLUDE BASEFLOWS IF ANY.
--------------------------------------------------------------------------------
--------------------
| ROUTE CHN(  0403)|
| IN= 2---> OUT= 1 |     Routing time step (min)'=  5.00
--------------------
               <------ DATA FOR SECTION (   1.1) ------>
               Distance      Elevation       Manning
                 100.00        338.30        0.0500
                 110.00        336.80        0.0500
                 135.00        336.00        0.0300      Main Channel
                 142.00        335.30        0.0500
                 148.00        335.30        0.0500
                 156.00        336.00        0.0500
                 165.00        338.30        0.0500

      <---------------------- TRAVEL TIME TABLE ---------------------->
       DEPTH    ELEV      VOLUME    FLOW RATE    VELOCITY   TRAV.TIME
        (m)      (m)     (cu.m.)      (cms)        (m/s)      (min)
       0.16   335.46    .231E+04       0.9          0.71      44.52
       0.32   335.62    .563E+04       3.2          1.09      29.11
       0.47   335.77    .997E+04       7.3          1.39      22.72
       0.63   335.93    .153E+05      13.4          1.66      19.04
       0.79   336.09    .218E+05      22.7          1.97      16.04
       0.95   336.25    .299E+05      35.3          2.25      14.10
       1.11   336.41    .396E+05      51.2          2.46      12.89
```

1.26	336.56	.510E+05	70.7	2.63	12.02
1.42	336.72	.641E+05	94.1	2.79	11.35
1.58	336.88	.787E+05	122.4	2.96	10.71
1.74	337.04	.939E+05	155.6	3.15	10.06
1.89	337.19	.110E+06	192.8	3.34	9.48
2.05	337.35	.126E+06	233.9	3.53	8.97
2.21	337.51	.143E+06	278.9	3.71	8.53
2.37	337.67	.160E+06	327.7	3.89	8.13
2.53	337.83	.178E+06	380.3	4.07	7.79
2.68	337.98	.196E+06	436.7	4.23	7.48
2.84	338.14	.215E+06	496.9	4.40	7.20
3.00	338.30	.234E+06	561.0	4.56	6.95

	<---- hydrograph ---->			<-pipe / channel->	
	AREA	QPEAK	TPEAK	R.V.	MAX DEPTH	MAX VEL
	(ha)	(cms)	(hrs)	(mm)	(m)	(m/s)
INFLOW : ID= 2 (0400)	227.30	7.00	6.17	33.11	0.46	1.36
OUTFLOW: ID= 1 (0403)	227.30	4.32	6.33	33.11	0.36	1.16

ADD HYD (0407)				
1 + 2 = 3	AREA	QPEAK	TPEAK	R.V.
	(ha)	(cms)	(hrs)	(mm)
ID1= 1 (0115):	100.96	10.422	6.17	36.08
+ ID2= 2 (0403):	227.30	4.324	6.33	33.11
ID = 3 (0407):	328.26	13.657	6.17	34.03

NOTE: PEAK FLOWS DO NOT INCLUDE BASEFLOWS IF ANY.

RESERVOIR(0113) / IN= 2---> OUT= 1 / DT= 5.0 min	OVERFLOW IS OFF			
	OUTFLOW (cms)	STORAGE (ha.m.)	OUTFLOW (cms)	STORAGE (ha.m.)
	0.0000	0.0000	1.6000	6.4000
	1.1000	2.9000	9.1000	10.0000
	1.3000	4.3000	12.0000	20.0000

	AREA	QPEAK	TPEAK	R.V.
	(ha)	(cms)	(hrs)	(mm)
INFLOW : ID= 2 (0407)	328.260	13.657	6.17	34.03
OUTFLOW: ID= 1 (0113)	328.260	1.367	15.17	34.02

PEAK FLOW REDUCTION [Qout/Qin](%)= 10.01
TIME SHIFT OF PEAK FLOW (min)=540.00

MAXIMUM STORAGE USED (ha.m.)= 4.7719

ADD HYD (0430)					
1 + 2 = 3		AREA	QPEAK	TPEAK	R.V.
		(ha)	(cms)	(hrs)	(mm)
ID1= 1 (0113):		328.26	1.367	15.17	34.02
+ ID2= 2 (0425):		21.68	1.980	5.83	36.09
ID = 3 (0430):		349.94	2.494	6.25	34.15

NOTE: PEAK FLOWS DO NOT INCLUDE BASEFLOWS IF ANY.

ROUTE CHN(0440)		
IN= 2---> OUT= 1	Routing time step (min)'=	5.00

<------ DATA FOR SECTION (1.1) ------>

Distance	Elevation	Manning	
100.00	325.40	0.0600	
120.00	324.60	0.0600	
126.00	323.90	0.0600	
130.00	323.00	0.0600	
140.00	322.30	0.0600 /0.0300	Main Channel
142.00	322.30	0.0300 /0.0600	Main Channel
150.00	323.90	0.0600	
155.00	324.60	0.0600	
160.00	325.40	0.0600	

<---------- TRAVEL TIME TABLE ---------->

DEPTH (m)	ELEV (m)	VOLUME (cu.m.)	FLOW RATE (cms)	VELOCITY (m/s)	TRAV.TIME (min)
0.16	322.46	.233E+03	0.6	0.96	6.96
0.33	322.63	.672E+03	2.1	1.26	5.27
0.49	322.79	.132E+04	4.9	1.48	4.51
0.65	322.95	.216E+04	9.0	1.66	4.03
0.82	323.12	.319E+04	14.9	1.87	3.57
0.98	323.28	.433E+04	22.5	2.08	3.21
1.14	323.44	.556E+04	31.6	2.27	2.93
1.31	323.61	.689E+04	42.3	2.45	2.72
1.47	323.77	.833E+04	54.6	2.62	2.54
1.63	323.93	.987E+04	68.3	2.77	2.41
1.79	324.09	.115E+05	82.8	2.87	2.33
1.96	324.26	.134E+05	99.2	2.96	2.25
2.12	324.42	.154E+05	117.9	3.06	2.18
2.28	324.58	.176E+05	138.8	3.15	2.11
2.45	324.75	.200E+05	157.4	3.14	2.12
2.61	324.91	.228E+05	179.6	3.15	2.11

```
       2.77   325.07    .259E+05     205.8          3.18       2.09
       2.94   325.24    .293E+05     236.1          3.23       2.07
       3.10   325.40    .330E+05     270.6          3.28       2.03

                                    <---- hydrograph ---->   <-pipe / channel->
                              AREA    QPEAK   TPEAK   R.V.   MAX DEPTH  MAX VEL
                              (ha)    (cms)   (hrs)   (mm)      (m)      (m/s)
   INFLOW : ID= 2 (  0430)  349.94     2.49    6.25  34.15      0.35      1.29
   OUTFLOW: ID= 1 (  0440)  349.94     2.40    6.33  34.15      0.34      1.28



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

--------------------
| ADD HYD  (  0485)|
|   1 +  2 =  3    |         AREA    QPEAK    TPEAK     R.V.
--------------------         (ha)    (cms)    (hrs)     (mm)
        ID1= 1 (  0440):   349.94   2.403     6.33    34.15
      + ID2= 2 (  0475):    56.21   9.543     6.08    36.09
        ================================================
        ID = 3 (  0485):   406.15  11.718     6.08    34.42

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

--------------------
| ADD HYD  (  0490)|
|   1 +  2 =  3    |         AREA    QPEAK    TPEAK     R.V.
--------------------         (ha)    (cms)    (hrs)     (mm)
        ID1= 1 (  0480):    43.10   6.559     6.00    36.09
      + ID2= 2 (  0485):   406.15  11.718     6.08    34.42
        ================================================
        ID = 3 (  0490):   449.25  17.844     6.08    34.58

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

--------------------
| ADD HYD  (  0491)|
|   1 +  2 =  3    |         AREA    QPEAK    TPEAK     R.V.
--------------------         (ha)    (cms)    (hrs)     (mm)
        ID1= 1 (  0482):    22.65   1.561     6.25    44.91
      + ID2= 2 (  0490):   449.25  17.844     6.08    34.58
        ================================================
        ID = 3 (  0491):   471.90  18.145     6.08    35.08

     NOTE:  PEAK FLOWS DO NOT INCLUDE BASEFLOWS IF ANY.
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```
| RESERVOIR(  0483)|     OVERFLOW IS OFF
| IN= 2---> OUT= 1 |
| DT=  5.0 min     |     OUTFLOW    STORAGE   |  OUTFLOW    STORAGE
--------------------      (cms)     (ha.m.)   |   (cms)     (ha.m.)
                          0.0000     0.0000   |   7.0800      2.4860
                          0.2760     0.0600   |   8.1000      3.3240
                          1.2000     0.3400   |   9.7980      4.6420
                          2.0400     0.6182   |  10.4940      7.4397
                          2.6400     1.1630   |  11.6850     10.3000
                          3.1200     1.7070   |  12.3480     11.4000

                                AREA     QPEAK     TPEAK       R.V.
                                (ha)     (cms)     (hrs)       (mm)
   INFLOW : ID= 2 (  0491)    471.900     18.145      6.08      35.08
   OUTFLOW: ID= 1 (  0483)    471.900      7.074      6.50      35.08

                   PEAK   FLOW   REDUCTION [Qout/Qin](%)= 38.99
                   TIME SHIFT OF PEAK FLOW         (min)= 25.00
                   MAXIMUM  STORAGE   USED       (ha.m.)=  2.4870

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

--------------------
| ADD HYD  (  0530)|
|   1 +  2 =  3    |         AREA    QPEAK    TPEAK     R.V.
--------------------         (ha)    (cms)    (hrs)     (mm)
        ID1= 1 (  0483):   471.90   7.074     6.50    35.08
      + ID2= 2 (  0540):     4.63   1.036     6.00    61.38
        ====================================================
        ID = 3 (  0530):   476.53   7.249     6.50    35.33

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

--------------------
| ADD HYD  (  0545)|
|   1 +  2 =  3    |         AREA    QPEAK    TPEAK     R.V.
--------------------         (ha)    (cms)    (hrs)     (mm)
        ID1= 1 (  0527):    74.79   8.318     6.25   213.37
      + ID2= 2 (  0530):   476.53   7.249     6.50    35.33
        ====================================================
        ID = 3 (  0545):   551.32  15.337     6.50    59.48

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

--------------------
| ADD HYD  (  0546)|
|   1 +  2 =  3    |         AREA    QPEAK    TPEAK     R.V.
--------------------         (ha)    (cms)    (hrs)     (mm)
```

```
        ID1= 1 (  0542):    25.25   5.333     6.00    61.38
      + ID2= 2 (  0545):   551.32  15.337     6.50    59.48
        ================================================
        ID = 3 (  0546):   576.57  16.404     6.42    59.57

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

--------------------
| ADD HYD  (  0547)|
|   1 +  2 =  3    |         AREA    QPEAK    TPEAK     R.V.
--------------------         (ha)    (cms)    (hrs)     (mm)
        ID1= 1 (  0543):    14.99   3.310     6.00    61.38
      + ID2= 2 (  0546):   576.57  16.404     6.42    59.57
        ================================================
        ID = 3 (  0547):   591.56  19.360     6.00    59.61

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

--------------------
| ADD HYD  (  0548)|
|   1 +  2 =  3    |         AREA    QPEAK    TPEAK     R.V.
--------------------         (ha)    (cms)    (hrs)     (mm)
        ID1= 1 (  0544):     1.13   0.266     6.00    61.38
      + ID2= 2 (  0547):   591.56  19.360     6.00    59.61
        ================================================
        ID = 3 (  0548):   592.69  19.625     6.00    59.62

     NOTE:  PEAK FLOWS DO NOT INCLUDE BASEFLOWS IF ANY.
------------------------------------------------------------------------------
--------------------
| ROUTE CHN(  0564)|
| IN= 2---> OUT= 1 |     Routing time step (min)'=  5.00
--------------------
               <------ DATA FOR SECTION (   1.1) ------>
               Distance      Elevation       Manning
                   0.00        101.50        0.0500
                   1.00        100.70        0.0500
                   1.50        100.55    0.0500 /0.0300  Main Channel
                   2.00         99.50        0.0300      Main Channel
                   3.50         99.60        0.0300      Main Channel
                   4.50        100.65    0.0300 /0.0500  Main Channel
                   6.00        101.45        0.0500

      <--------------------- TRAVEL TIME TABLE ---------------------->
       DEPTH    ELEV      VOLUME    FLOW RATE    VELOCITY   TRAV.TIME
        (m)      (m)     (cu.m.)      (cms)        (m/s)      (min)
       0.10    99.60    .353E+02       0.0          0.19      43.69
       0.19    99.69    .112E+03       0.1          0.37      22.76
```

```
       0.29    99.79    .195E+03       0.2          0.49      17.03
       0.38    99.88    .285E+03       0.3          0.59      14.23
       0.48    99.98    .381E+03       0.5          0.67      12.51
       0.57   100.07    .484E+03       0.7          0.74      11.32
       0.67   100.17    .594E+03       0.9          0.80      10.43
       0.76   100.26    .710E+03       1.2          0.86       9.74
       0.86   100.36    .832E+03       1.5          0.91       9.18
       0.95   100.45    .961E+03       1.8          0.96       8.72
       1.05   100.55    .110E+04       2.2          1.00       8.32
       1.16   100.66    .127E+04       2.7          1.07       7.80
       1.28   100.78    .148E+04       3.4          1.14       7.31
       1.39   100.89    .170E+04       4.1          1.20       6.94
       1.50   101.00    .195E+04       4.9          1.25       6.65
       1.61   101.11    .221E+04       5.8          1.30       6.41
       1.72   101.22    .250E+04       6.7          1.34       6.22
       1.84   101.34    .280E+04       7.7          1.38       6.04
       1.95   101.45    .313E+04       8.8          1.41       5.90

     **** WARNING:  TRAVEL TIME TABLE EXCEEDED
                                  <---- hydrograph ---->   <-pipe / channel->
                             AREA    QPEAK   TPEAK   R.V.   MAX DEPTH  MAX VEL
                             (ha)    (cms)   (hrs)   (mm)      (m)      (m/s)
   INFLOW : ID= 2 (  0505)   81.12    18.66    6.17  38.44      1.72      1.34
   OUTFLOW: ID= 1 (  0564)   81.12    28.30    6.50  38.44      1.95      1.41


     **** WARNING:  COMPUTATIONS FAILED TO CONVERGE.

--------------------------------------------------------------------------------
================================================================================
=======================

       V    V   I    SSSSS  U   U    A    L              (v 6.2.2007)
       V    V   I    SS     U   U   A A   L
        V  V    I     SS    U   U  AAAAA  L
        V  V    I      SS   U   U  A   A  L
         VV     I    SSSSS  UUUUU  A   A  LLLLL

        OOO   TTTTT  TTTTT  H   H  Y   Y  M   M   OOO    TM
       O   O    T      T    H   H   Y Y   MM MM  O   O
       O   O    T      T    H   H    Y    M   M  O   O
        OOO     T      T    H   H    Y    M   M   OOO
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                  *****  D E T A I L E D   O U T P U T *****
```

```
  Input   filename: C:\Program Files (x86)\Visual OTTHYMO 6.2\VO2\voin.dat

  Output  filename:
C:\Users\szaga\AppData\Local\Civica\VH5\755e78af-23fe-400e-9cfe-54285a1c407c\0c54c57
7-2d33-47c9-8f0f-1c42cabb82dd\scenar
  Summary filename:
C:\Users\szaga\AppData\Local\Civica\VH5\755e78af-23fe-400e-9cfe-54285a1c407c\0c54c57
7-2d33-47c9-8f0f-1c42cabb82dd\scenar


DATE: 02/17/2023                          TIME: 03:33:49

USER:



COMMENTS: _____________________________________________________________

--------------------------------------------------------------------------------
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  ***********************************************
  ** SIMULATION : Hadati Creek Watershed - Post **
  ***********************************************


--------------------
|    READ STORM    |    Filename: C:\Users\szaga\AppD
|                  |              ata\Local\Temp\
|                  |              3ddd6580-52dc-4449-bccd-814fa38467d3\6877d551
| Ptotal= 90.18 mm |    Comments: 100 year SCS Type II 12hr design storm
--------------------
                TIME    RAIN |  TIME    RAIN |'  TIME    RAIN |  TIME    RAIN
                 hrs   mm/hr |   hrs   mm/hr |'   hrs   mm/hr |   hrs   mm/hr
                0.00    2.26 |  3.00    3.61 |  6.00   16.23 |  9.00    3.16
                0.25    2.26 |  3.25    3.61 |  6.25   16.23 |  9.25    3.16
                0.50    2.26 |  3.50    3.61 |  6.50    7.21 |  9.50    3.16
                0.75    2.26 |  3.75    3.61 |  6.75    7.21 |  9.75    3.16
                1.00    2.26 |  4.00    5.41 |  7.00    5.41 | 10.00    1.80
                1.25    2.26 |  4.25    5.41 |  7.25    5.41 | 10.25    1.80
                1.50    2.26 |  4.50    7.21 |  7.50    5.41 | 10.50    1.80
                1.75    2.26 |  4.75    7.21 |  7.75    5.41 | 10.75    1.80
                2.00    2.70 |  5.00   10.82 |  8.00    3.16 | 11.00    1.80
                2.25    2.70 |  5.25   10.82 |  8.25    3.16 | 11.25    1.80
                2.50    2.70 |  5.50   43.29 |  8.50    3.16 | 11.50    1.80
                2.75    2.70 |  5.75  119.04 |  8.75    3.16 | 11.75    1.80

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CALIB	
STANDHYD (0544)	Area (ha)= 1.13
ID= 1 DT= 5.0 min	Total Imp(%)= 80.00 Dir. Conn.(%)= 79.00

		IMPERVIOUS	PERVIOUS (i)
Surface Area	(ha)=	0.90	0.23
Dep. Storage	(mm)=	1.50	5.00
Average Slope	(%)=	0.55	0.55
Length	(m)=	50.00	40.00
Mannings n	=	0.013	0.300

NOTE: RAINFALL WAS TRANSFORMED TO 5.0 MIN. TIME STEP.

---- TRANSFORMED HYETOGRAPH ----

TIME hrs	RAIN mm/hr	TIME hrs	RAIN mm/hr	TIME hrs	RAIN mm/hr	TIME hrs	RAIN mm/hr
0.083	2.26	3.083	3.61	6.083	16.23	9.08	3.16
0.167	2.26	3.167	3.61	6.167	16.23	9.17	3.16
0.250	2.26	3.250	3.61	6.250	16.23	9.25	3.16
0.333	2.26	3.333	3.61	6.333	16.23	9.33	3.16
0.417	2.26	3.417	3.61	6.417	16.23	9.42	3.16
0.500	2.26	3.500	3.61	6.500	16.23	9.50	3.16
0.583	2.26	3.583	3.61	6.583	7.21	9.58	3.16
0.667	2.26	3.667	3.61	6.667	7.21	9.67	3.16
0.750	2.26	3.750	3.61	6.750	7.21	9.75	3.16
0.833	2.25	3.833	3.61	6.833	7.21	9.83	3.16
0.917	2.26	3.917	3.61	6.917	7.21	9.92	3.16
1.000	2.26	4.000	3.61	7.000	7.21	10.00	3.16
1.083	2.25	4.083	5.41	7.083	5.41	10.08	1.80
1.167	2.26	4.167	5.41	7.167	5.41	10.17	1.80
1.250	2.26	4.250	5.41	7.250	5.41	10.25	1.80
1.333	2.26	4.333	5.41	7.333	5.41	10.33	1.80
1.417	2.26	4.417	5.41	7.417	5.41	10.42	1.80
1.500	2.26	4.500	5.41	7.500	5.41	10.50	1.80
1.583	2.26	4.583	7.21	7.583	5.41	10.58	1.80
1.667	2.26	4.667	7.21	7.667	5.41	10.67	1.80
1.750	2.26	4.750	7.21	7.750	5.41	10.75	1.80
1.833	2.26	4.833	7.21	7.833	5.41	10.83	1.80
1.917	2.26	4.917	7.21	7.917	5.41	10.92	1.80
2.000	2.26	5.000	7.21	8.000	5.41	11.00	1.80
2.083	2.70	5.083	10.82	8.083	3.16	11.08	1.80
2.167	2.70	5.167	10.82	8.167	3.16	11.17	1.80
2.250	2.70	5.250	10.82	8.250	3.16	11.25	1.80
2.333	2.70	5.333	10.82	8.333	3.16	11.33	1.80
2.417	2.70	5.417	10.82	8.417	3.16	11.42	1.80
2.500	2.70	5.500	10.82	8.500	3.16	11.50	1.80
2.583	2.70	5.583	43.29	8.583	3.16	11.58	1.80
2.667	2.70	5.667	43.29	8.667	3.16	11.67	1.80
2.750	2.70	5.750	43.29	8.750	3.16	11.75	1.80

2.833	2.70	5.833	119.04	8.833	3.16	11.83	1.80
2.917	2.70	5.917	119.04	8.917	3.16	11.92	1.80
3.000	2.70	6.000	119.04	9.000	3.16	12.00	1.80

Max.Eff.Inten.(mm/hr)=	119.04	111.85	
over (min)	5.00	15.00	
Storage Coeff. (min)=	1.88 (ii)	12.97 (ii)	
Unit Hyd. Tpeak (min)=	5.00	15.00	
Unit Hyd. peak (cms)=	0.32	0.08	
			TOTALS
PEAK FLOW (cms)=	0.30	0.04	0.333 (iii)
TIME TO PEAK (hrs)=	6.00	6.08	6.00
RUNOFF VOLUME (mm)=	88.68	31.37	76.65
TOTAL RAINFALL (mm)=	90.18	90.18	90.18
RUNOFF COEFFICIENT =	0.98	0.35	0.85

***** WARNING: STORAGE COEFF. IS SMALLER THAN TIME STEP!

(i) HORTONS EQUATION SELECTED FOR PERVIOUS LOSSES:
Fo (mm/hr)= 75.00 K (1/hr)= 4.14
Fc (mm/hr)= 12.50 Cum.Inf. (mm)= 0.00
(ii) TIME STEP (DT) SHOULD BE SMALLER OR EQUAL
THAN THE STORAGE COEFFICIENT.
(iii) PEAK FLOW DOES NOT INCLUDE BASEFLOW IF ANY.

CALIB
STANDHYD (0543)
ID= 1 DT= 5.0 min

Area (ha)= 14.99
Total Imp(%)= 80.00 Dir. Conn.(%)= 79.00

		IMPERVIOUS	PERVIOUS (i)
Surface Area	(ha)=	11.99	3.00
Dep. Storage	(mm)=	1.50	5.00
Average Slope	(%)=	0.55	0.55
Length	(m)=	200.00	40.00
Mannings n	=	0.013	0.300

NOTE: RAINFALL WAS TRANSFORMED TO 5.0 MIN. TIME STEP.

---- TRANSFORMED HYETOGRAPH ----

TIME hrs	RAIN mm/hr	TIME hrs	RAIN mm/hr	TIME hrs	RAIN mm/hr	TIME hrs	RAIN mm/hr
0.083	2.26	3.083	3.61	6.083	16.23	9.08	3.16
0.167	2.26	3.167	3.61	6.167	16.23	9.17	3.16
0.250	2.26	3.250	3.61	6.250	16.23	9.25	3.16
0.333	2.26	3.333	3.61	6.333	16.23	9.33	3.16
0.417	2.26	3.417	3.61	6.417	16.23	9.42	3.16
0.500	2.26	3.500	3.61	6.500	16.23	9.50	3.16

0.583	2.26	3.583	3.61	6.583	7.21	9.58	3.16
0.667	2.26	3.667	3.61	6.667	7.21	9.67	3.16
0.750	2.26	3.750	3.61	6.750	7.21	9.75	3.16
0.833	2.25	3.833	3.61	6.833	7.21	9.83	3.16
0.917	2.26	3.917	3.61	6.917	7.21	9.92	3.16
1.000	2.26	4.000	3.61	7.000	7.21	10.00	3.16
1.083	2.25	4.083	5.41	7.083	5.41	10.08	1.80
1.167	2.26	4.167	5.41	7.167	5.41	10.17	1.80
1.250	2.26	4.250	5.41	7.250	5.41	10.25	1.80
1.333	2.26	4.333	5.41	7.333	5.41	10.33	1.80
1.417	2.26	4.417	5.41	7.417	5.41	10.42	1.80
1.500	2.26	4.500	5.41	7.500	5.41	10.50	1.80
1.583	2.26	4.583	7.21	7.583	5.41	10.58	1.80
1.667	2.26	4.667	7.21	7.667	5.41	10.67	1.80
1.750	2.26	4.750	7.21	7.750	5.41	10.75	1.80
1.833	2.26	4.833	7.21	7.833	5.41	10.83	1.80
1.917	2.26	4.917	7.21	7.917	5.41	10.92	1.80
2.000	2.26	5.000	7.21	8.000	5.41	11.00	1.80
2.083	2.70	5.083	10.82	8.083	3.16	11.08	1.80
2.167	2.70	5.167	10.82	8.167	3.16	11.17	1.80
2.250	2.70	5.250	10.82	8.250	3.16	11.25	1.80
2.333	2.70	5.333	10.82	8.333	3.16	11.33	1.80
2.417	2.70	5.417	10.82	8.417	3.16	11.42	1.80
2.500	2.70	5.500	10.82	8.500	3.16	11.50	1.80
2.583	2.70	5.583	43.29	8.583	3.16	11.58	1.80
2.667	2.70	5.667	43.29	8.667	3.16	11.67	1.80
2.750	2.70	5.750	43.29	8.750	3.16	11.75	1.80
2.833	2.70	5.833	119.04	8.833	3.16	11.83	1.80
2.917	2.70	5.917	119.04	8.917	3.16	11.92	1.80
3.000	2.70	6.000	119.04	9.000	3.16	12.00	1.80

Max.Eff.Inten.(mm/hr)=	119.04	111.85	
over (min)	5.00	20.00	
Storage Coeff. (min)=	4.32 (ii)	15.41 (ii)	
Unit Hyd. Tpeak (min)=	5.00	20.00	
Unit Hyd. peak (cms)=	0.23	0.07	
			TOTALS
PEAK FLOW (cms)=	3.84	0.48	4.164 (iii)
TIME TO PEAK (hrs)=	6.00	6.17	6.00
RUNOFF VOLUME (mm)=	88.68	31.37	76.65
TOTAL RAINFALL (mm)=	90.18	90.18	90.18
RUNOFF COEFFICIENT =	0.98	0.35	0.85

***** WARNING: STORAGE COEFF. IS SMALLER THAN TIME STEP!

(i) HORTONS EQUATION SELECTED FOR PERVIOUS LOSSES:
Fo (mm/hr)= 75.00 K (1/hr)= 4.14
Fc (mm/hr)= 12.50 Cum.Inf. (mm)= 0.00
(ii) TIME STEP (DT) SHOULD BE SMALLER OR EQUAL
THAN THE STORAGE COEFFICIENT.

(iii) PEAK FLOW DOES NOT INCLUDE BASEFLOW IF ANY.

CALIB STANDHYD (0542) ID= 1 DT= 5.0 min	Area (ha)= 25.25 Total Imp(%)= 80.00 Dir. Conn.(%)= 79.00

		IMPERVIOUS	PERVIOUS (i)
Surface Area	(ha)=	20.20	5.05
Dep. Storage	(mm)=	1.50	5.00
Average Slope	(%)=	0.55	0.55
Length	(m)=	350.00	40.00
Mannings n	=	0.013	0.300

NOTE: RAINFALL WAS TRANSFORMED TO 5.0 MIN. TIME STEP.

---- TRANSFORMED HYETOGRAPH ----

TIME hrs	RAIN mm/hr	TIME hrs	RAIN mm/hr	TIME hrs	RAIN mm/hr	TIME hrs	RAIN mm/hr
0.083	2.26	3.083	3.61	6.083	16.23	9.08	3.16
0.167	2.26	3.167	3.61	6.167	16.23	9.17	3.16
0.250	2.26	3.250	3.61	6.250	16.23	9.25	3.16
0.333	2.26	3.333	3.61	6.333	16.23	9.33	3.16
0.417	2.26	3.417	3.61	6.417	16.23	9.42	3.16
0.500	2.26	3.500	3.61	6.500	16.23	9.50	3.16
0.583	2.26	3.583	3.61	6.583	7.21	9.58	3.16
0.667	2.26	3.667	3.61	6.667	7.21	9.67	3.16
0.750	2.26	3.750	3.61	6.750	7.21	9.75	3.16
0.833	2.25	3.833	3.61	6.833	7.21	9.83	3.16
0.917	2.26	3.917	3.61	6.917	7.21	9.92	3.16
1.000	2.26	4.000	3.61	7.000	7.21	10.00	3.16
1.083	2.25	4.083	5.41	7.083	5.41	10.08	1.80
1.167	2.26	4.167	5.41	7.167	5.41	10.17	1.80
1.250	2.26	4.250	5.41	7.250	5.41	10.25	1.80
1.333	2.26	4.333	5.41	7.333	5.41	10.33	1.80
1.417	2.26	4.417	5.41	7.417	5.41	10.42	1.80
1.500	2.26	4.500	5.41	7.500	5.41	10.50	1.80
1.583	2.26	4.583	7.21	7.583	5.41	10.58	1.80
1.667	2.26	4.667	7.21	7.667	5.41	10.67	1.80
1.750	2.26	4.750	7.21	7.750	5.41	10.75	1.80
1.833	2.26	4.833	7.21	7.833	5.41	10.83	1.80
1.917	2.26	4.917	7.21	7.917	5.41	10.92	1.80
2.000	2.26	5.000	7.21	8.000	5.41	11.00	1.80
2.083	2.70	5.083	10.82	8.083	3.16	11.08	1.80
2.167	2.70	5.167	10.82	8.167	3.16	11.17	1.80
2.250	2.70	5.250	10.82	8.250	3.16	11.25	1.80
2.333	2.70	5.333	10.82	8.333	3.16	11.33	1.80
2.417	2.70	5.417	10.82	8.417	3.16	11.42	1.80

```
                2.500    2.70 | 5.500   10.82 | 8.500    3.16 | 11.50    1.80
                2.583    2.70 | 5.583   43.29 | 8.583    3.16 | 11.58    1.80
                2.667    2.70 | 5.667   43.29 | 8.667    3.16 | 11.67    1.80
                2.750    2.70 | 5.750   43.29 | 8.750    3.16 | 11.75    1.80
                2.833    2.70 | 5.833  119.04 | 8.833    3.16 | 11.83    1.80
                2.917    2.70 | 5.917  119.04 | 8.917    3.16 | 11.92    1.80
                3.000    2.70 | 6.000  119.04 | 9.000    3.16 | 12.00    1.80

     Max.Eff.Inten.(mm/hr)=     119.04       111.85
               over (min)        5.00        20.00
     Storage Coeff.  (min)=       6.05 (ii)   17.13 (ii)
     Unit Hyd. Tpeak (min)=       5.00        20.00
     Unit Hyd. peak  (cms)=       0.19         0.06
                                                          *TOTALS*
     PEAK FLOW       (cms)=       6.23         0.77          6.749 (iii)
     TIME TO PEAK    (hrs)=       6.00         6.17           6.00
     RUNOFF VOLUME    (mm)=      88.68        31.37          76.65
     TOTAL RAINFALL   (mm)=      90.18        90.18          90.18
     RUNOFF COEFFICIENT   =       0.98         0.35           0.85


       (i) HORTONS EQUATION SELECTED FOR PERVIOUS LOSSES:
            Fo   (mm/hr)= 75.00           K  (1/hr)=  4.14
            Fc   (mm/hr)= 12.50     Cum.Inf.   (mm)=  0.00
      (ii) TIME STEP (DT) SHOULD BE SMALLER OR EQUAL
           THAN THE STORAGE COEFFICIENT.
     (iii) PEAK FLOW DOES NOT INCLUDE BASEFLOW IF ANY.

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--------------------
| STORE HYD(  0525)|   AREA       (ha)=   0.00
| ID= 1 DT=****min |   QPEAK     (cms)=   2.00
--------------------   TPEAK     (hrs)=  24.00
                       VOLUME     (mm)=*******

  TIME    FLOW |  TIME    FLOW |  TIME    FLOW |'  TIME    FLOW |  TIME    FLOW
   hrs     cms |   hrs     cms |   hrs     cms |'   hrs     cms |   hrs     cms
  0.00    1.00 | 24.00    2.00 |
--------------------------------------------------------------------------------
--------------------
| CALIB            |
| STANDHYD (  0510)|   Area    (ha)=  16.00
|ID= 1 DT= 5.0 min |   Total Imp(%)=  80.00   Dir. Conn.(%)=  79.00
--------------------
                              IMPERVIOUS    PERVIOUS (i)
     Surface Area     (ha)=      12.80         3.20
     Dep. Storage     (mm)=       1.50         5.00
     Average Slope     (%)=       0.50         0.25
     Length            (m)=     400.00        40.00
     Mannings n           =      0.013        0.300
```

NOTE: RAINFALL WAS TRANSFORMED TO 5.0 MIN. TIME STEP.

---- TRANSFORMED HYETOGRAPH ----

TIME hrs	RAIN mm/hr	TIME hrs	RAIN mm/hr	TIME hrs	RAIN mm/hr	TIME hrs	RAIN mm/hr
0.083	2.26	3.083	3.61	6.083	16.23	9.08	3.16
0.167	2.26	3.167	3.61	6.167	16.23	9.17	3.16
0.250	2.26	3.250	3.61	6.250	16.23	9.25	3.16
0.333	2.26	3.333	3.61	6.333	16.23	9.33	3.16
0.417	2.26	3.417	3.61	6.417	16.23	9.42	3.16
0.500	2.26	3.500	3.61	6.500	16.23	9.50	3.16
0.583	2.26	3.583	3.61	6.583	7.21	9.58	3.16
0.667	2.26	3.667	3.61	6.667	7.21	9.67	3.16
0.750	2.26	3.750	3.61	6.750	7.21	9.75	3.16
0.833	2.25	3.833	3.61	6.833	7.21	9.83	3.16
0.917	2.26	3.917	3.61	6.917	7.21	9.92	3.16
1.000	2.26	4.000	3.61	7.000	7.21	10.00	3.16
1.083	2.25	4.083	5.41	7.083	5.41	10.08	1.80
1.167	2.26	4.167	5.41	7.167	5.41	10.17	1.80
1.250	2.26	4.250	5.41	7.250	5.41	10.25	1.80
1.333	2.26	4.333	5.41	7.333	5.41	10.33	1.80
1.417	2.26	4.417	5.41	7.417	5.41	10.42	1.80
1.500	2.26	4.500	5.41	7.500	5.41	10.50	1.80
1.583	2.26	4.583	7.21	7.583	5.41	10.58	1.80
1.667	2.26	4.667	7.21	7.667	5.41	10.67	1.80
1.750	2.26	4.750	7.21	7.750	5.41	10.75	1.80
1.833	2.26	4.833	7.21	7.833	5.41	10.83	1.80
1.917	2.26	4.917	7.21	7.917	5.41	10.92	1.80
2.000	2.26	5.000	7.21	8.000	5.41	11.00	1.80
2.083	2.70	5.083	10.82	8.083	3.16	11.08	1.80
2.167	2.70	5.167	10.82	8.167	3.16	11.17	1.80
2.250	2.70	5.250	10.82	8.250	3.16	11.25	1.80
2.333	2.70	5.333	10.82	8.333	3.16	11.33	1.80
2.417	2.70	5.417	10.82	8.417	3.16	11.42	1.80
2.500	2.70	5.500	10.82	8.500	3.16	11.50	1.80
2.583	2.70	5.583	43.29	8.583	3.16	11.58	1.80
2.667	2.70	5.667	43.29	8.667	3.16	11.67	1.80
2.750	2.70	5.750	43.29	8.750	3.16	11.75	1.80
2.833	2.70	5.833	119.04	8.833	3.16	11.83	1.80
2.917	2.70	5.917	119.04	8.917	3.16	11.92	1.80
3.000	2.70	6.000	119.04	9.000	3.16	12.00	1.80

Max.Eff.Inten.(mm/hr)=	119.04	111.85
over (min)	5.00	25.00
Storage Coeff. (min)=	6.74 (ii)	20.79 (ii)
Unit Hyd. Tpeak (min)=	5.00	25.00
Unit Hyd. peak (cms)=	0.18	0.05

TOTALS

PEAK FLOW (cms)=	3.88	0.42	4.094 (iii)
TIME TO PEAK (hrs)=	6.00	6.25	6.00
RUNOFF VOLUME (mm)=	88.68	31.37	76.65
TOTAL RAINFALL (mm)=	90.18	90.18	90.18
RUNOFF COEFFICIENT =	0.98	0.35	0.85

(i) HORTONS EQUATION SELECTED FOR PERVIOUS LOSSES:
Fo (mm/hr)= 75.00 K (1/hr)= 4.14
Fc (mm/hr)= 12.50 Cum.Inf. (mm)= 0.00
(ii) TIME STEP (DT) SHOULD BE SMALLER OR EQUAL
THAN THE STORAGE COEFFICIENT.
(iii) PEAK FLOW DOES NOT INCLUDE BASEFLOW IF ANY.

CALIB
STANDHYD (0500)| Area (ha)= 244.00
ID= 1 DT= 5.0 min | Total Imp(%)= 46.00 Dir. Conn.(%)= 26.00

		IMPERVIOUS	PERVIOUS (i)
Surface Area	(ha)=	112.24	131.76
Dep. Storage	(mm)=	1.50	5.00
Average Slope	(%)=	0.80	0.80
Length	(m)=	1275.00	40.00
Mannings n	=	0.013	0.300

NOTE: RAINFALL WAS TRANSFORMED TO 5.0 MIN. TIME STEP.

---- TRANSFORMED HYETOGRAPH ----

TIME hrs	RAIN mm/hr	TIME hrs	RAIN mm/hr	TIME hrs	RAIN mm/hr	TIME hrs	RAIN mm/hr
0.083	2.26	3.083	3.61	6.083	16.23	9.08	3.16
0.167	2.26	3.167	3.61	6.167	16.23	9.17	3.16
0.250	2.26	3.250	3.61	6.250	16.23	9.25	3.16
0.333	2.26	3.333	3.61	6.333	16.23	9.33	3.16
0.417	2.26	3.417	3.61	6.417	16.23	9.42	3.16
0.500	2.26	3.500	3.61	6.500	16.23	9.50	3.16
0.583	2.26	3.583	3.61	6.583	7.21	9.58	3.16
0.667	2.26	3.667	3.61	6.667	7.21	9.67	3.16
0.750	2.26	3.750	3.61	6.750	7.21	9.75	3.16
0.833	2.25	3.833	3.61	6.833	7.21	9.83	3.16
0.917	2.26	3.917	3.61	6.917	7.21	9.92	3.16
1.000	2.26	4.000	3.61	7.000	7.21	10.00	3.16
1.083	2.25	4.083	5.41	7.083	5.41	10.08	1.80
1.167	2.26	4.167	5.41	7.167	5.41	10.17	1.80
1.250	2.26	4.250	5.41	7.250	5.41	10.25	1.80
1.333	2.26	4.333	5.41	7.333	5.41	10.33	1.80
1.417	2.26	4.417	5.41	7.417	5.41	10.42	1.80

1.500	2.26	4.500	5.41	7.500	5.41	10.50	1.80
1.583	2.26	4.583	7.21	7.583	5.41	10.58	1.80
1.667	2.26	4.667	7.21	7.667	5.41	10.67	1.80
1.750	2.26	4.750	7.21	7.750	5.41	10.75	1.80
1.833	2.26	4.833	7.21	7.833	5.41	10.83	1.80
1.917	2.26	4.917	7.21	7.917	5.41	10.92	1.80
2.000	2.26	5.000	7.21	8.000	5.41	11.00	1.80
2.083	2.70	5.083	10.82	8.083	3.16	11.08	1.80
2.167	2.70	5.167	10.82	8.167	3.16	11.17	1.80
2.250	2.70	5.250	10.82	8.250	3.16	11.25	1.80
2.333	2.70	5.333	10.82	8.333	3.16	11.33	1.80
2.417	2.70	5.417	10.82	8.417	3.16	11.42	1.80
2.500	2.70	5.500	10.82	8.500	3.16	11.50	1.80
2.583	2.70	5.583	43.29	8.583	3.16	11.58	1.80
2.667	2.70	5.667	43.29	8.667	3.16	11.67	1.80
2.750	2.70	5.750	43.29	8.750	3.16	11.75	1.80
2.833	2.70	5.833	119.04	8.833	3.16	11.83	1.80
2.917	2.70	5.917	119.04	8.917	3.16	11.92	1.80
3.000	2.70	6.000	119.04	9.000	3.16	12.00	1.80

Max.Eff.Inten.(mm/hr)=	119.04	150.55	
over (min)	10.00	25.00	
Storage Coeff. (min)=	11.73 (ii)	20.53 (ii)	
Unit Hyd. Tpeak (min)=	10.00	25.00	
Unit Hyd. peak (cms)=	0.10	0.05	
			TOTALS
PEAK FLOW (cms)=	15.54	24.76	34.262 (iii)
TIME TO PEAK (hrs)=	6.00	6.25	6.17
RUNOFF VOLUME (mm)=	88.68	36.25	49.88
TOTAL RAINFALL (mm)=	90.18	90.18	90.18
RUNOFF COEFFICIENT =	0.98	0.40	0.55

(i) HORTONS EQUATION SELECTED FOR PERVIOUS LOSSES:
Fo (mm/hr)= 75.00 K (1/hr)= 4.14
Fc (mm/hr)= 12.50 Cum.Inf. (mm)= 0.00
(ii) TIME STEP (DT) SHOULD BE SMALLER OR EQUAL
THAN THE STORAGE COEFFICIENT.
(iii) PEAK FLOW DOES NOT INCLUDE BASEFLOW IF ANY.

DUHYD (0505)	
Inlet Cap.= 9.000	
#of Inlets= 1	
Total(cms)= 9.0	

	AREA (ha)	QPEAK (cms)	TPEAK (hrs)	R.V. (mm)
TOTAL HYD.(ID= 1):	244.00	34.26	6.17	49.88
MAJOR SYS.(ID= 2):	102.03	25.26	6.17	49.88

```
     MINOR SYS.(ID= 3): 141.97      9.00      5.83   49.88

     NOTE:  PEAK FLOWS DO NOT INCLUDE BASEFLOWS IF ANY.

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--------------------
| ADD HYD  (  0515)|
|   1 +  2 =  3    |         AREA    QPEAK    TPEAK     R.V.
--------------------         (ha)    (cms)    (hrs)     (mm)
        ID1= 1 (  0505):   141.97   9.000     5.83    49.88
      + ID2= 2 (  0510):    16.00   4.094     6.00    76.65
        ================================================
        ID = 3 (  0515):   157.97  13.094     6.00    52.60

     NOTE:  PEAK FLOWS DO NOT INCLUDE BASEFLOWS IF ANY.
--------------------------------------------------------------------------------
--------------------
| DUHYD    (  0520)|
| Inlet Cap.= 3.050|
| #of Inlets=     1|
| Total(cms)=   3.0|      AREA     QPEAK     TPEAK    R.V.
--------------------      (ha)     (cms)     (hrs)    (mm)
     TOTAL HYD.(ID= 1): 157.97     13.09      6.00   52.60
     ================================================
     MAJOR SYS.(ID= 2):  67.56     10.04      6.00   52.60
     MINOR SYS.(ID= 3):  90.41      3.05      5.58   52.60

     NOTE:  PEAK FLOWS DO NOT INCLUDE BASEFLOWS IF ANY.

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--------------------
| ADD HYD  (  0526)|
|   1 +  2 =  3    |         AREA    QPEAK    TPEAK     R.V.
--------------------         (ha)    (cms)    (hrs)     (mm)
        ID1= 1 (  0520):    67.56  10.044     6.00    52.60
      + ID2= 2 (  0525):     0.00   2.000    24.00  *******
        ================================================
        ID = 3 (  0526):    67.56  11.294     6.00   244.20

     NOTE:  PEAK FLOWS DO NOT INCLUDE BASEFLOWS IF ANY.
--------------------------------------------------------------------------------
--------------------
| ROUTE CHN(  0527)|
| IN= 2---> OUT= 1 |     Routing time step (min)'=  5.00
--------------------
               <------ DATA FOR SECTION (   1.1) ------>
               Distance      Elevation       Manning
                 100.00        313.20        0.0500
```

140.00	312.40	0.0500 /0.0300	Main Channel
140.50	310.80	0.0300	Main Channel
141.50	310.80	0.0300	Main Channel
142.00	312.40	0.0300 /0.0500	Main Channel
160.00	313.20	0.0500	

<---------- TRAVEL TIME TABLE ---------->

DEPTH (m)	ELEV (m)	VOLUME (cu.m.)	FLOW RATE (cms)	VELOCITY (m/s)	TRAV.TIME (min)
0.12	310.92	.575E+02	0.1	0.40	18.86
0.25	311.05	.119E+03	0.2	0.57	13.13
0.37	311.17	.185E+03	0.3	0.69	10.87
0.49	311.29	.256E+03	0.4	0.78	9.61
0.62	311.42	.330E+03	0.6	0.86	8.77
0.74	311.54	.409E+03	0.8	0.92	8.17
0.86	311.66	.492E+03	1.1	0.97	7.70
0.98	311.78	.579E+03	1.3	1.02	7.32
1.11	311.91	.671E+03	1.6	1.07	7.01
1.23	312.03	.767E+03	1.9	1.11	6.74
1.35	312.15	.867E+03	2.2	1.15	6.50
1.48	312.28	.971E+03	2.6	1.19	6.29
1.60	312.40	.108E+04	2.9	1.23	6.11
1.73	312.53	.149E+04	3.6	1.10	6.85
1.87	312.67	.248E+04	4.9	0.88	8.52
2.00	312.80	.405E+04	6.9	0.77	9.74
2.13	312.93	.620E+04	10.1	0.73	10.21
2.27	313.07	.893E+04	14.6	0.74	10.17
2.40	313.20	.122E+05	20.7	0.76	9.85

		<---- hydrograph ---->			<-pipe / channel->	
	AREA (ha)	QPEAK (cms)	TPEAK (hrs)	R.V. (mm)	MAX DEPTH (m)	MAX VEL (m/s)
INFLOW : ID= 2 (0526)	67.56	11.29	6.00	244.20	2.17	0.74
OUTFLOW: ID= 1 (0527)	67.56	9.13	6.08	243.98	2.09	0.74

CALIB STANDHYD (0540) ID= 1 DT= 5.0 min	Area (ha)= 4.63 Total Imp(%)= 80.00 Dir. Conn.(%)= 79.00

		IMPERVIOUS	PERVIOUS (i)
Surface Area	(ha)=	3.70	0.93
Dep. Storage	(mm)=	1.50	5.00
Average Slope	(%)=	0.55	0.55
Length	(m)=	150.00	40.00
Mannings n	=	0.013	0.300

NOTE: RAINFALL WAS TRANSFORMED TO 5.0 MIN. TIME STEP.

---- TRANSFORMED HYETOGRAPH ----

TIME hrs	RAIN mm/hr	TIME hrs	RAIN mm/hr	TIME hrs	RAIN mm/hr	TIME hrs	RAIN mm/hr
0.083	2.26	3.083	3.61	6.083	16.23	9.08	3.16
0.167	2.26	3.167	3.61	6.167	16.23	9.17	3.16
0.250	2.26	3.250	3.61	6.250	16.23	9.25	3.16
0.333	2.26	3.333	3.61	6.333	16.23	9.33	3.16
0.417	2.26	3.417	3.61	6.417	16.23	9.42	3.16
0.500	2.26	3.500	3.61	6.500	16.23	9.50	3.16
0.583	2.26	3.583	3.61	6.583	7.21	9.58	3.16
0.667	2.26	3.667	3.61	6.667	7.21	9.67	3.16
0.750	2.26	3.750	3.61	6.750	7.21	9.75	3.16
0.833	2.25	3.833	3.61	6.833	7.21	9.83	3.16
0.917	2.26	3.917	3.61	6.917	7.21	9.92	3.16
1.000	2.26	4.000	3.61	7.000	7.21	10.00	3.16
1.083	2.25	4.083	5.41	7.083	5.41	10.08	1.80
1.167	2.26	4.167	5.41	7.167	5.41	10.17	1.80
1.250	2.26	4.250	5.41	7.250	5.41	10.25	1.80
1.333	2.26	4.333	5.41	7.333	5.41	10.33	1.80
1.417	2.26	4.417	5.41	7.417	5.41	10.42	1.80
1.500	2.26	4.500	5.41	7.500	5.41	10.50	1.80
1.583	2.26	4.583	7.21	7.583	5.41	10.58	1.80
1.667	2.26	4.667	7.21	7.667	5.41	10.67	1.80
1.750	2.26	4.750	7.21	7.750	5.41	10.75	1.80
1.833	2.26	4.833	7.21	7.833	5.41	10.83	1.80
1.917	2.26	4.917	7.21	7.917	5.41	10.92	1.80
2.000	2.26	5.000	7.21	8.000	5.41	11.00	1.80
2.083	2.70	5.083	10.82	8.083	3.16	11.08	1.80
2.167	2.70	5.167	10.82	8.167	3.16	11.17	1.80
2.250	2.70	5.250	10.82	8.250	3.16	11.25	1.80
2.333	2.70	5.333	10.82	8.333	3.16	11.33	1.80
2.417	2.70	5.417	10.82	8.417	3.16	11.42	1.80
2.500	2.70	5.500	10.82	8.500	3.16	11.50	1.80
2.583	2.70	5.583	43.29	8.583	3.16	11.58	1.80
2.667	2.70	5.667	43.29	8.667	3.16	11.67	1.80
2.750	2.70	5.750	43.29	8.750	3.16	11.75	1.80
2.833	2.70	5.833	119.04	8.833	3.16	11.83	1.80
2.917	2.70	5.917	119.04	8.917	3.16	11.92	1.80
3.000	2.70	6.000	119.04	9.000	3.16	12.00	1.80

Max.Eff.Inten.(mm/hr)=	119.04	111.85	
over (min)	5.00	15.00	
Storage Coeff. (min)=	3.64 (ii)	14.73 (ii)	
Unit Hyd. Tpeak (min)=	5.00	15.00	
Unit Hyd. peak (cms)=	0.25	0.08	
			TOTALS
PEAK FLOW (cms)=	1.20	0.16	1.339 (iii)

TIME TO PEAK (hrs)=	6.00	6.08	6.00
RUNOFF VOLUME (mm)=	88.68	31.37	76.65
TOTAL RAINFALL (mm)=	90.18	90.18	90.18
RUNOFF COEFFICIENT =	0.98	0.35	0.85

***** WARNING: STORAGE COEFF. IS SMALLER THAN TIME STEP!

(i) HORTONS EQUATION SELECTED FOR PERVIOUS LOSSES:
Fo (mm/hr)= 75.00 K (1/hr)= 4.14
Fc (mm/hr)= 12.50 Cum.Inf. (mm)= 0.00
(ii) TIME STEP (DT) SHOULD BE SMALLER OR EQUAL
THAN THE STORAGE COEFFICIENT.
(iii) PEAK FLOW DOES NOT INCLUDE BASEFLOW IF ANY.

CALIB STANDHYD (0600) ID= 1 DT= 5.0 min	Area (ha)= 9.73 Total Imp(%)= 52.00 Dir. Conn.(%)= 35.00

		IMPERVIOUS	PERVIOUS (i)
Surface Area	(ha)=	5.06	4.67
Dep. Storage	(mm)=	1.50	5.00
Average Slope	(%)=	2.00	2.00
Length	(m)=	254.69	33.00
Mannings n	=	0.013	0.300

NOTE: RAINFALL WAS TRANSFORMED TO 5.0 MIN. TIME STEP.

---- TRANSFORMED HYETOGRAPH ----

TIME hrs	RAIN mm/hr	TIME hrs	RAIN mm/hr	TIME hrs	RAIN mm/hr	TIME hrs	RAIN mm/hr
0.083	2.26	3.083	3.61	6.083	16.23	9.08	3.16
0.167	2.26	3.167	3.61	6.167	16.23	9.17	3.16
0.250	2.26	3.250	3.61	6.250	16.23	9.25	3.16
0.333	2.26	3.333	3.61	6.333	16.23	9.33	3.16
0.417	2.26	3.417	3.61	6.417	16.23	9.42	3.16
0.500	2.26	3.500	3.61	6.500	16.23	9.50	3.16
0.583	2.26	3.583	3.61	6.583	7.21	9.58	3.16
0.667	2.26	3.667	3.61	6.667	7.21	9.67	3.16
0.750	2.26	3.750	3.61	6.750	7.21	9.75	3.16
0.833	2.25	3.833	3.61	6.833	7.21	9.83	3.16
0.917	2.26	3.917	3.61	6.917	7.21	9.92	3.16
1.000	2.26	4.000	3.61	7.000	7.21	10.00	3.16
1.083	2.25	4.083	5.41	7.083	5.41	10.08	1.80
1.167	2.26	4.167	5.41	7.167	5.41	10.17	1.80
1.250	2.26	4.250	5.41	7.250	5.41	10.25	1.80
1.333	2.26	4.333	5.41	7.333	5.41	10.33	1.80
1.417	2.26	4.417	5.41	7.417	5.41	10.42	1.80

1.500	2.26	4.500	5.41	7.500	5.41	10.50	1.80
1.583	2.26	4.583	7.21	7.583	5.41	10.58	1.80
1.667	2.26	4.667	7.21	7.667	5.41	10.67	1.80
1.750	2.26	4.750	7.21	7.750	5.41	10.75	1.80
1.833	2.26	4.833	7.21	7.833	5.41	10.83	1.80
1.917	2.26	4.917	7.21	7.917	5.41	10.92	1.80
2.000	2.26	5.000	7.21	8.000	5.41	11.00	1.80
2.083	2.70	5.083	10.82	8.083	3.16	11.08	1.80
2.167	2.70	5.167	10.82	8.167	3.16	11.17	1.80
2.250	2.70	5.250	10.82	8.250	3.16	11.25	1.80
2.333	2.70	5.333	10.82	8.333	3.16	11.33	1.80
2.417	2.70	5.417	10.82	8.417	3.16	11.42	1.80
2.500	2.70	5.500	10.82	8.500	3.16	11.50	1.80
2.583	2.70	5.583	43.29	8.583	3.16	11.58	1.80
2.667	2.70	5.667	43.29	8.667	3.16	11.67	1.80
2.750	2.70	5.750	43.29	8.750	3.16	11.75	1.80
2.833	2.70	5.833	119.04	8.833	3.16	11.83	1.80
2.917	2.70	5.917	119.04	8.917	3.16	11.92	1.80
3.000	2.70	6.000	119.04	9.000	3.16	12.00	1.80

Max.Eff.Inten.(mm/hr)=	119.04	148.62	
over (min)	5.00	10.00	
Storage Coeff. (min)=	3.39 (ii)	9.38 (ii)	
Unit Hyd. Tpeak (min)=	5.00	10.00	
Unit Hyd. peak (cms)=	0.26	0.12	
			TOTALS
PEAK FLOW (cms)=	1.12	1.48	2.599 (iii)
TIME TO PEAK (hrs)=	6.00	6.00	6.00
RUNOFF VOLUME (mm)=	88.68	36.02	54.45
TOTAL RAINFALL (mm)=	90.18	90.18	90.18
RUNOFF COEFFICIENT =	0.98	0.40	0.60

***** WARNING: STORAGE COEFF. IS SMALLER THAN TIME STEP!

(i) HORTONS EQUATION SELECTED FOR PERVIOUS LOSSES:
Fo (mm/hr)= 75.00 K (1/hr)= 4.14
Fc (mm/hr)= 12.50 Cum.Inf. (mm)= 0.00
(ii) TIME STEP (DT) SHOULD BE SMALLER OR EQUAL
THAN THE STORAGE COEFFICIENT.
(iii) PEAK FLOW DOES NOT INCLUDE BASEFLOW IF ANY.

CALIB	
STANDHYD (0601)	Area (ha)= 6.95
ID= 1 DT= 5.0 min	Total Imp(%)= 70.00 Dir. Conn.(%)= 50.00

		IMPERVIOUS	PERVIOUS (i)
Surface Area	(ha)=	4.86	2.09
Dep. Storage	(mm)=	1.50	5.00

Average Slope	(%)=	2.00	2.00
Length	(m)=	215.25	33.00
Mannings n	=	0.013	0.300

NOTE: RAINFALL WAS TRANSFORMED TO 5.0 MIN. TIME STEP.

---- TRANSFORMED HYETOGRAPH ----

TIME hrs	RAIN mm/hr	TIME hrs	RAIN mm/hr	TIME hrs	RAIN mm/hr	TIME hrs	RAIN mm/hr
0.083	2.26	3.083	3.61	6.083	16.23	9.08	3.16
0.167	2.26	3.167	3.61	6.167	16.23	9.17	3.16
0.250	2.26	3.250	3.61	6.250	16.23	9.25	3.16
0.333	2.26	3.333	3.61	6.333	16.23	9.33	3.16
0.417	2.26	3.417	3.61	6.417	16.23	9.42	3.16
0.500	2.26	3.500	3.61	6.500	16.23	9.50	3.16
0.583	2.26	3.583	3.61	6.583	7.21	9.58	3.16
0.667	2.26	3.667	3.61	6.667	7.21	9.67	3.16
0.750	2.26	3.750	3.61	6.750	7.21	9.75	3.16
0.833	2.25	3.833	3.61	6.833	7.21	9.83	3.16
0.917	2.26	3.917	3.61	6.917	7.21	9.92	3.16
1.000	2.26	4.000	3.61	7.000	7.21	10.00	3.16
1.083	2.25	4.083	5.41	7.083	5.41	10.08	1.80
1.167	2.26	4.167	5.41	7.167	5.41	10.17	1.80
1.250	2.26	4.250	5.41	7.250	5.41	10.25	1.80
1.333	2.26	4.333	5.41	7.333	5.41	10.33	1.80
1.417	2.26	4.417	5.41	7.417	5.41	10.42	1.80
1.500	2.26	4.500	5.41	7.500	5.41	10.50	1.80
1.583	2.26	4.583	7.21	7.583	5.41	10.58	1.80
1.667	2.26	4.667	7.21	7.667	5.41	10.67	1.80
1.750	2.26	4.750	7.21	7.750	5.41	10.75	1.80
1.833	2.26	4.833	7.21	7.833	5.41	10.83	1.80
1.917	2.26	4.917	7.21	7.917	5.41	10.92	1.80
2.000	2.26	5.000	7.21	8.000	5.41	11.00	1.80
2.083	2.70	5.083	10.82	8.083	3.16	11.08	1.80
2.167	2.70	5.167	10.82	8.167	3.16	11.17	1.80
2.250	2.70	5.250	10.82	8.250	3.16	11.25	1.80
2.333	2.70	5.333	10.82	8.333	3.16	11.33	1.80
2.417	2.70	5.417	10.82	8.417	3.16	11.42	1.80
2.500	2.70	5.500	10.82	8.500	3.16	11.50	1.80
2.583	2.70	5.583	43.29	8.583	3.16	11.58	1.80
2.667	2.70	5.667	43.29	8.667	3.16	11.67	1.80
2.750	2.70	5.750	43.29	8.750	3.16	11.75	1.80
2.833	2.70	5.833	119.04	8.833	3.16	11.83	1.80
2.917	2.70	5.917	119.04	8.917	3.16	11.92	1.80
3.000	2.70	6.000	119.04	9.000	3.16	12.00	1.80

Max.Eff.Inten.(mm/hr)=		119.04	185.88
	over (min)	5.00	10.00
Storage Coeff. (min)=		3.07 (ii)	8.54 (ii)

```
     Unit Hyd. Tpeak (min)=       5.00        10.00
     Unit Hyd. peak  (cms)=       0.27         0.12
                                                          *TOTALS*
     PEAK FLOW       (cms)=       1.14         0.87          2.014 (iii)
     TIME TO PEAK    (hrs)=       6.00         6.00           6.00
     RUNOFF VOLUME    (mm)=      88.68        39.76          64.22
     TOTAL RAINFALL   (mm)=      90.18        90.18          90.18
     RUNOFF COEFFICIENT   =       0.98         0.44           0.71

***** WARNING: STORAGE COEFF. IS SMALLER THAN TIME STEP!

       (i) HORTONS EQUATION SELECTED FOR PERVIOUS LOSSES:
            Fo   (mm/hr)= 75.00           K  (1/hr)=  4.14
            Fc   (mm/hr)= 12.50     Cum.Inf.   (mm)=  0.00
      (ii) TIME STEP (DT) SHOULD BE SMALLER OR EQUAL
           THAN THE STORAGE COEFFICIENT.
     (iii) PEAK FLOW DOES NOT INCLUDE BASEFLOW IF ANY.

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

--------------------
| ADD HYD  (  0602)|
|   1 +  2 =  3    |         AREA    QPEAK    TPEAK     R.V.
--------------------         (ha)    (cms)    (hrs)     (mm)
        ID1= 1 (  0600):     9.73   2.599     6.00    54.45
      + ID2= 2 (  0601):     6.95   2.014     6.00    64.22
        ================================================
        ID = 3 (  0602):    16.68   4.612     6.00    58.52

     NOTE:  PEAK FLOWS DO NOT INCLUDE BASEFLOWS IF ANY.
--------------------------------------------------------------------------------
--------------------
| ROUTE CHN(  0563)|
| IN= 2---> OUT= 1 |     Routing time step (min)'=  5.00
--------------------
               <------ DATA FOR SECTION (   2.2) ------>
               Distance      Elevation       Manning
                   0.00          1.00        0.0350
                   2.00          0.50        0.0350
                   4.00          0.00    0.0350 /0.0350  Main Channel
                   4.50          0.00        0.0350      Main Channel
                   5.00          0.00    0.0350 /0.0350  Main Channel
                   7.00          0.50        0.0350
                   9.00          1.00        0.0350

      <--------------------- TRAVEL TIME TABLE ---------------------->
       DEPTH    ELEV      VOLUME    FLOW RATE    VELOCITY   TRAV.TIME
        (m)      (m)     (cu.m.)      (cms)        (m/s)      (min)
       0.05     0.05    .701E+01       0.0          0.64       2.87
       0.11     0.11    .165E+02       0.1          0.96       1.91
```

0.16	0.16	.283E+02	0.3	1.21	1.51
0.21	0.21	.427E+02	0.6	1.42	1.29
0.26	0.26	.594E+02	0.9	1.61	1.14
0.32	0.32	.786E+02	1.3	1.77	1.03
0.37	0.37	.100E+03	1.8	1.93	0.95
0.42	0.42	.124E+03	2.3	2.08	0.88
0.47	0.47	.151E+03	3.0	2.22	0.83
0.53	0.53	.180E+03	3.8	2.35	0.78
0.58	0.58	.211E+03	4.8	2.48	0.74
0.63	0.63	.245E+03	5.8	2.60	0.71
0.68	0.68	.281E+03	7.0	2.72	0.67
0.74	0.74	.320E+03	8.2	2.84	0.65
0.79	0.79	.361E+03	9.7	2.95	0.62
0.84	0.84	.405E+03	11.3	3.06	0.60
0.89	0.89	.451E+03	13.0	3.17	0.58
0.95	0.95	.499E+03	14.8	3.27	0.56
1.00	1.00	.550E+03	16.9	3.38	0.54

		<---- hydrograph ---->			<-pipe / channel->	
		AREA	QPEAK	TPEAK	R.V.	MAX DEPTH	MAX VEL
		(ha)	(cms)	(hrs)	(mm)	(m)	(m/s)
INFLOW : ID= 2 (0602)		16.68	4.61	6.00	58.52	0.57	2.46
OUTFLOW: ID= 1 (0563)		16.68	4.53	6.00	58.52	0.57	2.44

CALIB			
STANDHYD (0607)	Area (ha)=	5.97	
ID= 1 DT= 5.0 min	Total Imp(%)=	51.00	Dir. Conn.(%)= 35.00

		IMPERVIOUS	PERVIOUS (i)
Surface Area	(ha)=	3.04	2.93
Dep. Storage	(mm)=	1.50	5.00
Average Slope	(%)=	2.00	2.00
Length	(m)=	199.50	33.00
Mannings n	=	0.013	0.300

NOTE: RAINFALL WAS TRANSFORMED TO 5.0 MIN. TIME STEP.

---- TRANSFORMED HYETOGRAPH ----

TIME hrs	RAIN mm/hr	TIME hrs	RAIN mm/hr	TIME hrs	RAIN mm/hr	TIME hrs	RAIN mm/hr
0.083	2.26	3.083	3.61	6.083	16.23	9.08	3.16
0.167	2.26	3.167	3.61	6.167	16.23	9.17	3.16
0.250	2.26	3.250	3.61	6.250	16.23	9.25	3.16
0.333	2.26	3.333	3.61	6.333	16.23	9.33	3.16
0.417	2.26	3.417	3.61	6.417	16.23	9.42	3.16

0.500	2.26	3.500	3.61	6.500	16.23	9.50	3.16
0.583	2.26	3.583	3.61	6.583	7.21	9.58	3.16
0.667	2.26	3.667	3.61	6.667	7.21	9.67	3.16
0.750	2.26	3.750	3.61	6.750	7.21	9.75	3.16
0.833	2.25	3.833	3.61	6.833	7.21	9.83	3.16
0.917	2.26	3.917	3.61	6.917	7.21	9.92	3.16
1.000	2.26	4.000	3.61	7.000	7.21	10.00	3.16
1.083	2.25	4.083	5.41	7.083	5.41	10.08	1.80
1.167	2.26	4.167	5.41	7.167	5.41	10.17	1.80
1.250	2.26	4.250	5.41	7.250	5.41	10.25	1.80
1.333	2.26	4.333	5.41	7.333	5.41	10.33	1.80
1.417	2.26	4.417	5.41	7.417	5.41	10.42	1.80
1.500	2.26	4.500	5.41	7.500	5.41	10.50	1.80
1.583	2.26	4.583	7.21	7.583	5.41	10.58	1.80
1.667	2.26	4.667	7.21	7.667	5.41	10.67	1.80
1.750	2.26	4.750	7.21	7.750	5.41	10.75	1.80
1.833	2.26	4.833	7.21	7.833	5.41	10.83	1.80
1.917	2.26	4.917	7.21	7.917	5.41	10.92	1.80
2.000	2.26	5.000	7.21	8.000	5.41	11.00	1.80
2.083	2.70	5.083	10.82	8.083	3.16	11.08	1.80
2.167	2.70	5.167	10.82	8.167	3.16	11.17	1.80
2.250	2.70	5.250	10.82	8.250	3.16	11.25	1.80
2.333	2.70	5.333	10.82	8.333	3.16	11.33	1.80
2.417	2.70	5.417	10.82	8.417	3.16	11.42	1.80
2.500	2.70	5.500	10.82	8.500	3.16	11.50	1.80
2.583	2.70	5.583	43.29	8.583	3.16	11.58	1.80
2.667	2.70	5.667	43.29	8.667	3.16	11.67	1.80
2.750	2.70	5.750	43.29	8.750	3.16	11.75	1.80
2.833	2.70	5.833	119.04	8.833	3.16	11.83	1.80
2.917	2.70	5.917	119.04	8.917	3.16	11.92	1.80
3.000	2.70	6.000	119.04	9.000	3.16	12.00	1.80

Max.Eff.Inten.(mm/hr)=	119.04	145.32	
over (min)	5.00	10.00	
Storage Coeff. (min)=	2.93 (ii)	8.97 (ii)	
Unit Hyd. Tpeak (min)=	5.00	10.00	
Unit Hyd. peak (cms)=	0.28	0.12	
			TOTALS
PEAK FLOW (cms)=	0.69	0.92	1.609 (iii)
TIME TO PEAK (hrs)=	6.00	6.00	6.00
RUNOFF VOLUME (mm)=	88.68	35.62	54.19
TOTAL RAINFALL (mm)=	90.18	90.18	90.18
RUNOFF COEFFICIENT =	0.98	0.39	0.60

***** WARNING: STORAGE COEFF. IS SMALLER THAN TIME STEP!

(i) HORTONS EQUATION SELECTED FOR PERVIOUS LOSSES:
Fo (mm/hr)= 75.00 K (1/hr)= 4.14
Fc (mm/hr)= 12.50 Cum.Inf. (mm)= 0.00
(ii) TIME STEP (DT) SHOULD BE SMALLER OR EQUAL

```
           THAN THE STORAGE COEFFICIENT.
     (iii) PEAK FLOW DOES NOT INCLUDE BASEFLOW IF ANY.

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--------------------
| ADD HYD  (  0492)|
|   1 +  2 =  3    |         AREA    QPEAK    TPEAK     R.V.
--------------------         (ha)    (cms)    (hrs)     (mm)
        ID1= 1 (  0563):    16.68   4.527     6.00    58.52
      + ID2= 2 (  0607):     5.97   1.609     6.00    54.19
        ================================================
        ID = 3 (  0492):    22.65   6.136     6.00    57.38

     NOTE:  PEAK FLOWS DO NOT INCLUDE BASEFLOWS IF ANY.
--------------------------------------------------------------------------------
--------------------
| RESERVOIR(  0482)|     OVERFLOW IS OFF
| IN= 2---> OUT= 1 |
| DT=  5.0 min     |     OUTFLOW    STORAGE   |  OUTFLOW    STORAGE
--------------------      (cms)     (ha.m.)   |   (cms)     (ha.m.)
                          0.0000     0.0000   |   0.2910      0.3795
                          0.2590     0.0579   |   0.2970      0.4503
                          0.2660     0.1180   |   1.6320      0.5232
                          0.2720     0.1802   |   4.1680      0.5983
                          0.2790     0.2445   |   7.5660      0.6756
                          0.2850     0.3109   |   0.0000      0.0000

                                  AREA     QPEAK     TPEAK       R.V.
                                  (ha)     (cms)     (hrs)       (mm)
   INFLOW : ID= 2 (  0492)     22.650      6.136      6.00      57.38
   OUTFLOW: ID= 1 (  0482)     22.650      3.311      6.17      57.38

                  PEAK   FLOW   REDUCTION [Qout/Qin](%)= 53.96
                  TIME SHIFT OF PEAK FLOW         (min)= 10.00
                  MAXIMUM  STORAGE   USED       (ha.m.)=  0.5874

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--------------------
| CALIB            |
| STANDHYD (  0480)|   Area    (ha)=  43.10
|ID= 1 DT= 5.0 min |   Total Imp(%)=  42.00   Dir. Conn.(%)=  21.00
--------------------
                              IMPERVIOUS    PERVIOUS (i)
     Surface Area     (ha)=      18.10        25.00
     Dep. Storage     (mm)=       1.50         5.00
     Average Slope     (%)=       2.00         2.00
     Length            (m)=     680.00        40.00
     Mannings n           =      0.013        0.300
```

NOTE: RAINFALL WAS TRANSFORMED TO 5.0 MIN. TIME STEP.

---- TRANSFORMED HYETOGRAPH ----

TIME hrs	RAIN mm/hr	TIME hrs	RAIN mm/hr	TIME hrs	RAIN mm/hr	TIME hrs	RAIN mm/hr
0.083	2.26	3.083	3.61	6.083	16.23	9.08	3.16
0.167	2.26	3.167	3.61	6.167	16.23	9.17	3.16
0.250	2.26	3.250	3.61	6.250	16.23	9.25	3.16
0.333	2.26	3.333	3.61	6.333	16.23	9.33	3.16
0.417	2.26	3.417	3.61	6.417	16.23	9.42	3.16
0.500	2.26	3.500	3.61	6.500	16.23	9.50	3.16
0.583	2.26	3.583	3.61	6.583	7.21	9.58	3.16
0.667	2.26	3.667	3.61	6.667	7.21	9.67	3.16
0.750	2.26	3.750	3.61	6.750	7.21	9.75	3.16
0.833	2.25	3.833	3.61	6.833	7.21	9.83	3.16
0.917	2.26	3.917	3.61	6.917	7.21	9.92	3.16
1.000	2.26	4.000	3.61	7.000	7.21	10.00	3.16
1.083	2.25	4.083	5.41	7.083	5.41	10.08	1.80
1.167	2.26	4.167	5.41	7.167	5.41	10.17	1.80
1.250	2.26	4.250	5.41	7.250	5.41	10.25	1.80
1.333	2.26	4.333	5.41	7.333	5.41	10.33	1.80
1.417	2.26	4.417	5.41	7.417	5.41	10.42	1.80
1.500	2.26	4.500	5.41	7.500	5.41	10.50	1.80
1.583	2.26	4.583	7.21	7.583	5.41	10.58	1.80
1.667	2.26	4.667	7.21	7.667	5.41	10.67	1.80
1.750	2.26	4.750	7.21	7.750	5.41	10.75	1.80
1.833	2.26	4.833	7.21	7.833	5.41	10.83	1.80
1.917	2.26	4.917	7.21	7.917	5.41	10.92	1.80
2.000	2.26	5.000	7.21	8.000	5.41	11.00	1.80
2.083	2.70	5.083	10.82	8.083	3.16	11.08	1.80
2.167	2.70	5.167	10.82	8.167	3.16	11.17	1.80
2.250	2.70	5.250	10.82	8.250	3.16	11.25	1.80
2.333	2.70	5.333	10.82	8.333	3.16	11.33	1.80
2.417	2.70	5.417	10.82	8.417	3.16	11.42	1.80
2.500	2.70	5.500	10.82	8.500	3.16	11.50	1.80
2.583	2.70	5.583	43.29	8.583	3.16	11.58	1.80
2.667	2.70	5.667	43.29	8.667	3.16	11.67	1.80
2.750	2.70	5.750	43.29	8.750	3.16	11.75	1.80
2.833	2.70	5.833	119.04	8.833	3.16	11.83	1.80
2.917	2.70	5.917	119.04	8.917	3.16	11.92	1.80
3.000	2.70	6.000	119.04	9.000	3.16	12.00	1.80

Max.Eff.Inten.(mm/hr)=	119.04	149.56	
over (min)	5.00	15.00	
Storage Coeff. (min)=	6.11 (ii)	12.82 (ii)	
Unit Hyd. Tpeak (min)=	5.00	15.00	
Unit Hyd. peak (cms)=	0.19	0.08	
			TOTALS
PEAK FLOW (cms)=	2.82	6.56	8.721 (iii)

TIME TO PEAK (hrs)=	6.00	6.08	6.00
RUNOFF VOLUME (mm)=	88.68	36.13	47.17
TOTAL RAINFALL (mm)=	90.18	90.18	90.18
RUNOFF COEFFICIENT =	0.98	0.40	0.52

(i) HORTONS EQUATION SELECTED FOR PERVIOUS LOSSES:
Fo (mm/hr)= 75.00 K (1/hr)= 4.14
Fc (mm/hr)= 12.50 Cum.Inf. (mm)= 0.00
(ii) TIME STEP (DT) SHOULD BE SMALLER OR EQUAL
THAN THE STORAGE COEFFICIENT.
(iii) PEAK FLOW DOES NOT INCLUDE BASEFLOW IF ANY.

CALIB
STANDHYD (0460)| Area (ha)= 36.00
ID= 1 DT= 5.0 min | Total Imp(%)= 42.00 Dir. Conn.(%)= 21.00

		IMPERVIOUS	PERVIOUS (i)
Surface Area	(ha)=	15.12	20.88
Dep. Storage	(mm)=	1.50	5.00
Average Slope	(%)=	2.03	2.03
Length	(m)=	465.00	40.00
Mannings n	=	0.013	0.300

NOTE: RAINFALL WAS TRANSFORMED TO 5.0 MIN. TIME STEP.

---- TRANSFORMED HYETOGRAPH ----

TIME hrs	RAIN mm/hr	TIME hrs	RAIN mm/hr	TIME hrs	RAIN mm/hr	TIME hrs	RAIN mm/hr
0.083	2.26	3.083	3.61	6.083	16.23	9.08	3.16
0.167	2.26	3.167	3.61	6.167	16.23	9.17	3.16
0.250	2.26	3.250	3.61	6.250	16.23	9.25	3.16
0.333	2.26	3.333	3.61	6.333	16.23	9.33	3.16
0.417	2.26	3.417	3.61	6.417	16.23	9.42	3.16
0.500	2.26	3.500	3.61	6.500	16.23	9.50	3.16
0.583	2.26	3.583	3.61	6.583	7.21	9.58	3.16
0.667	2.26	3.667	3.61	6.667	7.21	9.67	3.16
0.750	2.26	3.750	3.61	6.750	7.21	9.75	3.16
0.833	2.25	3.833	3.61	6.833	7.21	9.83	3.16
0.917	2.26	3.917	3.61	6.917	7.21	9.92	3.16
1.000	2.26	4.000	3.61	7.000	7.21	10.00	3.16
1.083	2.25	4.083	5.41	7.083	5.41	10.08	1.80
1.167	2.26	4.167	5.41	7.167	5.41	10.17	1.80
1.250	2.26	4.250	5.41	7.250	5.41	10.25	1.80
1.333	2.26	4.333	5.41	7.333	5.41	10.33	1.80
1.417	2.26	4.417	5.41	7.417	5.41	10.42	1.80
1.500	2.26	4.500	5.41	7.500	5.41	10.50	1.80

1.583	2.26	4.583	7.21	7.583	5.41	10.58	1.80
1.667	2.26	4.667	7.21	7.667	5.41	10.67	1.80
1.750	2.26	4.750	7.21	7.750	5.41	10.75	1.80
1.833	2.26	4.833	7.21	7.833	5.41	10.83	1.80
1.917	2.26	4.917	7.21	7.917	5.41	10.92	1.80
2.000	2.26	5.000	7.21	8.000	5.41	11.00	1.80
2.083	2.70	5.083	10.82	8.083	3.16	11.08	1.80
2.167	2.70	5.167	10.82	8.167	3.16	11.17	1.80
2.250	2.70	5.250	10.82	8.250	3.16	11.25	1.80
2.333	2.70	5.333	10.82	8.333	3.16	11.33	1.80
2.417	2.70	5.417	10.82	8.417	3.16	11.42	1.80
2.500	2.70	5.500	10.82	8.500	3.16	11.50	1.80
2.583	2.70	5.583	43.29	8.583	3.16	11.58	1.80
2.667	2.70	5.667	43.29	8.667	3.16	11.67	1.80
2.750	2.70	5.750	43.29	8.750	3.16	11.75	1.80
2.833	2.70	5.833	119.04	8.833	3.16	11.83	1.80
2.917	2.70	5.917	119.04	8.917	3.16	11.92	1.80
3.000	2.70	6.000	119.04	9.000	3.16	12.00	1.80

Max.Eff.Inten.(mm/hr)=	119.04	149.56	
over (min)	5.00	15.00	
Storage Coeff. (min)=	4.84 (ii)	11.52 (ii)	
Unit Hyd. Tpeak (min)=	5.00	15.00	
Unit Hyd. peak (cms)=	0.22	0.09	
			TOTALS
PEAK FLOW (cms)=	2.43	5.73	7.639 (iii)
TIME TO PEAK (hrs)=	6.00	6.08	6.00
RUNOFF VOLUME (mm)=	88.68	36.13	47.17
TOTAL RAINFALL (mm)=	90.18	90.18	90.18
RUNOFF COEFFICIENT =	0.98	0.40	0.52

***** WARNING: STORAGE COEFF. IS SMALLER THAN TIME STEP!

(i) HORTONS EQUATION SELECTED FOR PERVIOUS LOSSES:
Fo (mm/hr)= 75.00 K (1/hr)= 4.14
Fc (mm/hr)= 12.50 Cum.Inf. (mm)= 0.00
(ii) TIME STEP (DT) SHOULD BE SMALLER OR EQUAL
THAN THE STORAGE COEFFICIENT.
(iii) PEAK FLOW DOES NOT INCLUDE BASEFLOW IF ANY.

CALIB	
STANDHYD (0455)	Area (ha)= 12.70
ID= 1 DT= 5.0 min	Total Imp(%)= 42.00 Dir. Conn.(%)= 21.00

		IMPERVIOUS	PERVIOUS (i)
Surface Area	(ha)=	5.33	7.37
Dep. Storage	(mm)=	1.50	5.00
Average Slope	(%)=	1.71	1.71

Length (m)=	300.00	40.00	
Mannings n =	0.013	0.300	

NOTE: RAINFALL WAS TRANSFORMED TO 5.0 MIN. TIME STEP.

---- TRANSFORMED HYETOGRAPH ----

TIME hrs	RAIN mm/hr	TIME hrs	RAIN mm/hr	TIME hrs	RAIN mm/hr	TIME hrs	RAIN mm/hr
0.083	2.26	3.083	3.61	6.083	16.23	9.08	3.16
0.167	2.26	3.167	3.61	6.167	16.23	9.17	3.16
0.250	2.26	3.250	3.61	6.250	16.23	9.25	3.16
0.333	2.26	3.333	3.61	6.333	16.23	9.33	3.16
0.417	2.26	3.417	3.61	6.417	16.23	9.42	3.16
0.500	2.26	3.500	3.61	6.500	16.23	9.50	3.16
0.583	2.26	3.583	3.61	6.583	7.21	9.58	3.16
0.667	2.26	3.667	3.61	6.667	7.21	9.67	3.16
0.750	2.26	3.750	3.61	6.750	7.21	9.75	3.16
0.833	2.25	3.833	3.61	6.833	7.21	9.83	3.16
0.917	2.26	3.917	3.61	6.917	7.21	9.92	3.16
1.000	2.26	4.000	3.61	7.000	7.21	10.00	3.16
1.083	2.25	4.083	5.41	7.083	5.41	10.08	1.80
1.167	2.26	4.167	5.41	7.167	5.41	10.17	1.80
1.250	2.26	4.250	5.41	7.250	5.41	10.25	1.80
1.333	2.26	4.333	5.41	7.333	5.41	10.33	1.80
1.417	2.26	4.417	5.41	7.417	5.41	10.42	1.80
1.500	2.26	4.500	5.41	7.500	5.41	10.50	1.80
1.583	2.26	4.583	7.21	7.583	5.41	10.58	1.80
1.667	2.26	4.667	7.21	7.667	5.41	10.67	1.80
1.750	2.26	4.750	7.21	7.750	5.41	10.75	1.80
1.833	2.26	4.833	7.21	7.833	5.41	10.83	1.80
1.917	2.26	4.917	7.21	7.917	5.41	10.92	1.80
2.000	2.26	5.000	7.21	8.000	5.41	11.00	1.80
2.083	2.70	5.083	10.82	8.083	3.16	11.08	1.80
2.167	2.70	5.167	10.82	8.167	3.16	11.17	1.80
2.250	2.70	5.250	10.82	8.250	3.16	11.25	1.80
2.333	2.70	5.333	10.82	8.333	3.16	11.33	1.80
2.417	2.70	5.417	10.82	8.417	3.16	11.42	1.80
2.500	2.70	5.500	10.82	8.500	3.16	11.50	1.80
2.583	2.70	5.583	43.29	8.583	3.16	11.58	1.80
2.667	2.70	5.667	43.29	8.667	3.16	11.67	1.80
2.750	2.70	5.750	43.29	8.750	3.16	11.75	1.80
2.833	2.70	5.833	119.04	8.833	3.16	11.83	1.80
2.917	2.70	5.917	119.04	8.917	3.16	11.92	1.80
3.000	2.70	6.000	119.04	9.000	3.16	12.00	1.80

Max.Eff.Inten.(mm/hr)=	119.04	149.56
over (min)	5.00	15.00
Storage Coeff. (min)=	3.92 (ii)	10.95 (ii)
Unit Hyd. Tpeak (min)=	5.00	15.00

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     Unit Hyd. peak  (cms)=       0.24         0.09
                                                          *TOTALS*
     PEAK FLOW       (cms)=       0.87         2.06          2.756 (iii)
     TIME TO PEAK    (hrs)=       6.00         6.08           6.00
     RUNOFF VOLUME    (mm)=      88.68        36.13          47.17
     TOTAL RAINFALL   (mm)=      90.18        90.18          90.18
     RUNOFF COEFFICIENT   =       0.98         0.40           0.52

***** WARNING: STORAGE COEFF. IS SMALLER THAN TIME STEP!

       (i) HORTONS EQUATION SELECTED FOR PERVIOUS LOSSES:
            Fo   (mm/hr)= 75.00           K  (1/hr)=  4.14
            Fc   (mm/hr)= 12.50     Cum.Inf.   (mm)=  0.00
      (ii) TIME STEP (DT) SHOULD BE SMALLER OR EQUAL
           THAN THE STORAGE COEFFICIENT.
     (iii) PEAK FLOW DOES NOT INCLUDE BASEFLOW IF ANY.

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--------------------
| ADD HYD  (  0465)|
|   1 +  2 =  3    |         AREA    QPEAK    TPEAK     R.V.
--------------------         (ha)    (cms)    (hrs)     (mm)
        ID1= 1 (  0455):    12.70   2.756     6.00    47.17
      + ID2= 2 (  0460):    36.00   7.639     6.00    47.17
        ================================================
        ID = 3 (  0465):    48.70  10.395     6.00    47.17

     NOTE:  PEAK FLOWS DO NOT INCLUDE BASEFLOWS IF ANY.
--------------------------------------------------------------------------------
--------------------
| CALIB            |
| STANDHYD (  0410)|   Area    (ha)=  24.20
|ID= 1 DT= 5.0 min |   Total Imp(%)=  42.00   Dir. Conn.(%)=  21.00
--------------------
                            IMPERVIOUS    PERVIOUS (i)
     Surface Area     (ha)=      10.16        14.04
     Dep. Storage     (mm)=       1.50         5.00
     Average Slope     (%)=       2.00         2.00
     Length            (m)=     401.00        40.00
     Mannings n           =      0.013        0.300

         NOTE:  RAINFALL WAS TRANSFORMED TO   5.0 MIN. TIME STEP.


                         ---- TRANSFORMED HYETOGRAPH ----
              TIME    RAIN |  TIME    RAIN |'  TIME    RAIN |  TIME    RAIN
               hrs   mm/hr |   hrs   mm/hr |'   hrs   mm/hr |   hrs   mm/hr
             0.083    2.26 | 3.083    3.61 | 6.083   16.23 |  9.08    3.16
             0.167    2.26 | 3.167    3.61 | 6.167   16.23 |  9.17    3.16
```

0.250	2.26	3.250	3.61	6.250	16.23	9.25	3.16
0.333	2.26	3.333	3.61	6.333	16.23	9.33	3.16
0.417	2.26	3.417	3.61	6.417	16.23	9.42	3.16
0.500	2.26	3.500	3.61	6.500	16.23	9.50	3.16
0.583	2.26	3.583	3.61	6.583	7.21	9.58	3.16
0.667	2.26	3.667	3.61	6.667	7.21	9.67	3.16
0.750	2.26	3.750	3.61	6.750	7.21	9.75	3.16
0.833	2.25	3.833	3.61	6.833	7.21	9.83	3.16
0.917	2.26	3.917	3.61	6.917	7.21	9.92	3.16
1.000	2.26	4.000	3.61	7.000	7.21	10.00	3.16
1.083	2.25	4.083	5.41	7.083	5.41	10.08	1.80
1.167	2.26	4.167	5.41	7.167	5.41	10.17	1.80
1.250	2.26	4.250	5.41	7.250	5.41	10.25	1.80
1.333	2.26	4.333	5.41	7.333	5.41	10.33	1.80
1.417	2.26	4.417	5.41	7.417	5.41	10.42	1.80
1.500	2.26	4.500	5.41	7.500	5.41	10.50	1.80
1.583	2.26	4.583	7.21	7.583	5.41	10.58	1.80
1.667	2.26	4.667	7.21	7.667	5.41	10.67	1.80
1.750	2.26	4.750	7.21	7.750	5.41	10.75	1.80
1.833	2.26	4.833	7.21	7.833	5.41	10.83	1.80
1.917	2.26	4.917	7.21	7.917	5.41	10.92	1.80
2.000	2.26	5.000	7.21	8.000	5.41	11.00	1.80
2.083	2.70	5.083	10.82	8.083	3.16	11.08	1.80
2.167	2.70	5.167	10.82	8.167	3.16	11.17	1.80
2.250	2.70	5.250	10.82	8.250	3.16	11.25	1.80
2.333	2.70	5.333	10.82	8.333	3.16	11.33	1.80
2.417	2.70	5.417	10.82	8.417	3.16	11.42	1.80
2.500	2.70	5.500	10.82	8.500	3.16	11.50	1.80
2.583	2.70	5.583	43.29	8.583	3.16	11.58	1.80
2.667	2.70	5.667	43.29	8.667	3.16	11.67	1.80
2.750	2.70	5.750	43.29	8.750	3.16	11.75	1.80
2.833	2.70	5.833	119.04	8.833	3.16	11.83	1.80
2.917	2.70	5.917	119.04	8.917	3.16	11.92	1.80
3.000	2.70	6.000	119.04	9.000	3.16	12.00	1.80

Max.Eff.Inten.(mm/hr)=	119.04	149.56	
over (min)	5.00	15.00	
Storage Coeff. (min)=	4.45 (ii)	11.16 (ii)	
Unit Hyd. Tpeak (min)=	5.00	15.00	
Unit Hyd. peak (cms)=	0.23	0.09	
			TOTALS
PEAK FLOW (cms)=	1.64	3.90	5.204 (iii)
TIME TO PEAK (hrs)=	6.00	6.08	6.00
RUNOFF VOLUME (mm)=	88.68	36.13	47.17
TOTAL RAINFALL (mm)=	90.18	90.18	90.18
RUNOFF COEFFICIENT =	0.98	0.40	0.52

***** WARNING: STORAGE COEFF. IS SMALLER THAN TIME STEP!

(i) HORTONS EQUATION SELECTED FOR PERVIOUS LOSSES:

```
            Fo   (mm/hr)= 75.00           K  (1/hr)=  4.14
            Fc   (mm/hr)= 12.50     Cum.Inf.   (mm)=  0.00
      (ii) TIME STEP (DT) SHOULD BE SMALLER OR EQUAL
           THAN THE STORAGE COEFFICIENT.
     (iii) PEAK FLOW DOES NOT INCLUDE BASEFLOW IF ANY.

--------------------------------------------------------------------------------
--------------------
| CALIB            |
| STANDHYD (  0415)|   Area    (ha)=   4.99
|ID= 1 DT= 5.0 min |   Total Imp(%)=  42.00   Dir. Conn.(%)=  21.00
--------------------
                            IMPERVIOUS    PERVIOUS (i)
     Surface Area     (ha)=       2.10         2.89
     Dep. Storage     (mm)=       1.50         5.00
     Average Slope     (%)=       2.86         2.86
     Length            (m)=     185.00        40.00
     Mannings n            =      0.013        0.300

         NOTE:  RAINFALL WAS TRANSFORMED TO   5.0 MIN. TIME STEP.
```

---- TRANSFORMED HYETOGRAPH ----

TIME hrs	RAIN mm/hr	TIME hrs	RAIN mm/hr	TIME hrs	RAIN mm/hr	TIME hrs	RAIN mm/hr
0.083	2.26	3.083	3.61	6.083	16.23	9.08	3.16
0.167	2.26	3.167	3.61	6.167	16.23	9.17	3.16
0.250	2.26	3.250	3.61	6.250	16.23	9.25	3.16
0.333	2.26	3.333	3.61	6.333	16.23	9.33	3.16
0.417	2.26	3.417	3.61	6.417	16.23	9.42	3.16
0.500	2.26	3.500	3.61	6.500	16.23	9.50	3.16
0.583	2.26	3.583	3.61	6.583	7.21	9.58	3.16
0.667	2.26	3.667	3.61	6.667	7.21	9.67	3.16
0.750	2.26	3.750	3.61	6.750	7.21	9.75	3.16
0.833	2.25	3.833	3.61	6.833	7.21	9.83	3.16
0.917	2.26	3.917	3.61	6.917	7.21	9.92	3.16
1.000	2.26	4.000	3.61	7.000	7.21	10.00	3.16
1.083	2.25	4.083	5.41	7.083	5.41	10.08	1.80
1.167	2.26	4.167	5.41	7.167	5.41	10.17	1.80
1.250	2.26	4.250	5.41	7.250	5.41	10.25	1.80
1.333	2.26	4.333	5.41	7.333	5.41	10.33	1.80
1.417	2.26	4.417	5.41	7.417	5.41	10.42	1.80
1.500	2.26	4.500	5.41	7.500	5.41	10.50	1.80
1.583	2.26	4.583	7.21	7.583	5.41	10.58	1.80
1.667	2.26	4.667	7.21	7.667	5.41	10.67	1.80
1.750	2.26	4.750	7.21	7.750	5.41	10.75	1.80
1.833	2.26	4.833	7.21	7.833	5.41	10.83	1.80
1.917	2.26	4.917	7.21	7.917	5.41	10.92	1.80
2.000	2.26	5.000	7.21	8.000	5.41	11.00	1.80
2.083	2.70	5.083	10.82	8.083	3.16	11.08	1.80

```
                2.167    2.70 | 5.167   10.82 | 8.167    3.16 | 11.17    1.80
                2.250    2.70 | 5.250   10.82 | 8.250    3.16 | 11.25    1.80
                2.333    2.70 | 5.333   10.82 | 8.333    3.16 | 11.33    1.80
                2.417    2.70 | 5.417   10.82 | 8.417    3.16 | 11.42    1.80
                2.500    2.70 | 5.500   10.82 | 8.500    3.16 | 11.50    1.80
                2.583    2.70 | 5.583   43.29 | 8.583    3.16 | 11.58    1.80
                2.667    2.70 | 5.667   43.29 | 8.667    3.16 | 11.67    1.80
                2.750    2.70 | 5.750   43.29 | 8.750    3.16 | 11.75    1.80
                2.833    2.70 | 5.833  119.04 | 8.833    3.16 | 11.83    1.80
                2.917    2.70 | 5.917  119.04 | 8.917    3.16 | 11.92    1.80
                3.000    2.70 | 6.000  119.04 | 9.000    3.16 | 12.00    1.80

     Max.Eff.Inten.(mm/hr)=     119.04       149.56
               over (min)        5.00        10.00
     Storage Coeff.  (min)=       2.51 (ii)    8.54 (ii)
     Unit Hyd. Tpeak (min)=       5.00        10.00
     Unit Hyd. peak  (cms)=       0.29         0.12
                                                          *TOTALS*
     PEAK FLOW       (cms)=       0.35         0.96          1.304 (iii)
     TIME TO PEAK    (hrs)=       6.00         6.00           6.00
     RUNOFF VOLUME    (mm)=      88.68        36.13          47.17
     TOTAL RAINFALL   (mm)=      90.18        90.18          90.18
     RUNOFF COEFFICIENT   =       0.98         0.40           0.52

***** WARNING: STORAGE COEFF. IS SMALLER THAN TIME STEP!

       (i) HORTONS EQUATION SELECTED FOR PERVIOUS LOSSES:
            Fo   (mm/hr)= 75.00           K  (1/hr)=  4.14
            Fc   (mm/hr)= 12.50     Cum.Inf.   (mm)=  0.00
      (ii) TIME STEP (DT) SHOULD BE SMALLER OR EQUAL
           THAN THE STORAGE COEFFICIENT.
     (iii) PEAK FLOW DOES NOT INCLUDE BASEFLOW IF ANY.

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

--------------------
| ADD HYD  (  0420)|
|   1 +  2 =  3    |         AREA    QPEAK    TPEAK     R.V.
--------------------         (ha)    (cms)    (hrs)     (mm)
       ID1= 1 (  0410):    24.20   5.204     6.00    47.17
     + ID2= 2 (  0415):     4.99   1.304     6.00    47.17
       ================================================
       ID = 3 (  0420):    29.19   6.509     6.00    47.17

     NOTE:  PEAK FLOWS DO NOT INCLUDE BASEFLOWS IF ANY.
--------------------------------------------------------------------------------
--------------------
| DUHYD    (  0425)|
| Inlet Cap.= 1.980|
| #of Inlets=     1|
```

```
| Total(cms)=   2.0|      AREA     QPEAK     TPEAK    R.V.
-------------------      (ha)     (cms)     (hrs)    (mm)
     TOTAL HYD.(ID= 1):  29.19      6.51      6.00   47.17
     ================================================
     MAJOR SYS.(ID= 2):  10.15      4.53      6.00   47.17
     MINOR SYS.(ID= 3):  19.04      1.98      5.83   47.17

     NOTE:  PEAK FLOWS DO NOT INCLUDE BASEFLOWS IF ANY.

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--------------------
| ADD HYD  (  0470)|
|   1 +  2 =  3    |         AREA    QPEAK    TPEAK     R.V.
--------------------         (ha)    (cms)    (hrs)     (mm)
       ID1= 1 (  0425):    10.15   4.529     6.00    47.17
     + ID2= 2 (  0465):    48.70  10.395     6.00    47.17
       ================================================
       ID = 3 (  0470):    58.85  14.924     6.00    47.17

     NOTE:  PEAK FLOWS DO NOT INCLUDE BASEFLOWS IF ANY.
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--------------------
| ROUTE CHN(  0475)|
| IN= 2---> OUT= 1 |     Routing time step (min)'=  5.00
--------------------
              <------ DATA FOR SECTION (   1.1) ------>
              Distance      Elevation       Manning
                100.00        324.60        0.0500
                115.00        321.60        0.0500
                120.00        320.80    0.0500 /0.0300  Main Channel
                122.00        320.80    0.0300 /0.0500  Main Channel
                138.00        321.60        0.0500
                148.00        322.30        0.0500
                154.00        323.10        0.0500
                164.00        324.60        0.0500

      <---------------------- TRAVEL TIME TABLE ---------------------->
       DEPTH    ELEV      VOLUME    FLOW RATE    VELOCITY   TRAV.TIME
        (m)      (m)     (cu.m.)      (cms)        (m/s)      (min)
       0.20   321.00    .398E+03       0.8          0.84       8.53
       0.40   321.20    .125E+04       3.3          1.13       6.33
       0.60   321.40    .255E+04       8.1          1.36       5.27
       0.80   321.60    .430E+04      15.6          1.56       4.59
       1.00   321.80    .644E+04      26.8          1.79       4.01
       1.20   322.00    .892E+04      41.2          1.99       3.61
       1.40   322.20    .117E+05      59.3          2.17       3.30
       1.60   322.40    .148E+05      81.9          2.37       3.02
       1.80   322.60    .182E+05     109.1          2.58       2.78
       2.00   322.80    .218E+05     140.2          2.77       2.59
```

2.20	323.00	.256E+05	175.3	2.95	2.43
2.40	323.20	.296E+05	214.7	3.12	2.29
2.60	323.40	.338E+05	258.6	3.29	2.18
2.80	323.60	.382E+05	306.7	3.46	2.07
3.00	323.80	.428E+05	359.1	3.61	1.98
3.20	324.00	.476E+05	416.0	3.76	1.91
3.40	324.20	.526E+05	477.5	3.91	1.83
3.60	324.40	.578E+05	543.5	4.05	1.77
3.80	324.60	.632E+05	614.3	4.18	1.71

		<---- hydrograph ---->			<-pipe / channel->	
	AREA	QPEAK	TPEAK	R.V.	MAX DEPTH	MAX VEL
	(ha)	(cms)	(hrs)	(mm)	(m)	(m/s)
INFLOW : ID= 2 (0470)	58.85	14.92	6.00	47.17	0.78	1.54
OUTFLOW: ID= 1 (0475)	58.85	13.38	6.08	47.17	0.74	1.49

CALIB STANDHYD (0105) ID= 1 DT= 5.0 min	Area (ha)= 51.32 Total Imp(%)= 42.00 Dir. Conn.(%)= 21.00

		IMPERVIOUS	PERVIOUS (i)
Surface Area	(ha)=	21.55	29.77
Dep. Storage	(mm)=	1.50	5.00
Average Slope	(%)=	2.00	2.00
Length	(m)=	550.00	40.00
Mannings n	=	0.013	0.300

NOTE: RAINFALL WAS TRANSFORMED TO 5.0 MIN. TIME STEP.

---- TRANSFORMED HYETOGRAPH ----

TIME hrs	RAIN mm/hr	TIME hrs	RAIN mm/hr	TIME hrs	RAIN mm/hr	TIME hrs	RAIN mm/hr
0.083	2.26	3.083	3.61	6.083	16.23	9.08	3.16
0.167	2.26	3.167	3.61	6.167	16.23	9.17	3.16
0.250	2.26	3.250	3.61	6.250	16.23	9.25	3.16
0.333	2.26	3.333	3.61	6.333	16.23	9.33	3.16
0.417	2.26	3.417	3.61	6.417	16.23	9.42	3.16
0.500	2.26	3.500	3.61	6.500	16.23	9.50	3.16
0.583	2.26	3.583	3.61	6.583	7.21	9.58	3.16
0.667	2.26	3.667	3.61	6.667	7.21	9.67	3.16
0.750	2.26	3.750	3.61	6.750	7.21	9.75	3.16
0.833	2.25	3.833	3.61	6.833	7.21	9.83	3.16
0.917	2.26	3.917	3.61	6.917	7.21	9.92	3.16
1.000	2.26	4.000	3.61	7.000	7.21	10.00	3.16
1.083	2.25	4.083	5.41	7.083	5.41	10.08	1.80

1.167	2.26	4.167	5.41	7.167	5.41	10.17	1.80
1.250	2.26	4.250	5.41	7.250	5.41	10.25	1.80
1.333	2.26	4.333	5.41	7.333	5.41	10.33	1.80
1.417	2.26	4.417	5.41	7.417	5.41	10.42	1.80
1.500	2.26	4.500	5.41	7.500	5.41	10.50	1.80
1.583	2.26	4.583	7.21	7.583	5.41	10.58	1.80
1.667	2.26	4.667	7.21	7.667	5.41	10.67	1.80
1.750	2.26	4.750	7.21	7.750	5.41	10.75	1.80
1.833	2.26	4.833	7.21	7.833	5.41	10.83	1.80
1.917	2.26	4.917	7.21	7.917	5.41	10.92	1.80
2.000	2.26	5.000	7.21	8.000	5.41	11.00	1.80
2.083	2.70	5.083	10.82	8.083	3.16	11.08	1.80
2.167	2.70	5.167	10.82	8.167	3.16	11.17	1.80
2.250	2.70	5.250	10.82	8.250	3.16	11.25	1.80
2.333	2.70	5.333	10.82	8.333	3.16	11.33	1.80
2.417	2.70	5.417	10.82	8.417	3.16	11.42	1.80
2.500	2.70	5.500	10.82	8.500	3.16	11.50	1.80
2.583	2.70	5.583	43.29	8.583	3.16	11.58	1.80
2.667	2.70	5.667	43.29	8.667	3.16	11.67	1.80
2.750	2.70	5.750	43.29	8.750	3.16	11.75	1.80
2.833	2.70	5.833	119.04	8.833	3.16	11.83	1.80
2.917	2.70	5.917	119.04	8.917	3.16	11.92	1.80
3.000	2.70	6.000	119.04	9.000	3.16	12.00	1.80

Max.Eff.Inten.(mm/hr)=	119.04	149.56	
over (min)	5.00	15.00	
Storage Coeff. (min)=	5.38 (ii)	12.08 (ii)	
Unit Hyd. Tpeak (min)=	5.00	15.00	
Unit Hyd. peak (cms)=	0.21	0.09	
			TOTALS
PEAK FLOW (cms)=	3.42	8.01	10.668 (iii)
TIME TO PEAK (hrs)=	6.00	6.08	6.00
RUNOFF VOLUME (mm)=	88.68	36.13	47.17
TOTAL RAINFALL (mm)=	90.18	90.18	90.18
RUNOFF COEFFICIENT =	0.98	0.40	0.52

(i) HORTONS EQUATION SELECTED FOR PERVIOUS LOSSES:
Fo (mm/hr)= 75.00 K (1/hr)= 4.14
Fc (mm/hr)= 12.50 Cum.Inf. (mm)= 0.00
(ii) TIME STEP (DT) SHOULD BE SMALLER OR EQUAL
THAN THE STORAGE COEFFICIENT.
(iii) PEAK FLOW DOES NOT INCLUDE BASEFLOW IF ANY.

RESERVOIR(0106)	OVERFLOW IS OFF			
IN= 2---> OUT= 1				
DT= 5.0 min	OUTFLOW (cms)	STORAGE (ha.m.)	OUTFLOW (cms)	STORAGE (ha.m.)

```
                        0.0000     0.0000   |   0.5000      0.4000
                        0.0100     0.0100   |   6.6000      0.8000
                        0.0260     0.2300   |   0.0000      0.0000
     **** WARNING : STORAGE-DISCHARGE TABLE WAS EXCEEDED.

                                 AREA     QPEAK     TPEAK       R.V.
                                 (ha)     (cms)     (hrs)       (mm)
   INFLOW : ID= 2 (  0105)     51.320     10.668      6.00      47.17
   OUTFLOW: ID= 1 (  0106)     51.320      7.689      6.17      47.16

                  PEAK   FLOW   REDUCTION [Qout/Qin](%)= 72.08
                  TIME SHIFT OF PEAK FLOW         (min)= 10.00
                  MAXIMUM  STORAGE   USED       (ha.m.)=  0.8782

--------------------------------------------------------------------------------
--------------------
| CALIB            |
| STANDHYD (  0110)|   Area    (ha)=  19.00
|ID= 1 DT= 5.0 min |   Total Imp(%)=  42.00   Dir. Conn.(%)=  21.00
--------------------
                              IMPERVIOUS    PERVIOUS (i)
     Surface Area     (ha)=       7.98        11.02
     Dep. Storage     (mm)=       1.50         5.00
     Average Slope     (%)=       2.00         2.00
     Length            (m)=     365.00        40.00
     Mannings n           =      0.013        0.300

         NOTE:  RAINFALL WAS TRANSFORMED TO   5.0 MIN. TIME STEP.


                            ---- TRANSFORMED HYETOGRAPH ----
               TIME    RAIN |  TIME    RAIN |'  TIME    RAIN |  TIME    RAIN
                hrs   mm/hr |   hrs   mm/hr |'   hrs   mm/hr |   hrs   mm/hr
              0.083    2.26 | 3.083    3.61 | 6.083   16.23 |  9.08    3.16
              0.167    2.26 | 3.167    3.61 | 6.167   16.23 |  9.17    3.16
              0.250    2.26 | 3.250    3.61 | 6.250   16.23 |  9.25    3.16
              0.333    2.26 | 3.333    3.61 | 6.333   16.23 |  9.33    3.16
              0.417    2.26 | 3.417    3.61 | 6.417   16.23 |  9.42    3.16
              0.500    2.26 | 3.500    3.61 | 6.500   16.23 |  9.50    3.16
              0.583    2.26 | 3.583    3.61 | 6.583    7.21 |  9.58    3.16
              0.667    2.26 | 3.667    3.61 | 6.667    7.21 |  9.67    3.16
              0.750    2.26 | 3.750    3.61 | 6.750    7.21 |  9.75    3.16
              0.833    2.25 | 3.833    3.61 | 6.833    7.21 |  9.83    3.16
              0.917    2.26 | 3.917    3.61 | 6.917    7.21 |  9.92    3.16
              1.000    2.26 | 4.000    3.61 | 7.000    7.21 | 10.00    3.16
              1.083    2.25 | 4.083    5.41 | 7.083    5.41 | 10.08    1.80
              1.167    2.26 | 4.167    5.41 | 7.167    5.41 | 10.17    1.80
              1.250    2.26 | 4.250    5.41 | 7.250    5.41 | 10.25    1.80
              1.333    2.26 | 4.333    5.41 | 7.333    5.41 | 10.33    1.80
              1.417    2.26 | 4.417    5.41 | 7.417    5.41 | 10.42    1.80
```

1.500	2.26	4.500	5.41	7.500	5.41	10.50	1.80
1.583	2.26	4.583	7.21	7.583	5.41	10.58	1.80
1.667	2.26	4.667	7.21	7.667	5.41	10.67	1.80
1.750	2.26	4.750	7.21	7.750	5.41	10.75	1.80
1.833	2.26	4.833	7.21	7.833	5.41	10.83	1.80
1.917	2.26	4.917	7.21	7.917	5.41	10.92	1.80
2.000	2.26	5.000	7.21	8.000	5.41	11.00	1.80
2.083	2.70	5.083	10.82	8.083	3.16	11.08	1.80
2.167	2.70	5.167	10.82	8.167	3.16	11.17	1.80
2.250	2.70	5.250	10.82	8.250	3.16	11.25	1.80
2.333	2.70	5.333	10.82	8.333	3.16	11.33	1.80
2.417	2.70	5.417	10.82	8.417	3.16	11.42	1.80
2.500	2.70	5.500	10.82	8.500	3.16	11.50	1.80
2.583	2.70	5.583	43.29	8.583	3.16	11.58	1.80
2.667	2.70	5.667	43.29	8.667	3.16	11.67	1.80
2.750	2.70	5.750	43.29	8.750	3.16	11.75	1.80
2.833	2.70	5.833	119.04	8.833	3.16	11.83	1.80
2.917	2.70	5.917	119.04	8.917	3.16	11.92	1.80
3.000	2.70	6.000	119.04	9.000	3.16	12.00	1.80

Max.Eff.Inten.(mm/hr)=	119.04	149.56	
over (min)	5.00	15.00	
Storage Coeff. (min)=	4.21 (ii)	10.91 (ii)	
Unit Hyd. Tpeak (min)=	5.00	15.00	
Unit Hyd. peak (cms)=	0.24	0.09	
			TOTALS
PEAK FLOW (cms)=	1.30	3.09	4.123 (iii)
TIME TO PEAK (hrs)=	6.00	6.08	6.00
RUNOFF VOLUME (mm)=	88.68	36.13	47.17
TOTAL RAINFALL (mm)=	90.18	90.18	90.18
RUNOFF COEFFICIENT =	0.98	0.40	0.52

***** WARNING: STORAGE COEFF. IS SMALLER THAN TIME STEP!

(i) HORTONS EQUATION SELECTED FOR PERVIOUS LOSSES:
Fo (mm/hr)= 75.00 K (1/hr)= 4.14
Fc (mm/hr)= 12.50 Cum.Inf. (mm)= 0.00
(ii) TIME STEP (DT) SHOULD BE SMALLER OR EQUAL
THAN THE STORAGE COEFFICIENT.
(iii) PEAK FLOW DOES NOT INCLUDE BASEFLOW IF ANY.

RESERVOIR(0111) IN= 2---> OUT= 1 DT= 5.0 min	OVERFLOW IS OFF			
	OUTFLOW (cms)	STORAGE (ha.m.)	OUTFLOW (cms)	STORAGE (ha.m.)
	0.0000	0.0000	1.0000	1.0000
	0.0100	0.0100	20.0000	1.1000
	0.0120	0.1000	0.0000	0.0000

	AREA (ha)	QPEAK (cms)	TPEAK (hrs)	R.V. (mm)
INFLOW : ID= 2 (0110)	19.000	4.123	6.00	47.17
OUTFLOW: ID= 1 (0111)	19.000	0.613	6.58	47.16

PEAK FLOW REDUCTION [Qout/Qin](%)= 14.87
TIME SHIFT OF PEAK FLOW (min)= 35.00
MAXIMUM STORAGE USED (ha.m.)= 0.6478

CALIB STANDHYD (0102) ID= 1 DT= 5.0 min	Area (ha)= 14.32 Total Imp(%)= 42.00 Dir. Conn.(%)= 21.00

		IMPERVIOUS	PERVIOUS (i)
Surface Area	(ha)=	6.01	8.31
Dep. Storage	(mm)=	1.50	5.00
Average Slope	(%)=	2.00	2.00
Length	(m)=	287.00	40.00
Mannings n	=	0.013	0.300

NOTE: RAINFALL WAS TRANSFORMED TO 5.0 MIN. TIME STEP.

---- TRANSFORMED HYETOGRAPH ----

TIME hrs	RAIN mm/hr	TIME hrs	RAIN mm/hr	TIME hrs	RAIN mm/hr	TIME hrs	RAIN mm/hr
0.083	2.26	3.083	3.61	6.083	16.23	9.08	3.16
0.167	2.26	3.167	3.61	6.167	16.23	9.17	3.16
0.250	2.26	3.250	3.61	6.250	16.23	9.25	3.16
0.333	2.26	3.333	3.61	6.333	16.23	9.33	3.16
0.417	2.26	3.417	3.61	6.417	16.23	9.42	3.16
0.500	2.26	3.500	3.61	6.500	16.23	9.50	3.16
0.583	2.26	3.583	3.61	6.583	7.21	9.58	3.16
0.667	2.26	3.667	3.61	6.667	7.21	9.67	3.16
0.750	2.26	3.750	3.61	6.750	7.21	9.75	3.16
0.833	2.25	3.833	3.61	6.833	7.21	9.83	3.16
0.917	2.26	3.917	3.61	6.917	7.21	9.92	3.16
1.000	2.26	4.000	3.61	7.000	7.21	10.00	3.16
1.083	2.25	4.083	5.41	7.083	5.41	10.08	1.80
1.167	2.26	4.167	5.41	7.167	5.41	10.17	1.80
1.250	2.26	4.250	5.41	7.250	5.41	10.25	1.80
1.333	2.26	4.333	5.41	7.333	5.41	10.33	1.80
1.417	2.26	4.417	5.41	7.417	5.41	10.42	1.80
1.500	2.26	4.500	5.41	7.500	5.41	10.50	1.80
1.583	2.26	4.583	7.21	7.583	5.41	10.58	1.80
1.667	2.26	4.667	7.21	7.667	5.41	10.67	1.80
1.750	2.26	4.750	7.21	7.750	5.41	10.75	1.80

1.833	2.26	4.833	7.21	7.833	5.41	10.83	1.80
1.917	2.26	4.917	7.21	7.917	5.41	10.92	1.80
2.000	2.26	5.000	7.21	8.000	5.41	11.00	1.80
2.083	2.70	5.083	10.82	8.083	3.16	11.08	1.80
2.167	2.70	5.167	10.82	8.167	3.16	11.17	1.80
2.250	2.70	5.250	10.82	8.250	3.16	11.25	1.80
2.333	2.70	5.333	10.82	8.333	3.16	11.33	1.80
2.417	2.70	5.417	10.82	8.417	3.16	11.42	1.80
2.500	2.70	5.500	10.82	8.500	3.16	11.50	1.80
2.583	2.70	5.583	43.29	8.583	3.16	11.58	1.80
2.667	2.70	5.667	43.29	8.667	3.16	11.67	1.80
2.750	2.70	5.750	43.29	8.750	3.16	11.75	1.80
2.833	2.70	5.833	119.04	8.833	3.16	11.83	1.80
2.917	2.70	5.917	119.04	8.917	3.16	11.92	1.80
3.000	2.70	6.000	119.04	9.000	3.16	12.00	1.80

Max.Eff.Inten.(mm/hr)=	119.04	149.56	
over (min)	5.00	15.00	
Storage Coeff. (min)=	3.64 (ii)	10.35 (ii)	
Unit Hyd. Tpeak (min)=	5.00	15.00	
Unit Hyd. peak (cms)=	0.25	0.09	
			TOTALS
PEAK FLOW (cms)=	0.98	2.37	3.171 (iii)
TIME TO PEAK (hrs)=	6.00	6.08	6.00
RUNOFF VOLUME (mm)=	88.68	36.13	47.17
TOTAL RAINFALL (mm)=	90.18	90.18	90.18
RUNOFF COEFFICIENT =	0.98	0.40	0.52

***** WARNING: STORAGE COEFF. IS SMALLER THAN TIME STEP!

(i) HORTONS EQUATION SELECTED FOR PERVIOUS LOSSES:
Fo (mm/hr)= 75.00 K (1/hr)= 4.14
Fc (mm/hr)= 12.50 Cum.Inf. (mm)= 0.00
(ii) TIME STEP (DT) SHOULD BE SMALLER OR EQUAL
THAN THE STORAGE COEFFICIENT.
(iii) PEAK FLOW DOES NOT INCLUDE BASEFLOW IF ANY.

CALIB
STANDHYD (0101)
ID= 1 DT= 5.0 min

Area (ha)= 16.32
Total Imp(%)= 42.00 Dir. Conn.(%)= 21.00

		IMPERVIOUS	PERVIOUS (i)
Surface Area	(ha)=	6.85	9.47
Dep. Storage	(mm)=	1.50	5.00
Average Slope	(%)=	2.00	2.00
Length	(m)=	309.00	40.00
Mannings n	=	0.013	0.300

NOTE: RAINFALL WAS TRANSFORMED TO 5.0 MIN. TIME STEP.

---- TRANSFORMED HYETOGRAPH ----

TIME hrs	RAIN mm/hr	TIME hrs	RAIN mm/hr	TIME hrs	RAIN mm/hr	TIME hrs	RAIN mm/hr
0.083	2.26	3.083	3.61	6.083	16.23	9.08	3.16
0.167	2.26	3.167	3.61	6.167	16.23	9.17	3.16
0.250	2.26	3.250	3.61	6.250	16.23	9.25	3.16
0.333	2.26	3.333	3.61	6.333	16.23	9.33	3.16
0.417	2.26	3.417	3.61	6.417	16.23	9.42	3.16
0.500	2.26	3.500	3.61	6.500	16.23	9.50	3.16
0.583	2.26	3.583	3.61	6.583	7.21	9.58	3.16
0.667	2.26	3.667	3.61	6.667	7.21	9.67	3.16
0.750	2.26	3.750	3.61	6.750	7.21	9.75	3.16
0.833	2.25	3.833	3.61	6.833	7.21	9.83	3.16
0.917	2.26	3.917	3.61	6.917	7.21	9.92	3.16
1.000	2.26	4.000	3.61	7.000	7.21	10.00	3.16
1.083	2.25	4.083	5.41	7.083	5.41	10.08	1.80
1.167	2.26	4.167	5.41	7.167	5.41	10.17	1.80
1.250	2.26	4.250	5.41	7.250	5.41	10.25	1.80
1.333	2.26	4.333	5.41	7.333	5.41	10.33	1.80
1.417	2.26	4.417	5.41	7.417	5.41	10.42	1.80
1.500	2.26	4.500	5.41	7.500	5.41	10.50	1.80
1.583	2.26	4.583	7.21	7.583	5.41	10.58	1.80
1.667	2.26	4.667	7.21	7.667	5.41	10.67	1.80
1.750	2.26	4.750	7.21	7.750	5.41	10.75	1.80
1.833	2.26	4.833	7.21	7.833	5.41	10.83	1.80
1.917	2.26	4.917	7.21	7.917	5.41	10.92	1.80
2.000	2.26	5.000	7.21	8.000	5.41	11.00	1.80
2.083	2.70	5.083	10.82	8.083	3.16	11.08	1.80
2.167	2.70	5.167	10.82	8.167	3.16	11.17	1.80
2.250	2.70	5.250	10.82	8.250	3.16	11.25	1.80
2.333	2.70	5.333	10.82	8.333	3.16	11.33	1.80
2.417	2.70	5.417	10.82	8.417	3.16	11.42	1.80
2.500	2.70	5.500	10.82	8.500	3.16	11.50	1.80
2.583	2.70	5.583	43.29	8.583	3.16	11.58	1.80
2.667	2.70	5.667	43.29	8.667	3.16	11.67	1.80
2.750	2.70	5.750	43.29	8.750	3.16	11.75	1.80
2.833	2.70	5.833	119.04	8.833	3.16	11.83	1.80
2.917	2.70	5.917	119.04	8.917	3.16	11.92	1.80
3.000	2.70	6.000	119.04	9.000	3.16	12.00	1.80

Max.Eff.Inten.(mm/hr)=	119.04	149.56	
over (min)	5.00	15.00	
Storage Coeff. (min)=	3.81 (ii)	10.51 (ii)	
Unit Hyd. Tpeak (min)=	5.00	15.00	
Unit Hyd. peak (cms)=	0.25	0.09	
			TOTALS
PEAK FLOW (cms)=	1.12	2.69	3.593 (iii)

```
     TIME TO PEAK    (hrs)=       6.00         6.08          6.00
     RUNOFF VOLUME    (mm)=      88.68        36.13         47.17
     TOTAL RAINFALL   (mm)=      90.18        90.18         90.18
     RUNOFF COEFFICIENT   =       0.98         0.40          0.52

***** WARNING: STORAGE COEFF. IS SMALLER THAN TIME STEP!

       (i) HORTONS EQUATION SELECTED FOR PERVIOUS LOSSES:
            Fo   (mm/hr)= 75.00           K  (1/hr)=  4.14
            Fc   (mm/hr)= 12.50     Cum.Inf.   (mm)=  0.00
      (ii) TIME STEP (DT) SHOULD BE SMALLER OR EQUAL
           THAN THE STORAGE COEFFICIENT.
     (iii) PEAK FLOW DOES NOT INCLUDE BASEFLOW IF ANY.

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--------------------
| ADD HYD  (  0103)|
|   1 +  2 =  3    |         AREA    QPEAK    TPEAK     R.V.
--------------------         (ha)    (cms)    (hrs)     (mm)
        ID1= 1 (  0101):    16.32   3.593     6.00    47.17
      + ID2= 2 (  0102):    14.32   3.171     6.00    47.17
        ================================================
        ID = 3 (  0103):    30.64   6.764     6.00    47.17

     NOTE:  PEAK FLOWS DO NOT INCLUDE BASEFLOWS IF ANY.
--------------------------------------------------------------------------------
--------------------
| RESERVOIR(  0104)|     OVERFLOW IS OFF
| IN= 2---> OUT= 1 |
| DT=  5.0 min     |     OUTFLOW    STORAGE   |  OUTFLOW    STORAGE
--------------------      (cms)     (ha.m.)   |   (cms)     (ha.m.)
                          0.0000     0.0000   |   1.0000      0.5000
                          0.0100     0.0100   |  10.0000      0.6000
                          0.0150     0.1332   |   0.0000      0.0000

                                 AREA     QPEAK     TPEAK       R.V.
                                 (ha)     (cms)     (hrs)       (mm)
   INFLOW : ID= 2 (  0103)     30.640      6.764      6.00      47.17
   OUTFLOW: ID= 1 (  0104)     30.640      7.048      6.08      47.16

                  PEAK   FLOW   REDUCTION [Qout/Qin](%)=104.21
                  TIME SHIFT OF PEAK FLOW         (min)=  5.00
                  MAXIMUM  STORAGE   USED       (ha.m.)=  0.5855

     **** WARNING : HYDROGRAPH PEAK WAS NOT REDUCED.
                    CHECK OUTFLOW/STORAGE TABLE  OR REDUCE DT.
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| ADD HYD  (  0114)|
|   1 +  2 =  3    |          AREA    QPEAK    TPEAK     R.V.
-------------------          (ha)    (cms)    (hrs)     (mm)
       ID1= 1 (  0104):    30.64   7.048     6.08    47.16
     + ID2= 2 (  0111):    19.00   0.613     6.58    47.16
       ================================================
       ID = 3 (  0114):    49.64   7.421     6.08    47.16

     NOTE:  PEAK FLOWS DO NOT INCLUDE BASEFLOWS IF ANY.
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-------------------
| ADD HYD  (  0115)|
|   1 +  2 =  3    |          AREA    QPEAK    TPEAK     R.V.
-------------------          (ha)    (cms)    (hrs)     (mm)
       ID1= 1 (  0106):    51.32   7.689     6.17    47.16
     + ID2= 2 (  0114):    49.64   7.421     6.08    47.16
       ================================================
       ID = 3 (  0115):   100.96  14.393     6.08    47.16

     NOTE:  PEAK FLOWS DO NOT INCLUDE BASEFLOWS IF ANY.
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-------------------
| CALIB           |
| STANDHYD (  0395)|   Area    (ha)=  51.20
|ID= 1 DT= 5.0 min |   Total Imp(%)=  10.00   Dir. Conn.(%)=   5.00
-------------------
                            IMPERVIOUS    PERVIOUS (i)
     Surface Area     (ha)=       5.12        46.08
     Dep. Storage     (mm)=       1.50         5.00
     Average Slope     (%)=       2.00         2.00
     Length            (m)=     900.00        40.00
     Mannings n             =      0.013        0.300

         NOTE:  RAINFALL WAS TRANSFORMED TO   5.0 MIN. TIME STEP.


                          ---- TRANSFORMED HYETOGRAPH ----
  TIME    RAIN |  TIME    RAIN |'  TIME    RAIN |  TIME    RAIN
   hrs   mm/hr |   hrs   mm/hr |'   hrs   mm/hr |   hrs   mm/hr
 0.083    2.26 | 3.083    3.61 | 6.083   16.23 |  9.08    3.16
 0.167    2.26 | 3.167    3.61 | 6.167   16.23 |  9.17    3.16
 0.250    2.26 | 3.250    3.61 | 6.250   16.23 |  9.25    3.16
 0.333    2.26 | 3.333    3.61 | 6.333   16.23 |  9.33    3.16
 0.417    2.26 | 3.417    3.61 | 6.417   16.23 |  9.42    3.16
 0.500    2.26 | 3.500    3.61 | 6.500   16.23 |  9.50    3.16
 0.583    2.26 | 3.583    3.61 | 6.583    7.21 |  9.58    3.16
 0.667    2.26 | 3.667    3.61 | 6.667    7.21 |  9.67    3.16
 0.750    2.26 | 3.750    3.61 | 6.750    7.21 |  9.75    3.16
 0.833    2.25 | 3.833    3.61 | 6.833    7.21 |  9.83    3.16
```

0.917	2.26	3.917	3.61	6.917	7.21	9.92	3.16
1.000	2.26	4.000	3.61	7.000	7.21	10.00	3.16
1.083	2.25	4.083	5.41	7.083	5.41	10.08	1.80
1.167	2.26	4.167	5.41	7.167	5.41	10.17	1.80
1.250	2.26	4.250	5.41	7.250	5.41	10.25	1.80
1.333	2.26	4.333	5.41	7.333	5.41	10.33	1.80
1.417	2.26	4.417	5.41	7.417	5.41	10.42	1.80
1.500	2.26	4.500	5.41	7.500	5.41	10.50	1.80
1.583	2.26	4.583	7.21	7.583	5.41	10.58	1.80
1.667	2.26	4.667	7.21	7.667	5.41	10.67	1.80
1.750	2.26	4.750	7.21	7.750	5.41	10.75	1.80
1.833	2.26	4.833	7.21	7.833	5.41	10.83	1.80
1.917	2.26	4.917	7.21	7.917	5.41	10.92	1.80
2.000	2.26	5.000	7.21	8.000	5.41	11.00	1.80
2.083	2.70	5.083	10.82	8.083	3.16	11.08	1.80
2.167	2.70	5.167	10.82	8.167	3.16	11.17	1.80
2.250	2.70	5.250	10.82	8.250	3.16	11.25	1.80
2.333	2.70	5.333	10.82	8.333	3.16	11.33	1.80
2.417	2.70	5.417	10.82	8.417	3.16	11.42	1.80
2.500	2.70	5.500	10.82	8.500	3.16	11.50	1.80
2.583	2.70	5.583	43.29	8.583	3.16	11.58	1.80
2.667	2.70	5.667	43.29	8.667	3.16	11.67	1.80
2.750	2.70	5.750	43.29	8.750	3.16	11.75	1.80
2.833	2.70	5.833	119.04	8.833	3.16	11.83	1.80
2.917	2.70	5.917	119.04	8.917	3.16	11.92	1.80
3.000	2.70	6.000	119.04	9.000	3.16	12.00	1.80

Max.Eff.Inten.(mm/hr)=	119.04	112.64	
over (min)	5.00	15.00	
Storage Coeff. (min)=	7.23 (ii)	14.74 (ii)	
Unit Hyd. Tpeak (min)=	5.00	15.00	
Unit Hyd. peak (cms)=	0.17	0.08	
			TOTALS
PEAK FLOW (cms)=	0.78	8.19	8.631 (iii)
TIME TO PEAK (hrs)=	6.00	6.08	6.08
RUNOFF VOLUME (mm)=	88.68	31.49	34.35
TOTAL RAINFALL (mm)=	90.18	90.18	90.18
RUNOFF COEFFICIENT =	0.98	0.35	0.38

***** WARNING:FOR AREAS WITH IMPERVIOUS RATIOS BELOW 20%
YOU SHOULD CONSIDER SPLITTING THE AREA.

(i) HORTONS EQUATION SELECTED FOR PERVIOUS LOSSES:
Fo (mm/hr)= 75.00 K (1/hr)= 4.14
Fc (mm/hr)= 12.50 Cum.Inf. (mm)= 0.00
(ii) TIME STEP (DT) SHOULD BE SMALLER OR EQUAL
THAN THE STORAGE COEFFICIENT.
(iii) PEAK FLOW DOES NOT INCLUDE BASEFLOW IF ANY.

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--------------------
| CALIB            |
| STANDHYD (  0365)|   Area    (ha)= 117.50
|ID= 1 DT= 5.0 min |   Total Imp(%)=  42.00   Dir. Conn.(%)=  21.00
--------------------
                            IMPERVIOUS    PERVIOUS (i)
     Surface Area     (ha)=      49.35        68.15
     Dep. Storage     (mm)=       1.50         5.00
     Average Slope     (%)=       2.00         2.00
     Length            (m)=     885.00        40.00
     Mannings n             =      0.013        0.300

         NOTE:  RAINFALL WAS TRANSFORMED TO   5.0 MIN. TIME STEP.
```

---- TRANSFORMED HYETOGRAPH ----

TIME hrs	RAIN mm/hr	TIME hrs	RAIN mm/hr	TIME hrs	RAIN mm/hr	TIME hrs	RAIN mm/hr
0.083	2.26	3.083	3.61	6.083	16.23	9.08	3.16
0.167	2.26	3.167	3.61	6.167	16.23	9.17	3.16
0.250	2.26	3.250	3.61	6.250	16.23	9.25	3.16
0.333	2.26	3.333	3.61	6.333	16.23	9.33	3.16
0.417	2.26	3.417	3.61	6.417	16.23	9.42	3.16
0.500	2.26	3.500	3.61	6.500	16.23	9.50	3.16
0.583	2.26	3.583	3.61	6.583	7.21	9.58	3.16
0.667	2.26	3.667	3.61	6.667	7.21	9.67	3.16
0.750	2.26	3.750	3.61	6.750	7.21	9.75	3.16
0.833	2.25	3.833	3.61	6.833	7.21	9.83	3.16
0.917	2.26	3.917	3.61	6.917	7.21	9.92	3.16
1.000	2.26	4.000	3.61	7.000	7.21	10.00	3.16
1.083	2.25	4.083	5.41	7.083	5.41	10.08	1.80
1.167	2.26	4.167	5.41	7.167	5.41	10.17	1.80
1.250	2.26	4.250	5.41	7.250	5.41	10.25	1.80
1.333	2.26	4.333	5.41	7.333	5.41	10.33	1.80
1.417	2.26	4.417	5.41	7.417	5.41	10.42	1.80
1.500	2.26	4.500	5.41	7.500	5.41	10.50	1.80
1.583	2.26	4.583	7.21	7.583	5.41	10.58	1.80
1.667	2.26	4.667	7.21	7.667	5.41	10.67	1.80
1.750	2.26	4.750	7.21	7.750	5.41	10.75	1.80
1.833	2.26	4.833	7.21	7.833	5.41	10.83	1.80
1.917	2.26	4.917	7.21	7.917	5.41	10.92	1.80
2.000	2.26	5.000	7.21	8.000	5.41	11.00	1.80
2.083	2.70	5.083	10.82	8.083	3.16	11.08	1.80
2.167	2.70	5.167	10.82	8.167	3.16	11.17	1.80
2.250	2.70	5.250	10.82	8.250	3.16	11.25	1.80
2.333	2.70	5.333	10.82	8.333	3.16	11.33	1.80
2.417	2.70	5.417	10.82	8.417	3.16	11.42	1.80
2.500	2.70	5.500	10.82	8.500	3.16	11.50	1.80
2.583	2.70	5.583	43.29	8.583	3.16	11.58	1.80
2.667	2.70	5.667	43.29	8.667	3.16	11.67	1.80

2.750	2.70	5.750	43.29	8.750	3.16	11.75	1.80
2.833	2.70	5.833	119.04	8.833	3.16	11.83	1.80
2.917	2.70	5.917	119.04	8.917	3.16	11.92	1.80
3.000	2.70	6.000	119.04	9.000	3.16	12.00	1.80

Max.Eff.Inten.(mm/hr)=	119.04	149.56	
over (min)	5.00	15.00	
Storage Coeff. (min)=	7.16 (ii)	13.86 (ii)	
Unit Hyd. Tpeak (min)=	5.00	15.00	
Unit Hyd. peak (cms)=	0.17	0.08	
			TOTALS
PEAK FLOW (cms)=	7.49	17.25	22.881 (iii)
TIME TO PEAK (hrs)=	6.00	6.08	6.00
RUNOFF VOLUME (mm)=	88.68	36.13	47.17
TOTAL RAINFALL (mm)=	90.18	90.18	90.18
RUNOFF COEFFICIENT =	0.98	0.40	0.52

(i) HORTONS EQUATION SELECTED FOR PERVIOUS LOSSES:
Fo (mm/hr)= 75.00 K (1/hr)= 4.14
Fc (mm/hr)= 12.50 Cum.Inf. (mm)= 0.00
(ii) TIME STEP (DT) SHOULD BE SMALLER OR EQUAL
THAN THE STORAGE COEFFICIENT.
(iii) PEAK FLOW DOES NOT INCLUDE BASEFLOW IF ANY.

CALIB
STANDHYD (0360)
ID= 1 DT= 5.0 min

Area (ha)= 30.00
Total Imp(%)= 37.00 Dir. Conn.(%)= 19.00

		IMPERVIOUS	PERVIOUS (i)
Surface Area	(ha)=	11.10	18.90
Dep. Storage	(mm)=	1.50	5.00
Average Slope	(%)=	2.00	2.00
Length	(m)=	447.00	40.00
Mannings n	=	0.013	0.300

NOTE: RAINFALL WAS TRANSFORMED TO 5.0 MIN. TIME STEP.

---- TRANSFORMED HYETOGRAPH ----

TIME hrs	RAIN mm/hr	TIME hrs	RAIN mm/hr	TIME hrs	RAIN mm/hr	TIME hrs	RAIN mm/hr
0.083	2.26	3.083	3.61	6.083	16.23	9.08	3.16
0.167	2.26	3.167	3.61	6.167	16.23	9.17	3.16
0.250	2.26	3.250	3.61	6.250	16.23	9.25	3.16
0.333	2.26	3.333	3.61	6.333	16.23	9.33	3.16
0.417	2.26	3.417	3.61	6.417	16.23	9.42	3.16
0.500	2.26	3.500	3.61	6.500	16.23	9.50	3.16

0.583	2.26	3.583	3.61	6.583	7.21	9.58	3.16
0.667	2.26	3.667	3.61	6.667	7.21	9.67	3.16
0.750	2.26	3.750	3.61	6.750	7.21	9.75	3.16
0.833	2.25	3.833	3.61	6.833	7.21	9.83	3.16
0.917	2.26	3.917	3.61	6.917	7.21	9.92	3.16
1.000	2.26	4.000	3.61	7.000	7.21	10.00	3.16
1.083	2.25	4.083	5.41	7.083	5.41	10.08	1.80
1.167	2.26	4.167	5.41	7.167	5.41	10.17	1.80
1.250	2.26	4.250	5.41	7.250	5.41	10.25	1.80
1.333	2.26	4.333	5.41	7.333	5.41	10.33	1.80
1.417	2.26	4.417	5.41	7.417	5.41	10.42	1.80
1.500	2.26	4.500	5.41	7.500	5.41	10.50	1.80
1.583	2.26	4.583	7.21	7.583	5.41	10.58	1.80
1.667	2.26	4.667	7.21	7.667	5.41	10.67	1.80
1.750	2.26	4.750	7.21	7.750	5.41	10.75	1.80
1.833	2.26	4.833	7.21	7.833	5.41	10.83	1.80
1.917	2.26	4.917	7.21	7.917	5.41	10.92	1.80
2.000	2.26	5.000	7.21	8.000	5.41	11.00	1.80
2.083	2.70	5.083	10.82	8.083	3.16	11.08	1.80
2.167	2.70	5.167	10.82	8.167	3.16	11.17	1.80
2.250	2.70	5.250	10.82	8.250	3.16	11.25	1.80
2.333	2.70	5.333	10.82	8.333	3.16	11.33	1.80
2.417	2.70	5.417	10.82	8.417	3.16	11.42	1.80
2.500	2.70	5.500	10.82	8.500	3.16	11.50	1.80
2.583	2.70	5.583	43.29	8.583	3.16	11.58	1.80
2.667	2.70	5.667	43.29	8.667	3.16	11.67	1.80
2.750	2.70	5.750	43.29	8.750	3.16	11.75	1.80
2.833	2.70	5.833	119.04	8.833	3.16	11.83	1.80
2.917	2.70	5.917	119.04	8.917	3.16	11.92	1.80
3.000	2.70	6.000	119.04	9.000	3.16	12.00	1.80

Max.Eff.Inten.(mm/hr)=	119.04	140.44		
over (min)	5.00	15.00		
Storage Coeff. (min)=	4.75 (ii)	11.63 (ii)		
Unit Hyd. Tpeak (min)=	5.00	15.00		
Unit Hyd. peak (cms)=	0.22	0.09		
			TOTALS	
PEAK FLOW (cms)=	1.83	4.81	6.183 (iii)	
TIME TO PEAK (hrs)=	6.00	6.08	6.00	
RUNOFF VOLUME (mm)=	88.68	35.04	45.23	
TOTAL RAINFALL (mm)=	90.18	90.18	90.18	
RUNOFF COEFFICIENT =	0.98	0.39	0.50	

***** WARNING: STORAGE COEFF. IS SMALLER THAN TIME STEP!
***** WARNING:FOR AREAS WITH IMPERVIOUS RATIOS BELOW 20%
YOU SHOULD CONSIDER SPLITTING THE AREA.

(i) HORTONS EQUATION SELECTED FOR PERVIOUS LOSSES:
Fo (mm/hr)= 75.00 K (1/hr)= 4.14
Fc (mm/hr)= 12.50 Cum.Inf. (mm)= 0.00

(ii) TIME STEP (DT) SHOULD BE SMALLER OR EQUAL
THAN THE STORAGE COEFFICIENT.
(iii) PEAK FLOW DOES NOT INCLUDE BASEFLOW IF ANY.

ROUTE CHN(0362)
IN= 2---> OUT= 1	Routing time step (min)'= 5.00

<------ DATA FOR SECTION (1.1) ------>

Distance	Elevation	Manning	
0.00	0.40	0.0300	
5.50	0.15	0.0300 /0.0150	Main Channel
5.51	0.00	0.0150	Main Channel
10.00	0.09	0.0150	Main Channel
14.49	0.00	0.0150	Main Channel
14.50	0.15	0.0150 /0.0300	Main Channel
20.00	0.40	0.0300	

<---------- TRAVEL TIME TABLE ---------->

DEPTH (m)	ELEV (m)	VOLUME (cu.m.)	FLOW RATE (cms)	VELOCITY (m/s)	TRAV.TIME (min)
0.02	0.02	.176E+02	0.0	0.21	80.52
0.04	0.04	.702E+02	0.0	0.33	50.72
0.06	0.06	.158E+03	0.1	0.43	38.71
0.08	0.08	.281E+03	0.1	0.52	31.95
0.09	0.09	.438E+03	0.3	0.62	26.84
0.11	0.11	.607E+03	0.5	0.77	21.66
0.13	0.13	.776E+03	0.7	0.90	18.45
0.15	0.15	.944E+03	1.0	1.03	16.22
0.17	0.17	.116E+04	1.3	1.16	14.36
0.20	0.20	.140E+04	1.8	1.27	13.13
0.22	0.22	.166E+04	2.3	1.36	12.24
0.24	0.24	.194E+04	2.8	1.44	11.58
0.26	0.26	.225E+04	3.4	1.51	11.05
0.29	0.29	.258E+04	4.0	1.57	10.63
0.31	0.31	.293E+04	4.8	1.62	10.27
0.33	0.33	.331E+04	5.5	1.67	9.97
0.35	0.35	.371E+04	6.4	1.72	9.71
0.38	0.38	.413E+04	7.3	1.76	9.48
0.40	0.40	.457E+04	8.2	1.80	9.28

		<---- hydrograph ---->			<-pipe / channel->	
	AREA (ha)	QPEAK (cms)	TPEAK (hrs)	R.V. (mm)	MAX DEPTH (m)	MAX VEL (m/s)
INFLOW : ID= 2 (0360)	30.00	6.18	6.00	45.23	0.35	1.71
OUTFLOW: ID= 1 (0362)	30.00	4.88	6.17	45.22	0.31	1.63

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| CALIB            |
| STANDHYD (  0350)|   Area    (ha)=  16.30
|ID= 1 DT= 5.0 min |   Total Imp(%)=  42.00   Dir. Conn.(%)=  21.00
--------------------
                            IMPERVIOUS    PERVIOUS (i)
     Surface Area     (ha)=       6.85         9.45
     Dep. Storage     (mm)=       1.50         5.00
     Average Slope     (%)=       1.00         1.00
     Length            (m)=     330.00        40.00
     Mannings n           =      0.013        0.300

         NOTE:  RAINFALL WAS TRANSFORMED TO   5.0 MIN. TIME STEP.
```

---- TRANSFORMED HYETOGRAPH ----

TIME hrs	RAIN mm/hr	TIME hrs	RAIN mm/hr	TIME hrs	RAIN mm/hr	TIME hrs	RAIN mm/hr
0.083	2.26	3.083	3.61	6.083	16.23	9.08	3.16
0.167	2.26	3.167	3.61	6.167	16.23	9.17	3.16
0.250	2.26	3.250	3.61	6.250	16.23	9.25	3.16
0.333	2.26	3.333	3.61	6.333	16.23	9.33	3.16
0.417	2.26	3.417	3.61	6.417	16.23	9.42	3.16
0.500	2.26	3.500	3.61	6.500	16.23	9.50	3.16
0.583	2.26	3.583	3.61	6.583	7.21	9.58	3.16
0.667	2.26	3.667	3.61	6.667	7.21	9.67	3.16
0.750	2.26	3.750	3.61	6.750	7.21	9.75	3.16
0.833	2.25	3.833	3.61	6.833	7.21	9.83	3.16
0.917	2.26	3.917	3.61	6.917	7.21	9.92	3.16
1.000	2.26	4.000	3.61	7.000	7.21	10.00	3.16
1.083	2.25	4.083	5.41	7.083	5.41	10.08	1.80
1.167	2.26	4.167	5.41	7.167	5.41	10.17	1.80
1.250	2.26	4.250	5.41	7.250	5.41	10.25	1.80
1.333	2.26	4.333	5.41	7.333	5.41	10.33	1.80
1.417	2.26	4.417	5.41	7.417	5.41	10.42	1.80
1.500	2.26	4.500	5.41	7.500	5.41	10.50	1.80
1.583	2.26	4.583	7.21	7.583	5.41	10.58	1.80
1.667	2.26	4.667	7.21	7.667	5.41	10.67	1.80
1.750	2.26	4.750	7.21	7.750	5.41	10.75	1.80
1.833	2.26	4.833	7.21	7.833	5.41	10.83	1.80
1.917	2.26	4.917	7.21	7.917	5.41	10.92	1.80
2.000	2.26	5.000	7.21	8.000	5.41	11.00	1.80
2.083	2.70	5.083	10.82	8.083	3.16	11.08	1.80
2.167	2.70	5.167	10.82	8.167	3.16	11.17	1.80
2.250	2.70	5.250	10.82	8.250	3.16	11.25	1.80
2.333	2.70	5.333	10.82	8.333	3.16	11.33	1.80
2.417	2.70	5.417	10.82	8.417	3.16	11.42	1.80
2.500	2.70	5.500	10.82	8.500	3.16	11.50	1.80
2.583	2.70	5.583	43.29	8.583	3.16	11.58	1.80

```
              2.667    2.70 | 5.667   43.29 | 8.667    3.16 | 11.67    1.80
              2.750    2.70 | 5.750   43.29 | 8.750    3.16 | 11.75    1.80
              2.833    2.70 | 5.833  119.04 | 8.833    3.16 | 11.83    1.80
              2.917    2.70 | 5.917  119.04 | 8.917    3.16 | 11.92    1.80
              3.000    2.70 | 6.000  119.04 | 9.000    3.16 | 12.00    1.80

     Max.Eff.Inten.(mm/hr)=     119.04       149.56
               over (min)        5.00        15.00
     Storage Coeff.  (min)=       4.88 (ii)   13.13 (ii)
     Unit Hyd. Tpeak (min)=       5.00        15.00
     Unit Hyd. peak  (cms)=       0.22         0.08
                                                          *TOTALS*
     PEAK FLOW       (cms)=       1.10         2.45          3.299 (iii)
     TIME TO PEAK    (hrs)=       6.00         6.08           6.00
     RUNOFF VOLUME    (mm)=      88.68        36.13          47.17
     TOTAL RAINFALL   (mm)=      90.18        90.18          90.18
     RUNOFF COEFFICIENT   =       0.98         0.40           0.52

***** WARNING: STORAGE COEFF. IS SMALLER THAN TIME STEP!

       (i) HORTONS EQUATION SELECTED FOR PERVIOUS LOSSES:
            Fo   (mm/hr)= 75.00           K  (1/hr)=  4.14
            Fc   (mm/hr)= 12.50     Cum.Inf.   (mm)=  0.00
      (ii) TIME STEP (DT) SHOULD BE SMALLER OR EQUAL
           THAN THE STORAGE COEFFICIENT.
     (iii) PEAK FLOW DOES NOT INCLUDE BASEFLOW IF ANY.

--------------------------------------------------------------------------------
--------------------
| ROUTE CHN(  0353)|
| IN= 2---> OUT= 1 |     Routing time step (min)'=  5.00
--------------------
               <------ DATA FOR SECTION (   1.1) ------>
               Distance      Elevation       Manning
                   0.00          0.26        0.0300
                   5.50          0.15    0.0300 /0.0150  Main Channel
                   5.51          0.00        0.0150      Main Channel
                  10.00          0.09        0.0150      Main Channel
                  14.49          0.00        0.0150      Main Channel
                  14.50          0.15    0.0150 /0.0300  Main Channel
                  20.00          0.26        0.0300

      <---------------------- TRAVEL TIME TABLE ---------------------->
       DEPTH    ELEV      VOLUME    FLOW RATE    VELOCITY   TRAV.TIME
        (m)      (m)     (cu.m.)      (cms)        (m/s)      (min)
       0.01     0.01    .929E+01       0.0          0.17      99.56
       0.03     0.03    .372E+02       0.0          0.27      62.72
       0.04     0.04    .836E+02       0.0          0.35      47.86
       0.05     0.05    .149E+03       0.1          0.42      39.51
       0.07     0.07    .232E+03       0.1          0.49      34.05
```

0.08	0.08	.334E+03	0.2	0.55	30.15
0.10	0.10	.454E+03	0.3	0.64	26.24
0.11	0.11	.576E+03	0.4	0.74	22.41
0.12	0.12	.699E+03	0.6	0.84	19.75
0.14	0.14	.822E+03	0.8	0.94	17.76
0.15	0.15	.944E+03	1.0	1.03	16.22
0.16	0.16	.108E+04	1.2	1.11	15.07
0.18	0.18	.123E+04	1.4	1.17	14.28
0.19	0.19	.140E+04	1.7	1.21	13.72
0.20	0.20	.159E+04	2.0	1.25	13.31
0.22	0.22	.180E+04	2.3	1.28	13.01
0.23	0.23	.203E+04	2.6	1.31	12.76
0.25	0.25	.227E+04	3.0	1.33	12.57
0.26	0.26	.254E+04	3.4	1.34	12.41

	<---- hydrograph ---->			<-pipe / channel->	
	AREA	QPEAK	TPEAK	R.V.	MAX DEPTH	MAX VEL
	(ha)	(cms)	(hrs)	(mm)	(m)	(m/s)
INFLOW : ID= 2 (0350)	16.30	3.30	6.00	47.17	0.26	1.34
OUTFLOW: ID= 1 (0353)	16.30	2.44	6.17	47.13	0.22	1.29

CALIB STANDHYD (0355) ID= 1 DT= 5.0 min	Area (ha)= 12.30 Total Imp(%)= 42.00 Dir. Conn.(%)= 21.00

		IMPERVIOUS	PERVIOUS (i)
Surface Area	(ha)=	5.17	7.13
Dep. Storage	(mm)=	1.50	5.00
Average Slope	(%)=	1.60	1.60
Length	(m)=	286.00	40.00
Mannings n	=	0.013	0.300

NOTE: RAINFALL WAS TRANSFORMED TO 5.0 MIN. TIME STEP.

---- TRANSFORMED HYETOGRAPH ----

TIME hrs	RAIN mm/hr	TIME hrs	RAIN mm/hr	TIME hrs	RAIN mm/hr	TIME hrs	RAIN mm/hr
0.083	2.26	3.083	3.61	6.083	16.23	9.08	3.16
0.167	2.26	3.167	3.61	6.167	16.23	9.17	3.16
0.250	2.26	3.250	3.61	6.250	16.23	9.25	3.16
0.333	2.26	3.333	3.61	6.333	16.23	9.33	3.16
0.417	2.26	3.417	3.61	6.417	16.23	9.42	3.16
0.500	2.26	3.500	3.61	6.500	16.23	9.50	3.16
0.583	2.26	3.583	3.61	6.583	7.21	9.58	3.16
0.667	2.26	3.667	3.61	6.667	7.21	9.67	3.16

0.750	2.26	3.750	3.61	6.750	7.21	9.75	3.16
0.833	2.25	3.833	3.61	6.833	7.21	9.83	3.16
0.917	2.26	3.917	3.61	6.917	7.21	9.92	3.16
1.000	2.26	4.000	3.61	7.000	7.21	10.00	3.16
1.083	2.25	4.083	5.41	7.083	5.41	10.08	1.80
1.167	2.26	4.167	5.41	7.167	5.41	10.17	1.80
1.250	2.26	4.250	5.41	7.250	5.41	10.25	1.80
1.333	2.26	4.333	5.41	7.333	5.41	10.33	1.80
1.417	2.26	4.417	5.41	7.417	5.41	10.42	1.80
1.500	2.26	4.500	5.41	7.500	5.41	10.50	1.80
1.583	2.26	4.583	7.21	7.583	5.41	10.58	1.80
1.667	2.26	4.667	7.21	7.667	5.41	10.67	1.80
1.750	2.26	4.750	7.21	7.750	5.41	10.75	1.80
1.833	2.26	4.833	7.21	7.833	5.41	10.83	1.80
1.917	2.26	4.917	7.21	7.917	5.41	10.92	1.80
2.000	2.26	5.000	7.21	8.000	5.41	11.00	1.80
2.083	2.70	5.083	10.82	8.083	3.16	11.08	1.80
2.167	2.70	5.167	10.82	8.167	3.16	11.17	1.80
2.250	2.70	5.250	10.82	8.250	3.16	11.25	1.80
2.333	2.70	5.333	10.82	8.333	3.16	11.33	1.80
2.417	2.70	5.417	10.82	8.417	3.16	11.42	1.80
2.500	2.70	5.500	10.82	8.500	3.16	11.50	1.80
2.583	2.70	5.583	43.29	8.583	3.16	11.58	1.80
2.667	2.70	5.667	43.29	8.667	3.16	11.67	1.80
2.750	2.70	5.750	43.29	8.750	3.16	11.75	1.80
2.833	2.70	5.833	119.04	8.833	3.16	11.83	1.80
2.917	2.70	5.917	119.04	8.917	3.16	11.92	1.80
3.000	2.70	6.000	119.04	9.000	3.16	12.00	1.80

Max.Eff.Inten.(mm/hr)=	119.04	149.56	
over (min)	5.00	15.00	
Storage Coeff. (min)=	3.89 (ii)	11.05 (ii)	
Unit Hyd. Tpeak (min)=	5.00	15.00	
Unit Hyd. peak (cms)=	0.25	0.09	
			TOTALS
PEAK FLOW (cms)=	0.84	1.99	2.661 (iii)
TIME TO PEAK (hrs)=	6.00	6.08	6.00
RUNOFF VOLUME (mm)=	88.68	36.13	47.17
TOTAL RAINFALL (mm)=	90.18	90.18	90.18
RUNOFF COEFFICIENT =	0.98	0.40	0.52

***** WARNING: STORAGE COEFF. IS SMALLER THAN TIME STEP!

(i) HORTONS EQUATION SELECTED FOR PERVIOUS LOSSES:
Fo (mm/hr)= 75.00 K (1/hr)= 4.14
Fc (mm/hr)= 12.50 Cum.Inf. (mm)= 0.00

(ii) TIME STEP (DT) SHOULD BE SMALLER OR EQUAL
THAN THE STORAGE COEFFICIENT.

(iii) PEAK FLOW DOES NOT INCLUDE BASEFLOW IF ANY.

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--------------------------------------------------------------------------------
--------------------
| ROUTE CHN(  0358)|
| IN= 2---> OUT= 1 |     Routing time step (min)'=  5.00
--------------------
               <------ DATA FOR SECTION (   1.1) ------>
               Distance      Elevation       Manning
                   0.00          0.26        0.0300
                   5.50          0.15    0.0300 /0.0150  Main Channel
                   5.51          0.00        0.0150      Main Channel
                  10.00          0.09        0.0150      Main Channel
                  14.49          0.00        0.0150      Main Channel
                  14.50          0.15    0.0150 /0.0300  Main Channel
                  20.00          0.26        0.0300

      <---------------------- TRAVEL TIME TABLE ---------------------->
       DEPTH    ELEV      VOLUME    FLOW RATE    VELOCITY   TRAV.TIME
        (m)      (m)     (cu.m.)      (cms)        (m/s)      (min)
       0.01     0.01    .102E+02       0.0          0.17     109.52
       0.03     0.03    .409E+02       0.0          0.27      68.99
       0.04     0.04    .920E+02       0.0          0.35      52.65
       0.05     0.05    .163E+03       0.1          0.42      43.46
       0.07     0.07    .255E+03       0.1          0.49      37.45
       0.08     0.08    .368E+03       0.2          0.55      33.17
       0.10     0.10    .499E+03       0.3          0.64      28.86
       0.11     0.11    .634E+03       0.4          0.74      24.66
       0.12     0.12    .769E+03       0.6          0.84      21.72
       0.14     0.14    .904E+03       0.8          0.94      19.54
       0.15     0.15    .104E+04       1.0          1.03      17.84
       0.16     0.16    .119E+04       1.2          1.11      16.57
       0.18     0.18    .135E+04       1.4          1.17      15.71
       0.19     0.19    .154E+04       1.7          1.21      15.10
       0.20     0.20    .175E+04       2.0          1.25      14.65
       0.22     0.22    .198E+04       2.3          1.28      14.31
       0.23     0.23    .223E+04       2.6          1.31      14.04
       0.25     0.25    .250E+04       3.0          1.33      13.82
       0.26     0.26    .279E+04       3.4          1.34      13.65

                                    <---- hydrograph ---->   <-pipe / channel->
                              AREA    QPEAK   TPEAK   R.V.   MAX DEPTH  MAX VEL
                              (ha)    (cms)   (hrs)   (mm)      (m)      (m/s)
   INFLOW : ID= 2 (  0355)   12.30     2.66    6.00  47.17      0.23      1.31
   OUTFLOW: ID= 1 (  0358)   12.30     1.86    6.17  47.12      0.20      1.23



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--------------------
| ADD HYD  (  0359)|
```

```
|   1 +  2 =  3    |         AREA    QPEAK    TPEAK     R.V.
--------------------         (ha)    (cms)    (hrs)     (mm)
       ID1= 1 (  0353):    16.30   2.435     6.17    47.13
     + ID2= 2 (  0358):    12.30   1.856     6.17    47.12
       ================================================
       ID = 3 (  0359):    28.60   4.291     6.17    47.13

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

--------------------
| ADD HYD  (  0363)|
|   1 +  2 =  3    |         AREA    QPEAK    TPEAK     R.V.
--------------------         (ha)    (cms)    (hrs)     (mm)
       ID1= 1 (  0359):    28.60   4.291     6.17    47.13
     + ID2= 2 (  0362):    30.00   4.880     6.17    45.22
       ================================================
       ID = 3 (  0363):    58.60   9.171     6.17    46.15

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

--------------------
| ADD HYD  (  0380)|
|   1 +  2 =  3    |         AREA    QPEAK    TPEAK     R.V.
--------------------         (ha)    (cms)    (hrs)     (mm)
       ID1= 1 (  0363):    58.60   9.171     6.17    46.15
     + ID2= 2 (  0365):   117.50  22.881     6.00    47.17
       ================================================
       ID = 3 (  0380):   176.10  30.231     6.08    46.83

     NOTE:  PEAK FLOWS DO NOT INCLUDE BASEFLOWS IF ANY.
--------------------------------------------------------------------------------
--------------------
| RESERVOIR(  0390)|     OVERFLOW IS OFF
| IN= 2---> OUT= 1 |
| DT=  5.0 min     |     OUTFLOW    STORAGE   |  OUTFLOW    STORAGE
--------------------      (cms)     (ha.m.)   |   (cms)     (ha.m.)
                          0.0000     0.0000   |   1.3100      1.6000
                          0.7700     0.2870   |   1.8600     23.2300
                          1.2600     0.9680   |   0.0000      0.0000

                                  AREA     QPEAK     TPEAK       R.V.
                                  (ha)     (cms)     (hrs)       (mm)
   INFLOW : ID= 2 (  0380)    176.100     30.231      6.08      46.83
   OUTFLOW: ID= 1 (  0390)    176.100      1.430      7.25      46.83

                  PEAK   FLOW   REDUCTION [Qout/Qin](%)=  4.73
                  TIME SHIFT OF PEAK FLOW         (min)= 70.00
                  MAXIMUM  STORAGE   USED       (ha.m.)=  6.3304
```

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--------------------
| ADD HYD  (  0400)|
|   1 +  2 =  3    |          AREA    QPEAK    TPEAK     R.V.
--------------------          (ha)    (cms)    (hrs)     (mm)
       ID1= 1 (  0390):   176.10   1.430     7.25    46.83
     + ID2= 2 (  0395):    51.20   8.631     6.08    34.35
       ================================================
       ID = 3 (  0400):   227.30   9.969     6.08    44.02

     NOTE:  PEAK FLOWS DO NOT INCLUDE BASEFLOWS IF ANY.
--------------------------------------------------------------------------------
--------------------
| ROUTE CHN(  0403)|
| IN= 2---> OUT= 1 |     Routing time step (min)'=  5.00
--------------------
              <------ DATA FOR SECTION (   1.1) ------>
              Distance      Elevation       Manning
                100.00        338.30        0.0500
                110.00        336.80        0.0500
                135.00        336.00        0.0300      Main Channel
                142.00        335.30        0.0500
                148.00        335.30        0.0500
                156.00        336.00        0.0500
                165.00        338.30        0.0500

      <---------------------- TRAVEL TIME TABLE ---------------------->
       DEPTH    ELEV      VOLUME    FLOW RATE    VELOCITY   TRAV.TIME
        (m)      (m)     (cu.m.)      (cms)        (m/s)      (min)
       0.16   335.46    .231E+04       0.9          0.71      44.52
       0.32   335.62    .563E+04       3.2          1.09      29.11
       0.47   335.77    .997E+04       7.3          1.39      22.72
       0.63   335.93    .153E+05      13.4          1.66      19.04
       0.79   336.09    .218E+05      22.7          1.97      16.04
       0.95   336.25    .299E+05      35.3          2.25      14.10
       1.11   336.41    .396E+05      51.2          2.46      12.89
       1.26   336.56    .510E+05      70.7          2.63      12.02
       1.42   336.72    .641E+05      94.1          2.79      11.35
       1.58   336.88    .787E+05     122.4          2.96      10.71
       1.74   337.04    .939E+05     155.6          3.15      10.06
       1.89   337.19    .110E+06     192.8          3.34       9.48
       2.05   337.35    .126E+06     233.9          3.53       8.97
       2.21   337.51    .143E+06     278.9          3.71       8.53
       2.37   337.67    .160E+06     327.7          3.89       8.13
       2.53   337.83    .178E+06     380.3          4.07       7.79
       2.68   337.98    .196E+06     436.7          4.23       7.48
       2.84   338.14    .215E+06     496.9          4.40       7.20
       3.00   338.30    .234E+06     561.0          4.56       6.95
```

```
                                    <---- hydrograph ---->   <-pipe / channel->
                                AREA    QPEAK   TPEAK   R.V.   MAX DEPTH  MAX VEL
                                (ha)    (cms)   (hrs)   (mm)      (m)      (m/s)
   INFLOW : ID= 2 (  0400)  227.30     9.97    6.08  44.02      0.54      1.50
   OUTFLOW: ID= 1 (  0403)  227.30     6.22    6.25  44.02      0.43      1.29



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

--------------------
| ADD HYD  (  0407)|
|   1 +  2 =  3    |         AREA    QPEAK    TPEAK     R.V.
--------------------         (ha)    (cms)    (hrs)     (mm)
       ID1= 1 (  0115):   100.96  14.393     6.08    47.16
     + ID2= 2 (  0403):   227.30   6.216     6.25    44.02
       ================================================
       ID = 3 (  0407):   328.26  18.926     6.17    44.98

     NOTE:  PEAK FLOWS DO NOT INCLUDE BASEFLOWS IF ANY.
--------------------------------------------------------------------------------
--------------------
| RESERVOIR(  0113)|     OVERFLOW IS OFF
| IN= 2---> OUT= 1 |
| DT=  5.0 min     |     OUTFLOW    STORAGE   |  OUTFLOW    STORAGE
--------------------      (cms)     (ha.m.)   |   (cms)     (ha.m.)
                          0.0000     0.0000   |   1.6000      6.4000
                          1.1000     2.9000   |   9.1000     10.0000
                          1.3000     4.3000   |  12.0000     20.0000

                                AREA     QPEAK     TPEAK       R.V.
                                (ha)     (cms)     (hrs)       (mm)
   INFLOW : ID= 2 (  0407)    328.260     18.926      6.17      44.98
   OUTFLOW: ID= 1 (  0113)    328.260      1.552     12.50      44.98

                  PEAK   FLOW   REDUCTION [Qout/Qin](%)=  8.20
                  TIME SHIFT OF PEAK FLOW         (min)=380.00
                  MAXIMUM  STORAGE   USED       (ha.m.)=  6.0640

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

--------------------
| ADD HYD  (  0430)|
|   1 +  2 =  3    |         AREA    QPEAK    TPEAK     R.V.
--------------------         (ha)    (cms)    (hrs)     (mm)
       ID1= 1 (  0113):   328.26   1.552    12.50    44.98
     + ID2= 2 (  0425):    19.04   1.980     5.83    47.17
       ================================================
       ID = 3 (  0430):   347.30   3.000     6.33    45.10
```

NOTE: PEAK FLOWS DO NOT INCLUDE BASEFLOWS IF ANY.

ROUTE CHN(0440)	
IN= 2---> OUT= 1	Routing time step (min)'= 5.00

<------ DATA FOR SECTION (1.1) ------>

Distance	Elevation	Manning	
100.00	325.40	0.0600	
120.00	324.60	0.0600	
126.00	323.90	0.0600	
130.00	323.00	0.0600	
140.00	322.30	0.0600 /0.0300	Main Channel
142.00	322.30	0.0300 /0.0600	Main Channel
150.00	323.90	0.0600	
155.00	324.60	0.0600	
160.00	325.40	0.0600	

<---------- TRAVEL TIME TABLE ---------->

DEPTH (m)	ELEV (m)	VOLUME (cu.m.)	FLOW RATE (cms)	VELOCITY (m/s)	TRAV.TIME (min)
0.16	322.46	.233E+03	0.6	0.96	6.96
0.33	322.63	.672E+03	2.1	1.26	5.27
0.49	322.79	.132E+04	4.9	1.48	4.51
0.65	322.95	.216E+04	9.0	1.66	4.03
0.82	323.12	.319E+04	14.9	1.87	3.57
0.98	323.28	.433E+04	22.5	2.08	3.21
1.14	323.44	.556E+04	31.6	2.27	2.93
1.31	323.61	.689E+04	42.3	2.45	2.72
1.47	323.77	.833E+04	54.6	2.62	2.54
1.63	323.93	.987E+04	68.3	2.77	2.41
1.79	324.09	.115E+05	82.8	2.87	2.33
1.96	324.26	.134E+05	99.2	2.96	2.25
2.12	324.42	.154E+05	117.9	3.06	2.18
2.28	324.58	.176E+05	138.8	3.15	2.11
2.45	324.75	.200E+05	157.4	3.14	2.12
2.61	324.91	.228E+05	179.6	3.15	2.11
2.77	325.07	.259E+05	205.8	3.18	2.09
2.94	325.24	.293E+05	236.1	3.23	2.07
3.10	325.40	.330E+05	270.6	3.28	2.03

		<---- hydrograph ---->			<-pipe / channel->	
	AREA (ha)	QPEAK (cms)	TPEAK (hrs)	R.V. (mm)	MAX DEPTH (m)	MAX VEL (m/s)
INFLOW : ID= 2 (0430)	347.30	3.00	6.33	45.10	0.38	1.33
OUTFLOW: ID= 1 (0440)	347.30	2.86	6.42	45.10	0.37	1.31

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

--------------------
| ADD HYD  (  0485)|
|   1 +  2 =  3    |         AREA    QPEAK    TPEAK     R.V.
--------------------         (ha)    (cms)    (hrs)     (mm)
       ID1= 1 (  0440):   347.30   2.860     6.42    45.10
     + ID2= 2 (  0475):    58.85  13.381     6.08    47.17
       ================================================
       ID = 3 (  0485):   406.15  15.674     6.08    45.40

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

--------------------
| ADD HYD  (  0490)|
|   1 +  2 =  3    |         AREA    QPEAK    TPEAK     R.V.
--------------------         (ha)    (cms)    (hrs)     (mm)
       ID1= 1 (  0480):    43.10   8.721     6.00    47.17
     + ID2= 2 (  0485):   406.15  15.674     6.08    45.40
       ================================================
       ID = 3 (  0490):   449.25  23.705     6.08    45.57

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

--------------------
| ADD HYD  (  0491)|
|   1 +  2 =  3    |         AREA    QPEAK    TPEAK     R.V.
--------------------         (ha)    (cms)    (hrs)     (mm)
       ID1= 1 (  0482):    22.65   3.311     6.17    57.38
     + ID2= 2 (  0490):   449.25  23.705     6.08    45.57
       ================================================
       ID = 3 (  0491):   471.90  26.971     6.08    46.14

     NOTE:  PEAK FLOWS DO NOT INCLUDE BASEFLOWS IF ANY.
--------------------------------------------------------------------------------
--------------------
| RESERVOIR(  0483)|     OVERFLOW IS OFF
| IN= 2---> OUT= 1 |
| DT=  5.0 min     |     OUTFLOW    STORAGE   |  OUTFLOW    STORAGE
--------------------      (cms)     (ha.m.)   |   (cms)     (ha.m.)
                          0.0000     0.0000   |   7.0800      2.4860
                          0.2760     0.0600   |   8.1000      3.3240
                          1.2000     0.3400   |   9.7980      4.6420
                          2.0400     0.6182   |  10.4940      7.4397
                          2.6400     1.1630   |  11.6850     10.3000
                          3.1200     1.7070   |  12.3480     11.4000

                                AREA     QPEAK     TPEAK       R.V.
```

```
                                (ha)     (cms)     (hrs)       (mm)
   INFLOW : ID= 2 (  0491)    471.900     26.971      6.08      46.14
   OUTFLOW: ID= 1 (  0483)    471.900      8.254      6.58      46.14

                  PEAK   FLOW   REDUCTION [Qout/Qin](%)= 30.60
                  TIME SHIFT OF PEAK FLOW         (min)= 30.00
                  MAXIMUM  STORAGE   USED       (ha.m.)=  3.4556

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

--------------------
| ADD HYD  (  0530)|
|   1 +  2 =  3    |         AREA    QPEAK    TPEAK     R.V.
--------------------         (ha)    (cms)    (hrs)     (mm)
       ID1= 1 (  0483):   471.90   8.254     6.58    46.14
     + ID2= 2 (  0540):     4.63   1.339     6.00    76.65
       ================================================
       ID = 3 (  0530):   476.53   8.464     6.50    46.43

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

--------------------
| ADD HYD  (  0545)|
|   1 +  2 =  3    |         AREA    QPEAK    TPEAK     R.V.
--------------------         (ha)    (cms)    (hrs)     (mm)
       ID1= 1 (  0527):    67.56   9.131     6.08   243.98
     + ID2= 2 (  0530):   476.53   8.464     6.50    46.43
       ================================================
       ID = 3 (  0545):   544.09  16.996     6.33    70.96

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

--------------------
| ADD HYD  (  0546)|
|   1 +  2 =  3    |         AREA    QPEAK    TPEAK     R.V.
--------------------         (ha)    (cms)    (hrs)     (mm)
       ID1= 1 (  0542):    25.25   6.749     6.00    76.65
     + ID2= 2 (  0545):   544.09  16.996     6.33    70.96
       ================================================
       ID = 3 (  0546):   569.34  19.381     6.00    71.21

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

--------------------
| ADD HYD  (  0547)|
|   1 +  2 =  3    |         AREA    QPEAK    TPEAK     R.V.
--------------------         (ha)    (cms)    (hrs)     (mm)
```

```
        ID1= 1 (  0543):    14.99   4.164     6.00    76.65
      + ID2= 2 (  0546):   569.34  19.381     6.00    71.21
        ================================================
        ID = 3 (  0547):   584.33  23.545     6.00    71.35

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

--------------------
| ADD HYD  (  0548)|
|   1 +  2 =  3    |         AREA    QPEAK    TPEAK     R.V.
--------------------         (ha)    (cms)    (hrs)     (mm)
        ID1= 1 (  0544):     1.13   0.333     6.00    76.65
      + ID2= 2 (  0547):   584.33  23.545     6.00    71.35
        ================================================
        ID = 3 (  0548):   585.46  23.877     6.00    71.36

     NOTE:  PEAK FLOWS DO NOT INCLUDE BASEFLOWS IF ANY.
--------------------------------------------------------------------------------
--------------------
| ROUTE CHN(  0564)|
| IN= 2---> OUT= 1 |     Routing time step (min)'=  5.00
--------------------
               <------ DATA FOR SECTION (   1.1) ------>
               Distance      Elevation       Manning
                   0.00        101.50        0.0500
                   1.00        100.70        0.0500
                   1.50        100.55    0.0500 /0.0300  Main Channel
                   2.00         99.50        0.0300      Main Channel
                   3.50         99.60        0.0300      Main Channel
                   4.50        100.65    0.0300 /0.0500  Main Channel
                   6.00        101.45        0.0500

      <---------------------- TRAVEL TIME TABLE ---------------------->
       DEPTH    ELEV      VOLUME    FLOW RATE    VELOCITY   TRAV.TIME
        (m)      (m)     (cu.m.)      (cms)        (m/s)      (min)
       0.10    99.60    .353E+02       0.0          0.19      43.69
       0.19    99.69    .112E+03       0.1          0.37      22.76
       0.29    99.79    .195E+03       0.2          0.49      17.03
       0.38    99.88    .285E+03       0.3          0.59      14.23
       0.48    99.98    .381E+03       0.5          0.67      12.51
       0.57   100.07    .484E+03       0.7          0.74      11.32
       0.67   100.17    .594E+03       0.9          0.80      10.43
       0.76   100.26    .710E+03       1.2          0.86       9.74
       0.86   100.36    .832E+03       1.5          0.91       9.18
       0.95   100.45    .961E+03       1.8          0.96       8.72
       1.05   100.55    .110E+04       2.2          1.00       8.32
       1.16   100.66    .127E+04       2.7          1.07       7.80
       1.28   100.78    .148E+04       3.4          1.14       7.31
       1.39   100.89    .170E+04       4.1          1.20       6.94
```

```
       1.50   101.00    .195E+04       4.9          1.25       6.65
       1.61   101.11    .221E+04       5.8          1.30       6.41
       1.72   101.22    .250E+04       6.7          1.34       6.22
       1.84   101.34    .280E+04       7.7          1.38       6.04
       1.95   101.45    .313E+04       8.8          1.41       5.90

     **** WARNING:  TRAVEL TIME TABLE EXCEEDED
                                    <---- hydrograph ---->   <-pipe / channel->
                              AREA    QPEAK   TPEAK   R.V.   MAX DEPTH  MAX VEL
                              (ha)    (cms)   (hrs)   (mm)      (m)      (m/s)
   INFLOW : ID= 2 (  0505)  102.03    25.26    6.17  49.88      1.80      1.37
   OUTFLOW: ID= 1 (  0564)  102.03    39.67    6.58  49.88      1.95      1.41


     **** WARNING:  COMPUTATIONS FAILED TO CONVERGE.

--------------------------------------------------------------------------------
================================================================================
=======================

       V    V   I    SSSSS  U   U    A    L             (v 6.2.2007)
       V    V   I    SS     U   U   A A   L
        V  V    I     SS    U   U  AAAAA  L
        V  V    I      SS   U   U  A   A  L
         VV     I    SSSSS  UUUUU  A   A  LLLLL

        OOO   TTTTT  TTTTT  H   H  Y   Y  M   M   OOO    TM
       O   O    T      T    H   H   Y Y   MM MM  O   O
       O   O    T      T    H   H    Y    M   M  O   O
        OOO     T      T    H   H    Y    M   M   OOO
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                 *****  D E T A I L E D   O U T P U T *****


  Input   filename: C:\Program Files (x86)\Visual OTTHYMO 6.2\VO2\voin.dat

  Output  filename:
C:\Users\szaga\AppData\Local\Civica\VH5\755e78af-23fe-400e-9cfe-54285a1c407c\68d580e
8-7965-4ecd-8335-664d8dc61d29\scenar
  Summary filename:
C:\Users\szaga\AppData\Local\Civica\VH5\755e78af-23fe-400e-9cfe-54285a1c407c\68d580e
8-7965-4ecd-8335-664d8dc61d29\scenar


DATE: 02/17/2023                          TIME: 03:33:49
```

USER:

COMMENTS: _____

****
** SIMULATION : Hadati Creek Watershed - Post **
****

| READ STORM |
| |
| Ptotal=211.07 mm |

Filename: C:\Users\szaga\AppData\Local\Temp\3ddd6580-52dc-4449-bccd-814fa38467d3\bf76f9f3

Comments: Regional SCS Type II 12hr design storm

TIME hrs	RAIN mm/hr	TIME hrs	RAIN mm/hr	TIME hrs	RAIN mm/hr	TIME hrs	RAIN mm/hr
0.00	6.35	3.00	12.70	6.00	23.11	9.00	52.83
0.25	6.35	3.25	12.70	6.25	23.11	9.25	52.83
0.50	6.35	3.50	12.70	6.50	23.11	9.50	52.83
0.75	6.35	3.75	12.70	6.75	23.11	9.75	52.83
1.00	4.32	4.00	16.76	7.00	12.70	10.00	37.85
1.25	4.32	4.25	16.76	7.25	12.70	10.25	37.85
1.50	4.32	4.50	16.76	7.50	12.70	10.50	37.85
1.75	4.32	4.75	16.76	7.75	12.70	10.75	37.85
2.00	6.35	5.00	12.70	8.00	12.70	11.00	12.70
2.25	6.35	5.25	12.70	8.25	12.70	11.25	12.70
2.50	6.35	5.50	12.70	8.50	12.70	11.50	12.70
2.75	6.35	5.75	12.70	8.75	12.70	11.75	12.70

| CALIB |
| STANDHYD (0544)|
|ID= 1 DT= 5.0 min |

Area (ha)= 1.13
Total Imp(%)= 80.00 Dir. Conn.(%)= 79.00

		IMPERVIOUS	PERVIOUS (i)
Surface Area	(ha)=	0.90	0.23
Dep. Storage	(mm)=	1.50	5.00
Average Slope	(%)=	0.55	0.55
Length	(m)=	50.00	40.00
Mannings n	=	0.013	0.300

NOTE: RAINFALL WAS TRANSFORMED TO 5.0 MIN. TIME STEP.

---- TRANSFORMED HYETOGRAPH ----

TIME hrs	RAIN mm/hr	TIME hrs	RAIN mm/hr	TIME hrs	RAIN mm/hr	TIME hrs	RAIN mm/hr
0.083	6.35	3.083	12.70	6.083	23.11	9.08	52.83
0.167	6.35	3.167	12.70	6.167	23.11	9.17	52.83
0.250	6.35	3.250	12.70	6.250	23.11	9.25	52.83
0.333	6.35	3.333	12.70	6.333	23.11	9.33	52.83
0.417	6.35	3.417	12.70	6.417	23.11	9.42	52.83
0.500	6.35	3.500	12.70	6.500	23.11	9.50	52.83
0.583	6.35	3.583	12.70	6.583	23.11	9.58	52.83
0.667	6.35	3.667	12.70	6.667	23.11	9.67	52.83
0.750	6.35	3.750	12.70	6.750	23.11	9.75	52.83
0.833	6.35	3.833	12.70	6.833	23.11	9.83	52.83
0.917	6.35	3.917	12.70	6.917	23.11	9.92	52.83
1.000	6.35	4.000	12.70	7.000	23.11	10.00	52.83
1.083	4.32	4.083	16.76	7.083	12.70	10.08	37.85
1.167	4.32	4.167	16.76	7.167	12.70	10.17	37.85
1.250	4.32	4.250	16.76	7.250	12.70	10.25	37.85
1.333	4.32	4.333	16.76	7.333	12.70	10.33	37.85
1.417	4.32	4.417	16.76	7.417	12.70	10.42	37.85
1.500	4.32	4.500	16.76	7.500	12.70	10.50	37.85
1.583	4.32	4.583	16.76	7.583	12.70	10.58	37.85
1.667	4.32	4.667	16.76	7.667	12.70	10.67	37.85
1.750	4.32	4.750	16.76	7.750	12.70	10.75	37.85
1.833	4.32	4.833	16.76	7.833	12.70	10.83	37.85
1.917	4.32	4.917	16.76	7.917	12.70	10.92	37.85
2.000	4.32	5.000	16.76	8.000	12.70	11.00	37.85
2.083	6.35	5.083	12.70	8.083	12.70	11.08	12.70
2.167	6.35	5.167	12.70	8.167	12.70	11.17	12.70
2.250	6.35	5.250	12.70	8.250	12.70	11.25	12.70
2.333	6.35	5.333	12.70	8.333	12.70	11.33	12.70
2.417	6.35	5.417	12.70	8.417	12.70	11.42	12.70
2.500	6.35	5.500	12.70	8.500	12.70	11.50	12.70
2.583	6.35	5.583	12.70	8.583	12.70	11.58	12.70
2.667	6.35	5.667	12.70	8.667	12.70	11.67	12.70
2.750	6.35	5.750	12.70	8.750	12.70	11.75	12.70
2.833	6.35	5.833	12.70	8.833	12.70	11.83	12.70
2.917	6.35	5.917	12.70	8.917	12.70	11.92	12.70
3.000	6.35	6.000	12.70	9.000	12.70	12.00	12.70

Max.Eff.Inten.(mm/hr)=	52.83	42.97		
over (min)	5.00	20.00		
Storage Coeff. (min)=	2.60 (ii)	18.86 (ii)		
Unit Hyd. Tpeak (min)=	5.00	20.00		
Unit Hyd. peak (cms)=	0.29	0.06		
			TOTALS	
PEAK FLOW (cms)=	0.13	0.03	0.156 (iii)	
TIME TO PEAK (hrs)=	9.75	10.00	10.00	

```
     RUNOFF VOLUME    (mm)=     209.57        81.35         182.64
     TOTAL RAINFALL   (mm)=     211.07       211.07         211.07
     RUNOFF COEFFICIENT   =       0.99         0.39           0.87

***** WARNING: STORAGE COEFF. IS SMALLER THAN TIME STEP!

       (i) HORTONS EQUATION SELECTED FOR PERVIOUS LOSSES:
            Fo   (mm/hr)= 75.00           K  (1/hr)=  4.14
            Fc   (mm/hr)= 12.50     Cum.Inf.   (mm)=  0.00
      (ii) TIME STEP (DT) SHOULD BE SMALLER OR EQUAL
           THAN THE STORAGE COEFFICIENT.
     (iii) PEAK FLOW DOES NOT INCLUDE BASEFLOW IF ANY.

--------------------------------------------------------------------------------
--------------------
| CALIB            |
| STANDHYD (  0543)|   Area    (ha)=  14.99
|ID= 1 DT= 5.0 min |   Total Imp(%)=  80.00   Dir. Conn.(%)=  79.00
--------------------
                            IMPERVIOUS    PERVIOUS (i)
     Surface Area     (ha)=      11.99         3.00
     Dep. Storage     (mm)=       1.50         5.00
     Average Slope     (%)=       0.55         0.55
     Length            (m)=     200.00        40.00
     Mannings n           =      0.013        0.300

         NOTE:  RAINFALL WAS TRANSFORMED TO   5.0 MIN. TIME STEP.


                         ---- TRANSFORMED HYETOGRAPH ----
                TIME    RAIN |  TIME    RAIN |'  TIME    RAIN |  TIME    RAIN
                 hrs   mm/hr |   hrs   mm/hr |'   hrs   mm/hr |   hrs   mm/hr
               0.083    6.35 | 3.083   12.70 | 6.083   23.11 |  9.08   52.83
               0.167    6.35 | 3.167   12.70 | 6.167   23.11 |  9.17   52.83
               0.250    6.35 | 3.250   12.70 | 6.250   23.11 |  9.25   52.83
               0.333    6.35 | 3.333   12.70 | 6.333   23.11 |  9.33   52.83
               0.417    6.35 | 3.417   12.70 | 6.417   23.11 |  9.42   52.83
               0.500    6.35 | 3.500   12.70 | 6.500   23.11 |  9.50   52.83
               0.583    6.35 | 3.583   12.70 | 6.583   23.11 |  9.58   52.83
               0.667    6.35 | 3.667   12.70 | 6.667   23.11 |  9.67   52.83
               0.750    6.35 | 3.750   12.70 | 6.750   23.11 |  9.75   52.83
               0.833    6.35 | 3.833   12.70 | 6.833   23.11 |  9.83   52.83
               0.917    6.35 | 3.917   12.70 | 6.917   23.11 |  9.92   52.83
               1.000    6.35 | 4.000   12.70 | 7.000   23.11 | 10.00   52.83
               1.083    4.32 | 4.083   16.76 | 7.083   12.70 | 10.08   37.85
               1.167    4.32 | 4.167   16.76 | 7.167   12.70 | 10.17   37.85
               1.250    4.32 | 4.250   16.76 | 7.250   12.70 | 10.25   37.85
               1.333    4.32 | 4.333   16.76 | 7.333   12.70 | 10.33   37.85
               1.417    4.32 | 4.417   16.76 | 7.417   12.70 | 10.42   37.85
               1.500    4.32 | 4.500   16.76 | 7.500   12.70 | 10.50   37.85
```

1.583	4.32	4.583	16.76	7.583	12.70	10.58	37.85
1.667	4.32	4.667	16.76	7.667	12.70	10.67	37.85
1.750	4.32	4.750	16.76	7.750	12.70	10.75	37.85
1.833	4.32	4.833	16.76	7.833	12.70	10.83	37.85
1.917	4.32	4.917	16.76	7.917	12.70	10.92	37.85
2.000	4.32	5.000	16.76	8.000	12.70	11.00	37.85
2.083	6.35	5.083	12.70	8.083	12.70	11.08	12.70
2.167	6.35	5.167	12.70	8.167	12.70	11.17	12.70
2.250	6.35	5.250	12.70	8.250	12.70	11.25	12.70
2.333	6.35	5.333	12.70	8.333	12.70	11.33	12.70
2.417	6.35	5.417	12.70	8.417	12.70	11.42	12.70
2.500	6.35	5.500	12.70	8.500	12.70	11.50	12.70
2.583	6.35	5.583	12.70	8.583	12.70	11.58	12.70
2.667	6.35	5.667	12.70	8.667	12.70	11.67	12.70
2.750	6.35	5.750	12.70	8.750	12.70	11.75	12.70
2.833	6.35	5.833	12.70	8.833	12.70	11.83	12.70
2.917	6.35	5.917	12.70	8.917	12.70	11.92	12.70
3.000	6.35	6.000	12.70	9.000	12.70	12.00	12.70

Max.Eff.Inten.(mm/hr)=	52.83	42.97	
over (min)	5.00	25.00	
Storage Coeff. (min)=	5.98 (ii)	22.24 (ii)	
Unit Hyd. Tpeak (min)=	5.00	25.00	
Unit Hyd. peak (cms)=	0.19	0.05	
			TOTALS
PEAK FLOW (cms)=	1.74	0.32	2.054 (iii)
TIME TO PEAK (hrs)=	10.00	10.08	10.00
RUNOFF VOLUME (mm)=	209.57	81.35	182.64
TOTAL RAINFALL (mm)=	211.07	211.07	211.07
RUNOFF COEFFICIENT =	0.99	0.39	0.87

(i) HORTONS EQUATION SELECTED FOR PERVIOUS LOSSES:
Fo (mm/hr)= 75.00 K (1/hr)= 4.14
Fc (mm/hr)= 12.50 Cum.Inf. (mm)= 0.00
(ii) TIME STEP (DT) SHOULD BE SMALLER OR EQUAL
THAN THE STORAGE COEFFICIENT.
(iii) PEAK FLOW DOES NOT INCLUDE BASEFLOW IF ANY.

CALIB
STANDHYD (0542)
ID= 1 DT= 5.0 min

Area (ha)= 25.25
Total Imp(%)= 80.00 Dir. Conn.(%)= 79.00

		IMPERVIOUS	PERVIOUS (i)
Surface Area	(ha)=	20.20	5.05
Dep. Storage	(mm)=	1.50	5.00
Average Slope	(%)=	0.55	0.55
Length	(m)=	350.00	40.00

Mannings n = 0.013 0.300

NOTE: RAINFALL WAS TRANSFORMED TO 5.0 MIN. TIME STEP.

---- TRANSFORMED HYETOGRAPH ----

TIME hrs	RAIN mm/hr	TIME hrs	RAIN mm/hr	TIME hrs	RAIN mm/hr	TIME hrs	RAIN mm/hr
0.083	6.35	3.083	12.70	6.083	23.11	9.08	52.83
0.167	6.35	3.167	12.70	6.167	23.11	9.17	52.83
0.250	6.35	3.250	12.70	6.250	23.11	9.25	52.83
0.333	6.35	3.333	12.70	6.333	23.11	9.33	52.83
0.417	6.35	3.417	12.70	6.417	23.11	9.42	52.83
0.500	6.35	3.500	12.70	6.500	23.11	9.50	52.83
0.583	6.35	3.583	12.70	6.583	23.11	9.58	52.83
0.667	6.35	3.667	12.70	6.667	23.11	9.67	52.83
0.750	6.35	3.750	12.70	6.750	23.11	9.75	52.83
0.833	6.35	3.833	12.70	6.833	23.11	9.83	52.83
0.917	6.35	3.917	12.70	6.917	23.11	9.92	52.83
1.000	6.35	4.000	12.70	7.000	23.11	10.00	52.83
1.083	4.32	4.083	16.76	7.083	12.70	10.08	37.85
1.167	4.32	4.167	16.76	7.167	12.70	10.17	37.85
1.250	4.32	4.250	16.76	7.250	12.70	10.25	37.85
1.333	4.32	4.333	16.76	7.333	12.70	10.33	37.85
1.417	4.32	4.417	16.76	7.417	12.70	10.42	37.85
1.500	4.32	4.500	16.76	7.500	12.70	10.50	37.85
1.583	4.32	4.583	16.76	7.583	12.70	10.58	37.85
1.667	4.32	4.667	16.76	7.667	12.70	10.67	37.85
1.750	4.32	4.750	16.76	7.750	12.70	10.75	37.85
1.833	4.32	4.833	16.76	7.833	12.70	10.83	37.85
1.917	4.32	4.917	16.76	7.917	12.70	10.92	37.85
2.000	4.32	5.000	16.76	8.000	12.70	11.00	37.85
2.083	6.35	5.083	12.70	8.083	12.70	11.08	12.70
2.167	6.35	5.167	12.70	8.167	12.70	11.17	12.70
2.250	6.35	5.250	12.70	8.250	12.70	11.25	12.70
2.333	6.35	5.333	12.70	8.333	12.70	11.33	12.70
2.417	6.35	5.417	12.70	8.417	12.70	11.42	12.70
2.500	6.35	5.500	12.70	8.500	12.70	11.50	12.70
2.583	6.35	5.583	12.70	8.583	12.70	11.58	12.70
2.667	6.35	5.667	12.70	8.667	12.70	11.67	12.70
2.750	6.35	5.750	12.70	8.750	12.70	11.75	12.70
2.833	6.35	5.833	12.70	8.833	12.70	11.83	12.70
2.917	6.35	5.917	12.70	8.917	12.70	11.92	12.70
3.000	6.35	6.000	12.70	9.000	12.70	12.00	12.70

Max.Eff.Inten.(mm/hr)=	52.83	42.97
over (min)	10.00	25.00
Storage Coeff. (min)=	8.37 (ii)	24.63 (ii)
Unit Hyd. Tpeak (min)=	10.00	25.00
Unit Hyd. peak (cms)=	0.12	0.05

				TOTALS
PEAK FLOW	(cms)=	2.92	0.53	3.443 (iii)
TIME TO PEAK	(hrs)=	10.00	10.17	10.00
RUNOFF VOLUME	(mm)=	209.57	81.35	182.64
TOTAL RAINFALL	(mm)=	211.07	211.07	211.07
RUNOFF COEFFICIENT	=	0.99	0.39	0.87

(i) HORTONS EQUATION SELECTED FOR PERVIOUS LOSSES:
Fo (mm/hr)= 75.00 K (1/hr)= 4.14
Fc (mm/hr)= 12.50 Cum.Inf. (mm)= 0.00
(ii) TIME STEP (DT) SHOULD BE SMALLER OR EQUAL
THAN THE STORAGE COEFFICIENT.
(iii) PEAK FLOW DOES NOT INCLUDE BASEFLOW IF ANY.

STORE HYD(0525)	AREA (ha)= 0.00
ID= 1 DT=****min	QPEAK (cms)= 2.00
	TPEAK (hrs)= 24.00
	VOLUME (mm)=*******

TIME hrs	FLOW cms	TIME hrs	FLOW cms	TIME hrs	FLOW cms	TIME hrs	FLOW cms	TIME hrs	FLOW cms
0.00	1.00	24.00	2.00						

CALIB	
STANDHYD (0510)	Area (ha)= 16.00
ID= 1 DT= 5.0 min	Total Imp(%)= 80.00 Dir. Conn.(%)= 79.00

		IMPERVIOUS	PERVIOUS (i)
Surface Area	(ha)=	12.80	3.20
Dep. Storage	(mm)=	1.50	5.00
Average Slope	(%)=	0.50	0.25
Length	(m)=	400.00	40.00
Mannings n	=	0.013	0.300

NOTE: RAINFALL WAS TRANSFORMED TO 5.0 MIN. TIME STEP.

---- TRANSFORMED HYETOGRAPH ----

TIME hrs	RAIN mm/hr	TIME hrs	RAIN mm/hr	TIME hrs	RAIN mm/hr	TIME hrs	RAIN mm/hr
0.083	6.35	3.083	12.70	6.083	23.11	9.08	52.83
0.167	6.35	3.167	12.70	6.167	23.11	9.17	52.83
0.250	6.35	3.250	12.70	6.250	23.11	9.25	52.83
0.333	6.35	3.333	12.70	6.333	23.11	9.33	52.83
0.417	6.35	3.417	12.70	6.417	23.11	9.42	52.83
0.500	6.35	3.500	12.70	6.500	23.11	9.50	52.83

0.583	6.35	3.583	12.70	6.583	23.11	9.58	52.83
0.667	6.35	3.667	12.70	6.667	23.11	9.67	52.83
0.750	6.35	3.750	12.70	6.750	23.11	9.75	52.83
0.833	6.35	3.833	12.70	6.833	23.11	9.83	52.83
0.917	6.35	3.917	12.70	6.917	23.11	9.92	52.83
1.000	6.35	4.000	12.70	7.000	23.11	10.00	52.83
1.083	4.32	4.083	16.76	7.083	12.70	10.08	37.85
1.167	4.32	4.167	16.76	7.167	12.70	10.17	37.85
1.250	4.32	4.250	16.76	7.250	12.70	10.25	37.85
1.333	4.32	4.333	16.76	7.333	12.70	10.33	37.85
1.417	4.32	4.417	16.76	7.417	12.70	10.42	37.85
1.500	4.32	4.500	16.76	7.500	12.70	10.50	37.85
1.583	4.32	4.583	16.76	7.583	12.70	10.58	37.85
1.667	4.32	4.667	16.76	7.667	12.70	10.67	37.85
1.750	4.32	4.750	16.76	7.750	12.70	10.75	37.85
1.833	4.32	4.833	16.76	7.833	12.70	10.83	37.85
1.917	4.32	4.917	16.76	7.917	12.70	10.92	37.85
2.000	4.32	5.000	16.76	8.000	12.70	11.00	37.85
2.083	6.35	5.083	12.70	8.083	12.70	11.08	12.70
2.167	6.35	5.167	12.70	8.167	12.70	11.17	12.70
2.250	6.35	5.250	12.70	8.250	12.70	11.25	12.70
2.333	6.35	5.333	12.70	8.333	12.70	11.33	12.70
2.417	6.35	5.417	12.70	8.417	12.70	11.42	12.70
2.500	6.35	5.500	12.70	8.500	12.70	11.50	12.70
2.583	6.35	5.583	12.70	8.583	12.70	11.58	12.70
2.667	6.35	5.667	12.70	8.667	12.70	11.67	12.70
2.750	6.35	5.750	12.70	8.750	12.70	11.75	12.70
2.833	6.35	5.833	12.70	8.833	12.70	11.83	12.70
2.917	6.35	5.917	12.70	8.917	12.70	11.92	12.70
3.000	6.35	6.000	12.70	9.000	12.70	12.00	12.70

Max.Eff.Inten.(mm/hr)=	52.83	42.97	
over (min)	10.00	30.00	
Storage Coeff. (min)=	9.33 (ii)	29.93 (ii)	
Unit Hyd. Tpeak (min)=	10.00	30.00	
Unit Hyd. peak (cms)=	0.12	0.04	
			TOTALS
PEAK FLOW (cms)=	1.85	0.32	2.150 (iii)
TIME TO PEAK (hrs)=	10.00	10.25	10.00
RUNOFF VOLUME (mm)=	209.57	81.35	182.64
TOTAL RAINFALL (mm)=	211.07	211.07	211.07
RUNOFF COEFFICIENT =	0.99	0.39	0.87

(i) HORTONS EQUATION SELECTED FOR PERVIOUS LOSSES:
Fo (mm/hr)= 75.00 K (1/hr)= 4.14
Fc (mm/hr)= 12.50 Cum.Inf. (mm)= 0.00

(ii) TIME STEP (DT) SHOULD BE SMALLER OR EQUAL
THAN THE STORAGE COEFFICIENT.

(iii) PEAK FLOW DOES NOT INCLUDE BASEFLOW IF ANY.

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| CALIB            |
| STANDHYD (  0500)|   Area    (ha)= 244.00
|ID= 1 DT= 5.0 min |   Total Imp(%)=  46.00   Dir. Conn.(%)=  26.00
--------------------
                             IMPERVIOUS    PERVIOUS (i)
     Surface Area     (ha)=     112.24       131.76
     Dep. Storage     (mm)=       1.50         5.00
     Average Slope     (%)=       0.80         0.80
     Length            (m)=    1275.00        40.00
     Mannings n             =      0.013        0.300

         NOTE:  RAINFALL WAS TRANSFORMED TO   5.0 MIN. TIME STEP.
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---- TRANSFORMED HYETOGRAPH ----

TIME hrs	RAIN mm/hr	TIME hrs	RAIN mm/hr	TIME hrs	RAIN mm/hr	TIME hrs	RAIN mm/hr
0.083	6.35	3.083	12.70	6.083	23.11	9.08	52.83
0.167	6.35	3.167	12.70	6.167	23.11	9.17	52.83
0.250	6.35	3.250	12.70	6.250	23.11	9.25	52.83
0.333	6.35	3.333	12.70	6.333	23.11	9.33	52.83
0.417	6.35	3.417	12.70	6.417	23.11	9.42	52.83
0.500	6.35	3.500	12.70	6.500	23.11	9.50	52.83
0.583	6.35	3.583	12.70	6.583	23.11	9.58	52.83
0.667	6.35	3.667	12.70	6.667	23.11	9.67	52.83
0.750	6.35	3.750	12.70	6.750	23.11	9.75	52.83
0.833	6.35	3.833	12.70	6.833	23.11	9.83	52.83
0.917	6.35	3.917	12.70	6.917	23.11	9.92	52.83
1.000	6.35	4.000	12.70	7.000	23.11	10.00	52.83
1.083	4.32	4.083	16.76	7.083	12.70	10.08	37.85
1.167	4.32	4.167	16.76	7.167	12.70	10.17	37.85
1.250	4.32	4.250	16.76	7.250	12.70	10.25	37.85
1.333	4.32	4.333	16.76	7.333	12.70	10.33	37.85
1.417	4.32	4.417	16.76	7.417	12.70	10.42	37.85
1.500	4.32	4.500	16.76	7.500	12.70	10.50	37.85
1.583	4.32	4.583	16.76	7.583	12.70	10.58	37.85
1.667	4.32	4.667	16.76	7.667	12.70	10.67	37.85
1.750	4.32	4.750	16.76	7.750	12.70	10.75	37.85
1.833	4.32	4.833	16.76	7.833	12.70	10.83	37.85
1.917	4.32	4.917	16.76	7.917	12.70	10.92	37.85
2.000	4.32	5.000	16.76	8.000	12.70	11.00	37.85
2.083	6.35	5.083	12.70	8.083	12.70	11.08	12.70
2.167	6.35	5.167	12.70	8.167	12.70	11.17	12.70
2.250	6.35	5.250	12.70	8.250	12.70	11.25	12.70
2.333	6.35	5.333	12.70	8.333	12.70	11.33	12.70
2.417	6.35	5.417	12.70	8.417	12.70	11.42	12.70
2.500	6.35	5.500	12.70	8.500	12.70	11.50	12.70

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               2.583    6.35 | 5.583   12.70 | 8.583   12.70 | 11.58   12.70
               2.667    6.35 | 5.667   12.70 | 8.667   12.70 | 11.67   12.70
               2.750    6.35 | 5.750   12.70 | 8.750   12.70 | 11.75   12.70
               2.833    6.35 | 5.833   12.70 | 8.833   12.70 | 11.83   12.70
               2.917    6.35 | 5.917   12.70 | 8.917   12.70 | 11.92   12.70
               3.000    6.35 | 6.000   12.70 | 9.000   12.70 | 12.00   12.70

     Max.Eff.Inten.(mm/hr)=      52.83        59.90
               over (min)        15.00        30.00
     Storage Coeff.  (min)=      16.24 (ii)   28.96 (ii)
     Unit Hyd. Tpeak (min)=      15.00        30.00
     Unit Hyd. peak  (cms)=       0.07         0.04
                                                        *TOTALS*
     PEAK FLOW       (cms)=       9.05        18.51         27.108 (iii)
     TIME TO PEAK    (hrs)=      10.00        10.25          10.08
     RUNOFF VOLUME    (mm)=     209.57       107.75         134.22
     TOTAL RAINFALL   (mm)=     211.07       211.07         211.07
     RUNOFF COEFFICIENT   =       0.99         0.51           0.64


       (i) HORTONS EQUATION SELECTED FOR PERVIOUS LOSSES:
            Fo   (mm/hr)= 75.00          K  (1/hr)=  4.14
            Fc   (mm/hr)= 12.50     Cum.Inf.   (mm)=  0.00
      (ii) TIME STEP (DT) SHOULD BE SMALLER OR EQUAL
           THAN THE STORAGE COEFFICIENT.
     (iii) PEAK FLOW DOES NOT INCLUDE BASEFLOW IF ANY.

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--------------------
| DUHYD    (  0505)|
| Inlet Cap.= 9.000|
| #of Inlets=     1|
| Total(cms)=   9.0|      AREA     QPEAK     TPEAK    R.V.
--------------------      (ha)     (cms)     (hrs)    (mm)
     TOTAL HYD.(ID= 1): 244.00     27.11     10.08  134.22
     ================================================
     MAJOR SYS.(ID= 2):  78.53     18.11     10.08  134.22
     MINOR SYS.(ID= 3): 165.47      9.00      6.75  134.22

     NOTE:  PEAK FLOWS DO NOT INCLUDE BASEFLOWS IF ANY.

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--------------------
| ADD HYD  (  0515)|
|   1 +  2 =  3    |         AREA    QPEAK    TPEAK     R.V.
--------------------         (ha)    (cms)    (hrs)     (mm)
        ID1= 1 (  0505):   165.47   9.000     6.75   134.22
      + ID2= 2 (  0510):    16.00   2.150    10.00   182.64
        ================================================
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        ID = 3 (  0515):   181.47  11.150    10.00   138.49

     NOTE:  PEAK FLOWS DO NOT INCLUDE BASEFLOWS IF ANY.
--------------------------------------------------------------------------------
--------------------
| DUHYD    (  0520)|
| Inlet Cap.= 3.050|
| #of Inlets=     1|
| Total(cms)=   3.0|      AREA     QPEAK     TPEAK    R.V.
--------------------      (ha)     (cms)     (hrs)    (mm)
     TOTAL HYD.(ID= 1): 181.47     11.15     10.00  138.49
     ================================================
     MAJOR SYS.(ID= 2):  98.05      8.10     10.00  138.49
     MINOR SYS.(ID= 3):  83.42      3.05      4.25  138.49

     NOTE:  PEAK FLOWS DO NOT INCLUDE BASEFLOWS IF ANY.

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--------------------
| ADD HYD  (  0526)|
|   1 +  2 =  3    |         AREA    QPEAK    TPEAK     R.V.
--------------------         (ha)    (cms)    (hrs)     (mm)
        ID1= 1 (  0520):    98.05   8.100    10.00   138.49
      + ID2= 2 (  0525):     0.00   2.000    24.00  *******
        ================================================
        ID = 3 (  0526):    98.05   9.517    10.00   270.52

     NOTE:  PEAK FLOWS DO NOT INCLUDE BASEFLOWS IF ANY.
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--------------------
| ROUTE CHN(  0527)|
| IN= 2---> OUT= 1 |     Routing time step (min)'=  5.00
--------------------
               <------ DATA FOR SECTION (   1.1) ------>
               Distance      Elevation       Manning
                 100.00        313.20        0.0500
                 140.00        312.40    0.0500 /0.0300  Main Channel
                 140.50        310.80        0.0300      Main Channel
                 141.50        310.80        0.0300      Main Channel
                 142.00        312.40    0.0300 /0.0500  Main Channel
                 160.00        313.20        0.0500

      <---------------------- TRAVEL TIME TABLE ---------------------->
       DEPTH    ELEV      VOLUME    FLOW RATE    VELOCITY   TRAV.TIME
        (m)      (m)     (cu.m.)      (cms)        (m/s)      (min)
       0.12   310.92    .575E+02       0.1          0.40      18.86
       0.25   311.05    .119E+03       0.2          0.57      13.13
       0.37   311.17    .185E+03       0.3          0.69      10.87
       0.49   311.29    .256E+03       0.4          0.78       9.61
```

0.62	311.42	.330E+03	0.6	0.86	8.77
0.74	311.54	.409E+03	0.8	0.92	8.17
0.86	311.66	.492E+03	1.1	0.97	7.70
0.98	311.78	.579E+03	1.3	1.02	7.32
1.11	311.91	.671E+03	1.6	1.07	7.01
1.23	312.03	.767E+03	1.9	1.11	6.74
1.35	312.15	.867E+03	2.2	1.15	6.50
1.48	312.28	.971E+03	2.6	1.19	6.29
1.60	312.40	.108E+04	2.9	1.23	6.11
1.73	312.53	.149E+04	3.6	1.10	6.85
1.87	312.67	.248E+04	4.9	0.88	8.52
2.00	312.80	.405E+04	6.9	0.77	9.74
2.13	312.93	.620E+04	10.1	0.73	10.21
2.27	313.07	.893E+04	14.6	0.74	10.17
2.40	313.20	.122E+05	20.7	0.76	9.85

		<---- hydrograph ---->			<-pipe / channel->	
		AREA	QPEAK	TPEAK	R.V.	MAX DEPTH	MAX VEL
		(ha)	(cms)	(hrs)	(mm)	(m)	(m/s)
INFLOW : ID= 2 (| 0526)	98.05	9.52	10.00	270.52	2.11	0.74
OUTFLOW: ID= 1 (| 0527)	98.05	9.39	10.08	270.36	2.10	0.74

CALIB
STANDHYD (0540)
ID= 1 DT= 5.0 min

Area (ha)= 4.63
Total Imp(%)= 80.00 Dir. Conn.(%)= 79.00

		IMPERVIOUS	PERVIOUS (i)
Surface Area	(ha)=	3.70	0.93
Dep. Storage	(mm)=	1.50	5.00
Average Slope	(%)=	0.55	0.55
Length	(m)=	150.00	40.00
Mannings n	=	0.013	0.300

NOTE: RAINFALL WAS TRANSFORMED TO 5.0 MIN. TIME STEP.

---- TRANSFORMED HYETOGRAPH ----

TIME	RAIN	TIME	RAIN	TIME	RAIN	TIME	RAIN
hrs	mm/hr	hrs	mm/hr	hrs	mm/hr	hrs	mm/hr
0.083	6.35	3.083	12.70	6.083	23.11	9.08	52.83
0.167	6.35	3.167	12.70	6.167	23.11	9.17	52.83
0.250	6.35	3.250	12.70	6.250	23.11	9.25	52.83
0.333	6.35	3.333	12.70	6.333	23.11	9.33	52.83
0.417	6.35	3.417	12.70	6.417	23.11	9.42	52.83
0.500	6.35	3.500	12.70	6.500	23.11	9.50	52.83
0.583	6.35	3.583	12.70	6.583	23.11	9.58	52.83

0.667	6.35	3.667	12.70	6.667	23.11	9.67	52.83
0.750	6.35	3.750	12.70	6.750	23.11	9.75	52.83
0.833	6.35	3.833	12.70	6.833	23.11	9.83	52.83
0.917	6.35	3.917	12.70	6.917	23.11	9.92	52.83
1.000	6.35	4.000	12.70	7.000	23.11	10.00	52.83
1.083	4.32	4.083	16.76	7.083	12.70	10.08	37.85
1.167	4.32	4.167	16.76	7.167	12.70	10.17	37.85
1.250	4.32	4.250	16.76	7.250	12.70	10.25	37.85
1.333	4.32	4.333	16.76	7.333	12.70	10.33	37.85
1.417	4.32	4.417	16.76	7.417	12.70	10.42	37.85
1.500	4.32	4.500	16.76	7.500	12.70	10.50	37.85
1.583	4.32	4.583	16.76	7.583	12.70	10.58	37.85
1.667	4.32	4.667	16.76	7.667	12.70	10.67	37.85
1.750	4.32	4.750	16.76	7.750	12.70	10.75	37.85
1.833	4.32	4.833	16.76	7.833	12.70	10.83	37.85
1.917	4.32	4.917	16.76	7.917	12.70	10.92	37.85
2.000	4.32	5.000	16.76	8.000	12.70	11.00	37.85
2.083	6.35	5.083	12.70	8.083	12.70	11.08	12.70
2.167	6.35	5.167	12.70	8.167	12.70	11.17	12.70
2.250	6.35	5.250	12.70	8.250	12.70	11.25	12.70
2.333	6.35	5.333	12.70	8.333	12.70	11.33	12.70
2.417	6.35	5.417	12.70	8.417	12.70	11.42	12.70
2.500	6.35	5.500	12.70	8.500	12.70	11.50	12.70
2.583	6.35	5.583	12.70	8.583	12.70	11.58	12.70
2.667	6.35	5.667	12.70	8.667	12.70	11.67	12.70
2.750	6.35	5.750	12.70	8.750	12.70	11.75	12.70
2.833	6.35	5.833	12.70	8.833	12.70	11.83	12.70
2.917	6.35	5.917	12.70	8.917	12.70	11.92	12.70
3.000	6.35	6.000	12.70	9.000	12.70	12.00	12.70

Max.Eff.Inten.(mm/hr)=	52.83	42.97		
over (min)	5.00	25.00		
Storage Coeff. (min)=	5.03 (ii)	21.29 (ii)		
Unit Hyd. Tpeak (min)=	5.00	25.00		
Unit Hyd. peak (cms)=	0.21	0.05		
			TOTALS	
PEAK FLOW (cms)=	0.54	0.10	0.636 (iii)	
TIME TO PEAK (hrs)=	10.00	10.08	10.00	
RUNOFF VOLUME (mm)=	209.57	81.35	182.64	
TOTAL RAINFALL (mm)=	211.07	211.07	211.07	
RUNOFF COEFFICIENT =	0.99	0.39	0.87	

(i) HORTONS EQUATION SELECTED FOR PERVIOUS LOSSES:
Fo (mm/hr)= 75.00 K (1/hr)= 4.14
Fc (mm/hr)= 12.50 Cum.Inf. (mm)= 0.00

(ii) TIME STEP (DT) SHOULD BE SMALLER OR EQUAL THAN THE STORAGE COEFFICIENT.

(iii) PEAK FLOW DOES NOT INCLUDE BASEFLOW IF ANY.

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| CALIB            |
| STANDHYD (  0600)|   Area    (ha)=   9.73
|ID= 1 DT= 5.0 min |   Total Imp(%)=  52.00   Dir. Conn.(%)=  35.00
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                             IMPERVIOUS    PERVIOUS (i)
     Surface Area     (ha)=       5.06         4.67
     Dep. Storage     (mm)=       1.50         5.00
     Average Slope     (%)=       2.00         2.00
     Length            (m)=     254.69        33.00
     Mannings n             =      0.013        0.300

         NOTE:  RAINFALL WAS TRANSFORMED TO   5.0 MIN. TIME STEP.
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---- TRANSFORMED HYETOGRAPH ----

TIME hrs	RAIN mm/hr	TIME hrs	RAIN mm/hr	TIME hrs	RAIN mm/hr	TIME hrs	RAIN mm/hr
0.083	6.35	3.083	12.70	6.083	23.11	9.08	52.83
0.167	6.35	3.167	12.70	6.167	23.11	9.17	52.83
0.250	6.35	3.250	12.70	6.250	23.11	9.25	52.83
0.333	6.35	3.333	12.70	6.333	23.11	9.33	52.83
0.417	6.35	3.417	12.70	6.417	23.11	9.42	52.83
0.500	6.35	3.500	12.70	6.500	23.11	9.50	52.83
0.583	6.35	3.583	12.70	6.583	23.11	9.58	52.83
0.667	6.35	3.667	12.70	6.667	23.11	9.67	52.83
0.750	6.35	3.750	12.70	6.750	23.11	9.75	52.83
0.833	6.35	3.833	12.70	6.833	23.11	9.83	52.83
0.917	6.35	3.917	12.70	6.917	23.11	9.92	52.83
1.000	6.35	4.000	12.70	7.000	23.11	10.00	52.83
1.083	4.32	4.083	16.76	7.083	12.70	10.08	37.85
1.167	4.32	4.167	16.76	7.167	12.70	10.17	37.85
1.250	4.32	4.250	16.76	7.250	12.70	10.25	37.85
1.333	4.32	4.333	16.76	7.333	12.70	10.33	37.85
1.417	4.32	4.417	16.76	7.417	12.70	10.42	37.85
1.500	4.32	4.500	16.76	7.500	12.70	10.50	37.85
1.583	4.32	4.583	16.76	7.583	12.70	10.58	37.85
1.667	4.32	4.667	16.76	7.667	12.70	10.67	37.85
1.750	4.32	4.750	16.76	7.750	12.70	10.75	37.85
1.833	4.32	4.833	16.76	7.833	12.70	10.83	37.85
1.917	4.32	4.917	16.76	7.917	12.70	10.92	37.85
2.000	4.32	5.000	16.76	8.000	12.70	11.00	37.85
2.083	6.35	5.083	12.70	8.083	12.70	11.08	12.70
2.167	6.35	5.167	12.70	8.167	12.70	11.17	12.70
2.250	6.35	5.250	12.70	8.250	12.70	11.25	12.70
2.333	6.35	5.333	12.70	8.333	12.70	11.33	12.70
2.417	6.35	5.417	12.70	8.417	12.70	11.42	12.70
2.500	6.35	5.500	12.70	8.500	12.70	11.50	12.70
2.583	6.35	5.583	12.70	8.583	12.70	11.58	12.70

2.667	6.35	5.667	12.70	8.667	12.70	11.67	12.70
2.750	6.35	5.750	12.70	8.750	12.70	11.75	12.70
2.833	6.35	5.833	12.70	8.833	12.70	11.83	12.70
2.917	6.35	5.917	12.70	8.917	12.70	11.92	12.70
3.000	6.35	6.000	12.70	9.000	12.70	12.00	12.70

Max.Eff.Inten.(mm/hr)=	52.83	59.04	
over (min)	5.00	15.00	
Storage Coeff. (min)=	4.69 (ii)	13.35 (ii)	
Unit Hyd. Tpeak (min)=	5.00	15.00	
Unit Hyd. peak (cms)=	0.22	0.08	
			TOTALS
PEAK FLOW (cms)=	0.50	0.75	1.253 (iii)
TIME TO PEAK (hrs)=	10.00	10.00	10.00
RUNOFF VOLUME (mm)=	209.57	106.67	142.69
TOTAL RAINFALL (mm)=	211.07	211.07	211.07
RUNOFF COEFFICIENT =	0.99	0.51	0.68

***** WARNING: STORAGE COEFF. IS SMALLER THAN TIME STEP!

(i) HORTONS EQUATION SELECTED FOR PERVIOUS LOSSES:
Fo (mm/hr)= 75.00 K (1/hr)= 4.14
Fc (mm/hr)= 12.50 Cum.Inf. (mm)= 0.00
(ii) TIME STEP (DT) SHOULD BE SMALLER OR EQUAL
THAN THE STORAGE COEFFICIENT.
(iii) PEAK FLOW DOES NOT INCLUDE BASEFLOW IF ANY.

CALIB
STANDHYD (0601)
ID= 1 DT= 5.0 min

Area (ha)= 6.95
Total Imp(%)= 70.00 Dir. Conn.(%)= 50.00

		IMPERVIOUS	PERVIOUS (i)
Surface Area	(ha)=	4.86	2.09
Dep. Storage	(mm)=	1.50	5.00
Average Slope	(%)=	2.00	2.00
Length	(m)=	215.25	33.00
Mannings n	=	0.013	0.300

NOTE: RAINFALL WAS TRANSFORMED TO 5.0 MIN. TIME STEP.

---- TRANSFORMED HYETOGRAPH ----

TIME hrs	RAIN mm/hr	TIME hrs	RAIN mm/hr	TIME hrs	RAIN mm/hr	TIME hrs	RAIN mm/hr
0.083	6.35	3.083	12.70	6.083	23.11	9.08	52.83
0.167	6.35	3.167	12.70	6.167	23.11	9.17	52.83
0.250	6.35	3.250	12.70	6.250	23.11	9.25	52.83
0.333	6.35	3.333	12.70	6.333	23.11	9.33	52.83

0.417	6.35	3.417	12.70	6.417	23.11	9.42	52.83
0.500	6.35	3.500	12.70	6.500	23.11	9.50	52.83
0.583	6.35	3.583	12.70	6.583	23.11	9.58	52.83
0.667	6.35	3.667	12.70	6.667	23.11	9.67	52.83
0.750	6.35	3.750	12.70	6.750	23.11	9.75	52.83
0.833	6.35	3.833	12.70	6.833	23.11	9.83	52.83
0.917	6.35	3.917	12.70	6.917	23.11	9.92	52.83
1.000	6.35	4.000	12.70	7.000	23.11	10.00	52.83
1.083	4.32	4.083	16.76	7.083	12.70	10.08	37.85
1.167	4.32	4.167	16.76	7.167	12.70	10.17	37.85
1.250	4.32	4.250	16.76	7.250	12.70	10.25	37.85
1.333	4.32	4.333	16.76	7.333	12.70	10.33	37.85
1.417	4.32	4.417	16.76	7.417	12.70	10.42	37.85
1.500	4.32	4.500	16.76	7.500	12.70	10.50	37.85
1.583	4.32	4.583	16.76	7.583	12.70	10.58	37.85
1.667	4.32	4.667	16.76	7.667	12.70	10.67	37.85
1.750	4.32	4.750	16.76	7.750	12.70	10.75	37.85
1.833	4.32	4.833	16.76	7.833	12.70	10.83	37.85
1.917	4.32	4.917	16.76	7.917	12.70	10.92	37.85
2.000	4.32	5.000	16.76	8.000	12.70	11.00	37.85
2.083	6.35	5.083	12.70	8.083	12.70	11.08	12.70
2.167	6.35	5.167	12.70	8.167	12.70	11.17	12.70
2.250	6.35	5.250	12.70	8.250	12.70	11.25	12.70
2.333	6.35	5.333	12.70	8.333	12.70	11.33	12.70
2.417	6.35	5.417	12.70	8.417	12.70	11.42	12.70
2.500	6.35	5.500	12.70	8.500	12.70	11.50	12.70
2.583	6.35	5.583	12.70	8.583	12.70	11.58	12.70
2.667	6.35	5.667	12.70	8.667	12.70	11.67	12.70
2.750	6.35	5.750	12.70	8.750	12.70	11.75	12.70
2.833	6.35	5.833	12.70	8.833	12.70	11.83	12.70
2.917	6.35	5.917	12.70	8.917	12.70	11.92	12.70
3.000	6.35	6.000	12.70	9.000	12.70	12.00	12.70

Max.Eff.Inten.(mm/hr)=	52.83	75.55	
over (min)	5.00	15.00	
Storage Coeff. (min)=	4.24 (ii)	12.09 (ii)	
Unit Hyd. Tpeak (min)=	5.00	15.00	
Unit Hyd. peak (cms)=	0.24	0.09	
			TOTALS
PEAK FLOW (cms)=	0.51	0.43	0.943 (iii)
TIME TO PEAK (hrs)=	10.00	10.00	10.00
RUNOFF VOLUME (mm)=	209.57	123.44	166.51
TOTAL RAINFALL (mm)=	211.07	211.07	211.07
RUNOFF COEFFICIENT =	0.99	0.58	0.79

***** WARNING: STORAGE COEFF. IS SMALLER THAN TIME STEP!

(i) HORTONS EQUATION SELECTED FOR PERVIOUS LOSSES:
Fo (mm/hr)= 75.00 K (1/hr)= 4.14
Fc (mm/hr)= 12.50 Cum.Inf. (mm)= 0.00

(ii) TIME STEP (DT) SHOULD BE SMALLER OR EQUAL
THAN THE STORAGE COEFFICIENT.
(iii) PEAK FLOW DOES NOT INCLUDE BASEFLOW IF ANY.

ADD HYD (0602)|		AREA	QPEAK	TPEAK	R.V.
1 + 2 = 3		(ha)	(cms)	(hrs)	(mm)
ID1= 1 (0600):		9.73	1.253	10.00	142.69
+ ID2= 2 (0601):		6.95	0.943	10.00	166.51
ID = 3 (0602):		16.68	2.196	10.00	152.61

NOTE: PEAK FLOWS DO NOT INCLUDE BASEFLOWS IF ANY.

ROUTE CHN(0563)		
IN= 2---> OUT= 1	Routing time step (min)'=	5.00

<------ DATA FOR SECTION (2.2) ------>

Distance	Elevation	Manning	
0.00	1.00	0.0350	
2.00	0.50	0.0350	
4.00	0.00	0.0350 /0.0350	Main Channel
4.50	0.00	0.0350	Main Channel
5.00	0.00	0.0350 /0.0350	Main Channel
7.00	0.50	0.0350	
9.00	1.00	0.0350	

<---------- TRAVEL TIME TABLE ---------->

DEPTH (m)	ELEV (m)	VOLUME (cu.m.)	FLOW RATE (cms)	VELOCITY (m/s)	TRAV.TIME (min)
0.05	0.05	.701E+01	0.0	0.64	2.87
0.11	0.11	.165E+02	0.1	0.96	1.91
0.16	0.16	.283E+02	0.3	1.21	1.51
0.21	0.21	.427E+02	0.6	1.42	1.29
0.26	0.26	.594E+02	0.9	1.61	1.14
0.32	0.32	.786E+02	1.3	1.77	1.03
0.37	0.37	.100E+03	1.8	1.93	0.95
0.42	0.42	.124E+03	2.3	2.08	0.88
0.47	0.47	.151E+03	3.0	2.22	0.83
0.53	0.53	.180E+03	3.8	2.35	0.78
0.58	0.58	.211E+03	4.8	2.48	0.74
0.63	0.63	.245E+03	5.8	2.60	0.71
0.68	0.68	.281E+03	7.0	2.72	0.67
0.74	0.74	.320E+03	8.2	2.84	0.65
0.79	0.79	.361E+03	9.7	2.95	0.62
0.84	0.84	.405E+03	11.3	3.06	0.60

0.89	0.89	.451E+03	13.0	3.17	0.58
0.95	0.95	.499E+03	14.8	3.27	0.56
1.00	1.00	.550E+03	16.9	3.38	0.54

	<---- hydrograph ---->			<-pipe / channel->	
	AREA (ha)	QPEAK (cms)	TPEAK (hrs)	R.V. (mm)	MAX DEPTH (m)	MAX VEL (m/s)
INFLOW : ID= 2 (0602)	16.68	2.20	10.00	152.61	0.41	2.04
OUTFLOW: ID= 1 (0563)	16.68	2.20	10.00	152.61	0.41	2.03

CALIB STANDHYD (0607) ID= 1 DT= 5.0 min	Area (ha)= 5.97 Total Imp(%)= 51.00 Dir. Conn.(%)= 35.00

		IMPERVIOUS	PERVIOUS (i)
Surface Area	(ha)=	3.04	2.93
Dep. Storage	(mm)=	1.50	5.00
Average Slope	(%)=	2.00	2.00
Length	(m)=	199.50	33.00
Mannings n	=	0.013	0.300

NOTE: RAINFALL WAS TRANSFORMED TO 5.0 MIN. TIME STEP.

---- TRANSFORMED HYETOGRAPH ----

TIME hrs	RAIN mm/hr	TIME hrs	RAIN mm/hr	TIME hrs	RAIN mm/hr	TIME hrs	RAIN mm/hr
0.083	6.35	3.083	12.70	6.083	23.11	9.08	52.83
0.167	6.35	3.167	12.70	6.167	23.11	9.17	52.83
0.250	6.35	3.250	12.70	6.250	23.11	9.25	52.83
0.333	6.35	3.333	12.70	6.333	23.11	9.33	52.83
0.417	6.35	3.417	12.70	6.417	23.11	9.42	52.83
0.500	6.35	3.500	12.70	6.500	23.11	9.50	52.83
0.583	6.35	3.583	12.70	6.583	23.11	9.58	52.83
0.667	6.35	3.667	12.70	6.667	23.11	9.67	52.83
0.750	6.35	3.750	12.70	6.750	23.11	9.75	52.83
0.833	6.35	3.833	12.70	6.833	23.11	9.83	52.83
0.917	6.35	3.917	12.70	6.917	23.11	9.92	52.83
1.000	6.35	4.000	12.70	7.000	23.11	10.00	52.83
1.083	4.32	4.083	16.76	7.083	12.70	10.08	37.85
1.167	4.32	4.167	16.76	7.167	12.70	10.17	37.85
1.250	4.32	4.250	16.76	7.250	12.70	10.25	37.85
1.333	4.32	4.333	16.76	7.333	12.70	10.33	37.85
1.417	4.32	4.417	16.76	7.417	12.70	10.42	37.85
1.500	4.32	4.500	16.76	7.500	12.70	10.50	37.85
1.583	4.32	4.583	16.76	7.583	12.70	10.58	37.85

1.667	4.32	4.667	16.76	7.667	12.70	10.67	37.85
1.750	4.32	4.750	16.76	7.750	12.70	10.75	37.85
1.833	4.32	4.833	16.76	7.833	12.70	10.83	37.85
1.917	4.32	4.917	16.76	7.917	12.70	10.92	37.85
2.000	4.32	5.000	16.76	8.000	12.70	11.00	37.85
2.083	6.35	5.083	12.70	8.083	12.70	11.08	12.70
2.167	6.35	5.167	12.70	8.167	12.70	11.17	12.70
2.250	6.35	5.250	12.70	8.250	12.70	11.25	12.70
2.333	6.35	5.333	12.70	8.333	12.70	11.33	12.70
2.417	6.35	5.417	12.70	8.417	12.70	11.42	12.70
2.500	6.35	5.500	12.70	8.500	12.70	11.50	12.70
2.583	6.35	5.583	12.70	8.583	12.70	11.58	12.70
2.667	6.35	5.667	12.70	8.667	12.70	11.67	12.70
2.750	6.35	5.750	12.70	8.750	12.70	11.75	12.70
2.833	6.35	5.833	12.70	8.833	12.70	11.83	12.70
2.917	6.35	5.917	12.70	8.917	12.70	11.92	12.70
3.000	6.35	6.000	12.70	9.000	12.70	12.00	12.70

Max.Eff.Inten.(mm/hr)=	52.83	57.58	
over (min)	5.00	15.00	
Storage Coeff. (min)=	4.05 (ii)	12.80 (ii)	
Unit Hyd. Tpeak (min)=	5.00	15.00	
Unit Hyd. peak (cms)=	0.24	0.08	
			TOTALS
PEAK FLOW (cms)=	0.31	0.46	0.768 (iii)
TIME TO PEAK (hrs)=	10.00	10.00	10.00
RUNOFF VOLUME (mm)=	209.57	104.77	141.45
TOTAL RAINFALL (mm)=	211.07	211.07	211.07
RUNOFF COEFFICIENT =	0.99	0.50	0.67

***** WARNING: STORAGE COEFF. IS SMALLER THAN TIME STEP!

(i) HORTONS EQUATION SELECTED FOR PERVIOUS LOSSES:
Fo (mm/hr)= 75.00 K (1/hr)= 4.14
Fc (mm/hr)= 12.50 Cum.Inf. (mm)= 0.00
(ii) TIME STEP (DT) SHOULD BE SMALLER OR EQUAL
THAN THE STORAGE COEFFICIENT.
(iii) PEAK FLOW DOES NOT INCLUDE BASEFLOW IF ANY.

ADD HYD (0492)				
1 + 2 = 3	AREA (ha)	QPEAK (cms)	TPEAK (hrs)	R.V. (mm)
ID1= 1 (0563):	16.68	2.195	10.00	152.61
+ ID2= 2 (0607):	5.97	0.768	10.00	141.45
ID = 3 (0492):	22.65	2.963	10.00	149.67

NOTE: PEAK FLOWS DO NOT INCLUDE BASEFLOWS IF ANY.

RESERVOIR(0482) IN= 2---> OUT= 1 DT= 5.0 min	OVERFLOW IS OFF			
	OUTFLOW (cms)	STORAGE (ha.m.)	OUTFLOW (cms)	STORAGE (ha.m.)
	0.0000	0.0000	0.2910	0.3795
	0.2590	0.0579	0.2970	0.4503
	0.2660	0.1180	1.6320	0.5232
	0.2720	0.1802	4.1680	0.5983
	0.2790	0.2445	7.5660	0.6756
	0.2850	0.3109	0.0000	0.0000

	AREA (ha)	QPEAK (cms)	TPEAK (hrs)	R.V. (mm)
INFLOW : ID= 2 (0492)	22.650	2.963	10.00	149.67
OUTFLOW: ID= 1 (0482)	22.650	2.948	10.00	149.67

PEAK FLOW REDUCTION [Qout/Qin](%)= 99.49
TIME SHIFT OF PEAK FLOW (min)= 0.00
MAXIMUM STORAGE USED (ha.m.)= 0.5624

CALIB STANDHYD (0480) ID= 1 DT= 5.0 min	Area (ha)= 43.10 Total Imp(%)= 42.00 Dir. Conn.(%)= 21.00		
		IMPERVIOUS	PERVIOUS (i)
Surface Area	(ha)=	18.10	25.00
Dep. Storage	(mm)=	1.50	5.00
Average Slope	(%)=	2.00	2.00
Length	(m)=	680.00	40.00
Mannings n	=	0.013	0.300

NOTE: RAINFALL WAS TRANSFORMED TO 5.0 MIN. TIME STEP.

---- TRANSFORMED HYETOGRAPH ----

TIME hrs	RAIN mm/hr	TIME hrs	RAIN mm/hr	TIME hrs	RAIN mm/hr	TIME hrs	RAIN mm/hr
0.083	6.35	3.083	12.70	6.083	23.11	9.08	52.83
0.167	6.35	3.167	12.70	6.167	23.11	9.17	52.83
0.250	6.35	3.250	12.70	6.250	23.11	9.25	52.83
0.333	6.35	3.333	12.70	6.333	23.11	9.33	52.83
0.417	6.35	3.417	12.70	6.417	23.11	9.42	52.83
0.500	6.35	3.500	12.70	6.500	23.11	9.50	52.83
0.583	6.35	3.583	12.70	6.583	23.11	9.58	52.83
0.667	6.35	3.667	12.70	6.667	23.11	9.67	52.83

0.750	6.35	3.750	12.70	6.750	23.11	9.75	52.83
0.833	6.35	3.833	12.70	6.833	23.11	9.83	52.83
0.917	6.35	3.917	12.70	6.917	23.11	9.92	52.83
1.000	6.35	4.000	12.70	7.000	23.11	10.00	52.83
1.083	4.32	4.083	16.76	7.083	12.70	10.08	37.85
1.167	4.32	4.167	16.76	7.167	12.70	10.17	37.85
1.250	4.32	4.250	16.76	7.250	12.70	10.25	37.85
1.333	4.32	4.333	16.76	7.333	12.70	10.33	37.85
1.417	4.32	4.417	16.76	7.417	12.70	10.42	37.85
1.500	4.32	4.500	16.76	7.500	12.70	10.50	37.85
1.583	4.32	4.583	16.76	7.583	12.70	10.58	37.85
1.667	4.32	4.667	16.76	7.667	12.70	10.67	37.85
1.750	4.32	4.750	16.76	7.750	12.70	10.75	37.85
1.833	4.32	4.833	16.76	7.833	12.70	10.83	37.85
1.917	4.32	4.917	16.76	7.917	12.70	10.92	37.85
2.000	4.32	5.000	16.76	8.000	12.70	11.00	37.85
2.083	6.35	5.083	12.70	8.083	12.70	11.08	12.70
2.167	6.35	5.167	12.70	8.167	12.70	11.17	12.70
2.250	6.35	5.250	12.70	8.250	12.70	11.25	12.70
2.333	6.35	5.333	12.70	8.333	12.70	11.33	12.70
2.417	6.35	5.417	12.70	8.417	12.70	11.42	12.70
2.500	6.35	5.500	12.70	8.500	12.70	11.50	12.70
2.583	6.35	5.583	12.70	8.583	12.70	11.58	12.70
2.667	6.35	5.667	12.70	8.667	12.70	11.67	12.70
2.750	6.35	5.750	12.70	8.750	12.70	11.75	12.70
2.833	6.35	5.833	12.70	8.833	12.70	11.83	12.70
2.917	6.35	5.917	12.70	8.917	12.70	11.92	12.70
3.000	6.35	6.000	12.70	9.000	12.70	12.00	12.70

Max.Eff.Inten.(mm/hr)=	52.83	59.46	
over (min)	10.00	20.00	
Storage Coeff. (min)=	8.46 (ii)	18.15 (ii)	
Unit Hyd. Tpeak (min)=	10.00	20.00	
Unit Hyd. peak (cms)=	0.12	0.06	
			TOTALS
PEAK FLOW (cms)=	1.33	3.90	5.222 (iii)
TIME TO PEAK (hrs)=	10.00	10.00	10.00
RUNOFF VOLUME (mm)=	209.57	107.20	128.70
TOTAL RAINFALL (mm)=	211.07	211.07	211.07
RUNOFF COEFFICIENT =	0.99	0.51	0.61

(i) HORTONS EQUATION SELECTED FOR PERVIOUS LOSSES:
Fo (mm/hr)= 75.00 K (1/hr)= 4.14
Fc (mm/hr)= 12.50 Cum.Inf. (mm)= 0.00
(ii) TIME STEP (DT) SHOULD BE SMALLER OR EQUAL
THAN THE STORAGE COEFFICIENT.
(iii) PEAK FLOW DOES NOT INCLUDE BASEFLOW IF ANY.

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| CALIB            |
| STANDHYD (  0460)|   Area    (ha)=  36.00
|ID= 1 DT= 5.0 min |   Total Imp(%)=  42.00   Dir. Conn.(%)=  21.00
--------------------
                             IMPERVIOUS    PERVIOUS (i)
     Surface Area     (ha)=      15.12         20.88
     Dep. Storage     (mm)=       1.50          5.00
     Average Slope     (%)=       2.03          2.03
     Length            (m)=     465.00         40.00
     Mannings n             =      0.013         0.300

         NOTE:  RAINFALL WAS TRANSFORMED TO   5.0 MIN. TIME STEP.
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---- TRANSFORMED HYETOGRAPH ----

TIME hrs	RAIN mm/hr	TIME hrs	RAIN mm/hr	TIME hrs	RAIN mm/hr	TIME hrs	RAIN mm/hr
0.083	6.35	3.083	12.70	6.083	23.11	9.08	52.83
0.167	6.35	3.167	12.70	6.167	23.11	9.17	52.83
0.250	6.35	3.250	12.70	6.250	23.11	9.25	52.83
0.333	6.35	3.333	12.70	6.333	23.11	9.33	52.83
0.417	6.35	3.417	12.70	6.417	23.11	9.42	52.83
0.500	6.35	3.500	12.70	6.500	23.11	9.50	52.83
0.583	6.35	3.583	12.70	6.583	23.11	9.58	52.83
0.667	6.35	3.667	12.70	6.667	23.11	9.67	52.83
0.750	6.35	3.750	12.70	6.750	23.11	9.75	52.83
0.833	6.35	3.833	12.70	6.833	23.11	9.83	52.83
0.917	6.35	3.917	12.70	6.917	23.11	9.92	52.83
1.000	6.35	4.000	12.70	7.000	23.11	10.00	52.83
1.083	4.32	4.083	16.76	7.083	12.70	10.08	37.85
1.167	4.32	4.167	16.76	7.167	12.70	10.17	37.85
1.250	4.32	4.250	16.76	7.250	12.70	10.25	37.85
1.333	4.32	4.333	16.76	7.333	12.70	10.33	37.85
1.417	4.32	4.417	16.76	7.417	12.70	10.42	37.85
1.500	4.32	4.500	16.76	7.500	12.70	10.50	37.85
1.583	4.32	4.583	16.76	7.583	12.70	10.58	37.85
1.667	4.32	4.667	16.76	7.667	12.70	10.67	37.85
1.750	4.32	4.750	16.76	7.750	12.70	10.75	37.85
1.833	4.32	4.833	16.76	7.833	12.70	10.83	37.85
1.917	4.32	4.917	16.76	7.917	12.70	10.92	37.85
2.000	4.32	5.000	16.76	8.000	12.70	11.00	37.85
2.083	6.35	5.083	12.70	8.083	12.70	11.08	12.70
2.167	6.35	5.167	12.70	8.167	12.70	11.17	12.70
2.250	6.35	5.250	12.70	8.250	12.70	11.25	12.70
2.333	6.35	5.333	12.70	8.333	12.70	11.33	12.70
2.417	6.35	5.417	12.70	8.417	12.70	11.42	12.70
2.500	6.35	5.500	12.70	8.500	12.70	11.50	12.70
2.583	6.35	5.583	12.70	8.583	12.70	11.58	12.70
2.667	6.35	5.667	12.70	8.667	12.70	11.67	12.70

2.750	6.35	5.750	12.70	8.750	12.70	11.75	12.70
2.833	6.35	5.833	12.70	8.833	12.70	11.83	12.70
2.917	6.35	5.917	12.70	8.917	12.70	11.92	12.70
3.000	6.35	6.000	12.70	9.000	12.70	12.00	12.70

Max.Eff.Inten.(mm/hr)=	52.83	59.46	
over (min)	5.00	20.00	
Storage Coeff. (min)=	6.71 (ii)	16.36 (ii)	
Unit Hyd. Tpeak (min)=	5.00	20.00	
Unit Hyd. peak (cms)=	0.18	0.06	
			TOTALS
PEAK FLOW (cms)=	1.11	3.30	4.413 (iii)
TIME TO PEAK (hrs)=	10.00	10.00	10.00
RUNOFF VOLUME (mm)=	209.57	107.20	128.70
TOTAL RAINFALL (mm)=	211.07	211.07	211.07
RUNOFF COEFFICIENT =	0.99	0.51	0.61

(i) HORTONS EQUATION SELECTED FOR PERVIOUS LOSSES:
Fo (mm/hr)= 75.00 K (1/hr)= 4.14
Fc (mm/hr)= 12.50 Cum.Inf. (mm)= 0.00
(ii) TIME STEP (DT) SHOULD BE SMALLER OR EQUAL
THAN THE STORAGE COEFFICIENT.
(iii) PEAK FLOW DOES NOT INCLUDE BASEFLOW IF ANY.

CALIB
STANDHYD (0455)| Area (ha)= 12.70
ID= 1 DT= 5.0 min | Total Imp(%)= 42.00 Dir. Conn.(%)= 21.00

		IMPERVIOUS	PERVIOUS (i)
Surface Area	(ha)=	5.33	7.37
Dep. Storage	(mm)=	1.50	5.00
Average Slope	(%)=	1.71	1.71
Length	(m)=	300.00	40.00
Mannings n	=	0.013	0.300

NOTE: RAINFALL WAS TRANSFORMED TO 5.0 MIN. TIME STEP.

---- TRANSFORMED HYETOGRAPH ----

TIME hrs	RAIN mm/hr	TIME hrs	RAIN mm/hr	TIME hrs	RAIN mm/hr	TIME hrs	RAIN mm/hr
0.083	6.35	3.083	12.70	6.083	23.11	9.08	52.83
0.167	6.35	3.167	12.70	6.167	23.11	9.17	52.83
0.250	6.35	3.250	12.70	6.250	23.11	9.25	52.83
0.333	6.35	3.333	12.70	6.333	23.11	9.33	52.83
0.417	6.35	3.417	12.70	6.417	23.11	9.42	52.83
0.500	6.35	3.500	12.70	6.500	23.11	9.50	52.83

0.583	6.35	3.583	12.70	6.583	23.11	9.58	52.83
0.667	6.35	3.667	12.70	6.667	23.11	9.67	52.83
0.750	6.35	3.750	12.70	6.750	23.11	9.75	52.83
0.833	6.35	3.833	12.70	6.833	23.11	9.83	52.83
0.917	6.35	3.917	12.70	6.917	23.11	9.92	52.83
1.000	6.35	4.000	12.70	7.000	23.11	10.00	52.83
1.083	4.32	4.083	16.76	7.083	12.70	10.08	37.85
1.167	4.32	4.167	16.76	7.167	12.70	10.17	37.85
1.250	4.32	4.250	16.76	7.250	12.70	10.25	37.85
1.333	4.32	4.333	16.76	7.333	12.70	10.33	37.85
1.417	4.32	4.417	16.76	7.417	12.70	10.42	37.85
1.500	4.32	4.500	16.76	7.500	12.70	10.50	37.85
1.583	4.32	4.583	16.76	7.583	12.70	10.58	37.85
1.667	4.32	4.667	16.76	7.667	12.70	10.67	37.85
1.750	4.32	4.750	16.76	7.750	12.70	10.75	37.85
1.833	4.32	4.833	16.76	7.833	12.70	10.83	37.85
1.917	4.32	4.917	16.76	7.917	12.70	10.92	37.85
2.000	4.32	5.000	16.76	8.000	12.70	11.00	37.85
2.083	6.35	5.083	12.70	8.083	12.70	11.08	12.70
2.167	6.35	5.167	12.70	8.167	12.70	11.17	12.70
2.250	6.35	5.250	12.70	8.250	12.70	11.25	12.70
2.333	6.35	5.333	12.70	8.333	12.70	11.33	12.70
2.417	6.35	5.417	12.70	8.417	12.70	11.42	12.70
2.500	6.35	5.500	12.70	8.500	12.70	11.50	12.70
2.583	6.35	5.583	12.70	8.583	12.70	11.58	12.70
2.667	6.35	5.667	12.70	8.667	12.70	11.67	12.70
2.750	6.35	5.750	12.70	8.750	12.70	11.75	12.70
2.833	6.35	5.833	12.70	8.833	12.70	11.83	12.70
2.917	6.35	5.917	12.70	8.917	12.70	11.92	12.70
3.000	6.35	6.000	12.70	9.000	12.70	12.00	12.70

Max.Eff.Inten.(mm/hr)=	52.83	59.46	
over (min)	5.00	20.00	
Storage Coeff. (min)=	5.43 (ii)	15.59 (ii)	
Unit Hyd. Tpeak (min)=	5.00	20.00	
Unit Hyd. peak (cms)=	0.20	0.07	
			TOTALS
PEAK FLOW (cms)=	0.39	1.17	1.564 (iii)
TIME TO PEAK (hrs)=	10.00	10.00	10.00
RUNOFF VOLUME (mm)=	209.57	107.20	128.70
TOTAL RAINFALL (mm)=	211.07	211.07	211.07
RUNOFF COEFFICIENT =	0.99	0.51	0.61

(i) HORTONS EQUATION SELECTED FOR PERVIOUS LOSSES:
Fo (mm/hr)= 75.00 K (1/hr)= 4.14
Fc (mm/hr)= 12.50 Cum.Inf. (mm)= 0.00
(ii) TIME STEP (DT) SHOULD BE SMALLER OR EQUAL
THAN THE STORAGE COEFFICIENT.
(iii) PEAK FLOW DOES NOT INCLUDE BASEFLOW IF ANY.

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| ADD HYD  (  0465)|
|   1 +  2 =  3    |          AREA    QPEAK    TPEAK     R.V.
--------------------          (ha)    (cms)    (hrs)     (mm)
       ID1= 1 (  0455):    12.70   1.564    10.00   128.70
     + ID2= 2 (  0460):    36.00   4.413    10.00   128.70
       ================================================
       ID = 3 (  0465):    48.70   5.977    10.00   128.70

     NOTE:  PEAK FLOWS DO NOT INCLUDE BASEFLOWS IF ANY.
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| CALIB            |
| STANDHYD (  0410)|   Area    (ha)=  24.20
|ID= 1 DT= 5.0 min |   Total Imp(%)=  42.00   Dir. Conn.(%)=  21.00
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                              IMPERVIOUS    PERVIOUS (i)
     Surface Area     (ha)=      10.16        14.04
     Dep. Storage     (mm)=       1.50         5.00
     Average Slope     (%)=       2.00         2.00
     Length            (m)=     401.00        40.00
     Mannings n             =     0.013        0.300

         NOTE:  RAINFALL WAS TRANSFORMED TO   5.0 MIN. TIME STEP.


                          ---- TRANSFORMED HYETOGRAPH ----
                TIME    RAIN |  TIME    RAIN |'  TIME    RAIN |  TIME    RAIN
                 hrs   mm/hr |   hrs   mm/hr |'   hrs   mm/hr |   hrs   mm/hr
               0.083    6.35 | 3.083   12.70 | 6.083   23.11 |  9.08   52.83
               0.167    6.35 | 3.167   12.70 | 6.167   23.11 |  9.17   52.83
               0.250    6.35 | 3.250   12.70 | 6.250   23.11 |  9.25   52.83
               0.333    6.35 | 3.333   12.70 | 6.333   23.11 |  9.33   52.83
               0.417    6.35 | 3.417   12.70 | 6.417   23.11 |  9.42   52.83
               0.500    6.35 | 3.500   12.70 | 6.500   23.11 |  9.50   52.83
               0.583    6.35 | 3.583   12.70 | 6.583   23.11 |  9.58   52.83
               0.667    6.35 | 3.667   12.70 | 6.667   23.11 |  9.67   52.83
               0.750    6.35 | 3.750   12.70 | 6.750   23.11 |  9.75   52.83
               0.833    6.35 | 3.833   12.70 | 6.833   23.11 |  9.83   52.83
               0.917    6.35 | 3.917   12.70 | 6.917   23.11 |  9.92   52.83
               1.000    6.35 | 4.000   12.70 | 7.000   23.11 | 10.00   52.83
               1.083    4.32 | 4.083   16.76 | 7.083   12.70 | 10.08   37.85
               1.167    4.32 | 4.167   16.76 | 7.167   12.70 | 10.17   37.85
               1.250    4.32 | 4.250   16.76 | 7.250   12.70 | 10.25   37.85
               1.333    4.32 | 4.333   16.76 | 7.333   12.70 | 10.33   37.85
               1.417    4.32 | 4.417   16.76 | 7.417   12.70 | 10.42   37.85
               1.500    4.32 | 4.500   16.76 | 7.500   12.70 | 10.50   37.85
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1.583	4.32	4.583	16.76	7.583	12.70	10.58	37.85
1.667	4.32	4.667	16.76	7.667	12.70	10.67	37.85
1.750	4.32	4.750	16.76	7.750	12.70	10.75	37.85
1.833	4.32	4.833	16.76	7.833	12.70	10.83	37.85
1.917	4.32	4.917	16.76	7.917	12.70	10.92	37.85
2.000	4.32	5.000	16.76	8.000	12.70	11.00	37.85
2.083	6.35	5.083	12.70	8.083	12.70	11.08	12.70
2.167	6.35	5.167	12.70	8.167	12.70	11.17	12.70
2.250	6.35	5.250	12.70	8.250	12.70	11.25	12.70
2.333	6.35	5.333	12.70	8.333	12.70	11.33	12.70
2.417	6.35	5.417	12.70	8.417	12.70	11.42	12.70
2.500	6.35	5.500	12.70	8.500	12.70	11.50	12.70
2.583	6.35	5.583	12.70	8.583	12.70	11.58	12.70
2.667	6.35	5.667	12.70	8.667	12.70	11.67	12.70
2.750	6.35	5.750	12.70	8.750	12.70	11.75	12.70
2.833	6.35	5.833	12.70	8.833	12.70	11.83	12.70
2.917	6.35	5.917	12.70	8.917	12.70	11.92	12.70
3.000	6.35	6.000	12.70	9.000	12.70	12.00	12.70

Max.Eff.Inten.(mm/hr)=	52.83	59.46	
over (min)	5.00	20.00	
Storage Coeff. (min)=	6.16 (ii)	15.86 (ii)	
Unit Hyd. Tpeak (min)=	5.00	20.00	
Unit Hyd. peak (cms)=	0.19	0.07	
			TOTALS
PEAK FLOW (cms)=	0.75	2.23	2.975 (iii)
TIME TO PEAK (hrs)=	10.00	10.00	10.00
RUNOFF VOLUME (mm)=	209.57	107.20	128.70
TOTAL RAINFALL (mm)=	211.07	211.07	211.07
RUNOFF COEFFICIENT =	0.99	0.51	0.61

(i) HORTONS EQUATION SELECTED FOR PERVIOUS LOSSES:
Fo (mm/hr)= 75.00 K (1/hr)= 4.14
Fc (mm/hr)= 12.50 Cum.Inf. (mm)= 0.00
(ii) TIME STEP (DT) SHOULD BE SMALLER OR EQUAL
THAN THE STORAGE COEFFICIENT.
(iii) PEAK FLOW DOES NOT INCLUDE BASEFLOW IF ANY.

CALIB
STANDHYD (0415)
ID= 1 DT= 5.0 min

Area (ha)= 4.99
Total Imp(%)= 42.00 Dir. Conn.(%)= 21.00

		IMPERVIOUS	PERVIOUS (i)
Surface Area	(ha)=	2.10	2.89
Dep. Storage	(mm)=	1.50	5.00
Average Slope	(%)=	2.86	2.86
Length	(m)=	185.00	40.00

Mannings n = 0.013 0.300

NOTE: RAINFALL WAS TRANSFORMED TO 5.0 MIN. TIME STEP.

---- TRANSFORMED HYETOGRAPH ----

TIME hrs	RAIN mm/hr	TIME hrs	RAIN mm/hr	TIME hrs	RAIN mm/hr	TIME hrs	RAIN mm/hr
0.083	6.35	3.083	12.70	6.083	23.11	9.08	52.83
0.167	6.35	3.167	12.70	6.167	23.11	9.17	52.83
0.250	6.35	3.250	12.70	6.250	23.11	9.25	52.83
0.333	6.35	3.333	12.70	6.333	23.11	9.33	52.83
0.417	6.35	3.417	12.70	6.417	23.11	9.42	52.83
0.500	6.35	3.500	12.70	6.500	23.11	9.50	52.83
0.583	6.35	3.583	12.70	6.583	23.11	9.58	52.83
0.667	6.35	3.667	12.70	6.667	23.11	9.67	52.83
0.750	6.35	3.750	12.70	6.750	23.11	9.75	52.83
0.833	6.35	3.833	12.70	6.833	23.11	9.83	52.83
0.917	6.35	3.917	12.70	6.917	23.11	9.92	52.83
1.000	6.35	4.000	12.70	7.000	23.11	10.00	52.83
1.083	4.32	4.083	16.76	7.083	12.70	10.08	37.85
1.167	4.32	4.167	16.76	7.167	12.70	10.17	37.85
1.250	4.32	4.250	16.76	7.250	12.70	10.25	37.85
1.333	4.32	4.333	16.76	7.333	12.70	10.33	37.85
1.417	4.32	4.417	16.76	7.417	12.70	10.42	37.85
1.500	4.32	4.500	16.76	7.500	12.70	10.50	37.85
1.583	4.32	4.583	16.76	7.583	12.70	10.58	37.85
1.667	4.32	4.667	16.76	7.667	12.70	10.67	37.85
1.750	4.32	4.750	16.76	7.750	12.70	10.75	37.85
1.833	4.32	4.833	16.76	7.833	12.70	10.83	37.85
1.917	4.32	4.917	16.76	7.917	12.70	10.92	37.85
2.000	4.32	5.000	16.76	8.000	12.70	11.00	37.85
2.083	6.35	5.083	12.70	8.083	12.70	11.08	12.70
2.167	6.35	5.167	12.70	8.167	12.70	11.17	12.70
2.250	6.35	5.250	12.70	8.250	12.70	11.25	12.70
2.333	6.35	5.333	12.70	8.333	12.70	11.33	12.70
2.417	6.35	5.417	12.70	8.417	12.70	11.42	12.70
2.500	6.35	5.500	12.70	8.500	12.70	11.50	12.70
2.583	6.35	5.583	12.70	8.583	12.70	11.58	12.70
2.667	6.35	5.667	12.70	8.667	12.70	11.67	12.70
2.750	6.35	5.750	12.70	8.750	12.70	11.75	12.70
2.833	6.35	5.833	12.70	8.833	12.70	11.83	12.70
2.917	6.35	5.917	12.70	8.917	12.70	11.92	12.70
3.000	6.35	6.000	12.70	9.000	12.70	12.00	12.70

Max.Eff.Inten.(mm/hr)=	52.83	59.46
over (min)	5.00	15.00
Storage Coeff. (min)=	3.48 (ii)	12.19 (ii)
Unit Hyd. Tpeak (min)=	5.00	15.00
Unit Hyd. peak (cms)=	0.26	0.09

```
                                                          *TOTALS*
     PEAK FLOW       (cms)=       0.15         0.47          0.626 (iii)
     TIME TO PEAK    (hrs)=      10.00        10.00          10.00
     RUNOFF VOLUME    (mm)=     209.57       107.20         128.70
     TOTAL RAINFALL   (mm)=     211.07       211.07         211.07
     RUNOFF COEFFICIENT   =       0.99         0.51           0.61

***** WARNING: STORAGE COEFF. IS SMALLER THAN TIME STEP!

       (i) HORTONS EQUATION SELECTED FOR PERVIOUS LOSSES:
            Fo   (mm/hr)= 75.00           K  (1/hr)=  4.14
            Fc   (mm/hr)= 12.50     Cum.Inf.   (mm)=  0.00
      (ii) TIME STEP (DT) SHOULD BE SMALLER OR EQUAL
           THAN THE STORAGE COEFFICIENT.
     (iii) PEAK FLOW DOES NOT INCLUDE BASEFLOW IF ANY.

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

--------------------
| ADD HYD  (  0420)|
|   1 +  2 =  3    |         AREA    QPEAK    TPEAK     R.V.
--------------------         (ha)    (cms)    (hrs)     (mm)
        ID1= 1 (  0410):    24.20   2.975    10.00   128.70
      + ID2= 2 (  0415):     4.99   0.626    10.00   128.70
        ================================================
        ID = 3 (  0420):    29.19   3.602    10.00   128.70

     NOTE:  PEAK FLOWS DO NOT INCLUDE BASEFLOWS IF ANY.
--------------------------------------------------------------------------------
--------------------
| DUHYD    (  0425)|
| Inlet Cap.= 1.980|
| #of Inlets=     1|
| Total(cms)=   2.0|      AREA     QPEAK     TPEAK    R.V.
--------------------      (ha)     (cms)     (hrs)    (mm)
     TOTAL HYD.(ID= 1):  29.19      3.60     10.00  128.70
     ================================================
     MAJOR SYS.(ID= 2):   4.95      1.62     10.00  128.70
     MINOR SYS.(ID= 3):  24.24      1.98      9.33  128.70

     NOTE:  PEAK FLOWS DO NOT INCLUDE BASEFLOWS IF ANY.

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--------------------
| ADD HYD  (  0470)|
|   1 +  2 =  3    |         AREA    QPEAK    TPEAK     R.V.
--------------------         (ha)    (cms)    (hrs)     (mm)
        ID1= 1 (  0425):     4.95   1.622    10.00   128.70
      + ID2= 2 (  0465):    48.70   5.977    10.00   128.70
```

```
        ==================================================
        ID = 3 (  0470):    53.65   7.598    10.00   128.70

     NOTE:  PEAK FLOWS DO NOT INCLUDE BASEFLOWS IF ANY.
--------------------------------------------------------------------------------
--------------------
| ROUTE CHN(  0475)|
| IN= 2---> OUT= 1 |     Routing time step (min)'=  5.00
--------------------
               <------ DATA FOR SECTION (   1.1) ------>
               Distance      Elevation       Manning
                 100.00        324.60        0.0500
                 115.00        321.60        0.0500
                 120.00        320.80    0.0500 /0.0300  Main Channel
                 122.00        320.80    0.0300 /0.0500  Main Channel
                 138.00        321.60        0.0500
                 148.00        322.30        0.0500
                 154.00        323.10        0.0500
                 164.00        324.60        0.0500

      <--------------------- TRAVEL TIME TABLE ---------------------->
       DEPTH    ELEV      VOLUME    FLOW RATE    VELOCITY   TRAV.TIME
        (m)      (m)     (cu.m.)      (cms)        (m/s)      (min)
       0.20   321.00    .398E+03       0.8          0.84       8.53
       0.40   321.20    .125E+04       3.3          1.13       6.33
       0.60   321.40    .255E+04       8.1          1.36       5.27
       0.80   321.60    .430E+04      15.6          1.56       4.59
       1.00   321.80    .644E+04      26.8          1.79       4.01
       1.20   322.00    .892E+04      41.2          1.99       3.61
       1.40   322.20    .117E+05      59.3          2.17       3.30
       1.60   322.40    .148E+05      81.9          2.37       3.02
       1.80   322.60    .182E+05     109.1          2.58       2.78
       2.00   322.80    .218E+05     140.2          2.77       2.59
       2.20   323.00    .256E+05     175.3          2.95       2.43
       2.40   323.20    .296E+05     214.7          3.12       2.29
       2.60   323.40    .338E+05     258.6          3.29       2.18
       2.80   323.60    .382E+05     306.7          3.46       2.07
       3.00   323.80    .428E+05     359.1          3.61       1.98
       3.20   324.00    .476E+05     416.0          3.76       1.91
       3.40   324.20    .526E+05     477.5          3.91       1.83
       3.60   324.40    .578E+05     543.5          4.05       1.77
       3.80   324.60    .632E+05     614.3          4.18       1.71

                                   <---- hydrograph ---->   <-pipe / channel->
                            AREA    QPEAK   TPEAK   R.V.   MAX DEPTH  MAX VEL
                            (ha)    (cms)   (hrs)   (mm)      (m)      (m/s)
   INFLOW : ID= 2 (  0470)   53.65     7.60   10.00 128.70      0.58      1.33
   OUTFLOW: ID= 1 (  0475)   53.65     7.51   10.00 128.70      0.58      1.33
```

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-------------------------------------------------------------------------------
--------------------
| CALIB            |
| STANDHYD (  0105)|   Area    (ha)=  51.32
|ID= 1 DT= 5.0 min |   Total Imp(%)=  42.00   Dir. Conn.(%)=  21.00
--------------------
                              IMPERVIOUS    PERVIOUS (i)
     Surface Area     (ha)=      21.55        29.77
     Dep. Storage     (mm)=       1.50         5.00
     Average Slope     (%)=       2.00         2.00
     Length            (m)=     550.00        40.00
     Mannings n           =      0.013        0.300

         NOTE:  RAINFALL WAS TRANSFORMED TO   5.0 MIN. TIME STEP.


                              ---- TRANSFORMED HYETOGRAPH ----
                 TIME    RAIN |  TIME    RAIN |'  TIME    RAIN |  TIME    RAIN
                  hrs   mm/hr |   hrs   mm/hr |'   hrs   mm/hr |   hrs   mm/hr
                0.083    6.35 | 3.083   12.70 | 6.083   23.11 |  9.08   52.83
                0.167    6.35 | 3.167   12.70 | 6.167   23.11 |  9.17   52.83
                0.250    6.35 | 3.250   12.70 | 6.250   23.11 |  9.25   52.83
                0.333    6.35 | 3.333   12.70 | 6.333   23.11 |  9.33   52.83
                0.417    6.35 | 3.417   12.70 | 6.417   23.11 |  9.42   52.83
                0.500    6.35 | 3.500   12.70 | 6.500   23.11 |  9.50   52.83
                0.583    6.35 | 3.583   12.70 | 6.583   23.11 |  9.58   52.83
                0.667    6.35 | 3.667   12.70 | 6.667   23.11 |  9.67   52.83
                0.750    6.35 | 3.750   12.70 | 6.750   23.11 |  9.75   52.83
                0.833    6.35 | 3.833   12.70 | 6.833   23.11 |  9.83   52.83
                0.917    6.35 | 3.917   12.70 | 6.917   23.11 |  9.92   52.83
                1.000    6.35 | 4.000   12.70 | 7.000   23.11 | 10.00   52.83
                1.083    4.32 | 4.083   16.76 | 7.083   12.70 | 10.08   37.85
                1.167    4.32 | 4.167   16.76 | 7.167   12.70 | 10.17   37.85
                1.250    4.32 | 4.250   16.76 | 7.250   12.70 | 10.25   37.85
                1.333    4.32 | 4.333   16.76 | 7.333   12.70 | 10.33   37.85
                1.417    4.32 | 4.417   16.76 | 7.417   12.70 | 10.42   37.85
                1.500    4.32 | 4.500   16.76 | 7.500   12.70 | 10.50   37.85
                1.583    4.32 | 4.583   16.76 | 7.583   12.70 | 10.58   37.85
                1.667    4.32 | 4.667   16.76 | 7.667   12.70 | 10.67   37.85
                1.750    4.32 | 4.750   16.76 | 7.750   12.70 | 10.75   37.85
                1.833    4.32 | 4.833   16.76 | 7.833   12.70 | 10.83   37.85
                1.917    4.32 | 4.917   16.76 | 7.917   12.70 | 10.92   37.85
                2.000    4.32 | 5.000   16.76 | 8.000   12.70 | 11.00   37.85
                2.083    6.35 | 5.083   12.70 | 8.083   12.70 | 11.08   12.70
                2.167    6.35 | 5.167   12.70 | 8.167   12.70 | 11.17   12.70
                2.250    6.35 | 5.250   12.70 | 8.250   12.70 | 11.25   12.70
                2.333    6.35 | 5.333   12.70 | 8.333   12.70 | 11.33   12.70
                2.417    6.35 | 5.417   12.70 | 8.417   12.70 | 11.42   12.70
                2.500    6.35 | 5.500   12.70 | 8.500   12.70 | 11.50   12.70
```

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              2.583    6.35 | 5.583   12.70 | 8.583   12.70 | 11.58   12.70
              2.667    6.35 | 5.667   12.70 | 8.667   12.70 | 11.67   12.70
              2.750    6.35 | 5.750   12.70 | 8.750   12.70 | 11.75   12.70
              2.833    6.35 | 5.833   12.70 | 8.833   12.70 | 11.83   12.70
              2.917    6.35 | 5.917   12.70 | 8.917   12.70 | 11.92   12.70
              3.000    6.35 | 6.000   12.70 | 9.000   12.70 | 12.00   12.70

    Max.Eff.Inten.(mm/hr)=      52.83        59.46
              over (min)         5.00        20.00
    Storage Coeff.  (min)=       7.45 (ii)   17.14 (ii)
    Unit Hyd. Tpeak (min)=       5.00        20.00
    Unit Hyd. peak  (cms)=       0.17         0.06
                                                        *TOTALS*
    PEAK FLOW       (cms)=       1.58         4.68          6.260 (iii)
    TIME TO PEAK    (hrs)=      10.00        10.00          10.00
    RUNOFF VOLUME    (mm)=     209.57       107.20         128.70
    TOTAL RAINFALL   (mm)=     211.07       211.07         211.07
    RUNOFF COEFFICIENT   =       0.99         0.51           0.61


      (i) HORTONS EQUATION SELECTED FOR PERVIOUS LOSSES:
           Fo   (mm/hr)= 75.00          K  (1/hr)=  4.14
           Fc   (mm/hr)= 12.50     Cum.Inf.   (mm)=  0.00
     (ii) TIME STEP (DT) SHOULD BE SMALLER OR EQUAL
          THAN THE STORAGE COEFFICIENT.
    (iii) PEAK FLOW DOES NOT INCLUDE BASEFLOW IF ANY.

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--------------------
| RESERVOIR(  0106)|     OVERFLOW IS OFF
| IN= 2---> OUT= 1 |
| DT=  5.0 min     |     OUTFLOW    STORAGE   |  OUTFLOW    STORAGE
--------------------      (cms)     (ha.m.)   |   (cms)     (ha.m.)
                          0.0000     0.0000   |   0.5000      0.4000
                          0.0100     0.0100   |   6.6000      0.8000
                          0.0260     0.2300   |   0.0000      0.0000

                                  AREA     QPEAK     TPEAK       R.V.
                                  (ha)     (cms)     (hrs)       (mm)
   INFLOW : ID= 2 (  0105)     51.320      6.260     10.00     128.70
   OUTFLOW: ID= 1 (  0106)     51.320      5.997     10.08     128.69

                  PEAK   FLOW   REDUCTION [Qout/Qin](%)= 95.79
                  TIME SHIFT OF PEAK FLOW         (min)=  5.00
                  MAXIMUM  STORAGE   USED       (ha.m.)=  0.7608

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--------------------
| CALIB            |
| STANDHYD (  0110)|   Area    (ha)=  19.00
```

|ID= 1 DT= 5.0 min | Total Imp(%)= 42.00 Dir. Conn.(%)= 21.00

		IMPERVIOUS	PERVIOUS (i)
Surface Area	(ha)=	7.98	11.02
Dep. Storage	(mm)=	1.50	5.00
Average Slope	(%)=	2.00	2.00
Length	(m)=	365.00	40.00
Mannings n	=	0.013	0.300

NOTE: RAINFALL WAS TRANSFORMED TO 5.0 MIN. TIME STEP.

---- TRANSFORMED HYETOGRAPH ----

TIME hrs	RAIN mm/hr	TIME hrs	RAIN mm/hr	TIME hrs	RAIN mm/hr	TIME hrs	RAIN mm/hr
0.083	6.35	3.083	12.70	6.083	23.11	9.08	52.83
0.167	6.35	3.167	12.70	6.167	23.11	9.17	52.83
0.250	6.35	3.250	12.70	6.250	23.11	9.25	52.83
0.333	6.35	3.333	12.70	6.333	23.11	9.33	52.83
0.417	6.35	3.417	12.70	6.417	23.11	9.42	52.83
0.500	6.35	3.500	12.70	6.500	23.11	9.50	52.83
0.583	6.35	3.583	12.70	6.583	23.11	9.58	52.83
0.667	6.35	3.667	12.70	6.667	23.11	9.67	52.83
0.750	6.35	3.750	12.70	6.750	23.11	9.75	52.83
0.833	6.35	3.833	12.70	6.833	23.11	9.83	52.83
0.917	6.35	3.917	12.70	6.917	23.11	9.92	52.83
1.000	6.35	4.000	12.70	7.000	23.11	10.00	52.83
1.083	4.32	4.083	16.76	7.083	12.70	10.08	37.85
1.167	4.32	4.167	16.76	7.167	12.70	10.17	37.85
1.250	4.32	4.250	16.76	7.250	12.70	10.25	37.85
1.333	4.32	4.333	16.76	7.333	12.70	10.33	37.85
1.417	4.32	4.417	16.76	7.417	12.70	10.42	37.85
1.500	4.32	4.500	16.76	7.500	12.70	10.50	37.85
1.583	4.32	4.583	16.76	7.583	12.70	10.58	37.85
1.667	4.32	4.667	16.76	7.667	12.70	10.67	37.85
1.750	4.32	4.750	16.76	7.750	12.70	10.75	37.85
1.833	4.32	4.833	16.76	7.833	12.70	10.83	37.85
1.917	4.32	4.917	16.76	7.917	12.70	10.92	37.85
2.000	4.32	5.000	16.76	8.000	12.70	11.00	37.85
2.083	6.35	5.083	12.70	8.083	12.70	11.08	12.70
2.167	6.35	5.167	12.70	8.167	12.70	11.17	12.70
2.250	6.35	5.250	12.70	8.250	12.70	11.25	12.70
2.333	6.35	5.333	12.70	8.333	12.70	11.33	12.70
2.417	6.35	5.417	12.70	8.417	12.70	11.42	12.70
2.500	6.35	5.500	12.70	8.500	12.70	11.50	12.70
2.583	6.35	5.583	12.70	8.583	12.70	11.58	12.70
2.667	6.35	5.667	12.70	8.667	12.70	11.67	12.70
2.750	6.35	5.750	12.70	8.750	12.70	11.75	12.70
2.833	6.35	5.833	12.70	8.833	12.70	11.83	12.70
2.917	6.35	5.917	12.70	8.917	12.70	11.92	12.70

```
              3.000    6.35 | 6.000   12.70 | 9.000   12.70 | 12.00   12.70

     Max.Eff.Inten.(mm/hr)=      52.83        59.46
               over (min)         5.00        20.00
     Storage Coeff.  (min)=       5.82 (ii)   15.52 (ii)
     Unit Hyd. Tpeak (min)=       5.00        20.00
     Unit Hyd. peak  (cms)=       0.20         0.07
                                                          *TOTALS*
     PEAK FLOW       (cms)=       0.59         1.75          2.340 (iii)
     TIME TO PEAK    (hrs)=      10.00        10.00          10.00
     RUNOFF VOLUME    (mm)=     209.57       107.20         128.70
     TOTAL RAINFALL   (mm)=     211.07       211.07         211.07
     RUNOFF COEFFICIENT   =       0.99         0.51           0.61


       (i) HORTONS EQUATION SELECTED FOR PERVIOUS LOSSES:
            Fo   (mm/hr)= 75.00          K  (1/hr)=  4.14
            Fc   (mm/hr)= 12.50     Cum.Inf.   (mm)=  0.00
      (ii) TIME STEP (DT) SHOULD BE SMALLER OR EQUAL
           THAN THE STORAGE COEFFICIENT.
     (iii) PEAK FLOW DOES NOT INCLUDE BASEFLOW IF ANY.

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--------------------
| RESERVOIR(  0111)|     OVERFLOW IS OFF
| IN= 2---> OUT= 1 |
| DT=  5.0 min     |     OUTFLOW    STORAGE   |  OUTFLOW    STORAGE
--------------------      (cms)     (ha.m.)   |   (cms)     (ha.m.)
                          0.0000     0.0000   |   1.0000      1.0000
                          0.0100     0.0100   |  20.0000      1.1000
                          0.0120     0.1000   |   0.0000      0.0000

                                  AREA     QPEAK     TPEAK       R.V.
                                  (ha)     (cms)     (hrs)       (mm)
   INFLOW : ID= 2 (  0110)     19.000      2.340     10.00     128.70
   OUTFLOW: ID= 1 (  0111)     19.000      2.069     10.50     128.68

                  PEAK   FLOW   REDUCTION [Qout/Qin](%)= 88.39
                  TIME SHIFT OF PEAK FLOW         (min)= 30.00
                  MAXIMUM  STORAGE   USED       (ha.m.)=  1.0148

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--------------------
| CALIB            |
| STANDHYD (  0102)|   Area    (ha)=  14.32
|ID= 1 DT= 5.0 min |   Total Imp(%)=  42.00   Dir. Conn.(%)=  21.00
--------------------
                              IMPERVIOUS    PERVIOUS (i)
     Surface Area     (ha)=       6.01         8.31
     Dep. Storage     (mm)=       1.50         5.00
```

Average Slope	(%)=	2.00	2.00
Length	(m)=	287.00	40.00
Mannings n	=	0.013	0.300

NOTE: RAINFALL WAS TRANSFORMED TO 5.0 MIN. TIME STEP.

---- TRANSFORMED HYETOGRAPH ----

TIME hrs	RAIN mm/hr	TIME hrs	RAIN mm/hr	TIME hrs	RAIN mm/hr	TIME hrs	RAIN mm/hr
0.083	6.35	3.083	12.70	6.083	23.11	9.08	52.83
0.167	6.35	3.167	12.70	6.167	23.11	9.17	52.83
0.250	6.35	3.250	12.70	6.250	23.11	9.25	52.83
0.333	6.35	3.333	12.70	6.333	23.11	9.33	52.83
0.417	6.35	3.417	12.70	6.417	23.11	9.42	52.83
0.500	6.35	3.500	12.70	6.500	23.11	9.50	52.83
0.583	6.35	3.583	12.70	6.583	23.11	9.58	52.83
0.667	6.35	3.667	12.70	6.667	23.11	9.67	52.83
0.750	6.35	3.750	12.70	6.750	23.11	9.75	52.83
0.833	6.35	3.833	12.70	6.833	23.11	9.83	52.83
0.917	6.35	3.917	12.70	6.917	23.11	9.92	52.83
1.000	6.35	4.000	12.70	7.000	23.11	10.00	52.83
1.083	4.32	4.083	16.76	7.083	12.70	10.08	37.85
1.167	4.32	4.167	16.76	7.167	12.70	10.17	37.85
1.250	4.32	4.250	16.76	7.250	12.70	10.25	37.85
1.333	4.32	4.333	16.76	7.333	12.70	10.33	37.85
1.417	4.32	4.417	16.76	7.417	12.70	10.42	37.85
1.500	4.32	4.500	16.76	7.500	12.70	10.50	37.85
1.583	4.32	4.583	16.76	7.583	12.70	10.58	37.85
1.667	4.32	4.667	16.76	7.667	12.70	10.67	37.85
1.750	4.32	4.750	16.76	7.750	12.70	10.75	37.85
1.833	4.32	4.833	16.76	7.833	12.70	10.83	37.85
1.917	4.32	4.917	16.76	7.917	12.70	10.92	37.85
2.000	4.32	5.000	16.76	8.000	12.70	11.00	37.85
2.083	6.35	5.083	12.70	8.083	12.70	11.08	12.70
2.167	6.35	5.167	12.70	8.167	12.70	11.17	12.70
2.250	6.35	5.250	12.70	8.250	12.70	11.25	12.70
2.333	6.35	5.333	12.70	8.333	12.70	11.33	12.70
2.417	6.35	5.417	12.70	8.417	12.70	11.42	12.70
2.500	6.35	5.500	12.70	8.500	12.70	11.50	12.70
2.583	6.35	5.583	12.70	8.583	12.70	11.58	12.70
2.667	6.35	5.667	12.70	8.667	12.70	11.67	12.70
2.750	6.35	5.750	12.70	8.750	12.70	11.75	12.70
2.833	6.35	5.833	12.70	8.833	12.70	11.83	12.70
2.917	6.35	5.917	12.70	8.917	12.70	11.92	12.70
3.000	6.35	6.000	12.70	9.000	12.70	12.00	12.70

Max.Eff.Inten.(mm/hr)=		52.83	59.46
over (min)		5.00	15.00
Storage Coeff. (min)=		5.04 (ii)	14.74 (ii)

Unit Hyd. Tpeak (min)=	5.00	15.00		
Unit Hyd. peak (cms)=	0.21	0.08		
			TOTALS	
PEAK FLOW (cms)=	0.44	1.34	1.780	(iii)
TIME TO PEAK (hrs)=	10.00	10.00	10.00	
RUNOFF VOLUME (mm)=	209.57	107.20	128.70	
TOTAL RAINFALL (mm)=	211.07	211.07	211.07	
RUNOFF COEFFICIENT =	0.99	0.51	0.61	

(i) HORTONS EQUATION SELECTED FOR PERVIOUS LOSSES:
Fo (mm/hr)= 75.00 K (1/hr)= 4.14
Fc (mm/hr)= 12.50 Cum.Inf. (mm)= 0.00
(ii) TIME STEP (DT) SHOULD BE SMALLER OR EQUAL
THAN THE STORAGE COEFFICIENT.
(iii) PEAK FLOW DOES NOT INCLUDE BASEFLOW IF ANY.

CALIB
STANDHYD (0101) | Area (ha)= 16.32
ID= 1 DT= 5.0 min | Total Imp(%)= 42.00 Dir. Conn.(%)= 21.00

		IMPERVIOUS	PERVIOUS (i)
Surface Area	(ha)=	6.85	9.47
Dep. Storage	(mm)=	1.50	5.00
Average Slope	(%)=	2.00	2.00
Length	(m)=	309.00	40.00
Mannings n	=	0.013	0.300

NOTE: RAINFALL WAS TRANSFORMED TO 5.0 MIN. TIME STEP.

---- TRANSFORMED HYETOGRAPH ----

TIME hrs	RAIN mm/hr	TIME hrs	RAIN mm/hr	TIME hrs	RAIN mm/hr	TIME hrs	RAIN mm/hr
0.083	6.35	3.083	12.70	6.083	23.11	9.08	52.83
0.167	6.35	3.167	12.70	6.167	23.11	9.17	52.83
0.250	6.35	3.250	12.70	6.250	23.11	9.25	52.83
0.333	6.35	3.333	12.70	6.333	23.11	9.33	52.83
0.417	6.35	3.417	12.70	6.417	23.11	9.42	52.83
0.500	6.35	3.500	12.70	6.500	23.11	9.50	52.83
0.583	6.35	3.583	12.70	6.583	23.11	9.58	52.83
0.667	6.35	3.667	12.70	6.667	23.11	9.67	52.83
0.750	6.35	3.750	12.70	6.750	23.11	9.75	52.83
0.833	6.35	3.833	12.70	6.833	23.11	9.83	52.83
0.917	6.35	3.917	12.70	6.917	23.11	9.92	52.83
1.000	6.35	4.000	12.70	7.000	23.11	10.00	52.83
1.083	4.32	4.083	16.76	7.083	12.70	10.08	37.85
1.167	4.32	4.167	16.76	7.167	12.70	10.17	37.85

1.250	4.32	4.250	16.76	7.250	12.70	10.25	37.85
1.333	4.32	4.333	16.76	7.333	12.70	10.33	37.85
1.417	4.32	4.417	16.76	7.417	12.70	10.42	37.85
1.500	4.32	4.500	16.76	7.500	12.70	10.50	37.85
1.583	4.32	4.583	16.76	7.583	12.70	10.58	37.85
1.667	4.32	4.667	16.76	7.667	12.70	10.67	37.85
1.750	4.32	4.750	16.76	7.750	12.70	10.75	37.85
1.833	4.32	4.833	16.76	7.833	12.70	10.83	37.85
1.917	4.32	4.917	16.76	7.917	12.70	10.92	37.85
2.000	4.32	5.000	16.76	8.000	12.70	11.00	37.85
2.083	6.35	5.083	12.70	8.083	12.70	11.08	12.70
2.167	6.35	5.167	12.70	8.167	12.70	11.17	12.70
2.250	6.35	5.250	12.70	8.250	12.70	11.25	12.70
2.333	6.35	5.333	12.70	8.333	12.70	11.33	12.70
2.417	6.35	5.417	12.70	8.417	12.70	11.42	12.70
2.500	6.35	5.500	12.70	8.500	12.70	11.50	12.70
2.583	6.35	5.583	12.70	8.583	12.70	11.58	12.70
2.667	6.35	5.667	12.70	8.667	12.70	11.67	12.70
2.750	6.35	5.750	12.70	8.750	12.70	11.75	12.70
2.833	6.35	5.833	12.70	8.833	12.70	11.83	12.70
2.917	6.35	5.917	12.70	8.917	12.70	11.92	12.70
3.000	6.35	6.000	12.70	9.000	12.70	12.00	12.70

Max.Eff.Inten.(mm/hr)=	52.83	59.46		
over (min)	5.00	15.00		
Storage Coeff. (min)=	5.27 (ii)	14.96 (ii)		
Unit Hyd. Tpeak (min)=	5.00	15.00		
Unit Hyd. peak (cms)=	0.21	0.08		
			TOTALS	
PEAK FLOW (cms)=	0.50	1.52	2.027 (iii)	
TIME TO PEAK (hrs)=	10.00	10.00	10.00	
RUNOFF VOLUME (mm)=	209.57	107.20	128.70	
TOTAL RAINFALL (mm)=	211.07	211.07	211.07	
RUNOFF COEFFICIENT =	0.99	0.51	0.61	

(i) HORTONS EQUATION SELECTED FOR PERVIOUS LOSSES:
Fo (mm/hr)= 75.00 K (1/hr)= 4.14
Fc (mm/hr)= 12.50 Cum.Inf. (mm)= 0.00
(ii) TIME STEP (DT) SHOULD BE SMALLER OR EQUAL
THAN THE STORAGE COEFFICIENT.
(iii) PEAK FLOW DOES NOT INCLUDE BASEFLOW IF ANY.

ADD HYD (0103)				
1 + 2 = 3	AREA (ha)	QPEAK (cms)	TPEAK (hrs)	R.V. (mm)
ID1= 1 (0101):	16.32	2.027	10.00	128.70

```
      + ID2= 2 (  0102):    14.32   1.780    10.00   128.70
        ================================================
        ID = 3 (  0103):    30.64   3.807    10.00   128.70

     NOTE:  PEAK FLOWS DO NOT INCLUDE BASEFLOWS IF ANY.
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--------------------
| RESERVOIR(  0104)|     OVERFLOW IS OFF
| IN= 2---> OUT= 1 |
| DT=  5.0 min     |     OUTFLOW    STORAGE   |  OUTFLOW    STORAGE
--------------------      (cms)     (ha.m.)   |   (cms)     (ha.m.)
                          0.0000     0.0000   |   1.0000      0.5000
                          0.0100     0.0100   |  10.0000      0.6000
                          0.0150     0.1332   |   0.0000      0.0000

                                 AREA     QPEAK     TPEAK       R.V.
                                 (ha)     (cms)     (hrs)       (mm)
   INFLOW : ID= 2 (  0103)     30.640      3.807     10.00     128.70
   OUTFLOW: ID= 1 (  0104)     30.640      3.797     10.00     128.69

                  PEAK   FLOW   REDUCTION [Qout/Qin](%)= 99.73
                  TIME SHIFT OF PEAK FLOW         (min)=  0.00
                  MAXIMUM  STORAGE   USED       (ha.m.)=  0.5312

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| ADD HYD  (  0114)|
|   1 +  2 =  3    |         AREA    QPEAK    TPEAK     R.V.
--------------------         (ha)    (cms)    (hrs)     (mm)
        ID1= 1 (  0104):    30.64   3.797    10.00   128.69
      + ID2= 2 (  0111):    19.00   2.069    10.50   128.68
        ================================================
        ID = 3 (  0114):    49.64   4.896    10.50   128.69

     NOTE:  PEAK FLOWS DO NOT INCLUDE BASEFLOWS IF ANY.
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| ADD HYD  (  0115)|
|   1 +  2 =  3    |         AREA    QPEAK    TPEAK     R.V.
--------------------         (ha)    (cms)    (hrs)     (mm)
        ID1= 1 (  0106):    51.32   5.997    10.08   128.69
      + ID2= 2 (  0114):    49.64   4.896    10.50   128.69
        ================================================
        ID = 3 (  0115):   100.96  10.540    10.08   128.69

     NOTE:  PEAK FLOWS DO NOT INCLUDE BASEFLOWS IF ANY.
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CALIB	
STANDHYD (0395)	Area (ha)= 51.20
ID= 1 DT= 5.0 min	Total Imp(%)= 10.00 Dir. Conn.(%)= 5.00

		IMPERVIOUS	PERVIOUS (i)
Surface Area	(ha)=	5.12	46.08
Dep. Storage	(mm)=	1.50	5.00
Average Slope	(%)=	2.00	2.00
Length	(m)=	900.00	40.00
Mannings n	=	0.013	0.300

NOTE: RAINFALL WAS TRANSFORMED TO 5.0 MIN. TIME STEP.

---- TRANSFORMED HYETOGRAPH ----

TIME hrs	RAIN mm/hr	TIME hrs	RAIN mm/hr	TIME hrs	RAIN mm/hr	TIME hrs	RAIN mm/hr
0.083	6.35	3.083	12.70	6.083	23.11	9.08	52.83
0.167	6.35	3.167	12.70	6.167	23.11	9.17	52.83
0.250	6.35	3.250	12.70	6.250	23.11	9.25	52.83
0.333	6.35	3.333	12.70	6.333	23.11	9.33	52.83
0.417	6.35	3.417	12.70	6.417	23.11	9.42	52.83
0.500	6.35	3.500	12.70	6.500	23.11	9.50	52.83
0.583	6.35	3.583	12.70	6.583	23.11	9.58	52.83
0.667	6.35	3.667	12.70	6.667	23.11	9.67	52.83
0.750	6.35	3.750	12.70	6.750	23.11	9.75	52.83
0.833	6.35	3.833	12.70	6.833	23.11	9.83	52.83
0.917	6.35	3.917	12.70	6.917	23.11	9.92	52.83
1.000	6.35	4.000	12.70	7.000	23.11	10.00	52.83
1.083	4.32	4.083	16.76	7.083	12.70	10.08	37.85
1.167	4.32	4.167	16.76	7.167	12.70	10.17	37.85
1.250	4.32	4.250	16.76	7.250	12.70	10.25	37.85
1.333	4.32	4.333	16.76	7.333	12.70	10.33	37.85
1.417	4.32	4.417	16.76	7.417	12.70	10.42	37.85
1.500	4.32	4.500	16.76	7.500	12.70	10.50	37.85
1.583	4.32	4.583	16.76	7.583	12.70	10.58	37.85
1.667	4.32	4.667	16.76	7.667	12.70	10.67	37.85
1.750	4.32	4.750	16.76	7.750	12.70	10.75	37.85
1.833	4.32	4.833	16.76	7.833	12.70	10.83	37.85
1.917	4.32	4.917	16.76	7.917	12.70	10.92	37.85
2.000	4.32	5.000	16.76	8.000	12.70	11.00	37.85
2.083	6.35	5.083	12.70	8.083	12.70	11.08	12.70
2.167	6.35	5.167	12.70	8.167	12.70	11.17	12.70
2.250	6.35	5.250	12.70	8.250	12.70	11.25	12.70
2.333	6.35	5.333	12.70	8.333	12.70	11.33	12.70
2.417	6.35	5.417	12.70	8.417	12.70	11.42	12.70
2.500	6.35	5.500	12.70	8.500	12.70	11.50	12.70
2.583	6.35	5.583	12.70	8.583	12.70	11.58	12.70
2.667	6.35	5.667	12.70	8.667	12.70	11.67	12.70
2.750	6.35	5.750	12.70	8.750	12.70	11.75	12.70

2.833	6.35	5.833	12.70	8.833	12.70	11.83	12.70
2.917	6.35	5.917	12.70	8.917	12.70	11.92	12.70
3.000	6.35	6.000	12.70	9.000	12.70	12.00	12.70

Max.Eff.Inten.(mm/hr)=	52.83	43.26	
over (min)	10.00	25.00	
Storage Coeff. (min)=	10.01 (ii)	21.02 (ii)	
Unit Hyd. Tpeak (min)=	10.00	25.00	
Unit Hyd. peak (cms)=	0.11	0.05	
			TOTALS
PEAK FLOW (cms)=	0.37	5.03	5.388 (iii)
TIME TO PEAK (hrs)=	10.00	10.08	10.08
RUNOFF VOLUME (mm)=	209.57	81.91	88.29
TOTAL RAINFALL (mm)=	211.07	211.07	211.07
RUNOFF COEFFICIENT =	0.99	0.39	0.42

***** WARNING:FOR AREAS WITH IMPERVIOUS RATIOS BELOW 20%
YOU SHOULD CONSIDER SPLITTING THE AREA.

(i) HORTONS EQUATION SELECTED FOR PERVIOUS LOSSES:
Fo (mm/hr)= 75.00 K (1/hr)= 4.14
Fc (mm/hr)= 12.50 Cum.Inf. (mm)= 0.00
(ii) TIME STEP (DT) SHOULD BE SMALLER OR EQUAL
THAN THE STORAGE COEFFICIENT.
(iii) PEAK FLOW DOES NOT INCLUDE BASEFLOW IF ANY.

CALIB
STANDHYD (0365) | Area (ha)= 117.50
ID= 1 DT= 5.0 min | Total Imp(%)= 42.00 Dir. Conn.(%)= 21.00

		IMPERVIOUS	PERVIOUS (i)
Surface Area	(ha)=	49.35	68.15
Dep. Storage	(mm)=	1.50	5.00
Average Slope	(%)=	2.00	2.00
Length	(m)=	885.00	40.00
Mannings n	=	0.013	0.300

NOTE: RAINFALL WAS TRANSFORMED TO 5.0 MIN. TIME STEP.

---- TRANSFORMED HYETOGRAPH ----

TIME hrs	RAIN mm/hr	TIME hrs	RAIN mm/hr	TIME hrs	RAIN mm/hr	TIME hrs	RAIN mm/hr
0.083	6.35	3.083	12.70	6.083	23.11	9.08	52.83
0.167	6.35	3.167	12.70	6.167	23.11	9.17	52.83
0.250	6.35	3.250	12.70	6.250	23.11	9.25	52.83
0.333	6.35	3.333	12.70	6.333	23.11	9.33	52.83
0.417	6.35	3.417	12.70	6.417	23.11	9.42	52.83

0.500	6.35	3.500	12.70	6.500	23.11	9.50	52.83
0.583	6.35	3.583	12.70	6.583	23.11	9.58	52.83
0.667	6.35	3.667	12.70	6.667	23.11	9.67	52.83
0.750	6.35	3.750	12.70	6.750	23.11	9.75	52.83
0.833	6.35	3.833	12.70	6.833	23.11	9.83	52.83
0.917	6.35	3.917	12.70	6.917	23.11	9.92	52.83
1.000	6.35	4.000	12.70	7.000	23.11	10.00	52.83
1.083	4.32	4.083	16.76	7.083	12.70	10.08	37.85
1.167	4.32	4.167	16.76	7.167	12.70	10.17	37.85
1.250	4.32	4.250	16.76	7.250	12.70	10.25	37.85
1.333	4.32	4.333	16.76	7.333	12.70	10.33	37.85
1.417	4.32	4.417	16.76	7.417	12.70	10.42	37.85
1.500	4.32	4.500	16.76	7.500	12.70	10.50	37.85
1.583	4.32	4.583	16.76	7.583	12.70	10.58	37.85
1.667	4.32	4.667	16.76	7.667	12.70	10.67	37.85
1.750	4.32	4.750	16.76	7.750	12.70	10.75	37.85
1.833	4.32	4.833	16.76	7.833	12.70	10.83	37.85
1.917	4.32	4.917	16.76	7.917	12.70	10.92	37.85
2.000	4.32	5.000	16.76	8.000	12.70	11.00	37.85
2.083	6.35	5.083	12.70	8.083	12.70	11.08	12.70
2.167	6.35	5.167	12.70	8.167	12.70	11.17	12.70
2.250	6.35	5.250	12.70	8.250	12.70	11.25	12.70
2.333	6.35	5.333	12.70	8.333	12.70	11.33	12.70
2.417	6.35	5.417	12.70	8.417	12.70	11.42	12.70
2.500	6.35	5.500	12.70	8.500	12.70	11.50	12.70
2.583	6.35	5.583	12.70	8.583	12.70	11.58	12.70
2.667	6.35	5.667	12.70	8.667	12.70	11.67	12.70
2.750	6.35	5.750	12.70	8.750	12.70	11.75	12.70
2.833	6.35	5.833	12.70	8.833	12.70	11.83	12.70
2.917	6.35	5.917	12.70	8.917	12.70	11.92	12.70
3.000	6.35	6.000	12.70	9.000	12.70	12.00	12.70

Max.Eff.Inten.(mm/hr)=	52.83	59.46	
over (min)	10.00	20.00	
Storage Coeff. (min)=	9.91 (ii)	19.60 (ii)	
Unit Hyd. Tpeak (min)=	10.00	20.00	
Unit Hyd. peak (cms)=	0.11	0.06	
			TOTALS
PEAK FLOW (cms)=	3.61	10.49	14.089 (iii)
TIME TO PEAK (hrs)=	10.00	10.08	10.00
RUNOFF VOLUME (mm)=	209.57	107.20	128.70
TOTAL RAINFALL (mm)=	211.07	211.07	211.07
RUNOFF COEFFICIENT =	0.99	0.51	0.61

(i) HORTONS EQUATION SELECTED FOR PERVIOUS LOSSES:
Fo (mm/hr)= 75.00 K (1/hr)= 4.14
Fc (mm/hr)= 12.50 Cum.Inf. (mm)= 0.00
(ii) TIME STEP (DT) SHOULD BE SMALLER OR EQUAL
THAN THE STORAGE COEFFICIENT.

(iii) PEAK FLOW DOES NOT INCLUDE BASEFLOW IF ANY.

CALIB STANDHYD (0360) ID= 1 DT= 5.0 min	Area (ha)= 30.00 Total Imp(%)= 37.00 Dir. Conn.(%)= 19.00

		IMPERVIOUS	PERVIOUS (i)
Surface Area	(ha)=	11.10	18.90
Dep. Storage	(mm)=	1.50	5.00
Average Slope	(%)=	2.00	2.00
Length	(m)=	447.00	40.00
Mannings n	=	0.013	0.300

NOTE: RAINFALL WAS TRANSFORMED TO 5.0 MIN. TIME STEP.

---- TRANSFORMED HYETOGRAPH ----

TIME hrs	RAIN mm/hr	TIME hrs	RAIN mm/hr	TIME hrs	RAIN mm/hr	TIME hrs	RAIN mm/hr
0.083	6.35	3.083	12.70	6.083	23.11	9.08	52.83
0.167	6.35	3.167	12.70	6.167	23.11	9.17	52.83
0.250	6.35	3.250	12.70	6.250	23.11	9.25	52.83
0.333	6.35	3.333	12.70	6.333	23.11	9.33	52.83
0.417	6.35	3.417	12.70	6.417	23.11	9.42	52.83
0.500	6.35	3.500	12.70	6.500	23.11	9.50	52.83
0.583	6.35	3.583	12.70	6.583	23.11	9.58	52.83
0.667	6.35	3.667	12.70	6.667	23.11	9.67	52.83
0.750	6.35	3.750	12.70	6.750	23.11	9.75	52.83
0.833	6.35	3.833	12.70	6.833	23.11	9.83	52.83
0.917	6.35	3.917	12.70	6.917	23.11	9.92	52.83
1.000	6.35	4.000	12.70	7.000	23.11	10.00	52.83
1.083	4.32	4.083	16.76	7.083	12.70	10.08	37.85
1.167	4.32	4.167	16.76	7.167	12.70	10.17	37.85
1.250	4.32	4.250	16.76	7.250	12.70	10.25	37.85
1.333	4.32	4.333	16.76	7.333	12.70	10.33	37.85
1.417	4.32	4.417	16.76	7.417	12.70	10.42	37.85
1.500	4.32	4.500	16.76	7.500	12.70	10.50	37.85
1.583	4.32	4.583	16.76	7.583	12.70	10.58	37.85
1.667	4.32	4.667	16.76	7.667	12.70	10.67	37.85
1.750	4.32	4.750	16.76	7.750	12.70	10.75	37.85
1.833	4.32	4.833	16.76	7.833	12.70	10.83	37.85
1.917	4.32	4.917	16.76	7.917	12.70	10.92	37.85
2.000	4.32	5.000	16.76	8.000	12.70	11.00	37.85
2.083	6.35	5.083	12.70	8.083	12.70	11.08	12.70
2.167	6.35	5.167	12.70	8.167	12.70	11.17	12.70
2.250	6.35	5.250	12.70	8.250	12.70	11.25	12.70
2.333	6.35	5.333	12.70	8.333	12.70	11.33	12.70
2.417	6.35	5.417	12.70	8.417	12.70	11.42	12.70

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               2.500    6.35 | 5.500   12.70 | 8.500   12.70 | 11.50   12.70
               2.583    6.35 | 5.583   12.70 | 8.583   12.70 | 11.58   12.70
               2.667    6.35 | 5.667   12.70 | 8.667   12.70 | 11.67   12.70
               2.750    6.35 | 5.750   12.70 | 8.750   12.70 | 11.75   12.70
               2.833    6.35 | 5.833   12.70 | 8.833   12.70 | 11.83   12.70
               2.917    6.35 | 5.917   12.70 | 8.917   12.70 | 11.92   12.70
               3.000    6.35 | 6.000   12.70 | 9.000   12.70 | 12.00   12.70

     Max.Eff.Inten.(mm/hr)=      52.83        55.42
               over (min)         5.00        20.00
     Storage Coeff.  (min)=       6.58 (ii)   16.55 (ii)
     Unit Hyd. Tpeak (min)=       5.00        20.00
     Unit Hyd. peak  (cms)=       0.18         0.06
                                                          *TOTALS*
     PEAK FLOW       (cms)=       0.84         2.78          3.618 (iii)
     TIME TO PEAK    (hrs)=      10.00        10.00          10.00
     RUNOFF VOLUME    (mm)=     209.57       101.80         122.28
     TOTAL RAINFALL   (mm)=     211.07       211.07         211.07
     RUNOFF COEFFICIENT   =       0.99         0.48           0.58

***** WARNING:FOR AREAS WITH IMPERVIOUS RATIOS BELOW 20%
              YOU SHOULD CONSIDER SPLITTING THE AREA.

       (i) HORTONS EQUATION SELECTED FOR PERVIOUS LOSSES:
            Fo   (mm/hr)= 75.00           K  (1/hr)=  4.14
            Fc   (mm/hr)= 12.50     Cum.Inf.   (mm)=  0.00
      (ii) TIME STEP (DT) SHOULD BE SMALLER OR EQUAL
           THAN THE STORAGE COEFFICIENT.
     (iii) PEAK FLOW DOES NOT INCLUDE BASEFLOW IF ANY.

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| ROUTE CHN(  0362)|
| IN= 2---> OUT= 1 |     Routing time step (min)'=  5.00
--------------------
               <------ DATA FOR SECTION (   1.1) ------>
               Distance      Elevation       Manning
                   0.00          0.40        0.0300
                   5.50          0.15    0.0300 /0.0150  Main Channel
                   5.51          0.00        0.0150      Main Channel
                  10.00          0.09        0.0150      Main Channel
                  14.49          0.00        0.0150      Main Channel
                  14.50          0.15    0.0150 /0.0300  Main Channel
                  20.00          0.40        0.0300

      <---------------------- TRAVEL TIME TABLE ---------------------->
       DEPTH    ELEV      VOLUME    FLOW RATE    VELOCITY   TRAV.TIME
         (m)      (m)     (cu.m.)      (cms)        (m/s)      (min)
       0.02     0.02    .176E+02       0.0          0.21      80.52
       0.04     0.04    .702E+02       0.0          0.33      50.72
```

0.06	0.06	.158E+03	0.1	0.43	38.71
0.08	0.08	.281E+03	0.1	0.52	31.95
0.09	0.09	.438E+03	0.3	0.62	26.84
0.11	0.11	.607E+03	0.5	0.77	21.66
0.13	0.13	.776E+03	0.7	0.90	18.45
0.15	0.15	.944E+03	1.0	1.03	16.22
0.17	0.17	.116E+04	1.3	1.16	14.36
0.20	0.20	.140E+04	1.8	1.27	13.13
0.22	0.22	.166E+04	2.3	1.36	12.24
0.24	0.24	.194E+04	2.8	1.44	11.58
0.26	0.26	.225E+04	3.4	1.51	11.05
0.29	0.29	.258E+04	4.0	1.57	10.63
0.31	0.31	.293E+04	4.8	1.62	10.27
0.33	0.33	.331E+04	5.5	1.67	9.97
0.35	0.35	.371E+04	6.4	1.72	9.71
0.38	0.38	.413E+04	7.3	1.76	9.48
0.40	0.40	.457E+04	8.2	1.80	9.28

		<---- hydrograph ---->			<-pipe / channel->	
	AREA	QPEAK	TPEAK	R.V.	MAX DEPTH	MAX VEL
	(ha)	(cms)	(hrs)	(mm)	(m)	(m/s)
INFLOW : ID= 2 (0360)	30.00	3.62	10.00	122.28	0.27	1.53
OUTFLOW: ID= 1 (0362)	30.00	3.50	10.08	122.26	0.27	1.52

CALIB STANDHYD (0350) ID= 1 DT= 5.0 min	Area (ha)= 16.30 Total Imp(%)= 42.00 Dir. Conn.(%)= 21.00

		IMPERVIOUS	PERVIOUS (i)
Surface Area	(ha)=	6.85	9.45
Dep. Storage	(mm)=	1.50	5.00
Average Slope	(%)=	1.00	1.00
Length	(m)=	330.00	40.00
Mannings n	=	0.013	0.300

NOTE: RAINFALL WAS TRANSFORMED TO 5.0 MIN. TIME STEP.

---- TRANSFORMED HYETOGRAPH ----

TIME hrs	RAIN mm/hr	TIME hrs	RAIN mm/hr	TIME hrs	RAIN mm/hr	TIME hrs	RAIN mm/hr
0.083	6.35	3.083	12.70	6.083	23.11	9.08	52.83
0.167	6.35	3.167	12.70	6.167	23.11	9.17	52.83
0.250	6.35	3.250	12.70	6.250	23.11	9.25	52.83
0.333	6.35	3.333	12.70	6.333	23.11	9.33	52.83
0.417	6.35	3.417	12.70	6.417	23.11	9.42	52.83

0.500	6.35	3.500	12.70	6.500	23.11	9.50	52.83
0.583	6.35	3.583	12.70	6.583	23.11	9.58	52.83
0.667	6.35	3.667	12.70	6.667	23.11	9.67	52.83
0.750	6.35	3.750	12.70	6.750	23.11	9.75	52.83
0.833	6.35	3.833	12.70	6.833	23.11	9.83	52.83
0.917	6.35	3.917	12.70	6.917	23.11	9.92	52.83
1.000	6.35	4.000	12.70	7.000	23.11	10.00	52.83
1.083	4.32	4.083	16.76	7.083	12.70	10.08	37.85
1.167	4.32	4.167	16.76	7.167	12.70	10.17	37.85
1.250	4.32	4.250	16.76	7.250	12.70	10.25	37.85
1.333	4.32	4.333	16.76	7.333	12.70	10.33	37.85
1.417	4.32	4.417	16.76	7.417	12.70	10.42	37.85
1.500	4.32	4.500	16.76	7.500	12.70	10.50	37.85
1.583	4.32	4.583	16.76	7.583	12.70	10.58	37.85
1.667	4.32	4.667	16.76	7.667	12.70	10.67	37.85
1.750	4.32	4.750	16.76	7.750	12.70	10.75	37.85
1.833	4.32	4.833	16.76	7.833	12.70	10.83	37.85
1.917	4.32	4.917	16.76	7.917	12.70	10.92	37.85
2.000	4.32	5.000	16.76	8.000	12.70	11.00	37.85
2.083	6.35	5.083	12.70	8.083	12.70	11.08	12.70
2.167	6.35	5.167	12.70	8.167	12.70	11.17	12.70
2.250	6.35	5.250	12.70	8.250	12.70	11.25	12.70
2.333	6.35	5.333	12.70	8.333	12.70	11.33	12.70
2.417	6.35	5.417	12.70	8.417	12.70	11.42	12.70
2.500	6.35	5.500	12.70	8.500	12.70	11.50	12.70
2.583	6.35	5.583	12.70	8.583	12.70	11.58	12.70
2.667	6.35	5.667	12.70	8.667	12.70	11.67	12.70
2.750	6.35	5.750	12.70	8.750	12.70	11.75	12.70
2.833	6.35	5.833	12.70	8.833	12.70	11.83	12.70
2.917	6.35	5.917	12.70	8.917	12.70	11.92	12.70
3.000	6.35	6.000	12.70	9.000	12.70	12.00	12.70

Max.Eff.Inten.(mm/hr)=	52.83	59.46	
over (min)	5.00	20.00	
Storage Coeff. (min)=	6.75 (ii)	18.68 (ii)	
Unit Hyd. Tpeak (min)=	5.00	20.00	
Unit Hyd. peak (cms)=	0.18	0.06	
			TOTALS
PEAK FLOW (cms)=	0.50	1.47	1.968 (iii)
TIME TO PEAK (hrs)=	10.00	10.00	10.00
RUNOFF VOLUME (mm)=	209.57	107.20	128.70
TOTAL RAINFALL (mm)=	211.07	211.07	211.07
RUNOFF COEFFICIENT =	0.99	0.51	0.61

(i) HORTONS EQUATION SELECTED FOR PERVIOUS LOSSES:
Fo (mm/hr)= 75.00 K (1/hr)= 4.14
Fc (mm/hr)= 12.50 Cum.Inf. (mm)= 0.00
(ii) TIME STEP (DT) SHOULD BE SMALLER OR EQUAL
THAN THE STORAGE COEFFICIENT.

(iii) PEAK FLOW DOES NOT INCLUDE BASEFLOW IF ANY.

ROUTE CHN(0353)	
IN= 2---> OUT= 1	Routing time step (min)'= 5.00

<------ DATA FOR SECTION (1.1) ------>

Distance	Elevation	Manning	
0.00	0.26	0.0300	
5.50	0.15	0.0300 /0.0150	Main Channel
5.51	0.00	0.0150	Main Channel
10.00	0.09	0.0150	Main Channel
14.49	0.00	0.0150	Main Channel
14.50	0.15	0.0150 /0.0300	Main Channel
20.00	0.26	0.0300	

<---------- TRAVEL TIME TABLE ---------->

DEPTH (m)	ELEV (m)	VOLUME (cu.m.)	FLOW RATE (cms)	VELOCITY (m/s)	TRAV.TIME (min)
0.01	0.01	.929E+01	0.0	0.17	99.56
0.03	0.03	.372E+02	0.0	0.27	62.72
0.04	0.04	.836E+02	0.0	0.35	47.86
0.05	0.05	.149E+03	0.1	0.42	39.51
0.07	0.07	.232E+03	0.1	0.49	34.05
0.08	0.08	.334E+03	0.2	0.55	30.15
0.10	0.10	.454E+03	0.3	0.64	26.24
0.11	0.11	.576E+03	0.4	0.74	22.41
0.12	0.12	.699E+03	0.6	0.84	19.75
0.14	0.14	.822E+03	0.8	0.94	17.76
0.15	0.15	.944E+03	1.0	1.03	16.22
0.16	0.16	.108E+04	1.2	1.11	15.07
0.18	0.18	.123E+04	1.4	1.17	14.28
0.19	0.19	.140E+04	1.7	1.21	13.72
0.20	0.20	.159E+04	2.0	1.25	13.31
0.22	0.22	.180E+04	2.3	1.28	13.01
0.23	0.23	.203E+04	2.6	1.31	12.76
0.25	0.25	.227E+04	3.0	1.33	12.57
0.26	0.26	.254E+04	3.4	1.34	12.41

		<---- hydrograph ---->			<-pipe / channel->	
	AREA (ha)	QPEAK (cms)	TPEAK (hrs)	R.V. (mm)	MAX DEPTH (m)	MAX VEL (m/s)
INFLOW : ID= 2 (0350)	16.30	1.97	10.00	128.70	0.20	1.25
OUTFLOW: ID= 1 (0353)	16.30	1.87	10.08	128.66	0.20	1.24

CALIB	
STANDHYD (0355)	Area (ha)= 12.30
ID= 1 DT= 5.0 min	Total Imp(%)= 42.00 Dir. Conn.(%)= 21.00

		IMPERVIOUS	PERVIOUS (i)
Surface Area	(ha)=	5.17	7.13
Dep. Storage	(mm)=	1.50	5.00
Average Slope	(%)=	1.60	1.60
Length	(m)=	286.00	40.00
Mannings n	=	0.013	0.300

NOTE: RAINFALL WAS TRANSFORMED TO 5.0 MIN. TIME STEP.

---- TRANSFORMED HYETOGRAPH ----

TIME hrs	RAIN mm/hr	TIME hrs	RAIN mm/hr	TIME hrs	RAIN mm/hr	TIME hrs	RAIN mm/hr
0.083	6.35	3.083	12.70	6.083	23.11	9.08	52.83
0.167	6.35	3.167	12.70	6.167	23.11	9.17	52.83
0.250	6.35	3.250	12.70	6.250	23.11	9.25	52.83
0.333	6.35	3.333	12.70	6.333	23.11	9.33	52.83
0.417	6.35	3.417	12.70	6.417	23.11	9.42	52.83
0.500	6.35	3.500	12.70	6.500	23.11	9.50	52.83
0.583	6.35	3.583	12.70	6.583	23.11	9.58	52.83
0.667	6.35	3.667	12.70	6.667	23.11	9.67	52.83
0.750	6.35	3.750	12.70	6.750	23.11	9.75	52.83
0.833	6.35	3.833	12.70	6.833	23.11	9.83	52.83
0.917	6.35	3.917	12.70	6.917	23.11	9.92	52.83
1.000	6.35	4.000	12.70	7.000	23.11	10.00	52.83
1.083	4.32	4.083	16.76	7.083	12.70	10.08	37.85
1.167	4.32	4.167	16.76	7.167	12.70	10.17	37.85
1.250	4.32	4.250	16.76	7.250	12.70	10.25	37.85
1.333	4.32	4.333	16.76	7.333	12.70	10.33	37.85
1.417	4.32	4.417	16.76	7.417	12.70	10.42	37.85
1.500	4.32	4.500	16.76	7.500	12.70	10.50	37.85
1.583	4.32	4.583	16.76	7.583	12.70	10.58	37.85
1.667	4.32	4.667	16.76	7.667	12.70	10.67	37.85
1.750	4.32	4.750	16.76	7.750	12.70	10.75	37.85
1.833	4.32	4.833	16.76	7.833	12.70	10.83	37.85
1.917	4.32	4.917	16.76	7.917	12.70	10.92	37.85
2.000	4.32	5.000	16.76	8.000	12.70	11.00	37.85
2.083	6.35	5.083	12.70	8.083	12.70	11.08	12.70
2.167	6.35	5.167	12.70	8.167	12.70	11.17	12.70
2.250	6.35	5.250	12.70	8.250	12.70	11.25	12.70
2.333	6.35	5.333	12.70	8.333	12.70	11.33	12.70
2.417	6.35	5.417	12.70	8.417	12.70	11.42	12.70
2.500	6.35	5.500	12.70	8.500	12.70	11.50	12.70
2.583	6.35	5.583	12.70	8.583	12.70	11.58	12.70
2.667	6.35	5.667	12.70	8.667	12.70	11.67	12.70
2.750	6.35	5.750	12.70	8.750	12.70	11.75	12.70

```
             2.833    6.35 | 5.833   12.70 | 8.833   12.70 | 11.83   12.70
             2.917    6.35 | 5.917   12.70 | 8.917   12.70 | 11.92   12.70
             3.000    6.35 | 6.000   12.70 | 9.000   12.70 | 12.00   12.70

   Max.Eff.Inten.(mm/hr)=      52.83        59.46
             over (min)         5.00        20.00
   Storage Coeff.  (min)=       5.38 (ii)   15.74 (ii)
   Unit Hyd. Tpeak (min)=       5.00        20.00
   Unit Hyd. peak  (cms)=       0.21         0.07
                                                      *TOTALS*
   PEAK FLOW       (cms)=       0.38         1.13          1.513 (iii)
   TIME TO PEAK    (hrs)=      10.00        10.00          10.00
   RUNOFF VOLUME    (mm)=     209.57       107.20         128.70
   TOTAL RAINFALL   (mm)=     211.07       211.07         211.07
   RUNOFF COEFFICIENT   =       0.99         0.51           0.61


     (i) HORTONS EQUATION SELECTED FOR PERVIOUS LOSSES:
          Fo   (mm/hr)= 75.00           K  (1/hr)=  4.14
          Fc   (mm/hr)= 12.50     Cum.Inf.   (mm)=  0.00
    (ii) TIME STEP (DT) SHOULD BE SMALLER OR EQUAL
         THAN THE STORAGE COEFFICIENT.
   (iii) PEAK FLOW DOES NOT INCLUDE BASEFLOW IF ANY.

--------------------------------------------------------------------------------
--------------------
| ROUTE CHN(  0358)|
| IN= 2---> OUT= 1 |     Routing time step (min)'=  5.00
--------------------
              <------ DATA FOR SECTION (   1.1) ------>
              Distance      Elevation       Manning
                  0.00          0.26        0.0300
                  5.50          0.15    0.0300 /0.0150  Main Channel
                  5.51          0.00        0.0150      Main Channel
                 10.00          0.09        0.0150      Main Channel
                 14.49          0.00        0.0150      Main Channel
                 14.50          0.15    0.0150 /0.0300  Main Channel
                 20.00          0.26        0.0300

     <---------------------- TRAVEL TIME TABLE ---------------------->
      DEPTH    ELEV      VOLUME    FLOW RATE    VELOCITY   TRAV.TIME
       (m)      (m)     (cu.m.)      (cms)        (m/s)      (min)
      0.01     0.01    .102E+02       0.0          0.17     109.52
      0.03     0.03    .409E+02       0.0          0.27      68.99
      0.04     0.04    .920E+02       0.0          0.35      52.65
      0.05     0.05    .163E+03       0.1          0.42      43.46
      0.07     0.07    .255E+03       0.1          0.49      37.45
      0.08     0.08    .368E+03       0.2          0.55      33.17
      0.10     0.10    .499E+03       0.3          0.64      28.86
      0.11     0.11    .634E+03       0.4          0.74      24.66
```

0.12	0.12	.769E+03	0.6	0.84	21.72
0.14	0.14	.904E+03	0.8	0.94	19.54
0.15	0.15	.104E+04	1.0	1.03	17.84
0.16	0.16	.119E+04	1.2	1.11	16.57
0.18	0.18	.135E+04	1.4	1.17	15.71
0.19	0.19	.154E+04	1.7	1.21	15.10
0.20	0.20	.175E+04	2.0	1.25	14.65
0.22	0.22	.198E+04	2.3	1.28	14.31
0.23	0.23	.223E+04	2.6	1.31	14.04
0.25	0.25	.250E+04	3.0	1.33	13.82
0.26	0.26	.279E+04	3.4	1.34	13.65

		<---- hydrograph ---->			<-pipe / channel->	
	AREA	QPEAK	TPEAK	R.V.	MAX DEPTH	MAX VEL
	(ha)	(cms)	(hrs)	(mm)	(m)	(m/s)
INFLOW : ID= 2 (0355)	12.30	1.51	10.00	128.70	0.18	1.18
OUTFLOW: ID= 1 (0358)	12.30	1.44	10.08	128.64	0.18	1.17

ADD HYD (0359)				
1 + 2 = 3	AREA	QPEAK	TPEAK	R.V.
	(ha)	(cms)	(hrs)	(mm)
ID1= 1 (0353):	16.30	1.875	10.08	128.66
+ ID2= 2 (0358):	12.30	1.436	10.08	128.64
ID = 3 (0359):	28.60	3.311	10.08	128.65

NOTE: PEAK FLOWS DO NOT INCLUDE BASEFLOWS IF ANY.

ADD HYD (0363)				
1 + 2 = 3	AREA	QPEAK	TPEAK	R.V.
	(ha)	(cms)	(hrs)	(mm)
ID1= 1 (0359):	28.60	3.311	10.08	128.65
+ ID2= 2 (0362):	30.00	3.504	10.08	122.26
ID = 3 (0363):	58.60	6.814	10.08	125.38

NOTE: PEAK FLOWS DO NOT INCLUDE BASEFLOWS IF ANY.

ADD HYD (0380)				
1 + 2 = 3	AREA	QPEAK	TPEAK	R.V.
	(ha)	(cms)	(hrs)	(mm)

```
        ID1= 1 (  0363):    58.60   6.814    10.08   125.38
      + ID2= 2 (  0365):   117.50  14.089    10.00   128.70
        ================================================
        ID = 3 (  0380):   176.10  20.834    10.00   127.59

     NOTE:  PEAK FLOWS DO NOT INCLUDE BASEFLOWS IF ANY.
--------------------------------------------------------------------------------
--------------------
| RESERVOIR(  0390)|     OVERFLOW IS OFF
| IN= 2---> OUT= 1 |
| DT=  5.0 min     |     OUTFLOW    STORAGE   |  OUTFLOW    STORAGE
--------------------      (cms)     (ha.m.)   |   (cms)     (ha.m.)
                          0.0000     0.0000   |   1.3100      1.6000
                          0.7700     0.2870   |   1.8600     23.2300
                          1.2600     0.9680   |   0.0000      0.0000

                                  AREA     QPEAK     TPEAK       R.V.
                                  (ha)     (cms)     (hrs)       (mm)
   INFLOW : ID= 2 (  0380)    176.100     20.834     10.00     127.59
   OUTFLOW: ID= 1 (  0390)    176.100      1.714     12.33     127.59

                  PEAK   FLOW   REDUCTION [Qout/Qin](%)=  8.23
                  TIME SHIFT OF PEAK FLOW         (min)=140.00
                  MAXIMUM  STORAGE   USED       (ha.m.)= 17.4981

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--------------------
| ADD HYD  (  0400)|
|   1 +  2 =  3    |         AREA    QPEAK    TPEAK     R.V.
--------------------         (ha)    (cms)    (hrs)     (mm)
        ID1= 1 (  0390):   176.10   1.714    12.33   127.59
      + ID2= 2 (  0395):    51.20   5.388    10.08    88.29
        ================================================
        ID = 3 (  0400):   227.30   6.909    10.08   118.74

     NOTE:  PEAK FLOWS DO NOT INCLUDE BASEFLOWS IF ANY.
--------------------------------------------------------------------------------
--------------------
| ROUTE CHN(  0403)|
| IN= 2---> OUT= 1 |     Routing time step (min)'=  5.00
--------------------
               <------ DATA FOR SECTION (   1.1) ------>
               Distance      Elevation       Manning
                 100.00        338.30        0.0500
                 110.00        336.80        0.0500
                 135.00        336.00        0.0300      Main Channel
                 142.00        335.30        0.0500
                 148.00        335.30        0.0500
                 156.00        336.00        0.0500
```

```
                165.00        338.30        0.0500

      <---------------------- TRAVEL TIME TABLE ---------------------->
       DEPTH     ELEV       VOLUME     FLOW RATE     VELOCITY   TRAV.TIME
        (m)       (m)      (cu.m.)       (cms)         (m/s)      (min)
       0.16    335.46     .231E+04        0.9           0.71      44.52
       0.32    335.62     .563E+04        3.2           1.09      29.11
       0.47    335.77     .997E+04        7.3           1.39      22.72
       0.63    335.93     .153E+05       13.4           1.66      19.04
       0.79    336.09     .218E+05       22.7           1.97      16.04
       0.95    336.25     .299E+05       35.3           2.25      14.10
       1.11    336.41     .396E+05       51.2           2.46      12.89
       1.26    336.56     .510E+05       70.7           2.63      12.02
       1.42    336.72     .641E+05       94.1           2.79      11.35
       1.58    336.88     .787E+05      122.4           2.96      10.71
       1.74    337.04     .939E+05      155.6           3.15      10.06
       1.89    337.19     .110E+06      192.8           3.34       9.48
       2.05    337.35     .126E+06      233.9           3.53       8.97
       2.21    337.51     .143E+06      278.9           3.71       8.53
       2.37    337.67     .160E+06      327.7           3.89       8.13
       2.53    337.83     .178E+06      380.3           4.07       7.79
       2.68    337.98     .196E+06      436.7           4.23       7.48
       2.84    338.14     .215E+06      496.9           4.40       7.20
       3.00    338.30     .234E+06      561.0           4.56       6.95

                                      <---- hydrograph ---->   <-pipe / channel->
                              AREA    QPEAK   TPEAK   R.V.   MAX DEPTH  MAX VEL
                              (ha)    (cms)   (hrs)   (mm)      (m)      (m/s)
   INFLOW : ID= 2 (  0400)  227.30     6.91   10.08 118.74      0.46      1.36
   OUTFLOW: ID= 1 (  0403)  227.30     6.38   10.33 118.74      0.44      1.30



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

--------------------
| ADD HYD  (  0407)|
|   1 +  2 =  3    |         AREA    QPEAK    TPEAK     R.V.
--------------------         (ha)    (cms)    (hrs)     (mm)
       ID1= 1 (  0115):   100.96  10.540    10.08   128.69
     + ID2= 2 (  0403):   227.30   6.377    10.33   118.74
       ================================================
       ID = 3 (  0407):   328.26  16.525    10.17   121.80

     NOTE:  PEAK FLOWS DO NOT INCLUDE BASEFLOWS IF ANY.
--------------------------------------------------------------------------------
--------------------
| RESERVOIR(  0113)|     OVERFLOW IS OFF
| IN= 2---> OUT= 1 |
| DT=  5.0 min     |     OUTFLOW    STORAGE   |  OUTFLOW    STORAGE
```

```
--------------------      (cms)     (ha.m.)   |   (cms)     (ha.m.)
                         0.0000     0.0000   |   1.6000      6.4000
                         1.1000     2.9000   |   9.1000     10.0000
                         1.3000     4.3000   |  12.0000     20.0000

                                   AREA     QPEAK     TPEAK       R.V.
                                   (ha)     (cms)     (hrs)       (mm)
   INFLOW : ID= 2 (  0407)    328.260     16.525     10.17     121.80
   OUTFLOW: ID= 1 (  0113)    328.260      9.456     11.50     121.80

                  PEAK   FLOW   REDUCTION [Qout/Qin](%)= 57.22
                  TIME SHIFT OF PEAK FLOW         (min)= 80.00
                  MAXIMUM  STORAGE   USED       (ha.m.)= 11.2348

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

--------------------
| ADD HYD  (  0430)|
|   1 +  2 =  3    |         AREA    QPEAK    TPEAK     R.V.
--------------------         (ha)    (cms)    (hrs)     (mm)
        ID1= 1 (  0113):   328.26   9.456    11.50   121.80
      + ID2= 2 (  0425):    24.24   1.980     9.33   128.70
        ================================================
        ID = 3 (  0430):   352.50  11.349    11.08   122.27

     NOTE:  PEAK FLOWS DO NOT INCLUDE BASEFLOWS IF ANY.
--------------------------------------------------------------------------------
--------------------
| ROUTE CHN(  0440)|
| IN= 2---> OUT= 1 |     Routing time step (min)'=  5.00
--------------------
               <------ DATA FOR SECTION (   1.1) ------>
               Distance      Elevation       Manning
                 100.00        325.40        0.0600
                 120.00        324.60        0.0600
                 126.00        323.90        0.0600
                 130.00        323.00        0.0600
                 140.00        322.30    0.0600 /0.0300  Main Channel
                 142.00        322.30    0.0300 /0.0600  Main Channel
                 150.00        323.90        0.0600
                 155.00        324.60        0.0600
                 160.00        325.40        0.0600

      <--------------------- TRAVEL TIME TABLE ---------------------->
       DEPTH    ELEV      VOLUME    FLOW RATE    VELOCITY   TRAV.TIME
        (m)      (m)     (cu.m.)      (cms)        (m/s)      (min)
       0.16   322.46    .233E+03       0.6          0.96       6.96
       0.33   322.63    .672E+03       2.1          1.26       5.27
       0.49   322.79    .132E+04       4.9          1.48       4.51
       0.65   322.95    .216E+04       9.0          1.66       4.03
```

0.82	323.12	.319E+04	14.9	1.87	3.57
0.98	323.28	.433E+04	22.5	2.08	3.21
1.14	323.44	.556E+04	31.6	2.27	2.93
1.31	323.61	.689E+04	42.3	2.45	2.72
1.47	323.77	.833E+04	54.6	2.62	2.54
1.63	323.93	.987E+04	68.3	2.77	2.41
1.79	324.09	.115E+05	82.8	2.87	2.33
1.96	324.26	.134E+05	99.2	2.96	2.25
2.12	324.42	.154E+05	117.9	3.06	2.18
2.28	324.58	.176E+05	138.8	3.15	2.11
2.45	324.75	.200E+05	157.4	3.14	2.12
2.61	324.91	.228E+05	179.6	3.15	2.11
2.77	325.07	.259E+05	205.8	3.18	2.09
2.94	325.24	.293E+05	236.1	3.23	2.07
3.10	325.40	.330E+05	270.6	3.28	2.03

		<---- hydrograph ---->			<-pipe / channel->	
	AREA	QPEAK	TPEAK	R.V.	MAX DEPTH	MAX VEL
	(ha)	(cms)	(hrs)	(mm)	(m)	(m/s)
INFLOW : ID= 2 (0430)	352.50	11.35	11.08	122.27	0.72	1.73
OUTFLOW: ID= 1 (0440)	352.50	11.32	11.08	122.27	0.71	1.73

ADD HYD (0485)				
1 + 2 = 3	AREA	QPEAK	TPEAK	R.V.
	(ha)	(cms)	(hrs)	(mm)
ID1= 1 (0440):	352.50	11.321	11.08	122.27
+ ID2= 2 (0475):	53.65	7.511	10.00	128.70
ID = 3 (0485):	406.15	16.120	10.75	123.12

NOTE: PEAK FLOWS DO NOT INCLUDE BASEFLOWS IF ANY.

ADD HYD (0490)				
1 + 2 = 3	AREA	QPEAK	TPEAK	R.V.
	(ha)	(cms)	(hrs)	(mm)
ID1= 1 (0480):	43.10	5.222	10.00	128.70
+ ID2= 2 (0485):	406.15	16.120	10.75	123.12
ID = 3 (0490):	449.25	19.973	10.67	123.66

NOTE: PEAK FLOWS DO NOT INCLUDE BASEFLOWS IF ANY.

```
--------------------
| ADD HYD  (  0491)|
|   1 +  2 =  3    |         AREA    QPEAK    TPEAK     R.V.
--------------------         (ha)    (cms)    (hrs)     (mm)
        ID1= 1 (  0482):    22.65   2.948    10.00   149.67
      + ID2= 2 (  0490):   449.25  19.973    10.67   123.66
        ====================================================
        ID = 3 (  0491):   471.90  22.431    10.08   124.90

     NOTE:  PEAK FLOWS DO NOT INCLUDE BASEFLOWS IF ANY.
--------------------------------------------------------------------------------
--------------------
| RESERVOIR(  0483)|     OVERFLOW IS OFF
| IN= 2---> OUT= 1 |
| DT=  5.0 min     |     OUTFLOW    STORAGE   |  OUTFLOW    STORAGE
--------------------      (cms)     (ha.m.)   |   (cms)     (ha.m.)
                          0.0000     0.0000   |   7.0800      2.4860
                          0.2760     0.0600   |   8.1000      3.3240
                          1.2000     0.3400   |   9.7980      4.6420
                          2.0400     0.6182   |  10.4940      7.4397
                          2.6400     1.1630   |  11.6850     10.3000
                          3.1200     1.7070   |  12.3480     11.4000

                                AREA     QPEAK     TPEAK       R.V.
                                (ha)     (cms)     (hrs)       (mm)
   INFLOW : ID= 2 (  0491)    471.900     22.431     10.08     124.90
   OUTFLOW: ID= 1 (  0483)    471.900     11.665     12.08     124.90

                  PEAK   FLOW   REDUCTION [Qout/Qin](%)= 52.00
                  TIME SHIFT OF PEAK FLOW         (min)=120.00
                  MAXIMUM  STORAGE   USED       (ha.m.)= 10.2523

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

--------------------
| ADD HYD  (  0530)|
|   1 +  2 =  3    |         AREA    QPEAK    TPEAK     R.V.
--------------------         (ha)    (cms)    (hrs)     (mm)
        ID1= 1 (  0483):   471.90  11.665    12.08   124.90
      + ID2= 2 (  0540):     4.63   0.636    10.00   182.64
        ====================================================
        ID = 3 (  0530):   476.53  11.800    12.00   125.46

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

--------------------
| ADD HYD  (  0545)|
|   1 +  2 =  3    |         AREA    QPEAK    TPEAK     R.V.
--------------------         (ha)    (cms)    (hrs)     (mm)
```

```
        ID1= 1 (  0527):    98.05   9.388    10.08   270.36
      + ID2= 2 (  0530):   476.53  11.800    12.00   125.46
        ================================================
        ID = 3 (  0545):   574.58  20.499    11.00   150.19

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

--------------------
| ADD HYD  (  0546)|
|   1 +  2 =  3    |         AREA    QPEAK    TPEAK     R.V.
--------------------         (ha)    (cms)    (hrs)     (mm)
        ID1= 1 (  0542):    25.25   3.443    10.00   182.64
      + ID2= 2 (  0545):   574.58  20.499    11.00   150.19
        ================================================
        ID = 3 (  0546):   599.83  23.082    10.08   151.56

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

--------------------
| ADD HYD  (  0547)|
|   1 +  2 =  3    |         AREA    QPEAK    TPEAK     R.V.
--------------------         (ha)    (cms)    (hrs)     (mm)
        ID1= 1 (  0543):    14.99   2.054    10.00   182.64
      + ID2= 2 (  0546):   599.83  23.082    10.08   151.56
        ================================================
        ID = 3 (  0547):   614.82  25.078    10.00   152.31

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

--------------------
| ADD HYD  (  0548)|
|   1 +  2 =  3    |         AREA    QPEAK    TPEAK     R.V.
--------------------         (ha)    (cms)    (hrs)     (mm)
        ID1= 1 (  0544):     1.13   0.156    10.00   182.64
      + ID2= 2 (  0547):   614.82  25.078    10.00   152.31
        ================================================
        ID = 3 (  0548):   615.95  25.234    10.00   152.37

     NOTE:  PEAK FLOWS DO NOT INCLUDE BASEFLOWS IF ANY.
--------------------------------------------------------------------------------
--------------------
| ROUTE CHN(  0564)|
| IN= 2---> OUT= 1 |     Routing time step (min)'=  5.00
--------------------
               <------ DATA FOR SECTION (   1.1) ------>
               Distance      Elevation       Manning
                   0.00        101.50        0.0500
```

1.00	100.70	0.0500	
1.50	100.55	0.0500 /0.0300	Main Channel
2.00	99.50	0.0300	Main Channel
3.50	99.60	0.0300	Main Channel
4.50	100.65	0.0300 /0.0500	Main Channel
6.00	101.45	0.0500	

<---------- TRAVEL TIME TABLE ---------->

DEPTH (m)	ELEV (m)	VOLUME (cu.m.)	FLOW RATE (cms)	VELOCITY (m/s)	TRAV.TIME (min)
0.10	99.60	.353E+02	0.0	0.19	43.69
0.19	99.69	.112E+03	0.1	0.37	22.76
0.29	99.79	.195E+03	0.2	0.49	17.03
0.38	99.88	.285E+03	0.3	0.59	14.23
0.48	99.98	.381E+03	0.5	0.67	12.51
0.57	100.07	.484E+03	0.7	0.74	11.32
0.67	100.17	.594E+03	0.9	0.80	10.43
0.76	100.26	.710E+03	1.2	0.86	9.74
0.86	100.36	.832E+03	1.5	0.91	9.18
0.95	100.45	.961E+03	1.8	0.96	8.72
1.05	100.55	.110E+04	2.2	1.00	8.32
1.16	100.66	.127E+04	2.7	1.07	7.80
1.28	100.78	.148E+04	3.4	1.14	7.31
1.39	100.89	.170E+04	4.1	1.20	6.94
1.50	101.00	.195E+04	4.9	1.25	6.65
1.61	101.11	.221E+04	5.8	1.30	6.41
1.72	101.22	.250E+04	6.7	1.34	6.22
1.84	101.34	.280E+04	7.7	1.38	6.04
1.95	101.45	.313E+04	8.8	1.41	5.90

**** WARNING: TRAVEL TIME TABLE EXCEEDED

	<---- hydrograph ---->				<-pipe / channel->	
	AREA (ha)	QPEAK (cms)	TPEAK (hrs)	R.V. (mm)	MAX DEPTH (m)	MAX VEL (m/s)
INFLOW : ID= 2 (0505)	78.53	18.11	10.08	134.22	1.92	1.40
OUTFLOW: ID= 1 (0564)	78.53	17.83	10.25	134.22	1.95	1.41

FINISH

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APPENDIX K:

FLOODPLAIN ANALYSIS

Cityview Ridge Subdivision (Formerly th P.T. Valeriote Property)
City of Guelph
Our File: 105-172
July 17, 2012

Comparison of Pre and Post-Development Flood Levels

Sec No.	Design Storm	Flow (cu m/s)			W.S. Elevation (m)			Tope Width (m)		
		POST	PRE	Difference	POST	PRE	Difference	POST	PRE	Difference
1	5 Year	3.99	3.99	0	316.29	316.29	0	34.52	34.52	0
1	25 Year	19.70	19.70	0	316.51	316.51	0	41.05	41.05	0
1	100 Year	34.10	34.10	0	316.66	316.66	0	45.22	45.22	0
1	Regional	38.60	38.60	0	316.70	316.70	0	46.40	46.40	0
2	5 Year	3.99	3.99	0	316.77	316.77	0	9.22	9.22	0
2	25 Year	19.70	19.70	0	317.84	317.84	0	28.11	28.11	0
2	100 Year	34.10	34.10	0	318.56	318.56	0	43.67	43.67	0
2	Regional	38.60	38.60	0	318.76	318.76	0	52.31	52.31	0
3	5 Year	3.99	3.99	0	317.26	317.26	0	21.89	21.89	0
3	25 Year	19.70	19.70	0	319.16	319.16	0	69.40	69.40	0
3	100 Year	34.10	34.10	0	319.74	319.74	0	141.61	141.61	0
3	Regional	38.60	38.60	0	320.43	320.43	0	154.38	154.38	0
4	5 Year	3.99	3.99	0	317.51	317.51	0	28.81	28.81	0
4	25 Year	19.70	19.70	0	319.16	319.16	0	69.44	69.44	0
4	100 Year	34.10	34.10	0	319.74	319.74	0	141.74	141.74	0
4	Regional	38.60	38.60	0	320.43	320.43	0	154.39	154.39	0
5	5 Year	3.99	3.99	0	317.51	317.51	0	28.83	28.83	0
5	25 Year	19.70	19.70	0	319.16	319.16	0	69.45	69.45	0
5	100 Year	34.10	34.10	0	319.74	319.74	0	141.75	141.75	0
5	Regional	38.60	38.60	0	320.43	320.43	0	154.39	154.39	0
6	5 Year	3.99	3.99	0	317.61	317.61	0	2.70	2.70	0
6	25 Year	19.70	19.70	0	319.15	319.15	0	47.90	47.90	0
6	100 Year	34.10	34.10	0	319.73	319.73	0	70.63	70.63	0
6	Regional	38.60	38.60	0	320.43	320.43	0	111.99	111.99	0
7	5 Year	3.99	3.99	0	317.92	317.92	0	2.70	2.70	0
7	25 Year	19.70	19.70	0	321.90	321.90	0	217.71	217.71	0
7	100 Year	34.10	34.10	0	322.84	322.84	0	256.71	256.71	0
7	Regional	38.60	38.60	0	322.92	322.92	0	257.16	257.16	0
7.1	5 Year	3.88	3.88	0	318.29	318.29	0	9.93	9.93	0
7.1	25 Year	19.10	19.10	0	321.90	321.90	0	87.25	87.25	0
7.1	100 Year	33.20	33.20	0	322.84	322.84	0	108.01	108.01	0
7.1	Regional	37.50	37.50	0	322.92	322.92	0	108.76	108.76	0

Sec No.	Design Storm	Flow (cu m/s)			W.S. Elevation (m)			Tope Width (m)		
		POST	PRE	Difference	POST	PRE	Difference	POST	PRE	Difference
7.2	5 Year	3.88	3.88	0	318.46	318.46	0	17.77	17.77	0
7.2	25 Year	19.10	19.10	0	321.90	321.90	0	102.47	102.47	0
7.2	100 Year	33.20	33.20	0	322.84	322.84	0	143.19	143.19	0
7.2	Regional	37.50	37.50	0	322.92	322.92	0	147.12	147.12	0
7.4	5 Year	3.88	3.88	0	318.49	318.49	0	20.75	20.75	0
7.4	25 Year	19.10	19.10	0	321.90	321.90	0	115.51	115.51	0
7.4	100 Year	33.20	33.20	0	322.84	322.84	0	164.21	164.21	0
7.4	Regional	37.50	37.50	0	322.92	322.92	0	167.36	167.36	0
7.6	5 Year	3.88	3.88	0	318.50	318.50	0	23.07	23.07	0
7.6	25 Year	19.10	19.10	0	321.90	321.90	0	135.91	135.91	0
7.6	100 Year	33.20	33.20	0	322.84	322.84	0	171.13	171.13	0
7.6	Regional	37.50	37.50	0	322.92	322.92	0	173.49	173.49	0
7.8	5 Year	3.88	3.88	0	318.52	318.52	0	24.59	24.59	0
7.8	25 Year	19.10	19.10	0	321.90	321.90	0	86.10	86.10	0
7.8	100 Year	33.20	33.20	0	322.84	322.84	0	167.67	167.67	0
7.8	Regional	37.50	37.50	0	322.92	322.92	0	172.11	172.11	0
8	5 Year	3.88	3.88	0	318.53	318.53	0	27.37	27.37	0
8	25 Year	19.10	19.10	0	321.90	321.90	0	71.51	71.51	0
8	100 Year	33.20	33.20	0	322.84	322.84	0	124.61	124.61	0
8	Regional	37.50	37.50	0	322.92	322.92	0	148.81	148.81	0
8.2	5 Year	3.88	3.88	0	318.54	318.54	0	25.89	25.89	0
8.2	25 Year	19.10	19.10	0	321.90	321.90	0	68.91	68.91	0
8.2	100 Year	33.20	33.20	0	322.84	322.84	0	80.54	80.54	0
8.2	Regional	37.50	37.50	0	322.92	322.92	0	81.53	81.53	0
8.4	5 Year	3.88	3.88	0	318.56	318.56	0	26.08	26.08	0
8.4	25 Year	19.10	19.10	0	321.90	321.90	0	67.40	67.40	0
8.4	100 Year	33.20	33.20	0	322.84	322.84	0	79.88	79.88	0
8.4	Regional	37.50	37.50	0	322.92	322.92	0	81.30	81.30	0
8.6	5 Year	3.88	3.88	0	318.68	318.68	0	18.51	18.51	0
8.6	25 Year	19.10	19.10	0	321.90	321.90	0	72.10	72.10	0
8.6	100 Year	33.20	33.20	0	322.84	322.84	0	83.91	83.91	0
8.6	Regional	37.50	37.50	0	322.92	322.92	0	85.08	85.08	0
8.8	5 Year	3.88	3.88	0	318.85	318.85	0	29.43	29.43	0
8.8	25 Year	19.10	19.10	0	321.91	321.91	0	76.87	76.87	0
8.8	100 Year	33.20	33.20	0	322.84	322.84	0	94.39	94.39	0
8.8	Regional	37.50	37.50	0	322.92	322.92	0	96.47	96.47	0
9	5 Year	3.88	3.88	0	318.89	318.89	0	19.97	19.97	0
9	25 Year	19.10	19.10	0	321.91	321.91	0	79.78	79.78	0
9	100 Year	33.20	33.20	0	322.84	322.84	0	93.77	93.77	0
9	Regional	37.50	37.50	0	322.92	322.92	0	95.54	95.54	0

Sec No.	Design Storm	Flow (cu m/s)			W.S. Elevation (m)			Tope Width (m)		
		POST	PRE	Difference	POST	PRE	Difference	POST	PRE	Difference
9.2	5 Year	3.88	3.88	0	319.17	319.17	0	27.90	27.90	0
9.2	25 Year	19.10	19.10	0	321.91	321.91	0	80.39	80.39	0
9.2	100 Year	33.20	33.20	0	322.84	322.84	0	98.70	98.70	0
9.2	Regional	37.50	37.50	0	322.92	322.92	0	102.83	102.83	0
9.4	5 Year	3.88	3.88	0	319.29	319.29	0	26.48	26.48	0
9.4	25 Year	19.10	19.10	0	321.91	321.91	0	90.30	90.30	0
9.4	100 Year	33.20	33.20	0	322.84	322.84	0	114.82	114.82	0
9.4	Regional	37.50	37.50	0	322.92	322.92	0	116.91	116.91	0
9.6	5 Year	3.88	3.88	0	319.33	319.33	0	22.08	22.08	0
9.6	25 Year	19.10	19.10	0	321.91	321.91	0	99.68	99.68	0
9.6	100 Year	33.20	33.20	0	322.84	322.84	0	117.49	117.49	0
9.6	Regional	37.50	37.50	0	322.92	322.92	0	119.01	119.01	0
9.7	5 Year	3.88	3.88	0	319.57	319.57	0	23.64	23.64	0
9.7	25 Year	19.10	19.10	0	321.91	321.91	0	101.41	101.41	0
9.7	100 Year	33.20	33.20	0	322.84	322.84	0	126.95	126.95	0
9.7	Regional	37.50	37.50	0	322.92	322.92	0	128.23	128.23	0
9.8	5 Year	3.88	3.88	0	319.77	319.77	0	25.74	25.74	0
9.8	25 Year	19.10	19.10	0	321.91	321.91	0	92.21	92.21	0
9.8	100 Year	33.20	33.20	0	322.84	322.84	0	127.80	136.09	8.29
9.8	Regional	37.50	37.50	0	322.92	322.92	0	128.37	139.38	11.01
9.9	5 Year	3.88	3.88	0	320.09	320.09	0	30.93	30.93	0
9.9	25 Year	19.10	19.10	0	321.90	321.90	0	81.14	81.14	0
9.9	100 Year	33.20	33.20	0	322.84	322.84	0	99.50	99.50	0
9.9	Regional	37.50	37.50	0	322.92	322.92	0	101.27	101.27	0
10	5 Year	3.88	3.88	0	320.14	320.14	0	44.86	44.86	0
10	25 Year	19.10	19.10	0	321.91	321.91	0	83.79	83.79	0
10	100 Year	33.20	33.20	0	322.84	322.84	0	102.95	102.95	0
10	Regional	37.50	37.50	0	322.92	322.92	0	104.59	104.59	0
11	5 Year	3.88	3.88	0	321.11	321.11	0	40.43	40.43	0
11	25 Year	19.10	19.10	0	322.72	322.72	0	87.53	87.53	0
11	100 Year	33.20	33.20	0	323.08	323.08	0	97.09	97.09	0
11	Regional	37.50	37.50	0	323.15	323.15	0	98.83	98.83	0
12	5 Year	3.88	3.88	0	321.14	321.14	0	47.28	47.28	0
12	25 Year	19.10	19.10	0	322.72	322.72	0	116.46	116.46	0
12	100 Year	33.20	33.20	0	323.09	323.09	0	125.46	125.46	0
12	Regional	37.50	37.50	0	323.15	323.15	0	127.11	127.11	0
13	5 Year	3.88	3.88	0	321.21	321.21	0	22.30	22.30	0
13	25 Year	19.10	19.10	0	322.73	322.73	0	58.71	58.71	0
13	100 Year	33.20	33.20	0	323.09	323.09	0	110.98	110.98	0
13	Regional	37.50	37.50	0	323.16	323.16	0	114.67	114.67	0

Sec No.	Design Storm	Flow (cu m/s)			W.S. Elevation (m)			Tope Width (m)		
		POST	PRE	Difference	POST	PRE	Difference	POST	PRE	Difference
14	5 Year	3.88	3.88	0	321.80	321.80	0	10.32	10.32	0
14	25 Year	19.10	19.10	0	322.72	322.72	0	64.91	64.91	0
14	100 Year	33.20	33.20	0	323.14	323.14	0	117.03	117.03	0
14	Regional	37.50	37.50	0	323.22	323.22	0	118.73	118.73	0
15	5 Year	3.69	3.69	0	322.84	322.84	0	26.55	26.55	0
15	25 Year	18.20	18.20	0	323.37	323.37	0	53.68	53.68	0
15	100 Year	31.60	31.60	0	323.65	323.65	0	76.40	76.40	0
15	Regional	35.80	35.80	0	323.72	323.72	0	84.70	84.70	0
16	5 Year	3.69	3.69	0	322.92	322.92	0	28.44	28.44	0
16	25 Year	18.20	18.20	0	323.43	323.43	0	41.85	41.85	0
16	100 Year	31.60	31.60	0	323.70	323.70	0	75.16	75.16	0
16	Regional	35.80	35.80	0	323.78	323.78	0	86.70	86.70	0
17	5 Year	3.69	3.69	0	324.97	324.97	0	328.35	328.35	0
17	25 Year	18.20	18.20	0	325.82	325.82	0	383.09	383.09	0
17	100 Year	31.60	31.60	0	325.90	325.90	0	387.87	387.87	0
17	Regional	35.80	35.80	0	325.92	325.92	0	389.45	389.45	0
18	5 Year	6.09	6.09	0	325.06	325.06	0	229.43	229.43	0
18	25 Year	19.30	19.30	0	325.82	325.82	0	279.50	279.50	0
18	100 Year	32.10	32.10	0	325.90	325.90	0	284.38	284.38	0
18	Regional	35.80	35.80	0	325.92	325.92	0	285.99	285.99	0
19	5 Year	6.09	6.09	0	325.06	325.06	0	206.06	206.06	0
19	25 Year	19.30	19.30	0	325.82	325.82	0	224.41	224.41	0
19	100 Year	32.10	32.10	0	325.90	325.90	0	225.63	225.63	0
19	Regional	35.80	35.80	0	325.92	325.92	0	226.04	226.04	0
20	5 Year	5.78	5.78	0	325.06	325.06	0	97.36	97.36	0
20	25 Year	18.30	18.30	0	325.82	325.82	0	108.08	108.08	0
20	100 Year	30.10	30.10	0	325.90	325.90	0	109.14	109.14	0
20	Regional	33.10	33.10	0	325.92	325.92	0	109.49	109.49	0
21	5 Year	5.78	5.78	0	325.06	325.06	0	122.56	122.56	0
21	25 Year	18.30	18.30	0	325.83	325.83	0	140.66	140.66	0
21	100 Year	30.10	30.10	0	325.90	325.90	0	142.72	142.72	0
21	Regional	33.10	33.10	0	325.93	325.93	0	143.40	143.40	0