Northgate and Erbsville Kartway Subdivisions Beaver Creek Meadows District, Waterloo

Preliminary

Stormwater Management Report

Project Location:

East of Erbsville Road
West of Beaver Creek Road
South of Conservation Drive
City of Waterloo

Prepared for:

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Engineers, Scientists, Surveyors.

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1.0 Introduction

1.1 Overview

MTE Consultants Inc. (MTE) was retained by 1017081 Ontario Limited and Gabriella Elizabeth Groff (Northgate) and 1455136 Ontario Inc. (Erbsville Kartway), to prepare a Preliminary Stormwater Management (SWM) Report in support of Plans of Subdivision, Plan of Condominium (Vacant Land Condominium), and Zoning By-law amendment applications. The Northgate and Erbsville Kartway properties are collectively referred to herein as the 'Subject Lands'.

This Preliminary SWM Report was originally submitted in July 2017, to support the Northgate and Erbsville Kartway Subdivision applications. Since that time, comments have been received from review Agencies and this report has been updated to address those comments. This report has also been revised to support the revised Draft Plan of Subdivision, as it has been an iterative process to develop this plan based on input from all disciplines of the project team.

The Subject Lands are comprised of 2 parcels; lands owned by Northgate and lands owned by Erbsville Kartway. The Northgate lands are approximately 49.29ha and the Erbsville Kartway lands are approximately 6.43ha, for a total area of 55.72ha of land within the City of Waterloo. Note that the Northgate property (49.29ha) consists of 34.08ha of land located within the proposed subdivision and 15.21ha of open space lands along Beaver Creek, identified as "additional lands" that are outside the boundaries of the subdivision.

The Subject Lands are located within the Beaver Creek Meadows District, for which the City of Waterloo has approved a District Plan. The Northgate lands are currently used for interim agricultural purposes and the Erbsville Kartway lands are currently developed with a single detached dwelling and a go-cart track. The location of the Subject Lands is illustrated in **Figure 1.1**, along with the general extent of the Beaver Creek Meadows District.

The lands are entirely within the Laurel Creek Watershed, specifically areas 391, 309, and 310 as defined in the *Laurel Creek Watershed Study - GRCA et al. (1993)* (LCWS). The Subject Lands are surrounded by the Laurel Creek Conservation Area, Reservoir, and Nature Centre to the south, Creekside Church and rural residential homes to the north, an existing mobile trailer park to the east (Green Acre Park – aka Martin Lands), and Laurel Creek and a woodlot to the west.

A Draft Plan of Subdivision for the proposed development has been prepared by MHBC Planning Ltd. (dated July 14, 2020) and forms the basis for the proposed stormwater management strategy (see **MHBC Drawing –Draft Plan Consolidation, dated July 14, 2020**). The Draft Plans of Subdivision includes single family residential blocks, multiple residential blocks, a potential mixed use block, stormwater management block, sanitary pumping station blocks, park blocks, open space blocks, walkways, and municipal right-of-ways.

This report should be read in conjunction with the following other reports;

- *Northgate and Erbsville Kartway Subdivisions - Beaver Creek Meadows District; Functional Servicing Report - MTE (July 17, 2020).*
- *Northgate and Erbsville Kartway Subdivisions - Beaver Creek Meadows District; Hydrogeology Assessment - MTE (July 17, 2020).*
- *Beaver Creek Meadows Communal Stormwater Management – Final Stormwater Management Report - MTE (June, 2020).*

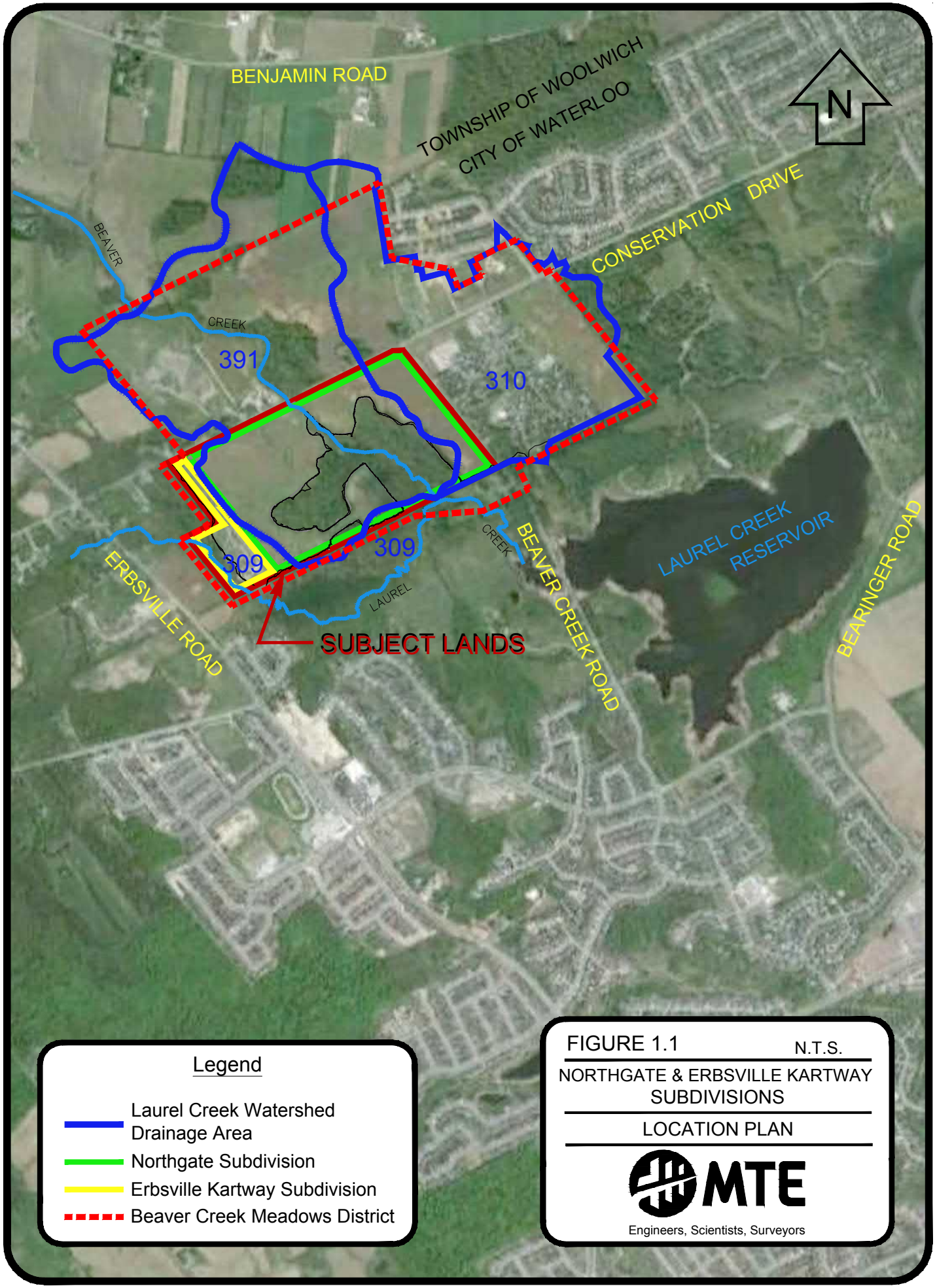


FIGURE 1.1 N.T.S.

NORTHGATE & ERBSVILLE KARTWAY SUBDIVISIONS

LOCATION PLAN

MTE

Engineers, Scientists, Surveyors

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1.2 Background Information

Subwatershed Study

The *North Waterloo Scoped Subwatershed Study - Stantec et al. (2013)* (NWSSS) was undertaken for the Beaver Creek Meadows District by the City of Waterloo and area landowners. The Study Area was broken down into two portions: the Primary Study Area (PSA) is the area located within the northwest portion of the City of Waterloo urban area, and the Secondary Study Area, which is primarily the agricultural lands within the Township areas. The Study Area is wholly contained with the Laurel Creek Watershed.

The specific goals of the NWSSS were to:

- Provide recommendations and approaches to manage resources to protect, maintain and, where possible, enhance the natural environment within the Study Area.
- Establish a Primary and Secondary Study Area.
- Provide information and recommendations to the land-use decision making process and assist in setting specific direction for subsequent planning processes with the Primary Study Area.
- Determine how future development can be planned and designed according to the targets set out in the Laurel Creek Watershed Study (LCWS) and implement the City of Waterloo Official Plan requirements for subwatershed planning.

Specific recommendations that pertain to the subject site with respect to stormwater management include a combination of lot-level, conveyance and end-of-pipe infiltration facilities, as well as end-of-pipe peak flow targets for return period design storms for end-of-pipe SWM facility design.

The Subject Lands are located within the Laurel Creek Watershed, specifically within portions of subwatersheds 391, 309, and 310 as defined within the LCWS. Drainage is directed to Beaver Creek (subwatershed 391), Laurel Creek (subwatershed 309), and directly to the Laurel Creek Reservoir Tributary (subwatershed 310) due to topographic conditions within the Subject Lands. It should be noted that this report focuses on presenting the stormwater management quality, quantity, and water balance measures that are proposed to be provided for the Northgate and Erbsville Kartway Subdivisions that are within subwatersheds 391 and 309 (i.e. the central and western portions of the development lands). The eastern portion of the Northgate lands, along with other development lands within subwatershed 310 is proposed to utilize a communal stormwater management facility to be located adjacent to Beaver Creek Road.

Beaver Creek Meadows Communal Stormwater Management – Evaluation of Alternatives – Final Study

The *Beaver Creek Meadows Communal Stormwater Management - Evaluation of Alternatives - Final Study* is the evaluation of alternatives and stormwater management strategy for the storm drainage of future development lands located within Laurel Creek subwatershed 310.

In December of 2013, Council for the City of Waterloo approved the NWSSS. The Active Developers within these subcatchment areas, comprising of Activa, Cook/Mattamy and Northgate (referred to herein as Active Developers/Active Developments), are working together to implement the recommendations of the NWSSS. MTE was retained by the Active Developers group to work with the agencies on the selection of the preferred alternative and final design of the Beaver Creek Meadows Communal SWM facility.

The study process involved the weighting and analysis of design alternatives as they related to the approved Final Terms of Reference (March 7, 2019). The outcome of this study was the selection of the preferred alternative and stormwater management strategy which will guide the final design and implementation of a new Communal SWM facility for Laurel Creek subwatershed 310.

A total of six SWM alternatives were identified and assessed/evaluated relative to the criteria/factors in accordance with the selected methodology. All alternatives are either a wetland type SWMF, wet pond type SWMF or a combination thereof. All alternatives outlet ultimately to the Laurel Creek Reservoir via the by-pass channel or the Laurel Creek Reservoir Tributary (LCRT). Through discussions with the Agency Steering Committee and the Active Developers, it was determined that Alternative 4A was the preferred alternative for the SWM strategy for the development lands.

Beaver Creek Meadows Communal Stormwater Management – Final Stormwater Management Report

A separate Final Stormwater Management Report has been prepared on behalf of the Active Developers group for the construction of the communal stormwater management facility and the overall stormwater management strategy for subwatershed 310.

Conservation Drive and Beaver Creek Road Municipal Class Environmental Assessment

A Municipal Class Environmental Assessment (EA) was undertaken for upgrades to Beaver Creek Road and Conservation Drive within the North Waterloo lands by Stantec Consulting on behalf of the City of Waterloo, and completed December 14, 2015. The EA was completed in order to review and implement infrastructure upgrades required for the proposed developments within the North Waterloo lands. The landowners are continuing to work with the City on implementation of the Class EA.

1.3 Purpose of Study

The purpose of this study is to develop a comprehensive stormwater management strategy for the current development proposal, taking the findings of previous studies into consideration, that is acceptable to the City of Waterloo, Region of Waterloo, the Grand River Conservation Authority (GRCA), and the Ministry of the Environment, Conservation and Parks (MECP- formerly known as the MOE).

1.4 Objectives

The objective of this stormwater management plan is to ensure that the proposed development includes the necessary controls to protect the hydrology and water quality of the receiving water systems. Further, this plan is also to ensure that the proposed draft plan provides the necessary blocks and corridors for stormwater management measures. The primary objectives of this study are as follows:

- Document criteria for the management of stormwater runoff from the study area.
- Recommend a comprehensive plan for controlling the quality of stormwater runoff from the study area (including temperature mitigation as required).
- Recommend a comprehensive plan for controlling the quantity of stormwater runoff from the study area.
- Recommend a comprehensive plan for balancing infiltration to groundwater and surface water inputs to existing features.
- Prepare preliminary designs for the recommended stormwater management infrastructure.

2.0 Existing Conditions and Background Information

2.1 Topographical Information

The Subject Lands consist of approximately 55.72ha. The majority of the property is currently used for agricultural purposes, with the exception of a 15.21ha forested area. Beaver Creek flows from north to south across the middle of the Subject Lands and confluences with Laurel Creek just south of the southern property boundary. The Erbsville Kartway lands is currently being used primarily as a go-kart business, with a single residence located along Conservation Drive and the western edge being in the floodplain of Laurel Creek. The soils are generally sandy and well-drained, as the area is located along the eastern flank of the Waterloo Moraine or Waterloo Sand Hills (NWSSS, 2013).

MTE conducted a detailed topographical survey of the property in May 2015, with some supplemental survey completed in 2016, 2017 and 2019. Existing topographic conditions for the Subject Lands as well as the surrounding lands are shown on **MTE Drawing 39502-104 EC1.1.**

The Subject Lands are moderately sloped throughout the majority of the site, generally between 2% and 10%. Existing elevations range between 343.5m near the southern edge of the property where Beaver Creek exits the Subject Lands, and 360m on the hill located near the intersection of Conservation Drive and Beaver Creek Road.

2.2 Pre-Development Conditions

The Subject Lands are located within the Laurel Creek Watershed, specifically within portions of subwatersheds 391, 309, and 310 as defined within the LCWS. Drainage is directed to Beaver Creek (subwatershed 391), Laurel Creek (subwatershed 309), and directly to the Laurel Creek Reservoir Tributary (LCRT) (subwatershed 310) due to topographic conditions within the Subject Lands. The pre-development drainage areas are illustrated on **Figure 2.1**.

The western portion of the site (including lands outside of the plans of subdivision) drains to Laurel Creek to the southwest. Laurel Creek is the main water feature within the Laurel Creek Watershed, and flows generally north to south adjacent to the western boundary of the Erbsville Kartway lands before it turns east approximately 200m south of the site and confluences with Beaver Creek. Downstream of the confluence with Beaver Creek, Laurel Creek outlets into the Laurel Creek Reservoir.

The central portion of the Subject Lands drains to Beaver Creek, which flows from north to south through the middle of the site. Beaver Creek has a main branch approximately 6.1km long, and drains a 697ha watershed consisting of mainly agricultural land. Beaver Creek joins Laurel Creek immediately to the south of the site, upstream of the Laurel Creek Reservoir.

The eastern portion of the site (including lands outside of the plans of subdivision) drains overland towards Beaver Creek Road, outletting to the Laurel Creek Reservoir Tributary and then directly to the Laurel Creek Reservoir. The Laurel Creek Reservoir is an engineered flood control facility for the City which is managed by the GRCA.

A fluvial geomorphological assessment was undertaken on Beaver Creek by Parish Geomorphic in 2011. This study included 4 reaches within the Primary Study Area, identified as BC-1 through BC-4. Based on the findings of the rapid assessment, 2 sites were selected for detailed field data collection, being BC-2 and BC-4. Since BC-2 is located upstream of the Subject Lands, only BC-4 will be assessed for the purposes of this study.

The GRCA's GAWSER (version 6.9.12) hydrologic model of Laurel Creek was updated by Stantec for the NWSSS. As part of the NWSSS, the current conditions model was run in continuous mode to estimate streamflow conditions and water balance information for the water features within and surrounding the study area. The continuous model utilized a 54-year (1951 – 2005) meteorological data set from the Waterloo Wellington airport.

2.3 Geotechnical and Hydrogeological Information

As noted in the NWSSS, the Subject Lands are located along the eastern flank of the physiographic region referred to as the Waterloo Moraine. The surficial geology in the Beaver Creek study area predominantly consists of sandy glaciofluvial deposits with areas of clay to silt-textured till. Modern alluvial deposits exist in the low lying areas associated with Beaver Creek and Laurel Creek.

To further understand the surficial geology within the study area, 6 monitoring wells, 7 test pits and 3 soil permeability tests were completed as part of the NWSSS in 2010, within the Subject Lands. Based on the results of this investigation, there were additional areas of clay to silt-textured till found along the southwest edge of the Subject Lands, as well as, just south of Conservation Drive within the Beaver Creek Valley. Also, ice-contact stratified deposits of sand and gravel were found in the central area of the west half of the Subject Lands, west of Beaver Creek. For more details of the Surficial Geology of the subject area refer to **Figure 5.5** of the NWSSS.

From 2014 to 2019, MTE carried out further hydrogeological investigation of the Subject Lands. The fieldwork for this investigation included 15 boreholes to depths ranging 5.2m to 25.0m on-site completed as 50mm monitoring wells, collection of soil samples, hydraulic 'slug' tests at the monitoring wells, and measurement of groundwater levels. Refer to MTE's Hydrogeological Assessment for additional information.

Based on the results of the hydrogeological investigation, the subsurface stratigraphy is generally described as topsoil underlain by a layer of fine sand interspersed with till and/or clay silt material, which was interpreted as Regional Aquifer 1/2 material, underlain at depth by deposits of silty clay, distinguished as the Lower Maryhill Till. Groundwater flow within the Subject Lands is generally towards the southeast to Beaver Creek.

For further information, refer to **Appendix G** for on-site borehole and monitoring well logs.

CONSERVATION DRIVE

BEAVER CREEK ROAD

391
101.6

309
10.8

310
70.1

309
10.8

Beaver Creek Floodline

Laurel Creek Floodline

Laurel Creek

FLOW

LEGEND

- SUBJECT LANDS (55.72 ha)
- DRAINAGE DIVIDE
- 391 / 101.6 — SUB-CATCHMENT NUMBER / AREA (ha.)

NOTE: CATCHMENT NUMBERING AS SHOWN ON FIGURE 6.1 IN THE NWSSS.

FIGURE 2.1

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NORTHGATE & ERBSVILLE KARTWAY SUBDIVISIONS

PRE-DEVELOPMENT DRAINAGE AREAS

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3.0 Stormwater Management Criteria

New developments are required to provide stormwater management in accordance with provincial and municipal policies as well as recommendations in related previous studies including:

- Stormwater Management Planning and Design Manual (MOE, 2003).
- GRCA Policies for the Administration of Ontario Regulation 150/06 (GRCA, October 2015).
- City of Waterloo - Stormwater Management Master Plan (Aquafor Beach, December 2019)
- City of Waterloo Development Engineering Manual (2013).
- North Waterloo Scoped Subwatershed Study (Stantec et al., November 2013).
- Beaver Creek Meadows Communal Stormwater Management – Final Stormwater Management Report (MTE, June 2020).

Based on the above policies and studies, the following stormwater management criteria have been established for subwatersheds 391, 309 and 310 within this study area:

- **Quality Control** – provide an *Enhanced* level of stormwater quality control for all developing areas.
- **Quantity and Erosion Control**
  - *Subwatershed 391* – post-development peak flows must be controlled to unit flow rate targets for a variety of return period design storm events.
  - *Subwatershed 309* – surface drainage should be incorporated into subwatershed 391 area during development.
  - *Subwatershed 310* – there is no quantity control requirements for post-development peak flows. If any drainage is directed to the Laurel Creek Reservoir Tributary (LCRT), an erosion impact assessment should be completed to demonstrate no negative impacts to the tributary.
- **Water Balance**
  - *Surface Water* – maintain existing surface water inputs to key natural features.
  - *Infiltration* - enhance post-development recharge rates as compared to existing conditions across the development area, to maintain existing groundwater recharge and discharge characteristics. A brief discussion of each of these criteria is included in the following subsections.
- **Thermal Mitigation** – provide temperature mitigation measures prior to discharge to the receiving systems.

3.1 Quality Control

All new stormwater management facilities proposed for the development will need to provide an Enhanced level of water quality protection prior to discharge to a surface or groundwater feature. This is established in Table 3.2 of the MOE's *Stormwater Management Planning and Design Manual* (2003).

3.2 Quantity and Erosion Control

Subwatershed 391

As an alternative to post-to-pre development control, a target unit flow rate approach was applied to subwatershed 391 to manage development of the subwatershed without causing increases in Beaver Creek peak flows. The target is in the form of L/s/ha of existing drainage area. This method was applied as it was found that typical post-to-pre SWM strategy would increase the magnitude of flows in the lower reaches of Beaver Creek. The unit flow rates for the 2, 5, and 100 year events are listed in **Table 3.1**.

An erosion assessment was completed as part of the NWSSS, and identified 2 sensitive reaches on Beaver Creek (BC-2 and BC-4). This assessment confirmed erosion thresholds and the duration of erosive flows under existing conditions (Table 11.6 of the NWSSS). These limits should be incorporated into proposed SWM measures to ensure existing erosion conditions are maintained under future developed conditions.

Additionally, all stormwater management facilities which outlet to a creek will incorporate 24-48 hours extended detention for a 25mm, 4-hour Chicago storm event.

Table 3.1 – Unit Flow Targets For Subwatershed 391

Return Period Storm Event	Unit Flow Target (L/s/ha)
2 year	1.1
5 year	10
100 year	55

Subwatershed 310

As per the NWSSS, there are no quantity control requirements for subwatershed 310. From an erosion perspective, the LCRT was not fully assessed in the NWSSS. As such, a fluvial geomorphological assessment was completed as part of the Beaver Creek Meadows Communal Stormwater Management Study by Water's Edge in 2019.

3.3 Water Balance

In the NWSSS, the existing conditions hydrologic model (GAWSER) was run for a 54-year simulation period to determine the average annual evapotranspiration, runoff and infiltration values for each catchment. The results for the catchments containing the subject site are illustrated on Table 11.5 of the NWSSS, and have been summarized in in **Table 3.2**.

Table 3.2 – Existing Conditions Annual Water Balance Values by Catchment

Condition	Hydrologic Component Values (mm/yr)			
	Catchment 3914	Catchment 3915	Catchment 3917	Catchment 3102
Precipitation	844.8	844.8	844.8	844.8
Evapotranspiration	553.0	551.9	551.0	507.2
Runoff	*79.9*	*69.9*	*116.7*	*154.2*
Infiltration	211.9	222.9	177.0	183.4

Surface Water

Existing annual surface water volume contributions from lands within the PSA to wetlands will be required to be met in post-development conditions.

Subwatershed 310 - Surface water volume contributions from the upstream lands, including the eastern portion of the subject land to the LCRT, will be required not less than the greenfield condition (no development).

Infiltration

Annual infiltration rates / volumes are required to be maintained in order to preserve existing groundwater recharge for the protection of natural features (eg. groundwater fed wetlands, and creek base flow) and the Region's water supply. The proposed conditions hydrologic model (GAWSER) was run for a 54-year simulation period to determine the average annual evapotranspiration, runoff and infiltration values for each catchment. The proposed conditions water balances are illustrated on Table 11.5 of the NWSSS, and have been summarized in **Table 3.3** below.

Table 3.3 – Post-Development Annual Water Balance Values by Catchment

Condition	Hydrologic Component Values (mm/yr)			
	Catchment 3914	Catchment 3915	Catchment 3917	Catchment 3102
Precipitation	844.8	844.8	844.8	844.8
Evapotranspiration	348.2	346.2	352.4	366.9
Runoff	234.5	231.9	251.6	196.3
Infiltration	*262.2*	*266.7*	*240.8*	*281.6*

4.0 Proposed Development and SWM Strategy

4.1 Proposed Area Grading

A preliminary finished grade contour plan illustrating road grades is enclosed **(MTE Drawing 39502-104 AG1.1)**. The grading design of the site was controlled by many factors which include servicing constraints (both sanitary and storm), matching existing grades along the adjacent properties and environmental features, maintaining appropriate separation between existing high groundwater and proposed house footings and infiltration facilities, as well as limiting the import of fill for the development.

4.2 Post-Development Conditions

The proposed SWM plan, to be further discussed within this report, incorporates a variety of SWM infrastructure under a treatment train approach. The plan has been designed to meet the criteria presented in Section 3.0 of this report.

The development lands are comprised of mainly residential land use with some park blocks, stormwater management facilities and two sanitary pumping station blocks. As discussed in Section 1.2, the Subject Lands are located within the Laurel Creek Watershed, specifically within portions of subwatersheds 391, 309, and 310. This report focuses on presenting the stormwater management strategy for the lands that are within subwatersheds 391 and 309 (i.e. the central and western portions of the development lands). The eastern portion of the Northgate lands, along with other development lands within subwatershed 310 will utilize a communal stormwater management facility located within the property of Mar-View Farms Limited, adjacent to Beaver Creek Road. The Beaver Creek Meadows Communal Stormwater Management-Final Stormwater Management Report (BCM-CSWM-FSWMR) has been prepared in support of the communal stormwater management facility. In the event the design or construction of the communal stormwater management facility is delayed, the owner of the Northgate Lands may propose to construct an alternate stormwater management facility in the southeast portion of the Northgate lands that are within subwatershed 310. The alternative facility is intended to be temporary and replaced with development when the communal facility is provided. However, the alternative facility can provide a permanent solution in the event that the communal facility is not constructed. A Technical Memorandum has been prepared (**Appendix H**) that details the preliminary design recommendations and criteria for the alternate facility if required.

For the lands within subwatershed 391 and 309, three (3) Stormwater Management Facilities (SWMF) are proposed to be integrated into the proposed development servicing three distinct drainage areas. It should be noted that, the proposed draft plans of subdivision for the Subject Lands contain a number of Blocks that will be developed through a Site Plan Approval process. As part of that process, a detailed Stormwater Management Plan will be prepared showing how the stormwater control measures will adhere to the criteria and be implemented within the Block. Two of these Blocks will contain future stormwater management facilities. It should be noted that the stormwater management controls within these Blocks have been conceptually designed and modeled as part of this study to confirm overall adherence to the criteria/targets described in Section 3.0. These facilities have been identified as SWMF 5915 and 5917 in this report and figures.

The location of the proposed facilities along with the drainage areas contributing to each facility are illustrated on **Figure 4.1** and **4.2**. Storm sewers will convey minor flows to the SWMFs. Major flows are to be contained within the right-of-ways and blocks and will also be directed to the SWMFs.

At the lot-level, for the lands within subwatersheds 391, 309 and 310, amended topsoil (increased depth of topsoil) and infiltration facilities are proposed within the development. Amended topsoil is a lot-level stormwater management practice that has received considerable attention in recent years. This practice involves adjusting the sub-grade of pervious areas to be landscaped, such that a deeper layer of topsoil (and amending it with compost to increase organic matter content) can be applied. Previous studies have demonstrated that amended topsoil can significantly reduce runoff volumes by absorbing, retaining, infiltrating and evapotranspiring a greater amount of precipitation than standard landscaping practices in new developments. In addition, roof runoff from a number of the lots adjacent to the wetland will provide surface water input to the wetland.

Lot-level infiltration galleries have been proposed for both single family and multi-residential blocks. For single family dwellings, the galleries will be located within the municipal right-of-ways. The condominium blocks will contain “common element” infiltration facilities, located and designed within the parameters of the individual block designs. These galleries have been designed to accept 30mm of runoff.

The end-of-pipe facilities will consist of a wet pond for subcatchment 3914, and two dry ponds for subcatchment 3915, and 3917. The facilities within subcatchments 3915 and 3917 will also include infiltration galleries to infiltrate treated non-roof (road, front/rear yard) runoff, during non-winter months. The infiltration facilities have been designed such that the contributing area produces no runoff during the 4 hour, 25 mm storm event. These facilities will have an oil-grit separator (such as a Stormceptor unit) providing an Enhanced level of water quality control upstream of the dry pond to treat stormwater runoff prior to entering the infiltration gallery.

The drainage area contributing to each of the proposed end-of-pipe SWM facilities was delineated into several catchments consisting of either roof area or non-roof development area. Soil parameters within each catchment were assigned based on the fraction of the post-development catchment located within each pre-development catchment area. Reservoir commands were included in the hydrologic model to reflect the lot-level infiltration facilities, the SWM facilities, and the end-of-pipe infiltration facilities.

The design of each of the proposed SWM measures is discussed in detail Section 5 of this report.

As per the NWSSS (Section 11.2.2, page 232), the areas of the development lands within subwatershed 309, draining west to Laurel Creek and the Erbsville tributary, will be partially redirected into subwatershed 391 in the post-development condition, draining to Beaver Creek. Of the 10.8ha of the Subject Lands within subwatershed 309, approximately 4.74ha will be re-directed to Beaver Creek through the Subject Lands. The remaining portion draining to subwatershed 309 consists of 4.01ha of open space/floodplain, and 2.05ha of rear yards along the west portion of the development and a small portion of the northwest corner of the site will still discharge surface runoff overland towards Laurel Creek.

The surrounding post-development drainage areas are shown on **Figure 4.1** and the detailed post-development site drainage areas are shown on **Figure 4.2**. The post-development modeling parameters and impervious calculations have been included in **Appendix A**.

3910

Subcatchment 3910 consists of Beaver Creek and its immediate wetland north of Conservation Drive, totals 17.29ha, and is proposed to remain unchanged from its pre-development condition. This area is outside of the subject property for this stormwater management report but within the overall North Waterloo study area, and has therefore been conceptually modeled. The area of

this catchment is slightly adjusted to exclude the area of Conservation Drive and the other corresponding model parameters are kept the same.

3911

Subcatchment 3911 consists of Beaver Creek and its immediate wetland south of Conservation Drive through the subject property, totals 20.31ha, and is proposed to remain unchanged from its pre-development condition. The area of this catchment is slightly adjusted to exclude the area of Conservation Drive and to be consistent with the new wetland boundary survey (completed in 2019, by the request of the Region). The other corresponding model parameters are kept the same.

3912

Subcatchment 3912 consists of developable lands north of Conservation Drive and west of Beaver Creek, totals 16.34ha, and shall remain the site of the Creekside Church. This area is outside of the subject property for this stormwater management report but within the overall North Waterloo study area, and has therefore been conceptually modeled. Subcatchment 3912 receives an additional 1.4ha from subcatchment 3091 (NWSSS Figure 6.2), which has been removed in the post-development condition. The area of this catchment is slightly adjusted to exclude the area of Conservation Drive. The other corresponding model parameters are determined with the same method described in NWSSS.

3913

Subcatchment 3913 consists of developable lands north of Conservation Drive and east of Beaver Creek, totals 11.62ha, and is proposed to drain to a stormwater management facility (SWMF 5913), which will outlet to Beaver Creek. This area is outside of the subject property for this stormwater management report but within the overall North Waterloo study area, and has therefore been conceptually modeled.

This catchment is adjacent to catchment 3107, which will drain to the communal stormwater management facility. The modeling details of catchment 3107 are documented in the BCM-CSWM-FSWMR and its supporting technical memorandum. The area of subcatchment 3913 is adjusted to exclude the area of Conservation Drive and to be aligned with the change of catchment 3107. The other corresponding model parameters are determined with the same method described in NWSSS.

3914

Subcatchment 3914 consists of developable lands south of Conservation Drive and west of Beaver Creek, totals 16.32ha. 12.43ha of it is proposed to drain to a stormwater management facility (SWMF 5914) in its northeast corner which will outlet to Beaver Creek. An area of 1.85ha along the edge of the lands will drain to the wetland/creek directly, shown as subcatchment 4914 in **Figure 4.2**. The lands comprise the west end of the subject property for this report, and contains multiple residential blocks, park blocks, and the stormwater management facility block. Subcatchment 3914 receives an additional 2.35ha from subcatchment 3091 (which has been removed) in the post-development condition. The balance of subcatchment 3091 (2.05ha) remains draining to Laurel Creek as subcatchment 9914 in the proposed modeling.

3915

Subcatchment 3915 consists of developable lands south of Conservation Drive and east of Beaver Creek, totals 1.55ha. 0.89ha of it is proposed to drain to a small stormwater management facility (SWMF 5915) in its southwest corner which will outlet to Beaver Creek. An area of 0.67ha along the edge of the lands will drain to the wetland/creek directly, shown as subcatchment 4915 in **Figure 4.2**. The lands comprise the north-central portion of the subject property for this report, and contains a multiple residential block.

3916
Subcatchment 3916 consists of lands northwest of subcatchment 3912, totals 2.6ha, drains to subcatchment 3912, and is proposed to remain unchanged from its pre-development condition. This area is outside of the subject property for this stormwater management report but within the overall North Waterloo study area, and has therefore been conceptually modeled.

3917
Subcatchment 3917 consists of developable lands southwest of Beaver Creek, totals 2.77ha. 1.27ha of it is proposed to drain to a small stormwater management facility (SWMF 5917) in its central portion. An area of 1.50ha along the edge of the lands will drain to the wetland/creek directly, shown as subcatchment 4917 in **Figure 4.2**. The lands comprise the south-central portion of the subject property for this report, and consists of vacant land condominium blocks.

3918
Subcatchment 3918 consists of lands along the southern edge of the subject property which drain north to subcatchments 3914 and 3917, totals 0.56ha, and is proposed to remain unchanged from its pre-development condition.

3919
Subcatchment 3919 consists of lands northeast of Beaver Creek, totals 13.6ha, drains to subcatchment 3910, and is proposed to remain unchanged in the post-development condition. This area is outside of the subject property for this stormwater management report but within the overall North Waterloo study area, and has therefore been conceptually modeled.

3092
Subcatchment 3092 consists of Laurel Creek and its immediate wetland along the west side of the subject property, totals 4.01ha, drains west to Laurel Creek, and is proposed to remain unchanged from its pre-development condition.

3093
Subcatchment 3093 consists of Laurel Creek wetland along the south edge of the subject property, totals 0.58ha, drains south to Laurel Creek, and is proposed to remain unchanged from its pre-development condition.

3101
Subcatchment 3101 consists of developable lands north of Conservation Drive and east of Beaver Creek Road, totals 10.46ha, and is proposed to drain to the communal stormwater management facility, which will outlet to the Laurel Creek Reservoir. The modeling details of catchment 3107 are documented in the BCM-CSWM-FSWMR and its supporting technical memorandum.

3102
Subcatchment 3102 consists of developable lands south of Conservation Drive and west of Beaver Creek Road, totals 8.66ha, and is proposed to drain to the communal stormwater management facility, which will outlet to the Laurel Creek Reservoir. The modeling details of catchment 3102 are documented in the BCM-CSWM-FSWMR and its supporting technical memorandum. This area comprises the eastern portion of the subject property for this report, and contains multiple residential blocks, vacant land condominium blocks and park blocks. Subcatchment 3102 receives an additional 1.36ha from subcatchment 3915 in the post-development condition.

3103
Subcatchment 3103 consists of Laurel Creek wetland along the south edge of the subject property, totals 0.50ha, drains southeast to the Laurel Creek, and is proposed to remain unchanged from its pre-development condition.

3104
Subcatchment 3104 consists of lands along the east and south edges of the North Waterloo study area, totals 4.72ha, drains west to subcatchment 3106, and is proposed to remain unchanged from its pre-development condition. This area is outside of the subject property for this stormwater management report but within the overall North Waterloo study area, and has therefore been conceptually modeled.

3105
Subcatchment 3105 consists of lands in the northeast corner of the North Waterloo study area, totals 3.61ha and is proposed to remain unchanged from its pre-development condition. This area is outside of the subject property for this stormwater management report but within the overall North Waterloo study area, and has therefore been conceptually modeled.

3106
Subcatchment 3106 consists of lands south of Conservation Drive and east of Beaver Creek Road, totals 30.07ha, and is proposed to drain to the communal stormwater management facility, which will outlet to the Laurel Creek Reservoir. The modeling details of catchment 3106 are documented in the BCM-CSWM-FSWMR and its supporting technical memorandum.

3107
Subcatchment 3107 consists of lands north of Conservation Drive and north/northwest of Beaver Creek Road, totals 11.25ha, and is proposed to drain to the communal stormwater management facility, which will outlet to the Laurel Creek Reservoir. The modeling details of catchment 3107 are documented in the BCM-CSWM-FSWMR and its supporting technical memorandum.

3920
Subcatchment 3920 consists of lands of Conservation Drive west of Beaver Road with total area of 1.45ha and is proposed to drain to Beaver Creek. This area is outside of the subject property for this stormwater management report but within the overall North Waterloo study area, and has therefore been conceptually modeled.

3181
Subcatchment 3181 consists of lands of Beaver Road with total area of 2.13ha and is proposed to drain to the communal stormwater management facility, which will outlet to the Laurel Creek Reservoir. The modeling details of catchment 3181 are documented in the BCM-CSWM-FSWMR and its supporting technical memorandum.

3182
Subcatchment 3182 consists of lands of Conservation Drive east of Beaver Road with total area of 1.40ha and is proposed to drain south to subcatchment 3106, eventually treated by the communal stormwater management facility. The modeling details of catchment 3182 are documented in the BCM-CSWM-FSWMR and its supporting technical memorandum.

3141
Subcatchment 3141 consists of lands south of the communal stormwater management facility with total area of 1.13ha and is proposed to remain unchanged from its pre-development condition. This area is outside of the subject property for this stormwater management report but within the overall North Waterloo study area, and has therefore been conceptually modeled.

301
265.1

NOTE:
AREA 301 IS UPSTREAM
OF AREA 381.

381
331.1

3916
2.6

3919
13.6

3105
3.61

3913
11.62

5913

5912

3912
16.34

3107
11.25

3910
17.29

3920
1.45

CONSERVATION DRIVE

NOTE:
AREA 3101 WAS INCREASED
FROM 9.3 to 10.5 ha IN THE
PROPOSED MODEL.

3101
10.46

3915
1.55

SWMF
5915

3181
2.13

3182
1.40

3914
16.32

SWMF
5914

3102
8.66

3104
4.72

3106
30.07

3911
20.31

BEAVER CREEK ROAD

3092
4.01

NOTE:
SEE FIGURE 4.2
FOR SITE DETAILS.

NOTE:
SWM FACILITY 5106 IS PROPOSED ON
THE MARTIN LANDS AND WILL PROVIDE
STORMWATER MANAGEMENT FOR
FOUR DIFFERENT DEVELOPERS.
(3101, 3102, 3104/3106 AND 3107)

3183
0.87

3917
2.77

SWMF
5917

3093
0.58

3103
0.5

SWMF
5106

3141
1.13

3918
0.56

LEGEND

- SUBJECT LANDS (55.72 ha)
- 305.0 — EXISTING CONTOURS (REGION OF WATERLOO)
- EXISTING DRIPLINE
- POST DEVELOPMENT DRAINAGE AREAS
- 5914 — PROPOSED SWM FACILITY
- 3101 / 10.2 — SUB-CATCHMENT NUMBER / AREA (ha.)
- SHADED AREAS MODELLED AS DEVELOPED

FIGURE 4.1

Date: JUL.06/20
Scale: 1:6000

NORTHGATE & ERBSVILLE
KARTWAY SUBDIVISIONS

POST DEVELOPMENT
CATCHMENT AREAS

MTE
Engineers, Scientists, Surveyors

Project No.: 39502-104

July 16, 2020 — 3:45 p.m. — Plotted By: AHenderson

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CONSERVATION DRIVE

2004 * (BC-2)

NOTE: EXTERNAL ARES 3101 & 3017 WILL DRAIN TO OFF-SITE SWM FACILITY 5106, NOTED BELOW.

3914 — 12.43

3915 — 0.89

4915 — 0.67

3102 — 8.66

3911 — 20.31

3092 — 4.01

9914 — 2.06

4914 — 1.83

3917 — 1.27

4917 — 1.50

3911 — -

3918 — 0.56

3093 — 0.58

3103 — 0.5

2009 * (BC-4)

SWM FACILITY 5914

SWMF 5915

SWMF 5917

SWM FACILITY 5106

MULTI-RES BLOCK

STREET ONE

STREET TWO

STREET THREE

STREET FOUR

STREET FIVE

STREET SIX

STREET EIGHT

BEAVER CREEK ROAD

Beaver Creek

Laurel Creek

Floodline

Stage 1

Stage 2

Stage 3

Stage 4

Stage 5

NOTE:
AREA 3102 WILL DRAIN TO OFF-SITE SWM FACILITY 5106 OR TEMPORARY POND.

LEGEND

- SUBJECT LANDS (55.72 ha)
- MAJOR OVERLAND FLOW ROUTE
- * EROSION ASSESSMENT NODE
- 391x / 1.000 — AREAS DRAINING TO SWM OR LID FACILITIES
- 491x / 1.000 — AREAS DRAINING TO BEAVER CREEK UNCONTROLLED
- 9914 / 2.140 — AREA DRAINING TO LAUREL CREEK UNCONTROLLED

FIGURE 4.2

Date: JUL.06/20
Scale: 1:3000

NORTHGATE & ERBSVILLE KARTWAY SUBDIVISIONS

DETAILED POST DEVELOPMENT SITE CATCHMENT AREAS

MTE
Engineers, Scientists, Surveyors

Project No.: 39502-104

July 16, 2020 — 4:02 p.m. — Plotted By: AHenderson

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5.0 Stormwater Management Design

5.1 Hydrologic Modeling

In order to quantify the hydrologic characteristic of the Primary Study Area (PSA) and the surrounding areas, an existing conditions hydrologic model was prepared as part of the NWSSS using the GAWSER (version 6.9.12) modeling platform. This model was then updated to reflect assumed proposed conditions and SWM strategies in the PSA to create a proposed hydrologic model. Both continuous and single event simulations were run. The proposed development conditions were modeled for the:

- Quality event (25mm depth, 4hr Chicago distribution).
- 2yr, 5yr and 100yr return period 24 hour SCS Type II distribution hyetographs derived from historical data from the Guelph Arboretum.
- Regional storm event (48hr, 285mm depth - Hurricane Hazel).
- 54-year continuous simulation period (meteorological data set from Waterloo Wellington Airport 1951-2005).

For the design of communal stormwater management for subwatershed 310, the proposed conditions model was updated in the spring of 2020 using GAWSER (version 6.9.18), based on proposed conditions and SWM strategies of the future developments within subwatershed 310. The details of this updated model are documented in the BCM-CSWM-FSWMR and its supporting technical memorandum. This model was then further updated to reflect the proposed development and SWM strategy of the subject land.

Refer to **Appendix A** for the relevant design parameters and design sheet calculations. The post-development design event modeling is included in **Appendix B**, and the post-development continuous simulation results are included in **Appendix C**.

5.2 Stormwater Management Facilities

The Subject Lands are located within the Laurel Creek Watershed, specifically within portions of subwatersheds 391, 309, and 310. This report focuses on presenting the stormwater management strategy for the lands that are within subwatersheds 391 and 309. The eastern portion of the Northgate lands, along with other development lands within subwatershed 310 will utilize a communal stormwater management facility located within the property of Mar-View Farms Limited, adjacent to Beaver Creek Road or an alternate SWM facility as outlined in Section 4.2. The BCM-CSWM-FSWMR has been prepared in support of the communal stormwater management facility.

For the lands within subwatershed 391 and 309, three SWMFs are proposed to be integrated into the proposed development servicing three distinct drainage areas. These facilities have been identified as SWMF 5914, 5915 and 5917 in this report and figures. SWMF 5914 is the main facility that will service the majority of the drainage area of the Northgate and Erbsville Kartway lands and will be in municipal ownership. The other two facilities (5915 and 5917) are located within Blocks of the subdivision and serve a relatively small drainage area. It should be noted that the stormwater management controls within these Blocks have been conceptually designed and modeled as part of this study to confirm overall adherence to the NWSSS criteria/targets.

5.2.1 Facility 5914

As discussed above, SWMF 5914 is the main facility that will service the majority of the drainage area of the Northgate and Erbsville Kartway lands. The total contribution area from subcatchment 3914 to SWMF 5914 is 12.44ha. This facility has been designed as a wet pond with a permanent pool depth of 1.0m. To supplement the western wetland water balance during non-winter months, treated flows will be directed to the wetland via a diversion manhole structure. A valve will close the wetland outlet pipe, such that chloride impacted water from road salting will not be sent to the wetland feature during the winter months (December 1 to March 31). This facility will be discussed in detail in subsequent sections of this report.

5.2.2 Facility 5106 or Alternate Facility

The eastern portion of the Northgate lands, along with other development lands within subwatershed 310 may utilize a communal stormwater management facility located within the property of Mar-View Farms Limited, adjacent to Beaver Creek Road or an alternate SWM facility as outlined in Section 4.2. The communal facility has been identified as SWMF 5106. This facility has been designed as a wet pond. The facility includes two cells, separated by a 'land bridge' that contains an easement for Hydro One. Both cells of this facility have been designed to meet the MOE's SWM design requirements for an Enhanced level of quality control. The design details for this facility are documented in the BCM-CSWM-FSWMR. The alternate facility is presented in **Appendix H**.

5.2.3 Facility 5915

This facility has a catchment area of approximately 0.89ha, and includes an oil-grit separator, dry pond and infiltration gallery (See **Figure 5.6**). Stormwater runoff entering the facility will be treated by an oil-grit separator (such as a Stormceptor unit), which will provide an Enhanced level of quality control. Treated flows will then enter the dry pond portion of the facility for quantity control. During non-winter months, routed flows will then enter into an end-of-pipe infiltration gallery beside the dry pond. The end-of pipe infiltration facility will function so that runoff under a 4hr-25mm event will be all infiltrated. A valve is proposed upstream of the infiltration facility, such that chloride impacted water from road salting will not be infiltrated during the winter months (December 1 to March 31).

5.2.4 Facility 5917

This facility has a catchment area of approximately 1.27ha, and includes an oil-grit separator, dry pond and infiltration gallery (See **Figure 5.6**). Stormwater runoff entering the facility will be treated by an oil-grit separator (such as a Stormceptor unit), which will provide an Enhanced level of quality control. Treated flows will then enter the dry pond portion of the facility for quantity control. During non-winter months, routed flows will then enter into an end-of-pipe infiltration gallery beside the dry pond. The end-of pipe infiltration facility will function so that runoff under a 4hr-25mm event will be all infiltrated. A valve is proposed upstream of the infiltration facility, such that chloride impacted water from road salting will not be infiltrated during the winter months (December 1 to March 31).

5.3 Stormwater Quality Control

5.3.1 Facility 5914

SWMF 5914 has been designed as a wet pond with a permanent pool depth of 1.0m. The wet facility will incorporate a sediment forebay with a depth of 1.5m, which offers benefits of dilution and settling of sediment. A planting scheme will be prepared that carefully selects plant species and their location in and around the basins to stabilize banks, mitigate temperate increases, deter waterfowl from nesting within the area, and provide aesthetics and safety benefits.

Since the majority of annual rainfall occurs in storms less than or equal to a 25mm event, the majority of water borne sediment is also transported to the stormwater management facilities in these less intense events. Therefore, the sediment forebay is designed targeting the smaller flows. Furthermore, since larger storm events will have greater peak flows, there is potential for re-suspension of accumulated sediment. The smaller flows into the forebay should be separated from the larger flows which should enter the main pond directly. To achieve this objective, an appropriately sized splitter structure upstream of the forebay is proposed.

Sizing of a splitter structure by simply sizing the outlet pipes based on their free flowing (Manning's) capacities often results in 'washout' of the forebay (and costly remediation) due to larger flows that result from surcharging of the splitter structure. The design of the splitter structure for this project incorporates both free flowing pipe capacities (i.e. assuming no surcharge and using Manning's equation) as well as the effects of head buildup within the splitter structure and associated discharge pipes.

The forebay design is based on classic particle settling and flow dispersion equations as presented in the MOE's 2003 *Stormwater Management Planning and Design Manual*. The methodology presented in that document suggests that the design flow for the forebay should be taken as the peak outflow from the facility. A forebay is typically designed to treat minor storm flows. Therefore, the main pond will essentially be empty (or at its permanent pool level) and there will be no mass of water at the outlet of the forebay that would control the flow through the forebay to the main pond's discharge rate.

This being the case, the design of the forebay should be based on the notion that the flow into the forebay equals the flow through the forebay, which equals the flow out of the forebay. In using this approach, the recommended settling velocity of 0.0003m/s (from MOE 2003) results in extremely large and un-achievable forebay lengths. Therefore, the forebay is designed to satisfy the following four conditions:

- Settling length based on a settling velocity of 0.0003m/s using the main pond peak discharge for the 25mm event (as per MOE 2003);
- Settling length based on a settling velocity of 0.0055m/s using the forebay inflow/outflow for the 25mm event;
- Dispersion length such that, based on flow and depth of water, the velocity through the forebay is less than 0.5m/s; and
- Velocity based on flow divided by cross-sectional area is less than 0.15m/s to prevent scouring.

The 2003 MOE document suggests that the clean-out frequency for a stormwater management facility be based on the sediment loading within the entire pond, however, it is recommended that the clean-out frequency be based on the loadings within the forebay only. While this typically results in more frequent clean-out, it is restricted to the forebay area only and avoids disturbance of the main pond. The clean-out frequency for the proposed SWM facilities can be found in the respective forebay design calculations in **Appendix A**.

Catchment area 3914 totals 16.32ha, as shown on **Figure 4.1**. Of this total, the drainage area to Facility 5914 is 12.43ha at 63.5% imperviousness. Additionally, due to site grading, the rear yards and back half of the roofs do not drain to the pond and are included in catchment 9914 (2.06ha at 40.1% impervious to Laurel Creek catchment 3092) and in catchment 4914 (1.83ha at 33.8% impervious to Beaver Creek catchment 3911), as shown on **Figure 4.2**.

MOE requires 210m^3/ha of total storage for an enhanced wet pond, 40m^3/ha of which is extended detention, so the required permanent pool and extended detention volumes for Facility 5914 are therefore 2,111m^3 and 497m^3, respectively.

The forebay and main pond have permanent pool volumes of 424m^3 and 2,377m^3, respectively, for a total permanent pool volume provided of 2,800m^3. In order to provide 48 hour extended detention for 497m^3 of storage, an 60mm orifice was utilized.

Refer to **Figure 5.1** and **Figure 5.2** for details of Facility 5914.

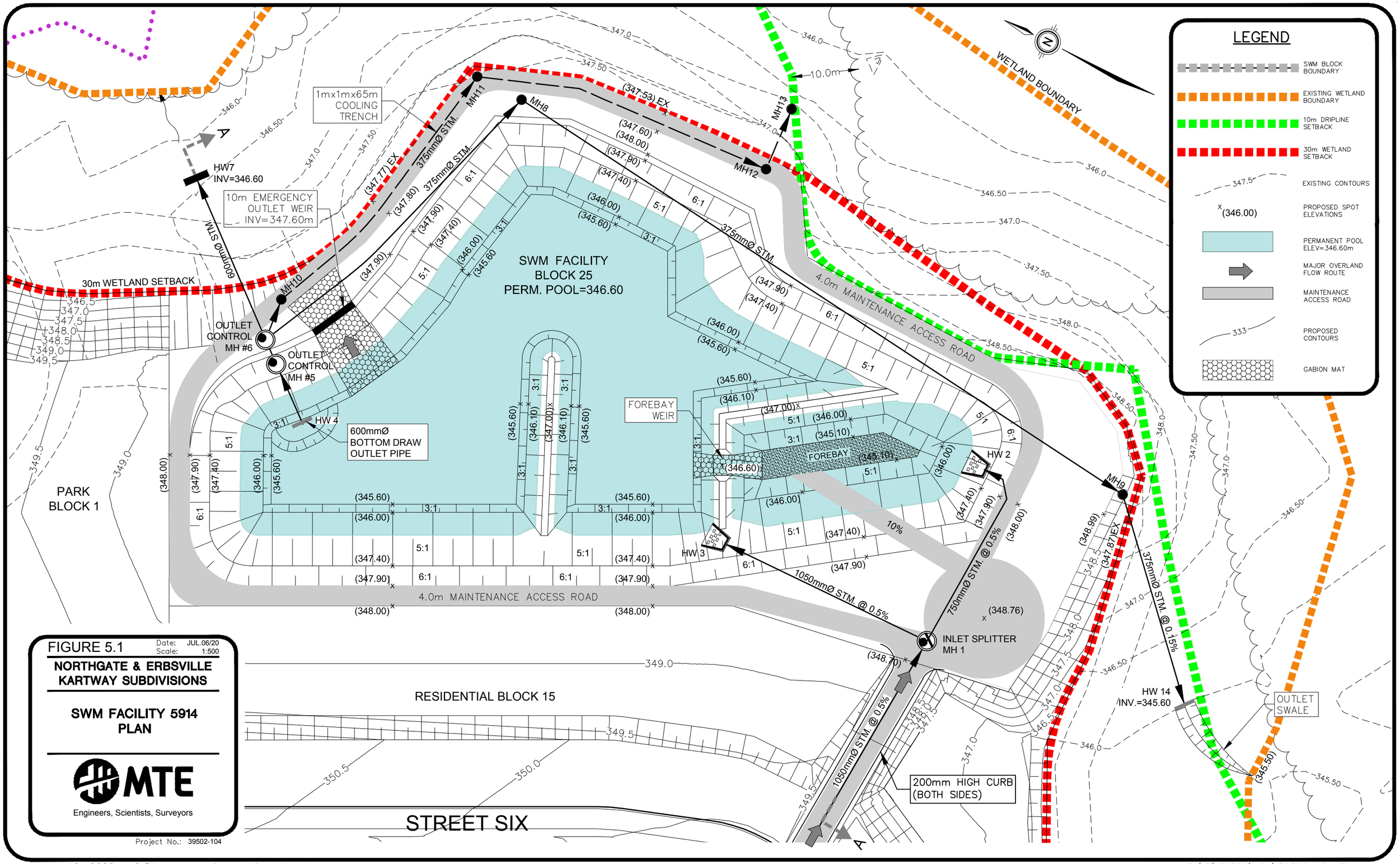


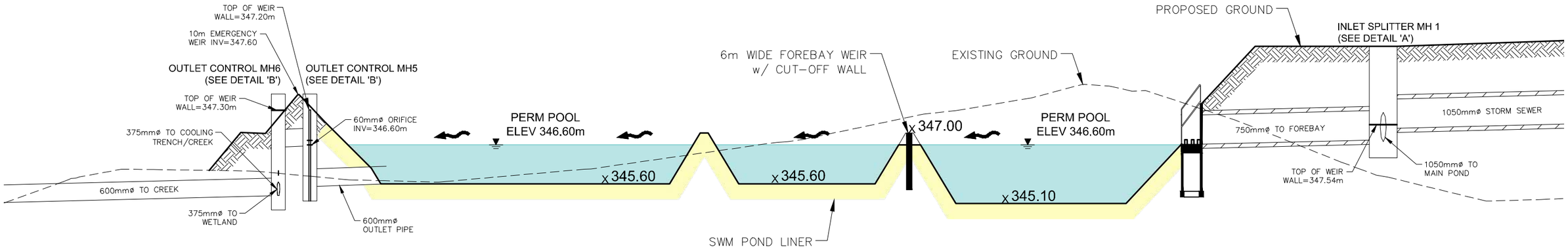
FIGURE 5.1 Date: JUL.06/20 Scale: 1:500

NORTHGATE & ERBSVILLE KARTWAY SUBDIVISIONS

SWM FACILITY 5914 PLAN

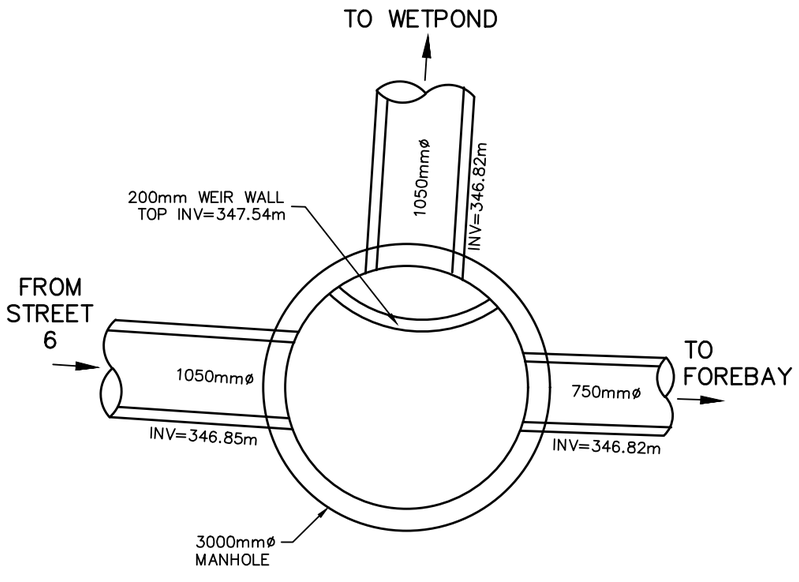
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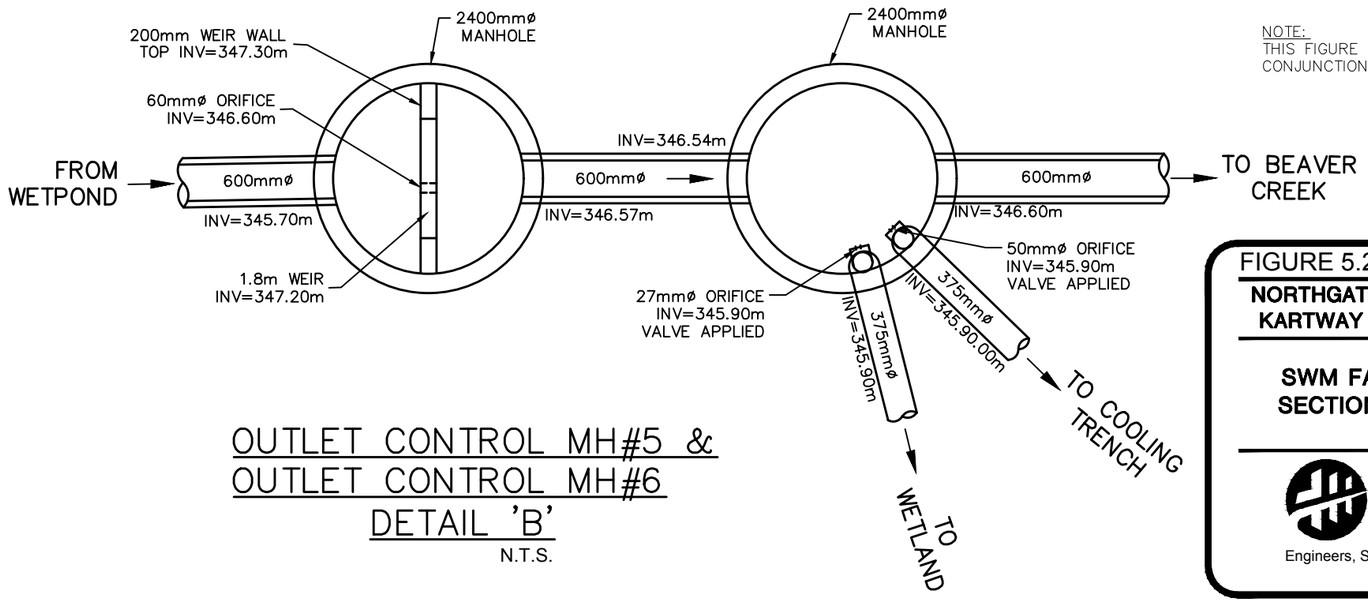


SWM FACILITY SECTION 'A-A'

SCALE H=1:500
V=1:100



INLET SPLITTER MH#1
DETAIL 'A'
N.T.S.



NOTE:
THIS FIGURE TO BE READ IN
CONJUNCTION WITH FIGURE 5.1

OUTLET CONTROL MH#5 &
OUTLET CONTROL MH#6
DETAIL 'B'
N.T.S.

FIGURE 5.2
Date: JUL.06/20
Scale: AS NOTED

NORTHGATE & ERBSVILLE KARTWAY SUBDIVISIONS

SWM FACILITY 5914 SECTION & DETAILS

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5.4 Stormwater Quantity Control

Flows for all storm events will be conveyed to the stormwater management facilities by a combination of storm sewer and overland flow route (road right-of-way). The post-development GAWSER design event modeling output is included in **Appendix B**.

This facility contains two outlet control manhole structures to control events up to the 100 year event. A 600mm diameter reverse sloped bottom-draw outlet pipe outlets into a control manhole, complete with an 60mm diameter orifice inside to provide extended detention control, as well as peak flow control for the 2 and 5 year storm events. A 1.8m long weir wall is provided inside control MH1 that will provide peak flow control for the storm events larger than the 5 year. An emergency overflow weir (10m wide) will allow the Regional Storm to pass through SWMF 5914.

The peak ponding elevation, storage, and outflow for Facility 5914 for the various design storms are shown in **Table 5.1**.

Table 5.1 – Proposed Event Model Output – Facility 5914

Storm Event	Maximum Ponding Elevation (m)	Peak Storage Requirement (m^3)	Allowable Peak Outflow (L/s)	Peak Outflow (L/s)
25 mm Storm Event	346.88	971	-	3.9
2 Year Storm Event	347.16	2,119	13.7	5.7
5 Year Storm Event	347.28	2,676	124.3	69.3
100 Year Storm Event	347.54	3,929	683.8	531.6
Regional Storm Event	347.73	4,890	-	1,673.0

Stormwater Management Facility 5914 design characteristics are summarized in **Table 5.2**. It should be noted that there are significant areas around the outer boundary of the multi-residential blocks that could not be directed to the proposed stormwater management facilities due to grading constraints. These areas (4915 and 4917), specifically rear yards and embankments, were included in the post-development model as draining un-controlled towards Beaver Creek catchment area 3911. This ensures a comprehensive assessment of water balance and erosion hour values. Refer to **Figure 4.2** for these catchment areas

Table 5.2 – Design Characteristics – Facility 5914

General	Facility Characteristics
Stormwater Management Facility Type	Wet Pond
Required MOE Water Quality Protection	Enhanced
Total Contributing Area	12.43ha
Imperviousness	63.5%
Bottom Elevation (of main facility)	345.60m
Storage	
Unit Area Storage Volume Requirements as per SWMMP (MOE 2003)	210 m^3/ha
Required Total Volume	2,608m^3
Permanent Pool	
Required Permanent Pool Volume	2,111m^3
Permanent Pool Volume Provided	2,800m^3
Permanent Pool Elevation	346.60m
Extended Detention (MOE)	
Minimum Required Volume	497m^3
Approximate Drawdown Time (for MOE Table 3.2 requirement)	94.5hr
Extended Detention Elevation	346.75m
Peak Release Rate for Extended Detention	0.0027 m^3/s
Forebay	
Required Forebay Length	18.3m
Actual Forebay Length	27.5m
Permanent Pool Elevation	346.60m
Bottom Elevation	345.10m
Outlet Controls	
Orifice 1 Diameter (Extended Detention)	60mm
Orifice 1 Invert Elevation	346.60m
Outlet Weir Length	1.8m
Outlet Weir Elevation (Quantity Control)	347.20m
Emergency Outlet Weir Length (Slope H:V =3:1)	10.0m
Emergency Outlet Weir Elevation	347.60m

5.5 Erosion Exceedance Analysis

As previously discussed, an erosion threshold analysis was completed on two sensitive reaches (BC-2 and BC-4) of Beaver Creek. Since BC-2 is located upstream of the Subject Lands, only BC-4 will be assessed for the purposes of this study. BC-4 is located at the downstream extend of the primary study area, immediately prior to the confluence with Laurel Creek. As discussed in the NWSSS, the threshold flows related to bank destabilization are lower the those for the creek bed, so the use of the bank flows as targets was used as a more conservative approach.

The critical bank and bed threshold exceedance flows for reach BC-4 are 310 L/s and 660L/s respectfully, and their existing conditions hours of exceedance (per year) are 188 and 83, respectively (Table 11.6 - NWSSS). From the post-development continuous model, the post-development yearly hours of exceedance under the proposed stormwater management scheme are 193 and 82, respectively. *It should be noted that the proposed conditions modeling completed as part of the NWSSS predicted yearly hours of exceedance for BC-4 of 196 and 83*. As described above, the revised proposed development continuous modeling (including the Northgate/Erbsville Kartway lands SWM strategy) has slightly lowered the NWSSS erosion exceedance duration.

A fluvial geomorphologic and erosion assessment was also completed for the LCRT as part of the BCM-CSWM-FSWMR. The erosion impact assessment concluded that under post-development conditions the erosion exceedance duration will be significantly reduced from current conditions.

5.6 Water Balance Analysis

During urban development, the conversion of pervious, vegetated area to impervious surfaces leads to a decrease in evapotranspiration and infiltration volumes and an increase in runoff volumes. The NWSSS established that both existing infiltration rates and existing surface water inputs to key natural features were to be maintained in the post-development condition.

Surface Water

The purpose of the surface water balance analysis is to identify potential impacts of the proposed development on the existing wetland feature (PSW) located near the central portion of the subject property. The hydrologic components (ET/R/I) used for the analysis were based on the GAWSER modeling results.

Figure 5.3 illustrates the existing surface water catchment areas for the central wetland. The pre-development surface water catchment area for the subject wetland was delineated into a western and eastern portion and also into catchments with similar existing topography, cover, and soil conditions. The on-site contributing area for the western and eastern portions was determined to be approximately 20.27ha and 12.68ha respectively, generating a total average annual runoff volume of 16,914m^3 and 10,729m^3 respectively. Calculations have been included in **Appendix D.**

Figure 5.4 illustrates the proposed conditions contributing drainage areas. Under post-development conditions, surface water contributions to the wetland include:

- runoff from the forested wetland and wetland setback.
- the open space areas adjacent to the wetland outside of the wetland setback.
- roof and rear yard runoff from adjacent lots directed to the wetland (39 lots adjacent to the western wetland, 5 lots in catchment 3917 and 0.18ha roofs in catchment 3915 drain to the eastern wetland).
- partial drainage from SWMF 5914 to the western wetland during non-winter months.

A total post-development runoff volume for the western and eastern wetlands of approximately 17,099m^3 and 10,932m^3 respectively was calculated based on the contributions from these areas. This represents a slight increase in total average annual runoff volume directed to the western and eastern wetland, of approximately 185m^3 (an increase of 1.1% annually) and 203m^3 (an increase of 1.9% annually).

Infiltration

The infiltration strategy identified for the subject development area is an enhancement over the current average annual volumes for the respective catchments. To that end, there are a variety of SWM practices that will be implemented within the development lands to achieve the infiltration targets that will include Lot-Level Controls, and End-of-Pipe Controls.

Lot-Level Controls

The lot level system will include amended topsoil (increased depth of topsoil) and infiltration facilities connected to roof areas.

Amended Topsoil

Amended topsoil is a lot-level, non-structural stormwater management practice that involves directing roof downspouts to gently sloping landscaped area that contain topsoil of sufficient permeability, depth (a topsoil depth of 450mm has been proposed) and quality to infiltrate and evaporate a significant portion of runoff during wet weather. The majority of the single family lots have been proposed with this practice, with the exception of lots adjacent to the central wetland that are required for surface water inputs to the wetland.

Amended topsoil/adsorbent landscape has been widely used in British Columbia for runoff reduction and the promotion of infiltration. Amended topsoil specifications as implemented in British Columbia have been provided in **Appendix E**. Area proposed to implement amended topsoil is shown in **Figure 5.5**.

Infiltration Facilities (Catchment 3914, 3915, 3917 and 3102)

The infiltration facilities have been designed to accept 30mm of runoff from the contributing roof area, which at preliminary design is assumed to be a total of 6.51 ha. The volume to area relationship modeled in GAWSER assumes a 0.35 void ratio. The facilities are to be oversized by 15% to provide some volumetric and infiltration capacity redundancy to allow for potential loss in performance over time. Roof runoff is to be directed to the infiltration facilities through direct connection of the roof leaders, and each facility will contain overflows to the storm sewer system.

Lot level infiltration galleries located within condominium blocks will be placed in a “common element”, and will likely consist of a series of independent infiltration galleries located in the front yards. Given the space requirements, the galleries will likely be constructed using a commercial subsurface storage system in order to provide the necessary volumetric efficiency. Runoff will enter the galleries through direct connection of roof leaders. The common element infiltration facilities are also to be oversized by 15%.

End-of-Pipe Controls

The end-of-pipe facilities within subcatchment 3915 and 3917 will contain subsurface infiltration galleries. Both infiltration facilities have been proposed downstream of a quality control device (oil-grit separator), and have been designed to produce no runoff during a 4hr-25mm design storm event. To avoid infiltrating chloride impacted runoff into the groundwater system, these two facilities will be ‘closed’ during winter months (December 1 to March 31).

Again, since these stormwater management controls are located within Blocks that will go through a Site Plan Approval process (and has only been conceptually designed and modeled as part of this study), sizing criteria has been included in Section 5.9.

The post-development GAWSER modeling has been utilized in order to determine whether the specified infiltration measures will achieve the criteria within the subject site. **Table 5.3** summarizes the post-development water balance resulting from the implementation of the proposed design measures.

Table 5.3 – Post-Development Annual Infiltration Values by Catchment

Condition	Hydrologic Component Values (mm/yr)			
	Catchment 3914	**Catchment 3915**	**Catchment 3917**	**Catchment 3102**
Precipitation	844.8	844.8	844.8	844.8
Existing Conditions Infiltration	211.9	222.9	177.0	183.4
NWSSS Infiltration Value	262.2	266.7	240.8	281.6
Proposed Infiltration Value	*268.3*	*298.5*	*287.5*	*300.4*

As can be seen from the summary table, implementation of the proposed infiltration measures results in an annual average infiltration depth of that exceeds the pre-development values and the NWSSS values for all catchments. More details of the post-development water balance are provided in **Appendix D**.

CONSERVATION DRIVE

BEAVER CREEK ROAD

CROPLAND

3914
10.32

3915
1.82

3911-1
8.12

WESTERN
WETLAND

3911-2
9.75

EASTERN
WETLAND

3917
1.27

3917
1.12

3918
0.57

WOODLOT

Beaver Creek

Floodline

Laurel Creek

Floodline

Laurel Creek

– SUBJECT LANDS
(55.714 ha)

WEST LOBE (3911–1, 3914, 3917 & 3918)
– PRE–DEVELOPMENT
WATER BALANCE AREA
– TOTAL 20.28 ha

EAST LOBE (3911–2, 3915 & 3917)
– PRE–DEVELOPMENT
WATER BALANCE AREA
– TOTAL 12.69 ha

FIGURE 5.3

Date: JUL.06/20
Scale: 1:3000

NORTHGATE & ERBSVILLE
KARTWAY SUBDIVISIONS

Pre-Development
Surface Water Balance Areas

MTE
Engineers, Scientists, Surveyors

Project No.: 39502-104

July 3, 2020 — 1:48 p.m. — Plotted By: KTaylor

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CONSERVATION DRIVE

STREET SEVEN

STREET FOUR

STREET THREE

STREET FIVE

STREET EIGHT

STREET SIX

STREET ONE

STREET TWO

BEAVER CREEK ROAD

Stage 1

Stage 2

Stage 3

Stage 4

Stage 5

Stage 6

Stage 7

Stage 8

REAR YARD

WESTERN WETLAND

EASTERN WETLAND

WOODLOT

Beaver Creek Floodline

Laurel Creek Floodline

Laurel Creek

FLOW

* 0.18ha ROOFS REQUIRED TO MEET SURFACE WATER BALANCE FOR THE EASTERN LOBE.

* 17 HALF ROOFS (90m2)
2 HALF ROOFS (130m2)
16 HALF ROOFS (153m2)
REQUIRED TO MEET SURFACE WATER BALANCE FOR THE WESTERN LOBE.

SOUTH SIDE OF ROAD TO DRAIN THROUGH CULVERTS UNDER PROPOSED CONDITION.

* 5 ROOFS (305m2) REQUIRED TO MEET SURFACE WATER BALANCE FOR THE EASTERN LOBE.

9152 / 0.10

1911-2 / 9.77

1911-1 / 7.17

9141 / 1.27

9171 / 0.81

9172 / 0.41

2911 / 0.96

3918 / 0.57

— SUBJECT LANDS (55.714 ha)

WEST LOBE (1911–1, 9141, 9171, 2911 & 3918)

— POST–DEVELOPMENT WATER BALANCE AREA

— NON–ROOF 11.20 ha — ROOF 0.87 ha

EAST LOBE (1911–2, 9152 & 9172)

— POST–DEVELOPMENT WATER BALANCE AREA

— NON–ROOF 11.03 ha — ROOF 0.18 ha

FIGURE 5.4

Date: JUL.06/20
Scale: 1:3000

NORTHGATE & ERBSVILLE KARTWAY SUBDIVISIONS

Post-Development Surface Water Balance Areas

MTE

Engineers, Scientists, Surveyors

Project No.: 39502-104

July 16, 2020 — 4:08 p.m. — Plotted By: AHenderson

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5.7 Thermal Mitigation

The main methodology of the thermal mitigation plan that was proposed as part of the NWSSS, was to infiltrate warmed stormwater below ground level where cold groundwater and/or relatively colder ambient temperatures will cool the stormwater, lowering the average stormwater temperatures prior to discharge to natural features.

The following measures have been proposed for the Subject Lands, and in combination will achieve the specified criteria.

Lot Level Infiltration

The majority of the stormwater runoff that is generated at the lot-level via roofs, and yards will be effectively disconnected from the creek during all rain events up to a 30 mm depth through the proposed at-source infiltration measures (amended topsoil and infiltration galleries).

End-of-Pipe Infiltration

Controlled development areas of subcatchment 3915 and 3917 will be designed to be completely disconnected from the creek during all non-winter rain events up to a 25 mm depth by means of subterranean manufactured infiltration chambers beside the dry ponds.

SWM Facility Design Features

The final component to address temperature concerns will be the design features that are incorporated into the end-of-pipe SWM facility. For Facility 5914, MTE is proposing a cooling trench as part of the thermal mitigation plan. The cooling trench will be located downstream of the SWM facility (to ensure maximum water quality treatment) and will take the form of a rock filled trench that will treat all flows from a 25mm storm event. To obtain maximum cooling effects, the proposed cooling trench will be located below the water table. MTE has completed monitoring of several cooling trenches designed and constructed over the past few years. Generally, if cooling trenches can be constructed in the water table and sized sufficiently large enough, and the inlet flows are restricted, then cooling of the surface discharge will be mitigated to achieve the target temperatures for frequent storm events.

Cooling infrastructure is to be designed to achieve an average discharge temperature that is equal to or less than the average stream temperature, for all storms up to the 25mm design storm event for normal climatic conditions. However, note that anomalous climatic conditions (i.e. ambient temperatures exceeding historical average temperatures, storm events larger than 25mm or back-to-back storms with sufficient volume) may influence discharge temperatures.

A conceptual heat transfer model has been prepared to estimate the performance of the cooling trenches during the 25mm storm event. A hard copy of portions of the model (to show the relevant parameters and pertinent design iteration) has been included in **Appendix F**. The model estimates a reduction in discharge temperature across the cooling trench, with an average flow-weighted discharge of approximately 21.9°C, and a maximum discharge temperature of 23.0°C. This model assumes that the inflow will be sent to a single cooling trench at 1m width, 1m height, and 65m length.

Other features to assist in reducing the temperature of surface runoff from the site are:

- Bottom draw outlet for cooling benefits resulting from thermal stratification within the facility.
- SWM facility perimeter plantings to be incorporated in the landscaping design for the facility.

CONSERVATION DRIVE

2004

2009

STREET ONE

STREET TWO

STREET THREE

STREET FOUR

STREET FIVE

STREET SIX

STREET SEVEN

STREET EIGHT

PARK

MULTI-RES BLOCK

SWM FACILITY 5914

SWMP 5915

SWMP 5917

END-OF-PIPE CONTROL
DRY POND

END-OF-PIPE CONTROL
INFILTRATION TRENCH

LOT LEVEL CONTROL
AMENDED TOPSOIL
(450mm DEPTH)

END-OF-PIPE CONTROL
DRY POND

Stage 1

Stage 2

Stage 3

Stage 4

Stage 5

Stage 6

Stage 7

Stage 8

Beaver Creek

Laurel Creek

Floodline

Escarpment

LEGEND

- SUBJECT LANDS (55.72 ha)
- AMENDED TOPSOIL AREA
- FULL ROOF TO INFILTRATION GALLERY 3.13ha
- FRONT HALF ROOF TO INFILTRATION GALLERY & REAR HALF ROOF TO REAR YARD 1.55ha
- FULL ROOF REAR YARD/ WETLAND 0.33ha
- EROSION ASSESSMENT NODE

FIGURE 5.5

Date: JUL.06/20
Scale: 1:3000

NORTHGATE & ERBSVILLE KARTWAY SUBDIVISIONS

DETAILED POST DEVELOPMENT INFILTRATION MEASURES

MTE

Engineers, Scientists, Surveyors

Project No.: 39502-104

July 16, 2020 — 4:12 p.m. — Plotted By: AHenderson

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2004 *

CONSERVATION DRIVE

END-OF-PIPE CONTROL
Infiltration Trench (543m^2);
1.05m storage depth
265m^3 total volume

MULTI-RES BLOCK

3915
0.89

SWMF
5915

LOT-LEVEL
Subsurface Infiltration
Gallery (0.10 ha roofs);
0.5m Storage Depth
35m^3 total volume (Stone)

STREET ONE

BIRD CORRIDOR (215m)

Beaver Creek

Floodline

END-OF-PIPE CONTROL
Infiltration Trench (339m^2);
0.75m storage depth
122m^3 total volume

OPEN SPACE

LOT-LEVEL
Subsurface Infiltration
Gallery (9 roofs);
1.0m Storage Depth
82m^3 total volume (Stone)

STREET TWO

3917
1.27

SWMF
5917

Surveyed Wetland

CONDO BLOCK

Stage 8

2009 *

N

LEGEND

- STUDY AREA
- * – EROSION ASSESSMENT NODE
- VOLUME REDUCTION FACILITY
- QUANTITIY CONTROL FACILITY

FIGURE 5.6

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NORTHGATE & ERBSVILLE
KARTWAY SUBDIVISIONS

CONCEPTUAL BLOCK LEVEL
SWM (5915 & 5917)

MTE
Engineers, Scientists, Surveyors

Project No.: 39502-104

July 16, 2020 — 4:16 p.m. — Plotted By: AHenderson

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5.8 Landscape Design

A landscape design for the proposed stormwater management facility (Facility 5914) will be completed during the final design stage of the development. The landscape design is to address aesthetics, erosion protection, long term bank stability, and to limit pedestrian access into the permanent pool components. To this end, the facility will be designed in accordance to the City of Waterloo's Stormwater Management Policies and Guidelines for aesthetics, landscape and safety of stormwater management facilities.

5.9 Chloride Impact Assessment

A chloride impact assessment for the Northgate & Erbsville Kartway subdivisions has been prepared as part of this study. The purpose of this assessment is to assess impacts to the groundwater system, and if necessary, mitigate the impacts by proposing enhanced development and construction techniques. The assessment requires the calculation of the salt loading from de-icing operation to the groundwater so as to ensure that groundwater chloride concentrations will remain within the Reasonable Use Guidelines established by the Ministry of the Environment, Conservation and Parks (MECP – formerly known as the MOE). The chloride impact assessment for the development is documented in a technical memorandum in **Appendix I.**

5.10 Block Level Stormwater Management

The proposed draft plans of subdivision for the subject property contains a number of Blocks that will be developed through a Site Plan Approval process. As part of that process, a detailed Stormwater Management Plan will be prepared showing how the stormwater control measures will adhere to the NWSSS criteria and be implemented within the Block. Two of these Blocks will contain future stormwater management facilities. To facilitate this process and ensure adherence with the NWSSS criteria, the following summarizes the overall approach for stormwater management for the two Blocks that will contain future stormwater management facilities (also see **Figure A1**):

Water Quality Control

Provide an *Enhanced* level of stormwater quality control. This can be achieved via an oil-grit separator for SWMF 5915 and 5917. The oil-grit separator will target 80% TSS removal for the storm drainage area draining to the dry ponds.

Water Quantity and Erosion Control

Post-development peak flows must be controlled to unit flow rate targets for the 2yr, 5yr and 100yr storm events. Refer to **Figure A1** for allowable unit flow targets.

SWMF 5915 - Water quantity control is expected to be achieved via a dry pond, complete with a multi-stage outlet structure.

SWMF 5917 – Water quantity control is expected to be achieved via a dry pond, complete with a multi-stage outlet structure.

Water Balance

Infiltration – maintain or enhance existing recharge rates across the development area.

–Within subcatchment 3915 and 3917, infiltration galleries sized for 30mm rainfall are to be provided for all the roof areas, except for those assigned to contribute surface water to the wetland. The end-of-pipe infiltration facility has been preliminarily sized such that no runoff is produced under a 4 hour, 25mm storm event. An infiltration rate within the facility block of 15mm/hr has been assumed as part of this design. Suitable soils must be provided, either through selective filling during area grading or replacement of existing soils that are not acceptable.

Thermal Mitigation

Provide temperature mitigation measures prior to discharge to the receiving systems.

–For both subcatchments 3915 and 3917, thermal mitigation is achieved through infiltration of all rainfall occurring up to and including the 4 hour, 25mm storm event.

6.0 Monitoring Program

In accordance with the recommendations of the NWSSS, a monitoring program is to be designed and implemented by the developer. The plan will serve to ensure that the mitigation measures proposed within the development are implemented and performing at an acceptable level, and will also help to communicate performance and understand potential impacts.

Based on the framework provided in the LCWS, the City of Waterloo has implemented the Laurel Creek Watershed Development Monitoring Program, which describes a monitoring strategy with three components:

1. ***System Monitoring*** – undertaken by the City
2. ***Development / During Construction Monitoring*** – The developer is responsible for monitoring during the development process and includes 3 stages;
    - Pre-Construction Monitoring (stage I)
    - During-Construction Monitoring (stage II)
    - Post-Construction Monitoring (stage III)
3. ***Post-Development Monitoring*** – the City is responsible for monitoring facilities following municipal assumption.

6.1 Pre-Construction Monitoring Program

This portion of the monitoring is intended to establish the detailed site background conditions and baseline data. This information will facilitate comparison with conditions during and following construction and allow an evaluation of the mitigation measures. The pre-construction monitoring program includes the following parameters:

- **Surface Water Quality** – Stantec is completing this portion of the monitoring for the subwatershed area under separate cover.
- **Surface Water Temperature** – Stantec is also completing this portion of the monitoring for the subwatershed area under separate cover.
- **Groundwater** – monitoring includes chemistry, levels, and temperature.
- **Biological** – Annual sampling (NRSI is completing this monitoring).

6.2 During-Construction Monitoring Program

The purpose of this stage of the monitoring is to continue with the pre-construction monitoring program in order to monitor the effectiveness of erosion and sediment control measures, and to confirm that mitigative measures are functioning properly. The proper function of SWM measures during construction should allow in-stream targets to be met during-construction. Additional monitoring (over and above the pre-construction program) will include:

- **Stormwater Management Facility** – Standard inspection of vegetation, structures, and general operation of hydraulic controls (observations of drawdown) within the Stormwater Management Facility. These inspections are to occur seasonally and typically after a significant rainfall event.
- **Erosion and Sediment Control** – per ESC plans.

This stage will begin at the commencement of area grading of the subdivision and will continue until 90% stabilization of the SWM Facility contributing catchment area is achieved (houses are constructed, lots are sodded). **Table 6.1** summarizes the during-construction monitoring activities.

Annual reports are to be submitted, summarizing the data collected along with any conclusions, to the City, the GRCA, and the Region.

6.3 Post-Construction Monitoring Program

This period of the monitoring will begin following 90% stabilization of the contributing catchment area to the SWM Facility (houses are constructed, lots are sodded). The purpose of this stage of the monitoring is to evaluate the performance of the constructed SWM Facility under "ultimate" operating conditions. The post-construction monitoring period will extend for a 2 year period. Monitoring during this stage will include all components from the pre-construction and during-construction monitoring program.

Table 6.2 summarizes the during and post-construction monitoring activities.

Table 6.1 - Pre-Construction Monitoring Summary

	NWSSS Recommended Monitoring Program				
	Component	*Frequency*	*Locations*	*Completed by or details*	*Status*
Surface Water	Water Quality	Annual Samples	Beaver Creek	Completed by Stantec – System monitoring	On-going
	Water Quality (Temperature)	Continuous (30 min. interval)	Beaver Creek	Completed by Stantec – System monitoring	On-going
Groundwater	Levels and Temperature	Continuous (60 min. interval)	Northgate & Erbsville Kartway Subdivisions	MW100-14; MW101-14; MW102-14; MW103-14; MW104-14; MW105a-14; MW105b-14; MW106-14; MW107-14; MW108-14; MW109a-14; MW109b-19R; MW110-14; MW8-10S; MW8-10D; MW10-10; MW12-10S; MW12-10D; MW13-10	MTE – 2015 to Present
	Chemistry	March, 2017	Northgate & Erbsville Kartway Subdivisions	MW101-14; MW102-14; MW103-14; MW104-14; MW105a-14; MW105b-14; MW109a-14; MW109b-14; MW110-14	
Biological	Refer to NRSI monitoring	Annual			

Table 6.2 - During and Post-Construction Monitoring Summary

	NWSSS Recommended Monitoring Program				
	Component	*Frequency*	*Locations*	*Completed by or details*	*Status*
Surface Water	Water Quality	Annual Samples	Beaver Creek	Completed by Stantec – System monitoring	Stantec – During/Post Development
	Water Quality (Temperature)	Continuous (30 min. interval)	Beaver Creek	Completed by Stantec – System monitoring	Stantec – During/Post Development
Groundwater	Levels and Temperature	Continuous (60 min. interval)	Northgate & Erbsville Kartway Subdivisions	MW100-14; MW101-14; MW103-14; MW104-14; MW107-14; MW108-14	MTE – During/Post Development
	Chemistry	Annual Samples	Northgate & Erbsville Kartway Subdivisions	MW100-14; MW101-14; MW103-14; MW104-14; MW107-14; MW108-14	MTE – During/Post Development
Stormwater Management Facility		Monthly (after significant rainfall event)	Northgate Subdivision	SWMF 5914	MTE – During/Post Development
Erosion & Sediment Control	Per ESC plans	Monthly (after significant rainfall event)	Northgate & Erbsville Kartway Subdivisions		MTE – During/Post Development
Biological	Refer to NRSI monitoring plan	Annual			

CONSERVATION DRIVE

MW8-10D
MW8-10S
MW101-14
MW103-14
MW105a-14
MW105b-14
MW102-14
MW111-14
MW104-14
MW10-10
MW106-14
NORTHGATE SUBDIVISION
MW108-14
BEAVER CREEK ROAD
Beaver Creek
MW110-14
MW107-14
MW109a-14
MW109b-19R
MW12-10D
MW12-10S
MW13-10
MW100-14
Laurel Creek
Laurel Creek

LEGEND

- SUBJECT LANDS (55.72 ha)
- WATER LEVEL MONITORING
- MW100-14 – MONITORING WELL IDENTIFICATION

FIGURE 6.1
Date: JUL.06/20
Scale: 1:3000
NORTHGATE & ERBSVILLE KARTWAY SUBDIVISIONS
PRE-CONSTRUCTION MONITORING

MTE
Engineers, Scientists, Surveyors

Project No.: 39502-104

July 3, 2020 — 2:30 p.m. — Plotted By: KTaylor

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7.0 Erosion and Sediment Control Measures

Precautions will be taken during construction to limit erosion and sedimentation. Erosion and Sediment Control Plans will be prepared and provided during the detailed design stage. The plans will illustrate the erosion and sediment control measures to be implemented during construction, which will limit impacts associated with site development.

Typically, the recommended construction sequence for erosion and sediment control measures are as follows:

- Placement of all sediment control fencing where required.
- Stripping and strategic placement of topsoil stockpiles. Placement of sediment control fencing around all stockpile areas.
- Construction of temporary sediment control ponds which will serve as sedimentation basins for the site during construction.
- Construction of temporary swales to direct runoff to sedimentation basins, with rock check dams as required to control velocities.
- Re-vegetation of completed areas as soon as possible after construction, including those areas not slated for construction within 60 days.

Where rock check dams are proposed to promote sedimentation and reduce velocities, clean aggregate is to be placed perpendicular to the direction of flow in the swale, with a small volume of excavation on the upstream side to provide storage for accumulated sediment.

Sediment control fencing shall consist of filter fabric attached to page wire fencing and sealed at ground level. It will be installed at the perimeter of the work areas and intermittently on sloped areas where required. Sediment control fencing will be placed around all topsoil stockpiles.

Storage consistent with the GRCA's requirement of 125m^3/ha of live and dead storage respectively (total 250m^3/ha), will be provided. This storage will be provided to ensure that suspended material will have ample time to settle out. In addition, the sediment basin will be sized with sufficient capacity to allow flows to pass without breaching. Once the active construction and grading activities have been completed, the sedimentation basins can be cleaned out.

Access to topsoil or fill storage areas will be located on the upstream side of storage piles. This practice will ensure continuity of the sediment control fencing in the downslope direction; which is most vulnerable to erosion and sediment deposition. Further, topsoil and hydroseed will be placed on all exposed areas following the completion of grading activities.

It is recommended that during construction, monitoring and inspection of the erosion and sediment controls be conducted to ensure the satisfactory performance of these measures. Reporting of the inspection and monitoring results should be distributed to the City of Waterloo and the GRCA. If it is found that the erosion and sediment control measures are not working adequately, they shall be augmented to the satisfaction of the City and the GRCA, based on field decisions.

8.0 Conclusions and Recommendations

Based on the foregoing analyses, it is concluded that:

1. The stormwater management strategy outlined herein will provide the Northgate and Erbsville Kartway developments with appropriate levels of quality, quantity, erosion, water balance and temperature control.
2. “Enhanced” quality control of stormwater runoff can be provided in the proposed stormwater management facility.
3. Quantity control targets for post-development peak flows as identified in the NWSSS can be achieved in the proposed stormwater management facility for the 2 year through the 100 year storm events.
4. Adequate storage and release rate control has been provided to meet the extended detention storage and drawdown requirements for the 25 mm storm events.
5. Implementing erosion and sediment controls during construction will minimize any negative impacts of construction activities on the adjacent properties and the receiving watercourse.
6. Water Balance targets can be satisfactorily met through the use of the prescribed lot-level, and end-of-pipe infiltration measures as described within this report.
7. Based on a conservative mass balance analysis, the expected average post-development groundwater chloride concentration of 29mg/L is below the Ontario Drinking Water Standard of 250mg/L and the Reasonable Use Concept limit of 126mg/L.

The findings of this report, and the above conclusions, lead to the following recommendations:

1. That a quality/quantity control stormwater management facility be constructed to provide control of stormwater as described in Sections 4 and 5 of this report.
2. That the Water Balance, as calculated in this report, be reviewed and re-confirmed during final design.
3. That during the site grading operations, soils be selectively excavated and placed, under the supervision of a geotechnical engineer, in order to maximize the post-development areas suitable for infiltration.
4. That erosion and sediment controls during construction as described in Section 6 of this report be implemented.
5. That the conceptual design and modeling of the future stormwater management facilities contained within the subdivision be reviewed and re-confirmed at the time of final design.
6. Salt Management Plans be prepared for all blocks subject to site plan approval and/or a plan of condominium approval.

All of which is respectfully submitted,

MTE Consultants Inc.





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Appendix A

SWM Design Calculations

NORTHGATE, NORTH WATERLOO
PRELIMINARY SWMF 5914
Waterloo, Ontario

Project Number:	39502-104
Date:	May 25, 2020
Design By:	EPB
File:	Q:\39502\104\Prelim SWM\SWMFs -epb\39502-104 SWMF5914 Design - epb.xlsx

Step 1: Choose Level of Water Quality Control

Enhanced 80% long-term S.S. removal

Step 2: Choose Type of Facility

Wet Pond

Step 3: Define Catchment area and Imperviousness

Catchment Area (ha)	Imperviousness (%)
12.43	63.5

Interpolated Storage Volume Requirement (m^3/ha)

209.8

Permanent Pool Required (m^3)

2111.0

Extended Detention Volume Required (m^3)

497.2

Table 3.2 Water Quality Storage Requirements based on Receiving Waters (from MOE Stormwater Management Planning and Design Manual, March 2003)

Protection Level	SWMP Type	Storage Volume (m^3/ha) for Impervious Level			
		35	55	70	85
Enhanced 80% long-term S.S. removal	*Wetlands*	80	105	120	140
	Hybrid Wet Pond/Wetland	110	150	175	195
	Wet Pond	140	190	225	250
Normal 70% long-term S.S. Removal	*Wetlands*	60	70	80	90
	Hybrid Wet Pond/Wetland	75	90	105	120
	Wet Pond	90	110	130	150
Basic 60% long-term S.S. Removal	*Wetlands*	60	60	60	60
	Hybrid Wet Pond/Wetland	60	70	75	80
	Wet Pond	60	75	85	95
	Dry Pond (Continuous Flow)	90	150	200	240

NORTHGATE, NORTH WATERLOO
PRELIMINARY SWMF 5914
Waterloo, Ontario

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STAGE-STORAGE RELATIONSHIP

Stage	Active Depth	Forebay (Permanent Pool)			Main Pond			Total Pond Volume	Active Storage Volume	Volume Summary		Comments	Stage
		Area	Volume	Cumulative Volume	Area	Volume	Cumulative Volume						
m	*m*	m^2	m^3	m^3	m^2	m^3	m^3	m^3	m^3	m^3			*m*
345.10		93	0	0	0	0	0	0					345.10
345.20		118	11	11	0	0	0	11					345.20
345.30		144	13	24	0	0	0	24					345.30
345.40		169	16	39	0	0	0	39					345.40
345.50		194	18	57	0	0	0	57					345.50
345.60		219	21	78	1777	0	0	78					345.60
345.70		245	23	101	1862	182	182	283					345.70
345.80		270	26	127	1946	190	372	499					345.80
345.90		295	28	155	2031	199	571	726					345.90
346.00		320	31	186	2115	207	778	964					346.00
346.10		346	33	219	2298	221	999	1218					346.10
346.20		371	36	255	2481	239	1238	1493					346.20
346.30		396	38	294	2664	257	1495	1789					346.30
346.40		421	41	334	2846	276	1771	2105					346.40
346.50		447	43	378	3029	294	2064	2442					346.50
346.60		472	46	**424**	3212	312	**2377**	**2800**				Permanent Pool	346.60
346.60	0.00				3326	0	0	2800	0				346.60
346.70	0.10				3509	342	342	3142	342	497	346.75	MOE Extended Detention	346.70
346.80	0.20				3692	360	702	3502	702				346.80
346.90	0.30				3875	378	1080	3880	1080	971	346.88	25mm	346.90
347.00	0.40				4057	397	1477	4277	1477				347.00
347.10	0.50				4240	415	1892	4692	1892	2119	347.16	2 yr	347.10
347.20	0.60				4423	433	2325	5125	2325				347.20
347.30	0.70				4606	451	2776	5577	2776	2676	347.28	5 yr	347.30
347.40	0.80				4789	470	3246	6046	3246				347.40
347.50	0.90				4972	488	3734	6534	3734				347.50
347.60	1.00				5155	506	4240	7041	4240	3929	347.54	100 yr	347.60
347.70	1.10				5338	525	4765	7565	4765	4890	347.73	Regional	347.70
347.80	1.20				5520	543	5308	8108	5308				347.80
347.90	1.30				5703	561	5869	8669	5869				347.90

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Orifice Calculations

$Q_o=C_d*A_o*(2*g*H_o)^{0.5}$

	Orifice 1	Orifice 2	Orifice 3
C_d	0.63	0.63	0.63
Invert (m)	346.60	500.00	500.00
Width (m)	0.00	0.00	0.00
Diameter/Height (m)	0.060	0.000	0.000
Type (H/V)	V	V	V

Cd	Description
0.63	Orifice Plate
0.82	Eccentric Reducer

Weir Calculations

$Q_w = 2/3*C_w*(2g)^{1/2}*L*H_w^{3/2} + 8/15*C_w*(2g)^{1/2}*\tan\theta*H_w^{5/2}$

		Emergency Overflow
Cw	0.50	0.50
Invert (m)	347.200	347.60
Length (m)	1.8	10
Side Slope (H:V)	0	3
Side Slope (rad)	0.000	1.249

STAGE-DISCHARGE RELATIONSHIP

MH#5

Stage	Active Volume	Orifice 1			Orifice 2			Orifice 3			Level Control Weir		Emergency Overflow Weir		Total Flow
		Area	H_o	Flow	Area	H_o	Flow	Area	H_o	Flow	H	Flow	H	Flow	
m	m^3	m^2	*m*	m^3/s	m^2	*m*	m^3/s	m^2	*m*	m^3/s	*m*	m^3/s	*m*	m^3/s	m^3/s
346.60	0	0.000	0.00	0.0000	0.00	0.00	0.0000	0.000	0.00	0.0000					0.0000
346.70	342	0.003	0.07	0.0021	0.00	0.00	0.0000	0.000	0.00	0.0000					0.0021
346.77	587	0.003	0.14	0.0029	0.00	0.00	0.0000	0.000	0.00	0.0000					0.0029
346.80	702	0.003	0.17	0.0033	0.00	0.00	0.0000	0.000	0.00	0.0000					0.0033
346.86	929	0.003	0.23	0.0038	0.00	0.00	0.0000	0.000	0.00	0.0000					0.0038
346.90	1080	0.003	0.27	0.0041	0.00	0.00	0.0000	0.000	0.00	0.0000					0.0041
347.00	1477	0.003	0.37	0.0048	0.00	0.00	0.0000	0.000	0.00	0.0000					0.0048
347.05	1684	0.003	0.42	0.0051	0.00	0.00	0.0000	0.000	0.00	0.0000					0.0051
347.10	1892	0.003	0.47	0.0054	0.00	0.00	0.0000	0.000	0.00	0.0000					0.0054
347.20	2325	0.003	0.57	0.0060	0.00	0.00	0.0000	0.000	0.00	0.0000	0.00	0.0000			0.0060
347.22	2415	0.003	0.59	0.0061	0.00	0.00	0.0000	0.000	0.00	0.0000	0.02	0.0075			0.0136
347.30	2776	0.003	0.67	0.0065	0.00	0.00	0.0000	0.000	0.00	0.0000	0.10	0.0840			0.0905
347.40	3246	0.003	0.77	0.0069	0.00	0.00	0.0000	0.000	0.00	0.0000	0.20	0.2377			0.2446
347.50	3734	0.003	0.87	0.0074	0.00	0.00	0.0000	0.000	0.00	0.0000	0.30	0.4367			0.4441
347.55	3987	0.003	0.92	0.0076	0.00	0.00	0.0000	0.000	0.00	0.0000	0.35	0.5503	0.00	0.0000	0.5579
347.60	4240	0.003	0.97	0.0078	0.00	0.00	0.0000	0.000	0.00	0.0000	0.40	0.6723	0.00	0.0000	0.6801
347.70	4765	0.003	1.07	0.0082	0.00	0.00	0.0000	0.000	0.00	0.0000	0.50	0.9396	0.10	0.4781	1.4259
347.73	4928	0.003	1.10	0.0083	0.00	0.00	0.0000	0.000	0.00	0.0000	0.53	1.0255	0.13	0.7137	1.7474
347.80	5308	0.003	1.17	0.0085	0.00	0.00	0.0000	0.000	0.00	0.0000	0.60	1.2352	0.20	1.3840	2.6277
347.90	5869	0.003	1.27	0.0089	0.00	0.00	0.0000	0.000	0.00	0.0000	0.70	1.5565	0.30	2.6008	4.1662

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Orifice Calculations

$Q_o=C_d*A_o*(2*g*H_o)^{0.5}$

	Orifice 1 cooling trench	Orifice 2 wetland	Outlet Pipe creek
C_d	0.63	0.63	0.63
Invert (m)	345.90	345.90	346.60
Width (m)	0.00	0.00	0.00
Diameter/Height (m)	0.050	0.027	0.600
Type (H/V)	V	V	V

Cd	Description
0.63	Orifice Plate
0.82	Eccentric Reducer

Weir Calculations

$Q_w = 2/3*C_w*(2g)^{1/2}*L*H_w^{3/2} + 8/15*C_w*(2g)^{1/2}*\tan\theta*H_w^{5/2}$

Level Control

Cw	0.50
Invert (m)	500.000
Length (m)	0
Side Slope (H:V)	0
Side Slope (rad)	0.000

STAGE-DISCHARGE RELATIONSHIP

MH#6

Stage	Active Volume	Orifice 1			Orifice 2			Orifice 3			Level Control Weir		Total Flow
		Area	H_o	Flow	Area	H_o	Flow	Area	H_o	Flow	H	Flow	
m	m^3	m^2	*m*	m^3/s	m^2	*m*	m^3/s	m^2	*m*	m^3/s	*m*	m^3/s	m^3/s
345.90	0	0.000	0.00	0.0000	0.000	0.00	0.0000	0.000	0.00	0.0000			0.0000
346.00	0	0.002	0.07	0.0015	0.001	0.09	0.0005	0.000	0.00	0.0000			0.0020
346.10	0	0.002	0.17	0.0023	0.001	0.19	0.0007	0.000	0.00	0.0000			0.0030
346.20	0	0.002	0.27	0.0029	0.001	0.29	0.0009	0.000	0.00	0.0000			0.0037
346.30	0	0.002	0.37	0.0034	0.001	0.39	0.0010	0.000	0.00	0.0000			0.0043
346.40	0	0.002	0.48	0.0038	0.001	0.49	0.0011	0.000	0.00	0.0000			0.0049
346.50	0	0.002	0.58	0.0042	0.001	0.59	0.0012	0.000	0.00	0.0000			0.0054
346.60	0	0.002	0.68	0.0045	0.001	0.69	0.0013	0.000	0.00	0.0000			0.0058
346.70	342	0.002	0.78	0.0048	0.001	0.79	0.0014	0.031	0.05	0.0193			0.0256
346.77	587	0.002	0.84	0.0050	0.001	0.85	0.0015	0.065	0.08	0.0524			0.0589
346.80	702	0.002	0.88	0.0051	0.001	0.89	0.0015	0.083	0.10	0.0728			0.0794
346.86	929	0.002	0.94	0.0053	0.001	0.95	0.0016	0.117	0.13	0.1182			0.1250
346.90	1080	0.002	0.98	0.0054	0.001	0.99	0.0016	0.141	0.15	0.1528			0.1598
347.00	1477	0.002	1.08	0.0057	0.001	1.09	0.0017	0.200	0.20	0.2499			0.2572
347.05	1684	0.002	1.13	0.0058	0.001	1.14	0.0017	0.227	0.22	0.3011			0.3086
347.10	1892	0.002	1.18	0.0059	0.001	1.19	0.0017	0.252	0.25	0.3513			0.3590
347.20	2325	0.002	1.28	0.0062	0.001	1.29	0.0018	0.283	0.30	0.4322			0.4402
347.22	2415	0.002	1.30	0.0062	0.001	1.31	0.0018	0.283	0.32	0.4463			0.4544
347.30	2776	0.002	1.38	0.0064	0.001	1.39	0.0019	0.283	0.40	0.4990			0.5073
347.40	3246	0.002	1.48	0.0067	0.001	1.49	0.0019	0.283	0.50	0.5579	0.00	0.0000	0.5665
347.50	3734	0.002	1.58	0.0069	0.001	1.59	0.0020	0.283	0.60	0.6112	0.00	0.0000	0.6201
347.55	3987	0.002	1.63	0.0070	0.001	1.64	0.0020	0.283	0.65	0.6361	0.00	0.0000	0.6451
347.60	4240	0.002	1.68	0.0071	0.001	1.69	0.0021	0.283	0.70	0.6601	0.00	0.0000	0.6693
347.70	4765	0.002	1.78	0.0073	0.001	1.79	0.0021	0.283	0.80	0.7057	0.00	0.0000	0.7151
347.73	4928	0.002	1.81	0.0074	0.001	1.82	0.0022	0.283	0.83	0.7188	0.00	0.0000	0.7283
347.80	5308	0.002	1.88	0.0075	0.001	1.89	0.0022	0.283	0.90	0.7485	0.00	0.0000	0.7582
347.90	5869	0.002	1.98	0.0077	0.001	1.99	0.0023	0.283	1.00	0.7890	0.00	0.0000	0.7990

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FOREBAY DESIGN CALCULATIONS - POND ON NORTHGATE LANDS
MOE SWM Planning and Design Manual, 2003

Forebay Design Flows

Flow into forebay during the 1:5-year return period event	0.828 m^3/s
Flow into forebay during the 25 mm - 4 hour design storm event	0.523 m^3/s
Peak flow from main pond outlet for the 25mm design storm (from MIDUSS)	0.004 m^3/s

Forebay Characteristics

b =	4.3 *m*	bottom width	
y =	1.5 *m*	depth	
z =	3 :1	side slope	(3:1 first 0.9 m depth then 5:1 for 0.6 m depth - same as main cell as per MOE)
w =	8.8 *m*	average width	
R =	0.96 *m*	hydraulic radius	
A =	13.2 m^2	cross-sectional area	

1. Length Calculation Based on Settling Velocity

L = forebay flow length ***(m)***
r = length-to-width ratio
Q_p = peak flow rate through forebay ***(m^3/s)***
v_s = settling velocity ***(m/s)***

$$L = \sqrt{\frac{rQ_p}{v_s}}$$ Equation 4.5: Forebay Settling Length

a) Required Settling Length (assuming Q_p = forebay through-flow & v_s = 0.0055 m/s)

Q_p =	0.52 m^3/s	peak flow rate through forebay
v_s =	0.0055 *m/s*	settling velocity
r =	2.08	length-to-width ratio
L =	18.3 *m*	required settling length
L =	***18.3*** *m*	***trial length***

b) Required Settling Length (assuming Q_p = pond discharge & v_s = 0.0003 m/s)

Q_p =	0.004 m^3/s	peak flow rate through forebay
v_s =	0.0003 *m/s*	settling velocity
r =	0.17	length-to-width ratio
L =	1.5 *m*	required settling length
L =	***1.5*** *m*	***trial length***

Table 1: Average settling velocities

	Mass Removed	Particle Size Range	Average Settling Velocity
	%	*µm*	*m/s*
	80 - 100	x ≤ 20	0.00000254
Enhanced:	70 - 80	20 < x ≤ 40	0.00001300
Normal:	60 - 70	40 < x ≤ 60	0.00002540
Basic:	40 - 60	60 < x ≤ 130	0.00012700
Medium Sand:	20 - 40	130 < x ≤ 400	0.00059267
Gross Grit:	0 - 20	400 < x ≤ 4000	0.00550333

2. Length Calculation Based on Flow Dispersion Length

Q =	0.83 m^3/s	inlet flow rate
d =	3 *m*	depth of permanent pool in forebay
V_f =	0.50 *m/s*	desired velocity in forebay (typical value ≤ 0.50 *m/s*)
L =	4.4 m	required length of dispersion

$$L_D = \frac{8Q}{dV_f}$$ Equation 4.6: Dispersion Length

3. Required Forebay Length

L =	**18.3** *m*	**design length**
r =	2.08	design length-to-width ratio (typical minimum of 2.0)

4. Scour Velocity

v_s =	0.15 *m/s*	scour velocity (typical value = 0.15 *m/s*)
v =	**0.06** *m/s*	**actual velocity**

OK The actual velocity through the forebay is less than the scour velocity.

5. Weir Flow From Forebay

L =	6 *m*	length of crest of weir
α =	1.65	coefficient
H =	0.3 *m*	head
Q =	**1.63** m^3/s	**discharge**

$$Q = \alpha L H^{1.5}$$ Equation 4.4: Weir Flow

OK The weir flow from the forebay exceeds the flow entering the forebay

6. Estimated Cleanout Frequencies

a) Forebay

Forebay volume	424 m^3
Estimated TSS removal efficiency	50%

Table 2: Annual sediment loading

Impervious Level	Annual Loading

Impervious level	61.0%	
Estimated annual sediment loading	2.3	m^3/ha
Contributing area	12.230	*ha*
Annual sediment volume	14	m^3/yr
Cleanout frequency for 33% volume reduction	**9.9**	*years*

%	m^3/ha
35%	0.6
55%	1.9
70%	2.8
85%	3.8

b) Stormwater Management Pond

Wetpond volume (excluding forebay)	2401	m^3
Estimated TSS removal efficiency	30%	
Impervious level	61.0%	
Estimated annual sediment loading	2.3	m^3/ha
Contributing area	12.230	*ha*
Annual sediment volume	8	m^3/yr
Cleanout frequency for 33% volume reduction	**93.9**	*years*

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FOREBAY SPLITTER MANHOLE DESIGN CALCULATION

	Forebay Inlet Pipe	Pond Inlet Pipe		Manhole Weir		
Number of pipes =	1	1				
Diameter =	675	1050	mm	Weir Elevation =	347.544	m
Area =	0.358	0.866	m^2	Weir Length =	0.750	m
Orifice Coefficient =	0.630	0.630		Weir Coefficient =	1.65	
Invert Elevation =	346.820	346.820	m	**Weir Opening**		
Slope =	0.50%	0.50%				
Hydraulic Radius =	0.169	0.263	m	Area =	2.000	m^2
Manning's 'n' =	0.013	0.013		Coefficient =	0.63	
Velocity =	1.661	2.230	m/s			
Pipe Capacity =	0.594	1.931	m^3/s			

Q_{25mm} =	0.522	m^3/s	forebay design flow (lower limit)
Q =	1.156	m^3/s	maximum design flow in sewer pipes

Water Elevation m	Head Above Invert m	Forebay Inflow m^3/s	Weir Head m	Weir Flow m^3/s	Weir Opening Flow m^3/s	Pipe Orifice Head m	Pipe Orifice Flow m^3/s	Total Pond Flow m^3/s
346.820								
346.920	0.100	0.007						0.007
347.020	0.200	0.038						0.038
347.120	0.300	0.082						0.082
347.220	0.400	0.138						0.138
347.320	0.500	0.202						0.202
347.420	0.600	0.275						0.275
347.520	0.700	0.499						0.499
347.544	**0.724**	**0.523**						**0.523**
347.620	0.800	0.591	0.076	0.026	1.538	0.800	0.641	0.617
347.720	0.900	0.670	0.176	0.091	2.340	0.900	0.782	0.761
347.820	1.000	0.741	0.276	0.179	2.931	1.000	0.933	0.920
347.920	1.100	0.805	0.376	0.285	3.421	1.100	1.528	1.090
347.957	**1.137**	**0.828**	**0.413**	**0.328**	**3.585**	**1.137**	**1.597**	**1.156**
348.020	1.200	0.865	0.476	0.406	3.849	1.200	1.709	1.271
348.120	1.300	0.921	0.576	0.541	4.234	1.300	1.872	1.462
348.220	1.400	0.973	0.676	0.688	4.586	1.400	2.022	1.661
348.320	1.500	1.023	0.776	0.846	4.914	1.500	2.161	1.869
348.420	1.600	1.071	0.876	1.015	5.221	1.600	2.292	2.085
348.520	1.700	1.116	0.976	1.193	5.511	1.700	2.416	2.310

Water Elevation	Head Above Invert	Forebay Inflow	Weir Head	Weir Flow	Weir Opening Flow	Pipe Orifice Head	Pipe Orifice Flow	Total Pond Flow
m	*m*	m^3/s	*m*	m^3/s	m^3/s	*m*	m^3/s	m^3/s
348.620	1.800	1.160	1.076	1.381	5.786	1.800	2.534	2.541
348.720	1.900	1.202	1.176	1.578	6.049	1.900	2.647	2.781
348.820	2.000	1.243	1.276	1.784	6.301	2.000	2.755	3.027
348.920	2.100	1.283	1.376	1.997	6.543	2.100	2.859	3.280
349.020	2.200	1.321	1.476	2.219	6.777	2.200	2.959	3.540
349.120	2.300	1.358	1.576	2.448	7.003	2.300	3.056	3.807
349.220	2.400	1.394	1.676	2.685	7.222	2.400	3.151	4.080
349.320	2.500	1.430	1.776	2.929	7.434	2.500	3.242	4.359
349.420	2.600	1.464	1.876	3.180	7.640	2.600	3.331	4.644
349.520	2.700	1.498	1.976	3.437	7.841	2.700	3.417	4.915

Notes:

1. Forebay inflow calcuated as: $Q = C \cdot A_o \cdot \sqrt{2g \cdot \left(H - \frac{2}{3} d \right)}$ for H > d

$$Q = f \cdot \frac{H}{d} \cdot C \cdot \sqrt{g} \cdot d^{2.5}$$ for H < d, where

$$f \cdot \frac{H}{d} = 0.494 \left(\frac{H}{d} \right)^{1.57} - 0.04 \left(\frac{H}{d} \right)^{0.5}$$

2. Bypassing inflow calculated as the smallest of

$Q = C_d \cdot L \cdot H^{1.5}$ weir flow

$Q = C \cdot A \cdot \sqrt{2g \cdot H}$ weir opening (orifice) flow

$Q = C \cdot A \cdot \sqrt{2g \cdot \left(H - \frac{2}{3} d \right)}$ pipe opening (orifice) flow

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Project Number:	39502-104
Date:	July 3, 2020
Design By:	EPB/XSP
File:	Q:\39502\104\Prelim SWM\SWMFs -epb\39502-104 Master SWM XSP July2.xlsx

FALLING HEAD DRAWDOWN CALCULATION
MOEE SWM Planning and Design Manual, 2003

$$t = \frac{0.66C_2h^{1.5} + 2C_3h^{0.5}}{2.75A_O}$$ Equation 4.11

where

t =	340357	***s***	
	94.5	***hr***	drawdown time
A_p =	3600.31	***m²***	surface area of the pond
C =	0.63		discharge coefficient
d =	60	***mm***	diameter of the orifice
A_O =	0.00283	***m²***	cross-sectional area of the orifice
g =	9.81	***m/s²***	gravitational acceleration constant
h_1 =	346.750	***m***	starting water elevation above the orifice
h_2 =	346.600	***m***	ending water elevation above the orifice
h =	0.15	***m***	maximum water elevation above the orifice
C_2 =	1828.75		slope coefficient from the area-depth linear regression
C_3 =	3326		intercept from the area-depth linear regression

	ELEVATION ***m***	STAGE ***m***	AREA ***m²***	COMMENTS
1	346.60	0	3326	
2	346.70	0.1	3509	
3	346.75	0.15	3600	MOE Extended Detention

DRAWDOWN TIME: 340357 ***s***
94.5 ***hr***

Regression Output:

m_1 =	1828.75	slope coefficient from the area-depth linear regression
b =	3326.00	intercept from the area-depth linear regression
se_1 =	0.00	standard error for coefficient m_1
se_b =	0.00	standard error for constant b
R^2 =	1.0000	coefficient of determination
se_y =	0.00	standard error of the ***y*** estimate
F =	###############	F statistic
df =	1	degrees of freedom
ss_{reg} =	39017	regression sum of squares
ss_{resid} =	0	residual sum of squares

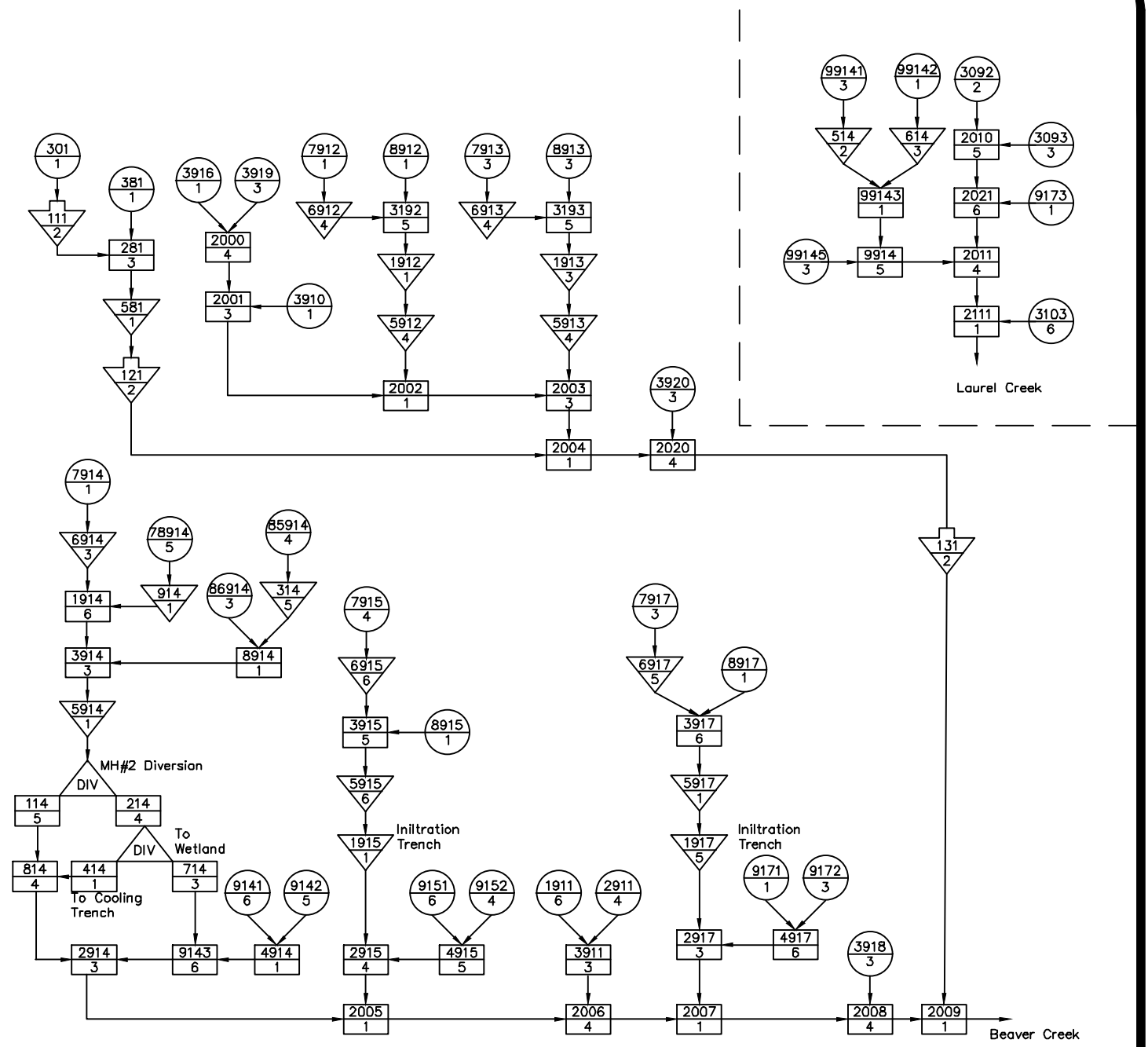
NORTHGATE, NORTH WATERLOO
PRELIMINARY STORMWATER MANAGEMENT
City of Waterloo, Ontario

Project Number: 39502-104
Date: June 3, 2020
Design By: XSP
File: Q:\39502\104\Prelim SWM\39502-104 Mater GAWSER Design Sheet - XSP 21May2020.xlsx

Catchment	Land Use	Area (ha)	Roof to Infiltration %	Roof to Infiltation (ha)	Remainder (ha)	Other Impervious %	Other Impervious (ha)	Total Impervious %
	Single Family Residential	2.15	42.5	0.92	1.24	10.0	0.22	52.5
	Multi Residential/Mix Use	2.18	35.0	0.76	1.42	35.0	0.76	70.0
	Multi Family Residential	1.74	35.0	0.61	1.13	35.0	0.61	70.0
3102	Add. Multi Family Residential	0.61	35.0	0.21	0.40	35.0	0.21	70.0
	Pump Station	0.17	0.0	0.00	0.17	43.8	0.07	43.8
	Road	1.37	0.0	0.00	1.37	75.0	1.03	75.0
	Park/Open Space	0.44	0.0	0.00	0.44	0.0	0.00	0.0
	Total	8.66	28.9	2.50	6.16	33.5	2.90	62.3
1911	Beaver Creek & Adjacent Wetland	19.35	0.0	0.00	19.35	1.0	0.19	1.0
2911	South edge undeveloped	0.96	0.0	0.00	0.96	1.0	0.01	1.0
3911	Total	20.31	0.0	0.00	20.31	1.0	0.20	1.0
	Single Family Residential	6.86	47.1	3.24	3.63	14.4	0.99	61.5
	Multi Family Residential	0.93	25.0	0.23	0.70	59.3	0.55	84.3
3914	Road	3.32	0.0	0.00	3.32	75.0	2.49	75.0
	Park	0.55	0.0	0.00	0.55	0.0	0.00	0.0
	SWM	0.74	0.0	0.00	0.74	52.0	0.39	52.0
	Walkway	0.02	0.0	0.00	0.02	50.0	0.01	50.0
	Total	12.43	27.9	3.47	8.96	35.6	4.43	63.5
9141	Single Family Residential	1.27	0.0	0.00	1.27	37.0	0.47	37.0
To west wetland	Subtotal	1.27	0.0	0.00	1.27	37.0	0.47	37.0
9142	Pump Station & Res. Front Yard	0.33	0.0	0.00	0.33	44.2	0.15	44.2
To Beaver Crk	Open Space	0.23	0.0	0.00	0.23	0.0	0.00	0.0
	Subtotal	0.56	0.0	0.00	0.56	26.4	0.15	26.4
4914	Total	1.83	0.0	0.00	1.83	33.8	0.62	33.8
9914	Single Family Residential	1.79	31.1	0.56	1.23	7.5	0.13	38.6
To Laurel Crk	Road/Open space	0.27	0.0	0.00	0.27	50.0	0.13	50.0
	Total	2.06	27.0	0.56	1.50	13.0	0.27	40.1
3917	Single Family Residential	0.69	44.2	0.31	0.39	11.0	0.08	55
	Road	0.35	0.0	0.00	0.35	100	0.35	100
	Walkway	0.005	0.0	0.00	0.00	50	0.002	50
	Open Space/SWM	0.22	0.0	0.00	0.22	45	0.10	45
	Total	1.27	24.0	0.31	0.97	41.8	0.53	65.8
9171	Single Family Residential	0.33	0.0	0.00	0.33	3.9	0.01	3.9
To west wetland	Open Space	0.48	0.0	0.00	0.48	0.0	0.00	0.0
	Subtotal	0.81	0.0	0.00	0.81	1.6	0.01	1.6
	Single Family Residential	0.34	0.0	0.00	0.34	50.2	0.17	50.2
9172	Open Space	0.05	0.0	0.00	0.05	0.0	0.00	0.0
To east wetland	Walkway	0.01	0.0	0.00	0.01	50	0.007	50
	Subtotal	0.41	0.0	0.00	0.41	43.7	0.18	43.7
(To 3093) **9173**	Single Family Residential,Rear yard	0.29	0.0	0.00	0.29	4.4	0.01	4.4
4917	Total	1.50	0.0	0.00	1.50	13.6	0.20	13.6
3915	Multi Family Residential	0.81	12.6	0.10	0.70	35.0	0.28	47.6
	SWM	0.08	0.0	0.00	0.08	100	0.08	100.0
	Total	0.89	11.5	0.10	0.79	41.0	0.36	52.5
9151	Residential Roof Area to wetland	0.18	0.0	0.00	0.18	100.0	0.18	100.0
9152	Open space	0.49	0.0	0.00	0.49	0.0	0.00	0.0
4915	Total	0.67	0.0	0.00	0.67	69.4	0.46	69.4
3918	Total	0.56	0.0	0.00	0.56	1.0	0.01	1.0
3093	Total	0.58	0.0	0.00	0.58	1.0	0.01	1.0
3103	Total	0.50	0.0	0.00	0.50	1.0	0.005	1.0
3092	Total	4.01	0.0	0.00	4.01	1.0	0.04	1.0
3920	Total (Conservation Dr.)	1.45	0.0	0.00	1.40	75.0	1.05	75.0
3107	Total	11.25	29.7	3.34	7.90	38.6	4.35	68.4
3913	Total	11.62	16.0	1.86	9.76	39.0	4.53	55.0
3910	Total	17.29	0.0	0.00	17.29	1.0	0.17	1.0
3912	Total	16.34	16.0	2.61	13.72	39.0	6.37	55.0

Appendix B

Proposed GAWSER Model & Design Event Output



LEGEND

- 3000 / 1 — HYDROGRAPH GENERATION NUMBER / GAWSER STORAGE LOCATION NUMBER
- 3000 / 1 — HYDROGRAPH ROUTING NUMBER / GAWSER STORAGE LOCATION NUMBER
- 3000 / 1 — HYDROGRAPH ADDITION NUMBER / GAWSER STORAGE LOCATION NUMBER
- 300 / 1 — HYDROGRAPH CHANNEL ROUTING NUMBER / GAWSER STORAGE LOCATION NUMBER
- DIV — DIVERSION

Proposed nw

Date: 5/21/20
Scale: N/A

BEAVER CREEK GAWSER MODEL (Non-Winter)

MTE
Engineers | Scientists | Surveyors

Project No.: 44719-114

P:\P\39502\104\TEMP DRAWINGS\XSP\39502-200-SchematicsMay.dwg

```
*  Waterloo North Scoped SWS
* ============================================================================
* August, 2011, M. Trudell
* Located in Waterloo,Ontario
* USE TO MAKE Continuous WAT Files
*
* MTE CTS Model (June 28, 2017)
* MTE Northgate, BCM-CSWMS Post Development Model (Jun, 2020)
* ============================================================================
*
* Response Unit Soil drainage parameters for North Waterloo Scoped SWS
* ====================================================================


READ SOIL PARAMETERS  NZONE=9
                        IMP  CLAY TILL   SILT TILL  SAND TILL  SND/GRV
                             MED  HIGH   MED  HIGH   MED  HIGH   MED  Swamp
                DS=    2   8.0  15.0   8.0  15.0   8.0  15.0   8.0   100
                KEFF=  0   2.0   4.0  10.0  15.0  15.0  40.0  25.0   0.1
                CS=    0   1.0   2.0   7.5  11.2  11.2  30.0  19.0  0.05
                D=     0   0.2   0.4   1.0   1.5   1.5   4.0   2.5  0.01
                SAV=   0   200   200   200   200   200   200   250   200
                HI=    0   100   100   100   200   100   200   200   200
                SMCI=  0  0.56  0.56  0.54  0.54  0.46  0.46   0.4  0.56
                IMCI=  0  0.46  0.46  0.40  0.40  0.23  0.23   0.1  0.46
                FCAPI= 0  0.46  0.46  0.40  0.40  0.23  0.23   0.1  0.46
                WILTI= 0  0.27  0.27  0.19  0.19  0.07  0.07  0.04  0.27
                HII=   0   150   150   300   400   300   600   400     5
                SMCII= 0  0.56  0.56  0.54  0.54  0.46  0.46   0.4  0.56
                IMCII= 0  0.46  0.46  0.40  0.40  0.23  0.23   0.1  0.46
                FCAPII=0  0.46  0.46  0.40  0.40  0.23  0.23   0.1  0.46
                WILTII=0  0.27  0.27  0.19  0.19  0.07  0.07  0.04  0.27
                X=     0    1     0     0     0     0     0     0     1
                FATR=  1    1     1     1     1     1     1     1     1
                INC =  1    1     5     1     5     1     5     1     5

*
* Go to event file
*
CHANGE INPUT FILE
*
* Main channel, in subcatchment 301                                     7
*
COMPUTE RATING CURVE ID=1  VS=     2.000   NSEGS=3
                      MIN EL=  100.00   MAX EL=  101.30
                      CHNSLP= 0.01000   FLNSLP= 0.01000
                      N= 0.100  DIST=   18.90
                      N=-0.080  DIST=   21.10
                      N= 0.100  DIST=   40.00
                        DIST    ELEV     DIST    ELEV     DIST    ELEV
                        0.00  101.30    18.90  100.80    19.00  100.40
                       20.00  100.00    21.00  100.40    21.10  100.80
                       40.00  101.30
                     RFN=0.0000 PCODE=1
*
*  Typical off-channel (Steep areas)                                    6
*
COMPUTE RATING CURVE ID=5  VS=     1.000   NSEGS=3
                      MIN EL=  100.00   MAX EL=  100.80
                      CHNSLP= 0.01500   FLNSLP= 0.01500
                      N= 0.350  DIST=   24.45
                      N=-0.150  DIST=   25.50
                      N= 0.350  DIST=   50.00
                        DIST    ELEV     DIST    ELEV     DIST    ELEV
```



```
                        0.00  100.80    24.45  100.30    24.75  100.00
                       25.25  100.00    25.50  100.30    50.00  100.80
                     RFN=0.0000 PCODE=1
*
* Compute runoff hydrograph from area  301
* VS=   2.000 is main channel & VS=   1.000 is off-channel
*
COMPUTE FLOWRATE    ID=1 NHD= 301 AREA=   2.6500 Sq km  L=  2910 m  W=   882 m
              SOIL ZONE I    II  III    IV    V    VI  VII  VIII   IX
                       1.0   0.0  0.0  50.7 23.3  11.5  2.9   0.0 10.6
                     RATING CURVES: IDMC=1 IDOC=5 QRMC=  0.50 QROC=  0.05
                     ROUTING MODEL=2 CONSTANTS: OVERLAND FTB= 3.0 TLO= 0.0
                     SUBSURFACE: KSS= 5.0 KGW= 384 h PCODE=1 WQPCODE=1
                     RBASIN=0 IDA=0 IDB=0 IDC=0 IDD=0 RBDUMP=0
                     GWFACT=0.50 GWON=1
                     SWQTH=   0.0 L/s SWPUMP=   0.0 L/s SWCODE=0
*
KEEP HYD             ID=1 CUTOFF=0 ICODE=5 ISTEP=1 IFORM=0 IDB=1 IMET=0
PRINT HYD            ID=1 PCODE=1 MODE=10
*
*  Beaver Creek, in subcatchment 381                                   13
*
COMPUTE RATING CURVE ID=2  VS=     3.000   NSEGS=3
                      MIN EL=  335.00   MAX EL=  354.00
                      CHNSLP= 0.02100   FLNSLP= 0.02100
                      N= 0.080  DIST=   89.00
                      N=-0.080  DIST=   95.00
                      N= 0.080  DIST=  213.00
                        DIST    ELEV     DIST    ELEV     DIST    ELEV
                        0.00  335.00    16.00  353.00    39.00  352.00
                       53.00  351.50    77.00  351.00    89.00  350.80
                       92.00  350.60    95.00  350.80   102.00  351.00
                      152.00  351.50   185.00  352.00   201.00  353.00
                      213.00  354.00
                     RFN=0.0000 PCODE=1
*
* Beaver Creek through 381
* Using Valley Section      3.000 As channel Rating Curve
*
ROUTE CHANNEL        ID=2 HYD NO= 111 INFLOW=1 LENGTH=  2100 m  SLOPE=0.00210
                     RCID=2 NS=1 PCODE=1 INDEX=1 PIPE=0 CANOPY=  0.0%
*
*  Main channel, in subcatchment 381                                    6
*
COMPUTE RATING CURVE ID=3  VS=     2.100   NSEGS=3
                      MIN EL=  100.40   MAX EL=  100.80
                      CHNSLP= 0.01700   FLNSLP= 0.01700
                      N= 0.060  DIST=    0.80
                      N=-0.060  DIST=    2.90
                      N= 0.060  DIST=    3.70
                        DIST    ELEV     DIST    ELEV     DIST    ELEV
                        0.00  100.80     0.80  100.60     1.70  100.40
                        2.10  100.40     2.90  100.60     3.70  100.80
                     RFN=0.0000 PCODE=1
*
* Typical off-channel (Flat slopes)                                     6
*
COMPUTE RATING CURVE ID=6  VS=     1.100   NSEGS=3
                      MIN EL=  100.00   MAX EL=  100.60
                      CHNSLP= 0.01000   FLNSLP= 0.01000
                      N= 0.350  DIST=   39.15
                      N=-0.150  DIST=   40.85
                      N= 0.350  DIST=   80.00
                        DIST    ELEV     DIST    ELEV     DIST    ELEV
```

```
                      0.00  100.60    39.15  100.20    39.75  100.00
                     40.25  100.00    40.85  100.20    80.00  100.60
                   RFN=0.0000 PCODE=1
*
* Compute runoff hydrograph from area  381
* VS=   2.100 is main channel & VS=   1.100 is off-channel
*
COMPUTE FLOWRATE    ID=1 NHD= 381 AREA=   3.3100 Sq km  L=  2340 m  W=   707 m
              SOIL ZONE I    II  III    IV    V    VI  VII  VIII   IX
                     1.0   0.0  0.0  73.4 13.2   1.3  0.5   0.0 10.6
                   RATING CURVES: IDMC=3 IDOC=6 QRMC=  0.50 QROC=  0.05
                   ROUTING MODEL=2 CONSTANTS: OVERLAND FTB= 3.0 TLO= 0.0
                   SUBSURFACE: KSS= 5.0 KGW= 384 h PCODE=1 WQPCODE=1
                   RBASIN=0 IDA=0 IDB=0 IDC=0 IDD=0 RBDUMP=0
                   GWFACT=0.50 GWON=1
                   SWQTH=   0.0 L/s SWPUMP=   0.0 L/s SWCODE=0
*
KEEP HYD            ID=1 CUTOFF=0 ICODE=5 ISTEP=1 IFORM=0 IDB=1 IMET=0
PRINT HYD           ID=1 PCODE=1 MODE=10
*
* Sum hydr.  111 &  381 call result  281
*
ADD HYD             ID=3 HYD NO= 281 IDA=2 IDB=1 ICODE=0                 AREA=     5.960
*
* Swamp storage reservoir
*
ROUTE RESERVOIR     ID=1 HYD NO= 581 INFLOW=3 PCODE=0 OPTION= 4
                    ILEVEL=   349.500
                     ELEVATION   OUTFLOW     STORAGE
                        (m)       (cms)       (ha*m)
                      349.500      0.0000      0.0100
                      350.000      0.4200      0.6700
                      350.500      3.0400      3.1200
                      351.000      8.8500      8.1100
                      351.500     15.2000     15.8700
                      352.000     21.5000     26.8500
                      352.500     28.7000     41.0200
                      352.800     34.3000     50.7600
*
KEEP HYD            ID=1 CUTOFF=0 ICODE=5 ISTEP=1 IFORM=0 IDB=1 IMET=0
PRINT HYD           ID=1 PCODE=1 MODE=10
*
* Beaver Creek in subcatchment 391, to Conservation Drive              11
*
COMPUTE RATING CURVE ID=4  VS=     4.000   NSEGS=3
                      MIN EL=  344.40   MAX EL=  346.02
                      CHNSLP= 0.02600   FLNSLP= 0.02600
                      N= 0.080  DIST=    6.50
                      N=-0.045  DIST=   12.60
                      N= 0.080  DIST=   16.20
                        DIST    ELEV     DIST    ELEV     DIST    ELEV
                        0.00  346.02     3.40  345.96     6.50  345.43
                        7.20  345.01     8.80  344.40     9.60  344.46
                       10.60  344.61    11.00  344.75    11.70  345.00
                       12.60  345.39    16.20  345.90
                     RFN=0.0000 PCODE=1
*
* Beaver Creek through 391, north of Conservation Drive
* Using Valley Section      4.000 As channel Rating Curve
*
ROUTE CHANNEL       ID=2 HYD NO= 121 INFLOW=1 LENGTH=   690 m  SLOPE=0.00310
                    RCID=4 NS=1 PCODE=1 INDEX=1 PIPE=0 CANOPY=  0.0%
*
***CHANGE INPUT FILE
```



```
*
* Response Unit Soil drainage parameters for North Waterloo Scoped SWS
* ====================================================================


READ SOIL PARAMETERS  NZONE=9
                           IMP  CLAY TILL   SILT TILL  SAND TILL   Roof  SAND
                                MED  HIGH   MED  HIGH   MED  HIGH   IMP   LOW
                  DS=    2   8.0  15.0   8.0  15.0   8.0  15.0   0.5   5.0
                  KEFF=  0   2.0   4.0  10.0  15.0  15.0  40.0   0.0  10.0
                  CS=    0   1.0   2.0   7.5  11.2  11.2  30.0   0.0   7.5
                  D=     0   0.2   0.4   1.0   1.5   1.5   4.0   0.0   1.0
                  SAV=   0   200   200   200   200   200   200   200   200
                  HI=    0   100   100   100   200   100   200     1   100
                  SMCI=  0  0.56  0.56  0.54  0.54  0.46  0.46  0.54  0.46
                  IMCI=  0  0.46  0.46  0.40  0.40  0.23  0.23  0.54  0.23
                  FCAPI= 0  0.46  0.46  0.40  0.40  0.23  0.23  0.40  0.23
                  WILTI= 0  0.27  0.27  0.19  0.19  0.07  0.07  0.40  0.07
                  HII=   0   150   150   300   400   300   600     1   300
                  SMCII= 0  0.56  0.56  0.54  0.54  0.46  0.46  0.54  0.46
                  IMCII= 0  0.46  0.46  0.40  0.40  0.23  0.23  0.54  0.23
                  FCAPII=0  0.46  0.46  0.40  0.40  0.23  0.23  0.40  0.23
                  WILTII=0  0.27  0.27  0.19  0.19  0.07  0.07  0.40  0.07
                  X=     0    1     0     0     0     0     0     0     0
                  FATR=  1    1     1     1     1     1     1     1     1
                  INC =  1    1     5     1     5     1     5     1     1

*
* Go to event file
*
CHANGE INPUT FILE
*
*  Main channel Parabolic Swale - Flat                                  7
*
COMPUTE RATING CURVE ID=1  VS=     7.000   NSEGS=3
                      MIN EL=  100.70   MAX EL=  103.00
                      CHNSLP= 0.01000   FLNSLP= 0.01000
                      N= 0.070  DIST=   20.00
                      N=-0.050  DIST=   30.00
                      N= 0.070  DIST=   50.00
                        DIST    ELEV     DIST    ELEV     DIST    ELEV
                        0.00  103.00    20.00  101.00    23.00  100.80
                       25.00  100.70    27.00  100.80    30.00  101.00
                       50.00  103.00
                     RFN=0.0000 PCODE=1
*
* Compute runoff hydrograph from area 3916
* VS=   7.000 is main channel & VS=   1.000 is off-channel
*
COMPUTE FLOWRATE    ID=1 NHD=3916 AREA=   0.0260 Sq km  L=   150 m  W=   100 m
              SOIL ZONE I    II  III    IV    V    VI  VII  VIII   IX
                     1.0   0.0  0.0  35.0  0.0  64.0  0.0   0.0  0.0
                   RATING CURVES: IDMC=1 IDOC=5 QRMC=  0.50 QROC=  0.05
                   ROUTING MODEL=2 CONSTANTS: OVERLAND FTB= 2.0 TLO= 0.0
                   SUBSURFACE: KSS= 5.0 KGW= 384 h PCODE=1 WQPCODE=1
                   RBASIN=0 IDA=0 IDB=0 IDC=0 IDD=0 RBDUMP=0
                   GWFACT=0.00 GWON=0
                   SWQTH=   0.0 L/s SWPUMP=   0.0 L/s SWCODE=0
*
KEEP HYD            ID=1 CUTOFF=0 ICODE=5 ISTEP=1 IFORM=0 IDB=1 IMET=0
PRINT HYD           ID=1 PCODE=1 MODE=10
*
* Compute runoff hydrograph from area 3919
* VS=   7.000 is main channel & VS=   1.000 is off-channel
```

```
*
COMPUTE FLOWRATE    ID=3 NHD=3919 AREA=   0.1360 Sq km  L=   200 m  W=   180 m
              SOIL ZONE I    II  III    IV    V    VI  VII  VIII   IX
                     1.0   0.0  0.0  22.0  3.0  74.0  0.0   0.0  0.0
                   RATING CURVES: IDMC=1 IDOC=5 QRMC=  0.50 QROC=  0.05
                   ROUTING MODEL=2 CONSTANTS: OVERLAND FTB= 2.0 TLO= 0.0
                   SUBSURFACE: KSS= 5.0 KGW= 384 h PCODE=1 WQPCODE=1
                   RBASIN=0 IDA=0 IDB=0 IDC=0 IDD=0 RBDUMP=0
                   GWFACT=0.00 GWON=0
                   SWQTH=   0.0 L/s SWPUMP=   0.0 L/s SWCODE=0
*
KEEP HYD            ID=3 CUTOFF=0 ICODE=5 ISTEP=1 IFORM=0 IDB=3 IMET=0
PRINT HYD           ID=3 PCODE=1 MODE=10
*
* Sum hydr. 3916 & 3919 call result 2000
*
ADD HYD             ID=4 HYD NO=2000 IDA=1 IDB=3 ICODE=0                  AREA=     0.162
*
* Compute runoff hydrograph from area 3910
* VS=   4.000 is main channel & VS=   1.100 is off-channel
*
COMPUTE FLOWRATE    ID=1 NHD=3910 AREA=   0.17295 Sq km  L=   300 m  W=   200 m
              SOIL ZONE I    II  III    IV    V    VI  VII  VIII   IX
                     1.0   0.0  5.0  16.3 38.1  11.9 27.7   0.0  0.0
                   RATING CURVES: IDMC=4 IDOC=6 QRMC=  0.50 QROC=  0.05
                   ROUTING MODEL=2 CONSTANTS: OVERLAND FTB= 2.0 TLO= 0.0
                   SUBSURFACE: KSS= 5.0 KGW= 384 h PCODE=1 WQPCODE=1
                   RBASIN=0 IDA=0 IDB=0 IDC=0 IDD=0 RBDUMP=0
                   GWFACT=0.00 GWON=0
                   SWQTH=   0.0 L/s SWPUMP=   0.0 L/s SWCODE=0
*
KEEP HYD            ID=1 CUTOFF=0 ICODE=5 ISTEP=1 IFORM=0 IDB=1 IMET=0
PRINT HYD           ID=1 PCODE=1 MODE=10
*
* Sum hydr. 2000 & 3910 call result 2001
*
ADD HYD             ID=3 HYD NO=2001 IDA=4 IDB=1 ICODE=0                  AREA=     0.338
*
*   Typical Urban Cross-Section                                          6
*
COMPUTE RATING CURVE ID=1  VS=     8.000   NSEGS=3
                      MIN EL=  295.00   MAX EL=  295.70
                      CHNSLP= 0.00500   FLNSLP= 0.00500
                      N= 0.015  DIST=  200.00
                      N=-0.015  DIST=  300.00
                      N= 0.015  DIST=  500.00
                        DIST    ELEV     DIST    ELEV     DIST    ELEV
                        0.00  295.70   200.00  295.50   200.10  295.00
                      299.90  295.00   300.00  295.50   500.00  295.70
                     RFN=0.0000 PCODE=1
*
*   Typical Urban Cross-Section                                          6
*
COMPUTE RATING CURVE ID=6  VS=     8.000   NSEGS=3
                      MIN EL=  295.00   MAX EL=  295.70
                      CHNSLP= 0.00500   FLNSLP= 0.00500
                      N= 0.015  DIST=  200.00
                      N=-0.015  DIST=  300.00
                      N= 0.015  DIST=  500.00
                        DIST    ELEV     DIST    ELEV     DIST    ELEV
                        0.00  295.70   200.00  295.50   200.10  295.00
                      299.90  295.00   300.00  295.50   500.00  295.70
                     RFN=0.0000 PCODE=1
*
```



```
* Compute runoff hydrograph from area 7912
* VS=   8.000 is main channel & VS=   8.000 is off-channel
*
COMPUTE FLOWRATE    ID=1 NHD=7912 AREA=   0.0261 Sq km  L=   450 m  W=    50 m
              SOIL ZONE I    II  III    IV    V    VI  VII  VIII   IX
                     1.0   0.0  0.0   0.0  0.0   0.0  0.0  99.0  0.0
                   RATING CURVES: IDMC=1 IDOC=6 QRMC=  0.50 QROC=  0.05
                   ROUTING MODEL=2 CONSTANTS: OVERLAND FTB= 1.2 TLO= 0.0
                   SUBSURFACE: KSS= 5.0 KGW= 384 h PCODE=1 WQPCODE=1
                   RBASIN=0 IDA=0 IDB=0 IDC=0 IDD=0 RBDUMP=0
                   GWFACT=0.00 GWON=0
                   SWQTH=   0.0 L/s SWPUMP=   0.0 L/s SWCODE=0
*
* Rooftop Infiltration for 7912
*
ROUTE SPECIAL POND  ID=4 HYD NO=6912 INFLOW=1 PCODE=0 OPTION= 5
                   Inflow controls:
                       USPCT=100% USDIV=0     PCTA=  0% ADIV=0
                       GWPCT=  0% GWDIV=0
                   Maximum level for Routing Tables:  ZMAX= 101.300
                   Recharge characteristics for Compartment A
                     LEVELA= 100.000                EVAPA= 0.0 mm/d ACODE=0
                     CDA=   0.000 mm/h  DZA= 10.00 m
                   Recharge characteristics for Compartment B
                     LEVELB= 100.000 CCBA= 0.00000  EVAPB= 0.0 mm/d BCODE=1
                     CDB=  15.000 mm/h  DZB= 10.00 m
                   Irrigation Pond Controls: IPOND=0
                   Number of points=  5
                                    Compartment  A          Compartment B
                   Elevation  Outflow Storage  SFArea Outflow Storage SFArea
                      (m)       (cms)  (ha*m)    (ha)   (cms)  (ha*m)    (ha)
                    100.000     0.000  0.0000  0.0000   0.000  0.0000  0.0654
                    100.999     0.000  0.0000  0.0000   0.000  0.0653  0.0654
                    101.000     0.000  0.0000  0.0000   0.001  0.0654  0.0654
                    101.200     0.000  0.0000  0.0000   0.480  0.0900  0.0654
                    101.300     0.000  0.0000  0.0000   0.520  0.1000  0.0654
*
* Compute runoff hydrograph from area 8912
* VS=   8.000 is main channel & VS=   8.000 is off-channel
*
COMPUTE FLOWRATE    ID=1 NHD=8912 AREA=   0.1372 Sq km  L=   450 m  W=    50 m
              SOIL ZONE I    II  III    IV    V    VI  VII  VIII   IX
                    46.4   0.0  0.0  53.6  0.0   0.0  0.0   0.0  0.0
                   RATING CURVES: IDMC=1 IDOC=1 QRMC=  0.50 QROC=  0.05
                   ROUTING MODEL=2 CONSTANTS: OVERLAND FTB= 1.2 TLO= 0.0
                   SUBSURFACE: KSS= 5.0 KGW= 384 h PCODE=1 WQPCODE=1
                   RBASIN=0 IDA=0 IDB=0 IDC=0 IDD=0 RBDUMP=0
                   GWFACT=0.00 GWON=0
                   SWQTH=   0.0 L/s SWPUMP=   0.0 L/s SWCODE=0
*
* Sum hydr. 6912 & 8912 call result 3912
*
ADD HYD             ID=5 HYD NO=3912 IDA=4 IDB=1 ICODE=0                  AREA=     0.168
*
KEEP HYD            ID=5 CUTOFF=0 ICODE=5 ISTEP=1 IFORM=0 IDB=5 IMET=0
PRINT HYD           ID=5 PCODE=1 MODE=10
*
* 1912 End-of-Pipe Infiltration (for Catchment 3912)
*
ROUTE SPECIAL POND  ID=1 HYD NO=1912 INFLOW=5 PCODE=0 OPTION=15
                   Inflow controls:
                       USPCT=100% USDIV=0     PCTA=  0% ADIV=0
                       GWPCT=  0% GWDIV=0
                   Maximum level for Routing Tables:  ZMAX= 200.300
```

```
                    Recharge characteristics for Compartment A
                      LEVELA= 198.340               EVAPA= 0.0 mm/d ACODE=0
                      CDA=   0.000 mm/h  DZA= 10.00 m
                    Recharge characteristics for Compartment B
                      LEVELB= 198.340 CCBA= 0.00000  EVAPB= 0.0 mm/d BCODE=1
                      CDB=  15.000 mm/h  DZB= 10.00 m
                    Irrigation Pond Controls: IPOND=0
                    Number of points=  5
                                 Compartment  A          Compartment B
                    Elevation  Outflow Storage  SFArea Outflow Storage SFArea
                       (m)       (cms)  (ha*m)    (ha)   (cms)  (ha*m)    (ha)
                     199.800     0.000  0.0000  0.0000   0.000  0.0000  0.0490
                     199.990     0.000  0.0000  0.0000   0.000  0.0816  0.0490
                     200.010     0.000  0.0000  0.0000   0.001  0.0817  0.0490
                     200.100     0.000  0.0000  0.0000   0.400  0.1100  0.0490
                     200.300     0.000  0.0000  0.0000   2.500  0.2200  0.0490
*
KEEP HYD            ID=1 CUTOFF=0 ICODE=5 ISTEP=1 IFORM=0 IDB=1 IMET=0
PRINT HYD           ID=1 PCODE=1 MODE=10
*
* 5912 Quantity SWM Basin
*
ROUTE SPECIAL POND  ID=4 HYD NO=5912 INFLOW=1 PCODE=0 OPTION=15
                    Inflow controls:
                        USPCT=100% USDIV=0     PCTA=  0% ADIV=0
                        GWPCT=  0% GWDIV=0
                    Maximum level for Routing Tables:  ZMAX= 203.600
                    Recharge characteristics for Compartment A
                      LEVELA= 200.000               EVAPA= 1.4 mm/d ACODE=0
                      CDA=   0.000 mm/h  DZA= 10.00 m
                    Recharge characteristics for Compartment B
                      LEVELB= 200.000 CCBA= 0.00000  EVAPB= 1.4 mm/d BCODE=0
                      CDB=   0.000 mm/h  DZB= 10.00 m
                    Irrigation Pond Controls: IPOND=0
                    Number of points= 10
                                 Compartment  A          Compartment B
                    Elevation  Outflow Storage  SFArea Outflow Storage SFArea
                       (m)       (cms)  (ha*m)    (ha)   (cms)  (ha*m)    (ha)
                     199.990     0.000  0.0000  0.0000  0.0000  0.0000  0.1614
                     200.000     0.000  0.0000  0.0000  0.0000  0.0033  0.1614
                     200.500     0.000  0.0000  0.0000  0.0090  0.0389  0.2053
                     201.000     0.000  0.0000  0.0000  0.0130  0.0599  0.2577
                     201.400     0.000  0.0000  0.0000  0.0156  0.2601  0.2626
                     202.400     0.000  0.0000  0.0000  0.1507  0.3472  0.3015
                     203.000     0.000  0.0000  0.0000  0.8237  0.5524  0.3501
                     203.300     0.000  0.0000  0.0000  1.1301  0.6321  0.3582
                     203.300     0.000  0.0000  0.0000  2.9175  0.6808  0.3691
                     203.600     0.000  0.0000  0.0000  4.9656  0.7002  0.3909
*
* Go to event file: 5912 Quantity SWM Basin
*
*
KEEP HYD            ID=4 CUTOFF=0 ICODE=5 ISTEP=1 IFORM=0 IDB=4 IMET=0
PRINT HYD           ID=4 PCODE=1 MODE=10
*
* Sum hydr. 2001 & 5912 call result 2002
*
ADD HYD             ID=1 HYD NO=2002 IDA=3 IDB=4 ICODE=0                  AREA=     0.506
*
* Compute runoff hydrograph from area 7913
* VS=   8.000 is main channel & VS=   8.000 is off-channel
*
COMPUTE FLOWRATE    ID=3 NHD=7913 AREA=   0.0186 Sq km  L=   450 m  W=    50 m
             SOIL ZONE I    II  III    IV    V    VI  VII  VIII   IX
```



```
                      1.0   0.0  0.0   0.0  0.0   0.0  0.0  99.0  0.0
                    RATING CURVES: IDMC=1 IDOC=1 QRMC=  0.50 QROC=  0.05
                    ROUTING MODEL=2 CONSTANTS: OVERLAND FTB= 1.2 TLO= 0.0
                    SUBSURFACE: KSS= 5.0 KGW= 384 h PCODE=1 WQPCODE=1
                    RBASIN=0 IDA=0 IDB=0 IDC=0 IDD=0 RBDUMP=0
                    GWFACT=0.00 GWON=0
                    SWQTH=   0.0 L/s SWPUMP=   0.0 L/s SWCODE=0
*
* Rooftop Infiltration for 7913
*
ROUTE SPECIAL POND  ID=4 HYD NO=6913 INFLOW=3 PCODE=0 OPTION= 5
                    Inflow controls:
                        USPCT=100% USDIV=0     PCTA=  0% ADIV=0
                        GWPCT=  0% GWDIV=0
                    Maximum level for Routing Tables:  ZMAX= 101.300
                    Recharge characteristics for Compartment A
                      LEVELA= 100.000               EVAPA= 0.0 mm/d ACODE=0
                      CDA=   0.000 mm/h  DZA= 10.00 m
                    Recharge characteristics for Compartment B
                      LEVELB= 100.000 CCBA= 0.00000  EVAPB= 0.0 mm/d BCODE=1
                      CDB=  15.000 mm/h  DZB= 10.00 m
                    Irrigation Pond Controls: IPOND=0
                    Number of points=  5
                                 Compartment  A          Compartment B
                    Elevation  Outflow Storage  SFArea Outflow Storage SFArea
                       (m)       (cms)  (ha*m)    (ha)   (cms)  (ha*m)    (ha)
                     100.000     0.000  0.0000  0.0000   0.000  0.0000  0.0465
                     100.999     0.000  0.0000  0.0000   0.000  0.0464  0.0465
                     101.000     0.000  0.0000  0.0000   0.001  0.0465  0.0465
                     101.200     0.000  0.0000  0.0000   0.450  0.0500  0.0465
                     101.300     0.000  0.0000  0.0000   0.500  0.0600  0.0465
*
* Compute runoff hydrograph from area 8913
* VS=   8.000 is main channel & VS=   8.000 is off-channel
*
COMPUTE FLOWRATE    ID=3 NHD=8913 AREA=   0.0976 Sq km  L=   450 m  W=    50 m
             SOIL ZONE I    II  III    IV    V    VI  VII  VIII   IX
                     46.4   0.0  0.0  18.4  0.0  35.2  0.0   0.0  0.0
                    RATING CURVES: IDMC=1 IDOC=1 QRMC=  0.50 QROC=  0.05
                    ROUTING MODEL=2 CONSTANTS: OVERLAND FTB= 1.2 TLO= 0.0
                    SUBSURFACE: KSS= 5.0 KGW= 384 h PCODE=1 WQPCODE=1
                    RBASIN=0 IDA=0 IDB=0 IDC=0 IDD=0 RBDUMP=0
                    GWFACT=0.00 GWON=0
                    SWQTH=   0.0 L/s SWPUMP=   0.0 L/s SWCODE=0
*
* Sum hydr. 6913 & 8913 call result 3913
*
ADD HYD             ID=5 HYD NO=3913 IDA=4 IDB=3 ICODE=0                  AREA=     0.110
*
KEEP HYD            ID=5 CUTOFF=0 ICODE=5 ISTEP=1 IFORM=0 IDB=5 IMET=0
PRINT HYD           ID=5 PCODE=1 MODE=10
*
* 1913 End-of-Pipe Infiltration
*
ROUTE SPECIAL POND  ID=3 HYD NO=1913 INFLOW=5 PCODE=0 OPTION=15
                    Inflow controls:
                        USPCT=100% USDIV=0     PCTA=  0% ADIV=0
                        GWPCT=  0% GWDIV=0
                    Maximum level for Routing Tables:  ZMAX= 200.300
                    Recharge characteristics for Compartment A
                      LEVELA= 198.340               EVAPA= 0.0 mm/d ACODE=0
                      CDA=   0.000 mm/h  DZA= 10.00 m
                    Recharge characteristics for Compartment B
                      LEVELB= 198.340 CCBA= 0.00000  EVAPB= 0.0 mm/d BCODE=1
```

```
                      CDB=  15.000 mm/h  DZB= 10.00 m
                    Irrigation Pond Controls: IPOND=0
                    Number of points=  5
                                Compartment  A          Compartment B
                    Elevation  Outflow Storage  SFArea Outflow Storage SFArea
                       (m)       (cms)  (ha*m)    (ha)   (cms)  (ha*m)    (ha)
                     199.800     0.000  0.0000  0.0000   0.000  0.0000  0.0349
                     199.990     0.000  0.0000  0.0000   0.000  0.0580  0.0349
                     200.010     0.000  0.0000  0.0000   0.001  0.0581  0.0349
                     200.100     0.000  0.0000  0.0000   0.400  0.0800  0.0349
                     200.300     0.000  0.0000  0.0000   2.100  0.2000  0.0349
*
KEEP HYD             ID=3 CUTOFF=0 ICODE=5 ISTEP=1 IFORM=0 IDB=3 IMET=0
PRINT HYD            ID=3 PCODE=1 MODE=10
*
* 5913 Quantity SWM Basin
*
ROUTE SPECIAL POND   ID=4 HYD NO=5913 INFLOW=3 PCODE=0 OPTION=15
                    Inflow controls:
                        USPCT=100% USDIV=0     PCTA=  0% ADIV=0
                        GWPCT=  0% GWDIV=0
                    Maximum level for Routing Tables:  ZMAX= 202.950
                    Recharge characteristics for Compartment A
                      LEVELA= 200.000                EVAPA= 1.4 mm/d ACODE=0
                      CDA=   0.000 mm/h  DZA= 10.00 m
                    Recharge characteristics for Compartment B
                      LEVELB= 200.000 CCBA= 0.00000  EVAPB= 1.4 mm/d BCODE=0
                      CDB=   0.000 mm/h  DZB= 10.00 m
                    Irrigation Pond Controls: IPOND=0
                    Number of points= 10
                                Compartment  A          Compartment B
                    Elevation  Outflow Storage  SFArea Outflow Storage SFArea
                       (m)       (cms)  (ha*m)    (ha)   (cms)  (ha*m)    (ha)
                     199.990     0.000  0.0000  0.0000  0.0000  0.0000  0.1754
                     200.000     0.000  0.0000  0.0000  0.0000  0.0023  0.1754
                     200.500     0.000  0.0000  0.0000  0.0100  0.0423  0.2230
                     201.000     0.000  0.0000  0.0000  0.0110  0.0651  0.2799
                     201.500     0.000  0.0000  0.0000  0.0128  0.1796  0.2852
                     202.600     0.000  0.0000  0.0000  0.1299  0.2168  0.3275
                     202.700     0.000  0.0000  0.0000  0.7141  0.3254  0.3803
                     202.800     0.000  0.0000  0.0000  1.2275  0.4226  0.3891
                     202.900     0.000  0.0000  0.0000  2.5163  0.5582  0.4009
                     202.950     0.000  0.0000  0.0000  4.3375  0.8118  0.4247
*
* Go to event file: 5913 Quantity SWM Basin
*
*
KEEP HYD             ID=4 CUTOFF=0 ICODE=5 ISTEP=1 IFORM=0 IDB=4 IMET=0
PRINT HYD            ID=4 PCODE=1 MODE=10
*
* Sum hydr. 2002 & 5913 call result 2003
*
ADD HYD              ID=3 HYD NO=2003 IDA=1 IDB=4 ICODE=0                  AREA=     0.616
*
* Beaver Creek at Conservation Drive
*
ADD HYD              ID=1 HYD NO=2004 IDA=2 IDB=3 ICODE=0                  AREA=     6.576
*
KEEP HYD             ID=1 CUTOFF=72 ICODE=3 ISTEPS=1 IFORM=0 IDB=1 IMET=2
KEEP HYD             ID=1 CUTOFF=72 ICODE=5 ISTEPS=1 IFORM=0 IDB=1 IMET=2
PRINT HYD            ID=1 PCODE=1 MODE=10
*
*
NEW DUMP OUTPUT      MODE=10 ID=1 IOPT=4 FTYPE=0
```



```
*
* Conservation Drive to downstream
* VS=   8.000 is main channel & VS=   8.000 is off-channel
*
COMPUTE FLOWRATE     ID=3 NHD=3920 AREA=   0.01446 Sq km  L=   554 m  W=  25 m
                SOIL ZONE I    II  III    IV    V    VI  VII  VIII   IX
                       75.0  0.0  0.0  25.0  0.0   0.0  0.0   0.0  0.0
                     RATING CURVES: IDMC=1 IDOC=1 QRMC=  0.50 QROC=  0.05
                     ROUTING MODEL=2 CONSTANTS: OVERLAND FTB= 1.2 TLO= 0.0
                     SUBSURFACE: KSS= 5.0 KGW= 384 h PCODE=1 WQPCODE=1
                     RBASIN=0 IDA=0 IDB=0 IDC=0 IDD=0 RBDUMP=0
                     GWFACT=0.00 GWON=0
                     SWQTH=   0.0 L/s SWPUMP=   0.0 L/s SWCODE=0
*
*
ADD HYD              ID=4 HYD NO=2020 IDA=1 IDB=3 ICODE=0                  AREA=     6.576
*
*
* Beaver Creek in subcatchment 391, from Conservation Drive to           19
*
COMPUTE RATING CURVE ID=4  VS=     5.000   NSEGS=3
                      MIN EL=  342.02   MAX EL=  343.63
                      CHNSLP= 0.02600   FLNSLP= 0.02600
                      N= 0.100  DIST=    8.25
                      N=-0.045  DIST=   13.28
                      N= 0.100  DIST=   20.67
                        DIST    ELEV     DIST    ELEV     DIST    ELEV
                        0.00  343.63     2.03  343.62     4.62  343.55
                        6.99  343.56     8.25  343.43     8.51  343.03
                        8.62  342.91     9.44  342.90    10.02  342.85
                       10.39  342.82    11.57  342.91    12.16  342.88
                       12.40  342.94    12.63  342.02    12.98  343.17
                       13.28  343.33    14.36  343.36    17.52  343.46
                       20.67  343.40
                     RFN=0.0000 PCODE=1
*
* Beaver Creek through 391, south of Conservation Drive
* Using Valley Section      5.000 As channel Rating Curve
*
ROUTE CHANNEL        ID=2 HYD NO= 131 INFLOW=4 LENGTH=   870 m  SLOPE=0.00250
                     RCID=4 NS=1 PCODE=1 INDEX=1 PIPE=0 CANOPY=  0.0
*
*=========================Northgate Western Portion==============================
* Compute runoff hydrograph from area 7914 (MTE Development)
* VS=   8.000 is main channel & VS=   8.000 is off-channel
*
* 7914 is multi-residential roof areas to rooftop infiltration gallery
*
COMPUTE FLOWRATE     ID=1 NHD=7914 AREA=   0.03469 Sq km  L=   20 m  W=   10 m
                SOIL ZONE I    II  III    IV    V    VI  VII  VIII   IX
                      1.0   0.0  0.0   0.0  0.0   0.0  0.0 99.0  0.0
                     RATING CURVES: IDMC=1 IDOC=1 QRMC=  0.50 QROC=  0.05
                     ROUTING MODEL=2 CONSTANTS: OVERLAND FTB= 1.2 TLO= 0.0
                     SUBSURFACE: KSS= 5.0 KGW= 384 h PCODE=1 WQPCODE=1
                     RBASIN=0 IDA=0 IDB=0 IDC=0 IDD=0 RBDUMP=0
                     GWFACT=0.00 GWON=0
                     SWQTH=   0.0 L/s SWPUMP=   0.0 L/s SWCODE=0
*
* Rooftop Infiltration for 7914 (sized for 30mm @ 1m deep galleries)
* 15% safety factor 0.35 void ratio
*
ROUTE SPECIAL POND   ID=3 HYD NO=6914 INFLOW=1 PCODE=0 OPTION= 5
                     Inflow controls:
                         USPCT=100% USDIV=0     PCTA=  0% ADIV=0
```

```
                      GWPCT=  0% GWDIV=0
                    Maximum level for Routing Tables:  ZMAX= 101.150
                    Recharge characteristics for Compartment A
                      LEVELA= 100.000                EVAPA= 0.0 mm/d ACODE=0
                      CDA=   0.000 mm/h  DZA= 10.00 m
                    Recharge characteristics for Compartment B
                      LEVELB= 100.000 CCBA= 0.00000  EVAPB= 0.0 mm/d BCODE=1
                      CDB=   5.000 mm/h  DZB= 10.00 m
                    Irrigation Pond Controls: IPOND=0
                    Number of points=  4
                                  Compartment  A          Compartment B
                    Elevation  Outflow Storage  SFArea Outflow Storage SFArea
                       (m)       (cms)  (ha*m)    (ha)   (cms)  (ha*m)    (ha)
                     100.000     0.000  0.0000  0.0000   0.000  0.0000  0.2973
                     100.999     0.000  0.0000  0.0000   0.000  0.1040  0.2973
                     101.000     0.000  0.0000  0.0000   0.001  0.1041  0.2973
                     101.150     0.000  0.0000  0.0000   1.000  0.1197  0.2973
*
KEEP HYD             ID=3 CUTOFF=0 ICODE=5 ISTEP=1 IFORM=0 IDB=3 IMET=0
PRINT HYD            ID=3 PCODE=1 MODE=10
*
*
* Compute runoff hydrograph from area 78914 (whole lot yard pervious areas to amended topsoil)
* VS=   8.000 is main channel & VS=   8.000 is off-channel
*
COMPUTE FLOWRATE    ID=5 NHD=78914 AREA=   0.02414 Sq km  L=   30 m  W=    14 m
               SOIL ZONE I    II  III    IV    V    VI  VII  VIII   IX
                      0.0   0.0  0.0  45.5  0.0  52.6  1.9  0.0   0.0
                    RATING CURVES: IDMC=1 IDOC=1 QRMC=  0.50 QROC=  0.05
                    ROUTING MODEL=2 CONSTANTS: OVERLAND FTB= 1.2 TLO= 0.0
                    SUBSURFACE: KSS= 5.0 KGW= 384 h PCODE=1 WQPCODE=1
                    RBASIN=0 IDA=0 IDB=0 IDC=0 IDD=0 RBDUMP=0
                    GWFACT=0.00 GWON=0
                    SWQTH=   0.0 L/s SWPUMP=   0.0 L/s SWCODE=0
*
*
* Routed through Amended Top Soil
* (450mm @30% void ratio, considered 60mm vol to be conservative)
* Foot print = 4102 pervious area
* 15% safty factor
*
ROUTE SPECIAL POND  ID=1 HYD NO=914 INFLOW=5 PCODE=0 OPTION=15
                    Inflow controls:
                        USPCT=100% USDIV=0     PCTA=  0% ADIV=0
                        GWPCT=  0% GWDIV=0
                    Maximum level for Routing Tables:  ZMAX= 100.069
                    Recharge characteristics for Compartment A
                      LEVELA= 100.000                EVAPA= 0.0 mm/d ACODE=0
                      CDA=   0.000 mm/h  DZA= 10.00 m
                    Recharge characteristics for Compartment B
                      LEVELB= 100.000 CCBA= 0.00000  EVAPB= 0.0 mm/d BCODE=1
                      CDB=   5.000 mm/h  DZB= 10.00 m
                    Irrigation Pond Controls: IPOND=0
                    Number of points=  4
                                  Compartment  A          Compartment B
                    Elevation  Outflow Storage  SFArea Outflow Storage SFArea
                       (m)       (cms)  (ha*m)    (ha)   (cms)  (ha*m)    (ha)
                     100.000     0.000  0.0000  0.0000   0.000  0.0000  2.4140
                     100.059     0.000  0.0000  0.0000   0.000  0.1424  2.4140
                     100.060     0.000  0.0000  0.0000   0.001  0.1448  2.4140
                     100.069     0.000  0.0000  0.0000   0.800  0.1666  2.4140
*
* Water balance on amended topsoil only
*
```



```
PRINT HYD            ID=1 PCODE=1 MODE=10
*
* Sum hydr. 914 & 6914 call result 1914 (flow to SWM Pond after all lot-level infiltration)
*
ADD HYD              ID=6 HYD NO=1914 IDA=3 IDB=1 ICODE=0                  AREA=     0.05894
*
*============================================================
*
* Compute runoff hydrograph from area 85914 (park drains to amended topsoil)
* VS=   8.000 is main channel & VS=   8.000 is off-channel
*
COMPUTE FLOWRATE    ID=4 NHD=85914 AREA=   0.00553 Sq km  L=   70 m  W=    70 m
               SOIL ZONE I    II  III    IV    V    VI  VII  VIII   IX
                      0.0   0.0  0.0  45.5  0.0  52.6  1.9  0.0   0.0
                    RATING CURVES: IDMC=1 IDOC=1 QRMC=  0.50 QROC=  0.05
                    ROUTING MODEL=2 CONSTANTS: OVERLAND FTB= 1.2 TLO= 0.0
                    SUBSURFACE: KSS= 5.0 KGW= 384 h PCODE=1 WQPCODE=1
                    RBASIN=0 IDA=0 IDB=0 IDC=0 IDD=0 RBDUMP=0
                    GWFACT=0.00 GWON=0
                    SWQTH=   0.0 L/s SWPUMP=   0.0 L/s SWCODE=0
*
* Routed through Amended Top Soil
* (450mm @30% void ratio, considered 60mm vol to be conservative)
* Foot print = 85914 pervious area
* 15% safty factor
*
ROUTE SPECIAL POND  ID=5 HYD NO=314 INFLOW=4 PCODE=0 OPTION=15
                    Inflow controls:
                        USPCT=100% USDIV=0     PCTA=  0% ADIV=0
                        GWPCT=  0% GWDIV=0
                    Maximum level for Routing Tables:  ZMAX= 100.069
                    Recharge characteristics for Compartment A
                      LEVELA= 100.000                EVAPA= 0.0 mm/d ACODE=0
                      CDA=   0.000 mm/h  DZA= 10.00 m
                    Recharge characteristics for Compartment B
                      LEVELB= 100.000 CCBA= 0.00000  EVAPB= 0.0 mm/d BCODE=1
                      CDB=   5.000 mm/h  DZB= 10.00 m
                    Irrigation Pond Controls: IPOND=0
                    Number of points=  4
                                  Compartment  A          Compartment B
                    Elevation  Outflow Storage  SFArea Outflow Storage SFArea
                       (m)       (cms)  (ha*m)    (ha)   (cms)  (ha*m)    (ha)
                     100.000     0.000  0.0000  0.0000   0.000  0.0000  0.5535
                     100.059     0.000  0.0000  0.0000   0.000  0.0327  0.5535
                     100.060     0.000  0.0000  0.0000   0.001  0.0332  0.5535
                     100.069     0.000  0.0000  0.0000   0.800  0.0382  0.5535
*
PRINT HYD            ID=5 PCODE=1 MODE=10
*
* Compute runoff hydrograph from area 86914 (remaining area to SWM facility)
* VS=   8.000 is main channel & VS=   8.000 is off-channel
*
COMPUTE FLOWRATE    ID=3 NHD=86914 AREA=   0.05996 Sq km  L=   450 m  W=    50 m
               SOIL ZONE I    II  III    IV    V    VI  VII  VIII   IX
                     73.8   0.0  0.0  11.9  0.0  13.8  0.5   0.0  0.0
                    RATING CURVES: IDMC=1 IDOC=1 QRMC=  0.50 QROC=  0.05
                    ROUTING MODEL=2 CONSTANTS: OVERLAND FTB= 1.2 TLO= 0.0
                    SUBSURFACE: KSS= 5.0 KGW= 384 h PCODE=1 WQPCODE=1
                    RBASIN=0 IDA=0 IDB=0 IDC=0 IDD=0 RBDUMP=0
                    GWFACT=0.00 GWON=0
                    SWQTH=   0.0 L/s SWPUMP=   0.0 L/s SWCODE=0
*
* Sum hydr. 314 & 86914 call result 8914 (all flows going to SWM facility)
*
```

```
ADD HYD             ID=1 HYD NO=8914 IDA=5 IDB=3 ICODE=0                  AREA=     0.0655
*
* Sum hydr. 1914 & 8914 call result 3914 (all flows going to SWM facility)
*
ADD HYD             ID=3 HYD NO=3914 IDA=6 IDB=1 ICODE=0                  AREA=     0.1244
*
PRINT HYD           ID=3 PCODE=1 MODE=10
*
* 5914 Quantity SWM Basin (Wetpond, no EoP infiltration)
*
ROUTE SPECIAL POND  ID=1 HYD NO=5914 INFLOW=3 PCODE=0 OPTION=15
                    Inflow controls:
                        USPCT=100% USDIV=0     PCTA=  0% ADIV=0
                        GWPCT=  0% GWDIV=0
                    Maximum level for Routing Tables:  ZMAX= 347.900
                    Recharge characteristics for Compartment A
                      LEVELA= 200.000               EVAPA= 1.4 mm/d ACODE=0
                      CDA=   0.000 mm/h  DZA= 10.00 m
                    Recharge characteristics for Compartment B
                      LEVELB= 346.600 CCBA= 0.00000  EVAPB= 1.4 mm/d BCODE=0
                      CDB=   0.000 mm/h  DZB= 10.00 m
                    Irrigation Pond Controls: IPOND=0
                    Number of points= 20
                                Compartment  A          Compartment B
                    Elevation  Outflow Storage  SFArea Outflow Storage SFArea
                       (m)       (cms)  (ha*m)    (ha)   (cms)  (ha*m)    (ha)
                     346.600     0.000  0.0000  0.0000  0.0000  0.0000  0.3326
                     346.700     0.000  0.0000  0.0000  0.0021  0.0342  0.3509
                     346.768     0.000  0.0000  0.0000  0.0029  0.0587  0.3633
                     346.800     0.000  0.0000  0.0000  0.0033  0.0702  0.3692
                     346.860     0.000  0.0000  0.0000  0.0038  0.0929  0.3801
                     346.900     0.000  0.0000  0.0000  0.0041  0.1080  0.3875
                     347.000     0.000  0.0000  0.0000  0.0048  0.1477  0.4058
                     347.050     0.000  0.0000  0.0000  0.0051  0.1684  0.4149
                     347.100     0.000  0.0000  0.0000  0.0054  0.1892  0.4240
                     347.200     0.000  0.0000  0.0000  0.0060  0.2325  0.4423
                     347.220     0.000  0.0000  0.0000  0.0136  0.2415  0.4460
                     347.300     0.000  0.0000  0.0000  0.0905  0.2776  0.4606
                     347.400     0.000  0.0000  0.0000  0.2446  0.3246  0.4789
                     347.500     0.000  0.0000  0.0000  0.4441  0.3734  0.4972
                     347.550     0.000  0.0000  0.0000  0.5579  0.3987  0.5063
                     347.600     0.000  0.0000  0.0000  0.6801  0.4240  0.5155
                     347.700     0.000  0.0000  0.0000  1.4259  0.4765  0.5338
                     347.730     0.000  0.0000  0.0000  1.7474  0.4928  0.5392
                     347.800     0.000  0.0000  0.0000  2.6277  0.5308  0.5521
                     347.900     0.000  0.0000  0.0000  4.1662  0.5869  0.5703
*
PRINT HYD           ID=1 PCODE=1 MODE=10
KEEP HYD            ID=1 CUTOFF=0 ICODE=0 ISTEP=1 IFORM=0 IDB=3 IMET=1
*
* Divert SWMF 5914 throughflow to western wetland/cooling trench
*
DIVERT FLOWS        INFLOW=1  DIVERT=5 HYD NO= 114 PCODE=1 OPTION=4
                    THRUFLO=4 HYD NOB= 214  THROUGHFLOW  DIVERSION
                                             0.0058      0.0000
                                             0.0062      0.0255
                                             0.0070      0.2142
                                             0.0077      0.5479
                                             0.0092      1.5498
                                             0.0100      4.1562
                  IDFLAG=0 IDSTOR=0 IGWT=0
*
PRINT HYD           ID=5 PCODE=1 MODE=10
*KEEP HYD            ID=5 CUTOFF=0 ICODE=0 ISTEP=1 IFORM=0 IDB=3 IMET=1
```



```
*
PRINT HYD           ID=4 PCODE=1 MODE=10
*
* Divert flows into cooling trench and wetland
*
DIVERT FLOWS        INFLOW=4 MAJOR DIVERT ID=1 HYD NO= 414 PCODE=1 OPTION=6
                    SPLIT FLOW PCT= 77.0 THRU FLOW=3 HYD NO= 714
*
PRINT HYD           ID=1 PCODE=1 MODE=10
KEEP HYD            ID=1 CUTOFF=0 ICODE=0 ISTEP=1 IFORM=0 IDB=3 IMET=1
*
PRINT HYD           ID=3 PCODE=1 MODE=10
*
* Sum hydr. 114 & 414 call result 814 drain to Beaver Creek
*
ADD HYD             ID=4 HYD NO= 814 IDA=5 IDB=1 ICODE=0
*
* Compute runoff hydrograph from area 9141 (remaining uncontrolled area to B.C., NOT to SWM facilty)
* (Roof and rear yeard to wetland of B.C.)
* VS=   8.000 is main channel & VS=   8.000 is off-channel
*
COMPUTE FLOWRATE    ID=6 NHD= 9141 AREA=   0.01271 Sq km  L=    20 m  W=    10 m
                SOIL ZONE I    II  III    IV    V    VI  VII  VIII   IX
                       37.0   0.0  0.0  28.7  0.0  33.2  1.1  0.0  0.0
                    RATING CURVES: IDMC=1 IDOC=1 QRMC=  0.50 QROC=  0.05
                    ROUTING MODEL=2 CONSTANTS: OVERLAND FTB= 1.2 TLO= 0.0
                    SUBSURFACE: KSS= 5.0 KGW= 384 h PCODE=1 WQPCODE=1
                    RBASIN=0 IDA=0 IDB=0 IDC=0 IDD=0 RBDUMP=0
                    GWFACT=0.00 GWON=0
                    SWQTH=   0.0 L/s SWPUMP=   0.0 L/s SWCODE=0
*
PRINT HYD           ID=6 PCODE=1 MODE=10
*
* Compute runoff hydrograph from area  9142 (remaining uncontrolled area to B.C., NOT to SWM facilty)
* (Other areas to B.C.)
* VS=   8.000 is main channel & VS=   8.000 is off-channel
*
COMPUTE FLOWRATE    ID=5 NHD= 9142 AREA=   0.00560 Sq km  L=  450 m  W=    50 m
                SOIL ZONE I    II  III    IV    V    VI  VII  VIII   IX
                       26.4   0.0  0.0  33.5  0.0  38.8  1.3  0.0  0.0
                    RATING CURVES: IDMC=1 IDOC=1 QRMC=  0.50 QROC=  0.05
                    ROUTING MODEL=2 CONSTANTS: OVERLAND FTB= 1.2 TLO= 0.0
                    SUBSURFACE: KSS= 5.0 KGW= 384 h PCODE=1 WQPCODE=1
                    RBASIN=0 IDA=0 IDB=0 IDC=0 IDD=0 RBDUMP=0
                    GWFACT=0.00 GWON=0
                    SWQTH=   0.0 L/s SWPUMP=   0.0 L/s SWCODE=0
*
* Sum hydr.  9141 &  9142 call result 4914 (all flows leaving X914 area)
*
ADD HYD             ID=1 HYD NO=4914 IDA=6 IDB=5 ICODE=0                  AREA=     0.01923
PRINT HYD           ID=1 PCODE=1 MODE=10
*
* Sum hydr.  714 &  4914 call result 9143
*
* Total flows from 4914 and 214
*
ADD HYD             ID=6 HYD NO=9143 IDA=3 IDB=1 ICODE=0
PRINT HYD           ID=6 PCODE=1 MODE=10
*
*
* Sum hydr. 9143 & 814 call result 2914 (all flows leaving X914 area)
*
ADD HYD             ID=3 HYD NO=2914 IDA=4 IDB=6 ICODE=0                  AREA=     0.14368
*
```

```
PRINT HYD           ID=3 PCODE=1 MODE=10
*
* MTE Development
* Compute runoff hydrograph from rooftop area 7915
* VS=   8.000 is main channel & VS=   8.000 is off-channel
*
*
COMPUTE FLOWRATE    ID=4 NHD=7915 AREA=   0.00102 Sq km  L=   20 m  W=    10 m
              SOIL ZONE I    II  III    IV    V    VI  VII  VIII   IX
                     1.0   0.0  0.0   0.0  0.0   0.0  0.0  99.0  0.0
                    RATING CURVES: IDMC=1 IDOC=1 QRMC=  0.50 QROC=  0.05
                    ROUTING MODEL=2 CONSTANTS: OVERLAND FTB= 1.2 TLO= 0.0
                    SUBSURFACE: KSS= 5.0 KGW= 384 h PCODE=1 WQPCODE=1
                    RBASIN=0 IDA=0 IDB=0 IDC=0 IDD=0 RBDUMP=0
                    GWFACT=0.00 GWON=0
                    SWQTH=   0.0 L/s SWPUMP=   0.0 L/s SWCODE=0
*
* Rooftop Infiltration for 7915 (sized for 30mm @ 0.5m deep galleries)
* 15% safety factor 0.35 void ratio
*
ROUTE SPECIAL POND  ID=6 HYD NO=6915 INFLOW=4 PCODE=0 OPTION= 5
                    Inflow controls:
                        USPCT=100% USDIV=0     PCTA=  0% ADIV=0
                        GWPCT=  0% GWDIV=0
                    Maximum level for Routing Tables:  ZMAX= 100.575
                    Recharge characteristics for Compartment A
                      LEVELA= 100.000               EVAPA= 0.0 mm/d ACODE=0
                      CDA=   0.000 mm/h  DZA= 10.00 m
                    Recharge characteristics for Compartment B
                      LEVELB= 100.000 CCBA= 0.00000  EVAPB= 0.0 mm/d BCODE=1
                      CDB=  15.000 mm/h  DZB= 10.00 m
                    Irrigation Pond Controls: IPOND=0
                    Number of points=  4
                                  Compartment  A          Compartment B
                    Elevation  Outflow Storage  SFArea Outflow Storage SFArea
                       (m)       (cms)  (ha*m)    (ha)   (cms)  (ha*m)    (ha)
                     100.000     0.000  0.0000  0.0000   0.000  0.0000  0.0174
                     100.499     0.000  0.0000  0.0000   0.000  0.0030  0.0174
                     100.500     0.000  0.0000  0.0000   0.001  0.0031  0.0174
                     101.575     0.000  0.0000  0.0000   1.000  0.0035  0.0174
*
COMPUTE FLOWRATE    ID=1 NHD=8915 AREA=   0.00786 Sq km  L=   200 m  W=    50 m
              SOIL ZONE I    II  III    IV    V    VI  VII  VIII   IX
                    46.4   0.0  0.0  19.0  0.0  34.6  0.0   0.0  0.0
                    RATING CURVES: IDMC=1 IDOC=1 QRMC=  0.50 QROC=  0.05
                    ROUTING MODEL=2 CONSTANTS: OVERLAND FTB= 1.2 TLO= 0.0
                    SUBSURFACE: KSS= 5.0 KGW= 384 h PCODE=1 WQPCODE=1
                    RBASIN=0 IDA=0 IDB=0 IDC=0 IDD=0 RBDUMP=0
                    GWFACT=0.00 GWON=0
                    SWQTH=   0.0 L/s SWPUMP=   0.0 L/s SWCODE=0
*
* Sum hydr. 7915 & 8915 call result 3915
*
ADD HYD             ID=5 HYD NO=3915 IDA=6 IDB=1 ICODE=0                  AREA=     0.01009
*
PRINT HYD           ID=5 PCODE=1 MODE=10
*
*
* 5915 Quantity SWM Basin (Quantity Control Dry pond)
*
ROUTE SPECIAL POND  ID=6 HYD NO=5915 INFLOW=5 PCODE=0 OPTION=15
                    Inflow controls:
                        USPCT=100% USDIV=0     PCTA=  0% ADIV=0
                        GWPCT=  0% GWDIV=0
```



```
                    Maximum level for Routing Tables:  ZMAX= 352.450
                    Recharge characteristics for Compartment A
                      LEVELA= 200.000               EVAPA= 1.4 mm/d ACODE=0
                      CDA=   0.000 mm/h  DZA= 10.00 m
                    Recharge characteristics for Compartment B
                      LEVELB= 351.15  CCBA= 0.00000  EVAPB= 1.4 mm/d BCODE=0
                      CDB=    0.000 mm/h  DZB= 10.00 m
                    Irrigation Pond Controls: IPOND=0
                    Number of points= 16
                                  Compartment  A          Compartment B
                    Elevation  Outflow Storage  SFArea Outflow Storage SFArea
                       (m)       (cms)  (ha*m)    (ha)   (cms)  (ha*m)    (ha)
                     351.150     0.000  0.0000  0.0000  0.0000  0.0000  0.0418
                     351.230     0.000  0.0000  0.0000  0.0048  0.0035  0.0447
                     351.250     0.000  0.0000  0.0000  0.0068  0.0044  0.0455
                     351.300     0.000  0.0000  0.0000  0.0108  0.0067  0.0473
                     351.350     0.000  0.0000  0.0000  0.0136  0.0091  0.0492
                     351.450     0.000  0.0000  0.0000  0.0180  0.0142  0.0528
                     351.550     0.000  0.0000  0.0000  0.0214  0.0197  0.0565
                     351.650     0.000  0.0000  0.0000  0.0244  0.0255  0.0602
                     351.750     0.000  0.0000  0.0000  0.0271  0.0317  0.0639
                     351.850     0.000  0.0000  0.0000  0.0295  0.0383  0.0675
                     351.950     0.000  0.0000  0.0000  0.0318  0.0452  0.0712
                     352.050     0.000  0.0000  0.0000  0.0338  0.0525  0.0749
                     352.120     0.000  0.0000  0.0000  0.0352  0.0580  0.0775
                     352.250     0.000  0.0000  0.0000  0.1890  0.0682  0.0823
                     352.350     0.000  0.0000  0.0000  0.4990  0.0766  0.0859
                     352.450     0.000  0.0000  0.0000  0.9437  0.0854  0.0896
*
KEEP HYD            ID=6 CUTOFF=0 ICODE=0 ISTEP=1 IFORM=0 IDB=3 IMET=1
*
PRINT HYD           ID=6 PCODE=1 MODE=10
*
* 1915 Infiltration Trench (Non-winter months)
*
ROUTE SPECIAL POND  ID=1 HYD NO=1915 INFLOW=6 PCODE=0 OPTION= 5
                    Inflow controls:
                        USPCT=100% USDIV=0     PCTA=  0% ADIV=0
                        GWPCT=  0% GWDIV=0
                    Maximum level for Routing Tables:  ZMAX= 351.110
                    Recharge characteristics for Compartment A
                      LEVELA= 350.050               EVAPA= 0.0 mm/d ACODE=0
                      CDA=   0.000 mm/h  DZA= 10.00 m
                    Recharge characteristics for Compartment B
                      LEVELB= 350.050 CCBA= 0.00000  EVAPB= 0.0 mm/d BCODE=1
                      CDB=  15.000 mm/h  DZB= 10.00 m
                    Irrigation Pond Controls: IPOND=0
                    Number of points=  9
                                  Compartment  A          Compartment B
                    Elevation  Outflow Storage  SFArea Outflow Storage SFArea
                       (m)       (cms)  (ha*m)    (ha)   (cms)  (ha*m)    (ha)
                     350.050     0.000  0.0000  0.0000   0.000  0.0000  0.0543
                     350.200     0.000  0.0000  0.0000   0.000  0.0020  0.0543
                     350.350     0.000  0.0000  0.0000   0.000  0.0046  0.0543
                     350.500     0.000  0.0000  0.0000   0.000  0.0091  0.0543
                     350.650     0.000  0.0000  0.0000   0.000  0.0154  0.0543
                     350.800     0.000  0.0000  0.0000   0.000  0.0196  0.0543
                     350.950     0.000  0.0000  0.0000   0.000  0.0242  0.0543
                     351.100     0.000  0.0000  0.0000   0.000  0.0265  0.0543
                     351.110     0.000  0.0000  0.0000   0.500  0.0265  0.0543
*
*
PRINT HYD           ID=1 PCODE=1 MODE=10
KEEP HYD            ID=1 CUTOFF=0 ICODE=0 ISTEP=1 IFORM=0 IDB=3 IMET=1
```

```
*
*
* Compute runoff hydrograph from  9151 (0.18ha residential roof area to B.C. Wetland)
* VS=   8.000 is main channel & VS=   8.000 is off-channel
*
COMPUTE FLOWRATE    ID=6 NHD= 9151 AREA=   0.00180 Sq km  L=   20 m  W=    10 m
              SOIL ZONE I    II  III    IV    V    VI  VII  VIII   IX
                     1.0   0.0  0.0   0.0  0.0   0.0  0.0  99.0  0.0
                   RATING CURVES: IDMC=1 IDOC=1 QRMC=  0.50 QROC=  0.05
                   ROUTING MODEL=2 CONSTANTS: OVERLAND FTB= 1.2 TLO= 0.0
                   SUBSURFACE: KSS= 5.0 KGW= 384 h PCODE=1 WQPCODE=1
                   RBASIN=0 IDA=0 IDB=0 IDC=0 IDD=0 RBDUMP=0
                   GWFACT=0.00 GWON=0
                   SWQTH=   0.0 L/s SWPUMP=   0.0 L/s SWCODE=0
*
PRINT HYD           ID=6 PCODE=1 MODE=10
*
* Compute runoff hydrograph from area 9152 (remaining area to Beaver Creek)
* VS=   8.000 is main channel & VS=   8.000 is off-channel
*
COMPUTE FLOWRATE    ID=4 NHD= 9152 AREA=   0.00485 Sq km  L=   50 m  W=    50 m
              SOIL ZONE I    II  III    IV    V    VI  VII  VIII   IX
                     0.0   0.0   0.0  35.4  0.0  64.6  0.0   0.0  0.0
                   RATING CURVES: IDMC=1 IDOC=1 QRMC=  0.50 QROC=  0.05
                   ROUTING MODEL=2 CONSTANTS: OVERLAND FTB= 1.2 TLO= 0.0
                   SUBSURFACE: KSS= 5.0 KGW= 384 h PCODE=1 WQPCODE=1
                   RBASIN=0 IDA=0 IDB=0 IDC=0 IDD=0 RBDUMP=0
                   GWFACT=0.00 GWON=0
                   SWQTH=   0.0 L/s SWPUMP=   0.0 L/s SWCODE=0
*
PRINT HYD           ID=4 PCODE=1 MODE=10
*
* Sum hydr.  9151 &  9152 call result 4915
*
ADD HYD             ID=5 HYD NO=4915 IDA=4 IDB=6 ICODE=0                  AREA=     0.01009
*
* Sum hydr. 4915 & 5915 call result 2915
*
ADD HYD             ID=4 HYD NO=2915 IDA=1 IDB=5 ICODE=0                  AREA=     0.01530
*
PRINT HYD           ID=4 PCODE=1 MODE=10
*
* Sum hydr. 2914 & 2915 call result 2005
*
ADD HYD             ID=1 HYD NO=2005 IDA=3 IDB=4 ICODE=0                  AREA=     0.17296
*
* Typical off-channel (Flat slopes)                                      6
*
COMPUTE RATING CURVE ID=6  VS=     1.100   NSEGS=3
                      MIN EL=  100.00   MAX EL=  100.60
                      CHNSLP= 0.01000   FLNSLP= 0.01000
                      N= 0.350  DIST=   39.15
                      N=-0.150  DIST=   40.85
                      N= 0.350  DIST=   80.00
                        DIST    ELEV     DIST    ELEV     DIST    ELEV
                        0.00  100.60    39.15  100.20    39.75  100.00
                       40.25  100.00    40.85  100.20    80.00  100.60
                     RFN=0.0000 PCODE=1
*
COMPUTE RATING CURVE ID=4  VS=     5.000   NSEGS=3
                      MIN EL=  342.02   MAX EL=  343.63
                      CHNSLP= 0.02600   FLNSLP= 0.02600
                      N= 0.100  DIST=    8.25
                      N=-0.045  DIST=   13.28
```



```
                      N= 0.100  DIST=   20.67
                        DIST    ELEV     DIST    ELEV     DIST    ELEV
                        0.00  343.63     2.03  343.62     4.62  343.55
                        6.99  343.56     8.25  343.43     8.51  343.03
                        8.62  342.91     9.44  342.90    10.02  342.85
                       10.39  342.82    11.57  342.91    12.16  342.88
                       12.40  342.94    12.63  342.02    12.98  343.17
                       13.28  343.33    14.36  343.36    17.52  343.46
                       20.67  343.40
                     RFN=0.0000 PCODE=1
*
*
* Compute runoff hydrograph from area 1911 (undeveloped Bever Creek and adjacent wetland)
* VS=   5.000 is main channel & VS=   1.100 is off-channel
*
COMPUTE FLOWRATE    ID=6 NHD= 1911  AREA=   0.19351 Sq km  L=   400 m  W=   250 m
              SOIL ZONE I    II  III    IV    V    VI  VII  VIII   IX
                     1.0   3.0 27.0   3.0 12.0  11.0 43.0   0.0  0.0
                   RATING CURVES: IDMC=4 IDOC=6 QRMC=  0.50 QROC=  0.05
                   ROUTING MODEL=2 CONSTANTS: OVERLAND FTB= 2.0 TLO= 0.0
                   SUBSURFACE: KSS= 5.0 KGW= 384 h PCODE=1 WQPCODE=1
                   RBASIN=0 IDA=0 IDB=0 IDC=0 IDD=0 RBDUMP=0
                   GWFACT=0.00 GWON=0
                   SWQTH=   0.0 L/s SWPUMP=   0.0 L/s SWCODE=0
*
PRINT HYD           ID=6 PCODE=1 MODE=10
*
* Compute runoff hydrograph from area 2911 (undeveloped property south edge)
* VS=   5.000 is main channel & VS=   1.100 is off-channel
*
COMPUTE FLOWRATE    ID=4 NHD= 2911  AREA=   0.00957 Sq km  L=    50 m  W=   100 m
              SOIL ZONE I    II  III    IV    V    VI  VII  VIII   IX
                     1.0   3.0 27.0   3.0 12.0  11.0 43.0   0.0  0.0
                   RATING CURVES: IDMC=4 IDOC=6 QRMC=  0.50 QROC=  0.05
                   ROUTING MODEL=2 CONSTANTS: OVERLAND FTB= 2.0 TLO= 0.0
                   SUBSURFACE: KSS= 5.0 KGW= 384 h PCODE=1 WQPCODE=1
                   RBASIN=0 IDA=0 IDB=0 IDC=0 IDD=0 RBDUMP=0
                   GWFACT=0.00 GWON=0
                   SWQTH=   0.0 L/s SWPUMP=   0.0 L/s SWCODE=0
*
PRINT HYD           ID=4 PCODE=1 MODE=10
*
* Sum hydr. 19111 & 2911 call result 3911
*
ADD HYD             ID=3 HYD NO=3911 IDA=6 IDB=4 ICODE=0                  AREA=     0.2021
*
* Sum hydr. 2005 & 3911 call result 2006
*
ADD HYD             ID=4 HYD NO=2006 IDA=1 IDB=3 ICODE=0                  AREA=     0.37595
*
* MTE Development
* Compute runoff hydrograph from area 7917 - Some rooftops to Infiltration gallery (approx 11 lots)
* VS=   8.000 is main channel & VS=   8.000 is off-channel
*
COMPUTE FLOWRATE    ID=3 NHD=7917 AREA=   0.00305 Sq km  L=   20 m  W=    10 m
              SOIL ZONE I    II  III    IV    V    VI  VII  VIII   IX
                     1.0   0.0  0.0  0.0  0.0   0.0  0.0  99.0  0.0
                   RATING CURVES: IDMC=1 IDOC=1 QRMC=  0.50 QROC=  0.05
                   ROUTING MODEL=2 CONSTANTS: OVERLAND FTB= 1.2 TLO= 0.0
                   SUBSURFACE: KSS= 5.0 KGW= 384 h PCODE=1 WQPCODE=1
                   RBASIN=0 IDA=0 IDB=0 IDC=0 IDD=0 RBDUMP=0
                   GWFACT=0.00 GWON=0
                   SWQTH=   0.0 L/s SWPUMP=   0.0 L/s SWCODE=0
*
```

```
* Rooftop Infiltration for 7917 (sized for 30mm @ 1m deep galleries)
* 15% safety factor 0.35 void ratio
*
ROUTE SPECIAL POND  ID=5 HYD NO=6917 INFLOW=3 PCODE=0 OPTION= 5
                    Inflow controls:
                        USPCT=100% USDIV=0     PCTA=  0% ADIV=0
                        GWPCT=  0% GWDIV=0
                    Maximum level for Routing Tables:  ZMAX= 101.150
                    Recharge characteristics for Compartment A
                      LEVELA= 100.000               EVAPA= 0.0 mm/d ACODE=0
                      CDA=   0.000 mm/h  DZA= 10.00 m
                    Recharge characteristics for Compartment B
                      LEVELB= 100.000 CCBA= 0.00000  EVAPB= 0.0 mm/d BCODE=1
                      CDB=  15.000 mm/h  DZB= 10.00 m
                    Irrigation Pond Controls: IPOND=0
                    Number of points=  4
                                  Compartment  A          Compartment B
                    Elevation  Outflow Storage  SFArea Outflow Storage SFArea
                       (m)       (cms)  (ha*m)    (ha)   (cms)  (ha*m)    (ha)
                     100.000     0.000  0.0000  0.0000   0.000  0.0000  0.0261
                     100.999     0.000  0.0000  0.0000   0.000  0.0091  0.0261
                     101.000     0.000  0.0000  0.0000   0.001  0.0092  0.0261
                     101.150     0.000  0.0000  0.0000   1.000  0.0105  0.0261
*
*
* Compute runoff hydrograph from area 8917 - Remainder Area in 3917
* VS=   8.000 is main channel & VS=   8.000 is off-channel
*
COMPUTE FLOWRATE    ID=1 NHD=8917 AREA=   0.00966 Sq km  L=  100 m  W=    10 m
              SOIL ZONE I    II  III    IV    V    VI  VII  VIII   IX
                    55.0   4.5  0.0  33.7  0.0   6.8  0.0   0.0  0.0
                    RATING CURVES: IDMC=1 IDOC=1 QRMC=  0.50 QROC=  0.05
                    ROUTING MODEL=2 CONSTANTS: OVERLAND FTB= 1.2 TLO= 0.0
                    SUBSURFACE: KSS= 5.0 KGW= 384 h PCODE=1 WQPCODE=1
                    RBASIN=0 IDA=0 IDB=0 IDC=0 IDD=0 RBDUMP=0
                    GWFACT=0.00 GWON=0
                    SWQTH=   0.0 L/s SWPUMP=   0.0 L/s SWCODE=0
*
* Sum hydr. 6917 & 8917 call result 3917
*
ADD HYD             ID=6 HYD NO=3917 IDA=5 IDB=1 ICODE=0                  AREA=     0.0091
*
*
*
* 5917 Quantity SWM Basin (Quantity Control Dry pond)
*
ROUTE SPECIAL POND  ID=1 HYD NO=5917 INFLOW=6 PCODE=0 OPTION=15
                    Inflow controls:
                        USPCT=100% USDIV=0     PCTA=  0% ADIV=0
                        GWPCT=  0% GWDIV=0
                    Maximum level for Routing Tables:  ZMAX= 349.300
                    Recharge characteristics for Compartment A
                      LEVELA= 200.000               EVAPA= 1.4 mm/d ACODE=0
                      CDA=   0.000 mm/h  DZA= 10.00 m
                    Recharge characteristics for Compartment B
                      LEVELB= 348.101 CCBA= 0.00000  EVAPB= 1.4 mm/d BCODE=0
                      CDB=    0.000 mm/h  DZB= 10.00 m
                    Irrigation Pond Controls: IPOND=0
                    Number of points= 16
                                  Compartment  A          Compartment B
                    Elevation  Outflow Storage  SFArea Outflow Storage SFArea
                       (m)       (cms)  (ha*m)    (ha)   (cms)  (ha*m)    (ha)
                     348.100     0.000  0.0000  0.0000  0.0000  0.0000  0.0400
                     348.101     0.000  0.0000  0.0000  0.0011  0.0000  0.0400
```



```
                     348.200     0.000  0.0000  0.0000  0.0027  0.0042  0.0437
                     348.300     0.000  0.0000  0.0000  0.0037  0.0087  0.0473
                     348.330     0.000  0.0000  0.0000  0.0039  0.0102  0.0484
                     348.470     0.000  0.0000  0.0000  0.0063  0.0173  0.0536
                     348.500     0.000  0.0000  0.0000  0.0067  0.0189  0.0547
                     348.600     0.000  0.0000  0.0000  0.0145  0.0246  0.0583
                     348.700     0.000  0.0000  0.0000  0.0222  0.0306  0.0620
                     348.800     0.000  0.0000  0.0000  0.0274  0.0370  0.0657
                     348.900     0.000  0.0000  0.0000  0.0316  0.0437  0.0694
                     349.000     0.000  0.0000  0.0000  0.0662  0.0509  0.0730
                     349.026     0.000  0.0000  0.0000  0.0842  0.0528  0.0740
                     349.100     0.000  0.0000  0.0000  0.2989  0.0583  0.0767
                     349.200     0.000  0.0000  0.0000  0.7153  0.0662  0.0804
                     349.300     0.000  0.0000  0.0000  1.2873  0.0744  0.0840
*
PRINT HYD           ID=1 PCODE=1 MODE=10
*
* Infiltration trench at 3917 (non-winter)
*
ROUTE SPECIAL POND  ID=5 HYD NO=1917 INFLOW=1 PCODE=0 OPTION= 5
                    Inflow controls:
                        USPCT=100% USDIV=0     PCTA=  0% ADIV=0
                        GWPCT=  0% GWDIV=0
                    Maximum level for Routing Tables:  ZMAX= 348.051
                    Recharge characteristics for Compartment A
                      LEVELA= 100.000               EVAPA= 0.0 mm/d ACODE=0
                      CDA=   0.000 mm/h  DZA= 10.00 m
                    Recharge characteristics for Compartment B
                      LEVELB= 347.300 CCBA= 0.00000  EVAPB= 0.0 mm/d BCODE=1
                      CDB=  15.000 mm/h  DZB= 10.00 m
                    Irrigation Pond Controls: IPOND=0
                    Number of points=  7
                                  Compartment  A          Compartment B
                    Elevation  Outflow Storage  SFArea Outflow Storage SFArea
                       (m)       (cms)  (ha*m)    (ha)   (cms)  (ha*m)    (ha)
                     347.300     0.000  0.0000  0.0000   0.000  0.0000  0.0339
                     347.450     0.000  0.0000  0.0000   0.000  0.0018  0.0339
                     347.600     0.000  0.0000  0.0000   0.000  0.0058  0.0339
                     347.750     0.000  0.0000  0.0000   0.000  0.0089  0.0339
                     347.900     0.000  0.0000  0.0000   0.000  0.0113  0.0339
                     348.050     0.000  0.0000  0.0000   0.000  0.0122  0.0339
                     348.051     0.000  0.0000  0.0000   0.500  0.0122  0.0339
*
PRINT HYD           ID=5 PCODE=1 MODE=10
*
* Compute runoff hydrograph from area  9171 (remaining area to Beaver Creek west wetland)
* VS=   8.000 is main channel & VS=   8.000 is off-channel
*
COMPUTE FLOWRATE    ID=1 NHD= 9171 AREA=   0.00805 Sq km  L=    45 m  W=    45 m
              SOIL ZONE I    II  III    IV    V    VI  VII  VIII   IX
                    1.6  10.0  0.0  73.5  0.0  14.9  0.0   0.0  0.0
                    RATING CURVES: IDMC=1 IDOC=1 QRMC=  0.50 QROC=  0.05
                    ROUTING MODEL=2 CONSTANTS: OVERLAND FTB= 1.2 TLO= 0.0
                    SUBSURFACE: KSS= 5.0 KGW= 384 h PCODE=1 WQPCODE=1
                    RBASIN=0 IDA=0 IDB=0 IDC=0 IDD=0 RBDUMP=0
                    GWFACT=0.00 GWON=0
                    SWQTH=   0.0 L/s SWPUMP=   0.0 L/s SWCODE=0
*
PRINT HYD           ID=1 PCODE=1 MODE=10
*
* Compute runoff hydrograph from area  9172 (remaining area to Beaver Creek east wetland)
* VS=   8.000 is main channel & VS=   8.000 is off-channel
*
COMPUTE FLOWRATE    ID=3 NHD= 9172 AREA=   0.00408 Sq km  L=    45 m  W=    45 m
```

```
             SOIL ZONE I    II  III    IV    V    VI  VII  VIII   IX
                     43.7  5.7  0.0  42.1  0.0   8.5  0.0   0.0  0.0
                   RATING CURVES: IDMC=1 IDOC=1 QRMC=  0.50 QROC=  0.05
                   ROUTING MODEL=2 CONSTANTS: OVERLAND FTB= 1.2 TLO= 0.0
                   SUBSURFACE: KSS= 5.0 KGW= 384 h PCODE=1 WQPCODE=1
                   RBASIN=0 IDA=0 IDB=0 IDC=0 IDD=0 RBDUMP=0
                   GWFACT=0.00 GWON=0
                   SWQTH=   0.0 L/s SWPUMP=   0.0 L/s SWCODE=0
*
PRINT HYD          ID=3 PCODE=1 MODE=10
*
* Sum hydr.  9171 &  9172 call result 4917
*
ADD HYD            ID=6 HYD NO=4917 IDA=1 IDB=3 ICODE=0                AREA=     0.01287
*
* Sum hydr. 5917 & 4917 call result 2917
*
ADD HYD            ID=3 HYD NO=2917 IDA=6 IDB=5 ICODE=0                AREA=     0.02573
*
*
* Total water balance leaving X917 area:
*
PRINT HYD          ID=3 PCODE=1 MODE=10
*
* Sum hydr. 2006 & 2917 call result 2007
*
ADD HYD            ID=1 HYD NO=2007 IDA=4 IDB=3 ICODE=0                AREA=     0.40133
*
*  Main channel Parabolic Swale - Flat                                  7
*
COMPUTE RATING CURVE ID=1  VS=     7.000   NSEGS=3
                      MIN EL=  100.70   MAX EL=  103.00
                      CHNSLP= 0.01000   FLNSLP= 0.01000
                      N= 0.070  DIST=   20.00
                      N=-0.050  DIST=   30.00
                      N= 0.070  DIST=   50.00
                        DIST    ELEV     DIST    ELEV     DIST    ELEV
                        0.00  103.00    20.00  101.00    23.00  100.80
                       25.00  100.70    27.00  100.80    30.00  101.00
                       50.00  103.00
                     RFN=0.0000 PCODE=1
*
* Compute runoff hydrograph from area 3918 (undeveloped)
* VS=   7.000 is main channel & VS=   1.000 is off-channel
*
COMPUTE FLOWRATE    ID=3 NHD=3918 AREA=   0.00565 Sq km  L=    50 m  W=   100 m
             SOIL ZONE I    II  III    IV    V    VI  VII  VIII   IX
                     1.0   0.0 20.0   0.0 79.0   0.0  0.0   0.0  0.0
                   RATING CURVES: IDMC=1 IDOC=5 QRMC=  0.50 QROC=  0.05
                   ROUTING MODEL=2 CONSTANTS: OVERLAND FTB= 2.0 TLO= 0.0
                   SUBSURFACE: KSS= 5.0 KGW= 384 h PCODE=1 WQPCODE=1
                   RBASIN=0 IDA=0 IDB=0 IDC=0 IDD=0 RBDUMP=0
                   GWFACT=0.00 GWON=0
                   SWQTH=   0.0 L/s SWPUMP=   0.0 L/s SWCODE=0
*
PRINT HYD          ID=3 PCODE=1 MODE=10
*
* Sum hydr. 2007 & 3918 call result 2008
*
ADD HYD            ID=4 HYD NO=2008 IDA=1 IDB=3 ICODE=0                AREA=     0.40733
*
*
* Beaver Creek at south end of Site
*
```



```
ADD HYD            ID=1 HYD NO=2009 IDA=2 IDB=4 ICODE=0                AREA=     6.98333
*
**========================Northgate Western Portion================================
*
* Go to event file: Beaver Creek at south end of Site
*
*CHANGE INPUT FILE
*
KEEP HYD           ID=1 CUTOFF=72 ICODE=5 ISTEPS=1 IFORM=0 IDB=1 IMET=2
*EEP HYD           ID=1 CUTOFF=72 ICODE=4 ISTEPS=1 IFORM=0 IDB=1 IMET=2
PRINT HYD          ID=1 PCODE=1 MODE=10
*
NEW DUMP OUTPUT    MODE=10 ID=1 IOPT=4 FTYPE=0
*
* To Laurel Creek
* Compute runoff hydrograph from area 3092
* VS=   7.000 is main channel & VS=   1.000 is off-channel
*
COMPUTE FLOWRATE    ID=2 NHD=3092 AREA=   0.04015 Sq km  L=   300 m  W=   100 m
             SOIL ZONE I    II  III    IV    V    VI  VII  VIII   IX
                     1.0  28.0  7.0  34.0  0.0  30.0  0.0   0.0  0.0
                   RATING CURVES: IDMC=1 IDOC=5 QRMC=  0.50 QROC=  0.05
                   ROUTING MODEL=2 CONSTANTS: OVERLAND FTB= 2.0 TLO= 0.0
                   SUBSURFACE: KSS= 5.0 KGW= 384 h PCODE=1 WQPCODE=1
                   RBASIN=0 IDA=0 IDB=0 IDC=0 IDD=0 RBDUMP=0
                   GWFACT=0.00 GWON=0
                   SWQTH=   0.0 L/s SWPUMP=   0.0 L/s SWCODE=0
*
PRINT HYD          ID=2 PCODE=1 MODE=10
*
* Compute runoff hydrograph from area 3093
* VS=   7.000 is main channel & VS=   1.000 is off-channel
*
COMPUTE FLOWRATE    ID=3 NHD=3093 AREA=   0.00579 Sq km  L=   150 m  W=   100 m
             SOIL ZONE I    II  III    IV    V    VI  VII  VIII   IX
                     1.0   0.0 40.0  18.0 41.0   0.0  0.0   0.0  0.0
                   RATING CURVES: IDMC=1 IDOC=5 QRMC=  0.50 QROC=  0.05
                   ROUTING MODEL=2 CONSTANTS: OVERLAND FTB= 2.0 TLO= 0.0
                   SUBSURFACE: KSS= 5.0 KGW= 384 h PCODE=1 WQPCODE=1
                   RBASIN=0 IDA=0 IDB=0 IDC=0 IDD=0 RBDUMP=0
                   GWFACT=0.00 GWON=0
                   SWQTH=   0.0 L/s SWPUMP=   0.0 L/s SWCODE=0
*
PRINT HYD          ID=3 PCODE=1 MODE=10
*
* Sum hydr. 3092 & 3093 call result 2010
*
ADD HYD            ID=5 HYD NO=2010 IDA=2 IDB=3 ICODE=0                AREA=     0.04736
*
* Compute runoff hydrograph from area 9173 (remaining area to Laurel Creek)
* VS=   8.000 is main channel & VS=   8.000 is off-channel
*
COMPUTE FLOWRATE    ID=1 NHD= 9173 AREA=   0.00288 Sq km  L=    45 m  W=    45 m
             SOIL ZONE I    II  III    IV    V    VI  VII  VIII   IX
                     0.0  10.1  0.0  74.8  0.0  15.1  0.0   0.0  0.0
                   RATING CURVES: IDMC=1 IDOC=1 QRMC=  0.50 QROC=  0.05
                   ROUTING MODEL=2 CONSTANTS: OVERLAND FTB= 1.2 TLO= 0.0
                   SUBSURFACE: KSS= 5.0 KGW= 384 h PCODE=1 WQPCODE=1
                   RBASIN=0 IDA=0 IDB=0 IDC=0 IDD=0 RBDUMP=0
                   GWFACT=0.00 GWON=0
                   SWQTH=   0.0 L/s SWPUMP=   0.0 L/s SWCODE=0
*
PRINT HYD          ID=1 PCODE=1 MODE=10
*
```

```
* Sum hydr. 2010 & 49173 call result 2021
* Total outflow from 309
*
ADD HYD             ID=6 HYD NO=2021 IDA=5 IDB=1 ICODE=0                  AREA=     0.04736
*
*=======(flow from X914 to Laurel Creek)==================
* Compute runoff hydrograph from area 99141 (roof area to infiltraion gallary)
* Close to Conservation Drive
* VS=   8.000 is main channel & VS=   8.000 is off-channel
*
COMPUTE FLOWRATE    ID=3 NHD=99141 AREA=   0.00135 Sq km  L=   20 m  W=    10 m
              SOIL ZONE I    II  III    IV    V    VI  VII  VIII   IX
                       1.0   0.0  0.0  0.0  0.0   0.0  0.0  99.0  0.0
                    RATING CURVES: IDMC=1 IDOC=1 QRMC=  0.50 QROC=  0.05
                    ROUTING MODEL=2 CONSTANTS: OVERLAND FTB= 1.2 TLO= 0.0
                    SUBSURFACE: KSS= 5.0 KGW= 384 h PCODE=1 WQPCODE=1
                    RBASIN=0 IDA=0 IDB=0 IDC=0 IDD=0 RBDUMP=0
                    GWFACT=0.00 GWON=0
                    SWQTH=   0.0 L/s SWPUMP=   0.0 L/s SWCODE=0
*
* Rooftop Infiltration for 99141 (sized for 30mm @ 1m deep galleries)
* 15% safety factor 0.35 void ratio
*
ROUTE SPECIAL POND  ID=2 HYD NO= 514 INFLOW=3 PCODE=0 OPTION= 5
                    Inflow controls:
                        USPCT=100% USDIV=0     PCTA=  0% ADIV=0
                        GWPCT=  0% GWDIV=0
                    Maximum level for Routing Tables:  ZMAX= 101.150
                    Recharge characteristics for Compartment A
                      LEVELA= 100.000               EVAPA= 0.0 mm/d ACODE=0
                      CDA=   0.000 mm/h  DZA= 10.00 m
                    Recharge characteristics for Compartment B
                      LEVELB= 100.000 CCBA= 0.00000  EVAPB= 0.0 mm/d BCODE=1
                      CDB=   5.000 mm/h  DZB= 10.00 m
                    Irrigation Pond Controls: IPOND=0
                    Number of points=  4
                                  Compartment  A          Compartment B
                    Elevation  Outflow Storage  SFArea Outflow Storage SFArea
                       (m)       (cms)  (ha*m)    (ha)   (cms)  (ha*m)    (ha)
                     100.000     0.000  0.0000  0.0000   0.000  0.0000  0.0116
                     100.999     0.000  0.0000  0.0000   0.000  0.0040  0.0116
                     101.000     0.000  0.0000  0.0000   0.001  0.0041  0.0116
                     101.150     0.000  0.0000  0.0000   1.000  0.0047  0.0116
*
* Compute runoff hydrograph from area 99142 (Rear roof and yard drains to amended topsoil)
* VS=   8.000 is main channel & VS=   8.000 is off-channel
*
COMPUTE FLOWRATE    ID=1 NHD=99142 AREA=   0.01520 Sq km  L=   30 m  W=    14 m
              SOIL ZONE I    II  III    IV    V    VI  VII  VIII   IX
                     27.7   0.0  0.0  32.9  0.0  38.1  1.3  0.0   0.0
                    RATING CURVES: IDMC=1 IDOC=1 QRMC=  0.50 QROC=  0.05
                    ROUTING MODEL=2 CONSTANTS: OVERLAND FTB= 1.2 TLO= 0.0
                    SUBSURFACE: KSS= 5.0 KGW= 384 h PCODE=1 WQPCODE=1
                    RBASIN=0 IDA=0 IDB=0 IDC=0 IDD=0 RBDUMP=0
                    GWFACT=0.00 GWON=0
                    SWQTH=   0.0 L/s SWPUMP=   0.0 L/s SWCODE=0
*
* Routed through Amended Top Soil
* (450mm @30% void ratio, considered 60mm vol to be conservative)
* Foot print = 99142 pervious area
* 15% safty factor
*
ROUTE SPECIAL POND  ID=3 HYD NO=614 INFLOW=1 PCODE=0 OPTION=15
                    Inflow controls:
```



```
                        USPCT=100% USDIV=0     PCTA=  0% ADIV=0
                        GWPCT=  0% GWDIV=0
                    Maximum level for Routing Tables:  ZMAX= 100.069
                    Recharge characteristics for Compartment A
                      LEVELA= 100.000               EVAPA= 0.0 mm/d ACODE=0
                      CDA=   0.000 mm/h  DZA= 10.00 m
                    Recharge characteristics for Compartment B
                      LEVELB= 100.000 CCBA= 0.00000  EVAPB= 0.0 mm/d BCODE=1
                      CDB=   5.000 mm/h  DZB= 10.00 m
                    Irrigation Pond Controls: IPOND=0
                    Number of points=  4
                                  Compartment  A          Compartment B
                    Elevation  Outflow Storage  SFArea Outflow Storage SFArea
                       (m)       (cms)  (ha*m)    (ha)   (cms)  (ha*m)    (ha)
                     100.000     0.000  0.0000  0.0000   0.000  0.0000  1.0993
                     100.059     0.000  0.0000  0.0000   0.000  0.0649  1.0993
                     100.060     0.000  0.0000  0.0000   0.001  0.0660  1.0993
                     100.069     0.000  0.0000  0.0000   0.800  0.0759  1.0993
*
ADD HYD             ID=1 HYD NO=99143 IDA=2 IDB=3 ICODE=0
*
*Compute runoff hydrograph from remainder area in 9914
*
COMPUTE FLOWRATE    ID=3 NHD=99145 AREA=   0.00404 Sq km  L=    50 m  W=    50 m
              SOIL ZONE I    II  III    IV    V    VI  VII  VIII   IX
                     66.7   0.0  0.0  15.1  0.0  17.5  0.6   0.0  0.0
                    RATING CURVES: IDMC=1 IDOC=5 QRMC=  0.50 QROC=  0.05
                    ROUTING MODEL=2 CONSTANTS: OVERLAND FTB= 2.0 TLO= 0.0
                    SUBSURFACE: KSS= 5.0 KGW= 384 h PCODE=1 WQPCODE=1
                    RBASIN=0 IDA=0 IDB=0 IDC=0 IDD=0 RBDUMP=0
                    GWFACT=0.00 GWON=0
                    SWQTH=   0.0 L/s SWPUMP=   0.0 L/s SWCODE=0
*
*Total flow from 9914
*
ADD HYD             ID=5 HYD NO=9914  IDA=1 IDB=3 ICODE=0
PRINT HYD           ID=5 PCODE=1 MODE=10
*
* Total outflow to Laurel Creek
*
ADD HYD             ID=4 HYD NO=2011 IDA=5 IDB=6 ICODE=0                  AREA=     0.06912
*
PRINT HYD           ID=4 PCODE=1 MODE=10
*
* Compute runoff hydrograph from area 3103
* VS=   7.000 is main channel & VS=   1.000 is off-channel
*
COMPUTE FLOWRATE    ID=6 NHD=3103 AREA=   0.00498 Sq km  L=    50 m  W=    50 m
              SOIL ZONE I    II  III    IV    V    VI  VII  VIII   IX
                       1.0   0.0 25.0   0.0  0.0  74.0  0.0   0.0  0.0
                    RATING CURVES: IDMC=1 IDOC=5 QRMC=  0.50 QROC=  0.05
                    ROUTING MODEL=2 CONSTANTS: OVERLAND FTB= 2.0 TLO= 0.0
                    SUBSURFACE: KSS= 5.0 KGW= 384 h PCODE=1 WQPCODE=1
                    RBASIN=0 IDA=0 IDB=0 IDC=0 IDD=0 RBDUMP=0
                    GWFACT=0.00 GWON=0
                    SWQTH=   0.0 L/s SWPUMP=   0.0 L/s SWCODE=0
*
PRINT HYD           ID=6 PCODE=1 MODE=10
*
* Total outflow to Laurel Creek
*
ADD HYD             ID=1 HYD NO=2111 IDA=4 IDB=6 ICODE=0                  AREA=     0.07112
*
*++++++++++++++++++++++++Laurel Creek Reservoir Tributary++++++++++++++++++++++++++++++++++
```

```
*
*  Main channel Parabolic Swale - Flat                                  7
*
COMPUTE RATING CURVE ID=1  VS=     7.000   NSEGS=3
                      MIN EL=  100.70   MAX EL=  103.00
                      CHNSLP= 0.01000   FLNSLP= 0.01000
                      N= 0.070  DIST=   20.00
                      N=-0.050  DIST=   30.00
                      N= 0.070  DIST=   50.00
                        DIST    ELEV     DIST    ELEV     DIST    ELEV
                        0.00  103.00    20.00  101.00    23.00  100.80
                       25.00  100.70    27.00  100.80    30.00  101.00
                       50.00  103.00
                     RFN=0.0000 PCODE=1
*
* Typical off-channel (Flat slopes)                                    6
*
COMPUTE RATING CURVE ID=6  VS=     1.100   NSEGS=3
                      MIN EL=  100.00   MAX EL=  100.60
                      CHNSLP= 0.01000   FLNSLP= 0.01000
                      N= 0.350  DIST=   39.15
                      N=-0.150  DIST=   40.85
                      N= 0.350  DIST=   80.00
                        DIST    ELEV     DIST    ELEV     DIST    ELEV
                        0.00  100.60    39.15  100.20    39.75  100.00
                       40.25  100.00    40.85  100.20    80.00  100.60
                     RFN=0.0000 PCODE=1
*
*
* Compute runoff hydrograph from area 3105
* VS=   7.000 is main channel & VS=   1.100 is off-channel
*
COMPUTE FLOWRATE    ID=1 NHD=3105 AREA=   0.0361 Sq km  L=   200 m  W=   180 m
              SOIL ZONE I    II  III    IV    V    VI  VII  VIII   IX
                       1.0   0.0  0.0  74.0  0.0  25.0  0.0   0.0  0.0
                     RATING CURVES: IDMC=1 IDOC=6 QRMC=  0.50 QROC=  0.05
                     ROUTING MODEL=2 CONSTANTS: OVERLAND FTB= 1.2 TLO= 0.0
                     SUBSURFACE: KSS= 5.0 KGW= 384 h PCODE=1 WQPCODE=1
                     RBASIN=0 IDA=0 IDB=0 IDC=0 IDD=0 RBDUMP=0
                     GWFACT=0.00 GWON=0
                     SWQTH=   0.0 L/s SWPUMP=   0.0 L/s SWCODE=0
*
PRINT HYD            ID=1 PCODE=1 MODE=10
*
*
*   Typical Urban Cross-Section                                        6
*
COMPUTE RATING CURVE ID=1  VS=     8.000   NSEGS=3
                      MIN EL=  295.00   MAX EL=  295.70
                      CHNSLP= 0.00500   FLNSLP= 0.00500
                      N= 0.015  DIST=  200.00
                      N=-0.015  DIST=  300.00
                      N= 0.015  DIST=  500.00
                        DIST    ELEV     DIST    ELEV     DIST    ELEV
                        0.00  295.70   200.00  295.50   200.10  295.00
                      299.90  295.00   300.00  295.50   500.00  295.70
                     RFN=0.0000 PCODE=1
*
*==============================Cook Mattamy=======================================
*
* Compute runoff hydrograph from area 7107
* VS=   8.000 is main channel & VS=   8.000 is off-channel
*
* Res.,school Roof to Roof Infiltration Gallery,
```



```
*
COMPUTE FLOWRATE    ID=2 NHD=7107 AREA=   0.03343 Sq km  L=    20 m  W=    10 m
              SOIL ZONE I    II  III    IV    V    VI  VII  VIII   IX
                       1.0   0.0  0.0   0.0  0.0   0.0  0.0  99.0  0.0
                     RATING CURVES: IDMC=1 IDOC=1 QRMC=  0.50 QROC=  0.05
                     ROUTING MODEL=2 CONSTANTS: OVERLAND FTB= 1.2 TLO= 0.0
                     SUBSURFACE: KSS= 5.0 KGW= 384 h PCODE=1 WQPCODE=1
                     RBASIN=0 IDA=0 IDB=0 IDC=0 IDD=0 RBDUMP=0
                     GWFACT=0.00 GWON=0
                     SWQTH=   0.0 L/s SWPUMP=   0.0 L/s SWCODE=0
*
* Infiltration Gallery, sized with 30mm rainfall, 1m depth
* 15% safety factor
* Void ratio 0.35
*
ROUTE SPECIAL POND  ID=3 HYD NO=6107 INFLOW=2 PCODE=0 OPTION= 5
                     Inflow controls:
                         USPCT=100% USDIV=0     PCTA=  0% ADIV=0
                         GWPCT=  0% GWDIV=0
                     Maximum level for Routing Tables:  ZMAX= 101.150
                     Recharge characteristics for Compartment A
                       LEVELA= 100.000                EVAPA= 0.0 mm/d ACODE=0
                       CDA=   0.000 mm/h  DZA= 10.00 m
                     Recharge characteristics for Compartment B
                       LEVELB= 100.000 CCBA= 0.00000  EVAPB= 0.0 mm/d BCODE=1
                       CDB=  15.000 mm/h  DZB= 10.00 m
                     Irrigation Pond Controls: IPOND=0
                     Number of points=  4
                                    Compartment  A          Compartment B
                     Elevation  Outflow Storage  SFArea Outflow Storage SFArea
                        (m)       (cms)  (ha*m)    (ha)   (cms)  (ha*m)    (ha)
                      100.000     0.000  0.0000  0.0000   0.000  0.0000  0.2865
                      100.999     0.000  0.0000  0.0000   0.000  0.1002  0.2865
                      101.000     0.000  0.0000  0.0000   0.001  0.1003  0.2865
                      101.150     0.000  0.0000  0.0000   0.800  0.1153  0.2865
*
PRINT HYD            ID=3 PCODE=1 MODE=10
*
* Residential,school pervious area to ameded top soil
*
COMPUTE FLOWRATE    ID=2 NHD=4107 AREA=  0.02709 Sq km  L=    30 m  W=    14 m
              SOIL ZONE I    II  III    IV    V    VI  VII  VIII   IX
                       0.0   0.0  0.0  36.8  0.0  63.2  0.0   0.0  0.0
                     RATING CURVES: IDMC=1 IDOC=1 QRMC=  0.50 QROC=  0.05
                     ROUTING MODEL=2 CONSTANTS: OVERLAND FTB= 1.2 TLO= 0.0
                     SUBSURFACE: KSS= 5.0 KGW= 384 h PCODE=1 WQPCODE=1
                     RBASIN=0 IDA=0 IDB=0 IDC=0 IDD=0 RBDUMP=0
                     GWFACT=0.00 GWON=0
                     SWQTH=   0.0 L/s SWPUMP=   0.0 L/s SWCODE=0
*
* Routed through Amended Top Soil (450mm @30% void ratio=135mm vol)
* Foot print = 4107 pervious area
* 15% safty factor
*
ROUTE SPECIAL POND  ID=5 HYD NO=5107 INFLOW=2 PCODE=0 OPTION=15
                     Inflow controls:
                         USPCT=100% USDIV=0     PCTA=  0% ADIV=0
                         GWPCT=  0% GWDIV=0
                     Maximum level for Routing Tables:  ZMAX= 101.069
                     Recharge characteristics for Compartment A
                       LEVELA= 100.000                EVAPA= 0.0 mm/d ACODE=0
                       CDA=   0.000 mm/h  DZA= 10.00 m
                     Recharge characteristics for Compartment B
                       LEVELB= 100.000 CCBA= 0.00000  EVAPB= 0.0 mm/d BCODE=1
```

```
                      CDB=  15.000 mm/h  DZB= 10.00 m
                    Irrigation Pond Controls: IPOND=0
                    Number of points=  4
                                 Compartment  A          Compartment B
                    Elevation  Outflow Storage  SFArea Outflow Storage SFArea
                       (m)       (cms)  (ha*m)    (ha)   (cms)  (ha*m)    (ha)
                     100.000     0.000  0.0000  0.0000   0.000  0.0000  2.7090
                     100.059     0.000  0.0000  0.0000   0.000  0.1598  2.7090
                     100.060     0.000  0.0000  0.0000   0.001  0.1625  2.7090
                     100.069     0.000  0.0000  0.0000   0.800  0.1869  2.7090
*
PRINT HYD           ID=5 PCODE=1 MODE=10
*
* Sum hydr. 6107 & 5107 call result 1107
*
ADD HYD             ID=4 HYD NO=1107 IDA=3 IDB=5 ICODE=0                  AREA=     0.0605
PRINT HYD           ID=4 PCODE=1 MODE=10
*
*
* Remainder Area
*
COMPUTE FLOWRATE    ID=2 NHD=8107 AREA=  0.05193 Sq km  L=   450 m  W=   50 m
              SOIL ZONE I    II  III    IV    V    VI  VII  VIII   IX
                     83.7   0.0  0.0   6.0  0.0  10.3  0.0   0.0  0.0
                    RATING CURVES: IDMC=1 IDOC=1 QRMC=  0.50 QROC=  0.05
                    ROUTING MODEL=2 CONSTANTS: OVERLAND FTB= 1.2 TLO= 0.0
                    SUBSURFACE: KSS= 5.0 KGW= 384 h PCODE=1 WQPCODE=1
                    RBASIN=0 IDA=0 IDB=0 IDC=0 IDD=0 RBDUMP=0
                    GWFACT=0.00 GWON=0
                    SWQTH=   0.0 L/s SWPUMP=   0.0 L/s SWCODE=0
*
*
* Sum hydr. 1107 & 8107 call result 3107
*
ADD HYD             ID=5 HYD NO=3107 IDA=4 IDB=2 ICODE=0                  AREA=     0.1125
*
PRINT HYD           ID=5 PCODE=1 MODE=10
*
* Sum hydr. 3105 & 3107 call result 2012
*
ADD HYD             ID=2 HYD NO=2012 IDA=1 IDB=5 ICODE=0                  AREA=     0.1388
PRINT HYD           ID=2 PCODE=1 MODE=10
*
*
*==============================Activa=========================================
*
* Compute runoff hydrograph from area 7101
* VS=   8.000 is main channel & VS=   8.000 is off-channel
* Res.Roof to Roof Infiltration Gallery,
*
COMPUTE FLOWRATE    ID=3 NHD=7101 AREA=  0.02361 Sq km  L=    20 m  W=    10 m
              SOIL ZONE I    II  III    IV    V    VI  VII  VIII   IX
                     1.0   0.0  0.0   0.0  0.0   0.0  0.0  99.0  0.0
                    RATING CURVES: IDMC=1 IDOC=1 QRMC=  0.50 QROC=  0.05
                    ROUTING MODEL=2 CONSTANTS: OVERLAND FTB= 1.2 TLO= 0.0
                    SUBSURFACE: KSS= 5.0 KGW= 384 h PCODE=1 WQPCODE=1
                    RBASIN=0 IDA=0 IDB=0 IDC=0 IDD=0 RBDUMP=0
                    GWFACT=0.00 GWON=0
                    SWQTH=   0.0 L/s SWPUMP=   0.0 L/s SWCODE=0
*
*
* Rooftop Infiltration for 7101, sized with 30mm rainfall, 15% safety factor
* Assume 0.75m depth
* Void ratio 0.35
```



```
*
ROUTE SPECIAL POND  ID=5 HYD NO=6101 INFLOW=3 PCODE=0 OPTION= 5
                    Inflow controls:
                        USPCT=100% USDIV=0     PCTA=  0% ADIV=0
                        GWPCT=  0% GWDIV=0
                    Maximum level for Routing Tables:  ZMAX= 100.863
                    Recharge characteristics for Compartment A
                      LEVELA= 100.000               EVAPA= 0.0 mm/d ACODE=0
                      CDA=   0.000 mm/h  DZA= 10.00 m
                    Recharge characteristics for Compartment B
                      LEVELB= 100.000 CCBA= 0.00000  EVAPB= 0.0 mm/d BCODE=1
                      CDB=  15.000 mm/h  DZB= 10.00 m
                    Irrigation Pond Controls: IPOND=0
                    Number of points=  4
                                 Compartment  A          Compartment B
                    Elevation  Outflow Storage  SFArea Outflow Storage SFArea
                       (m)       (cms)  (ha*m)    (ha)   (cms)  (ha*m)    (ha)
                     100.000     0.000  0.0000  0.0000   0.000  0.0000  0.2698
                     100.749     0.000  0.0000  0.0000   0.000  0.0707  0.2698
                     100.750     0.000  0.0000  0.0000   0.001  0.0708  0.2698
                     100.873     0.000  0.0000  0.0000   0.800  0.0814  0.2698
*
* Residential pervious area to ameded top soil
*
COMPUTE FLOWRATE    ID=1 NHD=4101 AREA=  0.02412 Sq km  L=    30 m  W=    14 m
              SOIL ZONE I    II  III    IV    V    VI  VII  VIII   IX
                     0.0   0.0  0.0 100.0  0.0   0.0  0.0   0.0  0.0
                    RATING CURVES: IDMC=1 IDOC=1 QRMC=  0.50 QROC=  0.05
                    ROUTING MODEL=2 CONSTANTS: OVERLAND FTB= 1.2 TLO= 0.0
                    SUBSURFACE: KSS= 5.0 KGW= 384 h PCODE=1 WQPCODE=1
                    RBASIN=0 IDA=0 IDB=0 IDC=0 IDD=0 RBDUMP=0
                    GWFACT=0.00 GWON=0
                    SWQTH=   0.0 L/s SWPUMP=   0.0 L/s SWCODE=0
*
* Routed through Amended Top Soil (450mm @30% void ratio=135mm vol)
* Foot print = 4101 pervious area
* 15% safty factor
*
ROUTE SPECIAL POND  ID=3 HYD NO=5101 INFLOW=1 PCODE=0 OPTION=15
                    Inflow controls:
                        USPCT=100% USDIV=0     PCTA=  0% ADIV=0
                        GWPCT=  0% GWDIV=0
                    Maximum level for Routing Tables:  ZMAX= 101.069
                    Recharge characteristics for Compartment A
                      LEVELA= 100.000               EVAPA= 0.0 mm/d ACODE=0
                      CDA=   0.000 mm/h  DZA= 10.00 m
                    Recharge characteristics for Compartment B
                      LEVELB= 100.000 CCBA= 0.00000  EVAPB= 0.0 mm/d BCODE=1
                      CDB=   4.000 mm/h  DZB= 10.00 m
                    Irrigation Pond Controls: IPOND=0
                    Number of points=  4
                                 Compartment  A          Compartment B
                    Elevation  Outflow Storage  SFArea Outflow Storage SFArea
                       (m)       (cms)  (ha*m)    (ha)   (cms)  (ha*m)    (ha)
                     100.000     0.000  0.0000  0.0000   0.000  0.0000  2.4116
                     100.059     0.000  0.0000  0.0000   0.000  0.1423  2.4116
                     100.060     0.000  0.0000  0.0000   0.001  0.1447  2.4116
                     100.069     0.000  0.0000  0.0000   0.800  0.1664  2.4116
*
PRINT HYD           ID=3 PCODE=1 MODE=10
*
* Sum hydr. 6101 & 5101 call result 1101
*
ADD HYD             ID=1 HYD NO=1101 IDA=5 IDB=3 ICODE=0                  AREA=     0.0477
```

```
PRINT HYD           ID=1 PCODE=1 MODE=10
*
**
* Remainder Area within development area
*
COMPUTE FLOWRATE    ID=5 NHD=8101 AREA=  0.03297 Sq km  L=   450 m  W=   50 m
              SOIL ZONE I    II  III    IV    V    VI  VII  VIII   IX
                    87.6   0.0  0.0  12.4  0.0   0.0  0.0   0.0  0.0
                   RATING CURVES: IDMC=1 IDOC=1 QRMC=  0.50 QROC=  0.05
                   ROUTING MODEL=2 CONSTANTS: OVERLAND FTB= 1.2 TLO= 0.0
                   SUBSURFACE: KSS= 5.0 KGW= 384 h PCODE=1 WQPCODE=1
                   RBASIN=0 IDA=0 IDB=0 IDC=0 IDD=0 RBDUMP=0
                   GWFACT=0.00 GWON=0
                   SWQTH=   0.0 L/s SWPUMP=   0.0 L/s SWCODE=0
*
*
* Sum hydr. 1101 & 8101 call result 2101
*
ADD HYD             ID=6 HYD NO=2101 IDA=1 IDB=5 ICODE=0                  AREA=     0.0807
*
PRINT HYD           ID=6 PCODE=1 MODE=10
*
* Exisitng development area
*
COMPUTE FLOWRATE    ID=3 NHD=9101 AREA=  0.02393 Sq km  L=   450 m  W=   50 m
              SOIL ZONE I    II  III    IV    V    VI  VII  VIII   IX
                    42.5   0.0  0.0  57.5  0.0   0.0  0.0   0.0  0.0
                   RATING CURVES: IDMC=1 IDOC=1 QRMC=  0.50 QROC=  0.05
                   ROUTING MODEL=2 CONSTANTS: OVERLAND FTB= 1.2 TLO= 0.0
                   SUBSURFACE: KSS= 5.0 KGW= 384 h PCODE=1 WQPCODE=1
                   RBASIN=0 IDA=0 IDB=0 IDC=0 IDD=0 RBDUMP=0
                   GWFACT=0.00 GWON=0
                   SWQTH=   0.0 L/s SWPUMP=   0.0 L/s SWCODE=0
*
* Sum hydr. 2101 & 9101 call result 2101
*
ADD HYD             ID=4 HYD NO=3101 IDA=6 IDB=3 ICODE=0                  AREA=     0.1047
*
PRINT HYD           ID=4 PCODE=1 MODE=10
*
* Divert 100yr Pre development flow to Mar-view Farm
* Existing Condition Subcatchmetn 3101 (21ha) 100yr Flow 0.7412m3/s
* Portionate flow 0.3693 m3/s(10.46ha) based on proposed development
* Post development 100yr flow 1.1547m3/s
*
DIVERT FLOWS        INFLOW=4  DIVERT=6 HYD NO=1112 PCODE=1 OPTION=4
                    THRUFLO=3 HYD NOB=1111  THROUGHFLOW  DIVERSION
                                             0.7854      0.3693
                  IDFLAG=0 IDSTOR=0 IGWT=0
*
*
* Sum hydr. 2012 & 1111 call result 2013
*
ADD HYD             ID=5 HYD NO=2013 IDA=2 IDB=3 ICODE=0                  AREA=     0.2445
*
*
*   Typical Beaver Creek Road Cross-Section                                    6
*
COMPUTE RATING CURVE ID=2  VS=     8.100   NSEGS=3
                      MIN EL=  199.76   MAX EL=  200.00
                      CHNSLP= 0.02070   FLNSLP= 0.02070
                      N= 0.015  DIST=    4.39
                      N=-0.015  DIST=   15.61
                      N= 0.015  DIST=   20.00
```



```
                       DIST    ELEV     DIST    ELEV     DIST    ELEV
                       0.00  200.00     4.39  199.91     4.40  199.76
                      10.00  199.87    15.60  199.76    15.61  199.91
                      20.00  200.00
                     RFN=0.0000 PCODE=1
*
*
* Flow rout through Beaver Creek Road
*
*ROUTE CHANNEL       ID=5 HYD NO= 171 INFLOW=1 LENGTH=   511 m  SLOPE=0.0207
*                    RCID=2 NS=1 PCODE=1 INDEX=1 PIPE=0 CANOPY=  0.0
*
*==============================Northgate=======================================
*
* Compute runoff hydrograph from area 7102
* VS=   8.000 is main channel & VS=   8.000 is off-channel
*
* Res., Mix, Pump Station Roof to Roof Infiltration Gallery,
*
COMPUTE FLOWRATE    ID=2 NHD=7102 AREA=   0.02491 Sq km  L=    20 m  W=    10 m
              SOIL ZONE I    II  III    IV    V    VI  VII  VIII   IX
                     1.0   0.0  0.0   0.0  0.0   0.0  0.0  99.0  0.0
                   RATING CURVES: IDMC=1 IDOC=1 QRMC=  0.50 QROC=  0.05
                   ROUTING MODEL=2 CONSTANTS: OVERLAND FTB= 1.2 TLO= 0.0
                   SUBSURFACE: KSS= 5.0 KGW= 384 h PCODE=1 WQPCODE=1
                   RBASIN=0 IDA=0 IDB=0 IDC=0 IDD=0 RBDUMP=0
                   GWFACT=0.00 GWON=0
                   SWQTH=   0.0 L/s SWPUMP=   0.0 L/s SWCODE=0
*
* Infiltration Gallery, sized with 30mm rainfall, 1m depth
* 15% safety factor
* Void ratio 0.35
*
ROUTE SPECIAL POND  ID=1 HYD NO=6102 INFLOW=2 PCODE=0 OPTION= 5
                    Inflow controls:
                        USPCT=100% USDIV=0     PCTA=  0% ADIV=0
                        GWPCT=  0% GWDIV=0
                    Maximum level for Routing Tables:  ZMAX= 101.150
                    Recharge characteristics for Compartment A
                      LEVELA= 100.000               EVAPA= 0.0 mm/d ACODE=0
                      CDA=   0.000 mm/h  DZA= 10.00 m
                    Recharge characteristics for Compartment B
                      LEVELB= 100.000 CCBA= 0.00000  EVAPB= 0.0 mm/d BCODE=1
                      CDB=  15.000 mm/h  DZB= 10.00 m
                    Irrigation Pond Controls: IPOND=0
                    Number of points=  4
                                    Compartment  A          Compartment B
                    Elevation  Outflow Storage  SFArea Outflow Storage SFArea
                       (m)       (cms)  (ha*m)    (ha)   (cms)  (ha*m)    (ha)
                     100.000     0.000  0.0000  0.0000   0.000  0.0000  0.2135
                     100.999     0.000  0.0000  0.0000   0.000  0.0746  0.2135
                     101.000     0.000  0.0000  0.0000   0.001  0.0747  0.2135
                     101.150     0.000  0.0000  0.0000   0.800  0.0859  0.2135
*
*
* Residential,Park and open space pervious area to ameded top soil
*
COMPUTE FLOWRATE    ID=2 NHD=4102 AREA=  0.02816 Sq km  L=    30 m  W=    14 m
              SOIL ZONE I    II  III    IV    V    VI  VII  VIII   IX
                     0.0   0.0  0.0   0.0  0.0 100.0  0.0   0.0  0.0
                   RATING CURVES: IDMC=1 IDOC=1 QRMC=  0.50 QROC=  0.05
                   ROUTING MODEL=2 CONSTANTS: OVERLAND FTB= 1.2 TLO= 0.0
                   SUBSURFACE: KSS= 5.0 KGW= 384 h PCODE=1 WQPCODE=1
                   RBASIN=0 IDA=0 IDB=0 IDC=0 IDD=0 RBDUMP=0
```

```
                    GWFACT=0.00 GWON=0
                    SWQTH=   0.0 L/s SWPUMP=   0.0 L/s SWCODE=0
*
PRINT HYD           ID=2 PCODE=1 MODE=10
*
* Routed through Amended Top Soil (450mm @30% void ratio=135mm vol)
* Foot print = 4102 pervious area
* 15% safty factor
*
ROUTE SPECIAL POND  ID=4 HYD NO=5102 INFLOW=2 PCODE=0 OPTION=15
                    Inflow controls:
                        USPCT=100% USDIV=0     PCTA=  0% ADIV=0
                        GWPCT=  0% GWDIV=0
                    Maximum level for Routing Tables:  ZMAX= 101.069
                    Recharge characteristics for Compartment A
                      LEVELA= 100.000                EVAPA= 0.0 mm/d ACODE=0
                      CDA=   0.000 mm/h  DZA= 10.00 m
                    Recharge characteristics for Compartment B
                      LEVELB= 100.000 CCBA= 0.00000  EVAPB= 0.0 mm/d BCODE=1
                      CDB=  15.000 mm/h  DZB= 10.00 m
                    Irrigation Pond Controls: IPOND=0
                    Number of points=  4
                                  Compartment  A          Compartment B
                    Elevation  Outflow Storage  SFArea Outflow Storage SFArea
                       (m)       (cms)  (ha*m)    (ha)   (cms)  (ha*m)    (ha)
                     100.000     0.000  0.0000  0.0000   0.000  0.0000  2.8155
                     100.059     0.000  0.0000  0.0000   0.000  0.1661  2.8155
                     100.060     0.000  0.0000  0.0000   0.001  0.1689  2.8155
                     100.069     0.000  0.0000  0.0000   0.800  0.1943  2.8155
*
PRINT HYD           ID=4 PCODE=1 MODE=10
*
* Sum hydr. 6102 & 5102 call result 1102
*
ADD HYD             ID=3 HYD NO=1102 IDA=1 IDB=4 ICODE=0                AREA=     0.0543
PRINT HYD           ID=3 PCODE=1 MODE=10
*
*
* Remainder Area
*
COMPUTE FLOWRATE    ID=2 NHD=8102 AREA=  0.03354 Sq km  L=   450 m  W=   20 m
              SOIL ZONE I    II  III    IV    V    VI  VII  VIII   IX
                     86.8   0.0  0.0   0.0  0.0  13.2  0.0   0.0  0.0
                    RATING CURVES: IDMC=1 IDOC=1 QRMC=  0.50 QROC=  0.05
                    ROUTING MODEL=2 CONSTANTS: OVERLAND FTB= 1.2 TLO= 0.0
                    SUBSURFACE: KSS= 5.0 KGW= 384 h PCODE=1 WQPCODE=1
                    RBASIN=0 IDA=0 IDB=0 IDC=0 IDD=0 RBDUMP=0
                    GWFACT=0.00 GWON=0
                    SWQTH=   0.0 L/s SWPUMP=   0.0 L/s SWCODE=0
*
*
* Sum hydr. 1102 & 8102 call result 3102
*
ADD HYD             ID=4 HYD NO=3102 IDA=3 IDB=2 ICODE=0                AREA=     0.0885
*
PRINT HYD           ID=4 PCODE=1 MODE=10
*
* Sum hydr. 2013 & 3102 call result 2014
*
ADD HYD             ID=2 HYD NO=2014 IDA=5 IDB=4 ICODE=0                AREA=
*
PRINT HYD           ID=2 PCODE=1 MODE=10
*
* Beaver Creek Road catchment 3018a
```



```
*
COMPUTE FLOWRATE    ID=3 NHD=3181 AREA=   0.02131 Sq km  L=   570 m  W=    20 m
              SOIL ZONE I    II  III    IV    V    VI  VII  VIII   IX
                     75.0  0.0  0.0   1.2  0.0   23.8  0.0   0.0  0.0
                    RATING CURVES: IDMC=1 IDOC=1 QRMC=  0.50 QROC=  0.05
                    ROUTING MODEL=2 CONSTANTS: OVERLAND FTB= 1.2 TLO= 0.0
                    SUBSURFACE: KSS= 5.0 KGW= 384 h PCODE=1 WQPCODE=1
                    RBASIN=0 IDA=0 IDB=0 IDC=0 IDD=0 RBDUMP=0
                    GWFACT=0.00 GWON=0
                    SWQTH=   0.0 L/s SWPUMP=   0.0 L/s SWCODE=0
*
PRINT HYD           ID=3 PCODE=1 MODE=10
*
* Sum hydr. 2014 & 3181 call result 2015
*
ADD HYD             ID=1 HYD NO=2015 IDA=2 IDB=3 ICODE=0                AREA=
*
PRINT HYD           ID=1 PCODE=1 MODE=10
*
*
*==================================MarView================================================
*
* Conservation Drive Catchment 3108b
*
COMPUTE FLOWRATE    ID=3 NHD=3182 AREA=   0.01403 Sq km  L=    20 m  W=   223 m
              SOIL ZONE I    II  III    IV    V    VI  VII  VIII   IX
                     75.0  0.0  0.0  19.4  0.0   5.6  0.0   0.0  0.0
                    RATING CURVES: IDMC=1 IDOC=1 QRMC=  0.50 QROC=  0.05
                    ROUTING MODEL=2 CONSTANTS: OVERLAND FTB= 1.2 TLO= 0.0
                    SUBSURFACE: KSS= 5.0 KGW= 384 h PCODE=1 WQPCODE=1
                    RBASIN=0 IDA=0 IDB=0 IDC=0 IDD=0 RBDUMP=0
                    GWFACT=0.00 GWON=0
                    SWQTH=   0.0 L/s SWPUMP=   0.0 L/s SWCODE=0
*
PRINT HYD           ID=3 PCODE=1 MODE=10
*
*
*  Main channel Parabolic Swale - Flat                                  7
*
COMPUTE RATING CURVE ID=6  VS=     7.000   NSEGS=3
                     MIN EL=  100.70   MAX EL=  103.00
                     CHNSLP= 0.01000   FLNSLP= 0.01000
                     N= 0.070  DIST=   20.00
                     N=-0.050  DIST=   30.00
                     N= 0.070  DIST=   50.00
                       DIST    ELEV     DIST    ELEV     DIST    ELEV
                        0.00  103.00    20.00  101.00    23.00  100.80
                       25.00  100.70    27.00  100.80    30.00  101.00
                       50.00  103.00
                     RFN=0.0000 PCODE=1
*
*  Typical off-channel (Steep areas)                                    6
*
COMPUTE RATING CURVE ID=5  VS=     1.000   NSEGS=3
                     MIN EL=  100.00   MAX EL=  100.80
                     CHNSLP= 0.01500   FLNSLP= 0.01500
                     N= 0.350  DIST=   24.45
                     N=-0.150  DIST=   25.50
                     N= 0.350  DIST=   50.00
                       DIST    ELEV     DIST    ELEV     DIST    ELEV
                        0.00  100.80    24.45  100.30    24.75  100.00
                       25.25  100.00    25.50  100.30    50.00  100.80
                     RFN=0.0000 PCODE=1
*
```

```
* Compute runoff hydrograph from area 3104
* VS=   7.000 is main channel & VS=   1.000 is off-channel
*
COMPUTE FLOWRATE    ID=4 NHD=3104 AREA=   0.0472 Sq km  L=   200 m  W=   150 m
              SOIL ZONE I    II  III    IV    V    VI  VII  VIII   IX
                     10.0   0.0  0.0  23.0 67.0   0.0  0.0   0.0  0.0
                    RATING CURVES: IDMC=6 IDOC=5 QRMC=  0.50 QROC=  0.05
                    ROUTING MODEL=2 CONSTANTS: OVERLAND FTB= 1.2 TLO= 0.0
                    SUBSURFACE: KSS= 5.0 KGW= 384 h PCODE=1 WQPCODE=1
                    RBASIN=0 IDA=0 IDB=0 IDC=0 IDD=0 RBDUMP=0
                    GWFACT=0.00 GWON=0
                    SWQTH=   0.0 L/s SWPUMP=   0.0 L/s SWCODE=0
*
PRINT HYD           ID=4 PCODE=1 MODE=10
*
* Sum hydr. 3182 & 3104 call result 2016
*
ADD HYD             ID=5 HYD NO=2016 IDA=3 IDB=4 ICODE=0                  AREA=
*
PRINT HYD           ID=5 PCODE=1 MODE=10
*
* Sum hydr. 1112 & 2016 call result 2017
*
ADD HYD             ID=4 HYD NO=2017 IDA=5 IDB=6 ICODE=0                  AREA=
*
PRINT HYD           ID=4 PCODE=1 MODE=10
*
* Compute runoff hydrograph from area 7106
* VS=   8.000 is main channel & VS=   8.000 is off-channel
* Roof area (total 16% of 3106) to infiltration gallery
*
COMPUTE FLOWRATE    ID=2 NHD=7106 AREA=   0.04811 Sq km  L=    20 m  W=    10 m
              SOIL ZONE I    II  III    IV    V    VI  VII  VIII   IX
                     1.0   0.0  0.0   0.0  0.0   0.0  0.0  99.0  0.0
                    RATING CURVES: IDMC=1 IDOC=1 QRMC=  0.50 QROC=  0.05
                    ROUTING MODEL=2 CONSTANTS: OVERLAND FTB= 1.2 TLO= 0.0
                    SUBSURFACE: KSS= 5.0 KGW= 384 h PCODE=1 WQPCODE=1
                    RBASIN=0 IDA=0 IDB=0 IDC=0 IDD=0 RBDUMP=0
                    GWFACT=0.00 GWON=0
                    SWQTH=   0.0 L/s SWPUMP=   0.0 L/s SWCODE=0
*
* Rooftop Infiltration for 7106  25mm
*
ROUTE SPECIAL POND  ID=3 HYD NO=6106 INFLOW=2 PCODE=0 OPTION= 5
                    Inflow controls:
                        USPCT=100% USDIV=0     PCTA=  0% ADIV=0
                        GWPCT=  0% GWDIV=0
                    Maximum level for Routing Tables:  ZMAX= 101.300
                    Recharge characteristics for Compartment A
                      LEVELA= 100.000               EVAPA= 0.0 mm/d ACODE=0
                      CDA=   0.000 mm/h  DZA= 10.00 m
                    Recharge characteristics for Compartment B
                      LEVELB= 100.000 CCBA= 0.00000  EVAPB= 0.0 mm/d BCODE=1
                      CDB=  15.000 mm/h  DZB= 10.00 m
                    Irrigation Pond Controls: IPOND=0
                    Number of points=  5
                                  Compartment  A          Compartment B
                    Elevation  Outflow Storage  SFArea Outflow Storage SFArea
                       (m)       (cms)  (ha*m)    (ha)   (cms)  (ha*m)    (ha)
                     100.000     0.000  0.0000  0.0000   0.000  0.0000  0.1203
                     100.999     0.000  0.0000  0.0000   0.000  0.1202  0.1203
                     101.000     0.000  0.0000  0.0000   0.001  0.1203  0.1203
                     101.200     0.000  0.0000  0.0000   0.950  0.1443  0.1203
                     101.300     0.000  0.0000  0.0000   1.050  0.1563  0.1203
```



```
*
*
* Compute runoff hydrograph from area 8106
* VS=   8.000 is main channel & VS=   8.000 is off-channel
* Remainder Area
*
COMPUTE FLOWRATE    ID=2 NHD=8106 AREA=   0.25256 Sq km  L=   450 m  W=    50 m
              SOIL ZONE I    II  III    IV    V    VI  VII  VIII   IX
                     46.4   0.0  0.0  41.7  0.0  11.9  0.0   0.0  0.0
                    RATING CURVES: IDMC=1 IDOC=1 QRMC=  0.50 QROC=  0.05
                    ROUTING MODEL=2 CONSTANTS: OVERLAND FTB= 1.2 TLO= 0.0
                    SUBSURFACE: KSS= 5.0 KGW= 384 h PCODE=1 WQPCODE=1
                    RBASIN=0 IDA=0 IDB=0 IDC=0 IDD=0 RBDUMP=0
                    GWFACT=0.00 GWON=0
                    SWQTH=   0.0 L/s SWPUMP=   0.0 L/s SWCODE=0
*
* Sum hydr. 6106 & 8106 call result 3106
*
ADD HYD             ID=5 HYD NO=3106 IDA=3 IDB=2 ICODE=0                  AREA=     0.3023
*
PRINT HYD           ID=5 PCODE=1 MODE=10
*
* Sum hydr. 2017 & 3106 call result 2018
*
ADD HYD             ID=2 HYD NO=2018 IDA=4 IDB=5 ICODE=0                  AREA=     0.3635
*
PRINT HYD           ID=2 PCODE=1 MODE=10
*
* 4106 End-of-Pipe Infiltration
*
ROUTE SPECIAL POND  ID=3 HYD NO=4106 INFLOW=2 PCODE=0 OPTION=15
                    Inflow controls:
                        USPCT=100% USDIV=0     PCTA=  0% ADIV=0
                        GWPCT=  0% GWDIV=0
                    Maximum level for Routing Tables:  ZMAX= 200.300
                    Recharge characteristics for Compartment A
                      LEVELA= 198.340               EVAPA= 0.0 mm/d ACODE=0
                      CDA=   0.000 mm/h  DZA= 10.00 m
                    Recharge characteristics for Compartment B
                      LEVELB= 198.340 CCBA= 0.00000  EVAPB= 0.0 mm/d BCODE=1
                      CDB=  15.000 mm/h  DZB= 10.00 m
                    Irrigation Pond Controls: IPOND=0
                    Number of points=  6
                                  Compartment  A          Compartment B
                    Elevation  Outflow Storage  SFArea Outflow Storage SFArea
                       (m)       (cms)  (ha*m)    (ha)   (cms)  (ha*m)    (ha)
                     199.800     0.000  0.0000  0.0000   0.000  0.0000  0.0902
                     199.990     0.000  0.0000  0.0000   0.000  0.1502  0.0902
                     200.010     0.000  0.0000  0.0000   0.001  0.1503  0.0902
                     200.100     0.000  0.0000  0.0000   0.400  0.1614  0.0902
                     200.200     0.000  0.0000  0.0000   1.000  0.1660  0.0902
                     200.300     0.000  0.0000  0.0000   2.000  0.1688  0.0902
*
KEEP HYD            ID=3 CUTOFF=0 ICODE=5 ISTEP=1 IFORM=0 IDB=2 IMET=0
PRINT HYD           ID=3 PCODE=1 MODE=10
*
*
*-------------------------------------------------------------------------------
* Divert 5yr flow from Cook/Mattamy 0.734cms, Northgate 0.470cms,Beaver Creek Rd 0.125cms
* Activa Post-Pre 100yr flow 0.785cms, total 2.114cms throughflow into storm sewer
*
DIVERT FLOWS        INFLOW=1  DIVERT=5 HYD NO=1113 PCODE=1 OPTION=4
                    THRUFLO=6 HYD NOB=1114  THROUGHFLOW  DIVERSION
                                             2.1140      5.0000
```

```
                  IDFLAG=0 IDSTOR=0 IGWT=0
*
* Divert 25mm event throughflow into SWMC1
*
DIVERT FLOWS        INFLOW=6  DIVERT=1 HYD NO= 116 PCODE=1 OPTION=4
                    THRUFLO=2 HYD NOB= 216  THROUGHFLOW  DIVERSION
                                         0.8423      0.0000
                                         0.8719      0.0364
                                         0.9639      0.3287
                                         1.0479      0.7735
                                         1.0543      0.8142
                                         1.1256      1.3294
                                         1.1983      1.9773
                                         1.2668      2.7057
                                         1.3318      3.5066
                  IDFLAG=0 IDSTOR=0 IGWT=0
*
*
* SWMF Cell1 Area 3183
*
COMPUTE FLOWRATE    ID=6 NHD=3183 AREA=   0.00872 Sq km  L=  100 m  W=   100 m
              SOIL ZONE I    II  III    IV    V    VI  VII  VIII   IX
                     70.1  0.0  0.0   0.0  0.0   29.9  0.0   0.0  0.0
                    RATING CURVES: IDMC=1 IDOC=1 QRMC=  0.50 QROC=  0.05
                    ROUTING MODEL=2 CONSTANTS: OVERLAND FTB= 1.2 TLO= 0.0
                    SUBSURFACE: KSS= 5.0 KGW= 384 h PCODE=1 WQPCODE=1
                    RBASIN=0 IDA=0 IDB=0 IDC=0 IDD=0 RBDUMP=0
                    GWFACT=0.00 GWON=0
                    SWQTH=   0.0 L/s SWPUMP=   0.0 L/s SWCODE=0
*
* Sum hydr. 216 & 3183 call result 2022
*
ADD HYD             ID=4 HYD NO=2022 IDA=2 IDB=6 ICODE=0                  AREA=
*
PRINT HYD           ID=4 PCODE=1 MODE=10
*
* North Waterloo Community SWMC1 (@catchment 3106) west of Hydro Easement
* Quality Control
*
ROUTE SPECIAL POND  ID=2 HYD NO=1106 INFLOW=4 PCODE=0 OPTION= 5
                    Inflow controls:
                        USPCT=100% USDIV=0     PCTA=  0% ADIV=0
                        GWPCT=  0% GWDIV=0
                    Maximum level for Routing Tables:  ZMAX= 348.30
                    Recharge characteristics for Compartment A
                      LEVELA= 347.200                EVAPA= 1.4 mm/d ACODE=0
                      CDA=   0.000 mm/h  DZA= 10.00 m
                    Recharge characteristics for Compartment B
                      LEVELB= 347.200 CCBA= 0.00000  EVAPB= 1.4 mm/d BCODE=0
                      CDB=   0.000 mm/h  DZB= 10.00 m
                    Irrigation Pond Controls: IPOND=0
                    Number of points=  17
                                  Compartment  A          Compartment B
                    Elevation  Outflow Storage  SFArea Outflow Storage SFArea
                       (m)       (cms)  (ha*m)    (ha)   (cms)  (ha*m)    (ha)
                     347.200     0.000  0.0000  0.0000  0.0000  0.0000  0.5375
                     347.201     0.000  0.0000  0.0000  0.0080  0.0000  0.5375
                     347.250     0.000  0.0000  0.0000  0.0082  0.0274  0.5582
                     347.300     0.000  0.0000  0.0000  0.0083  0.0548  0.5793
                     347.400     0.000  0.0000  0.0000  0.0164  0.1117  0.5901
                     347.450     0.000  0.0000  0.0000  0.0222  0.1409  0.5955
                     347.500     0.000  0.0000  0.0000  0.0263  0.1707  0.6009
                     347.600     0.000  0.0000  0.0000  0.0325  0.2319  0.6230
                     347.650     0.000  0.0000  0.0000  0.1935  0.2636  0.6343
```



```
                     347.700     0.000  0.0000  0.0000  0.4857  0.2953  0.6456
                     347.800     0.000  0.0000  0.0000  1.3095  0.3610  0.6686
                     347.850     0.000  0.0000  0.0000  1.9825  0.3948  0.6769
                     347.900     0.000  0.0000  0.0000  2.8527  0.4287  0.6853
                     348.000     0.000  0.0000  0.0000  5.0188  0.4981  0.7023
                     348.100     0.000  0.0000  0.0000  7.6643  0.5690  0.7154
                     348.200     0.000  0.0000  0.0000 10.7366  0.6411  0.7285
                     348.300     0.000  0.0000  0.0000 14.2059  0.7147  0.7418
*
*
*
DIVERT FLOWS        INFLOW=2  DIVERT=4 HYD NO=1115 PCODE=1 OPTION=4
                    THRUFLO=6 HYD NOB=1116  THROUGHFLOW  DIVERSION
                                         0.0080      0.0000
                                         0.0082      0.0000
                                         0.0083      0.0000
                                         0.0086      0.0078
                                         0.0087      0.0135
                                         0.0088      0.0174
                                         0.0091      0.0234
                                         0.0092      0.1843
                                         0.0093      0.4763
                                         0.0095      1.2999
                                         0.1767      1.8058
                                         0.4879      2.3648
                                         1.3940      3.6248
                                         5.8572      8.3487
                  IDFLAG=0 IDSTOR=0 IGWT=0
*
*
PRINT HYD           ID=6 PCODE=1 MODE=10
KEEP HYD            ID=6 CUTOFF=0 ICODE=0 ISTEP=1 IFORM=0 IDB=3 IMET=1
*
* Sum hydr. 1115 & 116 call result 1117
*
ADD HYD             ID=2 HYD NO=1117 IDA=4 IDB=1 ICODE=0                  AREA=
*
* Sum hydr. 1113 & 1117 call result 1118
*
ADD HYD             ID=1 HYD NO=1118 IDA=5 IDB=2 ICODE=0                  AREA=
*
* Divert 25mm event throughflow into SWMC2
*
DIVERT FLOWS        INFLOW=3  DIVERT=5 HYD NO= 416 PCODE=1 OPTION=4
                    THRUFLO=4 HYD NOB= 316  THROUGHFLOW  DIVERSION
                                         0.8553      0.0000
                                         0.9218      0.1299
                                         1.0093      0.4915
                                         1.0898      0.9838
                                         1.1647      1.5782
                                         1.2351      2.2595
                                         1.3017      3.0178
                                         1.3331      3.4151
                                         1.3650      3.8458
                                         1.4256      4.7382
                  IDFLAG=0 IDSTOR=0 IGWT=0
*
* North Waterloo Community SWMC2 (@catchment 3106) east of Hydro Easement
* Quality Control
*
ROUTE SPECIAL POND  ID=3 HYD NO=5106 INFLOW=4 PCODE=0 OPTION= 5
                    Inflow controls:
                        USPCT=100% USDIV=0     PCTA=  0% ADIV=0
                        GWPCT=  0% GWDIV=0
```

```
                    Maximum level for Routing Tables:  ZMAX= 348.500
                    Recharge characteristics for Compartment A
                      LEVELA= 347.400                EVAPA= 1.4 mm/d ACODE=0
                      CDA=   0.000 mm/h  DZA= 10.00 m
                    Recharge characteristics for Compartment B
                      LEVELB= 347.400 CCBA= 0.00000  EVAPB= 1.4 mm/d BCODE=0
                      CDB=   0.000 mm/h  DZB= 10.00 m
                    Irrigation Pond Controls: IPOND=0
                    Number of points= 17
                                  Compartment  A          Compartment B
                    Elevation  Outflow Storage  SFArea Outflow Storage SFArea
                       (m)       (cms)  (ha*m)    (ha)   (cms)  (ha*m)    (ha)
                     347.400     0.000  0.0000  0.0000  0.0000  0.0000  0.6693
                     347.401     0.000  0.0000  0.0000  0.0080  0.0000  0.6693
                     347.450     0.000  0.0000  0.0000  0.0082  0.0340  0.6806
                     347.500     0.000  0.0000  0.0000  0.0083  0.0681  0.6918
                     347.600     0.000  0.0000  0.0000  0.0164  0.1384  0.7147
                     347.650     0.000  0.0000  0.0000  0.0222  0.1744  0.7264
                     347.700     0.000  0.0000  0.0000  0.0263  0.2110  0.7381
                     347.800     0.000  0.0000  0.0000  0.0325  0.2860  0.7619
                     347.850     0.000  0.0000  0.0000  0.0351  0.3247  0.7740
                     347.900     0.000  0.0000  0.0000  0.1111  0.3634  0.7861
                     348.000     0.000  0.0000  0.0000  0.7061  0.4433  0.8108
                     348.050     0.000  0.0000  0.0000  1.2932  0.4843  0.8291
                     348.100     0.000  0.0000  0.0000  2.0871  0.5253  0.8291
                     348.200     0.000  0.0000  0.0000  4.1200  0.6091  0.8475
                     348.300     0.000  0.0000  0.0000  6.6497  0.6948  0.8661
                     348.400     0.000  0.0000  0.0000  9.6181  0.7823  0.8850
                     348.500     0.000  0.0000  0.0000 12.9924  0.8718  0.9034
*
*
*
DIVERT FLOWS        INFLOW=3  DIVERT=4 HYD NO=1120 PCODE=1 OPTION=4
                    THRUFLO=2 HYD NOB=1119  THROUGHFLOW  DIVERSION
                                             0.0080      0.0000
                                             0.0082      0.0000
                                             0.0083      0.0000
                                             0.0086      0.0078
                                             0.0087      0.0135
                                             0.0088      0.0174
                                             0.0091      0.0234
                                             0.0092      0.0259
                                             0.0093      0.1018
                                             0.0095      0.6965
                                             0.1767      1.1164
                                             0.4879      1.5992
                                             1.3940      2.7260
                                             5.8572      7.1352
                  IDFLAG=0 IDSTOR=0 IGWT=0
*
PRINT HYD           ID=2 PCODE=1 MODE=10
KEEP HYD            ID=2 CUTOFF=0 ICODE=0 ISTEP=1 IFORM=0 IDB=3 IMET=1
*
* Sum hydr. 416 & 1120 call result 1121
*
ADD HYD             ID=3 HYD NO=1121 IDA=5 IDB=4 ICODE=0                AREA=
*
* Total flow from SWMFs to Laurel Creek Reservoir Tributary (non-winter)
* Sum hydr. 1116 & 1119 call result 516
*
ADD HYD             ID=4 HYD NO=516  IDA=6 IDB=2 ICODE=0                AREA=
PRINT HYD           ID=4 PCODE=1 MODE=10
NEW DUMP OUTPUT     MODE=10 ID=4 IOPT=4 FTYPE=0
*
```



```
* Uncontrolled Green Area to LCRT
* Compute runoff hydrograph from area 3141
* VS=   7.000 is main channel & VS=   1.000 is off-channel
*
COMPUTE FLOWRATE    ID=2 NHD=3141 AREA=   0.01129 Sq km  L=   100 m  W=    60 m
                SOIL ZONE I    II  III    IV    V    VI  VII  VIII   IX
                       0.0   0.0  0.0   0.0 46.7   0.0 53.3   0.0  0.0
                    RATING CURVES: IDMC=6 IDOC=5 QRMC=  0.50 QROC=  0.05
                    ROUTING MODEL=2 CONSTANTS: OVERLAND FTB= 1.2 TLO= 0.0
                    SUBSURFACE: KSS= 5.0 KGW= 384 h PCODE=1 WQPCODE=1
                    RBASIN=0 IDA=0 IDB=0 IDC=0 IDD=0 RBDUMP=0
                    GWFACT=0.00 GWON=0
                    SWQTH=   0.0 L/s SWPUMP=   0.0 L/s SWCODE=0
*
PRINT HYD           ID=2 PCODE=1 MODE=10
*
*
* Total flow to Laurel Creek Reservoir Tributary
* Sum hydr. 516 & 3141 call result 616
*
ADD HYD             ID=6 HYD NO=616  IDA=4 IDB=2 ICODE=0                AREA=
*
PRINT HYD           ID=6 PCODE=1 MODE=10
NEW DUMP OUTPUT     MODE=10 ID=6 IOPT=4 FTYPE=0
*
*
* Total flow from SWMC1 & SWMC2 to Reservoir through bypass channel
*
* Sum hydr. 1118 & 1121 call result 716
*
ADD HYD             ID=2 HYD NO=716  IDA=1 IDB=3 ICODE=0                AREA=
PRINT HYD           ID=2 PCODE=1 MODE=10
*
* Total flow to Laurel Creek Reservoir
*
* Sum hydr. 616 & 716 call result 2019
*
ADD HYD             ID=5 HYD NO=2019  IDA=6 IDB=2 ICODE=0               AREA=
PRINT HYD           ID=5 PCODE=1 MODE=10
*
* Go to event file
*
CHANGE INPUT FILE
*
FINISH
```

```
  1  301    2.6500      1.75    0.0212          0. RCFLAGS    0    0 25MM.dat
  1  111    2.6500      1.73    0.0207          0. RCFLAGS    0    0
  1  381    3.3100      1.78    0.0292          0. RCFLAGS    0    0
  1  281    5.9600      1.76    0.0479          0. RCFLAGS    0    0
  1  581    5.9600      1.66    0.0355        659. RCFLAGS    0    0
  1  121    5.9600      1.66    0.0355          0. RCFLAGS    0    0
  1 3916    0.0260      3.50    0.0017          0. RCFLAGS    0    0
  1 3919    0.1360      3.48    0.0070          0. RCFLAGS    0    0
  1 2000    0.1620      3.48    0.0087          0. RCFLAGS    0    0
  1 3910    0.1730      3.31    0.0070          0. RCFLAGS    0    0
  1 2001    0.3350      3.40    0.0157          0. RCFLAGS    0    0
  1 7912    0.0261     23.59    0.1518          0. RCFLAGS    0    0
  1 6912    0.0261      0.00    0.0000        584. RCFLAGS    0    0
  1 8912    0.1372     12.52    0.3666          0. RCFLAGS    0    0
  1 3912    0.1633     10.52    0.3666          0. RCFLAGS    0    0
  1 1912    0.1633      3.79    0.1374        914. RCFLAGS    0    0
  1 5912    0.1633      3.75    0.0122        558. RCFLAGS    0    0
  1 2002    0.4983      3.51    0.0157          0. RCFLAGS    0    0
  1 7913    0.0186     23.59    0.1082          0. RCFLAGS    0    0
  1 6913    0.0186      0.00    0.0000        416. RCFLAGS    0    0
  1 8913    0.0976     12.49    0.2608          0. RCFLAGS    0    0
  1 3913    0.1162     10.49    0.2608          0. RCFLAGS    0    0
  1 1913    0.1162      3.79    0.1036        637. RCFLAGS    0    0
  1 5913    0.1162      3.73    0.0093        395. RCFLAGS    0    0
  1 2003    0.6145      3.55    0.0230          0. RCFLAGS    0    0
  1 2004    6.5745      1.84    0.0475          0. RCFLAGS    0    0
  1 3920    0.0145     18.16    0.0570          0. RCFLAGS    0    0
  1 2020    6.5889      1.87    0.0730          0. RCFLAGS    0    0
  1  131    6.5889      1.87    0.0659          0. RCFLAGS    0    0
  1 7914    0.0347     23.60    0.5347          0. RCFLAGS    0    0
  1 6914    0.0347      0.00    0.0000        785. RCFLAGS    0    0
178914    0.0241      3.31    0.0003          0. RCFLAGS    0    0
  1  914    0.0241      0.00    0.0000         13. RCFLAGS    0    0
  1 1914    0.0588      0.00    0.0000          0. RCFLAGS    0    0
185914    0.0055      3.31    0.0001          0. RCFLAGS    0    0
  1  314    0.0055      0.00    0.0000          3. RCFLAGS    0    0
186914    0.0600     17.92    0.2548          0. RCFLAGS    0    0
  1 8914    0.0655     16.40    0.2548          0. RCFLAGS    0    0
  1 3914    0.1243      8.64    0.2548          0. RCFLAGS    0    0
  1 5914    0.1243      7.08    0.0039        971. RCFLAGS    0    0
  1  214    0.1243      7.08    0.0039          0. RCFLAGS    0    0
  1  114    0.1243      0.00    0.0000          3. RCFLAGS    0    0
  1  714    0.1243      1.63    0.0009          0. RCFLAGS    0    0
  1  414    0.1243      5.45    0.0030        971. RCFLAGS    0    0
  1  814    0.1243      5.45    0.0030          0. RCFLAGS    0    0
  1 9141    0.0127     10.64    0.0725          0. RCFLAGS    0    0
  1 9142    0.0056      8.51    0.0085          0. RCFLAGS    0    0 25MM.dat
  1 4914    0.0183      9.98    0.0783          0. RCFLAGS    0    0
  1 9143    0.1426      2.70    0.0785          0. RCFLAGS    0    0
  1 2914    0.1426      7.45    0.0789          0. RCFLAGS    0    0
  1 7915    0.0010     23.60    0.0157          0. RCFLAGS    0    0
  1 6915    0.0010      0.00    0.0000         20. RCFLAGS    0    0
  1 8915    0.0079     12.48    0.0291          0. RCFLAGS    0    0
  1 3915    0.0089     11.05    0.0291          0. RCFLAGS    0    0
  1 5915    0.0089     11.00    0.0074         48. RCFLAGS    0    0
  1 1915    0.0089      0.00    0.0000         40. RCFLAGS    0    0
  1 9151    0.0018     23.60    0.0277          0. RCFLAGS    0    0
  1 9152    0.0049      3.31    0.0001          0. RCFLAGS    0    0
  1 4915    0.0067      8.80    0.0277          0. RCFLAGS    0    0
  1 2915    0.0155      3.77    0.0277          0. RCFLAGS    0    0
  1 2005    0.1582      7.09    0.1067          0. RCFLAGS    0    0
  1 1911    0.1935      3.67    0.0085          0. RCFLAGS    0    0
  1 2911    0.0096      3.64    0.0008          0. RCFLAGS    0    0
  1 3911    0.2031      3.66    0.0092          0. RCFLAGS    0    0
```



```
  1 2006    0.3612      5.16    0.1111          0. RCFLAGS    0    0
  1 7917    0.0031     23.60    0.0470          0. RCFLAGS    0    0
  1 6917    0.0031      0.00    0.0000         64. RCFLAGS    0    0
  1 8917    0.0097     14.82    0.0819          0. RCFLAGS    0    0
  1 3917    0.0127     11.27    0.0819          0. RCFLAGS    0    0
  1 5917    0.0127     11.26    0.0038         91. RCFLAGS    0    0
  1 1917    0.0127      0.00    0.0000         60. RCFLAGS    0    0
  1 9171    0.0081      5.01    0.0025          0. RCFLAGS    0    0
  1 9172    0.0041     12.75    0.0275          0. RCFLAGS    0    0
  1 4917    0.0121      7.62    0.0295          0. RCFLAGS    0    0
  1 2917    0.0248      3.72    0.0295          0. RCFLAGS    0    0
  1 2007    0.3861      5.07    0.1405          0. RCFLAGS    0    0
  1 3918    0.0057      3.09    0.0004          0. RCFLAGS    0    0
  1 2008    0.3917      5.04    0.1408          0. RCFLAGS    0    0
  1 2009    6.9806      2.04    0.1496          0. RCFLAGS    0    0
  1 3092    0.0402      7.27    0.0094          0. RCFLAGS    0    0
  1 3093    0.0058      3.12    0.0004          0. RCFLAGS    0    0
  1 2010    0.0459      6.75    0.0097          0. RCFLAGS    0    0
  1 9173    0.0029      4.63    0.0007          0. RCFLAGS    0    0
  1 2021    0.0488      6.63    0.0098          0. RCFLAGS    0    0
199141    0.0014     23.60    0.0208          0. RCFLAGS    0    0
  1  514    0.0014      0.00    0.0000         31. RCFLAGS    0    0
199142    0.0152      8.80    0.0649          0. RCFLAGS    0    0
  1  614    0.0152      0.00    0.0000         80. RCFLAGS    0    0
199143    0.0166      0.00    0.0000          0. RCFLAGS    0    0
199145    0.0040     16.53    0.0416          0. RCFLAGS    0    0
  1 9914    0.0206      3.24    0.0416          0. RCFLAGS    0    0
  1 2011    0.0694      5.62    0.0433          0. RCFLAGS    0    0
  1 3103    0.0050      3.29    0.0008          0. RCFLAGS    0    0 25MM.dat
  1 2111    0.0744      5.47    0.0441          0. RCFLAGS    0    0
  1 3105    0.0361      3.54    0.0021          0. RCFLAGS    0    0
  1 7107    0.0334     23.60    0.5153          0. RCFLAGS    0    0
  1 6107    0.0334      0.00    0.0000        704. RCFLAGS    0    0
  1 4107    0.0271      3.31    0.0004          0. RCFLAGS    0    0
  1 5107    0.0271      0.00    0.0000          5. RCFLAGS    0    0
  1 1107    0.0605      0.00    0.0000          0. RCFLAGS    0    0
  1 8107    0.0519     19.87    0.2503          0. RCFLAGS    0    0
  1 3107    0.1125      9.18    0.2503          0. RCFLAGS    0    0
  1 2012    0.1486      7.81    0.2524          0. RCFLAGS    0    0
  1 7101    0.0236     23.60    0.3639          0. RCFLAGS    0    0
  1 6101    0.0236      0.00    0.0000        482. RCFLAGS    0    0
  1 4101    0.0241      3.37    0.0003          0. RCFLAGS    0    0
  1 5101    0.0241      0.00    0.0000         16. RCFLAGS    0    0
  1 1101    0.0477      0.00    0.0000          0. RCFLAGS    0    0
  1 8101    0.0330     20.65    0.1663          0. RCFLAGS    0    0
  1 2101    0.0807      8.44    0.1663          0. RCFLAGS    0    0
  1 9101    0.0239     11.75    0.0586          0. RCFLAGS    0    0
  1 3101    0.1046      9.19    0.2249          0. RCFLAGS    0    0
  1 1111    0.1046      9.19    0.2249          0. RCFLAGS    0    0
  1 1112    0.1046      0.00    0.0000          0. RCFLAGS    0    0
  1 2013    0.2532      8.38    0.4773          0. RCFLAGS    0    0
  1 7102    0.0249     23.60    0.3840          0. RCFLAGS    0    0
  1 6102    0.0249      0.00    0.0000        525. RCFLAGS    0    0
  1 4102    0.0282      3.27    0.0004          0. RCFLAGS    0    0
  1 5102    0.0282      0.00    0.0000          5. RCFLAGS    0    0
  1 1102    0.0531      0.00    0.0000          0. RCFLAGS    0    0
  1 8102    0.0335     20.48    0.1739          0. RCFLAGS    0    0
  1 3102    0.0866      7.93    0.1739          0. RCFLAGS    0    0
  1 2014    0.3398      8.27    0.6511          0. RCFLAGS    0    0
  1 3181    0.0213     18.14    0.0830          0. RCFLAGS    0    0
  1 2015    0.3611      8.85    0.7341          0. RCFLAGS    0    0
  1 3182    0.0140     18.16    0.0846          0. RCFLAGS    0    0
  1 3104    0.0472      5.09    0.0340          0. RCFLAGS    0    0
  1 2016    0.0612      8.08    0.1186          0. RCFLAGS    0    0
```

1	2017	0.0612	8.08	0.1186	0.	RCFLAGS	0	0
1	7106	0.0481	23.60	0.7416	0.	RCFLAGS	0	0
1	6106	0.0481	0.00	0.0000	1087.	RCFLAGS	0	0
1	8106	0.2526	12.51	0.6749	0.	RCFLAGS	0	0
1	3106	0.3007	10.51	0.6749	0.	RCFLAGS	0	0
1	2018	0.3619	10.10	0.7935	0.	RCFLAGS	0	0
1	4106	0.3619	4.12	0.5443	1625.	RCFLAGS	0	0
1	1114	0.3611	8.85	0.7341	0.	RCFLAGS	0	0
1	1113	0.3611	0.00	0.0000	0.	RCFLAGS	0	0
1	216	0.3611	8.85	0.7341	0.	RCFLAGS	0	0
1	116	0.3611	0.00	0.0000	0.	RCFLAGS	0	0 25MM.dat
1	3183	0.0087	17.16	0.0518	0.	RCFLAGS	0	0
1	2022	0.3698	9.04	0.7859	0.	RCFLAGS	0	0
1	1106	0.3698	8.99	0.1041	2460.	RCFLAGS	0	0
1	1116	0.3698	4.71	0.0091	0.	RCFLAGS	0	0
1	1115	0.3698	4.28	0.0950	0.	RCFLAGS	0	0
1	1117	0.3698	4.28	0.0950	0.	RCFLAGS	0	0
1	1118	0.3611	4.38	0.0950	0.	RCFLAGS	0	0
1	316	0.3619	4.12	0.5443	0.	RCFLAGS	0	0
1	416	0.3619	0.00	0.0000	0.	RCFLAGS	0	0
1	5106	0.3619	4.08	0.0160	1351.	RCFLAGS	0	0
1	1119	0.3619	3.43	0.0086	0.	RCFLAGS	0	0
1	1120	0.3619	0.65	0.0074	0.	RCFLAGS	0	0
1	1121	0.3619	0.65	0.0074	0.	RCFLAGS	0	0
1	516	0.7317	4.08	0.0177	0.	RCFLAGS	0	0
1	3141	0.0113	3.06	0.0001	0.	RCFLAGS	0	0
1	616	0.7430	4.06	0.0177	0.	RCFLAGS	0	0
1	716	0.3611	5.03	0.1001	0.	RCFLAGS	0	0
1	2019	0.7430	6.51	0.1177	0.	RCFLAGS	0	0
2	301	2.6500	4.01	0.0338	0.	RCFLAGS	0	0 2.dat
2	111	2.6500	3.96	0.0326	0.	RCFLAGS	0	0
2	381	3.3100	4.03	0.0462	0.	RCFLAGS	0	0
2	281	5.9600	4.00	0.0758	0.	RCFLAGS	0	0
2	581	5.9600	3.81	0.0714	1221.	RCFLAGS	0	0
2	121	5.9600	3.80	0.0714	0.	RCFLAGS	0	0
2	3916	0.0260	7.95	0.0019	0.	RCFLAGS	0	0
2	3919	0.1360	8.06	0.0079	0.	RCFLAGS	0	0
2	2000	0.1620	8.04	0.0097	0.	RCFLAGS	0	0
2	3910	0.1730	8.08	0.0091	0.	RCFLAGS	0	0
2	2001	0.3350	8.06	0.0183	0.	RCFLAGS	0	0
2	7912	0.0261	46.92	0.1615	0.	RCFLAGS	0	0
2	6912	0.0261	15.72	0.0859	698.	RCFLAGS	0	0
2	8912	0.1372	25.76	0.3940	0.	RCFLAGS	0	0
2	3912	0.1633	24.15	0.3940	0.	RCFLAGS	0	0
2	1912	0.1633	14.87	0.3282	1049.	RCFLAGS	0	0
2	5912	0.1633	14.80	0.0147	1883.	RCFLAGS	0	0
2	2002	0.4983	10.27	0.0287	0.	RCFLAGS	0	0
2	7913	0.0186	46.92	0.1151	0.	RCFLAGS	0	0
2	6913	0.0186	15.80	0.1046	473.	RCFLAGS	0	0
2	8913	0.0976	25.68	0.2803	0.	RCFLAGS	0	0
2	3913	0.1162	24.10	0.2803	0.	RCFLAGS	0	0
2	1913	0.1162	14.88	0.2574	722.	RCFLAGS	0	0
2	5913	0.1162	14.79	0.0120	1305.	RCFLAGS	0	0
2	2003	0.6145	11.13	0.0388	0.	RCFLAGS	0	0
2	2004	6.5745	4.49	0.0828	0.	RCFLAGS	0	0
2	3920	0.0145	36.77	0.0619	0.	RCFLAGS	0	0
2	2020	6.5889	4.56	0.1051	0.	RCFLAGS	0	0
2	131	6.5889	4.55	0.1049	0.	RCFLAGS	0	0
2	7914	0.0347	46.93	0.3516	0.	RCFLAGS	0	0
2	6914	0.0347	10.18	0.0811	1054.	RCFLAGS	0	0
278914		0.0241	7.74	0.0006	0.	RCFLAGS	0	0
2	914	0.0241	0.00	0.0000	27.	RCFLAGS	0	0
2	1914	0.0588	6.00	0.0811	0.	RCFLAGS	0	0
285914		0.0055	7.74	0.0001	0.	RCFLAGS	0	0

2	314	0.0055	0.00	0.0000	6.	RCFLAGS	0	0
286914		0.0600	36.29	0.2738	0.	RCFLAGS	0	0
2	8914	0.0655	33.23	0.2738	0.	RCFLAGS	0	0
2	3914	0.1243	20.35	0.2864	0.	RCFLAGS	0	0
2	5914	0.1243	14.60	0.0057	2119.	RCFLAGS	0	0
2	214	0.1243	14.60	0.0057	0.	RCFLAGS	0	0
2	114	0.1243	0.00	0.0000	6.	RCFLAGS	0	0
2	714	0.1243	3.36	0.0013	0.	RCFLAGS	0	0
2	414	0.1243	11.24	0.0044	2119.	RCFLAGS	0	0
2	814	0.1243	11.24	0.0044	0.	RCFLAGS	0	0
2	9141	0.0127	22.06	0.0477	0.	RCFLAGS	0	0
2	9142	0.0056	17.89	0.0092	0.	RCFLAGS	0	0 2.dat
2	4914	0.0183	20.78	0.0568	0.	RCFLAGS	0	0
2	9143	0.1426	5.59	0.0576	0.	RCFLAGS	0	0
2	2914	0.1426	15.39	0.0600	0.	RCFLAGS	0	0
2	7915	0.0010	46.89	0.0103	0.	RCFLAGS	0	0
2	6915	0.0010	0.06	0.0001	30.	RCFLAGS	0	0
2	8915	0.0079	25.68	0.0370	0.	RCFLAGS	0	0
2	3915	0.0089	22.74	0.0370	0.	RCFLAGS	0	0
2	5915	0.0089	22.64	0.0112	70.	RCFLAGS	0	0
2	1915	0.0089	0.00	0.0000	77.	RCFLAGS	0	0
2	9151	0.0018	46.89	0.0182	0.	RCFLAGS	0	0
2	9152	0.0049	7.71	0.0001	0.	RCFLAGS	0	0
2	4915	0.0067	18.32	0.0183	0.	RCFLAGS	0	0
2	2915	0.0155	7.84	0.0183	0.	RCFLAGS	0	0
2	2005	0.1582	14.65	0.0782	0.	RCFLAGS	0	0
2	1911	0.1935	8.95	0.0320	0.	RCFLAGS	0	0
2	2911	0.0096	8.77	0.0023	0.	RCFLAGS	0	0
2	3911	0.2031	8.94	0.0344	0.	RCFLAGS	0	0
2	2006	0.3612	11.44	0.0940	0.	RCFLAGS	0	0
2	7917	0.0031	46.93	0.0309	0.	RCFLAGS	0	0
2	6917	0.0031	3.45	0.0046	92.	RCFLAGS	0	0
2	8917	0.0097	30.29	0.0580	0.	RCFLAGS	0	0
2	3917	0.0127	23.85	0.0580	0.	RCFLAGS	0	0
2	5917	0.0127	23.85	0.0051	139.	RCFLAGS	0	0
2	1917	0.0127	1.42	0.0026	122.	RCFLAGS	0	0
2	9171	0.0081	10.94	0.0090	0.	RCFLAGS	0	0
2	9172	0.0041	26.24	0.0203	0.	RCFLAGS	0	0
2	4917	0.0121	16.08	0.0293	0.	RCFLAGS	0	0
2	2917	0.0248	8.58	0.0293	0.	RCFLAGS	0	0
2	2007	0.3861	11.26	0.1233	0.	RCFLAGS	0	0
2	3918	0.0057	7.77	0.0015	0.	RCFLAGS	0	0
2	2008	0.3917	11.21	0.1239	0.	RCFLAGS	0	0
2	2009	6.9806	4.92	0.1782	0.	RCFLAGS	0	0
2	3092	0.0402	15.72	0.0413	0.	RCFLAGS	0	0
2	3093	0.0058	7.86	0.0015	0.	RCFLAGS	0	0
2	2010	0.0459	14.73	0.0416	0.	RCFLAGS	0	0
2	9173	0.0029	10.44	0.0028	0.	RCFLAGS	0	0
2	2021	0.0488	14.48	0.0421	0.	RCFLAGS	0	0
299141		0.0014	46.93	0.0137	0.	RCFLAGS	0	0
2	514	0.0014	10.51	0.0034	41.	RCFLAGS	0	0
299142		0.0152	18.46	0.0427	0.	RCFLAGS	0	0
2	614	0.0152	0.00	0.0000	125.	RCFLAGS	0	0
299143		0.0166	0.86	0.0034	0.	RCFLAGS	0	0
299145		0.0040	33.56	0.0273	0.	RCFLAGS	0	0
2	9914	0.0206	7.27	0.0273	0.	RCFLAGS	0	0
2	2011	0.0694	12.34	0.0580	0.	RCFLAGS	0	0
2	3103	0.0050	7.83	0.0016	0.	RCFLAGS	0	0 2.dat
2	2111	0.0744	12.04	0.0585	0.	RCFLAGS	0	0
2	3105	0.0361	8.06	0.0023	0.	RCFLAGS	0	0
2	7107	0.0334	46.93	0.3389	0.	RCFLAGS	0	0
2	6107	0.0334	3.32	0.0406	1010.	RCFLAGS	0	0
2	4107	0.0271	7.72	0.0007	0.	RCFLAGS	0	0
2	5107	0.0271	0.00	0.0000	10.	RCFLAGS	0	0

```
  2 1107    0.0605      1.83    0.0406          0. RCFLAGS    0    0
  2 8107    0.0519     40.12    0.2689          0. RCFLAGS    0    0
  2 3107    0.1125     19.51    0.2689          0. RCFLAGS    0    0
  2 2012    0.1486     16.73    0.2712          0. RCFLAGS    0    0
  2 7101    0.0236     46.93    0.2393          0. RCFLAGS    0    0
  2 6101    0.0236      1.77    0.0266        711. RCFLAGS    0    0
  2 4101    0.0241      7.85    0.0006          0. RCFLAGS    0    0
  2 5101    0.0241      0.00    0.0000         33. RCFLAGS    0    0
  2 1101    0.0477      0.87    0.0266          0. RCFLAGS    0    0
  2 8101    0.0330     41.65    0.1787          0. RCFLAGS    0    0
  2 2101    0.0807     17.53    0.1787          0. RCFLAGS    0    0
  2 9101    0.0239     24.24    0.0630          0. RCFLAGS    0    0
  2 3101    0.1046     19.07    0.2417          0. RCFLAGS    0    0
  2 1111    0.1046     19.07    0.2417          0. RCFLAGS    0    0
  2 1112    0.1046      0.00    0.0000          0. RCFLAGS    0    0
  2 2013    0.2532     17.70    0.5129          0. RCFLAGS    0    0
  2 7102    0.0249     46.93    0.2525          0. RCFLAGS    0    0
  2 6102    0.0249      3.34    0.0302        751. RCFLAGS    0    0
  2 4102    0.0282      7.64    0.0007          0. RCFLAGS    0    0
  2 5102    0.0282      0.00    0.0000         11. RCFLAGS    0    0
  2 1102    0.0531      1.57    0.0302          0. RCFLAGS    0    0
  2 8102    0.0335     41.31    0.1861          0. RCFLAGS    0    0
  2 3102    0.0866     16.96    0.1861          0. RCFLAGS    0    0
  2 2014    0.3398     17.51    0.6990          0. RCFLAGS    0    0
  2 3181    0.0213     36.72    0.0906          0. RCFLAGS    0    0
  2 2015    0.3611     18.64    0.7892          0. RCFLAGS    0    0
  2 3182    0.0140     36.78    0.1067          0. RCFLAGS    0    0
  2 3104    0.0472     11.50    0.0359          0. RCFLAGS    0    0
  2 2016    0.0612     17.29    0.1426          0. RCFLAGS    0    0
  2 2017    0.0612     17.29    0.1426          0. RCFLAGS    0    0
  2 7106    0.0481     46.93    0.4877          0. RCFLAGS    0    0
  2 6106    0.0481     15.84    0.3632       1295. RCFLAGS    0    0
  2 8106    0.2526     25.73    0.7253          0. RCFLAGS    0    0
  2 3106    0.3007     24.15    1.0614          0. RCFLAGS    0    0
  2 2018    0.3619     22.99    1.1117          0. RCFLAGS    0    0
  2 4106    0.3619     14.68    1.0103       1660. RCFLAGS    0    0
  2 1114    0.3611     18.64    0.7892          0. RCFLAGS    0    0
  2 1113    0.3611      0.00    0.0000          0. RCFLAGS    0    0
  2  216    0.3611     18.64    0.7892          0. RCFLAGS    0    0
  2  116    0.3611      0.00    0.0000          0. RCFLAGS    0    0 2.dat
  2 3183    0.0087     34.83    0.0620          0. RCFLAGS    0    0
  2 2022    0.3698     19.02    0.8512          0. RCFLAGS    0    0
  2 1106    0.3698     18.97    0.4913       2957. RCFLAGS    0    0
  2 1116    0.3698      6.86    0.0093          0. RCFLAGS    0    0
  2 1115    0.3698     12.11    0.4820          0. RCFLAGS    0    0
  2 1117    0.3698     12.11    0.4820          0. RCFLAGS    0    0
  2 1118    0.3611     12.40    0.4820          0. RCFLAGS    0    0
  2  316    0.3619     14.24    0.9078          0. RCFLAGS    0    0
  2  416    0.3619      0.45    0.1025          0. RCFLAGS    0    0
  2 5106    0.3619     14.17    0.0721       3436. RCFLAGS    0    0
  2 1119    0.3619      6.32    0.0092          0. RCFLAGS    0    0
  2 1120    0.3619      7.85    0.0629          0. RCFLAGS    0    0
  2 1121    0.3619      8.30    0.1025          0. RCFLAGS    0    0
  2  516    0.7317      6.59    0.0184          0. RCFLAGS    0    0
  2 3141    0.0113      7.71    0.0003          0. RCFLAGS    0    0
  2  616    0.7430      6.61    0.0184          0. RCFLAGS    0    0
  2  716    0.3611     20.71    0.5016          0. RCFLAGS    0    0
  2 2019    0.7430     16.68    0.5198          0. RCFLAGS    0    0
  3  301    2.6500      8.46    0.4342          0. RCFLAGS    0    0 5.dat
  3  111    2.6500      8.43    0.4128          0. RCFLAGS    0    0
  3  381    3.3100      9.95    0.8554          0. RCFLAGS    0    0
  3  281    5.9600      9.27    1.2095          0. RCFLAGS    0    0
  3  581    5.9600      9.04    0.6644       8985. RCFLAGS    0    0
  3  121    5.9600      9.04    0.6641          0. RCFLAGS    0    0
```



```
  3 3916    0.0260     12.34    0.0274          0. RCFLAGS    0    0
  3 3919    0.1360     11.68    0.0768          0. RCFLAGS    0    0
  3 2000    0.1620     11.79    0.1043          0. RCFLAGS    0    0
  3 3910    0.1730     12.20    0.0846          0. RCFLAGS    0    0
  3 2001    0.3350     12.00    0.1888          0. RCFLAGS    0    0
  3 7912    0.0261     64.45    0.2220          0. RCFLAGS    0    0
  3 6912    0.0261     33.20    0.1748        743. RCFLAGS    0    0
  3 8912    0.1372     38.30    0.7024          0. RCFLAGS    0    0
  3 3912    0.1633     37.48    0.8094          0. RCFLAGS    0    0
  3 1912    0.1633     27.68    0.7275       1272. RCFLAGS    0    0
  3 5912    0.1633     27.59    0.0948       3111. RCFLAGS    0    0
  3 2002    0.4983     17.11    0.2022          0. RCFLAGS    0    0
  3 7913    0.0186     64.45    0.1582          0. RCFLAGS    0    0
  3 6913    0.0186     33.28    0.1406        476. RCFLAGS    0    0
  3 8913    0.0976     36.06    0.4167          0. RCFLAGS    0    0
  3 3913    0.1162     35.62    0.5556          0. RCFLAGS    0    0
  3 1913    0.1162     25.69    0.4752        853. RCFLAGS    0    0
  3 5913    0.1162     25.54    0.0727       1986. RCFLAGS    0    0
  3 2003    0.6145     18.70    0.2129          0. RCFLAGS    0    0
  3 2004    6.5745      9.94    0.7630          0. RCFLAGS    0    0
  3 3920    0.0145     51.98    0.0932          0. RCFLAGS    0    0
  3 2020    6.5889     10.03    0.7682          0. RCFLAGS    0    0
  3  131    6.5889     10.03    0.7681          0. RCFLAGS    0    0
  3 7914    0.0347     64.46    0.4834          0. RCFLAGS    0    0
  3 6914    0.0347     27.71    0.2837       1085. RCFLAGS    0    0
378914    0.0241     12.64    0.0825          0. RCFLAGS    0    0
  3  914    0.0241      0.00    0.0000         73. RCFLAGS    0    0
  3 1914    0.0588     16.34    0.2837          0. RCFLAGS    0    0
385914    0.0055     12.64    0.0189          0. RCFLAGS    0    0
  3  314    0.0055      0.00    0.0000         17. RCFLAGS    0    0
386914    0.0600     50.51    0.3889          0. RCFLAGS    0    0
  3 8914    0.0655     46.25    0.3889          0. RCFLAGS    0    0
  3 3914    0.1243     32.09    0.6701          0. RCFLAGS    0    0
  3 5914    0.1243     25.10    0.0693       2676. RCFLAGS    0    0
  3  214    0.1243     15.84    0.0064          0. RCFLAGS    0    0
  3  114    0.1243      9.26    0.0629         17. RCFLAGS    0    0
  3  714    0.1243      3.64    0.0015          0. RCFLAGS    0    0
  3  414    0.1243     12.20    0.0049       2676. RCFLAGS    0    0
  3  814    0.1243     21.46    0.0678          0. RCFLAGS    0    0
  3 9141    0.0127     31.63    0.0929          0. RCFLAGS    0    0
  3 9142    0.0056     26.14    0.0167          0. RCFLAGS    0    0 5.dat
  3 4914    0.0183     29.95    0.1088          0. RCFLAGS    0    0
  3 9143    0.1426      7.02    0.1097          0. RCFLAGS    0    0
  3 2914    0.1426     25.72    0.1128          0. RCFLAGS    0    0
  3 7915    0.0010     64.46    0.0142          0. RCFLAGS    0    0
  3 6915    0.0010     13.48    0.0133         31. RCFLAGS    0    0
  3 8915    0.0079     36.10    0.0620          0. RCFLAGS    0    0
  3 3915    0.0089     33.51    0.0640          0. RCFLAGS    0    0
  3 5915    0.0089     33.38    0.0156        114. RCFLAGS    0    0
  3 1915    0.0089      0.00    0.0000        145. RCFLAGS    0    0
  3 9151    0.0018     64.46    0.0251          0. RCFLAGS    0    0
  3 9152    0.0049     11.98    0.0129          0. RCFLAGS    0    0
  3 4915    0.0067     26.19    0.0380          0. RCFLAGS    0    0
  3 2915    0.0155     11.21    0.0380          0. RCFLAGS    0    0
  3 2005    0.1582     24.30    0.1508          0. RCFLAGS    0    0
  3 1911    0.1935     15.26    0.1519          0. RCFLAGS    0    0
  3 2911    0.0096     14.99    0.0143          0. RCFLAGS    0    0
  3 3911    0.2031     15.25    0.1661          0. RCFLAGS    0    0
  3 2006    0.3612     19.21    0.2508          0. RCFLAGS    0    0
  3 7917    0.0031     64.46    0.0425          0. RCFLAGS    0    0
  3 6917    0.0031     18.23    0.0276         92. RCFLAGS    0    0
  3 8917    0.0097     43.54    0.1044          0. RCFLAGS    0    0
  3 3917    0.0127     37.47    0.1247          0. RCFLAGS    0    0
  3 5917    0.0127     37.46    0.0142        244. RCFLAGS    0    0
```

3 1917	0.0127	12.76	0.0080	122.	RCFLAGS	0	0	
3 9171	0.0081	19.09	0.0572	0.	RCFLAGS	0	0	
3 9172	0.0041	38.44	0.0409	0.	RCFLAGS	0	0	
3 4917	0.0121	25.60	0.0981	0.	RCFLAGS	0	0	
3 2917	0.0248	19.03	0.0981	0.	RCFLAGS	0	0	
3 2007	0.3861	19.20	0.3489	0.	RCFLAGS	0	0	
3 3918	0.0057	12.57	0.0116	0.	RCFLAGS	0	0	
3 2008	0.3917	19.10	0.3605	0.	RCFLAGS	0	0	
3 2009	6.9806	10.53	0.8331	0.	RCFLAGS	0	0	
3 3092	0.0402	24.64	0.1166	0.	RCFLAGS	0	0	
3 3093	0.0058	15.98	0.0129	0.	RCFLAGS	0	0	
3 2010	0.0459	23.55	0.1296	0.	RCFLAGS	0	0	
3 9173	0.0029	18.41	0.0201	0.	RCFLAGS	0	0	
3 2021	0.0488	23.25	0.1303	0.	RCFLAGS	0	0	
399141	0.0014	64.46	0.0188	0.	RCFLAGS	0	0	
3 514	0.0014	28.00	0.0134	41.	RCFLAGS	0	0	
399142	0.0152	26.86	0.0962	0.	RCFLAGS	0	0	
3 614	0.0152	0.00	0.0000	204.	RCFLAGS	0	0	
399143	0.0166	2.28	0.0134	0.	RCFLAGS	0	0	
399145	0.0040	46.91	0.0422	0.	RCFLAGS	0	0	
3 9914	0.0206	11.04	0.0556	0.	RCFLAGS	0	0	
3 2011	0.0694	19.62	0.1790	0.	RCFLAGS	0	0	
3 3103	0.0050	12.99	0.0126	0.	RCFLAGS	0	0	5.dat
3 2111	0.0744	19.18	0.1916	0.	RCFLAGS	0	0	
3 3105	0.0361	14.85	0.0683	0.	RCFLAGS	0	0	
3 7107	0.0334	64.46	0.4658	0.	RCFLAGS	0	0	
3 6107	0.0334	18.07	0.3021	1060.	RCFLAGS	0	0	
3 4107	0.0271	12.07	0.0748	0.	RCFLAGS	0	0	
3 5107	0.0271	0.00	0.0000	63.	RCFLAGS	0	0	
3 1107	0.0605	9.98	0.3021	0.	RCFLAGS	0	0	
3 8107	0.0519	55.50	0.3751	0.	RCFLAGS	0	0	
3 3107	0.1125	31.00	0.6656	0.	RCFLAGS	0	0	
3 2012	0.1486	27.08	0.7339	0.	RCFLAGS	0	0	
3 7101	0.0236	64.46	0.3290	0.	RCFLAGS	0	0	
3 6101	0.0236	15.72	0.2264	738.	RCFLAGS	0	0	
3 4101	0.0241	16.08	0.1810	0.	RCFLAGS	0	0	
3 5101	0.0241	0.00	0.0000	160.	RCFLAGS	0	0	
3 1101	0.0477	7.78	0.2264	0.	RCFLAGS	0	0	
3 8101	0.0330	58.02	0.2528	0.	RCFLAGS	0	0	
3 2101	0.0807	28.30	0.4729	0.	RCFLAGS	0	0	
3 9101	0.0239	36.42	0.1172	0.	RCFLAGS	0	0	
3 3101	0.1046	30.16	0.5900	0.	RCFLAGS	0	0	
3 1111	0.1046	30.16	0.5900	0.	RCFLAGS	0	0	
3 1112	0.1046	0.00	0.0000	0.	RCFLAGS	0	0	
3 2013	0.2532	28.35	1.3239	0.	RCFLAGS	0	0	
3 7102	0.0249	64.46	0.3471	0.	RCFLAGS	0	0	
3 6102	0.0249	18.10	0.2274	779.	RCFLAGS	0	0	
3 4102	0.0282	9.74	0.0010	0.	RCFLAGS	0	0	
3 5102	0.0282	0.00	0.0000	14.	RCFLAGS	0	0	
3 1102	0.0531	8.49	0.2274	0.	RCFLAGS	0	0	
3 8102	0.0335	56.80	0.2558	0.	RCFLAGS	0	0	
3 3102	0.0866	27.20	0.4694	0.	RCFLAGS	0	0	
3 2014	0.3398	28.06	1.7932	0.	RCFLAGS	0	0	
3 3181	0.0213	50.47	0.1251	0.	RCFLAGS	0	0	
3 2015	0.3611	29.38	1.9183	0.	RCFLAGS	0	0	
3 3182	0.0140	51.64	0.1670	0.	RCFLAGS	0	0	
3 3104	0.0472	16.76	0.0760	0.	RCFLAGS	0	0	
3 2016	0.0612	24.76	0.2431	0.	RCFLAGS	0	0	
3 2017	0.0612	24.76	0.2431	0.	RCFLAGS	0	0	
3 7106	0.0481	64.46	0.6704	0.	RCFLAGS	0	0	
3 6106	0.0481	26.49	0.3382	1374.	RCFLAGS	0	0	
3 8106	0.2526	37.54	1.2189	0.	RCFLAGS	0	0	
3 3106	0.3007	35.77	1.5201	0.	RCFLAGS	0	0	
3 2018	0.3619	33.91	1.7631	0.	RCFLAGS	0	0	

3 4106	0.3619	27.59	1.4463	1682.	RCFLAGS	0	0	
3 1114	0.3611	29.38	1.9183	0.	RCFLAGS	0	0	
3 1113	0.3611	0.00	0.0000	0.	RCFLAGS	0	0	
3 216	0.3611	25.82	1.0604	0.	RCFLAGS	0	0	
3 116	0.3611	3.56	0.8579	0.	RCFLAGS	0	0	5.dat
3 3183	0.0087	47.75	0.0852	0.	RCFLAGS	0	0	
3 2022	0.3698	26.33	1.0950	0.	RCFLAGS	0	0	
3 1106	0.3698	26.27	0.8881	3274.	RCFLAGS	0	0	
3 1116	0.3698	7.22	0.0094	0.	RCFLAGS	0	0	
3 1115	0.3698	19.05	0.8787	0.	RCFLAGS	0	0	
3 1117	0.3698	22.53	1.5692	0.	RCFLAGS	0	0	
3 1118	0.3611	23.08	1.5692	0.	RCFLAGS	0	0	
3 316	0.3619	24.82	0.9987	0.	RCFLAGS	0	0	
3 416	0.3619	2.77	0.4476	0.	RCFLAGS	0	0	
3 5106	0.3619	23.62	0.4490	4088.	RCFLAGS	0	0	
3 1119	0.3619	8.04	0.0094	0.	RCFLAGS	0	0	
3 1120	0.3619	15.58	0.4396	0.	RCFLAGS	0	0	
3 1121	0.3619	18.35	0.4626	0.	RCFLAGS	0	0	
3 516	0.7317	7.62	0.0187	0.	RCFLAGS	0	0	
3 3141	0.0113	10.25	0.0004	0.	RCFLAGS	0	0	
3 616	0.7430	7.66	0.0187	0.	RCFLAGS	0	0	
3 716	0.3611	41.47	2.0319	0.	RCFLAGS	0	0	
3 2019	0.7430	27.82	2.0500	0.	RCFLAGS	0	0	
4 301	2.6500	28.23	2.3115	0.	RCFLAGS	0	0	100.dat
4 111	2.6500	28.21	2.2647	0.	RCFLAGS	0	0	
4 381	3.3100	31.66	3.7703	0.	RCFLAGS	0	0	
4 281	5.9600	30.13	5.9551	0.	RCFLAGS	0	0	
4 581	5.9600	29.80	3.5819	35854.	RCFLAGS	0	0	
4 121	5.9600	29.80	3.5818	0.	RCFLAGS	0	0	
4 3916	0.0260	37.63	0.2053	0.	RCFLAGS	0	0	
4 3919	0.1360	36.38	0.8434	0.	RCFLAGS	0	0	
4 2000	0.1620	36.58	1.0486	0.	RCFLAGS	0	0	
4 3910	0.1730	31.30	0.6079	0.	RCFLAGS	0	0	
4 2001	0.3350	33.85	1.6565	0.	RCFLAGS	0	0	
4 7912	0.0261	109.14	0.3712	0.	RCFLAGS	0	0	
4 6912	0.0261	76.78	0.3549	836.	RCFLAGS	0	0	
4 8912	0.1372	73.56	1.5336	0.	RCFLAGS	0	0	
4 3912	0.1633	74.08	1.8885	0.	RCFLAGS	0	0	
4 1912	0.1633	63.91	1.7644	1815.	RCFLAGS	0	0	
4 5912	0.1633	63.56	0.7263	5227.	RCFLAGS	0	0	
4 2002	0.4983	43.59	1.6914	0.	RCFLAGS	0	0	
4 7913	0.0186	109.12	0.2645	0.	RCFLAGS	0	0	
4 6913	0.0186	76.86	0.2608	487.	RCFLAGS	0	0	
4 8913	0.0976	70.23	0.9920	0.	RCFLAGS	0	0	
4 3913	0.1162	71.29	1.2528	0.	RCFLAGS	0	0	
4 1913	0.1162	61.08	1.0882	1286.	RCFLAGS	0	0	
4 5913	0.1162	60.63	0.6382	3113.	RCFLAGS	0	0	
4 2003	0.6145	46.81	2.0523	0.	RCFLAGS	0	0	
4 2004	6.5745	31.39	3.8178	0.	RCFLAGS	0	0	
4 3920	0.0145	92.27	0.1727	0.	RCFLAGS	0	0	
4 2020	6.5889	31.52	3.8278	0.	RCFLAGS	0	0	
4 131	6.5889	31.51	3.8263	0.	RCFLAGS	0	0	
4 7914	0.0347	109.14	0.8083	0.	RCFLAGS	0	0	
4 6914	0.0347	71.34	0.7221	1190.	RCFLAGS	0	0	
478914	0.0241	37.74	0.4281	0.	RCFLAGS	0	0	
4 914	0.0241	0.00	0.0000	555.	RCFLAGS	0	0	
4 1914	0.0588	42.07	0.7221	0.	RCFLAGS	0	0	
485914	0.0055	37.74	0.0981	0.	RCFLAGS	0	0	
4 314	0.0055	0.00	0.0000	127.	RCFLAGS	0	0	
486914	0.0600	90.06	0.7288	0.	RCFLAGS	0	0	
4 8914	0.0655	82.46	0.7288	0.	RCFLAGS	0	0	
4 3914	0.1243	63.35	1.4510	0.	RCFLAGS	0	0	
4 5914	0.1243	55.83	0.5316	3929.	RCFLAGS	0	0	
4 214	0.1243	16.41	0.0076	0.	RCFLAGS	0	0	

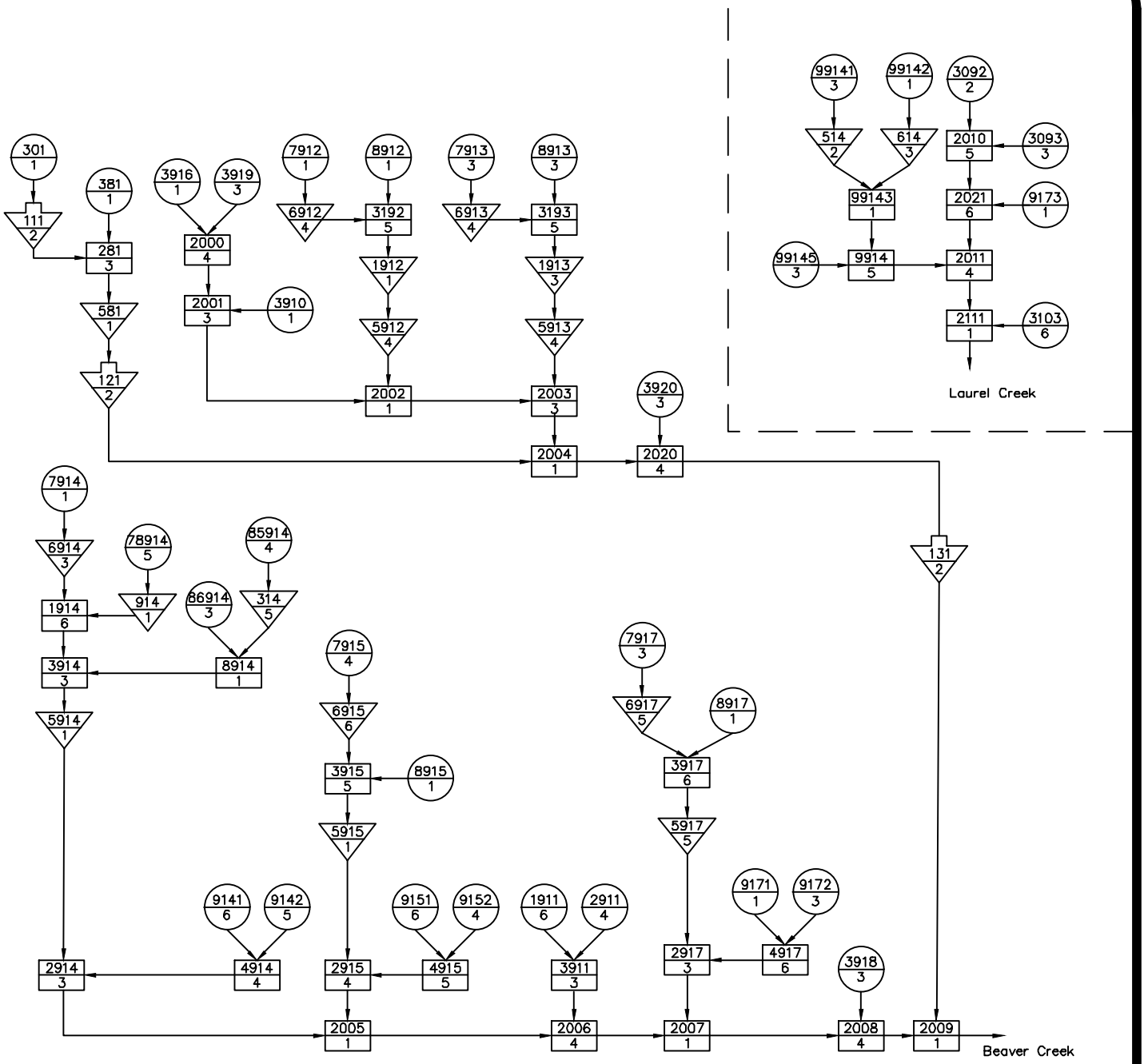
4	114	0.1243	39.43	0.5240	127.	RCFLAGS	0	0
4	714	0.1243	3.77	0.0018	0.	RCFLAGS	0	0
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4	814	0.1243	52.06	0.5299	0.	RCFLAGS	0	0
4	9141	0.0127	63.99	0.2518	0.	RCFLAGS	0	0
4	9142	0.0056	56.42	0.0504	0.	RCFLAGS	0	0 100.dat
4	4914	0.0183	61.68	0.2990	0.	RCFLAGS	0	0
4	9143	0.1426	11.21	0.3003	0.	RCFLAGS	0	0
4	2914	0.1426	56.58	0.5803	0.	RCFLAGS	0	0
4	7915	0.0010	109.12	0.0238	0.	RCFLAGS	0	0
4	6915	0.0010	47.11	0.0228	31.	RCFLAGS	0	0
4	8915	0.0079	70.28	0.1591	0.	RCFLAGS	0	0
4	3915	0.0089	67.62	0.1819	0.	RCFLAGS	0	0
4	5915	0.0089	67.45	0.0258	288.	RCFLAGS	0	0
4	1915	0.0089	14.05	0.0155	265.	RCFLAGS	0	0
4	9151	0.0018	109.12	0.0419	0.	RCFLAGS	0	0
4	9152	0.0049	37.07	0.0853	0.	RCFLAGS	0	0
4	4915	0.0067	56.57	0.1272	0.	RCFLAGS	0	0
4	2915	0.0155	32.26	0.1272	0.	RCFLAGS	0	0
4	2005	0.1582	54.20	0.5963	0.	RCFLAGS	0	0
4	1911	0.1935	38.07	0.6158	0.	RCFLAGS	0	0
4	2911	0.0096	37.85	0.0526	0.	RCFLAGS	0	0
4	3911	0.2031	38.06	0.6684	0.	RCFLAGS	0	0
4	2006	0.3612	45.12	1.1675	0.	RCFLAGS	0	0
4	7917	0.0031	109.12	0.0711	0.	RCFLAGS	0	0
4	6917	0.0031	57.62	0.0690	93.	RCFLAGS	0	0
4	8917	0.0097	80.86	0.2110	0.	RCFLAGS	0	0
4	3917	0.0127	75.29	0.2800	0.	RCFLAGS	0	0
4	5917	0.0127	75.28	0.0584	493.	RCFLAGS	0	0
4	1917	0.0127	47.77	0.0519	122.	RCFLAGS	0	0
4	9171	0.0081	47.77	0.1620	0.	RCFLAGS	0	0
4	9172	0.0041	73.92	0.0876	0.	RCFLAGS	0	0
4	4917	0.0121	56.57	0.2496	0.	RCFLAGS	0	0
4	2917	0.0248	52.07	0.2496	0.	RCFLAGS	0	0
4	2007	0.3861	45.57	1.2158	0.	RCFLAGS	0	0
4	3918	0.0057	36.32	0.0915	0.	RCFLAGS	0	0
4	2008	0.3917	45.44	1.2876	0.	RCFLAGS	0	0
4	2009	6.9806	32.30	4.1402	0.	RCFLAGS	0	0
4	3092	0.0402	56.90	0.3718	0.	RCFLAGS	0	0
4	3093	0.0058	46.46	0.0518	0.	RCFLAGS	0	0
4	2010	0.0459	55.59	0.4236	0.	RCFLAGS	0	0
4	9173	0.0029	46.41	0.0578	0.	RCFLAGS	0	0
4	2021	0.0488	55.04	0.4474	0.	RCFLAGS	0	0
499141		0.0014	109.14	0.0315	0.	RCFLAGS	0	0
4	514	0.0014	71.60	0.0312	41.	RCFLAGS	0	0
499142		0.0152	57.39	0.2932	0.	RCFLAGS	0	0
4	614	0.0152	0.00	0.0000	541.	RCFLAGS	0	0
499143		0.0166	5.84	0.0312	0.	RCFLAGS	0	0
499145		0.0040	85.09	0.0867	0.	RCFLAGS	0	0
4	9914	0.0206	21.39	0.1179	0.	RCFLAGS	0	0
4	2011	0.0694	45.06	0.5653	0.	RCFLAGS	0	0
4	3103	0.0050	42.27	0.0884	0.	RCFLAGS	0	0 100.dat
4	2111	0.0744	44.87	0.6537	0.	RCFLAGS	0	0
4	3105	0.0361	41.38	0.2987	0.	RCFLAGS	0	0
4	7107	0.0334	109.14	0.7790	0.	RCFLAGS	0	0
4	6107	0.0334	57.45	0.6305	1182.	RCFLAGS	0	0
4	4107	0.0271	37.20	0.4780	0.	RCFLAGS	0	0
4	5107	0.0271	0.00	0.0000	551.	RCFLAGS	0	0
4	1107	0.0605	31.74	0.6305	0.	RCFLAGS	0	0
4	8107	0.0519	97.00	0.6708	0.	RCFLAGS	0	0
4	3107	0.1125	61.87	1.3012	0.	RCFLAGS	0	0
4	2012	0.1486	56.89	1.5601	0.	RCFLAGS	0	0
4	7101	0.0236	109.14	0.5501	0.	RCFLAGS	0	0
4	6101	0.0236	52.97	0.4596	804.	RCFLAGS	0	0

4	4101	0.0241	43.20	0.4943	0.	RCFLAGS	0	0
4	5101	0.0241	0.00	0.0000	712.	RCFLAGS	0	0
4	1101	0.0477	26.20	0.4596	0.	RCFLAGS	0	0
4	8101	0.0330	100.53	0.4428	0.	RCFLAGS	0	0
4	2101	0.0807	56.57	0.9023	0.	RCFLAGS	0	0
4	9101	0.0239	71.01	0.2631	0.	RCFLAGS	0	0
4	3101	0.1046	59.87	1.1547	0.	RCFLAGS	0	0
4	1111	0.1046	53.95	0.7854	0.	RCFLAGS	0	0
4	1112	0.1046	5.92	0.3693	0.	RCFLAGS	0	0
4	2013	0.2532	55.68	2.3455	0.	RCFLAGS	0	0
4	7102	0.0249	109.14	0.5804	0.	RCFLAGS	0	0
4	6102	0.0249	57.48	0.4938	851.	RCFLAGS	0	0
4	4102	0.0282	33.71	0.4503	0.	RCFLAGS	0	0
4	5102	0.0282	0.00	0.0000	485.	RCFLAGS	0	0
4	1102	0.0531	26.98	0.4938	0.	RCFLAGS	0	0
4	8102	0.0335	98.75	0.4522	0.	RCFLAGS	0	0
4	3102	0.0866	54.77	0.9460	0.	RCFLAGS	0	0
4	2014	0.3398	55.45	3.2915	0.	RCFLAGS	0	0
4	3181	0.0213	90.02	0.2391	0.	RCFLAGS	0	0
4	2015	0.3611	57.49	3.5243	0.	RCFLAGS	0	0
4	3182	0.0140	91.75	0.3135	0.	RCFLAGS	0	0
4	3104	0.0472	39.67	0.3564	0.	RCFLAGS	0	0
4	2016	0.0612	51.61	0.6578	0.	RCFLAGS	0	0
4	2017	0.0612	61.72	1.0271	0.	RCFLAGS	0	0
4	7106	0.0481	109.14	1.1210	0.	RCFLAGS	0	0
4	6106	0.0481	77.00	1.0619	1577.	RCFLAGS	0	0
4	8106	0.2526	72.44	2.7365	0.	RCFLAGS	0	0
4	3106	0.3007	73.17	3.7116	0.	RCFLAGS	0	0
4	2018	0.3619	71.23	4.7387	0.	RCFLAGS	0	0
4	4106	0.3619	62.72	4.6974	1764.	RCFLAGS	0	0
4	1114	0.3611	50.66	2.1140	0.	RCFLAGS	0	0
4	1113	0.3611	6.82	1.4103	0.	RCFLAGS	0	0
4	216	0.3611	40.90	1.0841	0.	RCFLAGS	0	0
4	116	0.3611	9.77	1.0299	0.	RCFLAGS	0	0 100.dat
4	3183	0.0087	86.24	0.1841	0.	RCFLAGS	0	0
4	2022	0.3698	41.96	1.2683	0.	RCFLAGS	0	0
4	1106	0.3698	41.89	1.1381	3473.	RCFLAGS	0	0
4	1116	0.3698	8.05	0.0095	0.	RCFLAGS	0	0
4	1115	0.3698	33.84	1.1286	0.	RCFLAGS	0	0
4	1117	0.3698	43.38	2.1585	0.	RCFLAGS	0	0
4	1118	0.3611	51.25	3.4861	0.	RCFLAGS	0	0
4	316	0.3619	39.89	1.3294	0.	RCFLAGS	0	0
4	416	0.3619	22.82	3.3680	0.	RCFLAGS	0	0
4	5106	0.3619	39.79	1.0350	4663.	RCFLAGS	0	0
4	1119	0.3619	9.77	0.1032	0.	RCFLAGS	0	0
4	1120	0.3619	30.02	0.9318	0.	RCFLAGS	0	0
4	1121	0.3619	52.85	3.4100	0.	RCFLAGS	0	0
4	516	0.7317	8.90	0.1127	0.	RCFLAGS	0	0
4	3141	0.0113	23.04	0.0762	0.	RCFLAGS	0	0
4	616	0.7430	9.12	0.1127	0.	RCFLAGS	0	0
4	716	0.3611	104.21	6.8960	0.	RCFLAGS	0	0
4	2019	0.7430	59.76	6.9235	0.	RCFLAGS	0	0
5	301	2.6500	184.52	16.7127	0.	RCFLAGS	0	0 REG1.dat
5	111	2.6500	184.51	16.6346	0.	RCFLAGS	0	0
5	381	3.3100	195.64	22.8378	0.	RCFLAGS	0	0
5	281	5.9600	190.69	39.1026	0.	RCFLAGS	0	0
5	581	5.9600	190.54	24.5241	328016.	RCFLAGS	0	0
5	121	5.9600	190.54	24.5181	0.	RCFLAGS	0	0
5	3916	0.0260	183.40	0.3679	0.	RCFLAGS	0	0
5	3919	0.1360	179.18	1.8321	0.	RCFLAGS	0	0
5	2000	0.1620	179.86	2.2001	0.	RCFLAGS	0	0
5	3910	0.1730	152.23	2.0118	0.	RCFLAGS	0	0
5	2001	0.3350	165.59	4.2118	0.	RCFLAGS	0	0
5	7912	0.0261	278.80	0.3645	0.	RCFLAGS	0	0

5	6912	0.0261	236.40	0.3512	834.	RCFLAGS	0	0
5	8912	0.1372	240.10	1.9094	0.	RCFLAGS	0	0
5	3912	0.1633	239.51	2.2596	0.	RCFLAGS	0	0
5	1912	0.1633	231.27	2.1980	2042.	RCFLAGS	0	0
5	5912	0.1633	228.52	2.1887	6321.	RCFLAGS	0	0
5	2002	0.4983	186.22	6.3619	0.	RCFLAGS	0	0
5	7913	0.0186	278.80	0.2598	0.	RCFLAGS	0	0
5	6913	0.0186	236.51	0.2568	485.	RCFLAGS	0	0
5	8913	0.0976	227.09	1.3567	0.	RCFLAGS	0	0
5	3913	0.1162	228.60	1.6134	0.	RCFLAGS	0	0
5	1913	0.1162	220.17	1.5509	1612.	RCFLAGS	0	0
5	5913	0.1162	218.92	1.3767	4383.	RCFLAGS	0	0
5	2003	0.6145	192.40	7.4866	0.	RCFLAGS	0	0
5	2004	6.5745	190.71	24.9375	0.	RCFLAGS	0	0
5	3920	0.0145	260.48	0.1979	0.	RCFLAGS	0	0
5	2020	6.5889	190.87	24.9821	0.	RCFLAGS	0	0
5	131	6.5889	190.86	24.9772	0.	RCFLAGS	10	0
5	7914	0.0347	278.81	0.5016	0.	RCFLAGS	0	0
5	6914	0.0347	230.35	0.5110	1125.	RCFLAGS	0	0
578	914	0.0241	185.03	0.3450	0.	RCFLAGS	0	0
5	914	0.0241	88.38	0.3153	1534.	RCFLAGS	0	0
5	1914	0.0588	172.10	0.8220	0.	RCFLAGS	0	0
585	914	0.0055	185.03	0.0790	0.	RCFLAGS	0	0
5	314	0.0055	88.66	0.0776	337.	RCFLAGS	0	0
586	914	0.0600	253.86	0.8346	0.	RCFLAGS	0	0
5	8914	0.0655	239.91	0.9071	0.	RCFLAGS	0	0
5	3914	0.1243	207.82	1.7148	0.	RCFLAGS	0	0
5	5914	0.1243	195.18	1.6728	4890.	RCFLAGS	0	0
5	214	0.1243	14.60	0.0092	0.	RCFLAGS	0	0
5	114	0.1243	180.58	1.6636	337.	RCFLAGS	0	0
5	714	0.1243	3.36	0.0021	0.	RCFLAGS	0	0
5	414	0.1243	11.24	0.0071	4890.	RCFLAGS	0	0
5	814	0.1243	191.82	1.6707	0.	RCFLAGS	0	0
5	9141	0.0127	219.65	0.1825	0.	RCFLAGS	0	0
5	9142	0.0056	209.73	0.0775	0.	RCFLAGS	0	0 REG1.dat
5	4914	0.0183	216.61	0.2600	0.	RCFLAGS	0	0
5	9143	0.1426	30.73	0.2621	0.	RCFLAGS	0	0
5	2914	0.1426	197.93	1.9328	0.	RCFLAGS	0	0
5	7915	0.0010	278.81	0.0147	0.	RCFLAGS	0	0
5	6915	0.0010	168.54	0.0147	31.	RCFLAGS	0	0
5	8915	0.0079	227.31	0.1131	0.	RCFLAGS	0	0
5	3915	0.0089	220.56	0.1278	0.	RCFLAGS	0	0
5	5915	0.0089	220.44	0.1016	624.	RCFLAGS	0	0
5	1915	0.0089	142.29	0.0957	265.	RCFLAGS	0	0
5	9151	0.0018	278.81	0.0260	0.	RCFLAGS	0	0
5	9152	0.0049	183.14	0.0695	0.	RCFLAGS	0	0
5	4915	0.0067	209.03	0.0956	0.	RCFLAGS	0	0
5	2915	0.0155	170.87	0.1641	0.	RCFLAGS	0	0
5	2005	0.1582	195.28	2.0882	0.	RCFLAGS	0	0
5	1911	0.1935	149.15	1.9852	0.	RCFLAGS	0	0
5	2911	0.0096	148.30	0.1234	0.	RCFLAGS	0	0
5	3911	0.2031	149.11	2.0985	0.	RCFLAGS	0	0
5	2006	0.3612	169.33	4.1548	0.	RCFLAGS	0	0
5	7917	0.0031	278.81	0.0441	0.	RCFLAGS	0	0
5	6917	0.0031	196.77	0.0430	93.	RCFLAGS	0	0
5	8917	0.0097	245.66	0.1392	0.	RCFLAGS	0	0
5	3917	0.0127	233.93	0.1822	0.	RCFLAGS	0	0
5	5917	0.0127	233.88	0.1839	554.	RCFLAGS	0	0
5	1917	0.0127	196.22	0.1839	122.	RCFLAGS	0	0
5	9171	0.0081	206.66	0.1156	0.	RCFLAGS	0	0
5	9172	0.0041	237.49	0.0588	0.	RCFLAGS	0	0
5	4917	0.0121	217.03	0.1744	0.	RCFLAGS	0	0
5	2917	0.0248	206.38	0.3583	0.	RCFLAGS	0	0
5	2007	0.3861	171.71	4.5113	0.	RCFLAGS	0	0

5	3918	0.0057	180.93	0.0810	0.	RCFLAGS	0	0
5	2008	0.3917	171.84	4.5924	0.	RCFLAGS	0	0
5	2009	6.9806	189.79	28.0504	0.	RCFLAGS	0	0
5	3092	0.0402	210.27	0.5514	0.	RCFLAGS	0	0
5	3093	0.0058	201.00	0.0821	0.	RCFLAGS	0	0
5	2010	0.0459	209.10	0.6335	0.	RCFLAGS	0	0
5	9173	0.0029	205.79	0.0414	0.	RCFLAGS	0	0
5	2021	0.0488	208.90	0.6749	0.	RCFLAGS	0	0
599	141	0.0014	278.81	0.0195	0.	RCFLAGS	0	0
5	514	0.0014	230.28	0.0193	41.	RCFLAGS	0	0
599	142	0.0152	210.94	0.2179	0.	RCFLAGS	0	0
5	614	0.0152	121.12	0.2083	687.	RCFLAGS	0	0
599	143	0.0166	130.02	0.2276	0.	RCFLAGS	0	0
599	145	0.0040	247.34	0.0582	0.	RCFLAGS	0	0
5	9914	0.0206	153.04	0.2858	0.	RCFLAGS	0	0
5	2011	0.0694	192.33	0.9546	0.	RCFLAGS	0	0
5	3103	0.0050	186.21	0.0714	0.	RCFLAGS	0	0 REG1.dat
5	2111	0.0744	191.92	1.0261	0.	RCFLAGS	0	0
5	3105	0.0361	197.83	0.4996	0.	RCFLAGS	0	0
5	7107	0.0334	278.81	0.4833	0.	RCFLAGS	0	0
5	6107	0.0334	196.83	0.4826	1097.	RCFLAGS	0	0
5	4107	0.0271	183.66	0.3884	0.	RCFLAGS	0	0
5	5107	0.0271	40.30	0.2748	1709.	RCFLAGS	0	0
5	1107	0.0605	126.77	0.7448	0.	RCFLAGS	0	0
5	8107	0.0519	262.88	0.7242	0.	RCFLAGS	0	0
5	3107	0.1125	189.63	1.4690	0.	RCFLAGS	0	0
5	2012	0.1486	191.62	1.9686	0.	RCFLAGS	0	0
5	7101	0.0236	278.81	0.3414	0.	RCFLAGS	0	0
5	6101	0.0236	185.35	0.3386	756.	RCFLAGS	0	0
5	4101	0.0241	207.03	0.3466	0.	RCFLAGS	0	0
5	5101	0.0241	112.32	0.3258	1535.	RCFLAGS	0	0
5	1101	0.0477	148.45	0.6579	0.	RCFLAGS	0	0
5	8101	0.0330	269.47	0.4601	0.	RCFLAGS	0	0
5	2101	0.0807	197.89	1.1084	0.	RCFLAGS	0	0
5	9101	0.0239	237.32	0.3330	0.	RCFLAGS	0	0
5	3101	0.1046	206.91	1.4413	0.	RCFLAGS	0	0
5	1111	0.1046	183.43	0.9803	0.	RCFLAGS	0	0
5	1112	0.1046	23.48	0.4610	0.	RCFLAGS	0	0
5	2013	0.2532	188.24	2.9489	0.	RCFLAGS	0	0
5	7102	0.0249	278.81	0.3602	0.	RCFLAGS	0	0
5	6102	0.0249	196.85	0.3603	800.	RCFLAGS	0	0
5	4102	0.0282	170.05	0.4033	0.	RCFLAGS	0	0
5	5102	0.0282	37.25	0.2850	1779.	RCFLAGS	0	0
5	1102	0.0531	112.17	0.6348	0.	RCFLAGS	0	0
5	8102	0.0335	264.02	0.4707	0.	RCFLAGS	0	0
5	3102	0.0866	170.97	1.1056	0.	RCFLAGS	0	0
5	2014	0.3398	183.83	4.0545	0.	RCFLAGS	0	0
5	3181	0.0213	251.68	0.2906	0.	RCFLAGS	0	0
5	2015	0.3611	187.84	4.3451	0.	RCFLAGS	0	0
5	3182	0.0140	258.42	0.2025	0.	RCFLAGS	0	0
5	3104	0.0472	187.52	0.6726	0.	RCFLAGS	0	0
5	2016	0.0612	203.77	0.8751	0.	RCFLAGS	0	0
5	2017	0.0612	243.88	1.3360	0.	RCFLAGS	0	0
5	7106	0.0481	278.81	0.6956	0.	RCFLAGS	0	0
5	6106	0.0481	236.95	0.6994	1382.	RCFLAGS	0	0
5	8106	0.2526	235.70	3.5135	0.	RCFLAGS	0	0
5	3106	0.3007	235.90	4.2035	0.	RCFLAGS	0	0
5	2018	0.3619	237.25	5.5395	0.	RCFLAGS	0	0
5	4106	0.3619	229.96	5.5239	1787.	RCFLAGS	0	0
5	1114	0.3611	160.61	2.1140	0.	RCFLAGS	0	0
5	1113	0.3611	27.23	2.2311	0.	RCFLAGS	0	0
5	216	0.3611	123.23	1.0841	0.	RCFLAGS	0	0
5	116	0.3611	37.38	1.0299	0.	RCFLAGS	0	0 REG1.dat
5	3183	0.0087	245.94	0.1257	0.	RCFLAGS	0	0

5	2022	0.3698	126.12	1.2099	0.	RCFLAGS	0	0
5	1106	0.3698	125.71	1.2056	3527.	RCFLAGS	0	0
5	1116	0.3698	8.10	0.0095	0.	RCFLAGS	0	0
5	1115	0.3698	117.61	1.1961	0.	RCFLAGS	0	0
5	1117	0.3698	154.11	2.2260	0.	RCFLAGS	0	0
5	1118	0.3611	185.05	4.4571	0.	RCFLAGS	0	0
5	316	0.3619	133.84	1.3849	0.	RCFLAGS	0	0
5	416	0.3619	96.12	4.1390	0.	RCFLAGS	0	0
5	5106	0.3619	132.65	1.3749	4885.	RCFLAGS	0	0
5	1119	0.3619	16.72	0.2088	0.	RCFLAGS	0	0
5	1120	0.3619	115.94	1.1662	0.	RCFLAGS	0	0
5	1121	0.3619	212.06	5.3052	0.	RCFLAGS	0	0
5	516	0.7317	12.36	0.2182	0.	RCFLAGS	0	0
5	3141	0.0113	116.86	0.1450	0.	RCFLAGS	0	0
5	616	0.7430	13.95	0.3633	0.	RCFLAGS	0	0
5	716	0.3611	397.58	9.7622	0.	RCFLAGS	0	0
5	2019	0.7430	207.17	10.1255	0.	RCFLAGS	0	0



LEGEND

- 3000 / 1 — HYDROGRAPH GENERATION NUMBER / GAWSER STORAGE LOCATION NUMBER
- 3000 / 1 — HYDROGRAPH ROUTING NUMBER / GAWSER STORAGE LOCATION NUMBER
- 3000 / 1 — HYDROGRAPH ADDITION NUMBER / GAWSER STORAGE LOCATION NUMBER
- 300 / 1 — HYDROGRAPH CHANNEL ROUTING NUMBER / GAWSER STORAGE LOCATION NUMBER
- DIV — DIVERSION

Proposed w

Date: 5/21/20
Scale: N/A

BEAVER CREEK GAWSER MODEL (Winter)

MTE
Engineers | Scientists | Surveyors

Project No.: 44719-114

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*  Waterloo North Scoped SWS
* ===========================================================================
* August, 2011, M. Trudell
* Located in Waterloo,Ontario
* USE TO MAKE Continuous WAT Files
*
* MTE CTS Model (June 28, 2017)
* MTE Northgate, BCM-CSWMS Post Development Model (Jun, 2020)
* ===========================================================================
*
* Response Unit Soil drainage parameters for North Waterloo Scoped SWS
* ====================================================================


READ SOIL PARAMETERS  NZONE=9
                        IMP  CLAY TILL   SILT TILL  SAND TILL  SND/GRV
                             MED  HIGH   MED  HIGH   MED  HIGH   MED  Swamp
                DS=    2   8.0  15.0   8.0  15.0   8.0  15.0   8.0   100
                KEFF=  0   2.0   4.0  10.0  15.0  15.0  40.0  25.0   0.1
                CS=    0   1.0   2.0   7.5  11.2  11.2  30.0  19.0  0.05
                D=     0   0.2   0.4   1.0   1.5   1.5   4.0   2.5  0.01
                SAV=   0   200   200   200   200   200   200   250   200
                HI=    0   100   100   100   200   100   200   200   200
                SMCI=  0  0.56  0.56  0.54  0.54  0.46  0.46   0.4  0.56
                IMCI=  0  0.46  0.46  0.40  0.40  0.23  0.23   0.1  0.46
                FCAPI= 0  0.46  0.46  0.40  0.40  0.23  0.23   0.1  0.46
                WILTI= 0  0.27  0.27  0.19  0.19  0.07  0.07  0.04  0.27
                HII=   0   150   150   300   400   300   600   400     5
                SMCII= 0  0.56  0.56  0.54  0.54  0.46  0.46   0.4  0.56
                IMCII= 0  0.46  0.46  0.40  0.40  0.23  0.23   0.1  0.46
                FCAPII=0  0.46  0.46  0.40  0.40  0.23  0.23   0.1  0.46
                WILTII=0  0.27  0.27  0.19  0.19  0.07  0.07  0.04  0.27
                X=     0    1     0     0     0     0     0     0     1
                FATR=  1    1     1     1     1     1     1     1     1
                INC =  1    1     5     1     5     1     5     1     5

*
* Go to event file
*
CHANGE INPUT FILE
*
* Main channel, in subcatchment 301                                    7
*
COMPUTE RATING CURVE ID=1  VS=     2.000   NSEGS=3
                      MIN EL=  100.00   MAX EL=  101.30
                      CHNSLP= 0.01000   FLNSLP= 0.01000
                      N= 0.100  DIST=   18.90
                      N=-0.080  DIST=   21.10
                      N= 0.100  DIST=   40.00
                        DIST    ELEV     DIST    ELEV     DIST    ELEV
                        0.00  101.30    18.90  100.80    19.00  100.40
                       20.00  100.00    21.00  100.40    21.10  100.80
                       40.00  101.30
                     RFN=0.0000 PCODE=1
*
*  Typical off-channel (Steep areas)                                   6
*
COMPUTE RATING CURVE ID=5  VS=     1.000   NSEGS=3
                      MIN EL=  100.00   MAX EL=  100.80
                      CHNSLP= 0.01500   FLNSLP= 0.01500
                      N= 0.350  DIST=   24.45
                      N=-0.150  DIST=   25.50
                      N= 0.350  DIST=   50.00
                        DIST    ELEV     DIST    ELEV     DIST    ELEV
```



```
                        0.00  100.80    24.45  100.30    24.75  100.00
                       25.25  100.00    25.50  100.30    50.00  100.80
                     RFN=0.0000 PCODE=1
*
* Compute runoff hydrograph from area  301
* VS=   2.000 is main channel & VS=   1.000 is off-channel
*
COMPUTE FLOWRATE    ID=1 NHD= 301 AREA=   2.6500 Sq km  L=  2910 m  W=   882 m
              SOIL ZONE I    II  III    IV    V    VI  VII  VIII   IX
                        1.0   0.0  0.0  50.7 23.3  11.5  2.9   0.0 10.6
                     RATING CURVES: IDMC=1 IDOC=5 QRMC=  0.50 QROC=  0.05
                     ROUTING MODEL=2 CONSTANTS: OVERLAND FTB= 3.0 TLO= 0.0
                     SUBSURFACE: KSS= 5.0 KGW= 384 h PCODE=1 WQPCODE=1
                     RBASIN=0 IDA=0 IDB=0 IDC=0 IDD=0 RBDUMP=0
                     GWFACT=0.50 GWON=1
                     SWQTH=   0.0 L/s SWPUMP=   0.0 L/s SWCODE=0
*
KEEP HYD             ID=1 CUTOFF=0 ICODE=5 ISTEP=1 IFORM=0 IDB=1 IMET=0
PRINT HYD            ID=1 PCODE=1 MODE=10
*
*  Beaver Creek, in subcatchment 381                                  13
*
COMPUTE RATING CURVE ID=2  VS=     3.000   NSEGS=3
                      MIN EL=  335.00   MAX EL=  354.00
                      CHNSLP= 0.02100   FLNSLP= 0.02100
                      N= 0.080  DIST=   89.00
                      N=-0.080  DIST=   95.00
                      N= 0.080  DIST=  213.00
                        DIST    ELEV     DIST    ELEV     DIST    ELEV
                        0.00  335.00    16.00  353.00    39.00  352.00
                       53.00  351.50    77.00  351.00    89.00  350.80
                       92.00  350.60    95.00  350.80   102.00  351.00
                      152.00  351.50   185.00  352.00   201.00  353.00
                      213.00  354.00
                     RFN=0.0000 PCODE=1
*
* Beaver Creek through 381
* Using Valley Section      3.000 As channel Rating Curve
*
ROUTE CHANNEL        ID=2 HYD NO= 111 INFLOW=1 LENGTH=  2100 m  SLOPE=0.00210
                     RCID=2 NS=1 PCODE=1 INDEX=1 PIPE=0 CANOPY=  0.0%
*
*  Main channel, in subcatchment 381                                   6
*
COMPUTE RATING CURVE ID=3  VS=     2.100   NSEGS=3
                      MIN EL=  100.40   MAX EL=  100.80
                      CHNSLP= 0.01700   FLNSLP= 0.01700
                      N= 0.060  DIST=    0.80
                      N=-0.060  DIST=    2.90
                      N= 0.060  DIST=    3.70
                        DIST    ELEV     DIST    ELEV     DIST    ELEV
                        0.00  100.80     0.80  100.60     1.70  100.40
                        2.10  100.40     2.90  100.60     3.70  100.80
                     RFN=0.0000 PCODE=1
*
* Typical off-channel (Flat slopes)                                    6
*
COMPUTE RATING CURVE ID=6  VS=     1.100   NSEGS=3
                      MIN EL=  100.00   MAX EL=  100.60
                      CHNSLP= 0.01000   FLNSLP= 0.01000
                      N= 0.350  DIST=   39.15
                      N=-0.150  DIST=   40.85
                      N= 0.350  DIST=   80.00
                        DIST    ELEV     DIST    ELEV     DIST    ELEV
```

```
                      0.00  100.60    39.15  100.20    39.75  100.00
                     40.25  100.00    40.85  100.20    80.00  100.60
                   RFN=0.0000 PCODE=1
*
* Compute runoff hydrograph from area  381
* VS=   2.100 is main channel & VS=   1.100 is off-channel
*
COMPUTE FLOWRATE    ID=1 NHD= 381 AREA=   3.3100 Sq km  L=  2340 m  W=   707 m
              SOIL ZONE I    II  III    IV    V    VI  VII  VIII   IX
                     1.0   0.0  0.0  73.4 13.2   1.3  0.5   0.0 10.6
                   RATING CURVES: IDMC=3 IDOC=6 QRMC=  0.50 QROC=  0.05
                   ROUTING MODEL=2 CONSTANTS: OVERLAND FTB= 3.0 TLO= 0.0
                   SUBSURFACE: KSS= 5.0 KGW= 384 h PCODE=1 WQPCODE=1
                   RBASIN=0 IDA=0 IDB=0 IDC=0 IDD=0 RBDUMP=0
                   GWFACT=0.50 GWON=1
                   SWQTH=   0.0 L/s SWPUMP=   0.0 L/s SWCODE=0
*
KEEP HYD            ID=1 CUTOFF=0 ICODE=5 ISTEP=1 IFORM=0 IDB=1 IMET=0
PRINT HYD           ID=1 PCODE=1 MODE=10
*
* Sum hydr.  111 &  381 call result  281
*
ADD HYD             ID=3 HYD NO= 281 IDA=2 IDB=1 ICODE=0                 AREA=     5.960
*
* Swamp storage reservoir
*
ROUTE RESERVOIR     ID=1 HYD NO= 581 INFLOW=3 PCODE=0 OPTION= 4
                    ILEVEL=   349.500
                     ELEVATION   OUTFLOW     STORAGE
                        (m)       (cms)       (ha*m)
                      349.500      0.0000      0.0100
                      350.000      0.4200      0.6700
                      350.500      3.0400      3.1200
                      351.000      8.8500      8.1100
                      351.500     15.2000     15.8700
                      352.000     21.5000     26.8500
                      352.500     28.7000     41.0200
                      352.800     34.3000     50.7600
*
KEEP HYD            ID=1 CUTOFF=0 ICODE=5 ISTEP=1 IFORM=0 IDB=1 IMET=0
PRINT HYD           ID=1 PCODE=1 MODE=10
*
* Beaver Creek in subcatchment 391, to Conservation Drive              11
*
COMPUTE RATING CURVE ID=4  VS=     4.000   NSEGS=3
                      MIN EL=  344.40   MAX EL=  346.02
                      CHNSLP= 0.02600   FLNSLP= 0.02600
                      N= 0.080  DIST=    6.50
                      N=-0.045  DIST=   12.60
                      N= 0.080  DIST=   16.20
                        DIST    ELEV     DIST    ELEV     DIST    ELEV
                        0.00  346.02     3.40  345.96     6.50  345.43
                        7.20  345.01     8.80  344.40     9.60  344.46
                       10.60  344.61    11.00  344.75    11.70  345.00
                       12.60  345.39    16.20  345.90
                     RFN=0.0000 PCODE=1
*
* Beaver Creek through 391, north of Conservation Drive
* Using Valley Section      4.000 As channel Rating Curve
*
ROUTE CHANNEL       ID=2 HYD NO= 121 INFLOW=1 LENGTH=   690 m  SLOPE=0.00310
                    RCID=4 NS=1 PCODE=1 INDEX=1 PIPE=0 CANOPY=  0.0%
*
***CHANGE INPUT FILE
```



```
*
* Response Unit Soil drainage parameters for North Waterloo Scoped SWS
* ====================================================================


READ SOIL PARAMETERS  NZONE=9
                           IMP  CLAY TILL   SILT TILL  SAND TILL   Roof  SAND
                                MED  HIGH   MED  HIGH   MED  HIGH   IMP   LOW
                  DS=    2   8.0  15.0   8.0  15.0   8.0  15.0   0.5   5.0
                  KEFF=  0   2.0   4.0  10.0  15.0  15.0  40.0   0.0  10.0
                  CS=    0   1.0   2.0   7.5  11.2  11.2  30.0   0.0   7.5
                  D=     0   0.2   0.4   1.0   1.5   1.5   4.0   0.0   1.0
                  SAV=   0   200   200   200   200   200   200   200   200
                  HI=    0   100   100   100   200   100   200     1   100
                  SMCI=  0  0.56  0.56  0.54  0.54  0.46  0.46  0.54  0.46
                  IMCI=  0  0.46  0.46  0.40  0.40  0.23  0.23  0.54  0.23
                  FCAPI= 0  0.46  0.46  0.40  0.40  0.23  0.23  0.40  0.23
                  WILTI= 0  0.27  0.27  0.19  0.19  0.07  0.07  0.40  0.07
                  HII=   0   150   150   300   400   300   600     1   300
                  SMCII= 0  0.56  0.56  0.54  0.54  0.46  0.46  0.54  0.46
                  IMCII= 0  0.46  0.46  0.40  0.40  0.23  0.23  0.54  0.23
                  FCAPII=0  0.46  0.46  0.40  0.40  0.23  0.23  0.40  0.23
                  WILTII=0  0.27  0.27  0.19  0.19  0.07  0.07  0.40  0.07
                  X=     0    1     0     0     0     0     0     0     0
                  FATR=  1    1     1     1     1     1     1     1     1
                  INC =  1    1     5     1     5     1     5     1     1

*
* Go to event file
*
CHANGE INPUT FILE
*
*  Main channel Parabolic Swale - Flat                                  7
*
COMPUTE RATING CURVE ID=1  VS=     7.000   NSEGS=3
                      MIN EL=  100.70   MAX EL=  103.00
                      CHNSLP= 0.01000   FLNSLP= 0.01000
                      N= 0.070  DIST=   20.00
                      N=-0.050  DIST=   30.00
                      N= 0.070  DIST=   50.00
                        DIST    ELEV     DIST    ELEV     DIST    ELEV
                        0.00  103.00    20.00  101.00    23.00  100.80
                       25.00  100.70    27.00  100.80    30.00  101.00
                       50.00  103.00
                     RFN=0.0000 PCODE=1
*
* Compute runoff hydrograph from area 3916
* VS=   7.000 is main channel & VS=   1.000 is off-channel
*
COMPUTE FLOWRATE    ID=1 NHD=3916 AREA=   0.0260 Sq km  L=   150 m  W=   100 m
              SOIL ZONE I    II  III    IV    V    VI  VII  VIII   IX
                     1.0   0.0  0.0  35.0  0.0  64.0  0.0   0.0  0.0
                   RATING CURVES: IDMC=1 IDOC=5 QRMC=  0.50 QROC=  0.05
                   ROUTING MODEL=2 CONSTANTS: OVERLAND FTB= 2.0 TLO= 0.0
                   SUBSURFACE: KSS= 5.0 KGW= 384 h PCODE=1 WQPCODE=1
                   RBASIN=0 IDA=0 IDB=0 IDC=0 IDD=0 RBDUMP=0
                   GWFACT=0.00 GWON=0
                   SWQTH=   0.0 L/s SWPUMP=   0.0 L/s SWCODE=0
*
KEEP HYD            ID=1 CUTOFF=0 ICODE=5 ISTEP=1 IFORM=0 IDB=1 IMET=0
PRINT HYD           ID=1 PCODE=1 MODE=10
*
* Compute runoff hydrograph from area 3919
* VS=   7.000 is main channel & VS=   1.000 is off-channel
```

```
*
COMPUTE FLOWRATE    ID=3 NHD=3919 AREA=   0.1360 Sq km  L=   200 m  W=   180 m
              SOIL ZONE I    II  III    IV    V    VI  VII  VIII   IX
                     1.0   0.0  0.0  22.0  3.0  74.0  0.0   0.0  0.0
                   RATING CURVES: IDMC=1 IDOC=5 QRMC=  0.50 QROC=  0.05
                   ROUTING MODEL=2 CONSTANTS: OVERLAND FTB= 2.0 TLO= 0.0
                   SUBSURFACE: KSS= 5.0 KGW= 384 h PCODE=1 WQPCODE=1
                   RBASIN=0 IDA=0 IDB=0 IDC=0 IDD=0 RBDUMP=0
                   GWFACT=0.00 GWON=0
                   SWQTH=   0.0 L/s SWPUMP=   0.0 L/s SWCODE=0
*
KEEP HYD            ID=3 CUTOFF=0 ICODE=5 ISTEP=1 IFORM=0 IDB=3 IMET=0
PRINT HYD           ID=3 PCODE=1 MODE=10
*
* Sum hydr. 3916 & 3919 call result 2000
*
ADD HYD             ID=4 HYD NO=2000 IDA=1 IDB=3 ICODE=0                  AREA=     0.162
*
* Compute runoff hydrograph from area 3910
* VS=   4.000 is main channel & VS=   1.100 is off-channel
*
COMPUTE FLOWRATE    ID=1 NHD=3910 AREA=   0.17295 Sq km  L=   300 m  W=   200 m
              SOIL ZONE I    II  III    IV    V    VI  VII  VIII   IX
                     1.0   0.0  5.0  16.3 38.1  11.9 27.7   0.0  0.0
                   RATING CURVES: IDMC=4 IDOC=6 QRMC=  0.50 QROC=  0.05
                   ROUTING MODEL=2 CONSTANTS: OVERLAND FTB= 2.0 TLO= 0.0
                   SUBSURFACE: KSS= 5.0 KGW= 384 h PCODE=1 WQPCODE=1
                   RBASIN=0 IDA=0 IDB=0 IDC=0 IDD=0 RBDUMP=0
                   GWFACT=0.00 GWON=0
                   SWQTH=   0.0 L/s SWPUMP=   0.0 L/s SWCODE=0
*
KEEP HYD            ID=1 CUTOFF=0 ICODE=5 ISTEP=1 IFORM=0 IDB=1 IMET=0
PRINT HYD           ID=1 PCODE=1 MODE=10
*
* Sum hydr. 2000 & 3910 call result 2001
*
ADD HYD             ID=3 HYD NO=2001 IDA=4 IDB=1 ICODE=0                  AREA=     0.338
*
*   Typical Urban Cross-Section                                          6
*
COMPUTE RATING CURVE ID=1  VS=     8.000   NSEGS=3
                      MIN EL=  295.00   MAX EL=  295.70
                      CHNSLP= 0.00500   FLNSLP= 0.00500
                      N= 0.015  DIST=  200.00
                      N=-0.015  DIST=  300.00
                      N= 0.015  DIST=  500.00
                        DIST    ELEV     DIST    ELEV     DIST    ELEV
                        0.00  295.70   200.00  295.50   200.10  295.00
                      299.90  295.00   300.00  295.50   500.00  295.70
                     RFN=0.0000 PCODE=1
*
*   Typical Urban Cross-Section                                          6
*
COMPUTE RATING CURVE ID=6  VS=     8.000   NSEGS=3
                      MIN EL=  295.00   MAX EL=  295.70
                      CHNSLP= 0.00500   FLNSLP= 0.00500
                      N= 0.015  DIST=  200.00
                      N=-0.015  DIST=  300.00
                      N= 0.015  DIST=  500.00
                        DIST    ELEV     DIST    ELEV     DIST    ELEV
                        0.00  295.70   200.00  295.50   200.10  295.00
                      299.90  295.00   300.00  295.50   500.00  295.70
                     RFN=0.0000 PCODE=1
*
```



```
* Compute runoff hydrograph from area 7912
* VS=   8.000 is main channel & VS=   8.000 is off-channel
*
COMPUTE FLOWRATE    ID=1 NHD=7912 AREA=   0.0261 Sq km  L=   450 m  W=    50 m
              SOIL ZONE I    II  III    IV    V    VI  VII  VIII   IX
                     1.0   0.0  0.0   0.0  0.0   0.0  0.0  99.0  0.0
                   RATING CURVES: IDMC=1 IDOC=6 QRMC=  0.50 QROC=  0.05
                   ROUTING MODEL=2 CONSTANTS: OVERLAND FTB= 1.2 TLO= 0.0
                   SUBSURFACE: KSS= 5.0 KGW= 384 h PCODE=1 WQPCODE=1
                   RBASIN=0 IDA=0 IDB=0 IDC=0 IDD=0 RBDUMP=0
                   GWFACT=0.00 GWON=0
                   SWQTH=   0.0 L/s SWPUMP=   0.0 L/s SWCODE=0
*
* Rooftop Infiltration for 7912
*
ROUTE SPECIAL POND  ID=4 HYD NO=6912 INFLOW=1 PCODE=0 OPTION= 5
                   Inflow controls:
                       USPCT=100% USDIV=0     PCTA=  0% ADIV=0
                       GWPCT=  0% GWDIV=0
                   Maximum level for Routing Tables:  ZMAX= 101.300
                   Recharge characteristics for Compartment A
                     LEVELA= 100.000                EVAPA= 0.0 mm/d ACODE=0
                     CDA=   0.000 mm/h  DZA= 10.00 m
                   Recharge characteristics for Compartment B
                     LEVELB= 100.000 CCBA= 0.00000  EVAPB= 0.0 mm/d BCODE=1
                     CDB=  15.000 mm/h  DZB= 10.00 m
                   Irrigation Pond Controls: IPOND=0
                   Number of points=  5
                                    Compartment  A          Compartment B
                   Elevation  Outflow Storage  SFArea Outflow Storage SFArea
                      (m)       (cms)  (ha*m)    (ha)   (cms)  (ha*m)    (ha)
                    100.000     0.000  0.0000  0.0000   0.000  0.0000  0.0654
                    100.999     0.000  0.0000  0.0000   0.000  0.0653  0.0654
                    101.000     0.000  0.0000  0.0000   0.001  0.0654  0.0654
                    101.200     0.000  0.0000  0.0000   0.480  0.0900  0.0654
                    101.300     0.000  0.0000  0.0000   0.520  0.1000  0.0654
*
* Compute runoff hydrograph from area 8912
* VS=   8.000 is main channel & VS=   8.000 is off-channel
*
COMPUTE FLOWRATE    ID=1 NHD=8912 AREA=   0.1372 Sq km  L=   450 m  W=    50 m
              SOIL ZONE I    II  III    IV    V    VI  VII  VIII   IX
                    46.4   0.0  0.0  53.6  0.0   0.0  0.0   0.0  0.0
                   RATING CURVES: IDMC=1 IDOC=1 QRMC=  0.50 QROC=  0.05
                   ROUTING MODEL=2 CONSTANTS: OVERLAND FTB= 1.2 TLO= 0.0
                   SUBSURFACE: KSS= 5.0 KGW= 384 h PCODE=1 WQPCODE=1
                   RBASIN=0 IDA=0 IDB=0 IDC=0 IDD=0 RBDUMP=0
                   GWFACT=0.00 GWON=0
                   SWQTH=   0.0 L/s SWPUMP=   0.0 L/s SWCODE=0
*
* Sum hydr. 6912 & 8912 call result 3912
*
ADD HYD             ID=5 HYD NO=3912 IDA=4 IDB=1 ICODE=0                  AREA=     0.168
*
KEEP HYD            ID=5 CUTOFF=0 ICODE=5 ISTEP=1 IFORM=0 IDB=5 IMET=0
PRINT HYD           ID=5 PCODE=1 MODE=10
*
* 1912 End-of-Pipe Infiltration (for Catchment 3912)
*
ROUTE SPECIAL POND  ID=1 HYD NO=1912 INFLOW=5 PCODE=0 OPTION=15
                   Inflow controls:
                       USPCT=100% USDIV=0     PCTA=  0% ADIV=0
                       GWPCT=  0% GWDIV=0
                   Maximum level for Routing Tables:  ZMAX= 200.300
```

```
                    Recharge characteristics for Compartment A
                      LEVELA= 198.340               EVAPA= 0.0 mm/d ACODE=0
                      CDA=   0.000 mm/h  DZA= 10.00 m
                    Recharge characteristics for Compartment B
                      LEVELB= 198.340 CCBA= 0.00000  EVAPB= 0.0 mm/d BCODE=1
                      CDB=  15.000 mm/h  DZB= 10.00 m
                    Irrigation Pond Controls: IPOND=0
                    Number of points=  5
                                 Compartment  A          Compartment B
                    Elevation  Outflow Storage  SFArea Outflow Storage SFArea
                       (m)       (cms)  (ha*m)    (ha)   (cms)  (ha*m)    (ha)
                     199.800     0.000  0.0000  0.0000   0.000  0.0000  0.0490
                     199.990     0.000  0.0000  0.0000   0.000  0.0816  0.0490
                     200.010     0.000  0.0000  0.0000   0.001  0.0817  0.0490
                     200.100     0.000  0.0000  0.0000   0.400  0.1100  0.0490
                     200.300     0.000  0.0000  0.0000   2.500  0.2200  0.0490
*
KEEP HYD            ID=1 CUTOFF=0 ICODE=5 ISTEP=1 IFORM=0 IDB=1 IMET=0
PRINT HYD           ID=1 PCODE=1 MODE=10
*
* 5912 Quantity SWM Basin
*
ROUTE SPECIAL POND  ID=4 HYD NO=5912 INFLOW=1 PCODE=0 OPTION=15
                    Inflow controls:
                        USPCT=100% USDIV=0     PCTA=  0% ADIV=0
                        GWPCT=  0% GWDIV=0
                    Maximum level for Routing Tables:  ZMAX= 203.600
                    Recharge characteristics for Compartment A
                      LEVELA= 200.000               EVAPA= 1.4 mm/d ACODE=0
                      CDA=   0.000 mm/h  DZA= 10.00 m
                    Recharge characteristics for Compartment B
                      LEVELB= 200.000 CCBA= 0.00000  EVAPB= 1.4 mm/d BCODE=0
                      CDB=   0.000 mm/h  DZB= 10.00 m
                    Irrigation Pond Controls: IPOND=0
                    Number of points= 10
                                 Compartment  A          Compartment B
                    Elevation  Outflow Storage  SFArea Outflow Storage SFArea
                       (m)       (cms)  (ha*m)    (ha)   (cms)  (ha*m)    (ha)
                     199.990     0.000  0.0000  0.0000  0.0000  0.0000  0.1614
                     200.000     0.000  0.0000  0.0000  0.0000  0.0033  0.1614
                     200.500     0.000  0.0000  0.0000  0.0090  0.0389  0.2053
                     201.000     0.000  0.0000  0.0000  0.0130  0.0599  0.2577
                     201.400     0.000  0.0000  0.0000  0.0156  0.2601  0.2626
                     202.400     0.000  0.0000  0.0000  0.1507  0.3472  0.3015
                     203.000     0.000  0.0000  0.0000  0.8237  0.5524  0.3501
                     203.300     0.000  0.0000  0.0000  1.1301  0.6321  0.3582
                     203.300     0.000  0.0000  0.0000  2.9175  0.6808  0.3691
                     203.600     0.000  0.0000  0.0000  4.9656  0.7002  0.3909
*
* Go to event file: 5912 Quantity SWM Basin
*
*
KEEP HYD            ID=4 CUTOFF=0 ICODE=5 ISTEP=1 IFORM=0 IDB=4 IMET=0
PRINT HYD           ID=4 PCODE=1 MODE=10
*
* Sum hydr. 2001 & 5912 call result 2002
*
ADD HYD             ID=1 HYD NO=2002 IDA=3 IDB=4 ICODE=0                  AREA=     0.506
*
* Compute runoff hydrograph from area 7913
* VS=   8.000 is main channel & VS=   8.000 is off-channel
*
COMPUTE FLOWRATE    ID=3 NHD=7913 AREA=   0.0186 Sq km  L=   450 m  W=    50 m
             SOIL ZONE I    II  III    IV    V    VI  VII  VIII   IX
```



```
                      1.0   0.0  0.0   0.0  0.0   0.0  0.0  99.0  0.0
                    RATING CURVES: IDMC=1 IDOC=1 QRMC=  0.50 QROC=  0.05
                    ROUTING MODEL=2 CONSTANTS: OVERLAND FTB= 1.2 TLO= 0.0
                    SUBSURFACE: KSS= 5.0 KGW= 384 h PCODE=1 WQPCODE=1
                    RBASIN=0 IDA=0 IDB=0 IDC=0 IDD=0 RBDUMP=0
                    GWFACT=0.00 GWON=0
                    SWQTH=   0.0 L/s SWPUMP=   0.0 L/s SWCODE=0
*
* Rooftop Infiltration for 7913
*
ROUTE SPECIAL POND  ID=4 HYD NO=6913 INFLOW=3 PCODE=0 OPTION= 5
                    Inflow controls:
                        USPCT=100% USDIV=0     PCTA=  0% ADIV=0
                        GWPCT=  0% GWDIV=0
                    Maximum level for Routing Tables:  ZMAX= 101.300
                    Recharge characteristics for Compartment A
                      LEVELA= 100.000               EVAPA= 0.0 mm/d ACODE=0
                      CDA=   0.000 mm/h  DZA= 10.00 m
                    Recharge characteristics for Compartment B
                      LEVELB= 100.000 CCBA= 0.00000  EVAPB= 0.0 mm/d BCODE=1
                      CDB=  15.000 mm/h  DZB= 10.00 m
                    Irrigation Pond Controls: IPOND=0
                    Number of points=  5
                                 Compartment  A          Compartment B
                    Elevation  Outflow Storage  SFArea Outflow Storage SFArea
                       (m)       (cms)  (ha*m)    (ha)   (cms)  (ha*m)    (ha)
                     100.000     0.000  0.0000  0.0000   0.000  0.0000  0.0465
                     100.999     0.000  0.0000  0.0000   0.000  0.0464  0.0465
                     101.000     0.000  0.0000  0.0000   0.001  0.0465  0.0465
                     101.200     0.000  0.0000  0.0000   0.450  0.0500  0.0465
                     101.300     0.000  0.0000  0.0000   0.500  0.0600  0.0465
*
* Compute runoff hydrograph from area 8913
* VS=   8.000 is main channel & VS=   8.000 is off-channel
*
COMPUTE FLOWRATE    ID=3 NHD=8913 AREA=   0.0976 Sq km  L=   450 m  W=    50 m
             SOIL ZONE I    II  III    IV    V    VI  VII  VIII   IX
                     46.4   0.0  0.0  18.4  0.0  35.2  0.0   0.0  0.0
                    RATING CURVES: IDMC=1 IDOC=1 QRMC=  0.50 QROC=  0.05
                    ROUTING MODEL=2 CONSTANTS: OVERLAND FTB= 1.2 TLO= 0.0
                    SUBSURFACE: KSS= 5.0 KGW= 384 h PCODE=1 WQPCODE=1
                    RBASIN=0 IDA=0 IDB=0 IDC=0 IDD=0 RBDUMP=0
                    GWFACT=0.00 GWON=0
                    SWQTH=   0.0 L/s SWPUMP=   0.0 L/s SWCODE=0
*
* Sum hydr. 6913 & 8913 call result 3913
*
ADD HYD             ID=5 HYD NO=3913 IDA=4 IDB=3 ICODE=0                  AREA=     0.110
*
KEEP HYD            ID=5 CUTOFF=0 ICODE=5 ISTEP=1 IFORM=0 IDB=5 IMET=0
PRINT HYD           ID=5 PCODE=1 MODE=10
*
* 1913 End-of-Pipe Infiltration
*
ROUTE SPECIAL POND  ID=3 HYD NO=1913 INFLOW=5 PCODE=0 OPTION=15
                    Inflow controls:
                        USPCT=100% USDIV=0     PCTA=  0% ADIV=0
                        GWPCT=  0% GWDIV=0
                    Maximum level for Routing Tables:  ZMAX= 200.300
                    Recharge characteristics for Compartment A
                      LEVELA= 198.340               EVAPA= 0.0 mm/d ACODE=0
                      CDA=   0.000 mm/h  DZA= 10.00 m
                    Recharge characteristics for Compartment B
                      LEVELB= 198.340 CCBA= 0.00000  EVAPB= 0.0 mm/d BCODE=1
```

```
                      CDB=  15.000 mm/h  DZB= 10.00 m
                    Irrigation Pond Controls: IPOND=0
                    Number of points=  5
                                Compartment  A          Compartment B
                    Elevation  Outflow Storage  SFArea Outflow Storage SFArea
                       (m)       (cms)  (ha*m)    (ha)   (cms)  (ha*m)    (ha)
                     199.800     0.000  0.0000  0.0000   0.000  0.0000  0.0349
                     199.990     0.000  0.0000  0.0000   0.000  0.0580  0.0349
                     200.010     0.000  0.0000  0.0000   0.001  0.0581  0.0349
                     200.100     0.000  0.0000  0.0000   0.400  0.0800  0.0349
                     200.300     0.000  0.0000  0.0000   2.100  0.2000  0.0349
*
KEEP HYD             ID=3 CUTOFF=0 ICODE=5 ISTEP=1 IFORM=0 IDB=3 IMET=0
PRINT HYD            ID=3 PCODE=1 MODE=10
*
* 5913 Quantity SWM Basin
*
ROUTE SPECIAL POND   ID=4 HYD NO=5913 INFLOW=3 PCODE=0 OPTION=15
                    Inflow controls:
                        USPCT=100% USDIV=0     PCTA=  0% ADIV=0
                        GWPCT=  0% GWDIV=0
                    Maximum level for Routing Tables:  ZMAX= 202.950
                    Recharge characteristics for Compartment A
                      LEVELA= 200.000                EVAPA= 1.4 mm/d ACODE=0
                      CDA=   0.000 mm/h  DZA= 10.00 m
                    Recharge characteristics for Compartment B
                      LEVELB= 200.000 CCBA= 0.00000  EVAPB= 1.4 mm/d BCODE=0
                      CDB=   0.000 mm/h  DZB= 10.00 m
                    Irrigation Pond Controls: IPOND=0
                    Number of points= 10
                                Compartment  A          Compartment B
                    Elevation  Outflow Storage  SFArea Outflow Storage SFArea
                       (m)       (cms)  (ha*m)    (ha)   (cms)  (ha*m)    (ha)
                     199.990     0.000  0.0000  0.0000  0.0000  0.0000  0.1754
                     200.000     0.000  0.0000  0.0000  0.0000  0.0023  0.1754
                     200.500     0.000  0.0000  0.0000  0.0100  0.0423  0.2230
                     201.000     0.000  0.0000  0.0000  0.0110  0.0651  0.2799
                     201.500     0.000  0.0000  0.0000  0.0128  0.1796  0.2852
                     202.600     0.000  0.0000  0.0000  0.1299  0.2168  0.3275
                     202.700     0.000  0.0000  0.0000  0.7141  0.3254  0.3803
                     202.800     0.000  0.0000  0.0000  1.2275  0.4226  0.3891
                     202.900     0.000  0.0000  0.0000  2.5163  0.5582  0.4009
                     202.950     0.000  0.0000  0.0000  4.3375  0.8118  0.4247
*
* Go to event file: 5913 Quantity SWM Basin
*
*
KEEP HYD             ID=4 CUTOFF=0 ICODE=5 ISTEP=1 IFORM=0 IDB=4 IMET=0
PRINT HYD            ID=4 PCODE=1 MODE=10
*
* Sum hydr. 2002 & 5913 call result 2003
*
ADD HYD              ID=3 HYD NO=2003 IDA=1 IDB=4 ICODE=0                  AREA=     0.616
*
* Beaver Creek at Conservation Drive
*
ADD HYD              ID=1 HYD NO=2004 IDA=2 IDB=3 ICODE=0                  AREA=     6.576
*
KEEP HYD             ID=1 CUTOFF=72 ICODE=3 ISTEPS=1 IFORM=0 IDB=1 IMET=2
KEEP HYD             ID=1 CUTOFF=72 ICODE=5 ISTEPS=1 IFORM=0 IDB=1 IMET=2
PRINT HYD            ID=1 PCODE=1 MODE=10
*
*
NEW DUMP OUTPUT      MODE=10 ID=1 IOPT=4 FTYPE=0
```



```
*
* Conservation Drive to downstream
* VS=   8.000 is main channel & VS=   8.000 is off-channel
*
COMPUTE FLOWRATE     ID=3 NHD=3920 AREA=   0.01446 Sq km  L=   554 m  W=  25 m
                SOIL ZONE I    II  III    IV    V    VI  VII  VIII   IX
                       75.0  0.0  0.0  25.0  0.0   0.0  0.0   0.0  0.0
                     RATING CURVES: IDMC=1 IDOC=1 QRMC=  0.50 QROC=  0.05
                     ROUTING MODEL=2 CONSTANTS: OVERLAND FTB= 1.2 TLO= 0.0
                     SUBSURFACE: KSS= 5.0 KGW= 384 h PCODE=1 WQPCODE=1
                     RBASIN=0 IDA=0 IDB=0 IDC=0 IDD=0 RBDUMP=0
                     GWFACT=0.00 GWON=0
                     SWQTH=   0.0 L/s SWPUMP=   0.0 L/s SWCODE=0
*
*
ADD HYD              ID=4 HYD NO=2020 IDA=1 IDB=3 ICODE=0                  AREA=     6.576
*
*
* Beaver Creek in subcatchment 391, from Conservation Drive to           19
*
COMPUTE RATING CURVE ID=4  VS=     5.000   NSEGS=3
                      MIN EL=  342.02   MAX EL=  343.63
                      CHNSLP= 0.02600   FLNSLP= 0.02600
                      N= 0.100  DIST=    8.25
                      N=-0.045  DIST=   13.28
                      N= 0.100  DIST=   20.67
                        DIST    ELEV     DIST    ELEV     DIST    ELEV
                        0.00  343.63     2.03  343.62     4.62  343.55
                        6.99  343.56     8.25  343.43     8.51  343.03
                        8.62  342.91     9.44  342.90    10.02  342.85
                       10.39  342.82    11.57  342.91    12.16  342.88
                       12.40  342.94    12.63  342.02    12.98  343.17
                       13.28  343.33    14.36  343.36    17.52  343.46
                       20.67  343.40
                     RFN=0.0000 PCODE=1
*
* Beaver Creek through 391, south of Conservation Drive
* Using Valley Section      5.000 As channel Rating Curve
*
ROUTE CHANNEL        ID=2 HYD NO= 131 INFLOW=4 LENGTH=   870 m  SLOPE=0.00250
                     RCID=4 NS=1 PCODE=1 INDEX=1 PIPE=0 CANOPY=  0.0
*
*=========================Northgate Western Portion==============================
* Compute runoff hydrograph from area 7914 (MTE Development)
* VS=   8.000 is main channel & VS=   8.000 is off-channel
*
* 7914 is multi-residential roof areas to rooftop infiltration gallery
*
COMPUTE FLOWRATE     ID=1 NHD=7914 AREA=   0.03469 Sq km  L=   20 m  W=   10 m
                SOIL ZONE I    II  III    IV    V    VI  VII  VIII   IX
                      1.0   0.0  0.0   0.0  0.0   0.0  0.0 99.0  0.0
                     RATING CURVES: IDMC=1 IDOC=1 QRMC=  0.50 QROC=  0.05
                     ROUTING MODEL=2 CONSTANTS: OVERLAND FTB= 1.2 TLO= 0.0
                     SUBSURFACE: KSS= 5.0 KGW= 384 h PCODE=1 WQPCODE=1
                     RBASIN=0 IDA=0 IDB=0 IDC=0 IDD=0 RBDUMP=0
                     GWFACT=0.00 GWON=0
                     SWQTH=   0.0 L/s SWPUMP=   0.0 L/s SWCODE=0
*
* Rooftop Infiltration for 7914 (sized for 30mm @ 1m deep galleries)
* 15% safety factor 0.35 void ratio
*
ROUTE SPECIAL POND   ID=3 HYD NO=6914 INFLOW=1 PCODE=0 OPTION= 5
                     Inflow controls:
                         USPCT=100% USDIV=0     PCTA=  0% ADIV=0
```

```
                      GWPCT=  0% GWDIV=0
                    Maximum level for Routing Tables:  ZMAX= 101.150
                    Recharge characteristics for Compartment A
                      LEVELA= 100.000                EVAPA= 0.0 mm/d ACODE=0
                      CDA=   0.000 mm/h  DZA= 10.00 m
                    Recharge characteristics for Compartment B
                      LEVELB= 100.000 CCBA= 0.00000  EVAPB= 0.0 mm/d BCODE=1
                      CDB=   5.000 mm/h  DZB= 10.00 m
                    Irrigation Pond Controls: IPOND=0
                    Number of points=  4
                                  Compartment  A          Compartment B
                    Elevation  Outflow Storage  SFArea Outflow Storage SFArea
                       (m)       (cms)  (ha*m)    (ha)   (cms)  (ha*m)    (ha)
                     100.000     0.000  0.0000  0.0000   0.000  0.0000  0.2973
                     100.999     0.000  0.0000  0.0000   0.000  0.1040  0.2973
                     101.000     0.000  0.0000  0.0000   0.001  0.1041  0.2973
                     101.150     0.000  0.0000  0.0000   1.000  0.1197  0.2973
*
KEEP HYD             ID=3 CUTOFF=0 ICODE=5 ISTEP=1 IFORM=0 IDB=3 IMET=0
PRINT HYD            ID=3 PCODE=1 MODE=10
*
*
* Compute runoff hydrograph from area 78914 (whole lot yard pervious areas to amended topsoil)
* VS=   8.000 is main channel & VS=   8.000 is off-channel
*
COMPUTE FLOWRATE    ID=5 NHD=78914 AREA=   0.02414 Sq km  L=   30 m  W=    14 m
               SOIL ZONE I    II  III    IV    V    VI  VII  VIII   IX
                      0.0   0.0  0.0  45.5  0.0  52.6  1.9  0.0   0.0
                    RATING CURVES: IDMC=1 IDOC=1 QRMC=  0.50 QROC=  0.05
                    ROUTING MODEL=2 CONSTANTS: OVERLAND FTB= 1.2 TLO= 0.0
                    SUBSURFACE: KSS= 5.0 KGW= 384 h PCODE=1 WQPCODE=1
                    RBASIN=0 IDA=0 IDB=0 IDC=0 IDD=0 RBDUMP=0
                    GWFACT=0.00 GWON=0
                    SWQTH=   0.0 L/s SWPUMP=   0.0 L/s SWCODE=0
*
*
* Routed through Amended Top Soil
* (450mm @30% void ratio, considered 60mm vol to be conservative)
* Foot print = 4102 pervious area
* 15% safty factor
*
ROUTE SPECIAL POND  ID=1 HYD NO=914 INFLOW=5 PCODE=0 OPTION=15
                    Inflow controls:
                        USPCT=100% USDIV=0     PCTA=  0% ADIV=0
                        GWPCT=  0% GWDIV=0
                    Maximum level for Routing Tables:  ZMAX= 100.069
                    Recharge characteristics for Compartment A
                      LEVELA= 100.000                EVAPA= 0.0 mm/d ACODE=0
                      CDA=   0.000 mm/h  DZA= 10.00 m
                    Recharge characteristics for Compartment B
                      LEVELB= 100.000 CCBA= 0.00000  EVAPB= 0.0 mm/d BCODE=1
                      CDB=   5.000 mm/h  DZB= 10.00 m
                    Irrigation Pond Controls: IPOND=0
                    Number of points=  4
                                  Compartment  A          Compartment B
                    Elevation  Outflow Storage  SFArea Outflow Storage SFArea
                       (m)       (cms)  (ha*m)    (ha)   (cms)  (ha*m)    (ha)
                     100.000     0.000  0.0000  0.0000   0.000  0.0000  2.4140
                     100.059     0.000  0.0000  0.0000   0.000  0.1424  2.4140
                     100.060     0.000  0.0000  0.0000   0.001  0.1448  2.4140
                     100.069     0.000  0.0000  0.0000   0.800  0.1666  2.4140
*
* Water balance on amended topsoil only
*
```



```
PRINT HYD            ID=1 PCODE=1 MODE=10
*
* Sum hydr. 914 & 6914 call result 1914 (flow to SWM Pond after all lot-level infiltration)
*
ADD HYD              ID=6 HYD NO=1914 IDA=3 IDB=1 ICODE=0                  AREA=     0.05894
*
*============================================================
*
* Compute runoff hydrograph from area 85914 (park drains to amended topsoil)
* VS=   8.000 is main channel & VS=   8.000 is off-channel
*
COMPUTE FLOWRATE    ID=4 NHD=85914 AREA=   0.00553 Sq km  L=   70 m  W=    70 m
               SOIL ZONE I    II  III    IV    V    VI  VII  VIII   IX
                      0.0   0.0  0.0  45.5  0.0  52.6  1.9  0.0   0.0
                    RATING CURVES: IDMC=1 IDOC=1 QRMC=  0.50 QROC=  0.05
                    ROUTING MODEL=2 CONSTANTS: OVERLAND FTB= 1.2 TLO= 0.0
                    SUBSURFACE: KSS= 5.0 KGW= 384 h PCODE=1 WQPCODE=1
                    RBASIN=0 IDA=0 IDB=0 IDC=0 IDD=0 RBDUMP=0
                    GWFACT=0.00 GWON=0
                    SWQTH=   0.0 L/s SWPUMP=   0.0 L/s SWCODE=0
*
* Routed through Amended Top Soil
* (450mm @30% void ratio, considered 60mm vol to be conservative)
* Foot print = 85914 pervious area
* 15% safty factor
*
ROUTE SPECIAL POND  ID=5 HYD NO=314 INFLOW=4 PCODE=0 OPTION=15
                    Inflow controls:
                        USPCT=100% USDIV=0     PCTA=  0% ADIV=0
                        GWPCT=  0% GWDIV=0
                    Maximum level for Routing Tables:  ZMAX= 100.069
                    Recharge characteristics for Compartment A
                      LEVELA= 100.000                EVAPA= 0.0 mm/d ACODE=0
                      CDA=   0.000 mm/h  DZA= 10.00 m
                    Recharge characteristics for Compartment B
                      LEVELB= 100.000 CCBA= 0.00000  EVAPB= 0.0 mm/d BCODE=1
                      CDB=   5.000 mm/h  DZB= 10.00 m
                    Irrigation Pond Controls: IPOND=0
                    Number of points=  4
                                  Compartment  A          Compartment B
                    Elevation  Outflow Storage  SFArea Outflow Storage SFArea
                       (m)       (cms)  (ha*m)    (ha)   (cms)  (ha*m)    (ha)
                     100.000     0.000  0.0000  0.0000   0.000  0.0000  0.5535
                     100.059     0.000  0.0000  0.0000   0.000  0.0327  0.5535
                     100.060     0.000  0.0000  0.0000   0.001  0.0332  0.5535
                     100.069     0.000  0.0000  0.0000   0.800  0.0382  0.5535
*
PRINT HYD            ID=5 PCODE=1 MODE=10
*
* Compute runoff hydrograph from area 86914 (remaining area to SWM facility)
* VS=   8.000 is main channel & VS=   8.000 is off-channel
*
COMPUTE FLOWRATE    ID=3 NHD=86914 AREA=   0.05996 Sq km  L=   450 m  W=    50 m
               SOIL ZONE I    II  III    IV    V    VI  VII  VIII   IX
                     73.8   0.0  0.0  11.9  0.0  13.8  0.5   0.0  0.0
                    RATING CURVES: IDMC=1 IDOC=1 QRMC=  0.50 QROC=  0.05
                    ROUTING MODEL=2 CONSTANTS: OVERLAND FTB= 1.2 TLO= 0.0
                    SUBSURFACE: KSS= 5.0 KGW= 384 h PCODE=1 WQPCODE=1
                    RBASIN=0 IDA=0 IDB=0 IDC=0 IDD=0 RBDUMP=0
                    GWFACT=0.00 GWON=0
                    SWQTH=   0.0 L/s SWPUMP=   0.0 L/s SWCODE=0
*
* Sum hydr. 314 & 86914 call result 8914 (all flows going to SWM facility)
*
```

```
ADD HYD             ID=1 HYD NO=8914 IDA=5 IDB=3 ICODE=0                  AREA=     0.0655
*
* Sum hydr. 1914 & 8914 call result 3914 (all flows going to SWM facility)
*
ADD HYD             ID=3 HYD NO=3914 IDA=6 IDB=1 ICODE=0                  AREA=     0.1244
*
PRINT HYD           ID=3 PCODE=1 MODE=10
*
* 5914 Quantity SWM Basin (Wetpond, no EoP infiltration)
*
ROUTE SPECIAL POND  ID=1 HYD NO=5914 INFLOW=3 PCODE=0 OPTION=15
                    Inflow controls:
                        USPCT=100% USDIV=0     PCTA=  0% ADIV=0
                        GWPCT=  0% GWDIV=0
                    Maximum level for Routing Tables:  ZMAX= 347.900
                    Recharge characteristics for Compartment A
                      LEVELA= 200.000                EVAPA= 1.4 mm/d ACODE=0
                      CDA=   0.000 mm/h  DZA= 10.00 m
                    Recharge characteristics for Compartment B
                      LEVELB= 346.600 CCBA= 0.00000  EVAPB= 1.4 mm/d BCODE=0
                      CDB=   0.000 mm/h  DZB= 10.00 m
                    Irrigation Pond Controls: IPOND=0
                    Number of points= 20
                                Compartment  A          Compartment B
                    Elevation  Outflow Storage  SFArea Outflow Storage SFArea
                       (m)       (cms)  (ha*m)    (ha)   (cms)  (ha*m)    (ha)
                     346.600     0.000  0.0000  0.0000  0.0000  0.0000  0.3326
                     346.700     0.000  0.0000  0.0000  0.0021  0.0342  0.3509
                     346.768     0.000  0.0000  0.0000  0.0029  0.0587  0.3633
                     346.800     0.000  0.0000  0.0000  0.0033  0.0702  0.3692
                     346.860     0.000  0.0000  0.0000  0.0038  0.0929  0.3801
                     346.900     0.000  0.0000  0.0000  0.0041  0.1080  0.3875
                     347.000     0.000  0.0000  0.0000  0.0048  0.1477  0.4058
                     347.050     0.000  0.0000  0.0000  0.0051  0.1684  0.4149
                     347.100     0.000  0.0000  0.0000  0.0054  0.1892  0.4240
                     347.200     0.000  0.0000  0.0000  0.0060  0.2325  0.4423
                     347.220     0.000  0.0000  0.0000  0.0136  0.2415  0.4460
                     347.300     0.000  0.0000  0.0000  0.0905  0.2776  0.4606
                     347.400     0.000  0.0000  0.0000  0.2446  0.3246  0.4789
                     347.500     0.000  0.0000  0.0000  0.4441  0.3734  0.4972
                     347.550     0.000  0.0000  0.0000  0.5579  0.3987  0.5063
                     347.600     0.000  0.0000  0.0000  0.6801  0.4240  0.5155
                     347.700     0.000  0.0000  0.0000  1.4259  0.4765  0.5338
                     347.730     0.000  0.0000  0.0000  1.7474  0.4928  0.5392
                     347.800     0.000  0.0000  0.0000  2.6277  0.5308  0.5521
                     347.900     0.000  0.0000  0.0000  4.1662  0.5869  0.5703
*
PRINT HYD           ID=1 PCODE=1 MODE=10
KEEP HYD            ID=1 CUTOFF=0 ICODE=0 ISTEP=1 IFORM=0 IDB=3 IMET=1
*
*
*
* Compute runoff hydrograph from area 9141 (remaining uncontrolled area to B.C., NOT to SWM facilty)
* (Roof and rear yeard to wetland of B.C.)
* VS=   8.000 is main channel & VS=   8.000 is off-channel
*
COMPUTE FLOWRATE    ID=6 NHD= 9141 AREA=   0.01271 Sq km  L=    20 m  W=    10 m
             SOIL ZONE I    II  III    IV    V    VI  VII  VIII   IX
                    37.0   0.0  0.0  28.7  0.0  33.2  1.1  0.0  0.0
                    RATING CURVES: IDMC=1 IDOC=1 QRMC=  0.50 QROC=  0.05
                    ROUTING MODEL=2 CONSTANTS: OVERLAND FTB= 1.2 TLO= 0.0
                    SUBSURFACE: KSS= 5.0 KGW= 384 h PCODE=1 WQPCODE=1
                    RBASIN=0 IDA=0 IDB=0 IDC=0 IDD=0 RBDUMP=0
                    GWFACT=0.00 GWON=0
```



```
                    SWQTH=   0.0 L/s SWPUMP=   0.0 L/s SWCODE=0
*
PRINT HYD           ID=6 PCODE=1 MODE=10
*
* Compute runoff hydrograph from area  9142 (remaining uncontrolled area to B.C., NOT to SWM facilty)
* (Other areas to B.C.)
* VS=   8.000 is main channel & VS=   8.000 is off-channel
*
COMPUTE FLOWRATE    ID=5 NHD= 9142 AREA=   0.00560 Sq km  L=  450 m  W=    50 m
             SOIL ZONE I    II  III    IV    V    VI  VII  VIII   IX
                    26.4   0.0  0.0  33.5  0.0  38.8  1.3  0.0  0.0
                    RATING CURVES: IDMC=1 IDOC=1 QRMC=  0.50 QROC=  0.05
                    ROUTING MODEL=2 CONSTANTS: OVERLAND FTB= 1.2 TLO= 0.0
                    SUBSURFACE: KSS= 5.0 KGW= 384 h PCODE=1 WQPCODE=1
                    RBASIN=0 IDA=0 IDB=0 IDC=0 IDD=0 RBDUMP=0
                    GWFACT=0.00 GWON=0
                    SWQTH=   0.0 L/s SWPUMP=   0.0 L/s SWCODE=0
*
* Sum hydr.  9141 &  9142 call result 4914 (all flows leaving X914 area)
*
ADD HYD             ID=4 HYD NO=4914 IDA=6 IDB=5 ICODE=0                  AREA=     0.01923
PRINT HYD           ID=4 PCODE=1 MODE=10
*
*
* Sum hydr. 4914 & 5914 call result 2914 (all flows leaving X914 area)
*
ADD HYD             ID=3 HYD NO=2914 IDA=4 IDB=1 ICODE=0                  AREA=     0.14368
*
PRINT HYD           ID=3 PCODE=1 MODE=10
*
* MTE Development
* Compute runoff hydrograph from rooftop area 7915
* VS=   8.000 is main channel & VS=   8.000 is off-channel
*
*
COMPUTE FLOWRATE    ID=4 NHD=7915 AREA=   0.00102 Sq km  L=   20 m  W=    10 m
             SOIL ZONE I    II  III    IV    V    VI  VII  VIII   IX
                    1.0   0.0  0.0   0.0  0.0   0.0  0.0  99.0  0.0
                    RATING CURVES: IDMC=1 IDOC=1 QRMC=  0.50 QROC=  0.05
                    ROUTING MODEL=2 CONSTANTS: OVERLAND FTB= 1.2 TLO= 0.0
                    SUBSURFACE: KSS= 5.0 KGW= 384 h PCODE=1 WQPCODE=1
                    RBASIN=0 IDA=0 IDB=0 IDC=0 IDD=0 RBDUMP=0
                    GWFACT=0.00 GWON=0
                    SWQTH=   0.0 L/s SWPUMP=   0.0 L/s SWCODE=0
*
* Rooftop Infiltration for 7915 (sized for 30mm @ 0.5m deep galleries)
* 15% safety factor 0.35 void ratio
*
ROUTE SPECIAL POND  ID=6 HYD NO=6915 INFLOW=4 PCODE=0 OPTION= 5
                    Inflow controls:
                        USPCT=100% USDIV=0     PCTA=  0% ADIV=0
                        GWPCT=  0% GWDIV=0
                    Maximum level for Routing Tables:  ZMAX= 100.575
                    Recharge characteristics for Compartment A
                      LEVELA= 100.000                EVAPA= 0.0 mm/d ACODE=0
                      CDA=   0.000 mm/h  DZA= 10.00 m
                    Recharge characteristics for Compartment B
                      LEVELB= 100.000 CCBA= 0.00000  EVAPB= 0.0 mm/d BCODE=1
                      CDB=  15.000 mm/h  DZB= 10.00 m
                    Irrigation Pond Controls: IPOND=0
                    Number of points=  4
                                Compartment  A          Compartment B
                    Elevation  Outflow Storage  SFArea Outflow Storage SFArea
                       (m)       (cms)  (ha*m)    (ha)   (cms)  (ha*m)    (ha)
```

```
                     100.000     0.000  0.0000  0.0000   0.000  0.0000  0.0174
                     100.499     0.000  0.0000  0.0000   0.000  0.0030  0.0174
                     100.500     0.000  0.0000  0.0000   0.001  0.0031  0.0174
                     101.575     0.000  0.0000  0.0000   1.000  0.0035  0.0174
*
COMPUTE FLOWRATE    ID=1 NHD=8915 AREA=   0.00786 Sq km  L=   200 m  W=    50 m
               SOIL ZONE I    II  III    IV    V    VI  VII  VIII   IX
                     46.4   0.0  0.0  19.0  0.0  34.6  0.0   0.0  0.0
                    RATING CURVES: IDMC=1 IDOC=1 QRMC=  0.50 QROC=  0.05
                    ROUTING MODEL=2 CONSTANTS: OVERLAND FTB= 1.2 TLO= 0.0
                    SUBSURFACE: KSS= 5.0 KGW= 384 h PCODE=1 WQPCODE=1
                    RBASIN=0 IDA=0 IDB=0 IDC=0 IDD=0 RBDUMP=0
                    GWFACT=0.00 GWON=0
                    SWQTH=   0.0 L/s SWPUMP=   0.0 L/s SWCODE=0
*
* Sum hydr. 7915 & 8915 call result 3915
*
ADD HYD             ID=5 HYD NO=3915 IDA=6 IDB=1 ICODE=0                  AREA=     0.01009
*
PRINT HYD           ID=5 PCODE=1 MODE=10
*
*
* 5915 Quantity SWM Basin (Quantity Control Dry pond)
*
ROUTE SPECIAL POND  ID=1 HYD NO=5915 INFLOW=5 PCODE=0 OPTION=15
                    Inflow controls:
                        USPCT=100% USDIV=0     PCTA=  0% ADIV=0
                        GWPCT=  0% GWDIV=0
                    Maximum level for Routing Tables:  ZMAX= 352.450
                    Recharge characteristics for Compartment A
                      LEVELA= 200.000                EVAPA= 1.4 mm/d ACODE=0
                      CDA=   0.000 mm/h  DZA= 10.00 m
                    Recharge characteristics for Compartment B
                      LEVELB= 351.15  CCBA= 0.00000  EVAPB= 1.4 mm/d BCODE=0
                      CDB=    0.000 mm/h  DZB= 10.00 m
                    Irrigation Pond Controls: IPOND=0
                    Number of points= 16
                                    Compartment  A          Compartment B
                    Elevation  Outflow Storage  SFArea Outflow Storage SFArea
                       (m)       (cms)  (ha*m)    (ha)   (cms)  (ha*m)    (ha)
                     351.150     0.000  0.0000  0.0000  0.0000  0.0000  0.0418
                     351.230     0.000  0.0000  0.0000  0.0000  0.0035  0.0447
                     351.250     0.000  0.0000  0.0000  0.0000  0.0044  0.0455
                     351.300     0.000  0.0000  0.0000  0.0000  0.0067  0.0473
                     351.350     0.000  0.0000  0.0000  0.0021  0.0091  0.0492
                     351.450     0.000  0.0000  0.0000  0.0108  0.0142  0.0528
                     351.550     0.000  0.0000  0.0000  0.0159  0.0197  0.0565
                     351.650     0.000  0.0000  0.0000  0.0198  0.0255  0.0602
                     351.750     0.000  0.0000  0.0000  0.0230  0.0317  0.0639
                     351.850     0.000  0.0000  0.0000  0.0258  0.0383  0.0675
                     351.950     0.000  0.0000  0.0000  0.0283  0.0452  0.0712
                     352.050     0.000  0.0000  0.0000  0.0307  0.0525  0.0749
                     352.120     0.000  0.0000  0.0000  0.0322  0.0580  0.0775
                     352.250     0.000  0.0000  0.0000  0.1861  0.0682  0.0823
                     352.350     0.000  0.0000  0.0000  0.4963  0.0766  0.0859
                     352.450     0.000  0.0000  0.0000  0.9411  0.0854  0.0896
*
KEEP HYD            ID=1 CUTOFF=0 ICODE=0 ISTEP=1 IFORM=0 IDB=3 IMET=1
*
PRINT HYD           ID=1 PCODE=1 MODE=10
*
*
*
* Compute runoff hydrograph from  9151 (0.18ha residential roof area to B.C. Wetland)
```



```
* VS=   8.000 is main channel & VS=   8.000 is off-channel
*
COMPUTE FLOWRATE    ID=6 NHD= 9151 AREA=   0.00180 Sq km  L=   20 m  W=    10 m
               SOIL ZONE I    II  III    IV    V    VI  VII  VIII   IX
                      1.0   0.0  0.0   0.0  0.0   0.0  0.0  99.0  0.0
                    RATING CURVES: IDMC=1 IDOC=1 QRMC=  0.50 QROC=  0.05
                    ROUTING MODEL=2 CONSTANTS: OVERLAND FTB= 1.2 TLO= 0.0
                    SUBSURFACE: KSS= 5.0 KGW= 384 h PCODE=1 WQPCODE=1
                    RBASIN=0 IDA=0 IDB=0 IDC=0 IDD=0 RBDUMP=0
                    GWFACT=0.00 GWON=0
                    SWQTH=   0.0 L/s SWPUMP=   0.0 L/s SWCODE=0
*
PRINT HYD           ID=6 PCODE=1 MODE=10
*
* Compute runoff hydrograph from area 9152 (remaining area to Beaver Creek)
* VS=   8.000 is main channel & VS=   8.000 is off-channel
*
COMPUTE FLOWRATE    ID=4 NHD= 9152 AREA=   0.00485 Sq km  L=   50 m  W=    50 m
               SOIL ZONE I    II  III    IV    V    VI  VII  VIII   IX
                      0.0   0.0   0.0  35.4  0.0  64.6  0.0   0.0  0.0
                    RATING CURVES: IDMC=1 IDOC=1 QRMC=  0.50 QROC=  0.05
                    ROUTING MODEL=2 CONSTANTS: OVERLAND FTB= 1.2 TLO= 0.0
                    SUBSURFACE: KSS= 5.0 KGW= 384 h PCODE=1 WQPCODE=1
                    RBASIN=0 IDA=0 IDB=0 IDC=0 IDD=0 RBDUMP=0
                    GWFACT=0.00 GWON=0
                    SWQTH=   0.0 L/s SWPUMP=   0.0 L/s SWCODE=0
*
PRINT HYD           ID=4 PCODE=1 MODE=10
*
* Sum hydr.  9151 &  9152 call result 4915
*
ADD HYD             ID=5 HYD NO=4915 IDA=4 IDB=6 ICODE=0                  AREA=     0.01009
*
* Sum hydr. 4915 & 5915 call result 2915
*
ADD HYD             ID=4 HYD NO=2915 IDA=1 IDB=5 ICODE=0                  AREA=     0.01530
*
PRINT HYD           ID=4 PCODE=1 MODE=10
*
* Sum hydr. 2914 & 2915 call result 2005
*
ADD HYD             ID=1 HYD NO=2005 IDA=3 IDB=4 ICODE=0                  AREA=     0.17296
*
* Typical off-channel (Flat slopes)                                       6
*
COMPUTE RATING CURVE ID=6  VS=     1.100   NSEGS=3
                      MIN EL=  100.00   MAX EL=  100.60
                      CHNSLP= 0.01000   FLNSLP= 0.01000
                      N= 0.350  DIST=   39.15
                      N=-0.150  DIST=   40.85
                      N= 0.350  DIST=   80.00
                        DIST    ELEV     DIST    ELEV     DIST    ELEV
                        0.00  100.60    39.15  100.20    39.75  100.00
                       40.25  100.00    40.85  100.20    80.00  100.60
                     RFN=0.0000 PCODE=1
*
COMPUTE RATING CURVE ID=4  VS=     5.000   NSEGS=3
                      MIN EL=  342.02   MAX EL=  343.63
                      CHNSLP= 0.02600   FLNSLP= 0.02600
                      N= 0.100  DIST=    8.25
                      N=-0.045  DIST=   13.28
                      N= 0.100  DIST=   20.67
                        DIST    ELEV     DIST    ELEV     DIST    ELEV
                        0.00  343.63     2.03  343.62     4.62  343.55
```

```
                      6.99  343.56     8.25  343.43     8.51  343.03
                      8.62  342.91     9.44  342.90    10.02  342.85
                     10.39  342.82    11.57  342.91    12.16  342.88
                     12.40  342.94    12.63  342.02    12.98  343.17
                     13.28  343.33    14.36  343.36    17.52  343.46
                     20.67  343.40
                   RFN=0.0000 PCODE=1
*
*
* Compute runoff hydrograph from area 1911 (undeveloped Bever Creek and adjacent wetland)
* VS=   5.000 is main channel & VS=   1.100 is off-channel
*
COMPUTE FLOWRATE    ID=6 NHD= 1911  AREA=   0.19351 Sq km  L=   400 m  W=   250 m
              SOIL ZONE I    II  III    IV    V    VI  VII  VIII   IX
                     1.0   3.0 27.0   3.0 12.0  11.0 43.0   0.0  0.0
                   RATING CURVES: IDMC=4 IDOC=6 QRMC=  0.50 QROC=  0.05
                   ROUTING MODEL=2 CONSTANTS: OVERLAND FTB= 2.0 TLO= 0.0
                   SUBSURFACE: KSS= 5.0 KGW= 384 h PCODE=1 WQPCODE=1
                   RBASIN=0 IDA=0 IDB=0 IDC=0 IDD=0 RBDUMP=0
                   GWFACT=0.00 GWON=0
                   SWQTH=   0.0 L/s SWPUMP=   0.0 L/s SWCODE=0
*
PRINT HYD           ID=6 PCODE=1 MODE=10
*
* Compute runoff hydrograph from area 2911 (undeveloped property south edge)
* VS=   5.000 is main channel & VS=   1.100 is off-channel
*
COMPUTE FLOWRATE    ID=4 NHD= 2911  AREA=   0.00957 Sq km  L=    50 m  W=   100 m
              SOIL ZONE I    II  III    IV    V    VI  VII  VIII   IX
                     1.0   3.0 27.0   3.0 12.0  11.0 43.0   0.0  0.0
                   RATING CURVES: IDMC=4 IDOC=6 QRMC=  0.50 QROC=  0.05
                   ROUTING MODEL=2 CONSTANTS: OVERLAND FTB= 2.0 TLO= 0.0
                   SUBSURFACE: KSS= 5.0 KGW= 384 h PCODE=1 WQPCODE=1
                   RBASIN=0 IDA=0 IDB=0 IDC=0 IDD=0 RBDUMP=0
                   GWFACT=0.00 GWON=0
                   SWQTH=   0.0 L/s SWPUMP=   0.0 L/s SWCODE=0
*
PRINT HYD           ID=4 PCODE=1 MODE=10
*
* Sum hydr. 19111 & 2911 call result 3911
*
ADD HYD             ID=3 HYD NO=3911 IDA=6 IDB=4 ICODE=0                  AREA=     0.2021
*
* Sum hydr. 2005 & 3911 call result 2006
*
ADD HYD             ID=4 HYD NO=2006 IDA=1 IDB=3 ICODE=0                  AREA=     0.37595
*
* MTE Development
* Compute runoff hydrograph from area 7917 - Some rooftops to Infiltration gallery (approx 11 lots)
* VS=   8.000 is main channel & VS=   8.000 is off-channel
*
COMPUTE FLOWRATE    ID=3 NHD=7917 AREA=   0.00305 Sq km  L=   20 m  W=    10 m
              SOIL ZONE I    II  III    IV    V    VI  VII  VIII   IX
                     1.0   0.0  0.0  0.0  0.0   0.0  0.0  99.0  0.0
                   RATING CURVES: IDMC=1 IDOC=1 QRMC=  0.50 QROC=  0.05
                   ROUTING MODEL=2 CONSTANTS: OVERLAND FTB= 1.2 TLO= 0.0
                   SUBSURFACE: KSS= 5.0 KGW= 384 h PCODE=1 WQPCODE=1
                   RBASIN=0 IDA=0 IDB=0 IDC=0 IDD=0 RBDUMP=0
                   GWFACT=0.00 GWON=0
                   SWQTH=   0.0 L/s SWPUMP=   0.0 L/s SWCODE=0
*
* Rooftop Infiltration for 7917 (sized for 30mm @ 1m deep galleries)
* 15% safety factor 0.35 void ratio
*
```



```
ROUTE SPECIAL POND  ID=5 HYD NO=6917 INFLOW=3 PCODE=0 OPTION= 5
                    Inflow controls:
                        USPCT=100% USDIV=0     PCTA=  0% ADIV=0
                        GWPCT=  0% GWDIV=0
                    Maximum level for Routing Tables:  ZMAX= 101.150
                    Recharge characteristics for Compartment A
                      LEVELA= 100.000               EVAPA= 0.0 mm/d ACODE=0
                      CDA=   0.000 mm/h  DZA= 10.00 m
                    Recharge characteristics for Compartment B
                      LEVELB= 100.000 CCBA= 0.00000  EVAPB= 0.0 mm/d BCODE=1
                      CDB=  15.000 mm/h  DZB= 10.00 m
                    Irrigation Pond Controls: IPOND=0
                    Number of points=  4
                                    Compartment  A          Compartment B
                    Elevation  Outflow Storage  SFArea Outflow Storage SFArea
                       (m)       (cms)  (ha*m)    (ha)   (cms)  (ha*m)    (ha)
                     100.000     0.000  0.0000  0.0000   0.000  0.0000  0.0261
                     100.999     0.000  0.0000  0.0000   0.000  0.0091  0.0261
                     101.000     0.000  0.0000  0.0000   0.001  0.0092  0.0261
                     101.150     0.000  0.0000  0.0000   1.000  0.0105  0.0261
*
*
* Compute runoff hydrograph from area 8917 - Remainder Area in 3917
* VS=   8.000 is main channel & VS=   8.000 is off-channel
*
COMPUTE FLOWRATE    ID=1 NHD=8917 AREA=   0.00966 Sq km  L=  100 m  W=    10 m
              SOIL ZONE I    II  III    IV    V    VI  VII  VIII   IX
                     55.0   4.5  0.0  33.7  0.0   6.8  0.0   0.0  0.0
                   RATING CURVES: IDMC=1 IDOC=1 QRMC=  0.50 QROC=  0.05
                   ROUTING MODEL=2 CONSTANTS: OVERLAND FTB= 1.2 TLO= 0.0
                   SUBSURFACE: KSS= 5.0 KGW= 384 h PCODE=1 WQPCODE=1
                   RBASIN=0 IDA=0 IDB=0 IDC=0 IDD=0 RBDUMP=0
                   GWFACT=0.00 GWON=0
                   SWQTH=   0.0 L/s SWPUMP=   0.0 L/s SWCODE=0
*
* Sum hydr. 6917 & 8917 call result 3917
*
ADD HYD             ID=6 HYD NO=3917 IDA=5 IDB=1 ICODE=0                  AREA=     0.0091
*
*
*
* 5917 Quantity SWM Basin (Quantity Control Dry pond)
*
ROUTE SPECIAL POND  ID=5 HYD NO=5917 INFLOW=6 PCODE=0 OPTION=15
                    Inflow controls:
                        USPCT=100% USDIV=0     PCTA=  0% ADIV=0
                        GWPCT=  0% GWDIV=0
                    Maximum level for Routing Tables:  ZMAX= 349.300
                    Recharge characteristics for Compartment A
                      LEVELA= 200.000               EVAPA= 1.4 mm/d ACODE=0
                      CDA=   0.000 mm/h  DZA= 10.00 m
                    Recharge characteristics for Compartment B
                      LEVELB= 348.100 CCBA= 0.00000  EVAPB= 1.4 mm/d BCODE=0
                      CDB=    0.000 mm/h  DZB= 10.00 m
                    Irrigation Pond Controls: IPOND=0
                    Number of points= 16
                                    Compartment  A          Compartment B
                    Elevation  Outflow Storage  SFArea Outflow Storage SFArea
                       (m)       (cms)  (ha*m)    (ha)   (cms)  (ha*m)    (ha)
                     348.100     0.000  0.0000  0.0000  0.0000  0.0000  0.0400
                     348.101     0.000  0.0000  0.0000  0.0000  0.0000  0.0400
                     348.200     0.000  0.0000  0.0000  0.0000  0.0042  0.0437
                     348.300     0.000  0.0000  0.0000  0.0000  0.0087  0.0473
                     348.330     0.000  0.0000  0.0000  0.0000  0.0102  0.0484
```

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                    348.470     0.000  0.0000  0.0000  0.0014  0.0173  0.0536
                    348.500     0.000  0.0000  0.0000  0.0016  0.0189  0.0547
                    348.600     0.000  0.0000  0.0000  0.0089  0.0246  0.0583
                    348.700     0.000  0.0000  0.0000  0.0160  0.0306  0.0620
                    348.800     0.000  0.0000  0.0000  0.0207  0.0370  0.0657
                    348.900     0.000  0.0000  0.0000  0.0244  0.0437  0.0694
                    349.000     0.000  0.0000  0.0000  0.0586  0.0509  0.0730
                    349.026     0.000  0.0000  0.0000  0.0766  0.0528  0.0740
                    349.100     0.000  0.0000  0.0000  0.2909  0.0583  0.0767
                    349.200     0.000  0.0000  0.0000  0.7069  0.0662  0.0804
                    349.300     0.000  0.0000  0.0000  1.2786  0.0744  0.0840
*
*
PRINT HYD           ID=5 PCODE=1 MODE=10
*
* Compute runoff hydrograph from area  9171 (remaining area to Beaver Creek west wetland)
* VS=   8.000 is main channel & VS=   8.000 is off-channel
*
COMPUTE FLOWRATE    ID=1 NHD= 9171 AREA=   0.00805 Sq km  L=    45 m  W=    45 m
              SOIL ZONE I    II  III    IV    V    VI  VII  VIII   IX
                      1.6  10.0  0.0  73.5  0.0  14.9  0.0   0.0  0.0
                    RATING CURVES: IDMC=1 IDOC=1 QRMC=  0.50 QROC=  0.05
                    ROUTING MODEL=2 CONSTANTS: OVERLAND FTB= 1.2 TLO= 0.0
                    SUBSURFACE: KSS= 5.0 KGW= 384 h PCODE=1 WQPCODE=1
                    RBASIN=0 IDA=0 IDB=0 IDC=0 IDD=0 RBDUMP=0
                    GWFACT=0.00 GWON=0
                    SWQTH=   0.0 L/s SWPUMP=   0.0 L/s SWCODE=0
*
PRINT HYD           ID=1 PCODE=1 MODE=10
*
* Compute runoff hydrograph from area  9172 (remaining area to Beaver Creek east wetland)
* VS=   8.000 is main channel & VS=   8.000 is off-channel
*
COMPUTE FLOWRATE    ID=3 NHD= 9172 AREA=   0.00408 Sq km  L=    45 m  W=    45 m
              SOIL ZONE I    II  III    IV    V    VI  VII  VIII   IX
                     43.7  5.7  0.0  42.1  0.0   8.5  0.0   0.0  0.0
                    RATING CURVES: IDMC=1 IDOC=1 QRMC=  0.50 QROC=  0.05
                    ROUTING MODEL=2 CONSTANTS: OVERLAND FTB= 1.2 TLO= 0.0
                    SUBSURFACE: KSS= 5.0 KGW= 384 h PCODE=1 WQPCODE=1
                    RBASIN=0 IDA=0 IDB=0 IDC=0 IDD=0 RBDUMP=0
                    GWFACT=0.00 GWON=0
                    SWQTH=   0.0 L/s SWPUMP=   0.0 L/s SWCODE=0
*
PRINT HYD           ID=3 PCODE=1 MODE=10
*
* Sum hydr.  9171 &  9172 call result 4917
*
ADD HYD             ID=6 HYD NO=4917 IDA=1 IDB=3 ICODE=0                AREA=     0.01287
*
* Sum hydr. 5917 & 4917 call result 2917
*
ADD HYD             ID=3 HYD NO=2917 IDA=6 IDB=5 ICODE=0                AREA=     0.02573
*
*
* Total water balance leaving X917 area:
*
PRINT HYD           ID=3 PCODE=1 MODE=10
*
* Sum hydr. 2006 & 2917 call result 2007
*
ADD HYD             ID=1 HYD NO=2007 IDA=4 IDB=3 ICODE=0                AREA=     0.40133
*
*  Main channel Parabolic Swale - Flat                                   7
*
```



```
COMPUTE RATING CURVE ID=1  VS=     7.000   NSEGS=3
                     MIN EL=  100.70   MAX EL=  103.00
                     CHNSLP= 0.01000   FLNSLP= 0.01000
                     N= 0.070  DIST=   20.00
                     N=-0.050  DIST=   30.00
                     N= 0.070  DIST=   50.00
                       DIST    ELEV     DIST    ELEV     DIST    ELEV
                        0.00  103.00    20.00  101.00    23.00  100.80
                       25.00  100.70    27.00  100.80    30.00  101.00
                       50.00  103.00
                    RFN=0.0000 PCODE=1
*
* Compute runoff hydrograph from area 3918 (undeveloped)
* VS=   7.000 is main channel & VS=   1.000 is off-channel
*
COMPUTE FLOWRATE    ID=3 NHD=3918 AREA=   0.00565 Sq km  L=    50 m  W=   100 m
              SOIL ZONE I    II  III    IV    V    VI  VII  VIII   IX
                      1.0   0.0 20.0   0.0 79.0   0.0  0.0   0.0  0.0
                    RATING CURVES: IDMC=1 IDOC=5 QRMC=  0.50 QROC=  0.05
                    ROUTING MODEL=2 CONSTANTS: OVERLAND FTB= 2.0 TLO= 0.0
                    SUBSURFACE: KSS= 5.0 KGW= 384 h PCODE=1 WQPCODE=1
                    RBASIN=0 IDA=0 IDB=0 IDC=0 IDD=0 RBDUMP=0
                    GWFACT=0.00 GWON=0
                    SWQTH=   0.0 L/s SWPUMP=   0.0 L/s SWCODE=0
*
PRINT HYD           ID=3 PCODE=1 MODE=10
*
* Sum hydr. 2007 & 3918 call result 2008
*
ADD HYD             ID=4 HYD NO=2008 IDA=1 IDB=3 ICODE=0                AREA=     0.40733
*
*
* Beaver Creek at south end of Site
*
ADD HYD             ID=1 HYD NO=2009 IDA=2 IDB=4 ICODE=0                AREA=     6.98333
*
**=========================Northgate Western Portion================================
*
* Go to event file: Beaver Creek at south end of Site
*
*CHANGE INPUT FILE
*
KEEP HYD            ID=1 CUTOFF=72 ICODE=5 ISTEPS=1 IFORM=0 IDB=1 IMET=2
*EEP HYD            ID=1 CUTOFF=72 ICODE=4 ISTEPS=1 IFORM=0 IDB=1 IMET=2
PRINT HYD           ID=1 PCODE=1 MODE=10
*
NEW DUMP OUTPUT     MODE=10 ID=1 IOPT=4 FTYPE=0
*
* To Laurel Creek
* Compute runoff hydrograph from area 3092
* VS=   7.000 is main channel & VS=   1.000 is off-channel
*
COMPUTE FLOWRATE    ID=2 NHD=3092 AREA=   0.04015 Sq km  L=   300 m  W=   100 m
              SOIL ZONE I    II  III    IV    V    VI  VII  VIII   IX
                      1.0  28.0  7.0  34.0  0.0  30.0  0.0   0.0  0.0
                    RATING CURVES: IDMC=1 IDOC=5 QRMC=  0.50 QROC=  0.05
                    ROUTING MODEL=2 CONSTANTS: OVERLAND FTB= 2.0 TLO= 0.0
                    SUBSURFACE: KSS= 5.0 KGW= 384 h PCODE=1 WQPCODE=1
                    RBASIN=0 IDA=0 IDB=0 IDC=0 IDD=0 RBDUMP=0
                    GWFACT=0.00 GWON=0
                    SWQTH=   0.0 L/s SWPUMP=   0.0 L/s SWCODE=0
*
PRINT HYD           ID=2 PCODE=1 MODE=10
*
```

```
* Compute runoff hydrograph from area 3093
* VS=   7.000 is main channel & VS=   1.000 is off-channel
*
COMPUTE FLOWRATE    ID=3 NHD=3093 AREA=   0.00579 Sq km  L=   150 m  W=   100 m
              SOIL ZONE I    II  III    IV    V    VI  VII  VIII   IX
                       1.0   0.0 40.0  18.0 41.0   0.0  0.0   0.0  0.0
                     RATING CURVES: IDMC=1 IDOC=5 QRMC=  0.50 QROC=  0.05
                     ROUTING MODEL=2 CONSTANTS: OVERLAND FTB= 2.0 TLO= 0.0
                     SUBSURFACE: KSS= 5.0 KGW= 384 h PCODE=1 WQPCODE=1
                     RBASIN=0 IDA=0 IDB=0 IDC=0 IDD=0 RBDUMP=0
                     GWFACT=0.00 GWON=0
                     SWQTH=   0.0 L/s SWPUMP=   0.0 L/s SWCODE=0
*
PRINT HYD           ID=3 PCODE=1 MODE=10
*
* Sum hydr. 3092 & 3093 call result 2010
*
ADD HYD             ID=5 HYD NO=2010 IDA=2 IDB=3 ICODE=0                  AREA=     0.04736
*
* Compute runoff hydrograph from area 9173 (remaining area to Laurel Creek)
* VS=   8.000 is main channel & VS=   8.000 is off-channel
*
COMPUTE FLOWRATE    ID=1 NHD= 9173 AREA=   0.00288 Sq km  L=    45 m  W=    45 m
              SOIL ZONE I    II  III    IV    V    VI  VII  VIII   IX
                     0.0  10.1  0.0  74.8  0.0  15.1  0.0   0.0  0.0
                     RATING CURVES: IDMC=1 IDOC=1 QRMC=  0.50 QROC=  0.05
                     ROUTING MODEL=2 CONSTANTS: OVERLAND FTB= 1.2 TLO= 0.0
                     SUBSURFACE: KSS= 5.0 KGW= 384 h PCODE=1 WQPCODE=1
                     RBASIN=0 IDA=0 IDB=0 IDC=0 IDD=0 RBDUMP=0
                     GWFACT=0.00 GWON=0
                     SWQTH=   0.0 L/s SWPUMP=   0.0 L/s SWCODE=0
*
PRINT HYD           ID=1 PCODE=1 MODE=10
*
* Sum hydr. 2010 & 49173 call result 2021
* Total outflow from 309
*
ADD HYD             ID=6 HYD NO=2021 IDA=5 IDB=1 ICODE=0                  AREA=     0.04736
*
*=======(flow from X914 to Laurel Creek)==================
* Compute runoff hydrograph from area 99141 (roof area to infiltraion gallary)
* Close to Conservation Drive
* VS=   8.000 is main channel & VS=   8.000 is off-channel
*
COMPUTE FLOWRATE    ID=3 NHD=99141 AREA=   0.00135 Sq km  L=   20 m  W=    10 m
              SOIL ZONE I    II  III    IV    V    VI  VII  VIII   IX
                      1.0   0.0  0.0  0.0  0.0   0.0  0.0  99.0  0.0
                     RATING CURVES: IDMC=1 IDOC=1 QRMC=  0.50 QROC=  0.05
                     ROUTING MODEL=2 CONSTANTS: OVERLAND FTB= 1.2 TLO= 0.0
                     SUBSURFACE: KSS= 5.0 KGW= 384 h PCODE=1 WQPCODE=1
                     RBASIN=0 IDA=0 IDB=0 IDC=0 IDD=0 RBDUMP=0
                     GWFACT=0.00 GWON=0
                     SWQTH=   0.0 L/s SWPUMP=   0.0 L/s SWCODE=0
*
* Rooftop Infiltration for 99141 (sized for 30mm @ 1m deep galleries)
* 15% safety factor 0.35 void ratio
*
ROUTE SPECIAL POND  ID=2 HYD NO= 514 INFLOW=3 PCODE=0 OPTION= 5
                     Inflow controls:
                         USPCT=100% USDIV=0     PCTA=  0% ADIV=0
                         GWPCT=  0% GWDIV=0
                     Maximum level for Routing Tables:  ZMAX= 101.150
                     Recharge characteristics for Compartment A
                       LEVELA= 100.000               EVAPA= 0.0 mm/d ACODE=0
```



```
                         CDA=   0.000 mm/h  DZA= 10.00 m
                     Recharge characteristics for Compartment B
                       LEVELB= 100.000 CCBA= 0.00000  EVAPB= 0.0 mm/d BCODE=1
                       CDB=   5.000 mm/h  DZB= 10.00 m
                     Irrigation Pond Controls: IPOND=0
                     Number of points=  4
                                    Compartment  A          Compartment B
                     Elevation  Outflow Storage  SFArea Outflow Storage SFArea
                        (m)       (cms)  (ha*m)    (ha)   (cms)  (ha*m)    (ha)
                      100.000     0.000  0.0000  0.0000   0.000  0.0000  0.0116
                      100.999     0.000  0.0000  0.0000   0.000  0.0040  0.0116
                      101.000     0.000  0.0000  0.0000   0.001  0.0041  0.0116
                      101.150     0.000  0.0000  0.0000   1.000  0.0047  0.0116
*
* Compute runoff hydrograph from area 99142 (Rear roof and yard drains to amended topsoil)
* VS=   8.000 is main channel & VS=   8.000 is off-channel
*
COMPUTE FLOWRATE    ID=1 NHD=99142 AREA=   0.01520 Sq km  L=   30 m  W=    14 m
              SOIL ZONE I    II  III    IV    V    VI  VII  VIII   IX
                     27.7   0.0  0.0  32.9  0.0  38.1  1.3  0.0   0.0
                     RATING CURVES: IDMC=1 IDOC=1 QRMC=  0.50 QROC=  0.05
                     ROUTING MODEL=2 CONSTANTS: OVERLAND FTB= 1.2 TLO= 0.0
                     SUBSURFACE: KSS= 5.0 KGW= 384 h PCODE=1 WQPCODE=1
                     RBASIN=0 IDA=0 IDB=0 IDC=0 IDD=0 RBDUMP=0
                     GWFACT=0.00 GWON=0
                     SWQTH=   0.0 L/s SWPUMP=   0.0 L/s SWCODE=0
*
* Routed through Amended Top Soil
* (450mm @30% void ratio, considered 60mm vol to be conservative)
* Foot print = 99142 pervious area
* 15% safty factor
*
ROUTE SPECIAL POND  ID=3 HYD NO=614 INFLOW=1 PCODE=0 OPTION=15
                     Inflow controls:
                         USPCT=100% USDIV=0     PCTA=  0% ADIV=0
                         GWPCT=  0% GWDIV=0
                     Maximum level for Routing Tables:  ZMAX= 100.069
                     Recharge characteristics for Compartment A
                       LEVELA= 100.000               EVAPA= 0.0 mm/d ACODE=0
                       CDA=   0.000 mm/h  DZA= 10.00 m
                     Recharge characteristics for Compartment B
                       LEVELB= 100.000 CCBA= 0.00000  EVAPB= 0.0 mm/d BCODE=1
                       CDB=   5.000 mm/h  DZB= 10.00 m
                     Irrigation Pond Controls: IPOND=0
                     Number of points=  4
                                    Compartment  A          Compartment B
                     Elevation  Outflow Storage  SFArea Outflow Storage SFArea
                        (m)       (cms)  (ha*m)    (ha)   (cms)  (ha*m)    (ha)
                      100.000     0.000  0.0000  0.0000   0.000  0.0000  1.0993
                      100.059     0.000  0.0000  0.0000   0.000  0.0649  1.0993
                      100.060     0.000  0.0000  0.0000   0.001  0.0660  1.0993
                      100.069     0.000  0.0000  0.0000   0.800  0.0759  1.0993
*
ADD HYD             ID=1 HYD NO=99143 IDA=2 IDB=3 ICODE=0
*
*Compute runoff hydrograph from remainder area in 9914
*
COMPUTE FLOWRATE    ID=3 NHD=99145 AREA=   0.00404 Sq km  L=    50 m  W=    50 m
              SOIL ZONE I    II  III    IV    V    VI  VII  VIII   IX
                     66.7   0.0  0.0  15.1  0.0  17.5  0.6   0.0  0.0
                     RATING CURVES: IDMC=1 IDOC=5 QRMC=  0.50 QROC=  0.05
                     ROUTING MODEL=2 CONSTANTS: OVERLAND FTB= 2.0 TLO= 0.0
                     SUBSURFACE: KSS= 5.0 KGW= 384 h PCODE=1 WQPCODE=1
                     RBASIN=0 IDA=0 IDB=0 IDC=0 IDD=0 RBDUMP=0
```

```
                    GWFACT=0.00 GWON=0
                    SWQTH=   0.0 L/s SWPUMP=   0.0 L/s SWCODE=0
*
*Total flow from 9914
*
ADD HYD             ID=5 HYD NO=9914  IDA=1 IDB=3 ICODE=0
PRINT HYD           ID=5 PCODE=1 MODE=10
*
* Total outflow to Laurel Creek
*
ADD HYD             ID=4 HYD NO=2011 IDA=5 IDB=6 ICODE=0                  AREA=     0.06912
*
PRINT HYD           ID=4 PCODE=1 MODE=10
*
* Compute runoff hydrograph from area 3103
* VS=   7.000 is main channel & VS=   1.000 is off-channel
*
COMPUTE FLOWRATE    ID=6 NHD=3103 AREA=   0.00498 Sq km  L=    50 m  W=    50 m
              SOIL ZONE I    II  III    IV    V    VI  VII  VIII   IX
                     1.0   0.0 25.0   0.0  0.0  74.0  0.0   0.0  0.0
                    RATING CURVES: IDMC=1 IDOC=5 QRMC=  0.50 QROC=  0.05
                    ROUTING MODEL=2 CONSTANTS: OVERLAND FTB= 2.0 TLO= 0.0
                    SUBSURFACE: KSS= 5.0 KGW= 384 h PCODE=1 WQPCODE=1
                    RBASIN=0 IDA=0 IDB=0 IDC=0 IDD=0 RBDUMP=0
                    GWFACT=0.00 GWON=0
                    SWQTH=   0.0 L/s SWPUMP=   0.0 L/s SWCODE=0
*
PRINT HYD           ID=6 PCODE=1 MODE=10
*
* Total outflow to Laurel Creek
*
ADD HYD             ID=1 HYD NO=2111 IDA=4 IDB=6 ICODE=0                  AREA=     0.07112
*
*++++++++++++++++++++++Laurel Creek Reservoir Tributary++++++++++++++++++++++++++++++++++
*
*  Main channel Parabolic Swale - Flat                                   7
*
COMPUTE RATING CURVE ID=1  VS=     7.000   NSEGS=3
                     MIN EL=  100.70   MAX EL=  103.00
                     CHNSLP= 0.01000   FLNSLP= 0.01000
                     N= 0.070  DIST=   20.00
                     N=-0.050  DIST=   30.00
                     N= 0.070  DIST=   50.00
                       DIST    ELEV     DIST    ELEV     DIST    ELEV
                       0.00  103.00    20.00  101.00    23.00  100.80
                      25.00  100.70    27.00  100.80    30.00  101.00
                      50.00  103.00
                    RFN=0.0000 PCODE=1
*
* Typical off-channel (Flat slopes)                                     6
*
COMPUTE RATING CURVE ID=6  VS=     1.100   NSEGS=3
                     MIN EL=  100.00   MAX EL=  100.60
                     CHNSLP= 0.01000   FLNSLP= 0.01000
                     N= 0.350  DIST=   39.15
                     N=-0.150  DIST=   40.85
                     N= 0.350  DIST=   80.00
                       DIST    ELEV     DIST    ELEV     DIST    ELEV
                       0.00  100.60    39.15  100.20    39.75  100.00
                      40.25  100.00    40.85  100.20    80.00  100.60
                    RFN=0.0000 PCODE=1
*
*
* Compute runoff hydrograph from area 3105
```



```
* VS=   7.000 is main channel & VS=   1.100 is off-channel
*
COMPUTE FLOWRATE    ID=1 NHD=3105 AREA=   0.0361 Sq km  L=   200 m  W=   180 m
              SOIL ZONE I    II  III    IV    V    VI  VII  VIII   IX
                     1.0   0.0  0.0  74.0  0.0  25.0  0.0   0.0  0.0
                    RATING CURVES: IDMC=1 IDOC=6 QRMC=  0.50 QROC=  0.05
                    ROUTING MODEL=2 CONSTANTS: OVERLAND FTB= 1.2 TLO= 0.0
                    SUBSURFACE: KSS= 5.0 KGW= 384 h PCODE=1 WQPCODE=1
                    RBASIN=0 IDA=0 IDB=0 IDC=0 IDD=0 RBDUMP=0
                    GWFACT=0.00 GWON=0
                    SWQTH=   0.0 L/s SWPUMP=   0.0 L/s SWCODE=0
*
PRINT HYD           ID=1 PCODE=1 MODE=10
*
*
*   Typical Urban Cross-Section                                          6
*
COMPUTE RATING CURVE ID=1  VS=     8.000   NSEGS=3
                      MIN EL=  295.00   MAX EL=  295.70
                      CHNSLP= 0.00500   FLNSLP= 0.00500
                      N= 0.015  DIST=  200.00
                      N=-0.015  DIST=  300.00
                      N= 0.015  DIST=  500.00
                        DIST    ELEV     DIST    ELEV     DIST    ELEV
                        0.00  295.70   200.00  295.50   200.10  295.00
                      299.90  295.00   300.00  295.50   500.00  295.70
                     RFN=0.0000 PCODE=1
*
*==============================Cook Mattamy=======================================
*
* Compute runoff hydrograph from area 7107
* VS=   8.000 is main channel & VS=   8.000 is off-channel
*
* Res.,school Roof to Roof Infiltration Gallery,
*
COMPUTE FLOWRATE    ID=2 NHD=7107 AREA=   0.03343 Sq km  L=    20 m  W=    10 m
              SOIL ZONE I    II  III    IV    V    VI  VII  VIII   IX
                     1.0   0.0  0.0   0.0  0.0   0.0  0.0  99.0  0.0
                    RATING CURVES: IDMC=1 IDOC=1 QRMC=  0.50 QROC=  0.05
                    ROUTING MODEL=2 CONSTANTS: OVERLAND FTB= 1.2 TLO= 0.0
                    SUBSURFACE: KSS= 5.0 KGW= 384 h PCODE=1 WQPCODE=1
                    RBASIN=0 IDA=0 IDB=0 IDC=0 IDD=0 RBDUMP=0
                    GWFACT=0.00 GWON=0
                    SWQTH=   0.0 L/s SWPUMP=   0.0 L/s SWCODE=0
*
* Infiltration Gallery, sized with 30mm rainfall, 1m depth
* 15% safety factor
* Void ratio 0.35
*
ROUTE SPECIAL POND  ID=3 HYD NO=6107 INFLOW=2 PCODE=0 OPTION= 5
                    Inflow controls:
                        USPCT=100% USDIV=0     PCTA=  0% ADIV=0
                        GWPCT=  0% GWDIV=0
                    Maximum level for Routing Tables:  ZMAX= 101.150
                    Recharge characteristics for Compartment A
                      LEVELA= 100.000                EVAPA= 0.0 mm/d ACODE=0
                      CDA=   0.000 mm/h  DZA= 10.00 m
                    Recharge characteristics for Compartment B
                      LEVELB= 100.000 CCBA= 0.00000  EVAPB= 0.0 mm/d BCODE=1
                      CDB=  15.000 mm/h  DZB= 10.00 m
                    Irrigation Pond Controls: IPOND=0
                    Number of points=  4
                                   Compartment  A          Compartment B
                    Elevation  Outflow Storage  SFArea Outflow Storage SFArea
```

```
                      (m)       (cms)  (ha*m)    (ha)   (cms)  (ha*m)    (ha)
                    100.000     0.000  0.0000  0.0000   0.000  0.0000  0.2865
                    100.999     0.000  0.0000  0.0000   0.000  0.1002  0.2865
                    101.000     0.000  0.0000  0.0000   0.001  0.1003  0.2865
                    101.150     0.000  0.0000  0.0000   0.800  0.1153  0.2865
*
PRINT HYD           ID=3 PCODE=1 MODE=10
*
* Residential,school pervious area to ameded top soil
*
COMPUTE FLOWRATE    ID=2 NHD=4107 AREA=  0.02709 Sq km  L=    30 m  W=    14 m
             SOIL ZONE I    II  III    IV    V    VI  VII  VIII   IX
                    0.0   0.0  0.0  36.8  0.0  63.2  0.0   0.0  0.0
                   RATING CURVES: IDMC=1 IDOC=1 QRMC=  0.50 QROC=  0.05
                   ROUTING MODEL=2 CONSTANTS: OVERLAND FTB= 1.2 TLO= 0.0
                   SUBSURFACE: KSS= 5.0 KGW= 384 h PCODE=1 WQPCODE=1
                   RBASIN=0 IDA=0 IDB=0 IDC=0 IDD=0 RBDUMP=0
                   GWFACT=0.00 GWON=0
                   SWQTH=   0.0 L/s SWPUMP=   0.0 L/s SWCODE=0
*
* Routed through Amended Top Soil (450mm @30% void ratio=135mm vol)
* Foot print = 4107 pervious area
* 15% safty factor
*
ROUTE SPECIAL POND  ID=5 HYD NO=5107 INFLOW=2 PCODE=0 OPTION=15
                   Inflow controls:
                       USPCT=100% USDIV=0     PCTA=  0% ADIV=0
                       GWPCT=  0% GWDIV=0
                   Maximum level for Routing Tables:  ZMAX= 101.069
                   Recharge characteristics for Compartment A
                     LEVELA= 100.000                EVAPA= 0.0 mm/d ACODE=0
                     CDA=   0.000 mm/h  DZA= 10.00 m
                   Recharge characteristics for Compartment B
                     LEVELB= 100.000 CCBA= 0.00000  EVAPB= 0.0 mm/d BCODE=1
                     CDB=  15.000 mm/h  DZB= 10.00 m
                   Irrigation Pond Controls: IPOND=0
                   Number of points=  4
                                  Compartment  A          Compartment B
                   Elevation  Outflow Storage  SFArea Outflow Storage SFArea
                      (m)       (cms)  (ha*m)    (ha)   (cms)  (ha*m)    (ha)
                    100.000     0.000  0.0000  0.0000   0.000  0.0000  2.7090
                    100.059     0.000  0.0000  0.0000   0.000  0.1598  2.7090
                    100.060     0.000  0.0000  0.0000   0.001  0.1625  2.7090
                    100.069     0.000  0.0000  0.0000   0.800  0.1869  2.7090
*
PRINT HYD           ID=5 PCODE=1 MODE=10
*
* Sum hydr. 6107 & 5107 call result 1107
*
ADD HYD             ID=4 HYD NO=1107 IDA=3 IDB=5 ICODE=0                AREA=     0.0605
PRINT HYD           ID=4 PCODE=1 MODE=10
*
*
* Remainder Area
*
COMPUTE FLOWRATE    ID=2 NHD=8107 AREA=  0.05193 Sq km  L=   450 m  W=   50 m
             SOIL ZONE I    II  III    IV    V    VI  VII  VIII   IX
                   83.7   0.0  0.0   6.0  0.0  10.3  0.0   0.0  0.0
                   RATING CURVES: IDMC=1 IDOC=1 QRMC=  0.50 QROC=  0.05
                   ROUTING MODEL=2 CONSTANTS: OVERLAND FTB= 1.2 TLO= 0.0
                   SUBSURFACE: KSS= 5.0 KGW= 384 h PCODE=1 WQPCODE=1
                   RBASIN=0 IDA=0 IDB=0 IDC=0 IDD=0 RBDUMP=0
                   GWFACT=0.00 GWON=0
                   SWQTH=   0.0 L/s SWPUMP=   0.0 L/s SWCODE=0
```



```
*
*
* Sum hydr. 1107 & 8107 call result 3107
*
ADD HYD             ID=5 HYD NO=3107 IDA=4 IDB=2 ICODE=0                AREA=     0.1125
*
PRINT HYD           ID=5 PCODE=1 MODE=10
*
* Sum hydr. 3105 & 3107 call result 2012
*
ADD HYD             ID=2 HYD NO=2012 IDA=1 IDB=5 ICODE=0                AREA=     0.1388
PRINT HYD           ID=2 PCODE=1 MODE=10
*
*
*==============================Activa=====================================
*
* Compute runoff hydrograph from area 7101
* VS=   8.000 is main channel & VS=   8.000 is off-channel
* Res.Roof to Roof Infiltration Gallery,
*
COMPUTE FLOWRATE    ID=3 NHD=7101 AREA=  0.02361 Sq km  L=    20 m  W=    10 m
             SOIL ZONE I    II  III    IV    V    VI  VII  VIII   IX
                    1.0   0.0  0.0   0.0  0.0   0.0  0.0  99.0  0.0
                   RATING CURVES: IDMC=1 IDOC=1 QRMC=  0.50 QROC=  0.05
                   ROUTING MODEL=2 CONSTANTS: OVERLAND FTB= 1.2 TLO= 0.0
                   SUBSURFACE: KSS= 5.0 KGW= 384 h PCODE=1 WQPCODE=1
                   RBASIN=0 IDA=0 IDB=0 IDC=0 IDD=0 RBDUMP=0
                   GWFACT=0.00 GWON=0
                   SWQTH=   0.0 L/s SWPUMP=   0.0 L/s SWCODE=0
*
*
* Rooftop Infiltration for 7101, sized with 30mm rainfall, 15% safety factor
* Assume 0.75m depth
* Void ratio 0.35
*
ROUTE SPECIAL POND  ID=5 HYD NO=6101 INFLOW=3 PCODE=0 OPTION= 5
                   Inflow controls:
                       USPCT=100% USDIV=0     PCTA=  0% ADIV=0
                       GWPCT=  0% GWDIV=0
                   Maximum level for Routing Tables:  ZMAX= 100.863
                   Recharge characteristics for Compartment A
                     LEVELA= 100.000                EVAPA= 0.0 mm/d ACODE=0
                     CDA=   0.000 mm/h  DZA= 10.00 m
                   Recharge characteristics for Compartment B
                     LEVELB= 100.000 CCBA= 0.00000  EVAPB= 0.0 mm/d BCODE=1
                     CDB=  15.000 mm/h  DZB= 10.00 m
                   Irrigation Pond Controls: IPOND=0
                   Number of points=  4
                                  Compartment  A          Compartment B
                   Elevation  Outflow Storage  SFArea Outflow Storage SFArea
                      (m)       (cms)  (ha*m)    (ha)   (cms)  (ha*m)    (ha)
                    100.000     0.000  0.0000  0.0000   0.000  0.0000  0.2698
                    100.749     0.000  0.0000  0.0000   0.000  0.0707  0.2698
                    100.750     0.000  0.0000  0.0000   0.001  0.0708  0.2698
                    100.873     0.000  0.0000  0.0000   0.800  0.0814  0.2698
*
* Residential pervious area to ameded top soil
*
COMPUTE FLOWRATE    ID=1 NHD=4101 AREA=  0.02412 Sq km  L=    30 m  W=    14 m
             SOIL ZONE I    II  III    IV    V    VI  VII  VIII   IX
                    0.0   0.0  0.0 100.0  0.0   0.0  0.0   0.0  0.0
                   RATING CURVES: IDMC=1 IDOC=1 QRMC=  0.50 QROC=  0.05
                   ROUTING MODEL=2 CONSTANTS: OVERLAND FTB= 1.2 TLO= 0.0
                   SUBSURFACE: KSS= 5.0 KGW= 384 h PCODE=1 WQPCODE=1
```

```
                    RBASIN=0 IDA=0 IDB=0 IDC=0 IDD=0 RBDUMP=0
                    GWFACT=0.00 GWON=0
                    SWQTH=   0.0 L/s SWPUMP=   0.0 L/s SWCODE=0
*
* Routed through Amended Top Soil (450mm @30% void ratio=135mm vol)
* Foot print = 4101 pervious area
* 15% safty factor
*
ROUTE SPECIAL POND  ID=3 HYD NO=5101 INFLOW=1 PCODE=0 OPTION=15
                    Inflow controls:
                        USPCT=100% USDIV=0     PCTA=  0% ADIV=0
                        GWPCT=  0% GWDIV=0
                    Maximum level for Routing Tables:  ZMAX= 101.069
                    Recharge characteristics for Compartment A
                      LEVELA= 100.000               EVAPA= 0.0 mm/d ACODE=0
                      CDA=   0.000 mm/h  DZA= 10.00 m
                    Recharge characteristics for Compartment B
                      LEVELB= 100.000 CCBA= 0.00000  EVAPB= 0.0 mm/d BCODE=1
                      CDB=   4.000 mm/h  DZB= 10.00 m
                    Irrigation Pond Controls: IPOND=0
                    Number of points=  4
                                 Compartment  A          Compartment B
                    Elevation  Outflow Storage  SFArea Outflow Storage SFArea
                       (m)       (cms)  (ha*m)    (ha)   (cms)  (ha*m)    (ha)
                     100.000     0.000  0.0000  0.0000   0.000  0.0000  2.4116
                     100.059     0.000  0.0000  0.0000   0.000  0.1423  2.4116
                     100.060     0.000  0.0000  0.0000   0.001  0.1447  2.4116
                     100.069     0.000  0.0000  0.0000   0.800  0.1664  2.4116
*
PRINT HYD           ID=3 PCODE=1 MODE=10
*
* Sum hydr. 6101 & 5101 call result 1101
*
ADD HYD             ID=1 HYD NO=1101 IDA=5 IDB=3 ICODE=0                  AREA=     0.0477
PRINT HYD           ID=1 PCODE=1 MODE=10
*
**
* Remainder Area within development area
*
COMPUTE FLOWRATE    ID=5 NHD=8101 AREA=  0.03297 Sq km  L=   450 m  W=   50 m
              SOIL ZONE I    II  III    IV    V    VI  VII  VIII   IX
                    87.6   0.0  0.0  12.4  0.0   0.0  0.0   0.0  0.0
                    RATING CURVES: IDMC=1 IDOC=1 QRMC=  0.50 QROC=  0.05
                    ROUTING MODEL=2 CONSTANTS: OVERLAND FTB= 1.2 TLO= 0.0
                    SUBSURFACE: KSS= 5.0 KGW= 384 h PCODE=1 WQPCODE=1
                    RBASIN=0 IDA=0 IDB=0 IDC=0 IDD=0 RBDUMP=0
                    GWFACT=0.00 GWON=0
                    SWQTH=   0.0 L/s SWPUMP=   0.0 L/s SWCODE=0
*
*
* Sum hydr. 1101 & 8101 call result 2101
*
ADD HYD             ID=6 HYD NO=2101 IDA=1 IDB=5 ICODE=0                  AREA=     0.0807
*
PRINT HYD           ID=6 PCODE=1 MODE=10
*
* Exisitng development area
*
COMPUTE FLOWRATE    ID=3 NHD=9101 AREA=  0.02393 Sq km  L=   450 m  W=   50 m
              SOIL ZONE I    II  III    IV    V    VI  VII  VIII   IX
                    42.5   0.0  0.0  57.5  0.0   0.0  0.0   0.0  0.0
                    RATING CURVES: IDMC=1 IDOC=1 QRMC=  0.50 QROC=  0.05
                    ROUTING MODEL=2 CONSTANTS: OVERLAND FTB= 1.2 TLO= 0.0
                    SUBSURFACE: KSS= 5.0 KGW= 384 h PCODE=1 WQPCODE=1
```



```
                    RBASIN=0 IDA=0 IDB=0 IDC=0 IDD=0 RBDUMP=0
                    GWFACT=0.00 GWON=0
                    SWQTH=   0.0 L/s SWPUMP=   0.0 L/s SWCODE=0
*
* Sum hydr. 2101 & 9101 call result 2101
*
ADD HYD             ID=4 HYD NO=3101 IDA=6 IDB=3 ICODE=0                  AREA=     0.1047
*
PRINT HYD           ID=4 PCODE=1 MODE=10
*
* Divert 100yr Pre development flow to Mar-view Farm
* Existing Condition Subcatchmetn 3101 (21ha) 100yr Flow 0.7412m3/s
* Portionate flow 0.3693 m3/s(10.46ha) based on proposed development
* Post development 100yr flow 1.1547m3/s
*
DIVERT FLOWS        INFLOW=4  DIVERT=6 HYD NO=1112 PCODE=1 OPTION=4
                    THRUFLO=3 HYD NOB=1111  THROUGHFLOW  DIVERSION
                                             0.7854      0.3693
                   IDFLAG=0 IDSTOR=0 IGWT=0
*
*
* Sum hydr. 2012 & 1111 call result 2013
*
ADD HYD             ID=5 HYD NO=2013 IDA=2 IDB=3 ICODE=0                  AREA=     0.2445
*
*
*   Typical Beaver Creek Road Cross-Section                                      6
*
COMPUTE RATING CURVE ID=2  VS=     8.100   NSEGS=3
                     MIN EL=  199.76   MAX EL=  200.00
                     CHNSLP= 0.02070   FLNSLP= 0.02070
                     N= 0.015  DIST=    4.39
                     N=-0.015  DIST=   15.61
                     N= 0.015  DIST=   20.00
                       DIST    ELEV     DIST    ELEV     DIST    ELEV
                       0.00  200.00     4.39  199.91     4.40  199.76
                      10.00  199.87    15.60  199.76    15.61  199.91
                      20.00  200.00
                    RFN=0.0000 PCODE=1
*
*
* Flow rout through Beaver Creek Road
*
*ROUTE CHANNEL       ID=5 HYD NO= 171 INFLOW=1 LENGTH=   511 m  SLOPE=0.0207
*                    RCID=2 NS=1 PCODE=1 INDEX=1 PIPE=0 CANOPY=  0.0
*
*==============================Northgate=======================================
*
* Compute runoff hydrograph from area 7102
* VS=   8.000 is main channel & VS=   8.000 is off-channel
*
* Res., Mix, Pump Station Roof to Roof Infiltration Gallery,
*
COMPUTE FLOWRATE    ID=2 NHD=7102 AREA=   0.02491 Sq km  L=    20 m  W=    10 m
              SOIL ZONE I    II  III    IV    V    VI  VII  VIII   IX
                     1.0   0.0  0.0   0.0  0.0   0.0  0.0  99.0  0.0
                    RATING CURVES: IDMC=1 IDOC=1 QRMC=  0.50 QROC=  0.05
                    ROUTING MODEL=2 CONSTANTS: OVERLAND FTB= 1.2 TLO= 0.0
                    SUBSURFACE: KSS= 5.0 KGW= 384 h PCODE=1 WQPCODE=1
                    RBASIN=0 IDA=0 IDB=0 IDC=0 IDD=0 RBDUMP=0
                    GWFACT=0.00 GWON=0
                    SWQTH=   0.0 L/s SWPUMP=   0.0 L/s SWCODE=0
*
* Infiltration Gallery, sized with 30mm rainfall, 1m depth
```

```
* 15% safety factor
* Void ratio 0.35
*
ROUTE SPECIAL POND  ID=1 HYD NO=6102 INFLOW=2 PCODE=0 OPTION= 5
                    Inflow controls:
                        USPCT=100% USDIV=0     PCTA=  0% ADIV=0
                        GWPCT=  0% GWDIV=0
                    Maximum level for Routing Tables:  ZMAX= 101.150
                    Recharge characteristics for Compartment A
                      LEVELA= 100.000               EVAPA= 0.0 mm/d ACODE=0
                      CDA=   0.000 mm/h  DZA= 10.00 m
                    Recharge characteristics for Compartment B
                      LEVELB= 100.000 CCBA= 0.00000  EVAPB= 0.0 mm/d BCODE=1
                      CDB=  15.000 mm/h  DZB= 10.00 m
                    Irrigation Pond Controls: IPOND=0
                    Number of points=  4
                                 Compartment  A          Compartment B
                    Elevation  Outflow Storage  SFArea Outflow Storage SFArea
                       (m)       (cms)  (ha*m)    (ha)   (cms)  (ha*m)    (ha)
                     100.000     0.000  0.0000  0.0000   0.000  0.0000  0.2135
                     100.999     0.000  0.0000  0.0000   0.000  0.0746  0.2135
                     101.000     0.000  0.0000  0.0000   0.001  0.0747  0.2135
                     101.150     0.000  0.0000  0.0000   0.800  0.0859  0.2135
*
*
* Residential,Park and open space pervious area to ameded top soil
*
COMPUTE FLOWRATE    ID=2 NHD=4102 AREA=  0.02816 Sq km  L=    30 m  W=    14 m
              SOIL ZONE I    II  III    IV    V    VI  VII  VIII   IX
                     0.0   0.0  0.0   0.0  0.0 100.0  0.0   0.0  0.0
                    RATING CURVES: IDMC=1 IDOC=1 QRMC=  0.50 QROC=  0.05
                    ROUTING MODEL=2 CONSTANTS: OVERLAND FTB= 1.2 TLO= 0.0
                    SUBSURFACE: KSS= 5.0 KGW= 384 h PCODE=1 WQPCODE=1
                    RBASIN=0 IDA=0 IDB=0 IDC=0 IDD=0 RBDUMP=0
                    GWFACT=0.00 GWON=0
                    SWQTH=   0.0 L/s SWPUMP=   0.0 L/s SWCODE=0
*
PRINT HYD           ID=2 PCODE=1 MODE=10
*
* Routed through Amended Top Soil (450mm @30% void ratio=135mm vol)
* Foot print = 4102 pervious area
* 15% safty factor
*
ROUTE SPECIAL POND  ID=4 HYD NO=5102 INFLOW=2 PCODE=0 OPTION=15
                    Inflow controls:
                        USPCT=100% USDIV=0     PCTA=  0% ADIV=0
                        GWPCT=  0% GWDIV=0
                    Maximum level for Routing Tables:  ZMAX= 101.069
                    Recharge characteristics for Compartment A
                      LEVELA= 100.000               EVAPA= 0.0 mm/d ACODE=0
                      CDA=   0.000 mm/h  DZA= 10.00 m
                    Recharge characteristics for Compartment B
                      LEVELB= 100.000 CCBA= 0.00000  EVAPB= 0.0 mm/d BCODE=1
                      CDB=  15.000 mm/h  DZB= 10.00 m
                    Irrigation Pond Controls: IPOND=0
                    Number of points=  4
                                 Compartment  A          Compartment B
                    Elevation  Outflow Storage  SFArea Outflow Storage SFArea
                       (m)       (cms)  (ha*m)    (ha)   (cms)  (ha*m)    (ha)
                     100.000     0.000  0.0000  0.0000   0.000  0.0000  2.8155
                     100.059     0.000  0.0000  0.0000   0.000  0.1661  2.8155
                     100.060     0.000  0.0000  0.0000   0.001  0.1689  2.8155
                     100.069     0.000  0.0000  0.0000   0.800  0.1943  2.8155
*
```



```
PRINT HYD           ID=4 PCODE=1 MODE=10
*
* Sum hydr. 6102 & 5102 call result 1102
*
ADD HYD             ID=3 HYD NO=1102 IDA=1 IDB=4 ICODE=0                  AREA=     0.0543
PRINT HYD           ID=3 PCODE=1 MODE=10
*
*
* Remainder Area
*
COMPUTE FLOWRATE    ID=2 NHD=8102 AREA=  0.03354 Sq km  L=   450 m  W=   20 m
              SOIL ZONE I    II  III    IV    V    VI  VII  VIII   IX
                     86.8   0.0  0.0   0.0  0.0  13.2  0.0   0.0  0.0
                    RATING CURVES: IDMC=1 IDOC=1 QRMC=  0.50 QROC=  0.05
                    ROUTING MODEL=2 CONSTANTS: OVERLAND FTB= 1.2 TLO= 0.0
                    SUBSURFACE: KSS= 5.0 KGW= 384 h PCODE=1 WQPCODE=1
                    RBASIN=0 IDA=0 IDB=0 IDC=0 IDD=0 RBDUMP=0
                    GWFACT=0.00 GWON=0
                    SWQTH=   0.0 L/s SWPUMP=   0.0 L/s SWCODE=0
*
*
* Sum hydr. 1102 & 8102 call result 3102
*
ADD HYD             ID=4 HYD NO=3102 IDA=3 IDB=2 ICODE=0                  AREA=     0.0885
*
PRINT HYD           ID=4 PCODE=1 MODE=10
*
* Sum hydr. 2013 & 3102 call result 2014
*
ADD HYD             ID=2 HYD NO=2014 IDA=5 IDB=4 ICODE=0                  AREA=
*
PRINT HYD           ID=2 PCODE=1 MODE=10
*
* Beaver Creek Road catchment 3018a
*
COMPUTE FLOWRATE    ID=3 NHD=3181 AREA=   0.02131 Sq km  L=   570 m  W=    20 m
              SOIL ZONE I    II  III    IV    V    VI  VII  VIII   IX
                     75.0  0.0  0.0   1.2  0.0   23.8  0.0   0.0  0.0
                    RATING CURVES: IDMC=1 IDOC=1 QRMC=  0.50 QROC=  0.05
                    ROUTING MODEL=2 CONSTANTS: OVERLAND FTB= 1.2 TLO= 0.0
                    SUBSURFACE: KSS= 5.0 KGW= 384 h PCODE=1 WQPCODE=1
                    RBASIN=0 IDA=0 IDB=0 IDC=0 IDD=0 RBDUMP=0
                    GWFACT=0.00 GWON=0
                    SWQTH=   0.0 L/s SWPUMP=   0.0 L/s SWCODE=0
*
PRINT HYD           ID=3 PCODE=1 MODE=10
*
* Sum hydr. 2014 & 3181 call result 2015
*
ADD HYD             ID=1 HYD NO=2015 IDA=2 IDB=3 ICODE=0                  AREA=
*
PRINT HYD           ID=1 PCODE=1 MODE=10
*
*
*================================MarView=============================================
*
* Conservation Drive Catchment 3108b
*
COMPUTE FLOWRATE    ID=3 NHD=3182 AREA=   0.01403 Sq km  L=    20 m  W=   223 m
              SOIL ZONE I    II  III    IV    V    VI  VII  VIII   IX
                     75.0  0.0  0.0  19.4  0.0   5.6  0.0   0.0  0.0
                    RATING CURVES: IDMC=1 IDOC=1 QRMC=  0.50 QROC=  0.05
                    ROUTING MODEL=2 CONSTANTS: OVERLAND FTB= 1.2 TLO= 0.0
                    SUBSURFACE: KSS= 5.0 KGW= 384 h PCODE=1 WQPCODE=1
```

```
                    RBASIN=0 IDA=0 IDB=0 IDC=0 IDD=0 RBDUMP=0
                    GWFACT=0.00 GWON=0
                    SWQTH=   0.0 L/s SWPUMP=   0.0 L/s SWCODE=0
*
PRINT HYD           ID=3 PCODE=1 MODE=10
*
*
*  Main channel Parabolic Swale - Flat                                  7
*
COMPUTE RATING CURVE ID=6  VS=     7.000   NSEGS=3
                     MIN EL=  100.70   MAX EL=  103.00
                     CHNSLP= 0.01000   FLNSLP= 0.01000
                     N= 0.070  DIST=   20.00
                     N=-0.050  DIST=   30.00
                     N= 0.070  DIST=   50.00
                       DIST    ELEV     DIST    ELEV     DIST    ELEV
                       0.00  103.00    20.00  101.00    23.00  100.80
                      25.00  100.70    27.00  100.80    30.00  101.00
                      50.00  103.00
                    RFN=0.0000 PCODE=1
*
*  Typical off-channel (Steep areas)                                    6
*
COMPUTE RATING CURVE ID=5  VS=     1.000   NSEGS=3
                     MIN EL=  100.00   MAX EL=  100.80
                     CHNSLP= 0.01500   FLNSLP= 0.01500
                     N= 0.350  DIST=   24.45
                     N=-0.150  DIST=   25.50
                     N= 0.350  DIST=   50.00
                       DIST    ELEV     DIST    ELEV     DIST    ELEV
                       0.00  100.80    24.45  100.30    24.75  100.00
                      25.25  100.00    25.50  100.30    50.00  100.80
                    RFN=0.0000 PCODE=1
*
* Compute runoff hydrograph from area 3104
* VS=   7.000 is main channel & VS=   1.000 is off-channel
*
COMPUTE FLOWRATE    ID=4 NHD=3104 AREA=   0.0472 Sq km  L=   200 m  W=   150 m
              SOIL ZONE I    II  III    IV    V    VI  VII  VIII   IX
                     10.0   0.0  0.0  23.0 67.0   0.0  0.0   0.0  0.0
                    RATING CURVES: IDMC=6 IDOC=5 QRMC=  0.50 QROC=  0.05
                    ROUTING MODEL=2 CONSTANTS: OVERLAND FTB= 1.2 TLO= 0.0
                    SUBSURFACE: KSS= 5.0 KGW= 384 h PCODE=1 WQPCODE=1
                    RBASIN=0 IDA=0 IDB=0 IDC=0 IDD=0 RBDUMP=0
                    GWFACT=0.00 GWON=0
                    SWQTH=   0.0 L/s SWPUMP=   0.0 L/s SWCODE=0
*
PRINT HYD           ID=4 PCODE=1 MODE=10
*
* Sum hydr. 3182 & 3104 call result 2016
*
ADD HYD             ID=5 HYD NO=2016 IDA=3 IDB=4 ICODE=0                 AREA=
*
PRINT HYD           ID=5 PCODE=1 MODE=10
*
* Sum hydr. 1112 & 2016 call result 2017
*
ADD HYD             ID=4 HYD NO=2017 IDA=5 IDB=6 ICODE=0                 AREA=
*
PRINT HYD           ID=4 PCODE=1 MODE=10
*
* Compute runoff hydrograph from area 7106
* VS=   8.000 is main channel & VS=   8.000 is off-channel
* Roof area (total 16% of 3106) to infiltration gallery
```



```
*
COMPUTE FLOWRATE    ID=2 NHD=7106 AREA=   0.04811 Sq km  L=    20 m  W=    10 m
              SOIL ZONE I    II  III    IV    V    VI  VII  VIII   IX
                     1.0   0.0  0.0   0.0  0.0   0.0  0.0  99.0  0.0
                    RATING CURVES: IDMC=1 IDOC=1 QRMC=  0.50 QROC=  0.05
                    ROUTING MODEL=2 CONSTANTS: OVERLAND FTB= 1.2 TLO= 0.0
                    SUBSURFACE: KSS= 5.0 KGW= 384 h PCODE=1 WQPCODE=1
                    RBASIN=0 IDA=0 IDB=0 IDC=0 IDD=0 RBDUMP=0
                    GWFACT=0.00 GWON=0
                    SWQTH=   0.0 L/s SWPUMP=   0.0 L/s SWCODE=0
*
* Rooftop Infiltration for 7106  25mm
*
ROUTE SPECIAL POND  ID=3 HYD NO=6106 INFLOW=2 PCODE=0 OPTION= 5
                    Inflow controls:
                        USPCT=100% USDIV=0     PCTA=  0% ADIV=0
                        GWPCT=  0% GWDIV=0
                    Maximum level for Routing Tables:  ZMAX= 101.300
                    Recharge characteristics for Compartment A
                      LEVELA= 100.000               EVAPA= 0.0 mm/d ACODE=0
                      CDA=   0.000 mm/h  DZA= 10.00 m
                    Recharge characteristics for Compartment B
                      LEVELB= 100.000 CCBA= 0.00000  EVAPB= 0.0 mm/d BCODE=1
                      CDB=  15.000 mm/h  DZB= 10.00 m
                    Irrigation Pond Controls: IPOND=0
                    Number of points=  5
                                  Compartment  A          Compartment B
                    Elevation  Outflow Storage  SFArea Outflow Storage SFArea
                       (m)       (cms)  (ha*m)    (ha)   (cms)  (ha*m)    (ha)
                     100.000     0.000  0.0000  0.0000   0.000  0.0000  0.1203
                     100.999     0.000  0.0000  0.0000   0.000  0.1202  0.1203
                     101.000     0.000  0.0000  0.0000   0.001  0.1203  0.1203
                     101.200     0.000  0.0000  0.0000   0.950  0.1443  0.1203
                     101.300     0.000  0.0000  0.0000   1.050  0.1563  0.1203
*
*
* Compute runoff hydrograph from area 8106
* VS=   8.000 is main channel & VS=   8.000 is off-channel
* Remainder Area
*
COMPUTE FLOWRATE    ID=2 NHD=8106 AREA=   0.25256 Sq km  L=   450 m  W=    50 m
              SOIL ZONE I    II  III    IV    V    VI  VII  VIII   IX
                     46.4   0.0  0.0  41.7  0.0  11.9  0.0   0.0  0.0
                    RATING CURVES: IDMC=1 IDOC=1 QRMC=  0.50 QROC=  0.05
                    ROUTING MODEL=2 CONSTANTS: OVERLAND FTB= 1.2 TLO= 0.0
                    SUBSURFACE: KSS= 5.0 KGW= 384 h PCODE=1 WQPCODE=1
                    RBASIN=0 IDA=0 IDB=0 IDC=0 IDD=0 RBDUMP=0
                    GWFACT=0.00 GWON=0
                    SWQTH=   0.0 L/s SWPUMP=   0.0 L/s SWCODE=0
*
* Sum hydr. 6106 & 8106 call result 3106
*
ADD HYD             ID=5 HYD NO=3106 IDA=3 IDB=2 ICODE=0                 AREA=     0.3023
*
PRINT HYD           ID=5 PCODE=1 MODE=10
*
* Sum hydr. 2017 & 3106 call result 2018
*
ADD HYD             ID=2 HYD NO=2018 IDA=4 IDB=5 ICODE=0                 AREA=     0.3635
*
PRINT HYD           ID=2 PCODE=1 MODE=10
*
* 4106 End-of-Pipe Infiltration
*
```

```
ROUTE SPECIAL POND  ID=3 HYD NO=4106 INFLOW=2 PCODE=0 OPTION=15
                    Inflow controls:
                        USPCT=100% USDIV=0     PCTA=  0% ADIV=0
                        GWPCT=  0% GWDIV=0
                    Maximum level for Routing Tables:  ZMAX= 200.300
                    Recharge characteristics for Compartment A
                      LEVELA= 198.340               EVAPA= 0.0 mm/d ACODE=0
                      CDA=   0.000 mm/h  DZA= 10.00 m
                    Recharge characteristics for Compartment B
                      LEVELB= 198.340 CCBA= 0.00000  EVAPB= 0.0 mm/d BCODE=1
                      CDB=  15.000 mm/h  DZB= 10.00 m
                    Irrigation Pond Controls: IPOND=0
                    Number of points=  6
                                  Compartment  A          Compartment B
                    Elevation  Outflow Storage  SFArea Outflow Storage SFArea
                       (m)       (cms)  (ha*m)    (ha)   (cms)  (ha*m)    (ha)
                     199.800     0.000  0.0000  0.0000   0.000  0.0000  0.0902
                     199.990     0.000  0.0000  0.0000   0.000  0.1502  0.0902
                     200.010     0.000  0.0000  0.0000   0.001  0.1503  0.0902
                     200.100     0.000  0.0000  0.0000   0.400  0.1614  0.0902
                     200.200     0.000  0.0000  0.0000   1.000  0.1660  0.0902
                     200.300     0.000  0.0000  0.0000   2.000  0.1688  0.0902
*
KEEP HYD            ID=3 CUTOFF=0 ICODE=5 ISTEP=1 IFORM=0 IDB=2 IMET=0
PRINT HYD           ID=3 PCODE=1 MODE=10
*
*
*-------------------------------------------------------------------------------
* Divert 5yr flow from Cook/Mattamy 0.734cms, Northgate 0.470cms,Beaver Creek Rd 0.125cms
* Activa Post-Pre 100yr flow 0.785cms, total 2.114cms throughflow into storm sewer
*
DIVERT FLOWS        INFLOW=1  DIVERT=5 HYD NO=1113 PCODE=1 OPTION=4
                    THRUFLO=6 HYD NOB=1114  THROUGHFLOW  DIVERSION
                                             2.1140      5.0000
                   IDFLAG=0 IDSTOR=0 IGWT=0
*
* Divert 25mm event throughflow into SWMC1
*
DIVERT FLOWS        INFLOW=6  DIVERT=1 HYD NO= 116 PCODE=1 OPTION=4
                    THRUFLO=2 HYD NOB= 216  THROUGHFLOW  DIVERSION
                                            0.8423      0.0000
                                            0.8719      0.0364
                                            0.9639      0.3287
                                            1.0479      0.7735
                                            1.0543      0.8142
                                            1.1256      1.3294
                                            1.1983      1.9773
                                            1.2668      2.7057
                                            1.3318      3.5066
                   IDFLAG=0 IDSTOR=0 IGWT=0
*
*
* SWMF Cell1 Area 3183
*
COMPUTE FLOWRATE    ID=6 NHD=3183 AREA=   0.00872 Sq km  L=  100 m  W=   100 m
              SOIL ZONE I    II  III    IV    V    VI  VII  VIII   IX
                     70.1  0.0  0.0   0.0  0.0   29.9  0.0   0.0  0.0
                    RATING CURVES: IDMC=1 IDOC=1 QRMC=  0.50 QROC=  0.05
                    ROUTING MODEL=2 CONSTANTS: OVERLAND FTB= 1.2 TLO= 0.0
                    SUBSURFACE: KSS= 5.0 KGW= 384 h PCODE=1 WQPCODE=1
                    RBASIN=0 IDA=0 IDB=0 IDC=0 IDD=0 RBDUMP=0
                    GWFACT=0.00 GWON=0
                    SWQTH=   0.0 L/s SWPUMP=   0.0 L/s SWCODE=0
*
```



```
* Sum hydr. 216 & 3183 call result 2022
*
ADD HYD             ID=4 HYD NO=2022 IDA=2 IDB=6 ICODE=0                  AREA=
*
PRINT HYD           ID=4 PCODE=1 MODE=10
*
* North Waterloo Community SWMC1 (@catchment 3106) west of Hydro Easement
* Quality Control
*
ROUTE SPECIAL POND  ID=2 HYD NO=1106 INFLOW=4 PCODE=0 OPTION= 5
                    Inflow controls:
                        USPCT=100% USDIV=0     PCTA=  0% ADIV=0
                        GWPCT=  0% GWDIV=0
                    Maximum level for Routing Tables:  ZMAX= 348.30
                    Recharge characteristics for Compartment A
                      LEVELA= 347.200               EVAPA= 1.4 mm/d ACODE=0
                      CDA=   0.000 mm/h  DZA= 10.00 m
                    Recharge characteristics for Compartment B
                      LEVELB= 347.200 CCBA= 0.00000  EVAPB= 1.4 mm/d BCODE=0
                      CDB=   0.000 mm/h  DZB= 10.00 m
                    Irrigation Pond Controls: IPOND=0
                    Number of points=  17
                                  Compartment  A          Compartment B
                    Elevation  Outflow Storage  SFArea Outflow Storage SFArea
                       (m)       (cms)  (ha*m)    (ha)   (cms)  (ha*m)    (ha)
                     347.200     0.000  0.0000  0.0000  0.0000  0.0000  0.5375
                     347.201     0.000  0.0000  0.0000  0.0080  0.0000  0.5375
                     347.250     0.000  0.0000  0.0000  0.0082  0.0274  0.5582
                     347.300     0.000  0.0000  0.0000  0.0083  0.0548  0.5793
                     347.400     0.000  0.0000  0.0000  0.0164  0.1117  0.5901
                     347.450     0.000  0.0000  0.0000  0.0222  0.1409  0.5955
                     347.500     0.000  0.0000  0.0000  0.0263  0.1707  0.6009
                     347.600     0.000  0.0000  0.0000  0.0325  0.2319  0.6230
                     347.650     0.000  0.0000  0.0000  0.1935  0.2636  0.6343
                     347.700     0.000  0.0000  0.0000  0.4857  0.2953  0.6456
                     347.800     0.000  0.0000  0.0000  1.3095  0.3610  0.6686
                     347.850     0.000  0.0000  0.0000  1.9825  0.3948  0.6769
                     347.900     0.000  0.0000  0.0000  2.8527  0.4287  0.6853
                     348.000     0.000  0.0000  0.0000  5.0188  0.4981  0.7023
                     348.100     0.000  0.0000  0.0000  7.6643  0.5690  0.7154
                     348.200     0.000  0.0000  0.0000 10.7366  0.6411  0.7285
                     348.300     0.000  0.0000  0.0000 14.2059  0.7147  0.7418
*
*
*
DIVERT FLOWS        INFLOW=2  DIVERT=4 HYD NO=1115 PCODE=1 OPTION=4
                    THRUFLO=6 HYD NOB=1116  THROUGHFLOW  DIVERSION
                                            0.0080      0.0000
                                            0.0082      0.0000
                                            0.0083      0.0000
                                            0.0086      0.0078
                                            0.0087      0.0135
                                            0.0088      0.0174
                                            0.0091      0.0234
                                            0.0092      0.1843
                                            0.0093      0.4763
                                            0.0095      1.2999
                                            0.1767      1.8058
                                            0.4879      2.3648
                                            1.3940      3.6248
                                            5.8572      8.3487
                   IDFLAG=0 IDSTOR=0 IGWT=0
*
*
```

```
PRINT HYD           ID=6 PCODE=1 MODE=10
KEEP HYD            ID=6 CUTOFF=0 ICODE=0 ISTEP=1 IFORM=0 IDB=3 IMET=1
*
* Sum hydr. 1115 & 116 call result 1117
*
ADD HYD             ID=2 HYD NO=1117 IDA=4 IDB=1 ICODE=0                  AREA=
*
* Sum hydr. 1113 & 1117 call result 1118
*
ADD HYD             ID=1 HYD NO=1118 IDA=5 IDB=2 ICODE=0                  AREA=
*
* Divert 25mm event throughflow into SWMC2
*
DIVERT FLOWS        INFLOW=3  DIVERT=5 HYD NO= 416 PCODE=1 OPTION=4
                    THRUFLO=4 HYD NOB= 316  THROUGHFLOW  DIVERSION
                                          0.8553      0.0000
                                          0.9218      0.1299
                                          1.0093      0.4915
                                          1.0898      0.9838
                                          1.1647      1.5782
                                          1.2351      2.2595
                                          1.3017      3.0178
                                          1.3331      3.4151
                                          1.3650      3.8458
                                          1.4256      4.7382
                  IDFLAG=0 IDSTOR=0 IGWT=0
*
* North Waterloo Community SWMC2 (@catchment 3106) east of Hydro Easement
* Quality Control
*
ROUTE SPECIAL POND  ID=3 HYD NO=5106 INFLOW=4 PCODE=0 OPTION= 5
                    Inflow controls:
                        USPCT=100% USDIV=0     PCTA=  0% ADIV=0
                        GWPCT=  0% GWDIV=0
                    Maximum level for Routing Tables:  ZMAX= 348.500
                    Recharge characteristics for Compartment A
                      LEVELA= 347.400               EVAPA= 1.4 mm/d ACODE=0
                      CDA=   0.000 mm/h  DZA= 10.00 m
                    Recharge characteristics for Compartment B
                      LEVELB= 347.400 CCBA= 0.00000  EVAPB= 1.4 mm/d BCODE=0
                      CDB=   0.000 mm/h  DZB= 10.00 m
                    Irrigation Pond Controls: IPOND=0
                    Number of points= 17
                                  Compartment  A          Compartment B
                    Elevation  Outflow Storage  SFArea Outflow Storage SFArea
                       (m)       (cms)  (ha*m)    (ha)   (cms)  (ha*m)    (ha)
                     347.400     0.000  0.0000  0.0000  0.0000  0.0000  0.6693
                     347.401     0.000  0.0000  0.0000  0.0080  0.0000  0.6693
                     347.450     0.000  0.0000  0.0000  0.0082  0.0340  0.6806
                     347.500     0.000  0.0000  0.0000  0.0083  0.0681  0.6918
                     347.600     0.000  0.0000  0.0000  0.0164  0.1384  0.7147
                     347.650     0.000  0.0000  0.0000  0.0222  0.1744  0.7264
                     347.700     0.000  0.0000  0.0000  0.0263  0.2110  0.7381
                     347.800     0.000  0.0000  0.0000  0.0325  0.2860  0.7619
                     347.850     0.000  0.0000  0.0000  0.0351  0.3247  0.7740
                     347.900     0.000  0.0000  0.0000  0.1111  0.3634  0.7861
                     348.000     0.000  0.0000  0.0000  0.7061  0.4433  0.8108
                     348.050     0.000  0.0000  0.0000  1.2932  0.4843  0.8291
                     348.100     0.000  0.0000  0.0000  2.0871  0.5253  0.8291
                     348.200     0.000  0.0000  0.0000  4.1200  0.6091  0.8475
                     348.300     0.000  0.0000  0.0000  6.6497  0.6948  0.8661
                     348.400     0.000  0.0000  0.0000  9.6181  0.7823  0.8850
                     348.500     0.000  0.0000  0.0000 12.9924  0.8718  0.9034
*
```



```
*
*
DIVERT FLOWS        INFLOW=3  DIVERT=4 HYD NO=1120 PCODE=1 OPTION=4
                    THRUFLO=2 HYD NOB=1119  THROUGHFLOW  DIVERSION
                                          0.0080      0.0000
                                          0.0082      0.0000
                                          0.0083      0.0000
                                          0.0086      0.0078
                                          0.0087      0.0135
                                          0.0088      0.0174
                                          0.0091      0.0234
                                          0.0092      0.0259
                                          0.0093      0.1018
                                          0.0095      0.6965
                                          0.1767      1.1164
                                          0.4879      1.5992
                                          1.3940      2.7260
                                          5.8572      7.1352
                  IDFLAG=0 IDSTOR=0 IGWT=0
*
PRINT HYD           ID=2 PCODE=1 MODE=10
KEEP HYD            ID=2 CUTOFF=0 ICODE=0 ISTEP=1 IFORM=0 IDB=3 IMET=1
*
* Sum hydr. 416 & 1120 call result 1121
*
ADD HYD             ID=3 HYD NO=1121 IDA=5 IDB=4 ICODE=0                  AREA=
*
* Total flow from SWMFs to Laurel Creek Reservoir Tributary (non-winter)
* Sum hydr. 1116 & 1119 call result 516
*
ADD HYD             ID=4 HYD NO=516  IDA=6 IDB=2 ICODE=0                  AREA=
PRINT HYD           ID=4 PCODE=1 MODE=10
NEW DUMP OUTPUT     MODE=10 ID=4 IOPT=4 FTYPE=0
*
* Uncontrolled Green Area to LCRT
* Compute runoff hydrograph from area 3141
* VS=   7.000 is main channel & VS=   1.000 is off-channel
*
COMPUTE FLOWRATE    ID=2 NHD=3141 AREA=   0.01129 Sq km  L=   100 m  W=    60 m
              SOIL ZONE I    II  III    IV    V    VI  VII  VIII   IX
                     0.0   0.0  0.0   0.0 46.7   0.0 53.3   0.0  0.0
                    RATING CURVES: IDMC=6 IDOC=5 QRMC=  0.50 QROC=  0.05
                    ROUTING MODEL=2 CONSTANTS: OVERLAND FTB= 1.2 TLO= 0.0
                    SUBSURFACE: KSS= 5.0 KGW= 384 h PCODE=1 WQPCODE=1
                    RBASIN=0 IDA=0 IDB=0 IDC=0 IDD=0 RBDUMP=0
                    GWFACT=0.00 GWON=0
                    SWQTH=   0.0 L/s SWPUMP=   0.0 L/s SWCODE=0
*
PRINT HYD           ID=2 PCODE=1 MODE=10
*
*
* Total flow to Laurel Creek Reservoir Tributary
* Sum hydr. 516 & 3141 call result 616
*
ADD HYD             ID=6 HYD NO=616  IDA=4 IDB=2 ICODE=0                  AREA=
*
PRINT HYD           ID=6 PCODE=1 MODE=10
NEW DUMP OUTPUT     MODE=10 ID=6 IOPT=4 FTYPE=0
*
*
* Total flow from SWMC1 & SWMC2 to Reservoir through bypass channel
*
* Sum hydr. 1118 & 1121 call result 716
*
```

```
ADD HYD             ID=2 HYD NO=716  IDA=1 IDB=3 ICODE=0                 AREA=
PRINT HYD           ID=2 PCODE=1 MODE=10
*
* Total flow to Laurel Creek Reservoir
*
* Sum hydr. 616 & 716 call result 2019
*
ADD HYD             ID=5 HYD NO=2019  IDA=6 IDB=2 ICODE=0                 AREA=
PRINT HYD           ID=5 PCODE=1 MODE=10
*
* Go to event file
*
CHANGE INPUT FILE
*
FINISH
```

```
  1  301    2.6500      1.75    0.0212          0. RCFLAGS    0    0 25MM.dat
  1  111    2.6500      1.73    0.0207          0. RCFLAGS    0    0
  1  381    3.3100      1.78    0.0292          0. RCFLAGS    0    0
  1  281    5.9600      1.76    0.0479          0. RCFLAGS    0    0
  1  581    5.9600      1.66    0.0355        659. RCFLAGS    0    0
  1  121    5.9600      1.66    0.0355          0. RCFLAGS    0    0
  1 3916    0.0260      3.50    0.0017          0. RCFLAGS    0    0
  1 3919    0.1360      3.48    0.0070          0. RCFLAGS    0    0
  1 2000    0.1620      3.48    0.0087          0. RCFLAGS    0    0
  1 3910    0.1730      3.31    0.0070          0. RCFLAGS    0    0
  1 2001    0.3350      3.40    0.0157          0. RCFLAGS    0    0
  1 7912    0.0261     23.59    0.1518          0. RCFLAGS    0    0
  1 6912    0.0261      0.00    0.0000        584. RCFLAGS    0    0
  1 8912    0.1372     12.52    0.3666          0. RCFLAGS    0    0
  1 3912    0.1633     10.52    0.3666          0. RCFLAGS    0    0
  1 1912    0.1633      3.79    0.1374        914. RCFLAGS    0    0
  1 5912    0.1633      3.75    0.0122        558. RCFLAGS    0    0
  1 2002    0.4983      3.51    0.0157          0. RCFLAGS    0    0
  1 7913    0.0186     23.59    0.1082          0. RCFLAGS    0    0
  1 6913    0.0186      0.00    0.0000        416. RCFLAGS    0    0
  1 8913    0.0976     12.49    0.2608          0. RCFLAGS    0    0
  1 3913    0.1162     10.49    0.2608          0. RCFLAGS    0    0
  1 1913    0.1162      3.79    0.1036        637. RCFLAGS    0    0
  1 5913    0.1162      3.73    0.0093        395. RCFLAGS    0    0
  1 2003    0.6145      3.55    0.0230          0. RCFLAGS    0    0
  1 2004    6.5745      1.84    0.0475          0. RCFLAGS    0    0
  1 3920    0.0145     18.16    0.0570          0. RCFLAGS    0    0
  1 2020    6.5889      1.87    0.0730          0. RCFLAGS    0    0
  1  131    6.5889      1.87    0.0659          0. RCFLAGS    0    0
  1 7914    0.0347     23.60    0.5347          0. RCFLAGS    0    0
  1 6914    0.0347      0.00    0.0000        785. RCFLAGS    0    0
178914    0.0241      3.31    0.0003          0. RCFLAGS    0    0
  1  914    0.0241      0.00    0.0000         13. RCFLAGS    0    0
  1 1914    0.0588      0.00    0.0000          0. RCFLAGS    0    0
185914    0.0055      3.31    0.0001          0. RCFLAGS    0    0
  1  314    0.0055      0.00    0.0000          3. RCFLAGS    0    0
186914    0.0600     17.92    0.2548          0. RCFLAGS    0    0
  1 8914    0.0655     16.40    0.2548          0. RCFLAGS    0    0
  1 3914    0.1243      8.64    0.2548          0. RCFLAGS    0    0
  1 5914    0.1243      7.08    0.0039        971. RCFLAGS    0    0
  1 9141    0.0127     10.64    0.0725          0. RCFLAGS    0    0
  1 9142    0.0056      8.51    0.0085          0. RCFLAGS    0    0
  1 4914    0.0183      9.98    0.0783          0. RCFLAGS    0    0
  1 2914    0.1426      7.45    0.0789          0. RCFLAGS    0    0
  1 7915    0.0010     23.60    0.0157          0. RCFLAGS    0    0
  1 6915    0.0010      0.00    0.0000         20. RCFLAGS    0    0
  1 8915    0.0079     12.48    0.0291          0. RCFLAGS    0    0 25MM.dat
  1 3915    0.0089     11.05    0.0291          0. RCFLAGS    0    0
  1 5915    0.0089      3.15    0.0010         79. RCFLAGS    0    0
  1 9151    0.0018     23.60    0.0277          0. RCFLAGS    0    0
  1 9152    0.0049      3.31    0.0001          0. RCFLAGS    0    0
  1 4915    0.0067      8.80    0.0277          0. RCFLAGS    0    0
  1 2915    0.0155      5.57    0.0277          0. RCFLAGS    0    0
  1 2005    0.1582      7.26    0.1067          0. RCFLAGS    0    0
  1 1911    0.1935      3.67    0.0085          0. RCFLAGS    0    0
  1 2911    0.0096      3.64    0.0008          0. RCFLAGS    0    0
  1 3911    0.2031      3.66    0.0092          0. RCFLAGS    0    0
  1 2006    0.3612      5.24    0.1111          0. RCFLAGS    0    0
  1 7917    0.0031     23.60    0.0470          0. RCFLAGS    0    0
  1 6917    0.0031      0.00    0.0000         64. RCFLAGS    0    0
  1 8917    0.0097     14.82    0.0819          0. RCFLAGS    0    0
  1 3917    0.0127     11.27    0.0819          0. RCFLAGS    0    0
  1 5917    0.0127      2.80    0.0004        122. RCFLAGS    0    0
  1 9171    0.0081      5.01    0.0025          0. RCFLAGS    0    0
```



```
  1 9172    0.0041     12.75    0.0275          0. RCFLAGS    0    0
  1 4917    0.0121      7.62    0.0295          0. RCFLAGS    0    0
  1 2917    0.0248      5.15    0.0295          0. RCFLAGS    0    0
  1 2007    0.3861      5.23    0.1405          0. RCFLAGS    0    0
  1 3918    0.0057      3.09    0.0004          0. RCFLAGS    0    0
  1 2008    0.3917      5.20    0.1408          0. RCFLAGS    0    0
  1 2009    6.9806      2.05    0.1496          0. RCFLAGS    0    0
  1 3092    0.0402      7.27    0.0094          0. RCFLAGS    0    0
  1 3093    0.0058      3.12    0.0004          0. RCFLAGS    0    0
  1 2010    0.0459      6.75    0.0097          0. RCFLAGS    0    0
  1 9173    0.0029      4.63    0.0007          0. RCFLAGS    0    0
  1 2021    0.0488      6.63    0.0098          0. RCFLAGS    0    0
199141    0.0014     23.60    0.0208          0. RCFLAGS    0    0
  1  514    0.0014      0.00    0.0000         31. RCFLAGS    0    0
199142    0.0152      8.80    0.0649          0. RCFLAGS    0    0
  1  614    0.0152      0.00    0.0000         80. RCFLAGS    0    0
199143    0.0166      0.00    0.0000          0. RCFLAGS    0    0
199145    0.0040     16.53    0.0416          0. RCFLAGS    0    0
  1 9914    0.0206      3.24    0.0416          0. RCFLAGS    0    0
  1 2011    0.0694      5.62    0.0433          0. RCFLAGS    0    0
  1 3103    0.0050      3.29    0.0008          0. RCFLAGS    0    0
  1 2111    0.0744      5.47    0.0441          0. RCFLAGS    0    0
  1 3105    0.0361      3.54    0.0021          0. RCFLAGS    0    0
  1 7107    0.0334     23.60    0.5153          0. RCFLAGS    0    0
  1 6107    0.0334      0.00    0.0000        704. RCFLAGS    0    0
  1 4107    0.0271      3.31    0.0004          0. RCFLAGS    0    0
  1 5107    0.0271      0.00    0.0000          5. RCFLAGS    0    0
  1 1107    0.0605      0.00    0.0000          0. RCFLAGS    0    0
  1 8107    0.0519     19.87    0.2503          0. RCFLAGS    0    0 25MM.dat
  1 3107    0.1125      9.18    0.2503          0. RCFLAGS    0    0
  1 2012    0.1486      7.81    0.2524          0. RCFLAGS    0    0
  1 7101    0.0236     23.60    0.3639          0. RCFLAGS    0    0
  1 6101    0.0236      0.00    0.0000        482. RCFLAGS    0    0
  1 4101    0.0241      3.37    0.0003          0. RCFLAGS    0    0
  1 5101    0.0241      0.00    0.0000         16. RCFLAGS    0    0
  1 1101    0.0477      0.00    0.0000          0. RCFLAGS    0    0
  1 8101    0.0330     20.65    0.1663          0. RCFLAGS    0    0
  1 2101    0.0807      8.44    0.1663          0. RCFLAGS    0    0
  1 9101    0.0239     11.75    0.0586          0. RCFLAGS    0    0
  1 3101    0.1046      9.19    0.2249          0. RCFLAGS    0    0
  1 1111    0.1046      9.19    0.2249          0. RCFLAGS    0    0
  1 1112    0.1046      0.00    0.0000          0. RCFLAGS    0    0
  1 2013    0.2532      8.38    0.4773          0. RCFLAGS    0    0
  1 7102    0.0249     23.60    0.3840          0. RCFLAGS    0    0
  1 6102    0.0249      0.00    0.0000        525. RCFLAGS    0    0
  1 4102    0.0282      3.27    0.0004          0. RCFLAGS    0    0
  1 5102    0.0282      0.00    0.0000          5. RCFLAGS    0    0
  1 1102    0.0531      0.00    0.0000          0. RCFLAGS    0    0
  1 8102    0.0335     20.48    0.1739          0. RCFLAGS    0    0
  1 3102    0.0866      7.93    0.1739          0. RCFLAGS    0    0
  1 2014    0.3398      8.27    0.6511          0. RCFLAGS    0    0
  1 3181    0.0213     18.14    0.0830          0. RCFLAGS    0    0
  1 2015    0.3611      8.85    0.7341          0. RCFLAGS    0    0
  1 3182    0.0140     18.16    0.0846          0. RCFLAGS    0    0
  1 3104    0.0472      5.09    0.0340          0. RCFLAGS    0    0
  1 2016    0.0612      8.08    0.1186          0. RCFLAGS    0    0
  1 2017    0.0612      8.08    0.1186          0. RCFLAGS    0    0
  1 7106    0.0481     23.60    0.7416          0. RCFLAGS    0    0
  1 6106    0.0481      0.00    0.0000       1087. RCFLAGS    0    0
  1 8106    0.2526     12.51    0.6749          0. RCFLAGS    0    0
  1 3106    0.3007     10.51    0.6749          0. RCFLAGS    0    0
  1 2018    0.3619     10.10    0.7935          0. RCFLAGS    0    0
  1 4106    0.3619      4.12    0.5443       1625. RCFLAGS    0    0
  1 1114    0.3611      8.85    0.7341          0. RCFLAGS    0    0
```

```
  1 1113    0.3611      0.00    0.0000          0. RCFLAGS    0    0
  1  216    0.3611      8.85    0.7341          0. RCFLAGS    0    0
  1  116    0.3611      0.00    0.0000          0. RCFLAGS    0    0
  1 3183    0.0087     17.16    0.0518          0. RCFLAGS    0    0
  1 2022    0.3698      9.04    0.7859          0. RCFLAGS    0    0
  1 1106    0.3698      8.99    0.1041       2460. RCFLAGS    0    0
  1 1116    0.3698      4.71    0.0091          0. RCFLAGS    0    0
  1 1115    0.3698      4.28    0.0950          0. RCFLAGS    0    0
  1 1117    0.3698      4.28    0.0950          0. RCFLAGS    0    0
  1 1118    0.3611      4.38    0.0950          0. RCFLAGS    0    0
  1  316    0.3619      4.12    0.5443          0. RCFLAGS    0    0 25MM.dat
  1  416    0.3619      0.00    0.0000          0. RCFLAGS    0    0
  1 5106    0.3619      4.08    0.0160       1351. RCFLAGS    0    0
  1 1119    0.3619      3.43    0.0086          0. RCFLAGS    0    0
  1 1120    0.3619      0.65    0.0074          0. RCFLAGS    0    0
  1 1121    0.3619      0.65    0.0074          0. RCFLAGS    0    0
  1  516    0.7317      4.08    0.0177          0. RCFLAGS    0    0
  1 3141    0.0113      3.06    0.0001          0. RCFLAGS    0    0
  1  616    0.7430      4.06    0.0177          0. RCFLAGS    0    0
  1  716    0.3611      5.03    0.1001          0. RCFLAGS    0    0
  1 2019    0.7430      6.51    0.1177          0. RCFLAGS    0    0
  2  301    2.6500      4.01    0.0338          0. RCFLAGS    0    0 2.dat
  2  111    2.6500      3.96    0.0326          0. RCFLAGS    0    0
  2  381    3.3100      4.03    0.0462          0. RCFLAGS    0    0
  2  281    5.9600      4.00    0.0758          0. RCFLAGS    0    0
  2  581    5.9600      3.81    0.0714       1221. RCFLAGS    0    0
  2  121    5.9600      3.80    0.0714          0. RCFLAGS    0    0
  2 3916    0.0260      7.95    0.0019          0. RCFLAGS    0    0
  2 3919    0.1360      8.06    0.0079          0. RCFLAGS    0    0
  2 2000    0.1620      8.04    0.0097          0. RCFLAGS    0    0
  2 3910    0.1730      8.08    0.0091          0. RCFLAGS    0    0
  2 2001    0.3350      8.06    0.0183          0. RCFLAGS    0    0
  2 7912    0.0261     46.92    0.1615          0. RCFLAGS    0    0
  2 6912    0.0261     15.72    0.0859        698. RCFLAGS    0    0
  2 8912    0.1372     25.76    0.3940          0. RCFLAGS    0    0
  2 3912    0.1633     24.15    0.3940          0. RCFLAGS    0    0
  2 1912    0.1633     14.87    0.3282       1049. RCFLAGS    0    0
  2 5912    0.1633     14.80    0.0147       1883. RCFLAGS    0    0
  2 2002    0.4983     10.27    0.0287          0. RCFLAGS    0    0
  2 7913    0.0186     46.92    0.1151          0. RCFLAGS    0    0
  2 6913    0.0186     15.80    0.1046        473. RCFLAGS    0    0
  2 8913    0.0976     25.68    0.2803          0. RCFLAGS    0    0
  2 3913    0.1162     24.10    0.2803          0. RCFLAGS    0    0
  2 1913    0.1162     14.88    0.2574        722. RCFLAGS    0    0
  2 5913    0.1162     14.79    0.0120       1305. RCFLAGS    0    0
  2 2003    0.6145     11.13    0.0388          0. RCFLAGS    0    0
  2 2004    6.5745      4.49    0.0828          0. RCFLAGS    0    0
  2 3920    0.0145     36.77    0.0619          0. RCFLAGS    0    0
  2 2020    6.5889      4.56    0.1051          0. RCFLAGS    0    0
  2  131    6.5889      4.55    0.1049          0. RCFLAGS    0    0
  2 7914    0.0347     46.93    0.3516          0. RCFLAGS    0    0
  2 6914    0.0347     10.18    0.0811       1054. RCFLAGS    0    0
278914    0.0241      7.74    0.0006          0. RCFLAGS    0    0
  2  914    0.0241      0.00    0.0000         27. RCFLAGS    0    0
  2 1914    0.0588      6.00    0.0811          0. RCFLAGS    0    0
285914    0.0055      7.74    0.0001          0. RCFLAGS    0    0
  2  314    0.0055      0.00    0.0000          6. RCFLAGS    0    0
286914    0.0600     36.29    0.2738          0. RCFLAGS    0    0
  2 8914    0.0655     33.23    0.2738          0. RCFLAGS    0    0
  2 3914    0.1243     20.35    0.2864          0. RCFLAGS    0    0
  2 5914    0.1243     14.60    0.0057       2119. RCFLAGS    0    0
  2 9141    0.0127     22.06    0.0477          0. RCFLAGS    0    0
  2 9142    0.0056     17.89    0.0092          0. RCFLAGS    0    0
  2 4914    0.0183     20.78    0.0568          0. RCFLAGS    0    0
```



```
  2 2914    0.1426     15.39    0.0600          0. RCFLAGS    0    0
  2 7915    0.0010     46.89    0.0103          0. RCFLAGS    0    0
  2 6915    0.0010      0.06    0.0001         30. RCFLAGS    0    0
  2 8915    0.0079     25.68    0.0370          0. RCFLAGS    0    0 2.dat
  2 3915    0.0089     22.74    0.0370          0. RCFLAGS    0    0
  2 5915    0.0089     14.75    0.0053        110. RCFLAGS    0    0
  2 9151    0.0018     46.89    0.0182          0. RCFLAGS    0    0
  2 9152    0.0049      7.71    0.0001          0. RCFLAGS    0    0
  2 4915    0.0067     18.32    0.0183          0. RCFLAGS    0    0
  2 2915    0.0155     16.28    0.0204          0. RCFLAGS    0    0
  2 2005    0.1582     15.48    0.0804          0. RCFLAGS    0    0
  2 1911    0.1935      8.95    0.0320          0. RCFLAGS    0    0
  2 2911    0.0096      8.77    0.0023          0. RCFLAGS    0    0
  2 3911    0.2031      8.94    0.0344          0. RCFLAGS    0    0
  2 2006    0.3612     11.80    0.0961          0. RCFLAGS    0    0
  2 7917    0.0031     46.93    0.0309          0. RCFLAGS    0    0
  2 6917    0.0031      3.45    0.0046         92. RCFLAGS    0    0
  2 8917    0.0097     30.29    0.0580          0. RCFLAGS    0    0
  2 3917    0.0127     23.85    0.0580          0. RCFLAGS    0    0
  2 5917    0.0127     15.11    0.0029        199. RCFLAGS    0    0
  2 9171    0.0081     10.94    0.0090          0. RCFLAGS    0    0
  2 9172    0.0041     26.24    0.0203          0. RCFLAGS    0    0
  2 4917    0.0121     16.08    0.0293          0. RCFLAGS    0    0
  2 2917    0.0248     15.59    0.0300          0. RCFLAGS    0    0
  2 2007    0.3861     12.05    0.1261          0. RCFLAGS    0    0
  2 3918    0.0057      7.77    0.0015          0. RCFLAGS    0    0
  2 2008    0.3917     11.98    0.1267          0. RCFLAGS    0    0
  2 2009    6.9806      4.97    0.1810          0. RCFLAGS    0    0
  2 3092    0.0402     15.72    0.0413          0. RCFLAGS    0    0
  2 3093    0.0058      7.86    0.0015          0. RCFLAGS    0    0
  2 2010    0.0459     14.73    0.0416          0. RCFLAGS    0    0
  2 9173    0.0029     10.44    0.0028          0. RCFLAGS    0    0
  2 2021    0.0488     14.48    0.0421          0. RCFLAGS    0    0
299141    0.0014     46.93    0.0137          0. RCFLAGS    0    0
  2  514    0.0014     10.51    0.0034         41. RCFLAGS    0    0
299142    0.0152     18.46    0.0427          0. RCFLAGS    0    0
  2  614    0.0152      0.00    0.0000        125. RCFLAGS    0    0
299143    0.0166      0.86    0.0034          0. RCFLAGS    0    0
299145    0.0040     33.56    0.0273          0. RCFLAGS    0    0
  2 9914    0.0206      7.27    0.0273          0. RCFLAGS    0    0
  2 2011    0.0694     12.34    0.0580          0. RCFLAGS    0    0
  2 3103    0.0050      7.83    0.0016          0. RCFLAGS    0    0
  2 2111    0.0744     12.04    0.0585          0. RCFLAGS    0    0
  2 3105    0.0361      8.06    0.0023          0. RCFLAGS    0    0
  2 7107    0.0334     46.93    0.3389          0. RCFLAGS    0    0
  2 6107    0.0334      3.32    0.0406       1010. RCFLAGS    0    0
  2 4107    0.0271      7.72    0.0007          0. RCFLAGS    0    0
  2 5107    0.0271      0.00    0.0000         10. RCFLAGS    0    0
  2 1107    0.0605      1.83    0.0406          0. RCFLAGS    0    0
  2 8107    0.0519     40.12    0.2689          0. RCFLAGS    0    0 2.dat
  2 3107    0.1125     19.51    0.2689          0. RCFLAGS    0    0
  2 2012    0.1486     16.73    0.2712          0. RCFLAGS    0    0
  2 7101    0.0236     46.93    0.2393          0. RCFLAGS    0    0
  2 6101    0.0236      1.77    0.0266        711. RCFLAGS    0    0
  2 4101    0.0241      7.85    0.0006          0. RCFLAGS    0    0
  2 5101    0.0241      0.00    0.0000         33. RCFLAGS    0    0
  2 1101    0.0477      0.87    0.0266          0. RCFLAGS    0    0
  2 8101    0.0330     41.65    0.1787          0. RCFLAGS    0    0
  2 2101    0.0807     17.53    0.1787          0. RCFLAGS    0    0
  2 9101    0.0239     24.24    0.0630          0. RCFLAGS    0    0
  2 3101    0.1046     19.07    0.2417          0. RCFLAGS    0    0
  2 1111    0.1046     19.07    0.2417          0. RCFLAGS    0    0
  2 1112    0.1046      0.00    0.0000          0. RCFLAGS    0    0
  2 2013    0.2532     17.70    0.5129          0. RCFLAGS    0    0
```

```
  2 7102    0.0249     46.93    0.2525         0. RCFLAGS    0    0
  2 6102    0.0249      3.34    0.0302       751. RCFLAGS    0    0
  2 4102    0.0282      7.64    0.0007         0. RCFLAGS    0    0
  2 5102    0.0282      0.00    0.0000        11. RCFLAGS    0    0
  2 1102    0.0531      1.57    0.0302         0. RCFLAGS    0    0
  2 8102    0.0335     41.31    0.1861         0. RCFLAGS    0    0
  2 3102    0.0866     16.96    0.1861         0. RCFLAGS    0    0
  2 2014    0.3398     17.51    0.6990         0. RCFLAGS    0    0
  2 3181    0.0213     36.72    0.0906         0. RCFLAGS    0    0
  2 2015    0.3611     18.64    0.7892         0. RCFLAGS    0    0
  2 3182    0.0140     36.78    0.1067         0. RCFLAGS    0    0
  2 3104    0.0472     11.50    0.0359         0. RCFLAGS    0    0
  2 2016    0.0612     17.29    0.1426         0. RCFLAGS    0    0
  2 2017    0.0612     17.29    0.1426         0. RCFLAGS    0    0
  2 7106    0.0481     46.93    0.4877         0. RCFLAGS    0    0
  2 6106    0.0481     15.84    0.3632      1295. RCFLAGS    0    0
  2 8106    0.2526     25.73    0.7253         0. RCFLAGS    0    0
  2 3106    0.3007     24.15    1.0614         0. RCFLAGS    0    0
  2 2018    0.3619     22.99    1.1117         0. RCFLAGS    0    0
  2 4106    0.3619     14.68    1.0103      1660. RCFLAGS    0    0
  2 1114    0.3611     18.64    0.7892         0. RCFLAGS    0    0
  2 1113    0.3611      0.00    0.0000         0. RCFLAGS    0    0
  2  216    0.3611     18.64    0.7892         0. RCFLAGS    0    0
  2  116    0.3611      0.00    0.0000         0. RCFLAGS    0    0
  2 3183    0.0087     34.83    0.0620         0. RCFLAGS    0    0
  2 2022    0.3698     19.02    0.8512         0. RCFLAGS    0    0
  2 1106    0.3698     18.97    0.4913      2957. RCFLAGS    0    0
  2 1116    0.3698      6.86    0.0093         0. RCFLAGS    0    0
  2 1115    0.3698     12.11    0.4820         0. RCFLAGS    0    0
  2 1117    0.3698     12.11    0.4820         0. RCFLAGS    0    0
  2 1118    0.3611     12.40    0.4820         0. RCFLAGS    0    0
  2  316    0.3619     14.24    0.9078         0. RCFLAGS    0    0 2.dat
  2  416    0.3619      0.45    0.1025         0. RCFLAGS    0    0
  2 5106    0.3619     14.17    0.0721      3436. RCFLAGS    0    0
  2 1119    0.3619      6.32    0.0092         0. RCFLAGS    0    0
  2 1120    0.3619      7.85    0.0629         0. RCFLAGS    0    0
  2 1121    0.3619      8.30    0.1025         0. RCFLAGS    0    0
  2  516    0.7317      6.59    0.0184         0. RCFLAGS    0    0
  2 3141    0.0113      7.71    0.0003         0. RCFLAGS    0    0
  2  616    0.7430      6.61    0.0184         0. RCFLAGS    0    0
  2  716    0.3611     20.71    0.5016         0. RCFLAGS    0    0
  2 2019    0.7430     16.68    0.5198         0. RCFLAGS    0    0
  3  301    2.6500      8.46    0.4342         0. RCFLAGS    0    0 5.dat
  3  111    2.6500      8.43    0.4128         0. RCFLAGS    0    0
  3  381    3.3100      9.95    0.8554         0. RCFLAGS    0    0
  3  281    5.9600      9.27    1.2095         0. RCFLAGS    0    0
  3  581    5.9600      9.04    0.6644      8985. RCFLAGS    0    0
  3  121    5.9600      9.04    0.6641         0. RCFLAGS    0    0
  3 3916    0.0260     12.34    0.0274         0. RCFLAGS    0    0
  3 3919    0.1360     11.68    0.0768         0. RCFLAGS    0    0
  3 2000    0.1620     11.79    0.1043         0. RCFLAGS    0    0
  3 3910    0.1730     12.20    0.0846         0. RCFLAGS    0    0
  3 2001    0.3350     12.00    0.1888         0. RCFLAGS    0    0
  3 7912    0.0261     64.45    0.2220         0. RCFLAGS    0    0
  3 6912    0.0261     33.20    0.1748       743. RCFLAGS    0    0
  3 8912    0.1372     38.30    0.7024         0. RCFLAGS    0    0
  3 3912    0.1633     37.48    0.8094         0. RCFLAGS    0    0
  3 1912    0.1633     27.68    0.7275      1272. RCFLAGS    0    0
  3 5912    0.1633     27.59    0.0948      3111. RCFLAGS    0    0
  3 2002    0.4983     17.11    0.2022         0. RCFLAGS    0    0
  3 7913    0.0186     64.45    0.1582         0. RCFLAGS    0    0
  3 6913    0.0186     33.28    0.1406       476. RCFLAGS    0    0
  3 8913    0.0976     36.06    0.4167         0. RCFLAGS    0    0
  3 3913    0.1162     35.62    0.5556         0. RCFLAGS    0    0
```



```
  3 1913    0.1162     25.69    0.4752       853. RCFLAGS    0    0
  3 5913    0.1162     25.54    0.0727      1986. RCFLAGS    0    0
  3 2003    0.6145     18.70    0.2129         0. RCFLAGS    0    0
  3 2004    6.5745      9.94    0.7630         0. RCFLAGS    0    0
  3 3920    0.0145     51.98    0.0932         0. RCFLAGS    0    0
  3 2020    6.5889     10.03    0.7682         0. RCFLAGS    0    0
  3  131    6.5889     10.03    0.7681         0. RCFLAGS    0    0
  3 7914    0.0347     64.46    0.4834         0. RCFLAGS    0    0
  3 6914    0.0347     27.71    0.2837      1085. RCFLAGS    0    0
378914    0.0241     12.64    0.0825         0. RCFLAGS    0    0
  3  914    0.0241      0.00    0.0000        73. RCFLAGS    0    0
  3 1914    0.0588     16.34    0.2837         0. RCFLAGS    0    0
385914    0.0055     12.64    0.0189         0. RCFLAGS    0    0
  3  314    0.0055      0.00    0.0000        17. RCFLAGS    0    0
386914    0.0600     50.51    0.3889         0. RCFLAGS    0    0
  3 8914    0.0655     46.25    0.3889         0. RCFLAGS    0    0
  3 3914    0.1243     32.09    0.6701         0. RCFLAGS    0    0
  3 5914    0.1243     25.10    0.0693      2676. RCFLAGS    0    0
  3 9141    0.0127     31.63    0.0929         0. RCFLAGS    0    0
  3 9142    0.0056     26.14    0.0167         0. RCFLAGS    0    0
  3 4914    0.0183     29.95    0.1088         0. RCFLAGS    0    0
  3 2914    0.1426     25.72    0.1128         0. RCFLAGS    0    0
  3 7915    0.0010     64.46    0.0142         0. RCFLAGS    0    0
  3 6915    0.0010     13.48    0.0133        31. RCFLAGS    0    0
  3 8915    0.0079     36.10    0.0620         0. RCFLAGS    0    0 5.dat
  3 3915    0.0089     33.51    0.0640         0. RCFLAGS    0    0
  3 5915    0.0089     25.49    0.0127       163. RCFLAGS    0    0
  3 9151    0.0018     64.46    0.0251         0. RCFLAGS    0    0
  3 9152    0.0049     11.98    0.0129         0. RCFLAGS    0    0
  3 4915    0.0067     26.19    0.0380         0. RCFLAGS    0    0
  3 2915    0.0155     25.79    0.0467         0. RCFLAGS    0    0
  3 2005    0.1582     25.73    0.1595         0. RCFLAGS    0    0
  3 1911    0.1935     15.26    0.1519         0. RCFLAGS    0    0
  3 2911    0.0096     14.99    0.0143         0. RCFLAGS    0    0
  3 3911    0.2031     15.25    0.1661         0. RCFLAGS    0    0
  3 2006    0.3612     19.84    0.2595         0. RCFLAGS    0    0
  3 7917    0.0031     64.46    0.0425         0. RCFLAGS    0    0
  3 6917    0.0031     18.23    0.0276        92. RCFLAGS    0    0
  3 8917    0.0097     43.54    0.1044         0. RCFLAGS    0    0
  3 3917    0.0127     37.47    0.1247         0. RCFLAGS    0    0
  3 5917    0.0127     28.65    0.0145       293. RCFLAGS    0    0
  3 9171    0.0081     19.09    0.0572         0. RCFLAGS    0    0
  3 9172    0.0041     38.44    0.0409         0. RCFLAGS    0    0
  3 4917    0.0121     25.60    0.0981         0. RCFLAGS    0    0
  3 2917    0.0248     27.16    0.1026         0. RCFLAGS    0    0
  3 2007    0.3861     20.31    0.3621         0. RCFLAGS    0    0
  3 3918    0.0057     12.57    0.0116         0. RCFLAGS    0    0
  3 2008    0.3917     20.20    0.3737         0. RCFLAGS    0    0
  3 2009    6.9806     10.60    0.8375         0. RCFLAGS    0    0
  3 3092    0.0402     24.64    0.1166         0. RCFLAGS    0    0
  3 3093    0.0058     15.98    0.0129         0. RCFLAGS    0    0
  3 2010    0.0459     23.55    0.1296         0. RCFLAGS    0    0
  3 9173    0.0029     18.41    0.0201         0. RCFLAGS    0    0
  3 2021    0.0488     23.25    0.1303         0. RCFLAGS    0    0
399141    0.0014     64.46    0.0188         0. RCFLAGS    0    0
  3  514    0.0014     28.00    0.0134        41. RCFLAGS    0    0
399142    0.0152     26.86    0.0962         0. RCFLAGS    0    0
  3  614    0.0152      0.00    0.0000       204. RCFLAGS    0    0
399143    0.0166      2.28    0.0134         0. RCFLAGS    0    0
399145    0.0040     46.91    0.0422         0. RCFLAGS    0    0
  3 9914    0.0206     11.04    0.0556         0. RCFLAGS    0    0
  3 2011    0.0694     19.62    0.1790         0. RCFLAGS    0    0
  3 3103    0.0050     12.99    0.0126         0. RCFLAGS    0    0
  3 2111    0.0744     19.18    0.1916         0. RCFLAGS    0    0
```

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  3 3105    0.0361     14.85    0.0683          0. RCFLAGS    0    0
  3 7107    0.0334     64.46    0.4658          0. RCFLAGS    0    0
  3 6107    0.0334     18.07    0.3021       1060. RCFLAGS    0    0
  3 4107    0.0271     12.07    0.0748          0. RCFLAGS    0    0
  3 5107    0.0271      0.00    0.0000         63. RCFLAGS    0    0
  3 1107    0.0605      9.98    0.3021          0. RCFLAGS    0    0
  3 8107    0.0519     55.50    0.3751          0. RCFLAGS    0    0 5.dat
  3 3107    0.1125     31.00    0.6656          0. RCFLAGS    0    0
  3 2012    0.1486     27.08    0.7339          0. RCFLAGS    0    0
  3 7101    0.0236     64.46    0.3290          0. RCFLAGS    0    0
  3 6101    0.0236     15.72    0.2264        738. RCFLAGS    0    0
  3 4101    0.0241     16.08    0.1810          0. RCFLAGS    0    0
  3 5101    0.0241      0.00    0.0000        160. RCFLAGS    0    0
  3 1101    0.0477      7.78    0.2264          0. RCFLAGS    0    0
  3 8101    0.0330     58.02    0.2528          0. RCFLAGS    0    0
  3 2101    0.0807     28.30    0.4729          0. RCFLAGS    0    0
  3 9101    0.0239     36.42    0.1172          0. RCFLAGS    0    0
  3 3101    0.1046     30.16    0.5900          0. RCFLAGS    0    0
  3 1111    0.1046     30.16    0.5900          0. RCFLAGS    0    0
  3 1112    0.1046      0.00    0.0000          0. RCFLAGS    0    0
  3 2013    0.2532     28.35    1.3239          0. RCFLAGS    0    0
  3 7102    0.0249     64.46    0.3471          0. RCFLAGS    0    0
  3 6102    0.0249     18.10    0.2274        779. RCFLAGS    0    0
  3 4102    0.0282      9.74    0.0010          0. RCFLAGS    0    0
  3 5102    0.0282      0.00    0.0000         14. RCFLAGS    0    0
  3 1102    0.0531      8.49    0.2274          0. RCFLAGS    0    0
  3 8102    0.0335     56.80    0.2558          0. RCFLAGS    0    0
  3 3102    0.0866     27.20    0.4694          0. RCFLAGS    0    0
  3 2014    0.3398     28.06    1.7932          0. RCFLAGS    0    0
  3 3181    0.0213     50.47    0.1251          0. RCFLAGS    0    0
  3 2015    0.3611     29.38    1.9183          0. RCFLAGS    0    0
  3 3182    0.0140     51.64    0.1670          0. RCFLAGS    0    0
  3 3104    0.0472     16.76    0.0760          0. RCFLAGS    0    0
  3 2016    0.0612     24.76    0.2431          0. RCFLAGS    0    0
  3 2017    0.0612     24.76    0.2431          0. RCFLAGS    0    0
  3 7106    0.0481     64.46    0.6704          0. RCFLAGS    0    0
  3 6106    0.0481     26.49    0.3382       1374. RCFLAGS    0    0
  3 8106    0.2526     37.54    1.2189          0. RCFLAGS    0    0
  3 3106    0.3007     35.77    1.5201          0. RCFLAGS    0    0
  3 2018    0.3619     33.91    1.7631          0. RCFLAGS    0    0
  3 4106    0.3619     27.59    1.4463       1682. RCFLAGS    0    0
  3 1114    0.3611     29.38    1.9183          0. RCFLAGS    0    0
  3 1113    0.3611      0.00    0.0000          0. RCFLAGS    0    0
  3  216    0.3611     25.82    1.0604          0. RCFLAGS    0    0
  3  116    0.3611      3.56    0.8579          0. RCFLAGS    0    0
  3 3183    0.0087     47.75    0.0852          0. RCFLAGS    0    0
  3 2022    0.3698     26.33    1.0950          0. RCFLAGS    0    0
  3 1106    0.3698     26.27    0.8881       3274. RCFLAGS    0    0
  3 1116    0.3698      7.22    0.0094          0. RCFLAGS    0    0
  3 1115    0.3698     19.05    0.8787          0. RCFLAGS    0    0
  3 1117    0.3698     22.53    1.5692          0. RCFLAGS    0    0
  3 1118    0.3611     23.08    1.5692          0. RCFLAGS    0    0
  3  316    0.3619     24.82    0.9987          0. RCFLAGS    0    0 5.dat
  3  416    0.3619      2.77    0.4476          0. RCFLAGS    0    0
  3 5106    0.3619     23.62    0.4490       4088. RCFLAGS    0    0
  3 1119    0.3619      8.04    0.0094          0. RCFLAGS    0    0
  3 1120    0.3619     15.58    0.4396          0. RCFLAGS    0    0
  3 1121    0.3619     18.35    0.4626          0. RCFLAGS    0    0
  3  516    0.7317      7.62    0.0187          0. RCFLAGS    0    0
  3 3141    0.0113     10.25    0.0004          0. RCFLAGS    0    0
  3  616    0.7430      7.66    0.0187          0. RCFLAGS    0    0
  3  716    0.3611     41.47    2.0319          0. RCFLAGS    0    0
  3 2019    0.7430     27.82    2.0500          0. RCFLAGS    0    0
  4  301    2.6500     28.23    2.3115          0. RCFLAGS    0    0 100.dat
```



```
  4  111    2.6500     28.21    2.2647          0. RCFLAGS    0    0
  4  381    3.3100     31.66    3.7703          0. RCFLAGS    0    0
  4  281    5.9600     30.13    5.9551          0. RCFLAGS    0    0
  4  581    5.9600     29.80    3.5819      35854. RCFLAGS    0    0
  4  121    5.9600     29.80    3.5818          0. RCFLAGS    0    0
  4 3916    0.0260     37.63    0.2053          0. RCFLAGS    0    0
  4 3919    0.1360     36.38    0.8434          0. RCFLAGS    0    0
  4 2000    0.1620     36.58    1.0486          0. RCFLAGS    0    0
  4 3910    0.1730     31.30    0.6079          0. RCFLAGS    0    0
  4 2001    0.3350     33.85    1.6565          0. RCFLAGS    0    0
  4 7912    0.0261    109.14    0.3712          0. RCFLAGS    0    0
  4 6912    0.0261     76.78    0.3549        836. RCFLAGS    0    0
  4 8912    0.1372     73.56    1.5336          0. RCFLAGS    0    0
  4 3912    0.1633     74.08    1.8885          0. RCFLAGS    0    0
  4 1912    0.1633     63.91    1.7644       1815. RCFLAGS    0    0
  4 5912    0.1633     63.56    0.7263       5227. RCFLAGS    0    0
  4 2002    0.4983     43.59    1.6914          0. RCFLAGS    0    0
  4 7913    0.0186    109.12    0.2645          0. RCFLAGS    0    0
  4 6913    0.0186     76.86    0.2608        487. RCFLAGS    0    0
  4 8913    0.0976     70.23    0.9920          0. RCFLAGS    0    0
  4 3913    0.1162     71.29    1.2528          0. RCFLAGS    0    0
  4 1913    0.1162     61.08    1.0882       1286. RCFLAGS    0    0
  4 5913    0.1162     60.63    0.6382       3113. RCFLAGS    0    0
  4 2003    0.6145     46.81    2.0523          0. RCFLAGS    0    0
  4 2004    6.5745     31.39    3.8178          0. RCFLAGS    0    0
  4 3920    0.0145     92.27    0.1727          0. RCFLAGS    0    0
  4 2020    6.5889     31.52    3.8278          0. RCFLAGS    0    0
  4  131    6.5889     31.51    3.8263          0. RCFLAGS    0    0
  4 7914    0.0347    109.14    0.8083          0. RCFLAGS    0    0
  4 6914    0.0347     71.34    0.7221       1190. RCFLAGS    0    0
478914    0.0241     37.74    0.4281          0. RCFLAGS    0    0
  4  914    0.0241      0.00    0.0000        555. RCFLAGS    0    0
  4 1914    0.0588     42.07    0.7221          0. RCFLAGS    0    0
485914    0.0055     37.74    0.0981          0. RCFLAGS    0    0
  4  314    0.0055      0.00    0.0000        127. RCFLAGS    0    0
486914    0.0600     90.06    0.7288          0. RCFLAGS    0    0
  4 8914    0.0655     82.46    0.7288          0. RCFLAGS    0    0
  4 3914    0.1243     63.35    1.4510          0. RCFLAGS    0    0
  4 5914    0.1243     55.83    0.5316       3929. RCFLAGS    0    0
  4 9141    0.0127     63.99    0.2518          0. RCFLAGS    0    0
  4 9142    0.0056     56.42    0.0504          0. RCFLAGS    0    0
  4 4914    0.0183     61.68    0.2990          0. RCFLAGS    0    0
  4 2914    0.1426     56.58    0.5803          0. RCFLAGS    0    0
  4 7915    0.0010    109.12    0.0238          0. RCFLAGS    0    0
  4 6915    0.0010     47.11    0.0228         31. RCFLAGS    0    0
  4 8915    0.0079     70.28    0.1591          0. RCFLAGS    0    0 100.dat
  4 3915    0.0089     67.62    0.1819          0. RCFLAGS    0    0
  4 5915    0.0089     59.53    0.0244        351. RCFLAGS    0    0
  4 9151    0.0018    109.12    0.0419          0. RCFLAGS    0    0
  4 9152    0.0049     37.07    0.0853          0. RCFLAGS    0    0
  4 4915    0.0067     56.57    0.1272          0. RCFLAGS    0    0
  4 2915    0.0155     58.26    0.1475          0. RCFLAGS    0    0
  4 2005    0.1582     56.75    0.6207          0. RCFLAGS    0    0
  4 1911    0.1935     38.07    0.6158          0. RCFLAGS    0    0
  4 2911    0.0096     37.85    0.0526          0. RCFLAGS    0    0
  4 3911    0.2031     38.06    0.6684          0. RCFLAGS    0    0
  4 2006    0.3612     46.24    1.1920          0. RCFLAGS    0    0
  4 7917    0.0031    109.12    0.0711          0. RCFLAGS    0    0
  4 6917    0.0031     57.62    0.0690         93. RCFLAGS    0    0
  4 8917    0.0097     80.86    0.2110          0. RCFLAGS    0    0
  4 3917    0.0127     75.29    0.2800          0. RCFLAGS    0    0
  4 5917    0.0127     66.27    0.1058        535. RCFLAGS    0    0
  4 9171    0.0081     47.77    0.1620          0. RCFLAGS    0    0
  4 9172    0.0041     73.92    0.0876          0. RCFLAGS    0    0
```

```
   4 4917    0.0121     56.57    0.2496          0. RCFLAGS    0    0
   4 2917    0.0248     61.53    0.2737          0. RCFLAGS    0    0
   4 2007    0.3861     47.22    1.2878          0. RCFLAGS    0    0
   4 3918    0.0057     36.32    0.0915          0. RCFLAGS    0    0
   4 2008    0.3917     47.07    1.3320          0. RCFLAGS    0    0
   4 2009    6.9806     32.39    4.1613          0. RCFLAGS    0    0
   4 3092    0.0402     56.90    0.3718          0. RCFLAGS    0    0
   4 3093    0.0058     46.46    0.0518          0. RCFLAGS    0    0
   4 2010    0.0459     55.59    0.4236          0. RCFLAGS    0    0
   4 9173    0.0029     46.41    0.0578          0. RCFLAGS    0    0
   4 2021    0.0488     55.04    0.4474          0. RCFLAGS    0    0
 499141    0.0014    109.14    0.0315          0. RCFLAGS    0    0
   4  514    0.0014     71.60    0.0312         41. RCFLAGS    0    0
 499142    0.0152     57.39    0.2932          0. RCFLAGS    0    0
   4  614    0.0152      0.00    0.0000        541. RCFLAGS    0    0
 499143    0.0166      5.84    0.0312          0. RCFLAGS    0    0
 499145    0.0040     85.09    0.0867          0. RCFLAGS    0    0
   4 9914    0.0206     21.39    0.1179          0. RCFLAGS    0    0
   4 2011    0.0694     45.06    0.5653          0. RCFLAGS    0    0
   4 3103    0.0050     42.27    0.0884          0. RCFLAGS    0    0
   4 2111    0.0744     44.87    0.6537          0. RCFLAGS    0    0
   4 3105    0.0361     41.38    0.2987          0. RCFLAGS    0    0
   4 7107    0.0334    109.14    0.7790          0. RCFLAGS    0    0
   4 6107    0.0334     57.45    0.6305       1182. RCFLAGS    0    0
   4 4107    0.0271     37.20    0.4780          0. RCFLAGS    0    0
   4 5107    0.0271      0.00    0.0000        551. RCFLAGS    0    0
   4 1107    0.0605     31.74    0.6305          0. RCFLAGS    0    0
   4 8107    0.0519     97.00    0.6708          0. RCFLAGS    0    0 100.dat
   4 3107    0.1125     61.87    1.3012          0. RCFLAGS    0    0
   4 2012    0.1486     56.89    1.5601          0. RCFLAGS    0    0
   4 7101    0.0236    109.14    0.5501          0. RCFLAGS    0    0
   4 6101    0.0236     52.97    0.4596        804. RCFLAGS    0    0
   4 4101    0.0241     43.20    0.4943          0. RCFLAGS    0    0
   4 5101    0.0241      0.00    0.0000        712. RCFLAGS    0    0
   4 1101    0.0477     26.20    0.4596          0. RCFLAGS    0    0
   4 8101    0.0330    100.53    0.4428          0. RCFLAGS    0    0
   4 2101    0.0807     56.57    0.9023          0. RCFLAGS    0    0
   4 9101    0.0239     71.01    0.2631          0. RCFLAGS    0    0
   4 3101    0.1046     59.87    1.1547          0. RCFLAGS    0    0
   4 1111    0.1046     53.95    0.7854          0. RCFLAGS    0    0
   4 1112    0.1046      5.92    0.3693          0. RCFLAGS    0    0
   4 2013    0.2532     55.68    2.3455          0. RCFLAGS    0    0
   4 7102    0.0249    109.14    0.5804          0. RCFLAGS    0    0
   4 6102    0.0249     57.48    0.4938        851. RCFLAGS    0    0
   4 4102    0.0282     33.71    0.4503          0. RCFLAGS    0    0
   4 5102    0.0282      0.00    0.0000        485. RCFLAGS    0    0
   4 1102    0.0531     26.98    0.4938          0. RCFLAGS    0    0
   4 8102    0.0335     98.75    0.4522          0. RCFLAGS    0    0
   4 3102    0.0866     54.77    0.9460          0. RCFLAGS    0    0
   4 2014    0.3398     55.45    3.2915          0. RCFLAGS    0    0
   4 3181    0.0213     90.02    0.2391          0. RCFLAGS    0    0
   4 2015    0.3611     57.49    3.5243          0. RCFLAGS    0    0
   4 3182    0.0140     91.75    0.3135          0. RCFLAGS    0    0
   4 3104    0.0472     39.67    0.3564          0. RCFLAGS    0    0
   4 2016    0.0612     51.61    0.6578          0. RCFLAGS    0    0
   4 2017    0.0612     61.72    1.0271          0. RCFLAGS    0    0
   4 7106    0.0481    109.14    1.1210          0. RCFLAGS    0    0
   4 6106    0.0481     77.00    1.0619       1577. RCFLAGS    0    0
   4 8106    0.2526     72.44    2.7365          0. RCFLAGS    0    0
   4 3106    0.3007     73.17    3.7116          0. RCFLAGS    0    0
   4 2018    0.3619     71.23    4.7387          0. RCFLAGS    0    0
   4 4106    0.3619     62.72    4.6974       1764. RCFLAGS    0    0
   4 1114    0.3611     50.66    2.1140          0. RCFLAGS    0    0
   4 1113    0.3611      6.82    1.4103          0. RCFLAGS    0    0
```



```
   4  216    0.3611     40.90    1.0841          0. RCFLAGS    0    0
   4  116    0.3611      9.77    1.0299          0. RCFLAGS    0    0
   4 3183    0.0087     86.24    0.1841          0. RCFLAGS    0    0
   4 2022    0.3698     41.96    1.2683          0. RCFLAGS    0    0
   4 1106    0.3698     41.89    1.1381       3473. RCFLAGS    0    0
   4 1116    0.3698      8.05    0.0095          0. RCFLAGS    0    0
   4 1115    0.3698     33.84    1.1286          0. RCFLAGS    0    0
   4 1117    0.3698     43.38    2.1585          0. RCFLAGS    0    0
   4 1118    0.3611     51.25    3.4861          0. RCFLAGS    0    0
   4  316    0.3619     39.89    1.3294          0. RCFLAGS    0    0 100.dat
   4  416    0.3619     22.82    3.3680          0. RCFLAGS    0    0
   4 5106    0.3619     39.79    1.0350       4663. RCFLAGS    0    0
   4 1119    0.3619      9.77    0.1032          0. RCFLAGS    0    0
   4 1120    0.3619     30.02    0.9318          0. RCFLAGS    0    0
   4 1121    0.3619     52.85    3.4100          0. RCFLAGS    0    0
   4  516    0.7317      8.90    0.1127          0. RCFLAGS    0    0
   4 3141    0.0113     23.04    0.0762          0. RCFLAGS    0    0
   4  616    0.7430      9.12    0.1127          0. RCFLAGS    0    0
   4  716    0.3611    104.21    6.8960          0. RCFLAGS    0    0
   4 2019    0.7430     59.76    6.9235          0. RCFLAGS    0    0
   5  301    2.6500    184.52   16.7127          0. RCFLAGS    0    0 REG1.dat
   5  111    2.6500    184.51   16.6346          0. RCFLAGS    0    0
   5  381    3.3100    195.64   22.8378          0. RCFLAGS    0    0
   5  281    5.9600    190.69   39.1026          0. RCFLAGS    0    0
   5  581    5.9600    190.54   24.5241     328016. RCFLAGS    0    0
   5  121    5.9600    190.54   24.5181          0. RCFLAGS    0    0
   5 3916    0.0260    183.40    0.3679          0. RCFLAGS    0    0
   5 3919    0.1360    179.18    1.8321          0. RCFLAGS    0    0
   5 2000    0.1620    179.86    2.2001          0. RCFLAGS    0    0
   5 3910    0.1730    152.23    2.0118          0. RCFLAGS    0    0
   5 2001    0.3350    165.59    4.2118          0. RCFLAGS    0    0
   5 7912    0.0261    278.80    0.3645          0. RCFLAGS    0    0
   5 6912    0.0261    236.40    0.3512        834. RCFLAGS    0    0
   5 8912    0.1372    240.10    1.9094          0. RCFLAGS    0    0
   5 3912    0.1633    239.51    2.2596          0. RCFLAGS    0    0
   5 1912    0.1633    231.27    2.1980       2042. RCFLAGS    0    0
   5 5912    0.1633    228.52    2.1887       6321. RCFLAGS    0    0
   5 2002    0.4983    186.22    6.3619          0. RCFLAGS    0    0
   5 7913    0.0186    278.80    0.2598          0. RCFLAGS    0    0
   5 6913    0.0186    236.51    0.2568        485. RCFLAGS    0    0
   5 8913    0.0976    227.09    1.3567          0. RCFLAGS    0    0
   5 3913    0.1162    228.60    1.6134          0. RCFLAGS    0    0
   5 1913    0.1162    220.17    1.5509       1612. RCFLAGS    0    0
   5 5913    0.1162    218.92    1.3767       4383. RCFLAGS    0    0
   5 2003    0.6145    192.40    7.4866          0. RCFLAGS    0    0
   5 2004    6.5745    190.71   24.9375          0. RCFLAGS    0    0
   5 3920    0.0145    260.48    0.1979          0. RCFLAGS    0    0
   5 2020    6.5889    190.87   24.9821          0. RCFLAGS    0    0
   5  131    6.5889    190.86   24.9772          0. RCFLAGS   10    0
   5 7914    0.0347    278.81    0.5016          0. RCFLAGS    0    0
   5 6914    0.0347    230.35    0.5110       1125. RCFLAGS    0    0
 578914    0.0241    185.03    0.3450          0. RCFLAGS    0    0
   5  914    0.0241     88.38    0.3153       1534. RCFLAGS    0    0
   5 1914    0.0588    172.10    0.8220          0. RCFLAGS    0    0
 585914    0.0055    185.03    0.0790          0. RCFLAGS    0    0
   5  314    0.0055     88.66    0.0776        337. RCFLAGS    0    0
 586914    0.0600    253.86    0.8346          0. RCFLAGS    0    0
   5 8914    0.0655    239.91    0.9071          0. RCFLAGS    0    0
   5 3914    0.1243    207.82    1.7148          0. RCFLAGS    0    0
   5 5914    0.1243    195.18    1.6728       4890. RCFLAGS    0    0
   5 9141    0.0127    219.65    0.1825          0. RCFLAGS    0    0
   5 9142    0.0056    209.73    0.0775          0. RCFLAGS    0    0
   5 4914    0.0183    216.61    0.2600          0. RCFLAGS    0    0
   5 2914    0.1426    197.93    1.9328          0. RCFLAGS    0    0
```

5	7915	0.0010	278.81	0.0147	0.	RCFLAGS	0	0
5	6915	0.0010	168.54	0.0147	31.	RCFLAGS	0	0
5	8915	0.0079	227.31	0.1131	0.	RCFLAGS	0	0 REG1.dat
5	3915	0.0089	220.56	0.1278	0.	RCFLAGS	0	0
5	5915	0.0089	212.74	0.1177	637.	RCFLAGS	0	0
5	9151	0.0018	278.81	0.0260	0.	RCFLAGS	0	0
5	9152	0.0049	183.14	0.0695	0.	RCFLAGS	0	0
5	4915	0.0067	209.03	0.0956	0.	RCFLAGS	0	0
5	2915	0.0155	211.15	0.2133	0.	RCFLAGS	0	0
5	2005	0.1582	199.23	2.1461	0.	RCFLAGS	0	0
5	1911	0.1935	149.15	1.9852	0.	RCFLAGS	0	0
5	2911	0.0096	148.30	0.1234	0.	RCFLAGS	0	0
5	3911	0.2031	149.11	2.0985	0.	RCFLAGS	0	0
5	2006	0.3612	171.06	4.2127	0.	RCFLAGS	0	0
5	7917	0.0031	278.81	0.0441	0.	RCFLAGS	0	0
5	6917	0.0031	196.77	0.0430	93.	RCFLAGS	0	0
5	8917	0.0097	245.66	0.1392	0.	RCFLAGS	0	0
5	3917	0.0127	233.93	0.1822	0.	RCFLAGS	0	0
5	5917	0.0127	225.11	0.1830	556.	RCFLAGS	0	0
5	9171	0.0081	206.66	0.1156	0.	RCFLAGS	0	0
5	9172	0.0041	237.49	0.0588	0.	RCFLAGS	0	0
5	4917	0.0121	217.03	0.1744	0.	RCFLAGS	0	0
5	2917	0.0248	221.16	0.3574	0.	RCFLAGS	0	0
5	2007	0.3861	174.28	4.5693	0.	RCFLAGS	0	0
5	3918	0.0057	180.93	0.0810	0.	RCFLAGS	0	0
5	2008	0.3917	174.38	4.6503	0.	RCFLAGS	0	0
5	2009	6.9806	189.94	28.0529	0.	RCFLAGS	0	0
5	3092	0.0402	210.27	0.5514	0.	RCFLAGS	0	0
5	3093	0.0058	201.00	0.0821	0.	RCFLAGS	0	0
5	2010	0.0459	209.10	0.6335	0.	RCFLAGS	0	0
5	9173	0.0029	205.79	0.0414	0.	RCFLAGS	0	0
5	2021	0.0488	208.90	0.6749	0.	RCFLAGS	0	0
599141		0.0014	278.81	0.0195	0.	RCFLAGS	0	0
5	514	0.0014	230.28	0.0193	41.	RCFLAGS	0	0
599142		0.0152	210.94	0.2179	0.	RCFLAGS	0	0
5	614	0.0152	121.12	0.2083	687.	RCFLAGS	0	0
599143		0.0166	130.02	0.2276	0.	RCFLAGS	0	0
599145		0.0040	247.34	0.0582	0.	RCFLAGS	0	0
5	9914	0.0206	153.04	0.2858	0.	RCFLAGS	0	0
5	2011	0.0694	192.33	0.9546	0.	RCFLAGS	0	0
5	3103	0.0050	186.21	0.0714	0.	RCFLAGS	0	0
5	2111	0.0744	191.92	1.0261	0.	RCFLAGS	0	0
5	3105	0.0361	197.83	0.4996	0.	RCFLAGS	0	0
5	7107	0.0334	278.81	0.4833	0.	RCFLAGS	0	0
5	6107	0.0334	196.83	0.4826	1097.	RCFLAGS	0	0
5	4107	0.0271	183.66	0.3884	0.	RCFLAGS	0	0
5	5107	0.0271	40.30	0.2748	1709.	RCFLAGS	0	0
5	1107	0.0605	126.77	0.7448	0.	RCFLAGS	0	0
5	8107	0.0519	262.88	0.7242	0.	RCFLAGS	0	0 REG1.dat
5	3107	0.1125	189.63	1.4690	0.	RCFLAGS	0	0
5	2012	0.1486	191.62	1.9686	0.	RCFLAGS	0	0
5	7101	0.0236	278.81	0.3414	0.	RCFLAGS	0	0
5	6101	0.0236	185.35	0.3386	756.	RCFLAGS	0	0
5	4101	0.0241	207.03	0.3466	0.	RCFLAGS	0	0
5	5101	0.0241	112.32	0.3258	1535.	RCFLAGS	0	0
5	1101	0.0477	148.45	0.6579	0.	RCFLAGS	0	0
5	8101	0.0330	269.47	0.4601	0.	RCFLAGS	0	0
5	2101	0.0807	197.89	1.1084	0.	RCFLAGS	0	0
5	9101	0.0239	237.32	0.3330	0.	RCFLAGS	0	0
5	3101	0.1046	206.91	1.4413	0.	RCFLAGS	0	0
5	1111	0.1046	183.43	0.9803	0.	RCFLAGS	0	0
5	1112	0.1046	23.48	0.4610	0.	RCFLAGS	0	0
5	2013	0.2532	188.24	2.9489	0.	RCFLAGS	0	0
5	7102	0.0249	278.81	0.3602	0.	RCFLAGS	0	0

5	6102	0.0249	196.85	0.3603	800.	RCFLAGS	0	0
5	4102	0.0282	170.05	0.4033	0.	RCFLAGS	0	0
5	5102	0.0282	37.25	0.2850	1779.	RCFLAGS	0	0
5	1102	0.0531	112.17	0.6348	0.	RCFLAGS	0	0
5	8102	0.0335	264.02	0.4707	0.	RCFLAGS	0	0
5	3102	0.0866	170.97	1.1056	0.	RCFLAGS	0	0
5	2014	0.3398	183.83	4.0545	0.	RCFLAGS	0	0
5	3181	0.0213	251.68	0.2906	0.	RCFLAGS	0	0
5	2015	0.3611	187.84	4.3451	0.	RCFLAGS	0	0
5	3182	0.0140	258.42	0.2025	0.	RCFLAGS	0	0
5	3104	0.0472	187.52	0.6726	0.	RCFLAGS	0	0
5	2016	0.0612	203.77	0.8751	0.	RCFLAGS	0	0
5	2017	0.0612	243.88	1.3360	0.	RCFLAGS	0	0
5	7106	0.0481	278.81	0.6956	0.	RCFLAGS	0	0
5	6106	0.0481	236.95	0.6994	1382.	RCFLAGS	0	0
5	8106	0.2526	235.70	3.5135	0.	RCFLAGS	0	0
5	3106	0.3007	235.90	4.2035	0.	RCFLAGS	0	0
5	2018	0.3619	237.25	5.5395	0.	RCFLAGS	0	0
5	4106	0.3619	229.96	5.5239	1787.	RCFLAGS	0	0
5	1114	0.3611	160.61	2.1140	0.	RCFLAGS	0	0
5	1113	0.3611	27.23	2.2311	0.	RCFLAGS	0	0
5	216	0.3611	123.23	1.0841	0.	RCFLAGS	0	0
5	116	0.3611	37.38	1.0299	0.	RCFLAGS	0	0
5	3183	0.0087	245.94	0.1257	0.	RCFLAGS	0	0
5	2022	0.3698	126.12	1.2099	0.	RCFLAGS	0	0
5	1106	0.3698	125.71	1.2056	3527.	RCFLAGS	0	0
5	1116	0.3698	8.10	0.0095	0.	RCFLAGS	0	0
5	1115	0.3698	117.61	1.1961	0.	RCFLAGS	0	0
5	1117	0.3698	154.11	2.2260	0.	RCFLAGS	0	0
5	1118	0.3611	185.05	4.4571	0.	RCFLAGS	0	0
5	316	0.3619	133.84	1.3849	0.	RCFLAGS	0	0 REG1.dat
5	416	0.3619	96.12	4.1390	0.	RCFLAGS	0	0
5	5106	0.3619	132.65	1.3749	4885.	RCFLAGS	0	0
5	1119	0.3619	16.72	0.2088	0.	RCFLAGS	0	0
5	1120	0.3619	115.94	1.1662	0.	RCFLAGS	0	0
5	1121	0.3619	212.06	5.3052	0.	RCFLAGS	0	0
5	516	0.7317	12.36	0.2182	0.	RCFLAGS	0	0
5	3141	0.0113	116.86	0.1450	0.	RCFLAGS	0	0
5	616	0.7430	13.95	0.3633	0.	RCFLAGS	0	0
5	716	0.3611	397.58	9.7622	0.	RCFLAGS	0	0
5	2019	0.7430	207.17	10.1255	0.	RCFLAGS	0	0

Appendix C

Proposed GAWSER Continuous Simulation Model Output

```
                GAWSER V6.9.18 - Released - Sep. 21, 2016
                =========================================

                    Upper River Watershed Model
                  Generalized Water Balance Summary
                       Demonstration
                 ======================================
                            Non-Winter Model
   Input file 1=wb_D01.dat
   Input file 2=
   Output file =wb_D01.lst
* ========================================================================
* File created by Dr. H.O. Schroeter, January 10, 2000
* ========================================================================
START               KUNITS=2 TOTAL WATERSHED AREA=167    SQ KM
                    INITIAL BASEFLOW AT OUTLET: QBSS= 0.0000 QBGW= 0.000
                    PRINT OPTIONS: ECHO=3 OUTPUT=1 PLOTS=0 RCS=1 SUBW=1
                      PLOT CUTOFF=576 SUM=4 FREE=0
                    PARAMETER ADJUSTMENT FACTORS: FDS=1.00 FKEFF=0.25
                      FCS=0.30 FD=0.30 FSAV=1.0 FKO=1.00 FKSS=1.0 FKMF=1.00
                    INITIAL SOIL/SNOW WATER FACTORS:
                      FIMCI=1.00 FIMCII=1.00 FIWE=0.0000
                    GLOBAL RAINFALL SCALING FACTOR: GFRF=1.0000
                    SIMULATION CONTROLS: TTI=1.00000 IDEL=2 HOURS=576
                    SUBWATERSHED INITIAL BASEFLOWS: -999


                WATER BALANCE SUMMARY FOR HYDROGRAPH 3914
                =========================================

       Location:       Hydrograph 3914
       Scenario File: wb_D01.dat
       Period:        1951/01/01 to 2005/12/30      Area:     0.1243 km^2

                           Water Balance Quantities (in mm)
                                                Infiltration       Total
        Month    Precip        ET    Runoff  (Baseflow) (Losses)     Flow
         JAN       48.0       7.9      10.1       3.1      26.9      13.1
         FEB       42.6       7.1      13.6       2.6      19.3      16.2
         MAR       60.4       8.7      33.6       2.9      15.3      36.5
         APR       76.7      29.1      26.5       3.8      17.3      30.3
         MAY       77.8      48.5      21.6       4.0       3.7      25.6
         JUN       76.7      48.3      22.1       2.4       3.9      24.5
         JUL       85.1      44.7      27.6       1.3      11.6      28.9
         AUG       86.0      39.5      27.1       0.7      18.7      27.9
         SEP       79.4      29.5      23.7       0.7      25.5      24.4
         OCT       66.5      22.4      19.1       1.0      24.0      20.1
         NOV       82.3      12.3      25.1       1.7      43.2      26.8
         DEC       63.2       7.2      15.2       2.8      38.1      18.0

        Total     844.8     305.1     265.3      27.0     247.4     292.3


                WATER BALANCE SUMMARY FOR HYDROGRAPH 5914
                =========================================

       Location:       Hydrograph 5914
       Scenario File: wb_D01.dat
       Period:        1951/01/01 to 2005/12/30      Area:     0.1243 km^2

                           Water Balance Quantities (in mm)
                                                Infiltration       Total
        Month    Precip        ET    Runoff  (Baseflow) (Losses)     Flow
         JAN       48.0       7.9      10.5       3.2      26.3      13.8
```



```
         FEB       42.6       7.1      12.7       2.4      20.5      15.1
         MAR       60.4       8.9      32.1       3.0      16.3      35.2
         APR       76.7      30.4      26.1       3.9      16.3      30.0
         MAY       77.8      50.3      20.4       3.6       3.5      24.0
         JUN       76.7      50.2      20.0       2.5       4.0      22.5
         JUL       85.1      46.6      24.9       1.1      12.5      26.1
         AUG       86.0      41.2      26.0       0.9      18.0      26.8
         SEP       79.4      30.6      22.4       0.7      25.7      23.2
         OCT       66.5      23.0      19.3       1.1      23.1      20.4
         NOV       82.3      12.6      23.5       1.8      44.3      25.3
         DEC       63.2       7.2      15.3       3.1      37.6      18.4

        Total     844.8     316.0     253.5      27.2     248.1     280.7


                WATER BALANCE SUMMARY FOR HYDROGRAPH 2914
                =========================================

       Location:       Hydrograph 2914
       Scenario File: wb_D01.dat
       Period:        1951/01/01 to 2005/12/30      Area:     0.1426 km^2

                           Water Balance Quantities (in mm)
                                                Infiltration       Total
        Month    Precip        ET    Runoff  (Baseflow) (Losses)     Flow
         JAN       48.0       7.9      11.2       4.2      24.6      15.5
         FEB       42.6       7.1      14.1       2.9      18.6      16.9
         MAR       60.4       9.0      35.2       3.1      13.1      38.3
         APR       76.7      31.8      28.3       4.6      12.0      32.9
         MAY       77.8      53.2      21.6       4.7      -1.7      26.3
         JUN       76.7      53.1      21.5       2.3      -0.3      23.8
         JUL       85.1      49.1      29.6      -2.8       9.3      26.8
         AUG       86.0      43.2      27.6      -0.7      16.1      26.8
         SEP       79.4      31.7      24.2      -0.9      24.4      23.3
         OCT       66.5      23.8      20.5       0.3      21.9      20.8
         NOV       82.3      12.9      24.5       1.8      43.0      26.3
         DEC       63.2       7.2      15.8       4.2      36.0      20.0

        Total     844.8     330.1     274.0      23.7     217.0     297.6


                WATER BALANCE SUMMARY FOR HYDROGRAPH 2915
                =========================================

       Location:       Hydrograph 2915
       Scenario File: wb_D01.dat
       Period:        1951/01/01 to 2005/12/30      Area:     0.0155 km^2

                           Water Balance Quantities (in mm)
                                                Infiltration       Total
        Month    Precip        ET    Runoff  (Baseflow) (Losses)     Flow
         JAN       48.0       7.9       4.0       7.8      28.3      11.8
         FEB       42.6       7.1       5.9       6.5      23.2      12.4
         MAR       60.4       9.1      17.4       6.9      27.1      24.3
         APR       76.7      37.5      13.0       9.6      16.5      22.7
         MAY       77.8      66.1       7.7      10.3      -6.3      18.0
         JUN       76.7      66.3       7.2       6.1      -2.9      13.3
         JUL       85.1      60.1       9.8       3.2      12.0      13.0
         AUG       86.0      51.9       8.0       1.6      24.5       9.6
         SEP       79.4      36.9       7.3       1.5      33.6       8.8
         OCT       66.5      27.4       7.0       2.5      29.5       9.5
         NOV       82.3      13.9       9.1       4.3      55.0      13.4
         DEC       63.2       7.2       5.9       7.2      42.9      13.1
```

Total	844.8	391.4	102.4	67.5	283.5	169.9

WATER BALANCE SUMMARY FOR HYDROGRAPH 1915

Location: Hydrograph 1915
Scenario File: wb_D01.dat
Period: 1951/01/01 to 2005/12/30 Area: 0.0089 km^2

Water Balance Quantities (in mm)

Month	Precip	ET	Runoff	Infiltration (Baseflow)	(Losses)	Total Flow
JAN	48.0	7.9	0.0	0.0	40.1	0.0
FEB	42.6	7.1	0.0	0.0	35.5	0.0
MAR	60.4	9.0	0.0	0.0	51.4	0.0
APR	76.7	34.0	0.0	0.0	42.7	0.0
MAY	77.8	57.9	0.0	0.0	19.9	0.0
JUN	76.7	57.4	0.1	0.0	19.2	0.1
JUL	85.1	52.3	1.7	0.0	31.1	1.8
AUG	86.0	45.6	0.1	0.0	40.3	0.1
SEP	79.4	33.3	0.0	0.0	46.1	0.0
OCT	66.5	25.3	0.4	0.0	40.8	0.4
NOV	82.3	13.5	0.0	0.0	68.8	0.0
DEC	63.2	7.2	0.0	0.0	56.0	0.0
Total	844.8	350.6	2.3	0.0	491.8	2.3

WATER BALANCE SUMMARY FOR HYDROGRAPH 5917

Location: Hydrograph 5917
Scenario File: wb_D01.dat
Period: 1951/01/01 to 2005/12/30 Area: 0.0127 km^2

Water Balance Quantities (in mm)

Month	Precip	ET	Runoff	Infiltration (Baseflow)	(Losses)	Total Flow
JAN	48.0	7.9	13.2	6.8	20.0	20.1
FEB	42.6	7.1	18.2	5.5	11.8	23.7
MAR	60.4	8.7	46.4	6.6	-1.3	53.0
APR	76.7	28.8	35.2	8.2	4.6	43.4
MAY	77.8	47.1	25.5	8.0	-2.7	33.4
JUN	76.7	46.4	24.9	5.0	0.4	29.9
JUL	85.1	43.1	31.4	2.2	8.4	33.6
AUG	86.0	38.2	30.3	1.1	16.3	31.5
SEP	79.4	28.9	26.5	1.3	22.8	27.7
OCT	66.5	22.0	22.6	2.0	19.8	24.6
NOV	82.3	12.3	30.3	4.0	35.7	34.3
DEC	63.2	7.2	19.7	6.5	29.9	26.1
Total	844.8	297.7	324.2	57.2	165.7	381.4

WATER BALANCE SUMMARY FOR HYDROGRAPH 2917

Location: Hydrograph 2917
Scenario File: wb_D01.dat
Period: 1951/01/01 to 2005/12/30 Area: 0.0248 km^2

Water Balance Quantities (in mm)

Month	Precip	ET	Runoff	Infiltration (Baseflow)	(Losses)	Total Flow
JAN	48.0	7.9	4.5	8.5	27.1	13.0
FEB	42.6	7.1	7.4	7.2	21.0	14.5
MAR	60.4	9.2	22.4	7.5	21.3	30.0
APR	76.7	38.0	14.5	10.1	14.2	24.5
MAY	77.8	66.5	6.2	10.3	-5.1	16.5
JUN	76.7	66.4	5.2	5.9	-0.8	11.1
JUL	85.1	60.5	10.0	3.0	11.6	13.0
AUG	86.0	52.0	7.3	1.5	25.3	8.8
SEP	79.4	37.0	5.7	1.5	35.2	7.2
OCT	66.5	27.6	5.5	2.6	30.7	8.2
NOV	82.3	14.1	8.3	4.7	55.1	13.0
DEC	63.2	7.2	6.4	7.8	41.8	14.2
Total	844.8	393.5	103.5	70.5	277.3	174.0

WATER BALANCE SUMMARY FOR HYDROGRAPH 5917

Location: Hydrograph 5917
Scenario File: wb_D01.dat
Period: 1951/01/01 to 2005/12/30 Area: 0.0127 km^2

Water Balance Quantities (in mm)

Month	Precip	ET	Runoff	Infiltration (Baseflow)	(Losses)	Total Flow
JAN	48.0	7.9	13.2	6.8	20.0	20.1
FEB	42.6	7.1	18.2	5.5	11.8	23.7
MAR	60.4	8.7	46.4	6.6	-1.3	53.0
APR	76.7	28.8	35.2	8.2	4.6	43.4
MAY	77.8	47.1	25.5	8.0	-2.7	33.4
JUN	76.7	46.4	24.9	5.0	0.4	29.9
JUL	85.1	43.1	31.4	2.2	8.4	33.6
AUG	86.0	38.2	30.3	1.1	16.3	31.5
SEP	79.4	28.9	26.5	1.3	22.8	27.7
OCT	66.5	22.0	22.6	2.0	19.8	24.6
NOV	82.3	12.3	30.3	4.0	35.7	34.3
DEC	63.2	7.2	19.7	6.5	29.9	26.1
Total	844.8	297.7	324.2	57.2	165.7	381.4

WATER BALANCE SUMMARY FOR HYDROGRAPH 9141

Location: Hydrograph 9141
Scenario File: wb_D01.dat
Period: 1951/01/01 to 2005/12/30 Area: 0.0127 km^2

Water Balance Quantities (in mm)

Month	Precip	ET	Runoff	Infiltration (Baseflow)	(Losses)	Total Flow
JAN	48.0	7.9	11.9	15.3	12.9	27.2
FEB	42.6	7.1	17.0	12.9	5.7	29.9
MAR	60.4	9.3	47.4	13.7	-10.0	61.1
APR	76.7	40.1	34.7	18.9	-17.0	53.7
MAY	77.8	70.5	22.5	20.2	-35.3	42.7
JUN	76.7	70.6	22.1	12.1	-28.1	34.2
JUL	85.1	63.8	27.0	6.4	-12.1	33.4
AUG	86.0	54.5	25.6	3.5	2.5	29.1
SEP	79.4	38.6	23.1	3.1	14.6	26.2
OCT	66.5	29.0	19.9	4.9	12.7	24.8
NOV	82.3	14.8	26.6	8.4	32.4	35.0

DEC	63.2	7.2	17.7	14.0	24.2	31.8
Total	844.8	413.3	295.6	133.3	2.5	428.9

WATER BALANCE SUMMARY FOR HYDROGRAPH 1911

Location: Hydrograph 1911
Scenario File: wb_D01.dat
Period: 1951/01/01 to 2005/12/30 Area: 0.1935 km^2

Water Balance Quantities (in mm)

Month	Precip	ET	Runoff	Infiltration (Baseflow)	Infiltration (Losses)	Total Flow
JAN	48.0	7.9	5.3	19.4	15.4	24.6
FEB	42.6	7.1	7.8	16.9	10.8	24.7
MAR	60.4	9.8	25.1	19.9	5.6	45.0
APR	76.7	52.9	14.0	31.9	-22.1	45.9
MAY	77.8	97.8	3.3	33.1	-56.4	36.4
JUN	76.7	99.6	1.2	18.9	-42.9	20.0
JUL	85.1	97.3	3.1	9.9	-25.2	13.0
AUG	86.0	78.0	1.5	5.6	1.0	7.1
SEP	79.4	52.4	2.1	5.0	20.0	7.1
OCT	66.5	36.8	3.3	6.9	19.5	10.2
NOV	82.3	16.9	8.8	10.4	46.1	19.3
DEC	63.2	7.3	8.4	17.0	30.5	25.4
Total	844.8	563.7	83.8	194.9	2.4	278.6

WATER BALANCE SUMMARY FOR HYDROGRAPH 2911

Location: Hydrograph 2911
Scenario File: wb_D01.dat
Period: 1951/01/01 to 2005/12/30 Area: 0.0096 km^2

Water Balance Quantities (in mm)

Month	Precip	ET	Runoff	Infiltration (Baseflow)	Infiltration (Losses)	Total Flow
JAN	48.0	7.9	5.0	19.5	15.6	24.5
FEB	42.6	7.1	7.5	17.0	11.0	24.6
MAR	60.4	9.8	24.7	20.1	5.9	44.7
APR	76.7	52.9	13.5	32.0	-21.7	45.5
MAY	77.8	97.8	3.0	33.2	-56.2	36.2
JUN	76.7	99.6	1.0	18.9	-42.7	19.8
JUL	85.1	97.3	2.9	9.8	-24.9	12.7
AUG	86.0	78.0	1.3	5.2	1.5	6.5
SEP	79.4	52.4	1.9	4.5	20.7	6.3
OCT	66.5	36.8	3.0	6.5	20.3	9.4
NOV	82.3	16.9	8.4	10.3	46.6	18.7
DEC	63.2	7.3	8.1	17.1	30.7	25.2
Total	844.8	563.7	80.4	193.9	6.8	274.2

WATER BALANCE SUMMARY FOR HYDROGRAPH 3918

Location: Hydrograph 3918
Scenario File: wb_D01.dat
Period: 1951/01/01 to 2005/12/30 Area: 0.0057 km^2

Water Balance Quantities (in mm)

Month	Precip	ET	Runoff	Infiltration (Baseflow)	Infiltration (Losses)	Total Flow
JAN	48.0	7.9	3.6	18.9	17.5	22.5
FEB	42.6	7.1	5.9	16.9	12.7	22.8
MAR	60.4	9.8	24.2	19.3	7.1	43.5
APR	76.7	52.9	15.3	28.7	-20.2	44.0
MAY	77.8	98.1	2.5	32.5	-55.4	35.1
JUN	76.7	103.4	0.8	19.9	-47.4	20.7
JUL	85.1	103.2	2.4	10.5	-31.0	12.9
AUG	86.0	79.4	0.8	5.3	0.5	6.1
SEP	79.4	53.0	1.1	4.3	21.0	5.4
OCT	66.5	36.5	2.2	5.9	21.9	8.1
NOV	82.3	16.8	5.8	9.2	50.4	15.0
DEC	63.2	7.3	5.5	15.9	34.5	21.4
Total	844.8	575.5	70.1	187.4	11.7	257.6

WATER BALANCE SUMMARY FOR HYDROGRAPH 9171

Location: Hydrograph 9171
Scenario File: wb_D01.dat
Period: 1951/01/01 to 2005/12/30 Area: 0.0081 km^2

Water Balance Quantities (in mm)

Month	Precip	ET	Runoff	Infiltration (Baseflow)	Infiltration (Losses)	Total Flow
JAN	48.0	7.9	6.3	20.3	13.4	26.6
FEB	42.6	7.1	11.0	17.1	7.5	28.0
MAR	60.4	9.8	39.3	18.0	-6.6	57.2
APR	76.7	52.7	22.3	23.9	-22.2	46.3
MAY	77.8	97.8	4.5	24.6	-49.1	29.1
JUN	76.7	99.0	1.8	14.1	-38.1	15.8
JUL	85.1	89.0	5.7	7.2	-16.8	12.9
AUG	86.0	74.4	2.4	3.6	5.6	6.0
SEP	79.4	50.3	2.0	3.6	23.4	5.6
OCT	66.5	36.5	3.4	6.3	20.3	9.7
NOV	82.3	16.8	8.0	11.2	46.3	19.1
DEC	63.2	7.3	8.8	18.6	28.5	27.5
Total	844.8	548.7	115.5	168.5	12.1	284.0

WATER BALANCE SUMMARY FOR HYDROGRAPH 9172

Location: Hydrograph 9172
Scenario File: wb_D01.dat
Period: 1951/01/01 to 2005/12/30 Area: 0.0041 km^2

Water Balance Quantities (in mm)

Month	Precip	ET	Runoff	Infiltration (Baseflow)	Infiltration (Losses)	Total Flow
JAN	48.0	7.9	14.2	11.3	14.6	25.5
FEB	42.6	7.1	20.0	9.7	5.8	29.7
MAR	60.4	9.2	56.1	10.2	-15.1	66.3
APR	76.7	37.7	40.0	13.6	-14.7	53.7
MAY	77.8	65.0	26.7	13.9	-27.8	40.6
JUN	76.7	64.5	25.5	8.1	-21.4	33.6
JUL	85.1	58.7	31.8	3.6	-8.9	35.4
AUG	86.0	50.4	30.3	1.6	3.7	32.0
SEP	79.4	36.3	27.6	1.8	13.8	29.4

OCT	66.5	27.5	23.3	3.5	12.1	26.9
NOV	82.3	14.4	32.0	6.3	29.6	38.3
DEC	63.2	7.2	21.3	10.4	24.2	31.7
Total	844.8	385.9	348.8	94.1	15.9	443.0

WATER BALANCE SUMMARY FOR HYDROGRAPH 9151

Location: Hydrograph 9151
Scenario File: wb_D01.dat
Period: 1951/01/01 to 2005/12/30 Area: 0.0018 km^2

Water Balance Quantities (in mm)

Month	Precip	ET	Runoff	Infiltration (Baseflow)	Infiltration (Losses)	Total Flow
JAN	48.0	7.9	26.2	0.0	13.9	26.2
FEB	42.6	7.1	34.0	0.0	1.6	34.0
MAR	60.4	7.4	81.8	0.0	-28.8	81.8
APR	76.7	12.3	70.8	0.0	-6.4	70.8
MAY	77.8	16.9	61.0	0.0	-0.1	61.0
JUN	76.7	17.0	59.9	0.0	-0.2	59.9
JUL	85.1	18.4	66.4	0.0	0.3	66.4
AUG	86.0	19.3	67.0	0.0	-0.3	67.0
SEP	79.4	16.9	62.7	0.0	-0.2	62.7
OCT	66.5	12.1	54.5	0.0	-0.1	54.5
NOV	82.3	7.6	70.9	0.0	3.7	70.9
DEC	63.2	7.0	40.9	0.0	15.3	40.9
Total	844.8	149.8	696.3	0.0	-1.3	696.3

WATER BALANCE SUMMARY FOR HYDROGRAPH 9152

Location: Hydrograph 9152
Scenario File: wb_D01.dat
Period: 1951/01/01 to 2005/12/30 Area: 0.0049 km^2

Water Balance Quantities (in mm)

Month	Precip	ET	Runoff	Infiltration (Baseflow)	Infiltration (Losses)	Total Flow
JAN	48.0	7.9	3.2	24.9	12.0	28.0
FEB	42.6	7.1	6.2	20.8	8.5	27.0
MAR	60.4	9.8	25.3	22.1	3.3	47.4
APR	76.7	53.2	15.4	30.9	-22.8	46.3
MAY	77.8	99.4	2.1	32.9	-56.6	35.1
JUN	76.7	100.8	0.7	19.5	-44.2	20.2
JUL	85.1	89.9	3.5	10.3	-18.5	13.8
AUG	86.0	75.5	0.5	5.1	4.8	5.7
SEP	79.4	51.0	0.2	4.8	23.4	5.0
OCT	66.5	37.0	1.6	7.9	19.9	9.6
NOV	82.3	16.9	2.7	13.9	48.7	16.6
DEC	63.2	7.3	3.7	23.0	29.3	26.7
Total	844.8	555.8	65.2	216.0	7.8	281.2

File=DUMP0614.WTB Does not exist

WATER BALANCE SUMMARY FOR HYDROGRAPH 9914

Location: Hydrograph 9914
Scenario File: wb_D01.dat
Period: 1951/01/01 to 2005/12/30 Area: 0.0206 km^2

Water Balance Quantities (in mm)

Month	Precip	ET	Runoff	Infiltration (Baseflow)	Infiltration (Losses)	Total Flow
JAN	48.0	7.9	4.1	1.8	34.1	5.9
FEB	42.6	7.1	6.2	1.7	27.6	7.9
MAR	60.4	9.2	17.8	2.7	30.7	20.5
APR	76.7	38.6	10.1	2.1	25.9	12.2
MAY	77.8	67.7	7.8	2.2	0.1	10.0
JUN	76.7	67.9	7.9	1.2	-0.4	9.1
JUL	85.1	61.6	10.5	0.5	12.5	11.0
AUG	86.0	52.7	9.6	0.2	23.5	9.8
SEP	79.4	37.5	8.5	0.2	33.2	8.7
OCT	66.5	28.1	7.3	0.5	30.6	7.8
NOV	82.3	14.4	8.9	0.9	58.1	9.8
DEC	63.2	7.2	5.6	1.6	48.8	7.2
Total	844.8	400.0	104.4	15.4	324.9	119.9

WATER BALANCE SUMMARY FOR HYDROGRAPH 4914

Location: Hydrograph 4914
Scenario File: wb_D01.dat
Period: 1951/01/01 to 2005/12/30 Area: 0.0183 km^2

Water Balance Quantities (in mm)

Month	Precip	ET	Runoff	Infiltration (Baseflow)	Infiltration (Losses)	Total Flow
JAN	48.0	7.9	11.0	16.0	13.1	27.0
FEB	42.6	7.1	15.8	13.5	6.2	29.3
MAR	60.4	9.4	45.2	14.3	-8.5	59.5
APR	76.7	41.2	32.8	19.9	-17.3	52.7
MAY	77.8	73.0	20.7	21.2	-37.0	41.8
JUN	76.7	73.3	20.1	12.6	-29.3	32.7
JUL	85.1	66.1	24.9	6.6	-12.6	31.6
AUG	86.0	56.3	23.2	3.4	3.1	26.7
SEP	79.4	39.7	21.0	3.1	15.6	24.2
OCT	66.5	29.7	18.2	5.1	13.5	23.3
NOV	82.3	15.0	24.2	8.9	34.3	33.0
DEC	63.2	7.2	16.2	14.7	25.1	30.9
Total	844.8	426.0	273.3	139.4	6.2	412.7

WATER BALANCE SUMMARY FOR HYDROGRAPH 6914

Location: Hydrograph 6914
Scenario File: wb_D01.dat
Period: 1951/01/01 to 2005/12/30 Area: 0.0347 km^2

Water Balance Quantities (in mm)

Month	Precip	ET	Runoff	Infiltration (Baseflow)	Infiltration (Losses)	Total Flow
JAN	48.0	7.9	0.9	0.0	39.1	0.9
FEB	42.6	7.1	2.2	0.0	33.3	2.2
MAR	60.4	7.4	3.3	0.0	49.7	3.3
APR	76.7	12.3	3.4	0.0	61.0	3.4

MAY	77.8	16.9	3.9	0.0	57.1	3.9
JUN	76.7	17.0	4.2	0.0	55.5	4.2
JUL	85.1	18.4	12.0	0.0	54.7	12.0
AUG	86.0	19.3	10.2	0.0	56.6	10.2
SEP	79.4	16.9	5.8	0.0	56.7	5.8
OCT	66.5	12.1	2.9	0.0	51.5	2.9
NOV	82.3	7.6	3.6	0.0	71.0	3.6
DEC	63.2	7.0	0.6	0.0	55.6	0.6
Total	844.8	149.8	53.1	0.0	641.9	53.1

WATER BALANCE SUMMARY FOR HYDROGRAPH 114

Location: Hydrograph 114
Scenario File: wb_D01.dat
Period: 1951/01/01 to 2005/12/30 Area: 0.1243 km^2

Water Balance Quantities (in mm)

Month	Precip	ET	Runoff	Infiltration (Baseflow)	Infiltration (Losses)	Total Flow
JAN	48.0	7.9	0.4	0.0	39.7	0.4
FEB	42.6	7.1	0.7	0.0	34.8	0.7
MAR	60.4	8.9	0.9	0.0	50.5	1.0
APR	76.7	30.4	0.7	0.0	45.5	0.7
MAY	77.8	50.3	0.6	0.0	26.9	0.6
JUN	76.7	50.2	0.8	0.0	25.7	0.8
JUL	85.1	46.6	4.7	0.0	33.8	4.7
AUG	86.0	41.2	2.5	0.0	42.2	2.6
SEP	79.4	30.6	1.4	0.0	47.4	1.5
OCT	66.5	23.0	1.1	0.0	42.4	1.1
NOV	82.3	12.6	0.6	0.0	69.0	0.6
DEC	63.2	7.2	0.0	0.0	56.0	0.0
Total	844.8	316.0	14.4	0.4	514.1	14.7

WATER BALANCE SUMMARY FOR HYDROGRAPH 714

Location: Hydrograph 714
Scenario File: wb_D01.dat
Period: 1951/01/01 to 2005/12/30 Area: 0.1243 km^2

Water Balance Quantities (in mm)

Month	Precip	ET	Runoff	Infiltration (Baseflow)	Infiltration (Losses)	Total Flow
JAN	48.0	7.9	2.4	0.7	37.0	3.1
FEB	42.6	7.1	2.9	0.4	32.2	3.3
MAR	60.4	8.9	7.4	0.5	43.6	7.9
APR	76.7	30.4	6.0	0.7	39.5	6.7
MAY	77.8	50.3	4.7	0.7	22.2	5.4
JUN	76.7	50.2	4.7	0.3	21.5	5.0
JUL	85.1	46.6	5.7	-0.8	33.7	4.9
AUG	86.0	41.2	5.8	-0.3	39.2	5.6
SEP	79.4	30.6	5.3	-0.3	43.9	5.0
OCT	66.5	23.0	4.5	0.0	39.1	4.4
NOV	82.3	12.6	5.4	0.3	63.9	5.7
DEC	63.2	7.2	3.5	0.7	51.8	4.2
Total	844.8	316.0	58.3	2.8	467.7	61.1

WATER BALANCE SUMMARY FOR HYDROGRAPH 3092

Location: Hydrograph 3092
Scenario File: wb_D01.dat
Period: 1951/01/01 to 2005/12/30 Area: 0.0402 km^2

Water Balance Quantities (in mm)

Month	Precip	ET	Runoff	Infiltration (Baseflow)	Infiltration (Losses)	Total Flow
JAN	48.0	7.9	9.1	18.1	12.9	27.1
FEB	42.6	7.1	14.0	14.9	6.7	28.8
MAR	60.4	9.8	44.6	15.7	-9.6	60.2
APR	76.7	52.9	24.6	21.3	-22.1	45.9
MAY	77.8	97.4	5.6	21.7	-46.8	27.3
JUN	76.7	93.8	2.2	12.5	-31.8	14.7
JUL	85.1	85.6	6.2	6.8	-13.5	13.0
AUG	86.0	73.6	3.1	4.2	5.2	7.3
SEP	79.4	50.5	3.5	4.2	21.2	7.8
OCT	66.5	36.7	5.6	6.9	17.2	12.6
NOV	82.3	16.9	14.3	11.2	39.9	25.5
DEC	63.2	7.3	13.6	17.0	25.3	30.7
Total	844.8	539.4	146.4	154.4	4.4	300.9

WATER BALANCE SUMMARY FOR HYDROGRAPH 3093

Location: Hydrograph 3093
Scenario File: wb_D01.dat
Period: 1951/01/01 to 2005/12/30 Area: 0.0058 km^2

Water Balance Quantities (in mm)

Month	Precip	ET	Runoff	Infiltration (Baseflow)	Infiltration (Losses)	Total Flow
JAN	48.0	7.9	7.3	17.5	15.3	24.8
FEB	42.6	7.1	11.1	15.2	9.3	26.3
MAR	60.4	9.8	38.7	16.5	-4.5	55.2
APR	76.7	52.9	21.7	22.8	-20.8	44.5
MAY	77.8	97.6	4.3	25.1	-49.2	29.4
JUN	76.7	97.2	1.1	15.2	-36.8	16.3
JUL	85.1	94.2	4.0	8.0	-21.1	12.0
AUG	86.0	76.5	1.5	4.1	4.0	5.5
SEP	79.4	51.8	2.1	3.9	21.5	6.1
OCT	66.5	36.6	4.0	6.2	19.7	10.2
NOV	82.3	16.9	11.5	9.7	44.2	21.2
DEC	63.2	7.3	11.4	15.5	29.0	26.9
Total	844.8	555.8	118.8	159.6	10.7	278.3

WATER BALANCE SUMMARY FOR HYDROGRAPH 3103

Location: Hydrograph 3103
Scenario File: wb_D01.dat
Period: 1951/01/01 to 2005/12/30 Area: 0.0050 km^2

Water Balance Quantities (in mm)

Month	Precip	ET	Runoff	Infiltration (Baseflow)	Infiltration (Losses)	Total Flow
JAN	48.0	7.9	4.9	23.0	12.2	27.8
FEB	42.6	7.1	7.9	19.4	8.2	27.3

MAR	60.4	9.8	29.2	20.4	1.0	49.6
APR	76.7	52.9	17.0	28.3	-21.6	45.4
MAY	77.8	97.9	3.0	30.4	-53.5	33.5
JUN	76.7	94.9	0.9	18.2	-37.3	19.1
JUL	85.1	86.1	3.9	9.6	-14.5	13.6
AUG	86.0	74.1	1.0	5.1	5.9	6.1
SEP	79.4	50.6	1.3	5.0	22.5	6.3
OCT	66.5	36.8	3.0	8.2	18.4	11.3
NOV	82.3	16.9	7.1	13.8	44.5	20.9
DEC	63.2	7.3	7.1	21.6	27.3	28.6
Total	844.8	542.3	86.5	202.9	13.1	289.4

WATER BALANCE SUMMARY FOR HYDROGRAPH 9173

Location: Hydrograph 9173
Scenario File: wb_D01.dat
Period: 1951/01/01 to 2005/12/30 Area: 0.0029 km^2

Water Balance Quantities (in mm)

Month	Precip	ET	Runoff	Infiltration (Baseflow)	Infiltration (Losses)	Total Flow
JAN	48.0	7.9	5.5	20.1	14.4	25.7
FEB	42.6	7.1	10.0	17.2	8.3	27.2
MAR	60.4	9.8	37.5	18.8	-5.7	56.3
APR	76.7	53.2	22.1	24.7	-23.3	46.8
MAY	77.8	99.1	3.9	24.9	-50.0	28.8
JUN	76.7	100.3	1.1	14.0	-38.7	15.1
JUL	85.1	90.2	4.9	6.3	-16.2	11.1
AUG	86.0	75.4	1.6	2.9	6.2	4.5
SEP	79.4	50.9	1.3	3.3	24.0	4.6
OCT	66.5	36.9	2.8	6.3	20.6	9.1
NOV	82.3	16.9	6.5	11.3	47.5	17.8
DEC	63.2	7.3	7.6	18.6	29.7	26.2
Total	844.8	554.9	104.9	168.3	16.7	273.2

WATER BALANCE SUMMARY FOR HYDROGRAPH 3102

Location: Hydrograph 3102
Scenario File: wb_D01.dat
Period: 1951/01/01 to 2005/12/30 Area: 0.0866 km^2

Water Balance Quantities (in mm)

Month	Precip	ET	Runoff	Infiltration (Baseflow)	Infiltration (Losses)	Total Flow
JAN	48.0	7.9	8.9	1.4	29.8	10.3
FEB	42.6	7.1	11.8	1.2	22.6	12.9
MAR	60.4	8.7	28.3	1.2	22.3	29.5
APR	76.7	29.5	23.0	1.7	22.5	24.7
MAY	77.8	49.3	19.5	1.9	7.1	21.4
JUN	76.7	48.5	20.2	1.1	6.8	21.4
JUL	85.1	44.7	25.2	0.6	14.6	25.8
AUG	86.0	40.0	24.5	0.3	21.2	24.9
SEP	79.4	29.9	21.4	0.3	27.8	21.7
OCT	66.5	22.6	17.4	0.5	25.9	17.9
NOV	82.3	12.3	22.7	0.8	46.5	23.5
DEC	63.2	7.2	13.7	1.3	41.0	15.0
Total	844.8	307.8	236.6	12.3	288.1	249.0

WATER BALANCE SUMMARY FOR HYDROGRAPH 1917

Location: Hydrograph 1917
Scenario File: wb_D01.dat
Period: 1951/01/01 to 2005/12/30 Area: 0.0127 km^2

Water Balance Quantities (in mm)

Month	Precip	ET	Runoff	Infiltration (Baseflow)	Infiltration (Losses)	Total Flow
JAN	48.0	7.9	0.3	0.0	39.7	0.3
FEB	42.6	7.1	1.0	0.1	34.4	1.1
MAR	60.4	8.7	1.0	0.1	50.6	1.0
APR	76.7	28.8	1.3	0.1	46.5	1.4
MAY	77.8	47.1	0.7	0.1	30.0	0.7
JUN	76.7	46.4	0.8	0.0	29.5	0.9
JUL	85.1	43.1	5.8	0.1	36.2	5.8
AUG	86.0	38.2	3.0	0.1	44.7	3.1
SEP	79.4	28.9	1.0	0.1	49.5	1.1
OCT	66.5	22.0	1.2	0.0	43.2	1.2
NOV	82.3	12.3	1.0	0.1	68.9	1.0
DEC	63.2	7.2	0.1	0.0	55.9	0.1
Total	844.8	297.7	17.1	0.8	529.2	17.9

WATER BALANCE SUMMARY FOR HYDROGRAPH 5915

Location: Hydrograph 5915
Scenario File: wb_D01.dat
Period: 1951/01/01 to 2005/12/30 Area: 0.0089 km^2

Water Balance Quantities (in mm)

Month	Precip	ET	Runoff	Infiltration (Baseflow)	Infiltration (Losses)	Total Flow
JAN	48.0	7.9	12.2	11.6	16.2	23.8
FEB	42.6	7.1	17.1	9.3	9.1	26.4
MAR	60.4	9.0	44.2	11.1	-3.9	55.3
APR	76.7	34.0	34.2	14.6	-6.1	48.8
MAY	77.8	57.9	24.8	14.9	-19.8	39.8
JUN	76.7	57.4	24.1	9.6	-14.4	33.7
JUL	85.1	52.3	30.0	4.6	-1.7	34.6
AUG	86.0	45.6	28.5	2.5	9.4	31.0
SEP	79.4	33.3	25.3	2.3	18.5	27.6
OCT	66.5	25.3	21.7	3.7	15.8	25.4
NOV	82.3	13.5	28.0	6.8	34.0	34.8
DEC	63.2	7.2	17.9	10.8	27.3	28.7
Total	844.8	350.6	308.2	101.7	84.2	409.9

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                  GAWSER V6.9.18 - Released - Sep. 21, 2016
                  =========================================

                   Upper Speed River Watershed
                   Threshold Flow Exceedance Summaries
                   For Existing Conditions
                   =======================================
                              Non-Winter Model
   Input file 1=EXCEED1.dat
   Input file 2=
   Output file =EXCEED1.txt
* ====================================================================
* File created by Dr. H.O. Schroeter, P.Eng., November 10, 2011
* ====================================================================
START               KUNITS=2  TOTAL AREA=174 SQ KM
                    BASEFLOW AT OUTLET: QBSS=0.0    QBGW=0.60  CMS
                    PRINT OPTIONS:ECHO=3 OUTPUT=0 PLOTS=1 RCS=1 SUBW=1
                        PLOT CUTOFF TIME=576 SUM=4 FREE=0
                    PARAMETER ADJUSTMENT FACTORS: FDS=1  FKEFF=0.05
                       FCS=1.0 FD=1.0 FSAV=1.0 FKO=1.0 FKSS=1 FKMF=1
                    INITIAL SOIL/SNOW WATER FACTORS:
                       FIMCI=0.75  FIMCII=1.00 FIWE=0.0
                    GLOBAL RAINFALL SCALING FACTOR: GFRF=1.0
                    SIMULATION CONTROLS: TTI=1 HR IDEL=4 HOURS=576
                    SUBWATERSHED INITIAL BASEFLOWS IN CMS=-999

    STREAM DISCHARGE EXCEEDANCE SUMMARY FOR  616
    ============================================

    Location:  Hydrograph  616
    Period:   1951/ 1/ 1   to   2005/12/30

            Total           Threshold 1              Threshold 2
    Month   Hours        Flow   Hours    PCT        Flow   Hours    PCT
    JAN     40920.    0.02000      24.    0.1    0.01000    5494.   13.4
    FEB     37296.    0.02000      38.    0.1    0.01000    5934.   15.9
    MAR     40920.    0.02000     184.    0.4    0.01000   14924.   36.5
    APR     39600.    0.02000     131.    0.3    0.01000   12520.   31.6
    MAY     40920.    0.02000      18.    0.0    0.01000    9661.   23.6
    JUN     39600.    0.02000       4.    0.0    0.01000    7975.   20.1
    JUL     40920.    0.02000      14.    0.0    0.01000    6032.   14.7
    AUG     40920.    0.02000       3.    0.0    0.01000    5710.   14.0
    SEP     39600.    0.02000       0.    0.0    0.01000    6086.   15.4
    OCT     40920.    0.02000      12.    0.0    0.01000    6945.   17.0
    NOV     39600.    0.02000      14.    0.0    0.01000   10741.   27.1
    DEC     40896.    0.02000      12.    0.0    0.01000    7963.   19.5
    Total  482112.    0.02000     454.    0.1    0.01000   99985.   20.7

    STREAM DISCHARGE EXCEEDANCE SUMMARY FOR 2004
    ============================================

    Location:  Hydrograph 2004
    Period:   1951/ 1/ 1   to   2005/12/30

            Total           Threshold 1              Threshold 2
    Month   Hours        Flow   Hours    PCT        Flow   Hours    PCT
    JAN     40920.    0.36000     508.    1.2    0.27000     699.    1.7
    FEB     37296.    0.36000     789.    2.1    0.27000    1029.    2.8
    MAR     40920.    0.36000    3398.    8.3    0.27000    4305.   10.5
    APR     39600.    0.36000    2032.    5.1    0.27000    2544.    6.4
    MAY     40920.    0.36000     321.    0.8    0.27000     414.    1.0
    JUN     39600.    0.36000      56.    0.1    0.27000      83.    0.2
    JUL     40920.    0.36000     228.    0.6    0.27000     269.    0.7
    AUG     40920.    0.36000      97.    0.2    0.27000     129.    0.3
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    SEP     39600.    0.36000      31.    0.1    0.27000      38.    0.1
    OCT     40920.    0.36000     112.    0.3    0.27000     136.    0.3
    NOV     39600.    0.36000     429.    1.1    0.27000     598.    1.5
    DEC     40896.    0.36000     641.    1.6    0.27000     877.    2.1
    Total  482112.    0.36000    8642.    1.8    0.27000   11121.    2.3

    STREAM DISCHARGE EXCEEDANCE SUMMARY FOR 2009
    ============================================

    Location:  Hydrograph 2009
    Period:   1951/ 1/ 1   to   2005/12/30

            Total           Threshold 1              Threshold 2
    Month   Hours        Flow   Hours    PCT        Flow   Hours    PCT
    JAN     40920.    0.66000     254.    0.6    0.31000     629.    1.5
    FEB     37296.    0.66000     409.    1.1    0.31000     968.    2.6
    MAR     40920.    0.66000    1645.    4.0    0.31000    4026.    9.8
    APR     39600.    0.66000    1062.    2.7    0.31000    2382.    6.0
    MAY     40920.    0.66000     170.    0.4    0.31000     394.    1.0
    JUN     39600.    0.66000      39.    0.1    0.31000      76.    0.2
    JUL     40920.    0.66000     154.    0.4    0.31000     260.    0.6
    AUG     40920.    0.66000      37.    0.1    0.31000     126.    0.3
    SEP     39600.    0.66000      28.    0.1    0.31000      44.    0.1
    OCT     40920.    0.66000      63.    0.2    0.31000     127.    0.3
    NOV     39600.    0.66000     221.    0.6    0.31000     540.    1.4
    DEC     40896.    0.66000     308.    0.8    0.31000     806.    2.0
    Total  482112.    0.66000    4390.    0.9    0.31000   10378.    2.2
```

```
                GAWSER V6.9.18 - Released - Sep. 21, 2016
                =========================================

                    Upper River Watershed Model
                  Generalized Water Balance Summary
                      Demonstration
                 ======================================
                              Winter Model
   Input file 1=wb_D01.dat
   Input file 2=
   Output file =wb_D01.lst
* ========================================================================
* File created by Dr. H.O. Schroeter, January 10, 2000
* ========================================================================
START               KUNITS=2 TOTAL WATERSHED AREA=167    SQ KM
                    INITIAL BASEFLOW AT OUTLET: QBSS= 0.0000 QBGW= 0.000
                    PRINT OPTIONS: ECHO=3 OUTPUT=1 PLOTS=0 RCS=1 SUBW=1
                      PLOT CUTOFF=576 SUM=4 FREE=0
                    PARAMETER ADJUSTMENT FACTORS: FDS=1.00 FKEFF=0.25
                      FCS=0.30 FD=0.30 FSAV=1.0 FKO=1.00 FKSS=1.0 FKMF=1.00
                    INITIAL SOIL/SNOW WATER FACTORS:
                      FIMCI=1.00 FIMCII=1.00 FIWE=0.0000
                    GLOBAL RAINFALL SCALING FACTOR: GFRF=1.0000
                    SIMULATION CONTROLS: TTI=1.00000 IDEL=2 HOURS=576
                    SUBWATERSHED INITIAL BASEFLOWS: -999



                WATER BALANCE SUMMARY FOR HYDROGRAPH 3914
                =========================================

       Location:       Hydrograph 3914
       Scenario File: wb_D01.dat
       Period:        1951/01/01 to 2005/12/30      Area:     0.1243 km^2

                           Water Balance Quantities (in mm)
                                                Infiltration       Total
        Month    Precip        ET    Runoff  (Baseflow) (Losses)     Flow
         JAN       48.0       7.9      10.1       3.1      26.9      13.1
         FEB       42.6       7.1      13.6       2.6      19.3      16.2
         MAR       60.4       8.7      33.6       2.9      15.3      36.5
         APR       76.7      29.1      26.5       3.8      17.3      30.3
         MAY       77.8      48.5      21.6       4.0       3.7      25.6
         JUN       76.7      48.3      22.1       2.4       3.9      24.5
         JUL       85.1      44.7      27.6       1.3      11.6      28.9
         AUG       86.0      39.5      27.1       0.7      18.7      27.9
         SEP       79.4      29.5      23.7       0.7      25.5      24.4
         OCT       66.5      22.4      19.1       1.0      24.0      20.1
         NOV       82.3      12.3      25.1       1.7      43.2      26.8
         DEC       63.2       7.2      15.2       2.8      38.1      18.0

        Total     844.8     305.1     265.3      27.0     247.4     292.3


                WATER BALANCE SUMMARY FOR HYDROGRAPH 5914
                =========================================

       Location:       Hydrograph 5914
       Scenario File: wb_D01.dat
       Period:        1951/01/01 to 2005/12/30      Area:     0.1243 km^2

                           Water Balance Quantities (in mm)
                                                Infiltration       Total
        Month    Precip        ET    Runoff  (Baseflow) (Losses)     Flow
         JAN       48.0       7.9      10.5       3.2      26.3      13.8
```



```
         FEB       42.6       7.1      12.7       2.4      20.5      15.1
         MAR       60.4       8.9      32.1       3.0      16.3      35.2
         APR       76.7      30.4      26.1       3.9      16.3      30.0
         MAY       77.8      50.3      20.4       3.6       3.5      24.0
         JUN       76.7      50.2      20.0       2.5       4.0      22.5
         JUL       85.1      46.6      24.9       1.1      12.5      26.1
         AUG       86.0      41.2      26.0       0.9      18.0      26.8
         SEP       79.4      30.6      22.4       0.7      25.7      23.2
         OCT       66.5      23.0      19.3       1.1      23.1      20.4
         NOV       82.3      12.6      23.5       1.8      44.3      25.3
         DEC       63.2       7.2      15.3       3.1      37.6      18.4

        Total     844.8     316.0     253.5      27.2     248.1     280.7


                WATER BALANCE SUMMARY FOR HYDROGRAPH 2914
                =========================================

       Location:       Hydrograph 2914
       Scenario File: wb_D01.dat
       Period:        1951/01/01 to 2005/12/30      Area:     0.1426 km^2

                           Water Balance Quantities (in mm)
                                                Infiltration       Total
        Month    Precip        ET    Runoff  (Baseflow) (Losses)     Flow
         JAN       48.0       7.9      10.6       4.9      24.6      15.5
         FEB       42.6       7.1      13.1       3.8      18.6      16.9
         MAR       60.4       9.0      33.8       4.5      13.1      38.3
         APR       76.7      31.8      27.0       5.9      12.0      32.9
         MAY       77.8      53.2      20.4       5.9      -1.7      26.3
         JUN       76.7      53.1      20.0       3.8      -0.3      23.8
         JUL       85.1      49.1      24.9       1.9       9.3      26.8
         AUG       86.0      43.2      25.6       1.2      16.0      26.8
         SEP       79.4      31.7      22.3       1.0      24.4      23.3
         OCT       66.5      23.8      19.2       1.6      21.9      20.8
         NOV       82.3      12.9      23.6       2.7      43.0      26.3
         DEC       63.2       7.2      15.4       4.6      36.0      20.0

        Total     844.8     330.1     256.0      41.6     217.0     297.7


                WATER BALANCE SUMMARY FOR HYDROGRAPH 5915
                =========================================

       Location:       Hydrograph 5915
       Scenario File: wb_D01.dat
       Period:        1951/01/01 to 2005/12/30      Area:     0.0089 km^2

                           Water Balance Quantities (in mm)
                                                Infiltration       Total
        Month    Precip        ET    Runoff  (Baseflow) (Losses)     Flow
         JAN       48.0       7.9      12.1      11.6      16.3      23.7
         FEB       42.6       7.1      17.1       9.3       9.1      26.4
         MAR       60.4       9.8      43.6      10.9      -3.9      54.5
         APR       76.7      38.8      31.3      12.7      -6.2      44.0
         MAY       77.8      66.1      20.3      11.4     -19.9      31.7
         JUN       76.7      66.4      18.6       6.7     -15.0      25.3
         JUL       85.1      61.9      22.5       2.8      -2.1      25.3
         AUG       86.0      53.4      21.6       1.8       9.3      23.3
         SEP       79.4      38.4      20.0       1.9      19.1      22.0
         OCT       66.5      28.5      18.6       3.3      16.1      21.9
         NOV       82.3      15.2      26.3       6.5      34.3      32.7
         DEC       63.2       7.4      17.7      10.7      27.4      28.4
```

Total	844.8	401.1	269.7	89.5	84.4	359.2

WATER BALANCE SUMMARY FOR HYDROGRAPH 2915

Location: Hydrograph 2915
Scenario File: wb_D01.dat
Period: 1951/01/01 to 2005/12/30 Area: 0.0155 km^2

Water Balance Quantities (in mm)

Month	Precip	ET	Runoff	Infiltration (Baseflow)	Infiltration (Losses)	Total Flow
JAN	48.0	7.9	11.0	14.4	14.7	25.4
FEB	42.6	7.1	15.7	11.8	8.1	27.5
MAR	60.4	9.5	42.3	13.1	-4.5	55.4
APR	76.7	40.2	30.9	16.9	-11.4	47.8
MAY	77.8	70.8	19.4	16.8	-29.1	36.1
JUN	76.7	71.4	17.8	9.9	-22.4	27.7
JUL	85.1	65.6	21.7	4.8	-7.0	26.5
AUG	86.0	56.4	20.3	2.6	6.8	22.9
SEP	79.4	39.8	18.8	2.6	18.2	21.4
OCT	66.5	29.3	17.5	4.3	15.4	21.8
NOV	82.3	14.9	24.1	8.0	35.2	32.1
DEC	63.2	7.3	16.0	13.3	26.6	29.3
Total	844.8	420.3	255.3	118.6	50.5	373.9

File=DUMP0917.WTB Does not exist

WATER BALANCE SUMMARY FOR HYDROGRAPH 2917

Location: Hydrograph 2917
Scenario File: wb_D01.dat
Period: 1951/01/01 to 2005/12/30 Area: 0.0248 km^2

Water Balance Quantities (in mm)

Month	Precip	ET	Runoff	Infiltration (Baseflow)	Infiltration (Losses)	Total Flow
JAN	48.0	7.9	11.1	12.0	17.0	23.1
FEB	42.6	7.1	16.1	9.9	9.6	26.0
MAR	60.4	9.4	45.4	10.8	-5.2	56.1
APR	76.7	39.7	30.7	13.8	-7.4	44.4
MAY	77.8	69.4	16.9	13.4	-21.9	30.4
JUN	76.7	69.6	15.2	7.9	-15.9	23.0
JUL	85.1	64.0	20.1	3.7	-2.7	23.8
AUG	86.0	54.8	18.6	1.9	10.7	20.5
SEP	79.4	38.9	16.7	2.0	21.8	18.7
OCT	66.5	28.8	15.3	3.6	18.8	18.9
NOV	82.3	14.7	22.6	6.6	38.3	29.2
DEC	63.2	7.3	16.3	11.1	28.5	27.4
Total	844.8	411.6	244.9	96.6	91.6	341.5

WATER BALANCE SUMMARY FOR HYDROGRAPH 5917

Location: Hydrograph 5917
Scenario File: wb_D01.dat
Period: 1951/01/01 to 2005/12/30 Area: 0.0127 km^2

Water Balance Quantities (in mm)

Month	Precip	ET	Runoff	Infiltration (Baseflow)	Infiltration (Losses)	Total Flow
JAN	48.0	7.9	13.2	6.9	20.0	20.1
FEB	42.6	7.1	18.0	5.4	12.1	23.4
MAR	60.4	9.3	45.8	6.4	-1.1	52.2
APR	76.7	32.1	32.9	7.4	4.3	40.3
MAY	77.8	52.7	21.7	6.2	-2.8	27.9
JUN	76.7	52.6	20.4	3.8	-0.1	24.2
JUL	85.1	49.9	25.4	1.5	8.3	26.9
AUG	86.0	43.8	25.1	0.9	16.3	26.0
SEP	79.4	32.5	22.4	1.1	23.3	23.6
OCT	66.5	24.3	20.3	1.9	20.0	22.2
NOV	82.3	13.5	28.8	3.8	36.1	32.6
DEC	63.2	7.3	19.5	6.5	29.9	26.0
Total	844.8	333.1	293.5	51.9	166.3	345.3

WATER BALANCE SUMMARY FOR HYDROGRAPH 9141

Location: Hydrograph 9141
Scenario File: wb_D01.dat
Period: 1951/01/01 to 2005/12/30 Area: 0.0127 km^2

Water Balance Quantities (in mm)

Month	Precip	ET	Runoff	Infiltration (Baseflow)	Infiltration (Losses)	Total Flow
JAN	48.0	7.9	11.9	15.3	12.9	27.2
FEB	42.6	7.1	17.0	12.9	5.7	29.9
MAR	60.4	9.3	47.4	13.7	-10.0	61.1
APR	76.7	40.1	34.7	18.9	-17.0	53.7
MAY	77.8	70.5	22.5	20.2	-35.3	42.7
JUN	76.7	70.6	22.1	12.1	-28.1	34.2
JUL	85.1	63.8	27.0	6.4	-12.1	33.4
AUG	86.0	54.5	25.6	3.5	2.5	29.1
SEP	79.4	38.6	23.1	3.1	14.6	26.2
OCT	66.5	29.0	19.9	4.9	12.7	24.8
NOV	82.3	14.8	26.6	8.4	32.4	35.0
DEC	63.2	7.2	17.7	14.0	24.2	31.8
Total	844.8	413.3	295.6	133.3	2.5	428.9

WATER BALANCE SUMMARY FOR HYDROGRAPH 1911

Location: Hydrograph 1911
Scenario File: wb_D01.dat
Period: 1951/01/01 to 2005/12/30 Area: 0.1935 km^2

Water Balance Quantities (in mm)

Month	Precip	ET	Runoff	Infiltration (Baseflow)	Infiltration (Losses)	Total Flow
JAN	48.0	7.9	5.3	19.4	15.4	24.6
FEB	42.6	7.1	7.8	16.9	10.8	24.7
MAR	60.4	9.8	25.1	19.9	5.6	45.0
APR	76.7	52.9	14.0	31.9	-22.1	45.9
MAY	77.8	97.8	3.3	33.1	-56.4	36.4
JUN	76.7	99.6	1.2	18.9	-42.9	20.0
JUL	85.1	97.3	3.1	9.9	-25.2	13.0
AUG	86.0	78.0	1.5	5.6	1.0	7.1

SEP	79.4	52.4	2.1	5.0	20.0	7.1
OCT	66.5	36.8	3.3	6.9	19.5	10.2
NOV	82.3	16.9	8.8	10.4	46.1	19.3
DEC	63.2	7.3	8.4	17.0	30.5	25.4
Total	844.8	563.7	83.8	194.9	2.4	278.6

WATER BALANCE SUMMARY FOR HYDROGRAPH 2911

Location: Hydrograph 2911
Scenario File: wb_D01.dat
Period: 1951/01/01 to 2005/12/30 Area: 0.0096 km^2

Water Balance Quantities (in mm)

Month	Precip	ET	Runoff	Infiltration (Baseflow)	Infiltration (Losses)	Total Flow
JAN	48.0	7.9	5.0	19.5	15.6	24.5
FEB	42.6	7.1	7.5	17.0	11.0	24.6
MAR	60.4	9.8	24.7	20.1	5.9	44.7
APR	76.7	52.9	13.5	32.0	-21.7	45.5
MAY	77.8	97.8	3.0	33.2	-56.2	36.2
JUN	76.7	99.6	1.0	18.9	-42.7	19.8
JUL	85.1	97.3	2.9	9.8	-24.9	12.7
AUG	86.0	78.0	1.3	5.2	1.5	6.5
SEP	79.4	52.4	1.9	4.5	20.7	6.3
OCT	66.5	36.8	3.0	6.5	20.3	9.4
NOV	82.3	16.9	8.4	10.3	46.6	18.7
DEC	63.2	7.3	8.1	17.1	30.7	25.2
Total	844.8	563.7	80.4	193.9	6.8	274.2

WATER BALANCE SUMMARY FOR HYDROGRAPH 3918

Location: Hydrograph 3918
Scenario File: wb_D01.dat
Period: 1951/01/01 to 2005/12/30 Area: 0.0057 km^2

Water Balance Quantities (in mm)

Month	Precip	ET	Runoff	Infiltration (Baseflow)	Infiltration (Losses)	Total Flow
JAN	48.0	7.9	3.6	18.9	17.5	22.5
FEB	42.6	7.1	5.9	16.9	12.7	22.8
MAR	60.4	9.8	24.2	19.3	7.1	43.5
APR	76.7	52.9	15.3	28.7	-20.2	44.0
MAY	77.8	98.1	2.5	32.5	-55.4	35.1
JUN	76.7	103.4	0.8	19.9	-47.4	20.7
JUL	85.1	103.2	2.4	10.5	-31.0	12.9
AUG	86.0	79.4	0.8	5.3	0.5	6.1
SEP	79.4	53.0	1.1	4.3	21.0	5.4
OCT	66.5	36.5	2.2	5.9	21.9	8.1
NOV	82.3	16.8	5.8	9.2	50.4	15.0
DEC	63.2	7.3	5.5	15.9	34.5	21.4
Total	844.8	575.5	70.1	187.4	11.7	257.6

WATER BALANCE SUMMARY FOR HYDROGRAPH 9171

Location: Hydrograph 9171

Scenario File: wb_D01.dat
Period: 1951/01/01 to 2005/12/30 Area: 0.0081 km^2

Water Balance Quantities (in mm)

Month	Precip	ET	Runoff	Infiltration (Baseflow)	Infiltration (Losses)	Total Flow
JAN	48.0	7.9	6.3	20.3	13.4	26.6
FEB	42.6	7.1	11.0	17.1	7.5	28.0
MAR	60.4	9.8	39.3	18.0	-6.6	57.2
APR	76.7	52.7	22.3	23.9	-22.2	46.3
MAY	77.8	97.8	4.5	24.6	-49.1	29.1
JUN	76.7	99.0	1.8	14.1	-38.1	15.8
JUL	85.1	89.0	5.7	7.2	-16.8	12.9
AUG	86.0	74.4	2.4	3.6	5.6	6.0
SEP	79.4	50.3	2.0	3.6	23.4	5.6
OCT	66.5	36.5	3.4	6.3	20.3	9.7
NOV	82.3	16.8	8.0	11.2	46.3	19.1
DEC	63.2	7.3	8.8	18.6	28.5	27.5
Total	844.8	548.7	115.5	168.5	12.1	284.0

WATER BALANCE SUMMARY FOR HYDROGRAPH 9172

Location: Hydrograph 9172
Scenario File: wb_D01.dat
Period: 1951/01/01 to 2005/12/30 Area: 0.0041 km^2

Water Balance Quantities (in mm)

Month	Precip	ET	Runoff	Infiltration (Baseflow)	Infiltration (Losses)	Total Flow
JAN	48.0	7.9	14.2	11.3	14.6	25.5
FEB	42.6	7.1	20.0	9.7	5.8	29.7
MAR	60.4	9.2	56.1	10.2	-15.1	66.3
APR	76.7	37.7	40.0	13.6	-14.7	53.7
MAY	77.8	65.0	26.7	13.9	-27.8	40.6
JUN	76.7	64.5	25.5	8.1	-21.4	33.6
JUL	85.1	58.7	31.8	3.6	-8.9	35.4
AUG	86.0	50.4	30.3	1.6	3.7	32.0
SEP	79.4	36.3	27.6	1.8	13.8	29.4
OCT	66.5	27.5	23.3	3.5	12.1	26.9
NOV	82.3	14.4	32.0	6.3	29.6	38.3
DEC	63.2	7.2	21.3	10.4	24.2	31.7
Total	844.8	385.9	348.8	94.1	15.9	443.0

WATER BALANCE SUMMARY FOR HYDROGRAPH 9151

Location: Hydrograph 9151
Scenario File: wb_D01.dat
Period: 1951/01/01 to 2005/12/30 Area: 0.0018 km^2

Water Balance Quantities (in mm)

Month	Precip	ET	Runoff	Infiltration (Baseflow)	Infiltration (Losses)	Total Flow
JAN	48.0	7.9	26.2	0.0	13.9	26.2
FEB	42.6	7.1	34.0	0.0	1.6	34.0
MAR	60.4	7.4	81.8	0.0	-28.8	81.8
APR	76.7	12.3	70.8	0.0	-6.4	70.8
MAY	77.8	16.9	61.0	0.0	-0.1	61.0
JUN	76.7	17.0	59.9	0.0	-0.2	59.9

JUL	85.1	18.4	66.4	0.0	0.3	66.4
AUG	86.0	19.3	67.0	0.0	-0.3	67.0
SEP	79.4	16.9	62.7	0.0	-0.2	62.7
OCT	66.5	12.1	54.5	0.0	-0.1	54.5
NOV	82.3	7.6	70.9	0.0	3.7	70.9
DEC	63.2	7.0	40.9	0.0	15.3	40.9
Total	844.8	149.8	696.3	0.0	-1.3	696.3

WATER BALANCE SUMMARY FOR HYDROGRAPH 9152

Location: Hydrograph 9152
Scenario File: wb_D01.dat
Period: 1951/01/01 to 2005/12/30 Area: 0.0049 km^2

Water Balance Quantities (in mm)

Month	Precip	ET	Runoff	Infiltration (Baseflow)	Infiltration (Losses)	Total Flow
JAN	48.0	7.9	3.2	24.9	12.0	28.0
FEB	42.6	7.1	6.2	20.8	8.5	27.0
MAR	60.4	9.8	25.3	22.1	3.3	47.4
APR	76.7	53.2	15.4	30.9	-22.8	46.3
MAY	77.8	99.4	2.1	32.9	-56.6	35.1
JUN	76.7	100.8	0.7	19.5	-44.2	20.2
JUL	85.1	89.9	3.5	10.3	-18.5	13.8
AUG	86.0	75.5	0.5	5.1	4.8	5.7
SEP	79.4	51.0	0.2	4.8	23.4	5.0
OCT	66.5	37.0	1.6	7.9	19.9	9.6
NOV	82.3	16.9	2.7	13.9	48.7	16.6
DEC	63.2	7.3	3.7	23.0	29.3	26.7
Total	844.8	555.8	65.2	216.0	7.8	281.2

File=DUMP0614.WTB Does not exist

WATER BALANCE SUMMARY FOR HYDROGRAPH 9914

Location: Hydrograph 9914
Scenario File: wb_D01.dat
Period: 1951/01/01 to 2005/12/30 Area: 0.0206 km^2

Water Balance Quantities (in mm)

Month	Precip	ET	Runoff	Infiltration (Baseflow)	Infiltration (Losses)	Total Flow
JAN	48.0	7.9	4.1	1.8	34.1	5.9
FEB	42.6	7.1	6.2	1.7	27.6	7.9
MAR	60.4	9.2	17.8	2.7	30.7	20.5
APR	76.7	38.6	10.1	2.1	25.9	12.2
MAY	77.8	67.7	7.8	2.2	0.1	10.0
JUN	76.7	67.9	7.9	1.2	-0.4	9.1
JUL	85.1	61.6	10.5	0.5	12.5	11.0
AUG	86.0	52.7	9.6	0.2	23.5	9.8
SEP	79.4	37.5	8.5	0.2	33.2	8.7
OCT	66.5	28.1	7.3	0.5	30.6	7.8
NOV	82.3	14.4	8.9	0.9	58.1	9.8
DEC	63.2	7.2	5.6	1.6	48.8	7.2
Total	844.8	400.0	104.4	15.4	324.9	119.9

WATER BALANCE SUMMARY FOR HYDROGRAPH 4914

Location: Hydrograph 4914
Scenario File: wb_D01.dat
Period: 1951/01/01 to 2005/12/30 Area: 0.0183 km^2

Water Balance Quantities (in mm)

Month	Precip	ET	Runoff	Infiltration (Baseflow)	Infiltration (Losses)	Total Flow
JAN	48.0	7.9	11.0	16.0	13.1	27.0
FEB	42.6	7.1	15.8	13.5	6.2	29.3
MAR	60.4	9.4	45.2	14.3	-8.5	59.5
APR	76.7	41.2	32.8	19.9	-17.3	52.7
MAY	77.8	73.0	20.7	21.2	-37.0	41.8
JUN	76.7	73.3	20.1	12.6	-29.3	32.7
JUL	85.1	66.1	24.9	6.6	-12.6	31.6
AUG	86.0	56.3	23.2	3.4	3.1	26.7
SEP	79.4	39.7	21.0	3.1	15.6	24.2
OCT	66.5	29.7	18.2	5.1	13.5	23.3
NOV	82.3	15.0	24.2	8.9	34.3	33.0
DEC	63.2	7.2	16.2	14.7	25.1	30.9
Total	844.8	426.0	273.3	139.4	6.2	412.7

WATER BALANCE SUMMARY FOR HYDROGRAPH 6914

Location: Hydrograph 6914
Scenario File: wb_D01.dat
Period: 1951/01/01 to 2005/12/30 Area: 0.0347 km^2

Water Balance Quantities (in mm)

Month	Precip	ET	Runoff	Infiltration (Baseflow)	Infiltration (Losses)	Total Flow
JAN	48.0	7.9	0.9	0.0	39.1	0.9
FEB	42.6	7.1	2.2	0.0	33.3	2.2
MAR	60.4	7.4	3.3	0.0	49.7	3.3
APR	76.7	12.3	3.4	0.0	61.0	3.4
MAY	77.8	16.9	3.9	0.0	57.1	3.9
JUN	76.7	17.0	4.2	0.0	55.5	4.2
JUL	85.1	18.4	12.0	0.0	54.7	12.0
AUG	86.0	19.3	10.2	0.0	56.6	10.2
SEP	79.4	16.9	5.8	0.0	56.7	5.8
OCT	66.5	12.1	2.9	0.0	51.5	2.9
NOV	82.3	7.6	3.6	0.0	71.0	3.6
DEC	63.2	7.0	0.6	0.0	55.6	0.6
Total	844.8	149.8	53.1	0.0	641.9	53.1

File=DUMP0114.WTB Does not exist

File=DUMP0214.WTB Does not exist

WATER BALANCE SUMMARY FOR HYDROGRAPH 3092

Location: Hydrograph 3092
Scenario File: wb_D01.dat

Period: 1951/01/01 to 2005/12/30 Area: 0.0402 km^2

Water Balance Quantities (in mm)

Month	Precip	ET	Runoff	Infiltration (Baseflow)	(Losses)	Total Flow
JAN	48.0	7.9	9.1	18.1	12.9	27.1
FEB	42.6	7.1	14.0	14.9	6.7	28.8
MAR	60.4	9.8	44.6	15.7	-9.6	60.2
APR	76.7	52.9	24.6	21.3	-22.1	45.9
MAY	77.8	97.4	5.6	21.7	-46.8	27.3
JUN	76.7	93.8	2.2	12.5	-31.8	14.7
JUL	85.1	85.6	6.2	6.8	-13.5	13.0
AUG	86.0	73.6	3.1	4.2	5.2	7.3
SEP	79.4	50.5	3.5	4.2	21.2	7.8
OCT	66.5	36.7	5.6	6.9	17.2	12.6
NOV	82.3	16.9	14.3	11.2	39.9	25.5
DEC	63.2	7.3	13.6	17.0	25.3	30.7
Total	844.8	539.4	146.4	154.4	4.4	300.9

WATER BALANCE SUMMARY FOR HYDROGRAPH 3093

Location: Hydrograph 3093
Scenario File: wb_D01.dat
Period: 1951/01/01 to 2005/12/30 Area: 0.0058 km^2

Water Balance Quantities (in mm)

Month	Precip	ET	Runoff	Infiltration (Baseflow)	(Losses)	Total Flow
JAN	48.0	7.9	7.3	17.5	15.3	24.8
FEB	42.6	7.1	11.1	15.2	9.3	26.3
MAR	60.4	9.8	38.7	16.5	-4.5	55.2
APR	76.7	52.9	21.7	22.8	-20.8	44.5
MAY	77.8	97.6	4.3	25.1	-49.2	29.4
JUN	76.7	97.2	1.1	15.2	-36.8	16.3
JUL	85.1	94.2	4.0	8.0	-21.1	12.0
AUG	86.0	76.5	1.5	4.1	4.0	5.5
SEP	79.4	51.8	2.1	3.9	21.5	6.1
OCT	66.5	36.6	4.0	6.2	19.7	10.2
NOV	82.3	16.9	11.5	9.7	44.2	21.2
DEC	63.2	7.3	11.4	15.5	29.0	26.9
Total	844.8	555.8	118.8	159.6	10.7	278.3

WATER BALANCE SUMMARY FOR HYDROGRAPH 3103

Location: Hydrograph 3103
Scenario File: wb_D01.dat
Period: 1951/01/01 to 2005/12/30 Area: 0.0050 km^2

Water Balance Quantities (in mm)

Month	Precip	ET	Runoff	Infiltration (Baseflow)	(Losses)	Total Flow
JAN	48.0	7.9	4.9	23.0	12.2	27.8
FEB	42.6	7.1	7.9	19.4	8.2	27.3
MAR	60.4	9.8	29.2	20.4	1.0	49.6
APR	76.7	52.9	17.0	28.3	-21.6	45.4
MAY	77.8	97.9	3.0	30.4	-53.5	33.5
JUN	76.7	94.9	0.9	18.2	-37.3	19.1
JUL	85.1	86.1	3.9	9.6	-14.5	13.6

AUG	86.0	74.1	1.0	5.1	5.9	6.1
SEP	79.4	50.6	1.3	5.0	22.5	6.3
OCT	66.5	36.8	3.0	8.2	18.4	11.3
NOV	82.3	16.9	7.1	13.8	44.5	20.9
DEC	63.2	7.3	7.1	21.6	27.3	28.6
Total	844.8	542.3	86.5	202.9	13.1	289.4

WATER BALANCE SUMMARY FOR HYDROGRAPH 9173

Location: Hydrograph 9173
Scenario File: wb_D01.dat
Period: 1951/01/01 to 2005/12/30 Area: 0.0029 km^2

Water Balance Quantities (in mm)

Month	Precip	ET	Runoff	Infiltration (Baseflow)	(Losses)	Total Flow
JAN	48.0	7.9	5.5	20.1	14.4	25.7
FEB	42.6	7.1	10.0	17.2	8.3	27.2
MAR	60.4	9.8	37.5	18.8	-5.7	56.3
APR	76.7	53.2	22.1	24.7	-23.3	46.8
MAY	77.8	99.1	3.9	24.9	-50.0	28.8
JUN	76.7	100.3	1.1	14.0	-38.7	15.1
JUL	85.1	90.2	4.9	6.3	-16.2	11.1
AUG	86.0	75.4	1.6	2.9	6.2	4.5
SEP	79.4	50.9	1.3	3.3	24.0	4.6
OCT	66.5	36.9	2.8	6.3	20.6	9.1
NOV	82.3	16.9	6.5	11.3	47.5	17.8
DEC	63.2	7.3	7.6	18.6	29.7	26.2
Total	844.8	554.9	104.9	168.3	16.7	273.2

WATER BALANCE SUMMARY FOR HYDROGRAPH 3102

Location: Hydrograph 3102
Scenario File: wb_D01.dat
Period: 1951/01/01 to 2005/12/30 Area: 0.0866 km^2

Water Balance Quantities (in mm)

Month	Precip	ET	Runoff	Infiltration (Baseflow)	(Losses)	Total Flow
JAN	48.0	7.9	8.9	1.4	29.8	10.3
FEB	42.6	7.1	11.8	1.2	22.6	12.9
MAR	60.4	8.7	28.3	1.2	22.3	29.5
APR	76.7	29.5	23.0	1.7	22.5	24.7
MAY	77.8	49.3	19.5	1.9	7.1	21.4
JUN	76.7	48.5	20.2	1.1	6.8	21.4
JUL	85.1	44.7	25.2	0.6	14.6	25.8
AUG	86.0	40.0	24.5	0.3	21.2	24.9
SEP	79.4	29.9	21.4	0.3	27.8	21.7
OCT	66.5	22.6	17.4	0.5	25.9	17.9
NOV	82.3	12.3	22.7	0.8	46.5	23.5
DEC	63.2	7.2	13.7	1.3	41.0	15.0
Total	844.8	307.8	236.6	12.3	288.1	249.0

GAWSER V6.9.18 - Released - Sep. 21, 2016

Upper Speed River Watershed
Threshold Flow Exceedance Summaries
For Existing Conditions
Winter Model

Input file 1=EXCEED1.dat
Input file 2=
Output file =EXCEED1.txt

```
* ====================================================================
* File created by Dr. H.O. Schroeter, P.Eng., November 10, 2011
* ====================================================================
START               KUNITS=2  TOTAL AREA=174 SQ KM
                    BASEFLOW AT OUTLET: QBSS=0.0    QBGW=0.60  CMS
                    PRINT OPTIONS:ECHO=3 OUTPUT=0 PLOTS=1 RCS=1 SUBW=1
                        PLOT CUTOFF TIME=576 SUM=4 FREE=0
                    PARAMETER ADJUSTMENT FACTORS: FDS=1  FKEFF=0.05
                       FCS=1.0 FD=1.0 FSAV=1.0 FKO=1.0 FKSS=1 FKMF=1
                    INITIAL SOIL/SNOW WATER FACTORS:
                       FIMCI=0.75  FIMCII=1.00 FIWE=0.0
                    GLOBAL RAINFALL SCALING FACTOR: GFRF=1.0
                    SIMULATION CONTROLS: TTI=1 HR IDEL=4 HOURS=576
                    SUBWATERSHED INITIAL BASEFLOWS IN CMS=-999
```

STREAM DISCHARGE EXCEEDANCE SUMMARY FOR 616

Location: Hydrograph 616
Period: 1951/ 1/ 1 to 2005/12/30

Month	Total Hours	Threshold 1 Flow	Threshold 1 Hours	Threshold 1 PCT	Threshold 2 Flow	Threshold 2 Hours	Threshold 2 PCT
JAN	40920.	0.02000	24.	0.1	0.01000	5494.	13.4
FEB	37296.	0.02000	38.	0.1	0.01000	5934.	15.9
MAR	40920.	0.02000	184.	0.4	0.01000	14924.	36.5
APR	39600.	0.02000	131.	0.3	0.01000	12520.	31.6
MAY	40920.	0.02000	18.	0.0	0.01000	9661.	23.6
JUN	39600.	0.02000	4.	0.0	0.01000	7975.	20.1
JUL	40920.	0.02000	14.	0.0	0.01000	6032.	14.7
AUG	40920.	0.02000	3.	0.0	0.01000	5710.	14.0
SEP	39600.	0.02000	0.	0.0	0.01000	6086.	15.4
OCT	40920.	0.02000	12.	0.0	0.01000	6945.	17.0
NOV	39600.	0.02000	14.	0.0	0.01000	10741.	27.1
DEC	40896.	0.02000	12.	0.0	0.01000	7963.	19.5
Total	482112.	0.02000	454.	0.1	0.01000	99985.	20.7

STREAM DISCHARGE EXCEEDANCE SUMMARY FOR 2004

Location: Hydrograph 2004
Period: 1951/ 1/ 1 to 2005/12/30

Month	Total Hours	Threshold 1 Flow	Threshold 1 Hours	Threshold 1 PCT	Threshold 2 Flow	Threshold 2 Hours	Threshold 2 PCT
JAN	40920.	0.36000	508.	1.2	0.27000	699.	1.7
FEB	37296.	0.36000	789.	2.1	0.27000	1029.	2.8
MAR	40920.	0.36000	3398.	8.3	0.27000	4305.	10.5
APR	39600.	0.36000	2032.	5.1	0.27000	2544.	6.4
MAY	40920.	0.36000	321.	0.8	0.27000	414.	1.0
JUN	39600.	0.36000	56.	0.1	0.27000	83.	0.2
JUL	40920.	0.36000	228.	0.6	0.27000	269.	0.7
AUG	40920.	0.36000	97.	0.2	0.27000	129.	0.3

SEP	39600.	0.36000	31.	0.1	0.27000	38.	0.1
OCT	40920.	0.36000	112.	0.3	0.27000	136.	0.3
NOV	39600.	0.36000	429.	1.1	0.27000	598.	1.5
DEC	40896.	0.36000	641.	1.6	0.27000	877.	2.1
Total	482112.	0.36000	8642.	1.8	0.27000	11121.	2.3

STREAM DISCHARGE EXCEEDANCE SUMMARY FOR 2009

Location: Hydrograph 2009
Period: 1951/ 1/ 1 to 2005/12/30

Month	Total Hours	Threshold 1 Flow	Threshold 1 Hours	Threshold 1 PCT	Threshold 2 Flow	Threshold 2 Hours	Threshold 2 PCT
JAN	40920.	0.66000	255.	0.6	0.31000	634.	1.5
FEB	37296.	0.66000	411.	1.1	0.31000	970.	2.6
MAR	40920.	0.66000	1657.	4.0	0.31000	4040.	9.9
APR	39600.	0.66000	1069.	2.7	0.31000	2389.	6.0
MAY	40920.	0.66000	170.	0.4	0.31000	396.	1.0
JUN	39600.	0.66000	39.	0.1	0.31000	78.	0.2
JUL	40920.	0.66000	157.	0.4	0.31000	261.	0.6
AUG	40920.	0.66000	39.	0.1	0.31000	126.	0.3
SEP	39600.	0.66000	28.	0.1	0.31000	44.	0.1
OCT	40920.	0.66000	63.	0.2	0.31000	127.	0.3
NOV	39600.	0.66000	222.	0.6	0.31000	544.	1.4
DEC	40896.	0.66000	310.	0.8	0.31000	808.	2.0
Total	482112.	0.66000	4420.	0.9	0.31000	10417.	2.2

Appendix D

Water Balance Calculations

NORTHGATE, NORTH WATERLOO
PRELIMINARY STORMWATER MANAGEMENT
City of Waterloo, Ontario

Project Number: 39502-104
Date: July 3, 2020
Design By: XSP
File: Q:\39502\104\Prelim SWM\39502-104 Mater GAWSER Design Sheet - XSP 3Jul2020.xlsx

GAWSER Surface Water Balance

Existing Conditions **DEC1 to Mar 31**

Point of Interest	Catchment	Hydrograph Number	Area (ha)	Precipitation (mm)	Evapo-transpiration (mm)	Infiltration (mm)	Non-Winter Runoff (mm)	Winter Runoff (mm)	Total Runoff (mm)	Infiltration Volume (m^3)	Runoff Volume (m^3)
Existing Conditions	3914	3914	12.70	844.8	553.0	211.9	34.4	45.5	79.9	26,911	10,147
	3911	3911	19.50	844.8	563.7	197.3	37.2	46.6	83.8	38,474	16,341
	3917	3917	2.70	844.8	551.0	178.1	49.3	66.3	115.6	4,809	3,121
	3918	3918	0.60	844.8	575.5	198.9	31.0	39.5	70.5	1,193	423
	3915	3915	4.20	844.8	551.9	222.9	30.3	39.6	69.9	9,362	2,936
Western Wetland		3914	10.32	844.8	553.0	211.9	34.4	45.5	79.9	21,866	8,245
		3911	8.12	844.8	563.7	197.3	37.2	46.6	83.8	16,021	6,805
		3917	1.27	844.8	551.0	178.1	49.3	66.3	115.6	2,258	1,466
		3918	0.57	844.8	575.5	198.9	31.0	39.5	70.5	1,124	398
Total			**20.27**	**844.8**	**557.8**	**203.6**	**36.4**	**47.1**	**83.4**	41,269	**16,914**
Eastern Wetland		3911	9.75	844.8	563.7	197.3	37.2	46.6	83.8	19,230	8,168
		3917	1.12	844.8	551.0	178.1	49.3	66.3	115.6	1,986	1,289
		3915	1.82	844.8	551.9	222.9	30.3	39.6	69.9	4,058	1,273
Total			**12.68**	**844.8**	**560.9**	**199.3**	**37.3**	**47.3**	**84.6**	**25,274**	**10,729**

Proposed Conditions

Point of Interest	Catchment	Hydrograph Number	Area (ha)	Precipitation (mm)	Evapo-transpiration (mm)	Infiltration (mm)	Non-Winter Runoff (mm)	Winter Runoff (mm)	Total Runoff (mm)	Infiltration Volume (m^3)	Runoff Volume (m^3)
Western Wetland	4914	9141	1.27	844.8	413.3	135.8	201.6	94.0	295.6	1725	3,754
	3911	1911	7.17	844.8	563.7	197.3	37.2	46.6	83.8	14138	6,005
	3911	2911	0.96	844.8	563.7	200.7	35.1	45.3	80.4	1927	772
	3918	3918	0.57	844.8	575.5	199.1	30.9	39.2	70.1	1135	400
	4917	9171	0.81	844.8	548.7	180.6	50.1	65.4	115.5	1463	936
	SWMF diversion	714	12.43				42.1	0.0	42.1	0	5,233
Total			**10.78**	**844.8**	**496.9**	**189.2**	**105.6**	**53.1**	**158.7**	**20387**	**17,099**
Net Change											**1.1%**
Eastern Wetland	3911	1911	9.77	844.8	563.7	197.3	37.2	46.6	83.8	19268	8,184
	4915	9151	0.18	844.8	149.8	0.0	513.4	182.9	696.3	0	1,253
	4915	9152	0.10	844.8	555.8	223.8	26.8	38.4	65.2	222	65
	4917	9172	0.41	844.8	385.9	110.0	237.2	111.6	348.8	451	1,430
Total			**10.46**	**844.8**	**549.5**	**190.7**	**53.1**	**51.4**	**104.6**	**19942**	**10,932**
Net Change											**1.9%**

NORTHGATE, NORTH WATERLOO
PRELIMINARY STORMWATER MANAGEMENT
City of Waterloo, Ontario

Project Number: 39502-104
Date: July 3, 2020
Design By: XSP
File: Q:\39502\104\Prelim SWM\39502-104 Mater GAWSER Design Sheet - XSP 3Jul2020.xlsx

GAWSER Groundwater Balance
Proposed Conditions

Catchment	Hydrograph Number	Area *(ha)*	Precipitation *(mm)*	Evapo-transpiration *(mm)*	Non-Winter Infiltration *(mm)*	Winter Infiltration *(mm)*	Total Infiltration *(mm)*	Non-Winter Runoff *(mm)*	Winter Runoff *(mm)*	Total Runoff *(mm)*	Infiltration Volume *(m^3)*	Runoff Volume *(m^3)*
3102	3102	8.66	844.8	307.8	179.6	120.8	300.4	173.9	62.7	236.6	26,015	20,490
3911	1911	19.35	844.8	563.7	61.7	135.5	197.2	37.3	46.6	83.9	38,158	16,235
	2911	0.96	844.8	563.6	64.0	136.9	200.9	35.0	45.3	80.3	1,929	771
	Subtotal	20.31	844.8	563.7	61.8	135.6	197.4	37.2	46.5	83.7	40,087	17,006
3914	3914	12.43	844.8	305.0	163.5	111.0	274.5	192.8	72.5	265.3	34,120	32,977
	4914	1.83	844.8	426.0	51.1	94.4	145.5	185.1	88.2	273.3	2,663	5,001
	9914	2.06	844.8	400.2	191.3	149.0	340.3	70.6	33.7	104.3	7,010	2,149
	Subtotal	16.32	844.8	330.6	154.4	113.9	268.3	176.5	69.4	245.9	43,793	40,127
3915	2915	1.55	844.8	392.2	201.0	97.5	298.5	69.1	85.0	154.1	4,627	2,389
3917	2917	2.48	844.8	393.7	205.8	93.7	299.5	62.7	88.9	151.6	7,428	3,760
	9173	0.29	844.8	554.8	63.8	121.4	185.2	44.2	60.6	104.8	537	304
	Subtotal	2.77	844.8	410.6	190.9	96.6	287.5	60.8	85.9	146.7	7,965	4,064
3918	3918	0.57	844.8	575.8	56.1	142.8	198.9	30.9	39.2	70.1	1,134	400
3092	3092	4.02	844.8	539.3	58.1	101.0	159.1	65.1	81.3	146.4	6,396	5,885
3093	3093	0.58	844.8	555.8	56.5	113.8	170.3	50.2	68.5	118.7	988	688
3103	3103	0.50	844.8	542.4	83.0	133.1	216.1	37.2	49.1	86.3	1,081	432
Total Subject Lands		**55.28**	**844.8**	**440.4**	**117.8**	**121.2**	**238.9**	**103.9**	**61.6**	**165.5**	**132,084**	**91,479**

Appendix E

Amended Top Soil Specification

BMP Resources Topsoil Specifications Summary

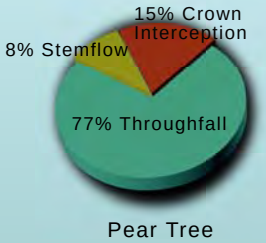
BMP Document	Minimum Topsoil Depth			Topsoil Texture (% dry weight)		Minimum Topsoil OM Content (% dry weight)		pH	Drainage	Subsoil Scarification	Mulch for Beds
	Lawn (Low Traffic)	Beds	Shrubs/ trees	Lawn (Low Traffic)	Beds	Lawn (Low Traffic)/ shrubs/trees	Beds/ shrubs				
BCLNA (2012) - “Well-groomed Areas” in which irrigation is recommended	150mm	300mm	450-900mm	Sand: 50-70% Silt: 10-25% Clay: 0-20% (Silt/clay max: 25%)	Sand: 50-70% Silt: 10-25% Clay: 0-20% (Silt/clay max: 25%)	3-10%	10-20%	Lawn/shrubs/ trees: 6.0-7.0 Beds: 4.5-6.5	“Percolation shall be such that no standing water is visible 60 minutes after at least 10 minutes of moderate to heavy rain or irrigation”	150mm	50mm
BCLNA (2012) - “Groomed” and “Moderate” Areas in which automatic irrigation is recommended	150mm	300mm	450-900mm	Sand: 50-70% Silt: 10-25% Clay: 0-20% (Silt/clay max: 35%)	Sand: 40-80% Silt: 10-25% Clay: 0-25% (Silt/clay max: 35%)	3-10%	10-20%	Lawn/shrubs/ trees: 6.0-7.0 Beds: 4.5-7.0	“Percolation shall be such that no standing water is visible 60 minutes after at least 10 minutes of moderate to heavy rain or irrigation”	150mm	50mm
BCLNA (2012) - “Open Space/ Play” and “Background” Areas in which irrigation is required less frequently	150mm	300mm	450-900mm	Sand: 30-70% Silt: 15-50% Clay: 15-30% (Silt/clay max: 60%)	Sand: 30-70% Silt: 15-50% Clay: 15-30% (Silt/clay max: 60%)	2-10%	5-20%	Lawn/shrubs/ trees: 6.0-7.0 Beds: 4.5-7.0	-	150mm	50mm
Master Municipal Construction Documents (2009)	150mm	300mm	450-900mm	Sand: 50-70% Silt: 10-30% Clay:7-20%	Sand: 50-70% Silt: 10-30% Clay:7-20%	5-10%	25-30%	Lawn/shrubs/ trees: 6.0-6.5 Beds: 4.5-6.0	Minimum saturated hydaulic conductivity (cm/ hr): 2.0	150mm	-
Metro Vancouver Stormwater Source Control Guidelines (2012)	150mm	450mm	450mm	Sand: 50-70% Silt: 10-25% Clay: 0-25%	Sand: 40-80% Silt: 10-25% Clay: 0-25%	8%	15%	-	Minimum infiltration rate should be 50mm/hr	150mm	Mulch is recommended
Topsoil Bylaws Toolkit (2012)	150mm-450mm	150mm-450mm	150mm-450mm	-	-	8%	15%	6.0-8.0	-	100mm	50mm
City of Vancouver Water Wise Landscape Guidelines (2009)	150mm-300mm	150mm-300mm	150mm-300mm	-	-	OM amendments are recommened		6.0-7.0	-	-	50mm

Table 4. BMP resources topsoil specifications summary.

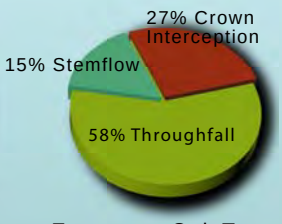
Source - Topsoil Requirements in Vancouver: The Need, The Benefits, and The Next Steps, City of Vancouver, 2016

DESIGN PRINCIPLES

- Maximize the area of absorbent landscape – either existing or constructed – on the site. Conserve as much existing vegetation and undisturbed soil as possible.
- Minimize impervious area by using multi-storey buildings, narrower roads, minimum parking, larger landscape areas, green roof, and pervious paving.
- Disconnect impervious areas from the storm sewer system, having them drain to absorbent landscape.
- Design absorbent landscape areas as dished areas that temporarily store stormwater and allow it to soak in, with overflow for large rain events to the storm drain system.
- Maximize the vegetation canopy cover over the site. Multi-layered evergreens are ideal, but deciduous cover is also beneficial for stormwater management.
- Ensure adequate growing medium depth for both horticultural and stormwater needs – a minimum 150mm for lawn areas, and 450mm depth for shrub/tree areas. In wetter climates with till subsoils, a minimum depth of 300mm for lawn is required to store 60mm of rainfall.
- Cultivate compost into surface soils to create minimum 8% organic matter for lawns, and 15% for planting beds.
- To avoid surface crusting and maintain surface permeability, install vegetative (grass, groundcovers, shrubs, trees) or organic cover (mulch, straw, wood fibre) as early as possible in the construction process, and prior to winter storms.
- Provide effective erosion control during construction, including erosion control on upstream sites that may flow into the absorbent landscape.



Pear Tree



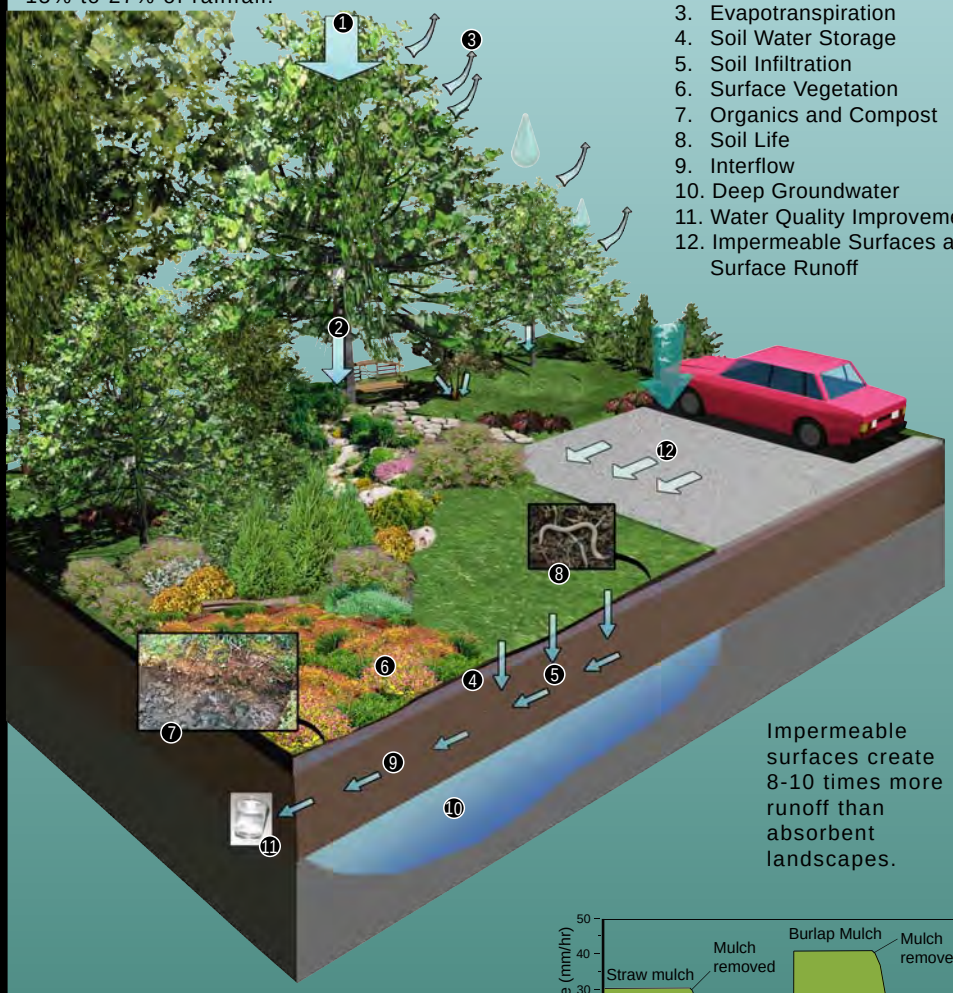
Evergreen Oak Tree

In most natural wooded conditions in the GVRD, 90% of rainfall volume never becomes runoff, but is either soaked into the soils or evaporates / transpirates. Trees, shrubs, grasses, surface organic matter, and soils all play a role.

Variables of Absorbent Landscape

1. Crown Interception
2. Throughfall and Stemflow
3. Evapotranspiration
4. Soil Water Storage
5. Soil Infiltration
6. Surface Vegetation
7. Organics and Compost
8. Soil Life
9. Interflow
10. Deep Groundwater
11. Water Quality Improvement
12. Impermeable Surfaces and Surface Runoff

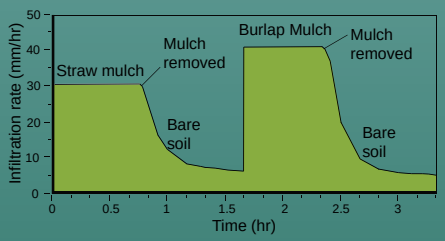
Winter tree canopies intercept 15% to 27% of rainfall.



Impermeable surfaces create 8-10 times more runoff than absorbent landscapes.

Organic matter and soil micro-organisms are vital to maintaining soil infiltration rates.

Rainfall storage in soil is 7% to 18% of soil volume.



Influence of surface cover on infiltration rate of sandy loam

Absorbent Landscapes

metrovancouver

LANARC CONSULTANTS LTD

kwl

Goya Ngan
Landscape Architect

Detailed design guidelines can be found in the Design Guidelines 2012 report, available at www.metrovancouver.org

Stormwater Source Control Design Guidelines 2012











Appendix F

Water Cooling Trench Modeling

NORTHGATE, NORTH WATERLOO
PRELIMINARY STORMWATER MANAGEMENT
City of Waterloo, Ontario

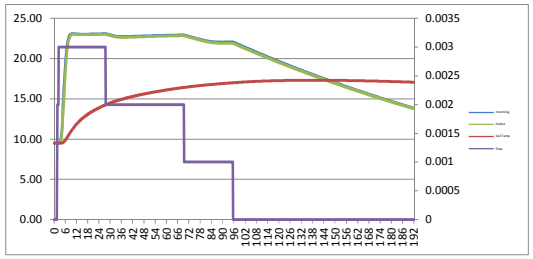
Project Number: 39502-104
Date: July 3, 2020
Design By: XSP
File: Q:\39502\104\Prelim SWM\39502-104 Cooling Trench Design.xlsx

Conduction/Mixing Temperature Model for Cooling Trench

Pond 4

Trench Dimensions			***Trench Characteristics***	
Width/Diameter	1 m		Void Ratio	0.4
Height	1 m		Segment Length	5 m
Perimeter	4.00 m		Segment #	13
Area	1.00 m^2		Total length	65 m
			Volume (V_T)	2.00 m^3
# of Trenchs	1		GW contact	5 m^2
Time increment	10 min		Hydraulic gradient	0.0032 m/m
Time increment	0.1667 hr		Hydraulic conductivity	2.67E-05 m/s
Initial Stormwater Temp	24 C		GW velocity	8.54E-08 m/s
Initial Trench Temp	9.5 C		Groundwater Inflow/Outflow	4.27E-07 m^3/s
Water Density	999 kg/m^3		Incoming Groundwater temp	9.5 C
Sat. Soil. Thermal Cond. (k)	2 J/m.s.K			
Saturated Soil Heat Cap (Ch)	2.80E+06 $J/m^3.K$			
Cooling Trench Rock Thermal Cond. (k)	2.15 J/m.s.K			
Cooling Trench Rock Heat Cap (Ch)	1.91E+06 $J/m^3.K$			
Soil temperature evaluation depth	0.1 m			

Length	65 m
Total trench length	65 m
Maximum outlet temp	23.04 C
Flow weighted temp	21.95 C
Treated Volume per trench	672.60 m^3
Total treated volume	672.6 m^3



Sources:
1. Ghildyal et al., 1987
2. Koorevaar et al., 1983
3. Incropera et al., 2002

		1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
		Q	Q_T	T_I	T_I	T_M	T_M	T_S	T_S	c	k	$T_{INT-INS}$	$T_{INT-AVG}$	q	ΔT	T_{FINAL}
		Total Cooling Trench	Individual Trench	Incoming Water		Mixed Water/Stone		Soil	Soil	Water	Water	Instant	Average	Heat		Water
	Time	Flow	Flow	Temperature	Temperature	Temperature	Temperature	Temperature	Temperature	Specific Heat	Therm. Cond.	Interface Temp.	Interface Temp.	Transfer	Temp Change	End Temp.
	(hr)	(m^3/s)	(m^3/s)	C	K	C	K	K	C	J/kg.K	J/m.s.K	K	K	J/s	C or K	C
1	0.00	0	0	9.50	282.65	9.5	282.65	282.65	9.50	4192.84	0.59	282.65	282.65	0.00		9.50
2	0.17	0	0	9.50	282.65	9.50	282.65	282.65	9.50	4192.84	0.59	282.65	282.65	0.00	0.00000	9.50
3	0.33	0	0	9.50	282.65	9.50	282.65	282.65	9.50	4192.84	0.59	282.65	282.65	0.00	0.00000	9.50
4	0.50	0	0	9.50	282.65	9.50	282.65	282.65	9.50	4192.84	0.59	282.65	282.65	0.00	0.00000	9.50
5	0.67	0	0	9.50	282.65	9.50	282.65	282.65	9.50	4192.84	0.59	282.65	282.65	0.00	0.00000	9.50
6	0.83	0	0	9.50	282.65	9.50	282.65	282.65	9.50	4192.84	0.59	282.65	282.65	0.00	0.00000	9.50
7	1.00	0	0	9.50	282.65	9.50	282.65	282.65	9.50	4192.84	0.59	282.65	282.65	0.00	0.00000	9.50
8	1.17	0	0	9.50	282.65	9.50	282.65	282.65	9.50	4192.84	0.59	282.65	282.65	0.00	0.00000	9.50
9	1.33	0	0	9.50	282.65	9.50	282.65	282.65	9.50	4192.84	0.59	282.65	282.65	0.00	0.00000	9.50
10	1.50	0.001	0.001	9.50	282.65	9.50	282.65	282.65	9.50	4192.84	0.59	282.65	282.65	0.00	0.00000	9.50
11	1.67	0.002	0.002	9.50	282.65	9.50	282.65	282.65	9.50	4192.84	0.59	282.65	282.65	0.00	0.00000	9.50
12	1.83	0.002	0.002	9.50	282.65	9.50	282.65	282.65	9.50	4192.84	0.59	282.65	282.65	0.00	0.00000	9.50
13	2.00	0.002	0.002	9.50	282.65	9.50	282.65	282.65	9.50	4192.84	0.59	282.65	282.65	0.00	0.00000	9.50
14	2.17	0.002	0.002	9.50	282.65	9.50	282.65	282.65	9.50	4192.84	0.59	282.65	282.65	0.00	0.00000	9.50
15	2.33	0.003	0.003	9.50	282.65	9.50	282.65	282.65	9.50	4192.84	0.59	282.65	282.65	0.01	0.00000	9.50
16	2.50	0.003	0.003	9.51	282.66	9.50	282.65	282.65	9.50	4192.84	0.59	282.65	282.65	0.03	0.00000	9.50
17	2.67	0.003	0.003	9.53	282.68	9.51	282.66	282.65	9.50	4192.82	0.59	282.66	282.65	0.11	0.00000	9.51
18	2.83	0.003	0.003	9.56	282.71	9.53	282.68	282.65	9.50	4192.79	0.59	282.66	282.65	0.30	-0.00001	9.53

Appendix G

Borehole Logs

Client: Northgate Lands Corp.

Project: Northgate Lands Subdivision

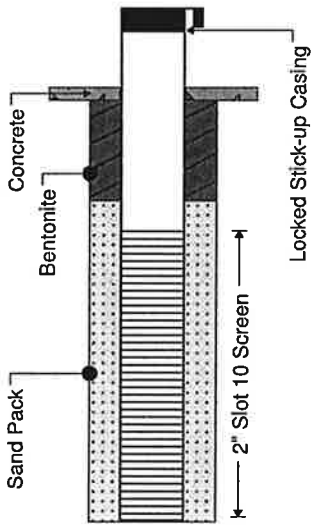
Location: Conservation Dr. Waterloo, Ontario

Borehole Number: MW100-14

Job Number: 39502-104

Drill Date: 12/12/14

Depth (m)	Elevation (m)	Soil Description	Symbol	Number	Type	N-Value	Standard Penetration Graph (25 50 75)	Headspace (ppm)	Groundwater Observations and Well Details
0.00	344.68	Ground Elevation							
0.00	343.92	**TOPSOIL** borwn, sandy silt, trace organics, damp							
0.76	343.16	**SILT** stiff, brown, clayey silt, little sand, trace gravel, moist		1	SS	3			
1.52	342.39	**SAND** compact, borwnish grey, medium sand, some gravel, little silt, saturated		2	SS	14			
2.29	341.58	compact, brown, fine sand		3	SS	13			
3.10	340.87	**CLAY** stiff, grey, silty clay, wet		4	SS	26			
3.81	340.11	**SAND** compact, brown, fine sand, brown, saturated		5	SS	22			
4.57	339.50	**CLAY TILL** very stiff, grey, clay till , some silt, wet		6	SS	21			
5.18		no clasts observed, some silt							
		Borehole Terminated at 5.18m							



January 9, 2015
Water Level 1.8 mbTOC (343.77 masl)

Reviewed By: ALB

Method: CME75 Hollow Stem Auger

Notes:

MTE Consultants Inc.
520 Bingemans Centre Drive
Kitchener, Ontario
N2B 3X9
(519) 743-6500

Logged By: TFC

Sheet: 1 of 1

Client: Northgate Lands Corp.

Project: Northgate Lands Subdivision

Location: Conservation Dr. Waterloo, Ontario

Borehole Number: MW101-14

Job Number: 39502-104

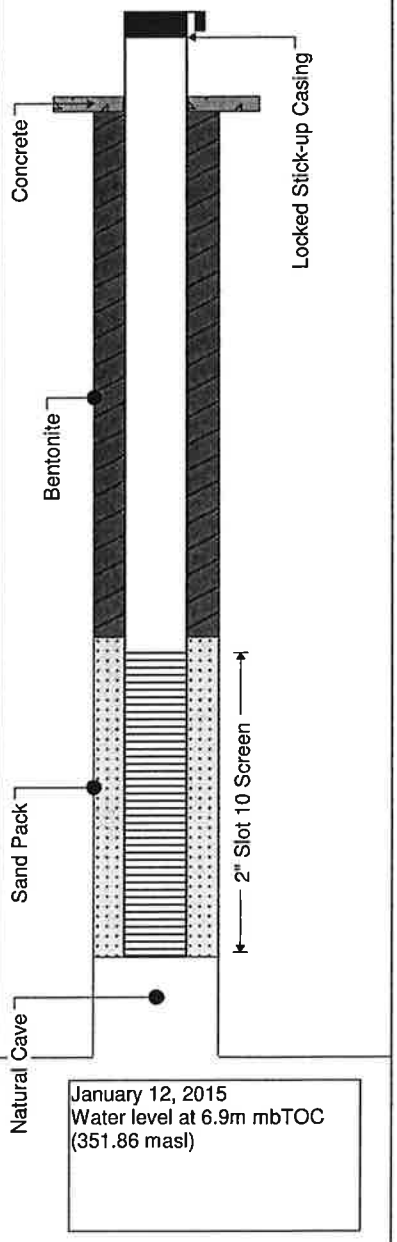
Drill Date: 12/12/14

Depth (m)	Elevation (m)	Soil Description	Number	Type	N-Value
	357.85	Ground Elevation			
0.0	0.00	**TOPSOIL** light brown, silty sand, little organics, damp			
	357.09				
	0.76	**SAND** loose, brown, medium to coarse sand, trace gravel, moist	1	SS	6
	356.33				
2.0	1.52	compact, grey brown, medium to coarse sand, little gravel, moist	2	SS	11
			3	SS	8
	354.80				
	3.05	compact, grey brown, fine to medium sand, trace gravel, moist	4	SS	13
	354.04				
4.0	3.81	compact, grey borwn, fine to medium sand, moist	5	SS	22
	353.58				
	4.27	wet	6	SS	30
	352.52				
	5.33	compact, grey brown, fine to medium sand, trace gravel, wet	7	SS	21
	352.06				
6.0	5.79	saturated			
		compact, grey brown, fine sand	8	SS	18
	350.23				
	7.62	compact, brown, fine sand	9	SS	25
8.0					
	348.71				
	9.14	compact, grey brown, medium to coarse sand	10	SS	30
	348.10				
10.0	9.75	Borehole Terminated at 9.75			

Standard Penetration Graph: 25 50 75

Headspace (ppm)

Groundwater Observations and Well Details



Reviewed By: ALB

Method: CME75 Hollow Stem Auger

Notes:

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Sheet: 1 of 1

Client: Northgate Lands Corp.

Project: Northgate Lands Subdivision

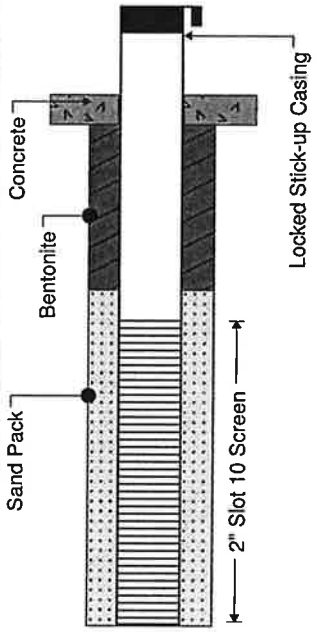
Location: Conservation Dr. Waterloo, Ontario

Borehole Number: MW102-14

Job Number: 39502-104

Drill Date: 12/12/14

Depth (m)	Elevation (m)	Soil Description	Symbol	Number	Type	N-Value	Standard Penetration Graph (25 50 75)	Headspace (ppm)	Groundwater Observations and Well Details
0.0	350.95	Ground Elevation							
0.0	350.95	**TOPSOIL** dark brown, silty sand, little organics, damp							
0.76	350.19	**SILT TILL** firm, brown, clayey silt till, some sand, trace gravel, moist		1	SS	6			
1.52	349.43	stiff, brown, oxidation staining, mottled tan brown, some fine sand moist		2	SS	17			
1.98	348.97	stiff, grey, clayey silt till, trace sand, grey, wet		3	SS	11			
3.05	347.90	**SILT** stiff, grey, clayey silt, saturated		4	SS	9			
				5	SS	13			
				6	SS	11			
5.94	345.01	Borehole Terminated at 5.94		7	SS	16			



January 12, 2015
Water level 1.8 mbTOC (349.9 masl)

Reviewed By: ALB

Method: CME75 Hollow Stem Auger

Notes:

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Sheet: 1 of 1

Client: Northgate Lands Corp.

Project: Northgate Lands Subdivision

Location: Conservation Dr. Waterloo, Ontario

Borehole Number: MW103-14

Job Number: 39502-104

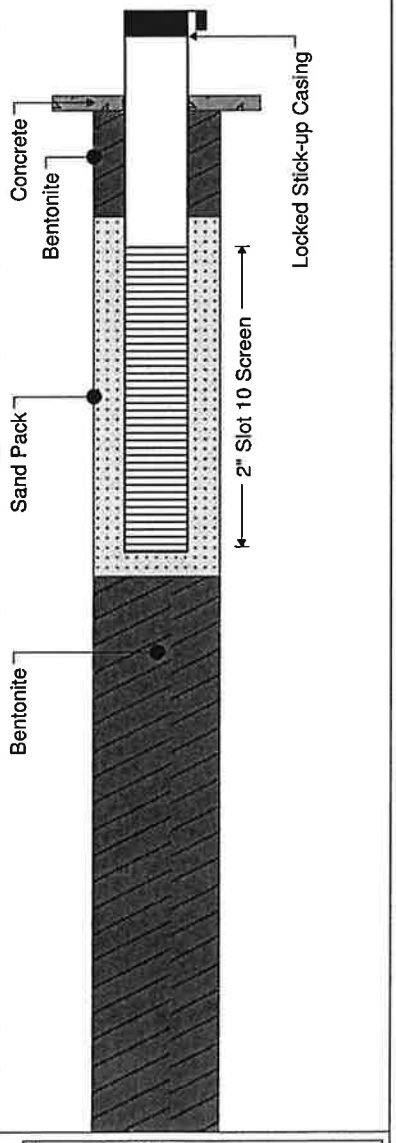
Drill Date: 12/11/14

Depth (m)	Elevation (m)	Soil Description	Number	Type	N-Value
	345.78	Ground Elevation			
	0.00	**TOPSOIL** dark brown, silty sand, little organics, moist			
	345.02 0.76	**SAND** loose, brown, medium to course sand, few gravel, trace organics, wet	1	SS	8
	344.26 1.52		2	SS	26
2.0	343.80 1.98	compact, brown, medium sand, trace gravel, saturated			
		compact, greyish brown, medium to course sand, trace gravel	3	SS	16
	342.88 2.90	**CLAY TILL** very stiff, grey, clay till, some silt, trace fine sand, wet	4	SS	17
4.0		**SAND** compact, grey, medium sand, grey, saturated	5	SS	12
	341.21 4.57	**CLAY** very stiff, grey, clay till, some silt, trace fine sand, wet	6	SS	17
	340.45 5.33	**SILT** compact, grey, sandy silt, saturated	7	SS	10
6.0	339.68 6.10	**SILT** compact, brownish grey, clayey silt, some fine sand, saturated	8	SS	2
	338.16 7.62	**SAND** very loose, brownish grey, silty fine sand	9	SS	17
8.0		compact brownish grey, fine sand, some silt			
			10	SS	36
	335.87 9.91	**SAND** dense, brownish grey, silty fine sand	11	SS	33
10.0	335.26 10.52	Borehole Terminated at 10.52m			

Standard Penetration Graph: 25 50 75

Headspace (ppm)

Groundwater Observations and Well Details



January 8, 2015
Water level 1.3 mbTOC (345.3 masl)

Reviewed By: ALB

Method: CME75 Hollow Stem Auger

Notes:

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Sheet: 1 of 1

Client: Northgate Lands Corp.

Project: Northgate Lands Subdivision

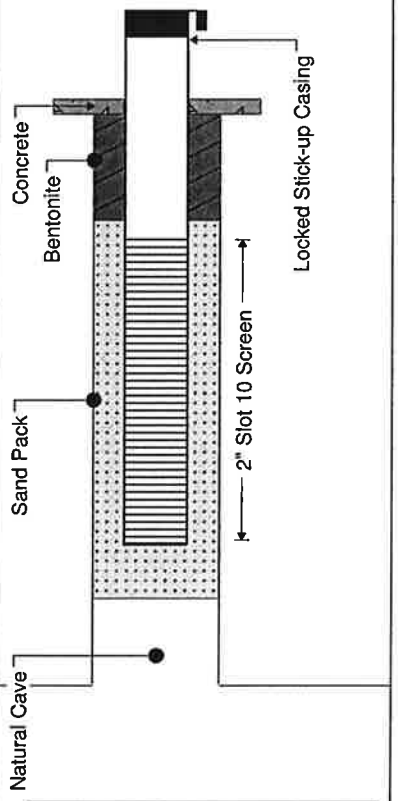
Location: Conservation Dr. Waterloo, Ontario

Borehole Number: MW104-14

Job Number: 39502-104

Drill Date: 12/11/14

Depth (m)	Elevation (m)	Soil Description	Symbol	Number	Type	N-Value	Standard Penetration Graph (25 50 75)	Headspace (ppm)	Groundwater Observations and Well Details
	346.17	Ground Elevation							
0.00		**TOPSOIL** dark brown, silty sand, little organics, damp							
	345.41								
0.76		**SAND** loose, orange brown, fine sand, moist		1	SS	7			
	344.65								
1.52		compact, saturated		2	SS	14			
2.0				3	SS	10			
				4	SS	15			
	342.64								
3.53		compact, greyish brown, fine sand		5	SS	26			
4.0				6	SS	11			
				7	SS	4			
	340.23								
5.94		Borehole Terminated at 5.94							
6.0									
8.0									
10.0									



January 8, 2015
Water level 1.9 mbTOC (345.19 masl)

Reviewed By: ALB

Method: CME75 Hollow Stem Auger

Notes:

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Kitchener, Ontario
N2B 3X9
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Sheet: 1 of 1

Client: Northgate Lands Corp.

Project: Northgate Lands Subdivision

Location: Conservation Dr. Waterloo, Ontario

Borehole Number: MW105A-14

Job Number: 39502-104

Drill Date: 12/15/14

Depth (m)	Elevation (m)	Soil Description	Symbol	Number	Type	N-Value	Standard Penetration Graph (25 50 75)	Headspace (ppm)	Groundwater Observations and Well Details
0.0	349.58	Ground Elevation							
0.0	0.00	**TOPSOIL** brown, silty sand, little organics, damp							
	348.82								
	0.76	**SILT** firm, brown, clayey silt, little sand, laminated grey silt layers, moist		1	SS	8			
2.0	348.28			2	SS	6			
	1.30								
	347.29	**SAND** loose, brown, silty fine sand,wet saturated		3	SS	7			
	2.29								
4.0	345.77			4	SS	20			
	3.81	**SAND** compact, dark brown, fine sand		5	SS	13			
				6	SS	23			
6.0				7	SS	19			
				8	SS	23			
	341.96								
	7.62	**SILT** dense, grey, clayey silt till		9	SS	18			
8.0				10	SS	26			
10.0				11	SS	20			

Concrete

Locked Stick-up Casing

Bentonite

Reviewed By: ALB

Method: CME75 Hollow Stem Auger

Notes: * Sampler advanced under static pressure

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Kitchener, Ontario
N2B 3X9
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Logged By: TFC

Sheet: 1 of 2

Client: Northgate Lands Corp.

Project: Northgate Lands Subdivision

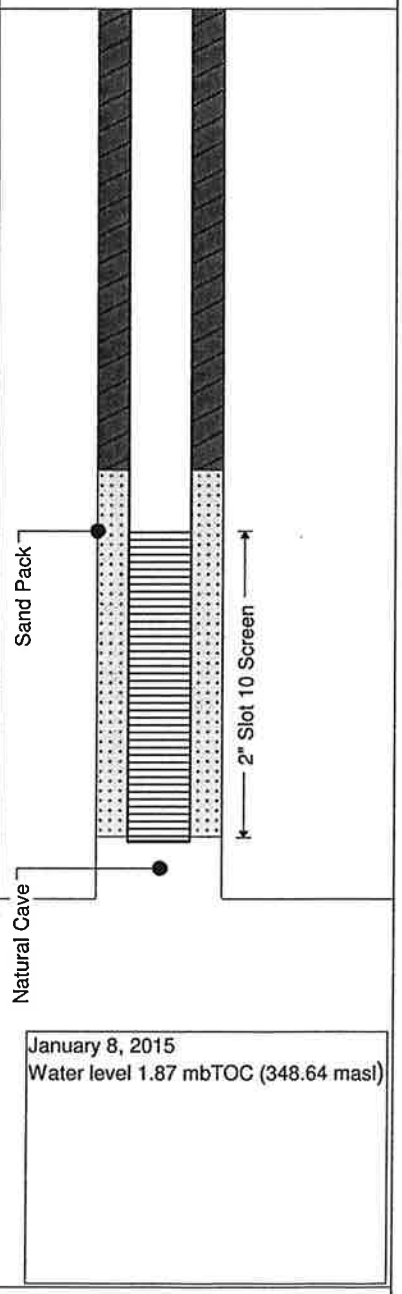
Location: Conservation Dr. Waterloo, Ontario

Borehole Number: MW105A-14

Job Number: 39502-104

Drill Date: 12/15/14

Depth (m)	Elevation (m)	Soil Description	Symbol	Number	Type	N-Value	Standard Penetration Graph (25 50 75)	Headspace (ppm)	Groundwater Observations and Well Details
40.0	337.39								
	12.19	**SILT** compact, grey		12	SS	15			
42.0									
13.0									
44.0									
46.0				13	SS	14			
48.0									
15.0									
50.0				14	SS	14			
52.0									
54.0									
17.0									
56.0									
58.0									
60.0	331.29								
	18.29	**SAND** very loose, greyish brown, fine sand		15	SS	0*			
62.0									
19.0									
64.0									
66.0	329.16			16	SS	15			
	20.42	Borehole Terminate at 20.42m							
68.0									
21.0									
70.0									
72.0									
74.0									
23.0									
76.0									
78.0									



Reviewed By: ALB

Method: CME75 Hollow Stem Auger

Notes: * Sampler advanced under static pressure

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Sheet: 2 of 2

Client: Northgate Lands Corp.

Project: Northgate Lands Subdivision

Location: Conservation Dr. Waterloo, Ontario

Borehole Number: MW105B-14

Job Number: 39502-104

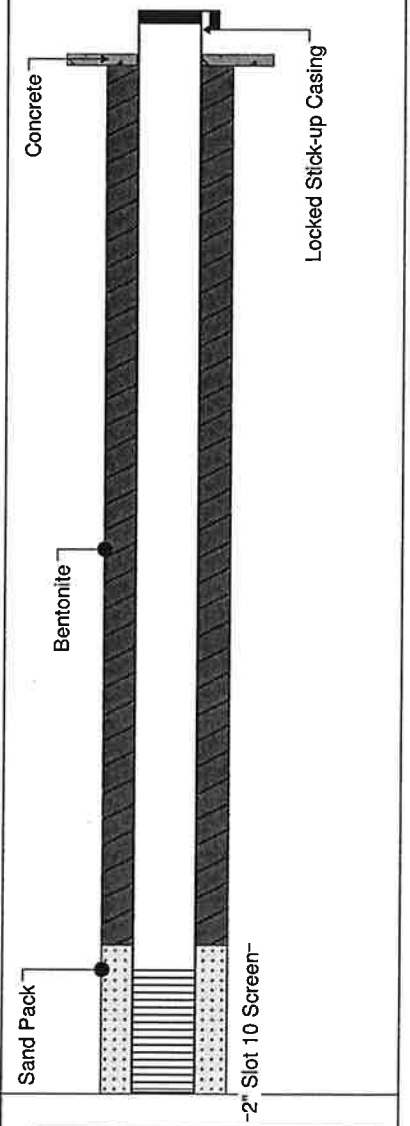
Drill Date: 12/15/14

Depth (m)	Elevation (m)	Soil Description	Number	Type	N-Value
	349.66	Ground Elevation			
	0.00	**TOPSOIL** brown, silty sand, little organics, moist			
	348.90		1	SS	8
	0.76	**SILT** firm, brown, clayey silt, little sand, laminated grey silt layers, moist	2	SS	6
	348.36				
	1.30				
2.0	347.37		3	SS	7
	2.29	**SAND** loose, brown, silty fine sand, wet saturated	4	SS	20
	345.85				
4.0	3.81	**SAND** compact, dark brown, fine sand	5	SS	13
			6	SS	23
			7	SS	19
6.0			8	SS	23
	342.04				
	7.62	**SILT TILL** dense, grey, clayey silt till	9	SS	18
8.0					
			10	SS	26
10.0					
			11	SS	20
	337.47				
12.0	12.19	**SILT** compact, grey	12	SS	15
	336.86				
	12.80	Borehole Terminate at 12.8m			
14.0					

Standard Penetration Graph: 25 50 75

Headspace (ppm)

Groundwater Observations and Well Details



January 8, 2015
Water level 1.87 mbTOC (348.33 masl)

Reviewed By: ALB

Method: CME75 Hollow Stem Auger

Notes: * Sampler advanced under static pressure

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Client: Northgate Lands Corp.

Project: Northgate Lands Subdivision

Location: Conservation Dr. Waterloo, Ontario

Borehole Number: MW106-14

Job Number: 39502-104

Drill Date: 12/10/14

Depth (m)	Elevation (m)	Soil Description	Symbol	Number	Type	N-Value	Standard Penetration Graph (25 50 75)	Headspace (ppm)	Groundwater Observations and Well Details
	350.79	Ground Elevation							
0.0	0.00	**TOPSOIL** light brown, silty sand, little organics, damp							
	350.03								
	0.76	**SILT** compact, tan, sandy silt, little fine sand, little clay, trace organic, moist		1	SS	10			
	349.27								
2.0	1.52			2	SS	9			
		wet		3	SS	27			
	347.74								
	3.05	**SILT TILL** dense, light brown, silt till, moist		4	SS	33			
	346.98								
4.0	3.81	**SILT** compact, grey, clayey silt till, moist		5	SS	22			
				6	SS	34			
	345.46								
	5.33	compact, grey, clayey silt		7	SS	40			
6.0	344.69								
	6.10	**SILT** compact, grey, silt		8	SS	28			
		saturated							
	343.17								
	7.62	compact, grey, some fine sand layers		9	SS	14			
8.0									
				10	SS	21			
10.0									
				11	SS	16			
12.0									
	337.99			12	SS	12			
	12.80								January 8, 2015 Water level 3.08 mbTOC (348.55 masl)
14.0									

Reviewed By: ALB

Method: CME75 Hollow Stem Auger

Notes:

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Sheet: 1 of 1

Client: Northgate Lands Corp.

Project: Northgate Lands Subdivision

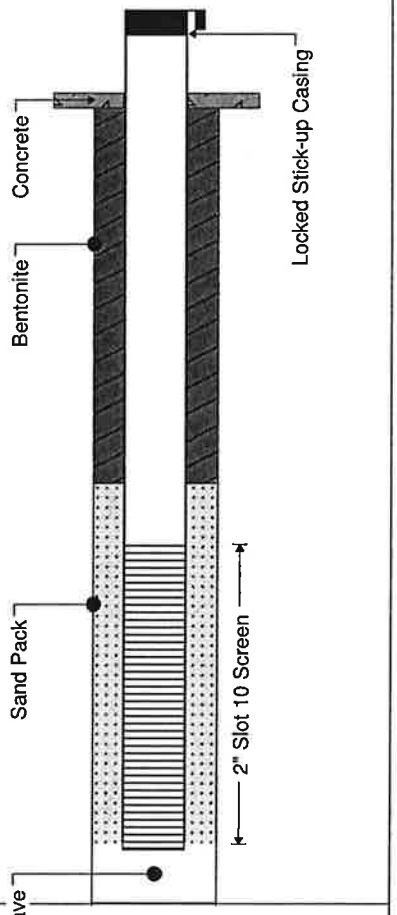
Location: Conservation Dr. Waterloo, Ontario

Borehole Number: MW107-14

Job Number: 39502-104

Drill Date: 12/17/14

Depth (m)	Elevation (m)	Soil Description	Symbol	Number	Type	N-Value	Standard Penetration Graph (25 50 75)	Headspace (ppm)	Groundwater Observations and Well Details
ft / m	350.58	Ground Elevation							
	0.00	**TOPSOIL** grey brown to dark brown, sandy silt, trace organics, damp							
	349.74								
	0.84	**SAND** loose, brown, silty fine sand, damp		1	SS	4			
2.0		**SAND** compact, tan, fine sand, damp		2	SS	12			
				3	SS	16			
	347.53								
	3.05	moist		4	SS	15			
	346.62								
4.0	3.96	compact, dark brown, fine sand, wet		5	SS	25			
	346.01								
	4.57	saturated		6	SS	27			
				7	SS	20			
6.0				8	SS	5			
	342.90								
	7.68	dense, brownish grey, fine sand		9	SS	48			
8.0	342.35								
	8.23	Borehole Terminated at 8.23m							
10.0									



January 7, 2015
Water level 5.18 mbTOC (346.26 masl)

Reviewed By: ALB

Method: CME75 Hollow Stem Auger

Notes: Aardvark

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Client: Northgate Lands Corp.

Project: Northgate Lands Subdivision

Location: Conservation Dr. Waterloo, Ontario

Borehole Number: MW108-14

Job Number: 39502-104

Drill Date: 12/16/14

Depth (m)	Elevation (m)	Soil Description	Symbol	Number	Type	N-Value	Standard Penetration Graph (25 50 75)	Headspace (ppm)	Groundwater Observations and Well Details
	346.21	Ground Elevation							
0.00		**TOPSOIL** brown to dark brown, some clay, organics, damp							
0.76	345.45	**SILT** stiff, tan, clayey silt, trace course sand, trace organics, damp		1	SS	11			
1.52	344.69	compact, tan, clayey silt, some fine sand, trace course sand, moist		2	SS	14			
2.29	343.92	**SAND** compact, tan, fine sand, saturated		3	SS	17			
				4	SS	20			
3.81	342.40	dense, mottled tan brown with oxidation staining, fine sand		5	SS	40			
4.57	341.64	dense, brown, fine sand							
		compact, grey brown, fine sand		6	SS	14			
				7	SS	20			
6.10	340.11	compact, grey, fine sand		8	SS	15			
6.71	339.50	Borehole Terminated at 6.71m							

Concrete
Bentonite
Sand Pack
Natural Cave
Locked Stick-up Casing
2" Slot 10 Screen

January 8, 2015
Water level 1.85 mbTOC (345.08 masl)

Reviewed By: ALB

Method: CME75 Hollow Stem Auger

Notes:

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Client: Northgate Lands Corp.

Project: Northgate Lands Subdivision

Location: Conservation Dr. Waterloo, Ontario

Borehole Number: MW109A-14

Job Number: 39502-104

Drill Date: 12/18/14

Depth (m)	Elevation (m)	Soil Description	Number	Type	N-Value	Standard Penetration Graph (25 50 75)	Headspace (ppm)	Groundwater Observations and Well Details
	349.77	Ground Elevation						
0.00		**TOPSOIL** loose, dark brown, fill, silty sand, little organics, damp	1	SS	8			
1.0			2	SS	15			
3.0		**SILT TILL** stiff, brown, clayey silt till, moist	3	SS	15			
5.0								
2.0		mottled brown, no clasts observed, moist	4	SS	9			
7.0								
9.0	346.72							
3.05		**CLAY** stiff, grey, little silt, moist	5	SS	10			
11.0								
4.0			6	SS	7			
13.0								
15.0			7	SS	9			
17.0	344.41							
5.36		**SAND** loose, brown, silty fine sand, wet	8	SS	8			
6.0	343.67							
6.10		**SAND** loose, brownish grey, fine to medium sand, saturated	9	SS	18			
21.0		compact, brown, fine sand						
23.0								
25.0			10	SS	16			
8.0								
27.0								
29.0			11	SS	5			
31.0								
10.0								
33.0								
35.0			12	SS	11			
37.0								
39.0								
12.0	337.58							
12.19		compact, brown, fine sand, little silt	13	SS	14			
41.0								
43.0								
45.0	336.05							
13.72		compact brownish grey, fine sand, little silt	14	SS	23			
14.0								
47.0								

Concrete

Locked Stick-up Casing

Bentonite

Reviewed By: ALB

Method: CME75 Hollow Stem Auger

Notes:

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Client: Northgate Lands Corp.

Project: Northgate Lands Subdivision

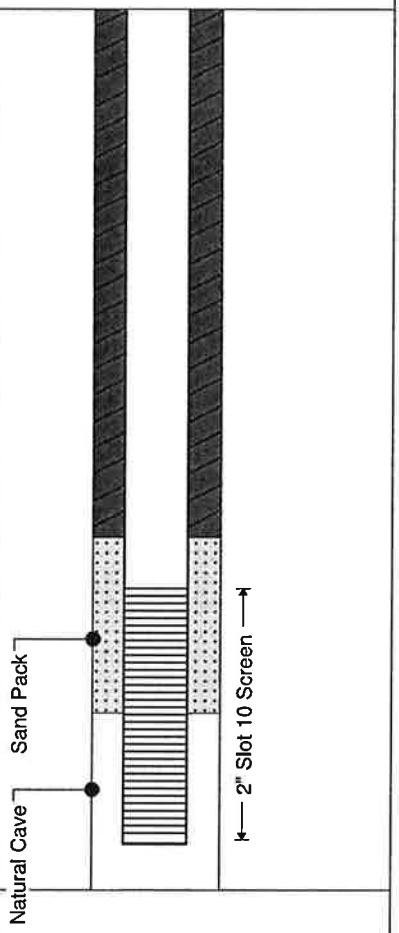
Location: Conservation Dr. Waterloo, Ontario

Borehole Number: MW109A-14

Job Number: 39502-104

Drill Date: 12/18/14

Depth (m)	Elevation (m)	Soil Description	Symbol	Number	Type	N-Value	Standard Penetration Graph (25 50 75)	Headspace (ppm)	Groundwater Observations and Well Details
49.0									
51.0				15	SS	30			
53.0	16.0								
55.0	333.01								
	16.76	**CLAY** hard, brownish grey, silty clay, some fine sand,wet		16	SS	40			
57.0									
59.0	18.0								
	331.48								
	18.29	**SAND** dense, brown, fine sand, saturated		17	SS	37			
61.0									
63.0		**CLAY** hard, brownish grey, clay, wet							
65.0	20.0			18	SS	22			
67.0									
69.0									
	328.43								
	21.34	**SAND** dense, brownish grey, silty fine sand, saturated		19	SS	36			
71.0									
73.0	22.0								
75.0				20	SS	37			
77.0									
79.0	24.0								
81.0				21	SS	19			
	324.78								
	24.99	Borehole Terminated at 24.99m							
83.0									
85.0	26.0								
87.0									
89.0									
91.0	28.0								
93.0									
95.0									
97.0									



January 7, 2015
Water level 3.87 mbTOC (346.62 masl)

Reviewed By: ALB

Method: CME75 Hollow Stem Auger

Notes:

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Sheet: 2 of 2

Client: Northgate Lands Corp.

Project: Northgate Lands Subdivision

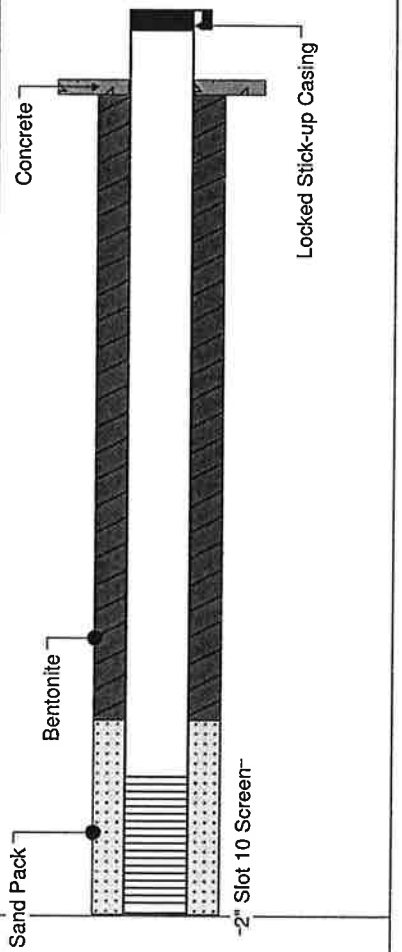
Location: Conservation Dr. Waterloo, Ontario

Borehole Number: MW109B-14

Job Number: 39502-104

Drill Date: 12/18/14

Depth (m)	Elevation (m)	Soil Description	Symbol	Number	Type	N-Value	Standard Penetration Graph (25 50 75)	Headspace (ppm)	Groundwater Observations and Well Details
	349.77	Ground Elevation							
0.00		**TOPSOIL** loose, dark brown, fill, silty sand, little organics, damp		1	SS	8			
2.0		**SILT TILL** stiff, brown, clayey silt till, moist; mottled brown, no clasts observed, moist		2	SS	15			
				3	SS	15			
				4	SS	9			
	346.72								
3.05		**CLAY** stiff, grey, little silt, moist		5	SS	10			
4.0				6	SS	7			
				7	SS	9			
	344.41								
5.36		**SAND** loose, brown, silty fine sand, wet		8	SS	8			
6.0	343.67								
6.10		**SAND** loose, brownish grey, fine to medium sand, saturated; compact, brown, fine sand		9	SS	18			
8.0				10	SS	16			
	340.63								
9.14		Borehole Terminated at 9.14m							
10.0									
12.0									



January 5, 2015
Water level 4.76 mbTOC (345.76 masl)

Reviewed By: ALB

Method: CME75 Hollow Stem Auger

Notes:

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Sheet: 1 of 1

Client: Northgate Lands Corp.

Project: Northgate Lands Subdivision

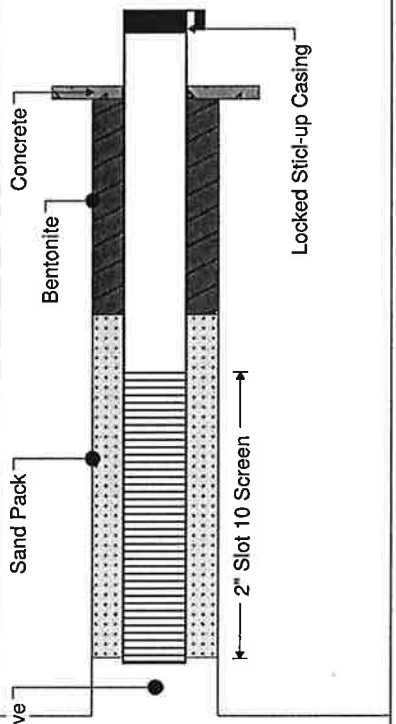
Location: 675 Conservation Dr. Waterloo, Ontario

Borehole Number: MW110-14

Job Number: 39502-104

Drill Date: 12/17/14

Depth (m)	Elevation (m)	Soil Description	Symbol	Number	Type	N-Value	Standard Penetration Graph (25 50 75)	Headspace (ppm)	Groundwater Observations and Well Details
0.0	349.37	Ground Elevation							
0.0 – 0.76	349.37 – 348.61	**TOPSOIL** dark brown, silty sand, trace organics, moist							
0.76 – 1.52	348.61 – 347.85	**SAND** compact, grey, fine to medium sand,some silt, some gravel, wet		1	SS	19			
1.52 – 2.44	347.85 – 346.93	compact, brownish grey, fine sand, some silt, wet		2	SS	16			
2.44 – 6.71	346.93 – 342.66	saturated		3	SS	13			
				4	SS	8			
				5	SS	9			
				6	SS	14			
				7	SS	0*			
				8	SS	1			
6.71	342.66	Borehole Terminated at 6.71m							



January 7, 2015
Water level 2.10 mbTOC (348.08 masl)

Reviewed By: ALB

Method: CME75 Hollow Stem Auger

Notes: * Sampler advanced under static pressure

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Sheet: 1 of 1

Client: Northgate Lands Corp.

Project: Northgate Lands Subdivision

Location: 675 Conservation Dr. Waterloo, Ontario

Borehole Number: MW111-14

Job Number: 39502-104

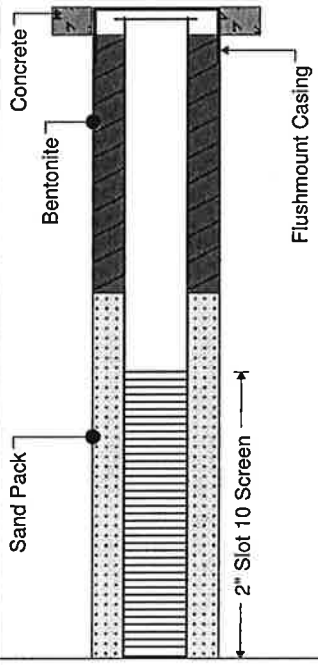
Drill Date: 12/17/14

Depth (m)	Elevation (m)	Soil Description	Number	Type	N-Value
	349.43	Ground Elevation			
0.0	0.00	**TOPSOIL** tan brown, silty sand, trace organics, moist			
	348.67				
0.76	0.76	**SILT** firm, mottled borwn, clayey silt till, moist	1	SS	6
1.5			2	SS	9
2.0	347.14				
	2.29	**SAND** compact, brown, silty fine sand, saturated	3	SS	21
3.0		**CLAY** very stiff, brown, clay, little silt, little sand, wet	4	SS	19
4.0		**SAND** compact, grey, fine sand, saturated	5	SS	26
	344.86				
	4.57	**CLAY** very stiff, brown, clay, little silt, little sand, wet	6	SS	43
6.0	343.33	**SILT** hard, grey, clayey silt, little sand, wet	7	SS	34
	6.10		8	SS	17
	342.50				
	6.93	**CLAY** very stiff, grey, clay, some silt, wet			
8.0		Borehole Terminated at 6.93m			
10.0					
12.0					

Standard Penetration Graph: 25 50 75

Headspace (ppm)

Groundwater Observations and Well Details



January 7, 2015
Water level 0.75 mbTOC (348.56 masl)

Reviewed By: ALB

Method: CME75 Hollow Stem Auger

Notes:

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Sheet: 1 of 1

Monitoring Well: MW8-10

Project:	North Waterloo Subwatershed Study	**Field investigator:**	R.Dong/L.Veale
Client:		**Contractor:**	Pro Core Drilling
Location:	North Waterloo, ON; 08	**Drilling method:**	Track Mount, CME55, Hollow Stem Auger
Number:	160340875	**Date started/completed:**	05-Mar-2010 / 08-Mar-2010

SUBSURFACE PROFILE				HYDROGEOLOGY		SAMPLE DETAILS					WELL DETAILS
Depth (ft)	Depth (m)	Graphic Log	Lithologic Description	Elevation (m AMSL) / Depth (m BGS)	Hydro-Stratigraphic Unit	Description	Sample Number	Sample Type	N Value	Recovery	GS Elev: 350.44 m AMSL TOC Elev: 351.28 m AMSL Easting: 532289 Northing: 4814537 Stick-up: 0.82 m GS Elev: 350.38 m AMSL TOC Elev: 351.28 m AMSL Easting: 532271 Northing: 4814538 Stick-up: 0.90 m
			Ground Surface	350.44							
0	0		TOPSOIL some organic material, dark brown, stiff, dry	0.00 349.60			1	SS	2-2-2-3 (4)	12" 50%	Cement
			SILT little fine sand, trace clay, light brown	0.84 348.91			2	SS	5-7-9-2 (16)	9" 38%	Holeplug
5			becoming wet at 1.37 m BGS	1.52							
	2		SILT light brown, homogeneous, stiff, wet				3	SS	3-5-7-12 (12)	24" 100%	52 mm Schedule 40 PVC casing
							4	SS	9-13-14-14 (27)	24" 100%	
10							5	PQ	n/a	29" 161%	Top of sand (2.74 m BGS)
	4		some clay beginning at 3.6 m BGS, becoming brownish grey, firm		ATB1	Upper Maryhill Till and Equivalents	6	PQ	n/a	54" 90%	Top of screen (3.05 m BGS) No.2 Silica Sand No.10 Slot PVC screen 50 mm diameter
15											
20	6						7	PQ	n/a	54" 90%	Bottom of screen (4.57 m BGS)
							8	PQ	n/a	54" 90%	
25	8			341.93							
			SAND fine grained, some silt, brown, homogeneous, wet	8.51			9	PQ	n/a	49" 82%	
30	10		trace silt beginning at 9.8 m BGS				10	PQ	n/a	55" 92%	
35											
40	12		little silt beginning at 12.5 m BGS, becoming greyish brown, soft				11	PQ	n/a	51" 85%	52 mm Schedule 80 PVC casing
							12	PQ	n/a	55" 92%	
45	14						13	PQ	n/a	55" 92%	
50											
55	16		layer of fine sand, trace silt, stiff at 16.2 to 17.1 m BGS				14	PQ	n/a	28" 47%	
60	18						15	PQ	n/a	55" 92%	Bentonite Grout
			some silt beginning at 18.9 m BGS				16	PQ	n/a	58" 97%	
65	20										
70							17	PQ	n/a	56" 93%	
	22		trace silt beginning at 21.6 m BGS				18	PQ	n/a	37" 62%	
75				328.03 22.40							
			fine grained, little medium grained sand, grey brown, wet		AFB1 / AFB2	Upper / Middle Moraine Stratified Sediments and Equivalents	19	PQ	n/a	38" 63%	
80	24		seam of grey brown, fine sand with little silt 0.2 m thick at 24.5 m BGS								
			medium sand content between 24.7 to 26.2 m BGS				20	PQ	n/a	44" 73%	
85	26										
							21	PQ	n/a	60" 100%	
90			seam of medium sand 0.2 m thick at 27.7 m BGS								

Notes:
m AMSL - metres above mean sea level
m BGS - metres below ground surface
m BTOC - metres below top of casing
SS - split-spoon sample
PQ - wireline continuous core sample
n/a - not available

mAMSL - metres above mean sea level
mBGS - metres below ground surface

PQ - continuous core sampling
SS - split spoon sampling

Drawn By/Checked By: OR/LV

Stantec

STANTEC BOREHOLE AND WELL - CLUST 11X17 160340875 - DPS.GPJ EDGE DATA TEMPLATE.GDT 2/4/11 MJFRASER

Monitoring Well: MW8-10

Project:	North Waterloo Subwatershed Study	**Field Investigator:**	R.Dong/L.Veale
Client:		**Contractor:**	Pro Core Drilling
Location:	North Waterloo, ON; 08	**Drilling method:**	Track Mount, CME55, Hollow Stem Auger
Number:	160340875	**Date started/completed:**	05-Mar-2010 / 08-Mar-2010

SUBSURFACE PROFILE				HYDROGEOLOGY		SAMPLE DETAILS				WELL DETAILS	
Depth (ft)	Depth (m)	Graphic Log	Lithologic Description	Elevation (m AMSL) Depth (m BGS)	Hydro Stratigraphic Unit	Description	Sample Number	Sample Type	N Value	Recovery	GS Elev: 350.44 m AMSL TOC Elev: 351.26 m AMSL Easting: 532269 Northing: 4814537 Stick-up: 0.82 m
95			little silt from 28.0 to 28.7 m BGS fine grained, little medium grained sand, grey brown, wet				22	PQ	n/a	60" 100%	
100	30						23	PQ	n/a	14" 23%	
105	32						24	PQ	n/a	50" 83%	Bentonite Grout
110	34		seam of fine sand 5 cm thick at 33.8 m BGS				25	PQ	n/a	25" 42%	
115	36						26	PQ	n/a	3" 5%	Holeplug
120			seam of homogeneous fine sand between 36.9 and 37.4 m BGS, and				27	PQ	n/a	3" 5%	Top of sand (35.97 m BGS) Top of screen (36.58 m BGS)
125	38		37.8 and 38.1 m BGS, and				28	PQ	n/a	60" 100%	No.2 Silica Sand
			38.8 and 38.8 m BGS	311.42							No.10 Slot PVC screen 50 mm diameter
			trace gravel beginning at 39.0 m BGS	39.01			29	PQ	n/a	41" 82%	
130	40		SAND AND COBBLE large cobble at 39 m BGS, at 39.5 m and 39.7 m BGS	310.76	AFB3	Lower Moraine Stratified Sediments					Bottom of screen (39.68)
			End of Borehole	39.68							
135	42										
140											
145	44										
150	46										
155											
160	48										
165	50										
170	52										
175											
180	54										
185	56										

Notes:
m AMSL - metres above mean sea level
m BGS - metres below ground surface
m BTOC - metres below top of casing
SS - split-spoon sample
PQ - wireline continuous core sample
n/a - not available

mAMSL - metres above mean sea level
mBGS - metres below ground surface

PQ - continuous core sampling
SS - split spoon sampling

Drawn By/Checked By: OR/LV

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STANTEC BOREHOLE AND WELL - CLIENT 11X17 - MOD0875 - DPS.GPJ EQUIS DATA TEMPLATE.GDT 2/1/11 MAFRASER

Monitoring Well: MW9-10

Project:	North Waterloo Subwatershed Study	**Field Investigator:**	J.Koch
Client:		**Contractor:**	Pro Core Drilling
Location:	North Waterloo, ON; 09	**Drilling method:**	Track Mount, CME75, Hollow Stem Auger
Number:	160340875	**Date started/completed:**	02-Mar-2010 / 04-Mar-2010

SUBSURFACE PROFILE				HYDROGEOLOGY		SAMPLE DETAILS				WELL DETAILS	
Depth (ft)	Depth (m)	Graphic Log	Lithologic Description	Elevation (m AMSL) / Depth (m BGS)	Hydro Stratigraphic Unit	Description	Sample Number	Sample Type	N Value	Recovery	GS Elev: 345.71 m AMSL TOC Elev: 346.50 m AMSL Easting: 532634 Northing: 4814717 Stick-up: 0.79 m
			Ground Surface	345.71							
0	0		TOPSOIL some clay and silt, dark brown	0.00 344.95			1	SS	n/a	6" 25%	Cement
			CLAY some silt, trace gravel, brown, firm	0.76 344.19			2	SS	2-5-7-9 (12)	14" 58%	Holeplug
5	2		brownish grey, homogeneous, firm, wet	1.52	ATB1	Upper Maryhill Port Stanley Till and Equivalents	3	SS	4-5-7-9 (12)	15" 63%	52 mm Schedule 40 PVC casing
							4	SS	2-3-4-6 (7)	15" 63%	Top of sand (2.61 m BGS)
10							5	PQ	n/a	25" 96%	Top of screen (3.05 m BGS)
	4			341.90							No.2 Silica Sand
			SANDY SILT some clay, brownish grey, firm, wet	3.81 340.93			6	PQ	n/a	52.5" 88%	No.10 Slot PVC screen 50 mm diameter
15			SAND medium grained, silty to some silt, brownish grey, soft, wet	4.76 340.02							Bottom of screen (4.57 m BGS)
20	6		SILT sandy to some sand, greyish brown, very stiff, wet	5.69			7	PQ	n/a	44" 73%	
			seam of fine sand, little silt between 6.6 and 9.5 m BGS				8	PQ	n/a	59" 98%	
25	8		little clay between 8.1 and 9.5 m BGS				9	PQ	n/a	58" 96%	
30			stratified layers of clayey silt, little to some sand, firm to soft and silt, little clay, very hard between 9.5 and 11.3 m BGS								52 mm Schedule 80 PVC casing
	10		becoming soft at 11.3 m BGS				10	PQ	n/a	58" 95%	
35											
40	12				AFB1 / AFB2	Upper / Mide Moraine Stratified Sediments and Equivalents	11	PQ	n/a	59" 100%	
			laminated sediments at 13.4 m BGS				12	PQ	n/a	57" 95%	Bentonite Grout
45	14		little fine sand beginning at 14.2 m BGS, soft to firm								
50							13	PQ	n/a	51" 85%	
	16						14	PQ	n/a	58" 97%	
55			laminated sediments at 17.1 m BGS								
60	18		trace fine sand beginning at 18.8 m BGS				15	PQ	n/a	54" 88%	
65	20		cobble, 11 cm diameter, at 19.8 m BGS	325.82 19.89			16	PQ	n/a	43" 73%	
			SAND AND GRAVEL coarse grained gravel, some fine gravel, some cobbles, rounded particles		AFB3	Lower Moraine Stratified Sediments	17	PQ	n/a	n/a	
70				324.09							
	22		SILT TILL some fine sand, some coarse gravel, trace fine gravel, grey, very hard, moist	21.82			18	PQ	n/a	60" 101%	
75											Holeplug
	24				ATC1	Upper/ Main Catfish Creek Till	19	PQ	n/a	45" 61%	Top of sand (23.98 m BGS)
80											Top of screen (24.48 m BGS)
85	26						20	PQ	n/a	54" 90%	No.2 Silica Sand
											No.10 Slot PVC screen 50 mm diameter
90	28		End of Borehole	318.20 27.51							Bottom of screen (27.51)

Notes:
m AMSL - metres above mean sea level
m BGS - metres below ground surface
m BTOC - metres below top of casing
SS - split-spoon sample
PQ - wireline continuous core sample
n/a - not available

mAMSL - metres above mean sea level
mBGS - metres below ground surface

PQ - continuous core sampling
SS - split spoon sampling

Drawn By/Checked By: OR/LV

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STANTEC BOREHOLE AND WELL - CLIENT 11X17 - 160340875 - DPS.GPJ EGAS DATA TEMPLATE.GDT 3/1/11 MJFRASER

Monitoring Well: MW10-10

Project:	North Waterloo Subwatershed Study	**Drilling method:**	Track Mount, CME55, Hollow Stem Auger
Client:		**Date started/completed:**	19-Mar-2010
Location:	North Waterloo, ON	**Ground surface elevation:**	346.25 m AMSL
Number:	160340875	**Top of casing elevation:**	347.05 m AMSL
Field investigator:	A.Vandenhoff	**Easting:**	532654
Contractor:	Pro Core Drilling	**Northing:**	4814388

SUBSURFACE PROFILE				HYDROGEOLOGY		SAMPLE DETAILS				WELL DETAILS	
Depth (ft)	Depth (m)	Graphic Log	Lithologic Description	Elevation (m AMSL) Depth (m BGS)	Hydro Stratigraphic Unit	Description	Sample Number	Sample Type	N Value	Recovery	Diagram	Description
												Stick-up = 0.80 m
0	0		Ground Surface	346.25								
			TOPSOIL some clay, organics, dark brown	0.00 345.94								Concrete
			SAND fine to medium grained, light brown with oxidation staining throughout	0.30			1	SS	2-4-5-8 (9)	16" 67%		Holeplug
							2	SS	10-8-6-6 (14)	0" 0%		52 mm Schedule 40 PVC casing
5				344.57								Top of sand (0.9 m BGS)
			SILTY CLAY light brown	1.68 344.42	AFB1 / AFB2	Upper / Midle Moraine Stratified Sediments and Equivalents	3	SS	3-5-5-5 (10)	18" 75%		Top of screen (1.5 m BGS)
	2		SAND fine grained, some medium sand and silt, light brown, loose to compact, wet	1.83								No.2 Silica Sand
			becoming finer with depth				4	SS	2-3-4-5 (7)	8" 33%		No.10 Slot PVC screen 50 mm diameter
10							5	SS	6-8-10-8 (18)	16" 67%		Bottom of screen (3.1 m BGS)
				342.59								
			End of Borehole	3.66								
	4											
15												
20	6											
25												
	8											

Screen Interval: 1.52 - 3.05 m BGS
Sand Pack Interval: 0.91 - 3.05 m BGS
Well Seal Interval: 0.30 - 0.91 m BGS

Notes:
m AMSL - metres above mean sea level
m BGS - metres below ground surface
m BTOC - metres below top of casing
SS - split-spoon sample
n/a - not available

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STANTEC BOREHOLE AND WELL 160330875 - DPS.GPJ EQUIS DATA TEMPLATE.GDT 2/1/11 MJFRASER

Monitoring Well: MW11-10

Project:	North Waterloo Subwatershed Study	**Drilling method:**	Track Mount, CME55, Hollow Stem Auger
Client:		**Date started/completed:**	05-Mar-2010 / 08-Mar-2010
Location:	North Waterloo, ON	**Ground surface elevation:**	355.07 m AMSL
Number:	160340875	**Top of casing elevation:**	355.96 m AMSL
Field investigator:	A.Vandenhoff	**Easting:**	533047
Contractor:	Pro Core Drilling	**Northing:**	4814655

SUBSURFACE PROFILE					HYDROGEOLOGY		SAMPLE DETAILS				WELL DETAILS	
Depth (ft)	Depth (m)	Graphic Log	Lithologic Description	Elevation (m AMSL) Depth (m BGS)	Hydro Stratigraphic Unit	Description	Sample Number	Sample Type	N Value	Recovery	Diagram	Description
												Stick-up = 0.69 m
0	0		Ground Surface	355.07								
			SAND fine to medium grained, trace silt and organics, light brown	0.00 354.76								Concrete
			SAND fine to medium grained, light brown, some oxidation staining, loose	0.30			1	SS	1-3-3-5 (6)	11" 46%		
			some coarse sand and gravel at 0.8 to 1.4 m BGS				2	SS	4-6-7-6 (13)	6" 25%		52 mm Schedule 40 PVC casing
5							3	SS	4-7-12-14 (19)	14" 58%		
	2		SILTY SAND fine grained sand, light brown, compact, moist	353.09 1.98 352.93								Holeplug
			SAND fine grained, some medium sand, light brown, loose to compact, moist	2.13			4	SS	5-10-12-12 (22)	15" 63%		
10					AFB1 / AFB2	Upper / Midle Moraine Stratified Sediments and Equivalents	5	SS	2-10-16-18 (26)	15" 63%		
			fine to coarse grained sand, trace gravel, light brown, loose, wet	351.41 3.66								Top of sand (3.7 m BGS)
	4											Top of screen (4.3 m BGS)
15							6	SS	7-11-12-12 (23)	20" 83%		No.2 Silica Sand
												No.10 Slot PVC screen 50 mm diameter
	6			348.97								Bottom of screen (5.8 m BGS)
20			SILTY CLAY grey	6.10			7	SS	2-4-5-5 (9)	24" 100%		Natural Cave
				348.36								
			End of Borehole	6.71								
25												
	8											

Screen Interval: 4.27 - 5.79 m BGS
Sand Pack Interval: 3.66 - 5.79 m BGS
Well Seal Interval: 0.30 - 3.66 m BGS

Notes:
m AMSL - metres above mean sea level
m BGS - metres below ground surface
m BTOC - metres below top of casing
SS - split-spoon sample
n/a - not available

Drawn By/Checked By: OR/LV

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STANTEC BOREHOLE AND WELL 160330875 - DPS.GPJ EQUIS DATA TEMPLATE.GDT 2/1/11 MJFRASER

Monitoring Well: MW12-10

Project:	North Waterloo Subwatershed Study	**Field Investigator:**	R Dong
Client:		**Contractor:**	Pro Core Drilling
Location:	North Waterloo, ON; 12	**Drilling method:**	Track Mount, CME55, Hollow Stem Auger
Number:	160340875	**Date started/completed:**	09-Mar-2010 / 11-Mar-2010

SUBSURFACE PROFILE				HYDROGEOLOGY		SAMPLE DETAILS				WELL DETAILS
Depth (ft)	Depth (m)	Graphic Log	Lithologic Description	Elevation (m AMSL) / Depth (m BGS)	Hydro Stratigraphic Unit	Description	Sample Number	Sample Type	N Value	Recovery	GS Elev: 348.63 m AMSL TOC Elev: 349.52 m AMSL Easting: 532584 Northing: 4814125 Stick-up: 0.89 m
			Ground Surface	348.63							
0	0		TOPSOIL brown, decaying wood, moist	0.00			1	SS	2-3-4-4 (7)	12" 50%	Cement
				347.26			2	SS	3-4-4-4 (8)	10" 42%	Holeplug
5	2		CLAYEY SILT trace fine sand, light and dark brown mottled, soft, moist	1.37			3	SS	6-1-7-4 (8)	8" 33%	
			SILTY CLAY light brown and brown mottled, very stiff, moist	340.34 2.29			4	SS	6-6-8-14 (14)	17" 71%	52 mm Schedule 40 PVC casing
10			SILT little clay, trace coarse and fine gravel, trace well graded sand, brown, very soft, moist to wet	346.17 2.46			5	SS	n/a	14" 74%	Holeplug
				345.25							
15	4		SILTY CLAY little fine sand, trace cobbles, light brown, firm, moist to wet	3.38			6	PQ	n/a	24" 40%	Top of sand (4.57 m BGS)
			becoming stiff, brown at 4.9m BGS								Top of screen (5.18 m BGS)
			seam of wet, brown, fine sand, 0.23 m thick at 5.3 m BGS								No.2 Silica Sand
20	6		becoming brown grey at 5.9 m BGS		ATB1	Upper Maryhill Port Stanley Till and Equivalents	7	PQ	n/a	48" 79%	No.10 Slot PVC screen 50 mm diameter
			trace gravel beginning at 7.0 m BGS								Bottom of screen (6.71m BGS)
			trace coarse and medium sand beginning at 7.5 m BGS lensed trace soft clay pockets (1-2 mm in diameter), red and grey starting at 7.5 m BGS				8	PQ	n/a	50" 83%	
25	8		lensed trace to little silt pockets								52 mm Schedule 80 PVC casing
			laminated 2 mm thick of soft grey clay at 9.4 m BGS				9	PQ	n/a	61" 100%	
30	10										
			seam of wet silt and very fine sand, 0.05 m thick at 10.4 m BGS seam of little fine and coarse gravel, little well graded sand, 0.2 m thick at 10.5 m BGS seam of silt and very fine sand 0.05 thick between 10.7 and 11.0 m BGS				10	PQ	n/a	49" 83%	
35			seam of fine sand 2 mm thick at 11.4 m BGS	337.10							
			SILT AND SAND fine grained, brown grey, homogeneous, wet	11.53 336.64			11	PQ	n/a	52" 93%	
40	12		SAND fine grained, brown grey, homogeneous, wet	11.99							Bentonite Grout
			seam of silt, 0.01 m thick at 12.9 m BGS				12	PQ	n/a	46" 102%	
45			seam of silt, 0.01 m thick at 13.3 m BGS								
	14		seam of silt, 0.01 m thick at 14.4 m BGS				13	PQ	n/a	42" 70%	
50											
	16		seam of browny grey silty clay with lensed grey clay 0.05 m thick at 15.8 m BGS some medium sand between 16.1 and 16.5 m BGS		AFB1 / AFB2	Upper / Middle Moraine Stratified Sediments and Equivalents	14	PQ	n/a	43" 63%	
55							15	PQ	n/a	42" 89%	
60	18		pocket of very fine sand, 0.03 m diameter at 18.5 m BGS some medium sand between 18.3 and 18.7 m BGS seam of firm silty clay 0.03 m thick at 18.7 m BGS								
			seam of coarse gravel 0.05 m thick at 19.3 m BGS				16	PQ	n/a	34" 59%	
65	20		seam of sand, stiff, 0.1 m thick at 20.0 m BGS								
			seam of some silt 0.04 m thick at 20.8 m BGS seam of some silt 0.13 m thick at 20.9 m BGS stratified clayey silt 0.03 m thick at 21.1 m BGS	327.50 21.13 327.09			17	PQ	n/a	48" 89%	
70			SAND AND SILT stratified fine sand with little silt, 2 cm thick and coarse sand with fine gravel 0.2 cm thick browny grey, wet	21.54							Holeplug
	22		SAND AND GRAVEL well graded, brown and grey, wet				18	PQ	n/a	36" 74%	Top of sand (21.95 m BGS)
75											Top of screen (22.56 m BGS)
					AFB3	Lower Moraine Stratified Sediments					
80	24										No.2 Silica Sand
				323.48							No.10 Slot PVC screen 50 mm diameter
			SANDY SILT TILL little medium sand coarse sand, trace to little fine and coarse gravel, grey brown, brown very hard, moist	25.15	ATC1	Upper/Main Catfish Creek Till	19	PQ	n/a	44" 69%	
85	26			322.37							Bottom of screen (25.60 m BGS)
			End of Borehole	26.26							
90	28										

Notes:
m AMSL - metres above mean sea level
m BGS - metres below ground surface
m BTOC - metres below top of casing
SS - split-spoon sample
PQ - wireline continuous core sample
n/a - not available

mAMSL - metres above mean sea level
mBGS - metres below ground surface

PQ - continuous core sampling
SS - split spoon sampling

Drawn By/Checked By: OR/LV

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STANTEC BOREHOLE AND WELL - CLUST 1 (V3) - MOSSKRR - DPS.GPJ - EQUIS DATA TEMPLATE.GDT - 2/3/11 - MURHAISER

Monitoring Well: MW13-10

Project:	North Waterloo Subwatershed Study	**Drilling method:**	Track Mount, CME55, Hollow Stem Auger
Client:		**Date started/completed:**	19-Mar-2010
Location:	North Waterloo, ON	**Ground surface elevation:**	345.34 m AMSL
Number:	160340875	**Top of casing elevation:**	346.15 m AMSL
Field investigator:	A.Vandenhoff	**Easting:**	533060
Contractor:	Pro Core Drilling	**Northing:**	4814339

SUBSURFACE PROFILE				HYDROGEOLOGY		SAMPLE DETAILS				WELL DETAILS	
Depth (ft)	Depth (m)	Graphic Log	Lithologic Description	Elevation (m AMSL) Depth (m BGS)	Hydro Stratigraphic Unit	Description	Sample Number	Sample Type	N Value	Recovery	Diagram	Description
												Stick-up = 0.81 m
0	0		Ground Surface	345.34								
			TOPSOIL clay, organic material, dark brown	0.00			1	SS	1-2-4-6 (6)	7" 29%		Concrete
				344.42								Holeplug
			SILTY CLAY light brown	0.91			2	SS	1-2-4-4 (6)	24" 100%		
5			becoming coarser with depth		ATB1	Upper Maryhill Port Stanley Till and Equivalents						52 mm Schedule 40 PVC casing
	2		becoming clayey silt, some sandy silt				3	SS	2-3-6-8 (9)	14" 58%		
				343.05								
			SANDY SILT fine grained sand, light brown, moist	2.29			4	SS	6-6-6-7 (12)	2" 8%		Top of sand (2.4 m BGS)
10				342.14								Top of screen (3.1 m BGS)
			SILTY SAND fine grained, light brown, wet	3.20			5	SS	0-3-3-7 (6)	16" 67%		No.2 Silica Sand
	4				AFB1 / AFB2	Upper / Midle Moraine Stratified Sediments and Equivalents						No.10 Slot PVC screen 50 mm diameter
15			some medium sand, trace silt beginning at 4.6 m BGS				6	SS	1-2-2-3 (4)	24" 100%		Bottom of screen (4.6 m BGS)
				340.16								
			End of Borehole	5.18								
20	6											
25	8											

Screen Interval: 3.05 - 4.57 m BGS
Sand Pack Interval: 2.44 - 4.57 m BGS
Well Seal Interval: 0.30 - 2.44 m BGS

Notes:
m AMSL - metres above mean sea level
m BGS - metres below ground surface
m BTOC - metres below top of casing
SS - split-spoon sample
n/a - not available

Drawn By/Checked By: OR/LV

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STANTEC BOREHOLE AND WELL 160330875 - DPS.GPJ EQUIS DATA TEMPLATE.GDT 2/1/11 MJFRASER

Test Pit: TP3-10

Project:	North Waterloo Subwatershed Study	**Drilling method:**	Rubber Tire Backhoe
Client:		**Date started/completed:**	10-Mar-2010
Location:	North Waterloo, ON	**Ground surface elevation:**	350.20 m AMSL
Number:	160340875	**Top of casing elevation:**	n/a
Field investigator:	L.Jo	**Easting:**	532454
Contractor:	Pro Core Drilling	**Northing:**	4814491

SUBSURFACE PROFILE					HYDROGEOLOGY		SAMPLE DETAILS		
Depth (ft)	Depth (m)	Graphic Log	Lithologic Description	Elevation (m AMSL) Depth (m BGS)	Hydro Stratigraphic Unit	Description	Sample Number	Sample Type	Recovery
			Ground Surface	350.20					
			TOPSOIL silt, organics, dark brown, moist	0.00					
				349.90					
			SANDY SILT fine grained, light brown, loose, moist	0.30	ATB1	Upper Maryhill Port Stanley Till and Equivalents			
2	1								
4									
6	2								
8									
10	3								
12			End of Test Pit	346.54 3.66					
	4								
14									

Notes:
m AMSL - metres above mean sea level
m BGS - metres below ground surface
m BTOC - metres below top of casing
n/a - not available

No standing water encountered within excavation

Drawn By/Checked By: OR/LV

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STANTEC BOREHOLE AND WELL 160330875 - DPS.GPJ EQUIS DATA TEMPLATE.GDT 1/18/11 MJFRASER

Test Pit: TP4-10

Project:	North Waterloo Subwatershed Study	**Drilling method:**	Rubber Tire Backhoe
Client:		**Date started/completed:**	10-Mar-2010
Location:	North Waterloo, ON	**Ground surface elevation:**	346.80 m AMSL
Number:	160340875	**Top of casing elevation:**	n/a
Field investigator:	L.Jo	**Easting:**	532628
Contractor:	Pro Core Drilling	**Northing:**	4814574

SUBSURFACE PROFILE					HYDROGEOLOGY		SAMPLE DETAILS		
Depth (ft)	Depth (m)	Graphic Log	Lithologic Description	Elevation (m AMSL) Depth (m BGS)	Hydro Stratigraphic Unit	Description	Sample Number	Sample Type	Recovery
			Ground Surface	346.80					
			TOPSOIL clayey silt with organics, dark brown, moist	0.00					
				346.40					
			SAND medium grained, some fine and coarse sand, light brown, loose, moist	0.40					
2					AFB1 / AFB2	Upper / Middle Moraine Stratified Sediments and Equivalents			
	1		becoming wet at 1.0 m BGS	345.79					
			SAND some fine gravel, light brown, loose, well graded, wet	1.01					
4									
			standing water encountered at 1.8 m BGS	345.03					
6			End of Test Pit	1.77					
	2								
8									
10	3								
12									
	4								
14									

Notes:
m AMSL - metres above mean sea level
m BGS - metres below ground surface
m BTOC - metres below top of casing
n/a - not available

Drawn By/Checked By: OR/LV

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STANTEC BOREHOLE AND WELL 160330875 - DPS.GPJ EQUIS DATA TEMPLATE.GDT 1/18/11 MJFRASER

Test Pit: TP6-10

Project:	North Waterloo Subwatershed Study	**Drilling method:**	Rubber Tire Backhoe
Client:		**Date started/completed:**	11-Mar-2010
Location:	North Waterloo, ON	**Ground surface elevation:**	350.60 m AMSL
Number:	160340875	**Top of casing elevation:**	n/a
Field investigator:	L.Jo	**Easting:**	532803
Contractor:	Pro Core Drilling	**Northing:**	4814702

SUBSURFACE PROFILE				HYDROGEOLOGY		SAMPLE DETAILS		
Depth (ft)	Depth (m)	Graphic Log	Lithologic Description	Elevation (m AMSL) Depth (m BGS)	Hydro Stratigraphic Unit	Description	Sample Number	Sample Type	Recovery
			Ground Surface	350.60					
			TOPSOIL organics, dark brown, moist	0.00					
				350.20					
			CLAYEY SILT light brown, soft, moist	0.40					
2	1		wet layer at 1.1 m BGS		ATB1	Upper Maryhill Port Stanley Till and Equivalents			
4									
6	2								
				348.31					
8			SILT some clay, grey, soft, moist to wet	2.29					
				347.70					
10	3		CLAY grey, soft to firm, moist to wet	2.90					
				347.49					
			End of Test Pit	3.11					
12	4								
14									

Notes:
m AMSL - metres above mean sea level
m BGS - metres below ground surface
m BTOC - metres below top of casing
n/a - not available

No standing water encountered within excavation

Drawn By/Checked By: OR/LV

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STANTEC BOREHOLE AND WELL 160330875 - DPS.GPJ EQUIS DATA TEMPLATE.GDT 1/18/11 MJFRASER

Test Pit: TP7-10

Project:	North Waterloo Subwatershed Study	**Drilling method:**	Rubber Tire Backhoe
Client:		**Date started/completed:**	10-Mar-2010
Location:	North Waterloo, ON	**Ground surface elevation:**	352.80 m AMSL
Number:	160340875	**Top of casing elevation:**	n/a
Field investigator:	L.Jo	**Easting:**	532458
Contractor:	Pro Core Drilling	**Northing:**	4814292

SUBSURFACE PROFILE					HYDROGEOLOGY		SAMPLE DETAILS		
Depth (ft)	Depth (m)	Graphic Log	Lithologic Description	Elevation (m AMSL) Depth (m BGS)	Hydro Stratigraphic Unit	Description	Sample Number	Sample Type	Recovery
			Ground Surface	352.80					
			TOPSOIL clayey sand, organics, brown	0.00 352.50					
			SAND fine grained, brown, loose, moist	0.30	AFB1 / AFB2	Upper / Middle Moraine Stratified Sediments and Equivalents			
2									
	1								
4									
6									
	2								
8									
10									
	3								
12									
	4		End of Test Pit	348.84 3.96					
14									

Notes:
m AMSL - metres above mean sea level
m BGS - metres below ground surface
m BTOC - metres below top of casing
n/a - not available

No standing water encountered within excavation

Drawn By/Checked By: OR/LV

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Sheet 1 of 1

STANTEC BOREHOLE AND WELL 160330875 - DPS.GPJ EQUIS DATA TEMPLATE.GDT 1/18/11 MJFRASER

Test Pit: TP8-10

Project:	North Waterloo Subwatershed Study	**Drilling method:**	Rubber Tire Backhoe
Client:		**Date started/completed:**	10-Mar-2010
Location:	North Waterloo, ON	**Ground surface elevation:**	346.30 m AMSL
Number:	160340875	**Top of casing elevation:**	n/a
Field investigator:	L.Jo	**Easting:**	532890
Contractor:	Pro Core Drilling	**Northing:**	4814475

SUBSURFACE PROFILE					HYDROGEOLOGY		SAMPLE DETAILS		
Depth (ft)	Depth (m)	Graphic Log	Lithologic Description	Elevation (m AMSL) Depth (m BGS)	Hydro Stratigraphic Unit	Description	Sample Number	Sample Type	Recovery
			Ground Surface	346.30					
			CLAYEY SILT some organics, brown, moist	0.00	ATB1	Upper Maryhill Port Stanley Till and Equivalents			
				345.08					
			SILT some clay, light brown, soft to firm, moist	1.22					
				344.47					
			SAND fine grained, little silt, light brown, loose	1.83	AFB1 / AFB2	Upper / Middle Moraine Stratified Sediments and Equivalents			
			becoming wet at 2.3 m BGS						
			standing water encountered at 3.35 m BGS	342.95					
			End of Test Pit	3.35					

Notes:
m AMSL - metres above mean sea level
m BGS - metres below ground surface
m BTOC - metres below top of casing
n/a - not available

Drawn By/Checked By: OR/LV

Stantec

STANTEC BOREHOLE AND WELL 160330975 - DPS.GPJ EQUIS DATA TEMPLATE.GDT 1/18/11 MJFRASER

Test Pit: TP9-10

Project:	North Waterloo Subwatershed Study	**Drilling method:**	Rubber Tire Backhoe
Client:		**Date started/completed:**	11-Mar-2010
Location:	North Waterloo, ON	**Ground surface elevation:**	356.60 m AMSL
Number:	160340875	**Top of casing elevation:**	n/a
Field investigator:	L.Jo	**Easting:**	533098
Contractor:	Pro Core Drilling	**Northing:**	4814768

SUBSURFACE PROFILE				HYDROGEOLOGY		SAMPLE DETAILS		
Depth (ft)	Depth (m)	Graphic Log	Lithologic Description	Elevation (m AMSL) Depth (m BGS)	Hydro Stratigraphic Unit	Description	Sample Number	Sample Type	Recovery
			Ground Surface	356.60					
			TOPSOIL FROST fine grained with organics, dark brown, moist	0.00 356.30					
			SAND fine to medium grained, medium to light brown, loose, moist	0.30	AFB1 / AFB2	Upper / Middle Moraine Stratified Sediments and Equivalents			
2	1								
4									
6	2								
8									
10	3								
12									
	4		End of Test Pit	352.66 3.94					
14									

Notes:
m AMSL - metres above mean sea level
m BGS - metres below ground surface
m BTOC - metres below top of casing
n/a - not available

No standing water encountered within excavation

Drawn By/Checked By: OR/LV

Stantec

Sheet 1 of 1

STANTEC BOREHOLE AND WELL 160330875 - DPS.GPJ EQUIS DATA TEMPLATE.GDT 1/18/11 MJFRASER

Test Pit: TP10-10

Project:	North Waterloo Subwatershed Study	**Drilling method:**	Rubber Tire Backhoe
Client:		**Date started/completed:**	10-Mar-2010
Location:	North Waterloo, ON	**Ground surface elevation:**	355.20 m AMSL
Number:	160340875	**Top of casing elevation:**	n/a
Field investigator:	L.Jo	**Easting:**	533243
Contractor:	Pro Core Drilling	**Northing:**	4814589

SUBSURFACE PROFILE				HYDROGEOLOGY		SAMPLE DETAILS		
Depth (ft)	Depth (m)	Graphic Log	Lithologic Description	Elevation (m AMSL) Depth (m BGS)	Hydro Stratigraphic Unit	Description	Sample Number	Sample Type	Recovery
			Ground Surface	355.20					
			TOPSOIL fine to medium grained sand with organics, dark brown, moist	0.00 354.90					
			SAND fine to medium grained, some coarse sand, trace gravel, trace cobbles (rounded), trace boulders, light brown, loose, moist	0.30					
2	1		gravel seam approx 0.15 m thick at 0.9 m BGS						
4									
6	2				AFB1 / AFB2	Upper / Middle Moraine Stratified Sediments and Equivalents			
8									
10	3			351.33					
12	4		End of Test Pit	3.87					
14									

Notes:
m AMSL - metres above mean sea level
m BGS - metres below ground surface
m BTOC - metres below top of casing
n/a - not available

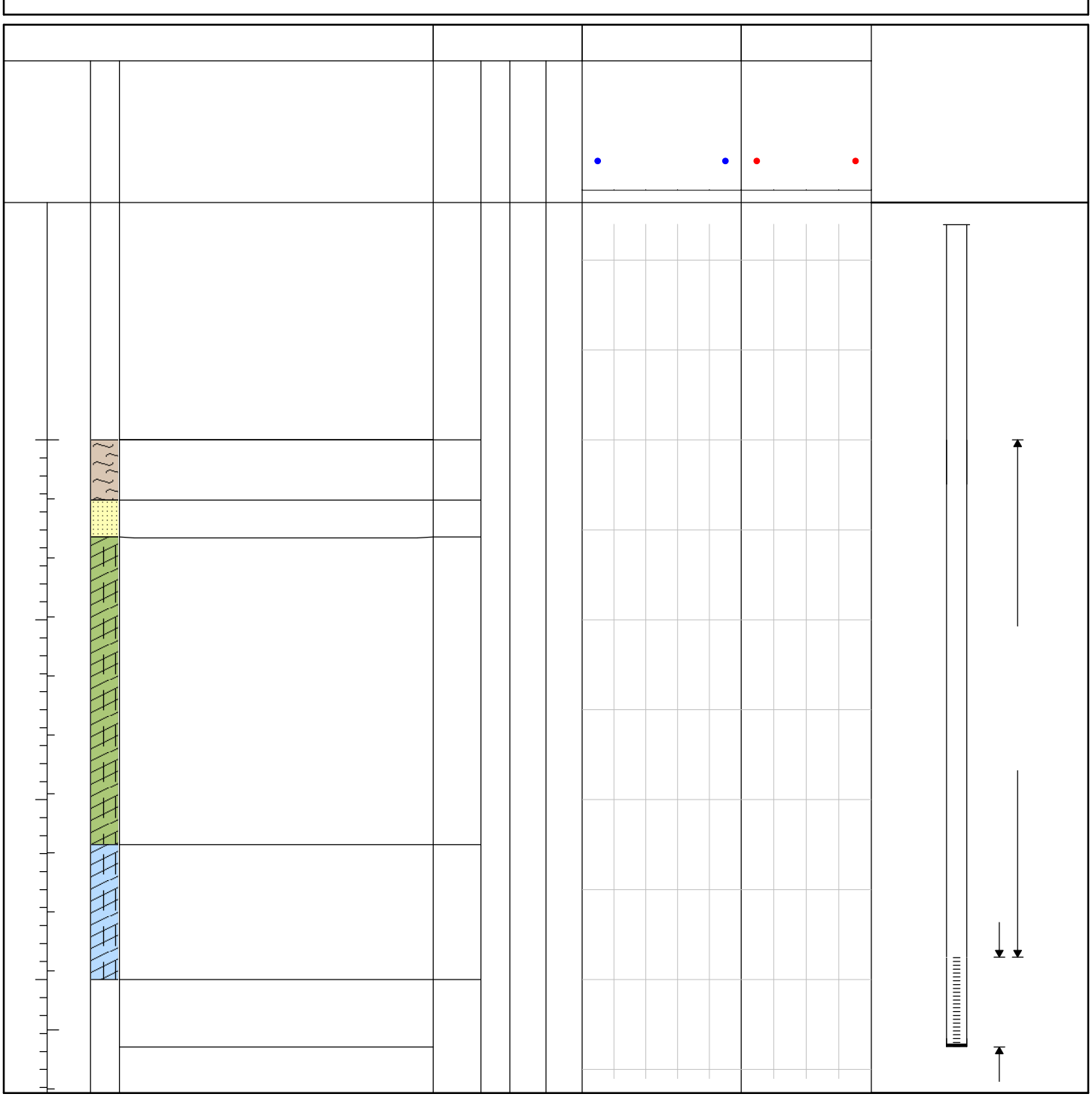
No standing water encountered within excavation

Drawn By/Checked By: OR/LV

Stantec

Sheet 1 of 1

STANTEC BOREHOLE AND WELL 160330875 - DPS.GPJ EQUIS DATA TEMPLATE.GDT 1/18/11 MJFRASER



MTE

Appendix H

Temporary Facility

Technical Memorandum

Project Name:	Northgate and Erbsville Kartway Subdivisions, Waterloo	**MTE File No.:**	39502-104
To:	Valentina Lazic – MTE	**Date:**	July 17, 2020
cc:	Garett Korber, Jeff Martens - MTE	**From:**	Eva Bako

RE: Northgate Subdivision (Subwatershed 310) – Temporary/Alternate Stormwater Management Facility West of Beaver Creek Road

The eastern portion of the Northgate lands, along with other development lands within subwatershed 310 may utilize a communal stormwater management facility located within the property of Mar-View Farms Limited on the east side of Beaver Creek Road. The Beaver Creek Meadows Communal Stormwater Management-Final Stormwater Management Report (BCM-CSWM-FSWMR) has been prepared in support of the communal stormwater management facility.

In the event the design or construction of the communal stormwater management facility is delayed, the owner of the Northgate lands may construct a temporary stormwater management facility in the southeast portion of the Northgate lands that are within subwatershed 310. It is intended that this temporary facility be developed for residential uses when the communal facility is constructed.

Alternatively, if the communal stormwater management facility is not approved, constructed or otherwise implemented, then an alternate (permanent) stormwater management facility could be constructed within the southeast portion of the Northgate lands.

This Technical Memorandum describes the design criteria and preliminary design details of the temporary/alternate stormwater management facility.

The eastern portion of the Northgate lands is within subcatchment 3102 and consists of approximately 8.66ha of land in the post-development condition. **Table 1** summarizes the design criteria to be used and **Table 2** describes the catchment parameters of 3102 in the post-development condition.

Table 1 - Stormwater Management Design Criteria

Quality Control	Enhanced Level as per MOE Guidelines
Quantity Control	None
Erosion Control	Extended Detention as per MOE guidelines

Table 2 - Post-Development Catchment Parameters

Catchment	3102
Description	Located west of Beaver Creek Road, developable areas of Northgate Subdivision
Area (ha)	8.66
IMP (%)	62.4
Roof Area to Infiltrate (ha)	2.49
Roof Area to Infiltrate (%)	28.8
Roof Runoff Capture	30 mm
Applied 450 mm Amended Topsoil	Yes

Temporary Pond Design

The temporary pond is located within Multiple Residential Block 9 - Stage 1, as shown on **Figure 1.1**. A storm connection from Street Two to the stormwater management pond is proposed. An easement will be required within Block 7 to provide maintenance for the storm sewer and maintenance access to the pond. An oil-grit separator has been proposed upstream of the wet pond, located close to the street for ease of access and maintenance, as an appropriate alternative to a forebay. A Stormceptor EF120 has been preliminarily sized at this time (sizing calculations are attached). The outfall structure and emergency overflow weir is located in the southeast corner. The outfall is proposed to discharge to the proposed Beaver Creek storm sewer and drains ultimately to Laurel Creek.

Maintenance Obligations

The subdivider will be responsible for on-going maintenance of the temporary stormwater management pond until such time as the communal stormwater management facility is operational to the satisfaction of the City of Waterloo. The subdivider will be responsible for decommissioning the facility at that time. These requirements can be incorporated as conditions of draft plan approval.

Alternate Pond Design

If a determination is made that the communal facility will not service the Northgate lands that are within subwatershed 310, an alternate (permanent) facility will be constructed within Blocks 7, 8, and 9 - Stage 1 as shown on **Figure 1.2**, and be assumed by the City. The characteristics of the alternate facility are presented in **Table 3** below. **Figure 1.2** illustrates the conceptual layout of the facility, and **Figure 1.3** illustrates the inlet and outlet cross-sections and outlet control details. Calculation sheets are attached for further reference

Quality Control

The facility has been designed as a wet pond with a permanent pool depth of 1.5m to achieve an Enhanced level of water quality control. Subcatchment 3102 has an area of approximately 8.66ha at 62.4% impervious. MOE design criteria requires 207m^3/ha of total storage for an enhanced wet pond, 40m^3/ha of which is extended detention, as a result, the required permanent pool and extended detention volumes for the temporary facility are therefore 1,448m^3 and 346m^3, respectively. The alternate pond design provides approximately 1,448m^3 of permanent pool volume. In order to provide 48 hour extended detention for 346m^3 of storage, an 58mm diameter orifice is required.

Quantity Control

Quantity control is not required for subcatchment 3102.

Table 3 – Alternate Facility Characteristics

General	Facility Characteristics
Stormwater Management Facility Type	Wet Pond
Required MOE Water Quality Protection	Enhanced
Total Contributing Area	8.66ha
Imperviousness	62.4%
Bottom Elevation (of main facility)	346.50m
Storage	
Unit Area Storage Volume Requirements as per SWMMP (MOE 2003)	207 m^3/ha
Required Total Volume	1,795m^3
Permanent Pool	
Required Permanent Pool Volume	1,448m^3
Permanent Pool Volume Provided	1,448m^3
Permanent Pool Elevation	348.00m
Extended Detention (MOE)	
Minimum Required Volume	346m^3
Approximate Drawdown Time (for MOE Table 3.2 requirement)	48hr
Extended Detention Elevation	348.12
Peak Release Rate for Extended Detention	0.0022m^3/s
Forebay	
Required Forebay Length	44m
Actual Forebay Length	50m
Permanent Pool Elevation	348.00m
Bottom Elevation	346.50m
Outlet Controls	
Orifice 1 Diameter (Extended Detention)	74mm
Orifice 1 Invert Elevation	348.60m
Orifice 2 Diameter	675mm
Orifice 2 Elevation	348.92m
Emergency Outlet Weir Length	6m
Emergency Outlet Weir Elevation	349.80m

Summary

The draft plan of subdivision reserves sufficient land, and the related blocks are configured such that both the temporary or permanent stormwater management facilities can be accommodated.

Northgate and Erbsville Kartway Subdivisions

Alternative Pond

Waterloo, Ontario

Project Number: 39502-104
Date: July 10, 2020
Design By: EPB
File: Q:\39502\104\Temp_Pond\39502-104 Alternative_Pond Design - epb.xlsx

FALLING HEAD DRAWDOWN CALCULATION

MOEE SWM Planning and Design Manual, 2003

$$t = \frac{0.66C_2h^{1.5} + 2C_3h^{0.5}}{2.75A_O}$$ Equation 4.11

where

t =	173069	*s*	
	48.1	*hr*	drawdown time
A_p =	3022.52	m^2	surface area of the pond
C =	0.63		discharge coefficient
d =	74	*mm*	diameter of the orifice
A_O =	0.0043	m^2	cross-sectional area of the orifice
g =	9.81	m/s^2	gravitational acceleration constant
h_1 =	348.120	*m*	starting water elevation above the orifice
h_2 =	348.000	*m*	ending water elevation above the orifice
h =	0.12	*m*	maximum water elevation above the orifice
C_2 =	846		slope coefficient from the area-depth linear regression
C_3 =	2921		intercept from the area-depth linear regression

	ELEVATION *m*	STAGE *m*	AREA m^2	COMMENTS
1	348.000	0	2921.0	
2	348.100	0.1	3005.6	
3	348.120	0.12	3022.5	MOE Extended Detention
4	348.200	0.2	3090.2	
5	348.300	0.3	3174.8	
6	348.400	0.4	3259.4	

DRAWDOWN TIME: 173069 *s*
48.1 *hr*

Regression Output:

m_1 =	846.00	slope coefficient from the area-depth linear regression
b =	2921.00	intercept from the area-depth linear regression
se_1 =	0.00	standard error for coefficient m_1
se_b =	0.00	standard error for constant b
R^2 =	1.0000	coefficient of determination
se_y =	0.00	standard error of the *y* estimate
F =	8.4835E+30	F statistic
df =	4	degrees of freedom
ss_{reg} =	75389	regression sum of squares
ss_{resid} =	0	residual sum of squares

PROJECT NAME
STORMWATER MANAGEMENT
City, Ontario

Project Number: #####-###
Date: July 13, 2020
Design By: XXX
File: Q:\39502\104\Temp_Pond\39502-104 Alternative_Pond Design - epb.xlsx

FOREBAY DESIGN CALCULATIONS
MOE SWM Planning and Design Manual, 2003

Forebay Design Flows

Flow into forebay during the 1:5-year return period event	0.47	m^3/s
Flow into forebay during the 25 mm - 4 hour design storm event	0.17	m^3/s
Peak flow from main pond outlet for the 25mm design storm (from MIDUSS)	0.174	m^3/s

Forebay Characteristics

b =	8.8	*m*	bottom width
y =	1.5	*m*	depth
z =	3	:1	side slope
w =	13.3	*m*	average width
R =	1.09	*m*	hydraulic radius
A =	20.0	m^2	cross-sectional area

1. Length Calculation Based on Settling Velocity

L = forebay flow length *(m)*
r = length-to-width ratio
Q_p = peak flow rate through forebay *(m^3/s)*
v_s = settling velocity *(m/s)*

$$L = \sqrt{\frac{rQ_p}{v_s}}$$ Equation 4.5: Forebay Settling Length

a) Required Settling Length (assuming Q_p = forebay through-flow & v_s = 0.0055 m/s)

Q_p =	0.17	m^3/s	peak flow rate through forebay
v_s =	0.0055	*m/s*	settling velocity
r =	0.19		length-to-width ratio
L =	2.4	*m*	required settling length
L =	*2.5*	*m*	*trial length*

b) Required Settling Length (assuming Q_p = pond discharge & v_s = 0.0003 m/s)

Q_p =	0.174	m^3/s	peak flow rate through forebay
v_s =	0.0003	*m/s*	settling velocity
r =	3.31		length-to-width ratio
L =	43.8	*m*	required settling length
L =	*44*	*m*	*trial length*

Table 1: Average settling velocities

	Mass Removed	Particle Size Range	Average Settling Velocity
	%	*μm*	*m/s*
	80 - 100	x ≤ 20	0.00000254
Enhanced:	70 - 80	20 < x ≤ 40	0.00001300
Normal:	60 - 70	40 < x ≤ 60	0.00002540
Basic:	40 - 60	60 < x ≤ 130	0.00012700
Medium Sand:	20 - 40	130 < x ≤ 400	0.00059267
Gross Grit:	0 - 20	400 < x ≤ 4000	0.00550333

2. Length Calculation Based on Flow Dispersion Length

Q = 0.47 m^3/s inlet flow rate
d = 1.5 *m* depth of permanent pool in forebay
V_f = 0.50 *m/s* desired velocity in forebay (typical value ≤ 0.50 *m/s*)
L = 5.0 m required length of dispersion

$$L_D = \frac{8Q}{dV_f}$$ Equation 4.6: Dispersion Length

3. Required Forebay Length

L = 43.8 *m* design length
r = 3.29 design length-to-width ratio (typical minimum of 2.0)

4. Scour Velocity

v_s = 0.15 *m/s* scour velocity (typical value = 0.15 *m/s*)
v = 0.02 *m/s* **actual velocity** OK The actual velocity through the forebay is less than the scour velocity.

5. Weir Flow From Forebay

L = 7 *m* length of crest of weir
α = 1.65 coefficient
H = 0.5 *m* head
Q = 4.08 m^3/s **discharge** OK The weir flow from the forebay exceeds the flow entering the forebay

$$Q = \alpha L H^{1.5}$$ Equation 4.4: Weir Flow

6. Estimated Cleanout Frequencies

a) Forebay

Forebay volume	1813	m^3
Estimated TSS removal efficiency	50%	
Impervious level	62%	
Estimated annual sediment loading	2.3	m^3/ha
Contributing area	8.66	*ha*
Annual sediment volume	10	m^3/yr
Cleanout frequency for 33% volume reduction	**58.9**	***years***

Table 2: Annual sediment loading

Impervious Level	Annual Loading
%	m^3/ha
35%	0.6
55%	1.9
70%	2.8
85%	3.8

b) Stormwater Management Pond

Wetpond volume (excluding forebay)	6628	m^3
Estimated TSS removal efficiency	30%	
Impervious level	62%	
Estimated annual sediment loading	2.3	m^3/ha
Contributing area	8.66	*ha*
Annual sediment volume	6	m^3/yr
Cleanout frequency for 33% volume reduction	**359.2**	***years***

Northgate and Erbsville Kartway Subdivisions
Alternative Pond
Waterloo, Ontario

Project Number: 39502-104
Date: July 10, 2020
Design By: EPB
File: Q:\39502\104\Temp_Pond\39502-104 Alternative_Pond Design - epb.xlsx

Orifice Calculations

$Q_o=C_d*A_o*(2*g*H_o)^{0.5}$

	Orifice 1 ext. detention	Orifice 2	Orifice 3
C_d	0.63	0.63	0.63
Invert (m)	348.000	348.92	9999.000
Width (m)	0.00	0.00	0.00
Diameter/Height (m)	0.058	0.675	0.000
Type (H/V)	V	H	V

Cd	Description
0.63	Orifice Plate
0.82	Eccentric Reducer

Weir Calculations

$Q_w = 2/3*C_w*(2g)^{1/2}*L*H_w^{3/2} + 8/15*C_w*(2g)^{1/2}*\tan\theta*H_w^{5/2}$

Level Control		Emergency Overflow	
Cw	0.50	Cw	0.50
Invert (m)	9999.000	Invert (m)	349.80
Length (m)	1	Length (m)	3
Side Slope (H:V)	0	Slope (H:V)	3
Side Slope (rad)	0.000	Slope (rad)	1.249

STAGE-DISCHARGE RELATIONSHIP

			Orifice 1			Orifice 2			Orifice 3			Level Control Weir		Emergency Overflow Weir			Extended Detention	Erosion Control
	Stage	Active Volume	Area	H_o	Flow	Area	H_o	Flow	Area	H_o	Flow	H	Flow	H	Flow	Total Flow	Average Discharge	Increment Volume	Increment Dewatering Time	Cumulative Dewatering Time	Cumulative Dewatering Time
	m	m^3	m^2	m	m^3/s	m^2	m	m^3/s	m^2	m	m^3/s	m	m^3/s	m	m^3/s	m^3/s	m^3/s	m^3	hours	hours	hours
	348.00	0	0.000	0.00	0.0000	0.36	0.00	0.0000	0.000	0.00	0.0000	0.00	0.0000			0.0000	0.0010	296	83.80	117.56	
	348.10	296	0.003	0.07	0.0020	0.36	0.00	0.0000	0.000	0.00	0.0000	0.00	0.0000			0.0020	0.0021	60	8.00	33.76	
Ext.Det.	348.12	357	0.003	0.09	0.0022	0.36	0.00	0.0000	0.000	0.00	0.0000	0.00	0.0000			0.0022	0.0026	245	25.76	25.76	
	348.20	601	0.003	0.17	0.0030	0.36	0.00	0.0000	0.000	0.00	0.0000	0.00	0.0000			0.0030	0.0034	313			
	348.30	914	0.003	0.27	0.0038	0.36	0.00	0.0000	0.000	0.00	0.0000	0.00	0.0000			0.0038	0.0042	322			
	348.40	1236	0.003	0.37	0.0045	0.36	0.00	0.0000	0.000	0.00	0.0000	0.00	0.0000			0.0045	0.0048	330			
	348.50	1566	0.003	0.47	0.0051	0.36	0.00	0.0000	0.000	0.00	0.0000	0.00	0.0000			0.0051	0.0053	339			
	348.60	1905	0.003	0.57	0.0056	0.36	0.00	0.0000	0.000	0.00	0.0000	0.00	0.0000			0.0056	0.0058	347			
	348.70	2252	0.003	0.67	0.0060	0.36	0.00	0.0000	0.000	0.00	0.0000	0.00	0.0000			0.0060					
	348.80	2608	0.003	0.77	0.0065	0.36	0.00	0.0000	0.000	0.00	0.0000	0.00	0.0000			0.0065					
	348.90	2972	0.003	0.87	0.0069	0.36	0.00	0.0000	0.000	0.00	0.0000	0.00	0.0000			0.0069					
	349.00	3344	0.003	0.97	0.0073	0.36	0.08	0.2824	0.000	0.00	0.0000	0.00	0.0000			0.2897					
	349.10	3725	0.003	1.07	0.0076	0.36	0.18	0.4237	0.000	0.00	0.0000	0.00	0.0000			0.4313					
	349.20	4114	0.003	1.17	0.0080	0.36	0.28	0.5284	0.000	0.00	0.0000	0.00	0.0000			0.5364					
	349.30	4512	0.003	1.27	0.0083	0.36	0.38	0.6156	0.000	0.00	0.0000	0.00	0.0000			0.6239					
	349.40	4918	0.003	1.37	0.0086	0.36	0.48	0.6918	0.000	0.00	0.0000	0.00	0.0000			0.7005					
	349.50	5333	0.003	1.47	0.0089	0.36	0.58	0.7605	0.000	0.00	0.0000	0.00	0.0000	0.00	0.0000	0.7694					
	349.60	5756	0.003	1.57	0.0092	0.36	0.68	0.8235	0.000	0.00	0.0000	0.00	0.0000	0.00	0.0000	0.8327					
	349.70	6188	0.003	1.67	0.0095	0.36	0.78	0.8819	0.000	0.00	0.0000	0.00	0.0000	0.00	0.0000	0.8915					
100yr	349.80	6628	0.003	1.77	0.0098	0.36	0.88	0.9368	0.000	0.00	0.0000	0.00	0.0000	0.00	0.0000	0.9466					
	349.90	7077	0.003	1.87	0.0101	0.36	0.98	0.9886	0.000	0.00	0.0000	0.00	0.0000	0.10	0.1513	1.1499					
	350.00	7534	0.000	1.97	0.0000	0.36	1.08	1.0378	0.000	0.00	0.0000	0.00	0.0000	0.20	0.4596	1.4973					
	350.10	8000	0.000	2.07	0.0000	0.36	1.18	1.0847	0.000	0.00	0.0000	0.00	0.0000	0.30	0.9025	1.9873					

Northgate and Erbsville Kartway Subdivisions

Temporary Pond

Waterloo, Ontario

Project Number:	39502-104
Date:	May 29, 2020
Design By:	EPB
File:	Q:\39502\104\Temp_Pond\39502-104 TempPond Design - epb.xlsx

FALLING HEAD DRAWDOWN CALCULATION

MOEE SWM Planning and Design Manual, 2003

$$t = \frac{0.66C_2h^{1.5} + 2C_3h^{0.5}}{2.75A_O}$$ Equation 4.11

where

t =	177235	*s*	
	49.2	*hr*	drawdown time
A_p =	1260.71	m^2	surface area of the pond
C =	0.63		discharge coefficient
d =	58	*mm*	diameter of the orifice
A_O =	0.00264	m^2	cross-sectional area of the orifice
g =	9.81	m/s^2	gravitational acceleration constant
h_1 =	348.885	*m*	starting water elevation above the orifice
h_2 =	348.600	*m*	ending water elevation above the orifice
h =	0.285	*m*	maximum water elevation above the orifice
C_2 =	286.111		slope coefficient from the area-depth linear regression
C_3 =	1179.17		intercept from the area-depth linear regression

	ELEVATION *m*	STAGE *m*	AREA m^2	COMMENTS
1	348.600	0	1179.2	
2	348.700	0.1	1207.8	
3	348.800	0.2	1236.4	
4	348.885	0.285	1260.7	MOE Extended Detention
5	348.900	0.3	1265.0	
6	349.000	0.4	1293.6	

DRAWDOWN TIME: 177235 *s*
49.2 *hr*

Regression Output:

m_1 =	286.11	slope coefficient from the area-depth linear regression
b =	1179.17	intercept from the area-depth linear regression
se_1 =	0.00	standard error for coefficient m_1
se_b =	0.00	standard error for constant b
R^2 =	1.0000	coefficient of determination
se_y =	0.00	standard error of the *y* estimate
F =	############	F statistic
df =	4	degrees of freedom
ss_{reg} =	8679	regression sum of squares
ss_{resid} =	0	residual sum of squares

Northgate and Erbsville Kartway Subdivisions

Temporary Pond

Waterloo, Ontario

Project Number:	39502-104
Date:	May 29, 2020
Design By:	EPB
File:	Q:\39502\104\Temp_Pond\39502-104 TempPond Design - epb.xlsx

Step 1: Choose Level of Water Quality Control

Enhanced 80% long-term S.S. removal

Step 2: Choose Type of Facility

Wet Pond

Step 3: Define Catchment area and Imperviousness

Catchment Area (ha)	Imperviousness (%)
8.66	62.4

Interpolated Storage Volume Requirement (m^3/ha)

207.3

Permanent Pool Required (m^3)

1448.5

Extended Detention Volume Required (m^3)

346.4

Table 3.2 Water Quality Storage Requirements based on Receiving Waters (from MOE Stormwater Management Planning and Design Manual, March 2003)

Protection Level	SWMP Type	Storage Volume (m^3/ha) for Impervious Level			
		35	55	70	85
Enhanced 80% long-term S.S. removal	*Wetlands*	80	105	120	140
	Hybrid Wet Pond/Wetland	110	150	175	195
	Wet Pond	140	190	225	250
Normal 70% long-term S.S. Removal	*Wetlands*	60	70	80	90
	Hybrid Wet Pond/Wetland	75	90	105	120
	Wet Pond	90	110	130	150
Basic 60% long-term S.S. Removal	*Wetlands*	60	60	60	60
	Hybrid Wet Pond/Wetland	60	70	75	80
	Wet Pond	60	75	85	95
	Dry Pond (Continuous Flow)	90	150	200	240

Brief Stormceptor Sizing Report - Northgate

Project Information & Location			
Project Name	Northgate	**Project Number**	21798
City	Waterloo	**State/ Province**	Ontario
Country	Canada	**Date**	3/27/2020
Designer Information		**EOR Information (optional)**	
Name	Adam Slawich	**Name**	
Company	MTE Consultants Inc.	**Company**	
Phone #	519-743-6500	**Phone #**	
Email	aslawich@mte85.com	**Email**	

Stormwater Treatment Recommendation

The recommended Stormceptor Model(s) which achieve or exceed the user defined water quality objective for each site within the project are listed in the below Sizing Summary table.

Site Name	
Target TSS Removal (%)	60
TSS Removal (%) Provided	61
Recommended Stormceptor Model	STC 4000

The recommended Stormceptor Model achieves the water quality objectives based on the selected inputs, historical rainfall records and selected particle size distribution.

Stormceptor Sizing Summary	
Stormceptor Model	**% TSS Removal Provided**
STC 300	30
STC 750	44
STC 1000	45
STC 1500	46
STC 2000	52
STC 3000	54
STC 4000	61
STC 5000	62
STC 6000	66
STC 9000	72
STC 10000	72
STC 14000	77
StormceptorMAX	Custom

Sizing Details

Drainage Area	
Total Area (ha)	8.66
Imperviousness %	63.00

Rainfall	
Station Name	WATERLOO WELLINGTON A
State/Province	Ontario
Station ID #	9387
Years of Records	34
Latitude	43°27'N
Longitude	80°23'W

Water Quality Objective	
TSS Removal (%)	60.0
Runoff Volume Capture (%)	
Oil Spill Capture Volume (L)	
Peak Conveyed Flow Rate (L/s)	
Water Quality Flow Rate (L/s)	

Up Stream Storage	
Storage (ha-m)	Discharge (cms)
0.000	0.000

Up Stream Flow Diversion	
Max. Flow to Stormceptor (cms)	

Particle Size Distribution (PSD)
The selected PSD defines TSS removal

Fine Distribution		
Particle Diameter (microns)	Distribution %	Specific Gravity
20.0	20.0	1.30
60.0	20.0	1.80
150.0	20.0	2.20
400.0	20.0	2.65
2000.0	20.0	2.65

Notes

• Stormceptor performance estimates are based on simulations using PCSWMM for Stormceptor, which uses the EPA Rainfall and Runoff modules.
• Design estimates listed are only representative of specific project requirements based on total suspended solids (TSS) removal defined by the selected PSD, and based on stable site conditions only, after construction is completed.
• For submerged applications or sites specific to spill control, please contact your local Stormceptor representative for further design assistance.

For Stormceptor Specifications and Drawings Please Visit:
http://www.imbriumsystems.com/technical-specifications

BEAVER CREEK ROAD

PROPOSED BEAVER CREEK STORM SEWER

PROPOSED BEAVER CREEK STORM SEWER

PROPOSED BEAVER CREEK STORM SEWER

Inv.=348.96

Ex. EP

Ex. CL Road

Ex. EP

Ex. HP

Ex. Bell Ped

Ex. Sign

Ex. Sign

Ex. Bell Ped

Ex. HP w/Tran.

BH14
Elev.=350.26

CULVERT

675mmØ STM.

348.50

348.0

347.50

347.0

349.50

350.0

349.0

350.0

350.50

351.0

LEGEND

- SITE BOUNDARY
- 347.5 — EXISTING CONTOURS
- x(346.00) — PROPOSED SPOT ELEVATIONS
- PERMANENT POOL ELEV=348.60
- MAJOR OVERLAND FLOW ROUTE
- MAINTENANCE ACCESS ROAD
- 333 — PROPOSED CONTOURS
- GABION MAT

TOP 350.70

4m ACCESS ROAD

3:1

3:1

3:1

3:1

5:1

TEMPORARY SWMF
PERM. POOL=348.60

(347.10)

(347.10)

(347.10)

CSP
RISER 5

6m WIDE
OVERFLOW
WEIR

HW4

MH 3

675mmØ STM.

MH 2

4m ACCESS
ROAD

675mmØ STM.

OGS 1

675mmØ STM.

MH205

STREET TWO

351.5

351.5

350.5

350.0

353.0

352.5

352.0

350.0

350.5

351.0

347.5

349.5

347.5

350.0

FIGURE 1.1

Date: JUL.06/20
Scale: 1:500

NORTHGATE & ERBSVILLE KARTWAY SUBDIVISIONS

TEMPORARY SWMF DESIGN

MTE
Engineers, Scientists, Surveyors

Project No.: 39502-104

July 16, 2020 — 4:53 p.m. — Plotted By: AHenderson

P:\P\39502\104\39502-104-F33-TEMP POND.dwg

BEAVER CREEK ROAD

PROPOSED BEAVER CREEK STORM SEWER

Ex. Bell Pedestal

Ex. Sign

Ex. Bell Cabinet

Ex. DW

Inv.=348.96

Ex. EP

Ex. CL Road

BH14
Elev.=350.26

Ex. HP

Ex. HP w/Tran.

MH X
INV 345.8

1950mmØ STM.

CULVERT

675mmØ STM.

4m ACCESS ROAD

(350.10)

5:1

NWL 348.0

(346.50)

SWM FACILITY BLOCK 7,8,9
PERM. POOL=348.00

FOREBAY WEIR

3:1

FOREBAY

HW3

MH2

MH1

CSP
RISER 4

4%

6m WIDE
OVERFLOW
WEIR

TOP 350.10

4m ACCESS ROAD

4:1

ACCESS
FROM
STREET

MH205

675mmØ STM.

STREET TWO

A

B

LEGEND

- SITE BOUNDARY
- 347.5 — EXISTING CONTOURS
- x(346.00) — PROPOSED SPOT ELEVATIONS
- PERMANENT POOL ELEV=348.00
- MAJOR OVERLAND FLOW ROUTE
- MAINTENANCE ACCESS ROAD
- 333 — PROPOSED CONTOURS
- GABION MAT

FIGURE 1.2

Date: JUL.10/20
Scale: 1:500

NORTHGATE & ERBSVILLE KARTWAY SUBDIVISIONS

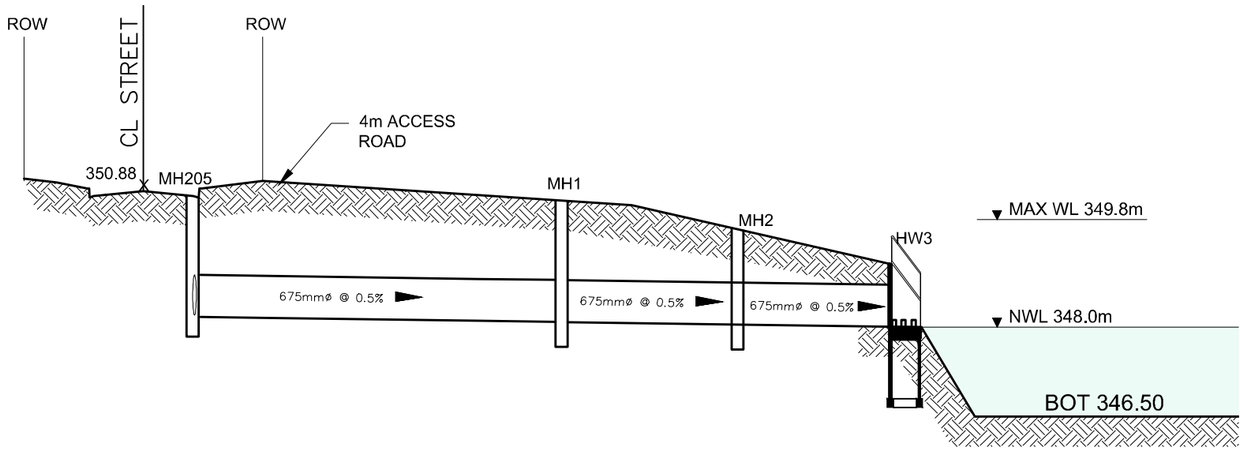
PERMANENT SWMF DESIGN

MTE
Engineers, Scientists, Surveyors

Project No.: 39502-104

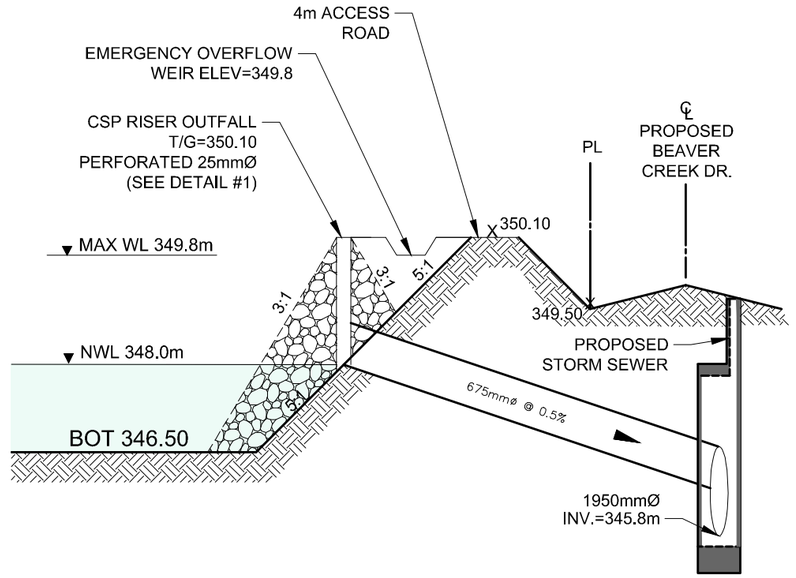
July 16, 2020 — 4:32 p.m. — Plotted By: AHenderson

P:\P\39502\104\39502-104-F34-PERMANENT POND.dwg



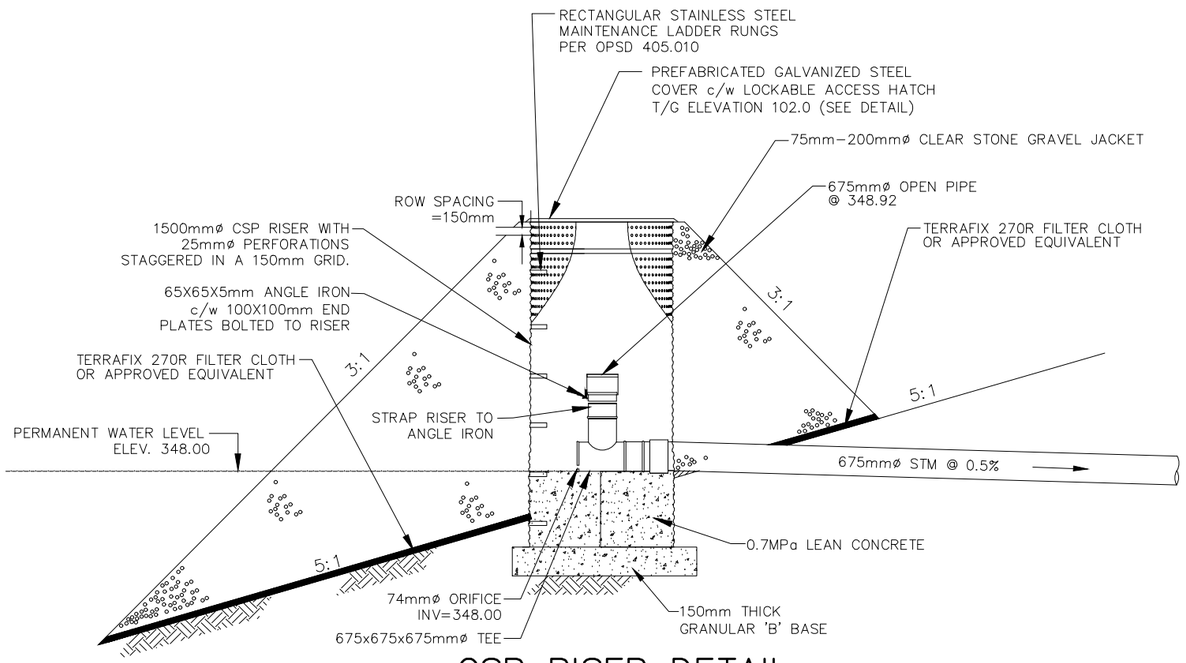
SWM FACILITY SECTION 'A-A'

SCALE H=1:500
V=1:100



SWM FACILITY SECTION 'B-B'

SCALE H=1:500
V=1:100



CSP RISER DETAIL

N.T.S.

DETAIL #1

NOTE:
THIS FIGURE TO BE READ IN CONJUNCTION WITH FIGURE 1.2

FIGURE 1.3
Date: JUL.06/20
Scale: AS NOTED

NORTHGATE & ERBSVILLE KARTWAY SUBDIVISIONS

PERMANENT SWMF DESIGN SECTIONS & DETAILS

MTE
Engineers, Scientists, Surveyors

Project No.: 39502-104

Appendix I

Chloride Impact Assessment

Technical Memorandum

Project Name:	Northgate & Erbsville Kartway Subdivisions, Waterloo	**MTE File No.:**	39502-104
To:		**Date:**	July 17, 2020
cc:	Garett Korber, Jeff Martens - MTE	**From:**	Kevin Kocken Valentina Lazic, P.Eng.

RE: Chloride Impact Assessment

1.0 Introduction

MTE Consultants Inc. (MTE) was retained by 1017081 Ontario Limited and Gabriella Elizabeth Groff (Northgate) and 1455136 Ontario Inc. (Erbsville Kartway), to prepare a Chloride Impact Assessment in support of Plans of Subdivision, Plan of Condominium (Vacant Land Condominium), and Zoning By-law amendment applications. The Northgate and Erbsville Kartway properties are collectively referred to herein as the 'Subject Lands'.

The Subject Lands are comprised of 2 parcels; lands owned by Northgate and lands owned by Erbsville Kartway. The Northgate lands are approximately 49.29ha and the Erbsville Kartway lands are approximately 6.43ha, for a total area of 55.72ha of land within the City of Waterloo. Note that the Northgate property (49.29ha) consists of 34.08ha of land located within the proposed subdivision and 15.21ha of open space lands along Beaver Creek, identified as "additional lands" that are outside the boundaries of the subdivision.

In the Region of Waterloo, the assessment of road salt and its impact on groundwater quality must be made for all new developments located within the capture zone of municipal wells. This memorandum presents the preliminary findings and work completed to date by MTE related to the chloride impact assessment for the Northgate & Erbsville Kartway Subdivision. The assessment requires the calculation of the salt loading from de-icing operation to the groundwater so as to ensure that groundwater chloride concentrations will remain within the Reasonable Use Guidelines established by the Ministry of the Environment, Conservation and Parks (MECP -formerly known as the MOE). The purpose of this study is to assess impacts to the groundwater system, and if necessary, mitigate the impacts by proposing enhanced development and construction techniques.

1.1 Reasonable Use Concept

The assessment of road salt and its implications on groundwater can be made by estimating the total chloride levels under post-development conditions due to road salting activities and comparing the estimated value with specific target criteria for chloride concentrations. Although the Region of Waterloo has yet to establish groundwater quality criterion for chlorides, the Ontario Drinking Water Standard (ODWS) for chloride of 250mg/L, generally defines the upper limit of acceptability. The MECP's Reasonable Use Concept (RUC) has been adopted for various studies conducted in the Region to assess the impact of road salt on groundwater quality per the Region's document entitled *Draft Protocol for Evaluating Road Salt Impacts to Groundwater Using the Reasonable Use Concept*, dated January, 2008.

The RUC establishes limits for the allowable concentrations of contaminants based on background groundwater quality and the reasonable use of groundwater on an adjacent property. The limits are set such that there would not be any significant effect on the use of the groundwater on the adjacent property. Since the reasonable use of groundwater is commonly drinking water, the Reasonable Use limits are typically set on this basis. As a result, the quality of groundwater may not be degraded by an amount in excess of:

- 50% of the difference between background and the Ontario Drinking Water Objectives for non-health related parameters (e.g. chloride), or
- 25% of the difference between background and the Ontario Drinking Water Objectives for health related parameters (e.g. lead).

The RUC has been incorporated in Regulation 232/98. The reasonable use requirements have been included directly as performance specifications for the site specific design approach. In cases where the reasonable use of groundwater is other than drinking water, for example where background groundwater quality is poor, the RUC guideline allows alternative concentration limits to be set. These alternative limits would be determined on a case-by-case basis.

For development-scale chloride impact assessments in the Region of Waterloo the background chloride level is considered to be the concentration in the groundwater prior to anthropogenic impacts, i.e. 2.5mg/L (Draft Protocol for Evaluating Road Salt Impacts to Groundwater Using the Reasonable Use Concept. ROW, DOCs #409317, Version 1.0 January, 2008). Thus, given the Ontario Drinking Water Standard for chloride is 250mg/L and the background anthropogenic chloride concentration in the groundwater is approximately 2.5mg/L, the maximum RUC concentration of chloride in groundwater should not exceed **126mg/L**.

2.0 Chloride Impact – Mass Balance Analysis

To quantify the potential impacts to the existing groundwater quality as a result of future winter salt application related to the development of the proposed Northgate & Erbsville Kartway subdivisions, a conservative mass balance analysis was completed. Both municipal roads and private parking areas within mixed use, and multi-residential have been included in this analysis.

This mass balance approach, although basic, is considered a conservative evaluation since it does not include any dilution from groundwater already present in the system, any flow through dilution effects, or any off-site effects. All of these effects would result in additional dilution of the chloride concentrations. It should be noted that the salt application rates used in this analysis also do not include the expected 25% reduction in average salt application rates and the Best Management Practices recommended in previous studies for the Region.

Refer to **Figure MS5.1** (attached) for the proposed road layout and classification used in the analysis.

2.1 Road Lengths, Parking Areas, Salt Application Rates and Infiltration

2.1.1 Road Lengths

The road lengths used in the analysis are based on the current Draft Plan of Subdivision for the Northgate and Erbsville Kartway Subdivision (MHBC – July 14, 2020). There are no existing or proposed Regional or Collector roads within the development area.

2.1.2 Parking Areas

Although not explicitly shown in the Draft Plans of Subdivision, the area of private parking (for all hard surfaces; such as asphalt surfaces and concrete sidewalks) within the multi-residential/mixed-use blocks have been included for the purposes of calculating total annual salt application. Private parking areas are included within Stage 1 – Block 9 and 10; Stage 3 – Blocks 1 to 3; Stage 4 – Blocks 20 and 21. For the purposes of calculating total annual salt weight (in tonnes), the area of the private parking has been based on a percentage of the overall block area. For the above mentioned blocks, 50% has been used for this analysis. The proposed parking areas used in the analysis are based on the current Draft Plans of Subdivision for the Northgate and Erbsville Kartway Subdivision (MHBC – July 14, 2020).

2.1.3 Salt Application Rates

The annual salt application rates used for this analysis were based on a 2003 Region of Waterloo Study entitled: *Road Salt Management and Chloride Reduction Study Phase 2: Evaluation of Chloride Reduction Options*, Stantec Consulting Ltd., 2003. The study detailed local application rates observed over a 14-year period and found the following results:

- Primary roads 44 tonnes / 2 lane km
- Secondary roads 22 tonnes / 2 lane km
- Local roads 1 tonne / 2 lane km

The annual salt application rate for private parking areas was suggested by Regional staff based on recent studies/analysis completed. This suggested application rate is 15 tonnes / ha.

2.1.4 Infiltration Volume

A detailed water balance analysis has been completed for the development and is included in Section 5.6 of the *Preliminary Stormwater Management Report*. This analysis was undertaken to ensure pre-development infiltration rates are maintained or enhanced. The annual infiltration rate of the development area is calculated to be approximately 268.3mm/yr, which equates to an annual infiltration volume of 132,084m^3/yr. For more details of the water balance analysis, refer to Appendix D of the SWM report.

2.2 Mass Balance Analysis

Based on the assumptions above, a mass balance analysis was completed for the Northgate & Erbsville Kartway Subdivision. For a complete breakdown of detailed calculations refer to the attached spreadsheet found in **Appendix 1**.

3.0 Mitigative Measures

The estimated post-development groundwater chloride concentration of **29mg/L** is below the corresponding RUC limits of **126mg/L**. As a best management practice, Salt Management Plans for all blocks within the development lands subject to site plan approval or plan of condominium approval should be completed to address potential groundwater quality impacts relate to winter de-icing operations.

3.1 Salt Management Plans

For the multiple residential/mixed use blocks within the Northgate lands, it is likely that snow removal and ice control will be undertaken by a private winter maintenance service provider. As such, it is recommended that a site specific Salt Management Plan be implemented as part of the future development of these sites. The purpose of the Salt Management Plan will be to reduce the impact of all winter maintenance activities involving salting practices on the surface water and groundwater resources. The Salt Management Plan should outline operational practices and strategies for three main areas of concern: general salt use, salt storage, and snow storage/disposal. With respect to snow storage, it is recommended that the snow be stored on impervious surfaces that are connected to a storm sewer system, or if impervious surfaces are not available that the snow is stored in open spaces that are clay lined to prevent chloride impacted water from infiltrating into the groundwater system.

4.0 Conclusions and Recommendations

Based on the foregoing analyses, it is concluded that:

1. Based on a simple conservative mass balance analysis, the expected average post-development groundwater chloride concentration of 29mg/L is below the Ontario Drinking Water Standard of 250mg/L and the Reasonable Use Concept limit of 126mg/L.

2. The mass balance analysis performed in this study is considered to be a conservative evaluation since it does not include any dilution from groundwater already present in the system, any flow through dilution effects, or any off-site effects, all of which would result in additional dilution of the chloride infiltration.

It is recommended that:

1. Salt Management Plans be prepared for all blocks subject to site plan approval and/or a plan of condominium approval.

Appendix 1

Chloride Impact Assessment Calculations and Figure

MASS BALANCE (CHLORIDE IMPACT) ANALYSIS

Northgate & Erbsville Kartway Subdivision
Waterloo, ON

Project Number: 39502-104
Date: July 17, 2020
Design By: KXK/XSP
File: Q:\39502\104\Chloride Impact Analysis\39502-104 Chloride Impact Mass Balance - July 17 2020.xlsx

Legend

User inputs value
Excel calculates
Use 'Goal Seek' to solve for the required infiltration volume (i.e. dilution)

Reasonable Use Concept Calculations

$$C_m = C_b + x(C_r - C_b)$$

Maximum Allowable Concentration beneath the adjacent property (i.e. Reasonable Use Criteria)

Where:

C_b =	2.5	(mg/L)	Natural Uncontaminated Background Cl- level[1]
C_r =	250	(mg/L)	Ontario Drinking Water Standard (ODWS) Cl^-
x =	0.5		Constant for Non-Health Related Parameter
$\therefore C_m$ =	**126**	**(mg/L)**	

	Calculation Factors	Length of Road[2] (km)	Private Parking Areas (ha)	Annual Salt Application[3] (tonne/2-lane km)-Roads (tonne/ha)-Parking Areas	Total Annual Salt Weight tonnes	Infiltration Volume m^3	Chloride Concentration mg/L	RUC Check
Salt Volume Calculations	Primary Road	0.00		44	0			
	Secondary Road	0.00		22	0.00			
	Local Road	3.22		1	3.22			
	Private Parking Areas		3.63	15	54.44			
	Total weight of salt applied				57.66			
	Roads - Salt infiltration rate into subsurface[4]				28%			
	Parking Areas - Salt infiltration rate into subsurface[6]				10%			
	Annual volume of salt infiltrated to subsurface				6.35			
RUC Calculations	Total (passive & active) surface water infiltration					132,084		
	Additional Cl^- input into subsurface from proposed development based on total surface water infiltration[5]						**29.1**	**OKAY**

NOTES:

(1) The natural uncontaminated background groundwater chloride level was assumed to be 2.5 mg/L, which is typical for ambient groundwater level in southwestern Ontario.

(2) Primary, Secondary, and Local road lengths are based on the Draft Plan by MHBC, dated July 14, 2020.

(3) The salt application rates used in the analysis for Primary, Secondary, and Local Roads are based on values presented in the Region of Waterloo Report: "Road Salt Management and Chloride Reduction Study Phase 2: Evaluation of Chloride Reduction Options", Stantec Consulting Ltd., 2003.

(4) The value of 28% of salt that will infiltrate into the subsurface is referenced from - "Evaluation of Road Salt Impacts and Management Strategies for Groundwater Supplies Using GIS and Mass Balance Modeling Techniques", C.T. Johnson, M. Bester, D.L. Rudolph, J.W. Robinson, E.W. Hodgins, 2004.

(5) On a simple dilution basis, this is the amount of additional chloride input based on the molecular weight ratio of Sodium to Chloride in the total volume of salt (0.606).

(6) The value of 10% of salt that will infiltrate into the subsurface is based on an assumption that the majority of snow storage from private parking areas will be stored on an impervious surface.

CONSERVATION DRIVE

BEAVER CREEK ROAD

Blk. 20 Multiple Residential

Blk. 21 Multiple Residential

Blk. 2 Multiple Residential

Blk. 3 Multiple Residential / Mixed Use

Blk. 1 Multiple Residential

STREET ONE

STREET TWO

STREET THREE

STREET FOUR

STREET FIVE

STREET SIX

STREET SEVEN

STREET EIGHT

Stage 1

Stage 2

Stage 3

Stage 4

Stage 5

Stage 6

Stage 7

Stage 8

EASTERN WETLAND

WESTERN WETLAND

Beaver Creek

Laurel Creek

7.3m Private Road

LEGEND

- SITE BOUNDARY
- STAGE LIMIT
- SWM FACILITY BLOCK
- PRIVATE ROADS =1.15 km
- LOCAL ROADS =2.07 km

WELLHEAD PROTECTION (MUN)

- WHPA C
- WHPA D
- MULTI-RES/ MIXED USE BLOCKS

MS5.1

Date: JUL.06/20
Scale: 1:3000

CHLORIDE IMPACT ASSESSMENT

MTE

Engineers, Scientists, Surveyors

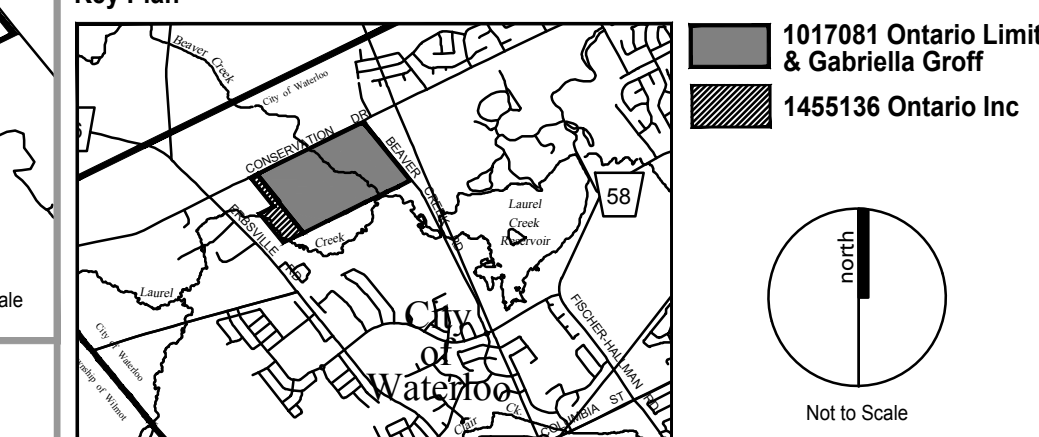
Project No.: 39502-104

July 16, 2020 — 1:53 p.m. — Plotted By: AHenderson

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Figure 6





Legal Description

PART OF LOT 28, GERMAN COMPANY TRACT,
(GEOGRAPHIC TOWNSHIP OF WATERLOO),
CITY OF WATERLOO,
REGIONAL MUNICIPALITY OF WATERLOO

Additional Information Required Under Section 51(17) of the Planning Act R.S.O. 1990, c.P.13 as Amended

A. As Shown B. As Shown C. As Shown
D. Residential, Park, Open Space, Stormwater Management
E. As Shown F. As Shown
G. As Shown H. Municipal Water Supply I. Sandy Loam
J. As Shown K. All Services As Required L. As Shown

Area Schedule **30T - 17401**

Description	STAGE 1 Lots/Blks	STAGE 1 Area	STAGE 1 Units (min/max)	STAGE 2 Lots/Blks	STAGE 2 Area	STAGE 2 Units (min/max)
Residential	1-6	1.838	37-54			
Residential / SWM	7,8	0.296	9-11			
Mult. Residential / SWM	9	0.462	40			
Multiple Residential	10	0.597	48			
Multiple Res./Mixed Use						
Park				1	0.444	
Walkway	11,12	0.038				
Open Space	13,14	0.594				
Pumping Station	15	0.170				
Storm Water Mgmt						
Residential Consolidation						
Walkway Consolidation						
Road Widening	16	0.186				
0.3m Reserve	17-19	0.010				
Roads		0.886				
TOTAL	19	5.077	134-153	1	0.444	

Description	STAGE 3 Lots/Blks	STAGE 3 Area	STAGE 3 Units	STAGE 4 Lots/Blks	STAGE 4 Area	STAGE 4 Units (min/max)
Residential				1-19	4.919	104-161
Residential / SWM						
Multiple Residential	1,2	2.839	103-187	20,21	1.185	88
Mult. Residential / SWM						
Multiple Res./Mixed Use	3	2.176	131-320			
Walkway				22,23	0.039	
Open Space	4	1.355		24	1.565	
Pumping Station				25	0.156	
Storm Water Mgmt				26	0.864	9-14
Residential Consolidation				27,28	0.238	
Walkway Consolidation				29	0.004	
Road Widening	5,6	0.421		30	0.359	
0.3m Reserve	7-10	0.014		31-36	0.008	
Roads		0.463			2.649	
TOTAL	10	7.268	234-507	36	11.986	201-263

Description	STAGE 5 Lots/Blks	STAGE 5 Area	STAGE 5 Units (min/max)	STAGE 6 Lots/Blks	STAGE 6 Area	STAGE 6 Units (min/max)	STAGE 7 Lots/Blks	STAGE 7 Area	STAGE 7 Units (min/max)	STAGE 8 Lots/Blks	STAGE 8 Area	STAGE 8 Units (min/max)	TOTAL Lots/Blks	TOTAL Area	TOTAL Units (min/max)
Residential													25	6.757	141-215
Residential / SWM													2	0.296	9-11
Mult. Residential / SWM													1	0.462	40
Multiple Residential													5	4.621	239-323
Multiple Res./Mixed Use													1	2.176	131-320
Park	1	0.671											2	1.115	
Walkway													4	0.077	
Open Space				3,4	0.789		2,3	0.615					8	4.918	
Pumping Station													2	0.326	
Storm Water Mgmt													1	0.864	
Residential Consolidation													2	0.238	9-14
Vacant Land Condominium				1	2.232	28	1	0.727	7	1	19.370	14	3	22.329	49
Block Consolidation				5-7	0.074	3							3	0.074	3
Future Common Element				2	0.037								1	0.037	
Walkway Consolidation													1	0.004	
Road Widening													4	0.966	
0.3m Reserve													13	0.032	
Roads														3.998	
TOTAL	1	0.671		7	3.132	31	3	1.342	7	1	4.164	14	78	49.290	621-975

Area Schedule - 1455136 Ontario Inc. 30T-17402

Description	Stage 1 Lots/Blks	Stage 1 Area	Stage 1 Units (min/max)	Stage 2 Lots/Blks	Stage 2 Area	Stage 2 Units (min/max)	TOTAL Lots/Blks	TOTAL Area	TOTAL Units (min/max)	1017081 Ontario Limited, Gabriella Groff & 1455136 Ontario Inc. Lots/Blks	Area	Units (min/max)
Residential										25	6.757	141-215
Residential / SWM										2	0.296	9-11
Multiple Residential / SWM										1	0.462	40
Multiple Residential										5	4.621	239-323
Multiple Res./Mixed Use										1	2.176	131-320
Park										2	1.115	
Walkway										4	0.077	
Open Space	4	0.828		2	2.931		2	3.759		10	8.677	
Pumping Station										2	0.326	
Storm Water Mgmt										1	0.864	
Residential Consolidation	1,2	0.607	10-14				2	0.607	10-14	4	0.845	19-28
Vacant Land Condominium				1	1.912	23	1	1.912	23	4	9.035	72
Block Consolidation				3-5	0.100	3	3	0.100	3	6	0.174	6
Future Common Element										1	0.037	
Walkway Consolidation	3	0.010					1	0.010		2	0.014	
Road Widening	5	0.040					1	0.040		5	1.006	
0.3m Reserve	6	0.001					1	0.001		14	0.033	
Roads											3.998	
TOTAL	6	1.486	10-14	5	4.943	26	11	6.429	36-40	89	55.719	657-1,015

Date	Issued / Revision	By
July 14,2020	Input Stormwater Management Block in Stage 1. Stage 8 Expanded. Revise Area Schedule.	LHB
June 15,2020	Input Conceptual & Proposed Developments North of Conservation Drive.	LHB
May 28,2020	Walkway Added in Stage 4. Revise Private Road in Stage 7.	LHB
April 15,2020	Kartway Block Consolidations added to Plan. Area Schedules Edits.	LHB
April 9,2020	Plan Revised per City and Regional Comments.	LHB
October 24,2019	Updated Contours, Wetland Limits, Driplines,Topographic Features and Plan Revisions.	LHB
August 28,2019	Frontages and Additional Dimensioning Added to All Blocks.	LHB
July 31,2019	Revise Road Widening at Beaver Creek Road & Conservation Drive. Revise Area Schedule.	LHB
Mar. 11,2019	Revise Walkway-Stage 1, Pumping Station-Stage 3, Park-Stage 4, Adjust Limits of Plan & Revise Area Schedule.	LHB
Feb. 26,2019	Revise Stages 3 & 4 Lotting, Park and SWM Areas. Revise Area Schedule.	LHB
Dec. 20,2018	Revise Stage 4 Park, Add Residential Unit Yields per Block, Revise Area Schedule.	LHB
Nov. 14,2018	Edits to Street One, Stage 2 & Stage 5 Lotting, Stage 3 SWM Pond, Parks & Area Schedule.	LHB
Oct. 24,2018	Streets 1 & 2, Park and Multiple Blocks Redesigned. Area Schedule Revised.	LHB
Oct. 18,2018	Stages 3 & 4 Redesigned. Area Schedule Revised.	LHB
Oct. 10,2018	West Area Revised to Align Main Access with Church Access	LHB

- Boundary information provided by MacDonald Tamblyn Surveying Ltd., February 5,2008, Plan 58R-16404.
- Topographic information provided by MTE Engineering, September-October 2019. Contour Interval - 0.5m.
*- BCM District Plan, Low Density Residential 2 calculated at 35-60 Units per Hectare
**- BCM District Plan, Mixed Use Medium Density Residential calculated at 60-100 Units per Hectare
***- Multiple Block Unit Yield based on Conceptual Site Plan prepared by MHBC Planning.
VLC - denotes Vacant Land Condominium.
- Floodline mapping obtained from North Waterloo Scoped Subwatershed Study, November 2012 and GRCA Developement Resource On-Line Mapping, January 23,2017.
- Single Family Residential Lots based on: min. @ 13.7m, max. @ 9.0m wide lots.

MHBC PLANNING URBAN DESIGN & LANDSCAPE ARCHITECTURE
200-540 BINGEMANS CENTRE DR. KITCHENER, ON, N2B 3X9 | P: 519.576.3650 F: 519.576.0121 | WWW.MHBCPLAN.COM

Approval Stamp

Date July 14,2020
File No. 14148A
Plan Scale 1:2,000
Drawn By L.H.B.
Checked By P.B. / T.H.

Project **1017081 Ontario Limited, Gabriella Groff & 1455136 Ontario Inc.**
Conservation Drive
Waterloo, Ontario

north

File Name **DRAFT PLAN CONSOLIDATION**

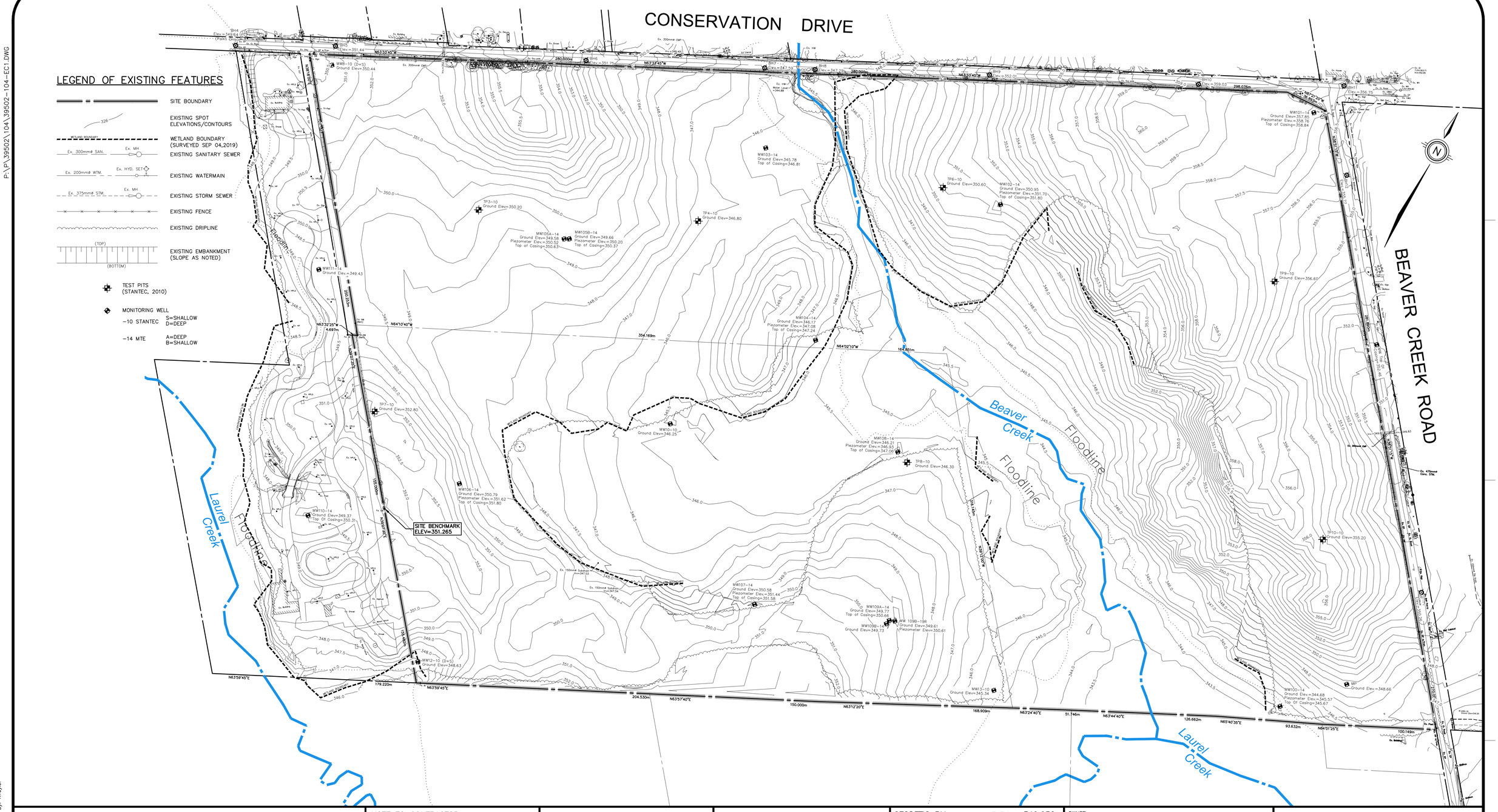
K:\14148A-NORTHGATE-WATERLOO\REPORT\FIGURE 6 - DRAFT PLAN CONSILIDATION JULY 14 2020.DWG

39502-104-EC1.1

MTE FILE No: P:_P\39502\104\39502-104-EC1.DWG

EXISTING CONDITIONS PLAN

July 2, 2020 – 2:48 p.m. – Plotted By: KTaylor



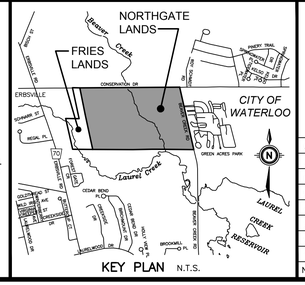
NOTE TO CONTRACTOR :

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THE OWNER/ARCHITECT/CONTRACTOR IS ADVISED THAT M.T.E. CONSULTANTS INC. CANNOT CERTIFY ANY COMPONENT OF THE SITE WORKS NOT INSPECTED DURING CONSTRUCTION. IT IS THE RESPONSIBILITY OF THE GENERAL CONTRACTOR TO NOTIFY M.T.E. CONSULTANTS INC. PRIOR TO COMMENCEMENT OF CONSTRUCTION TO ARRANGE FOR INSPECTION.



No.	REVISION	BY	DATE
8.			
7.			
6.			
5.			
4.			
3.			
2.			
1.	FOR REVIEW	VAL	MAY.29/20

GEODETIC BM ELEV. = 349.950m

TABLET SET ON N.E. END OF E. CURB OF CONCRETE BOX CULVERT ON REGIONAL RD. 16 IN ERBSVILLE, 4.9m E. OF CONTRELINE OF REGIONAL RD. 16 32m N.E. OF THE N.E. CORNER OF WHITE FRAME HOUSE, 161m S. OF THE INTERSECTION OF REGIONAL RD. 14 AND 16.

SITE BENCHMARK ELEV. = 351.265m

TOP OF SIB (SEE PLAN FOR LOCATION)

OWNER

1017081 ONTARIO LIMITED & GABRIELLA ELIZABETH GROFF/1455136 ONTARIO INC

1455136 ONTARIO INC. KITCHENER

PROJECT

NORTHGATE AND ERBSVILLE KARTWAY SUBDIVISIONS

CONSERVATION DRIVE WATERLOO

DRAWING

EXISTING CONDITIONS PLAN


MTE

Engineers, Scientists, Surveyors

519-743-6500

Project Manager V.LAZIC	Project No. 39502-104
Design By	Checked By
Drawn By KAT	Checked By MSB
Surveyed By MTE	Drawing No. EC1.1
Date Aug.14/14	
Scale 1:1500	Sheet of

MTE FILE No: 39502-104-AG1.1
FINISHED GRADE CONTOURS PLAN
P:\P\39502\104\39502-104-AG1.DWG



July 7, 2020 — 1:06 p.m. — Plotted By: AHenderson

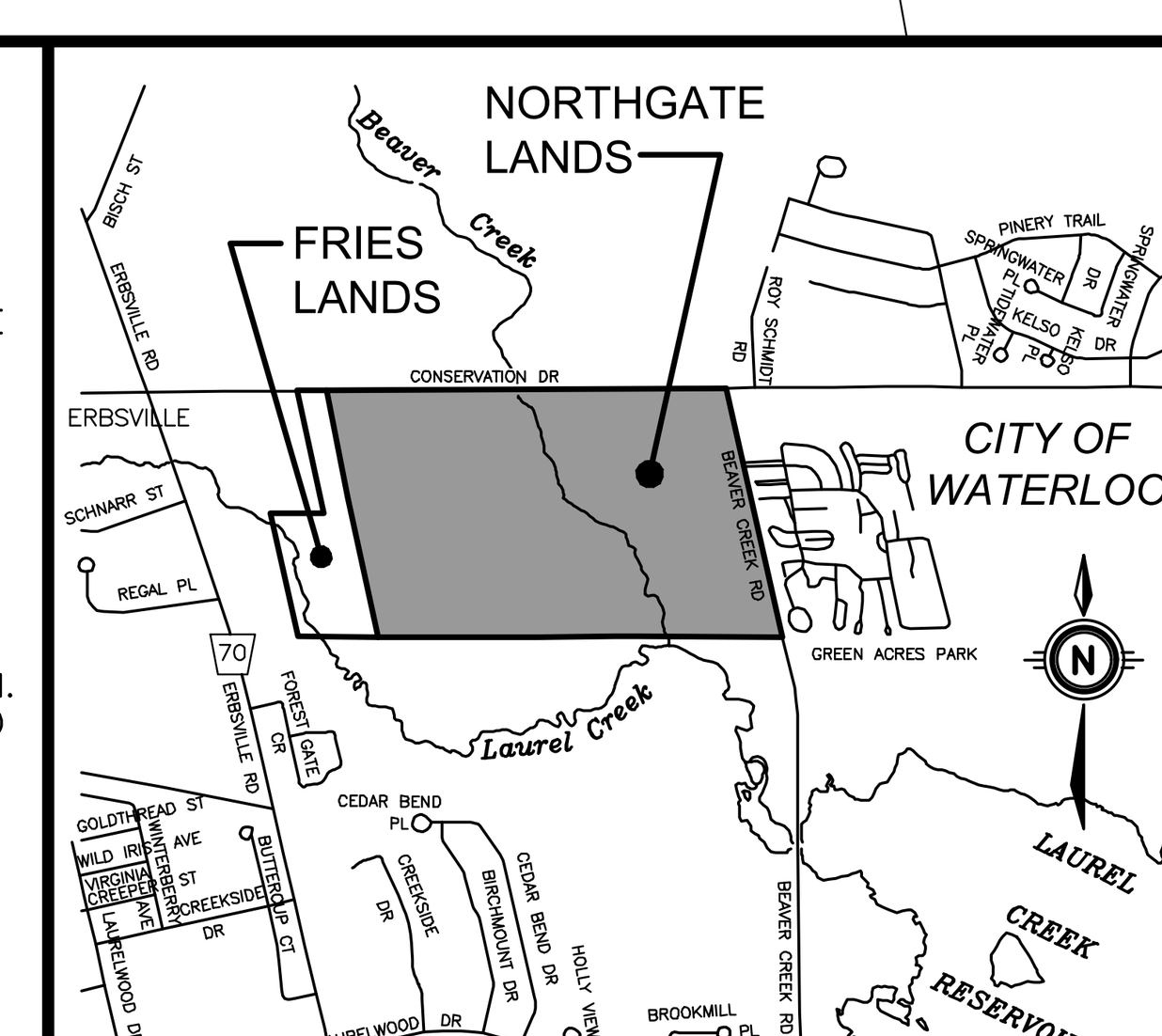
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KEY PLAN N.T.S.

No.	REVISION	BY	DATE
8.			
7.			
6.			
5.			
4.			
3.			
2.			
1.	FOR REVIEW	VAL	MAY.28/20

GEODETIC BM ELEV. = 349.950m
TABLET SET ON N.E. END OF E. CURB OF CONCRETE BOX CULVERT ON REGIONAL RD. 16 IN ERBSVILLE, 4.9m E. OF CONTRELINE OF REGIONAL RD. 16 32m N.E. OF THE N.E. CORNER OF WHITE FRAME HOUSE, 161m S. OF THE INTERSECTION OF REGIONAL RD. 14 AND 16.

SITE BENCHMARK ELEV. = 351.265m
TOP OF SIB (SEE PLAN FOR LOCATION)

OWNER
1017081 ONTARIO LIMITED & GABRIELLA ELIZABETH GROFF/1455136 ONTARIO INC
1455136 ONTARIO INC. KITCHENER

PROJECT
NORTHGATE AND ERBSVILLE KARTWAY SUBDIVISIONS
CONSERVATION DRIVE WATERLOO

DRAWING
FINISHED GRADE CONTOURS PLAN

MTE
Engineers, Scientists, Surveyors
519-743-6500

Project Manager	V.LAZIC	Project No.	39502-104
Design By		Checked By	
Drawn By	KAT	Checked By	MSB
Surveyed By	MTE	Drawing No.	AG1.1
Date	May.15/20		
Scale	1:1500	Sheet of	