The Manors of Belfountain Corp.

FUNCTIONAL SERVICING REPORT

The Manors of Belfountain, Town of Caledon

2017-0701

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Table of Contents

LIST OF TABLES

APPENDICES

1 Introduction

Cole Engineering Group Ltd. (COLE) was retained by Manors of Belfountain Corp., (the "Owner") to prepare a site specific Functional Servicing Report (FSR), for a proposed residential development on the property, in accordance with the Town of Caledon (the "Town") and the Regional Municipality of Peel (the "Region") development guidelines.

The purpose of this report is to provide site specific information for the Town's review with respect to the infrastructure required to support the proposed development as pertaining to storm drainage, sanitary servicing, water supply and site grading.

1.1 Background Documents

The following documents were reviewed in the preparation of this report:

- *Engineering Design Criteria Town of Caledon*, dated January 2009;
- *Stormwater Management Planning and Design Manual*, prepared by the Ministry of Environment and Climate Control, dated March, 2003;
- *CVC Stormwater Management Criteria*, Aug 2012;
- Depression Storage Areas, Falby Burnside Associates, DWG 9659 SWM2, dated Mar 1998;
- Memos and previous engineering work for the site, Burnside Associates, 2000 to 2012;
- *Hydrogeological Investigation Report*, Cole Engineering Group Ltd., 2018; and,
- Terraprobe Limited, 1990. *Hydrogeological Investigation, Proposed Residential Subdivision Part Lot 9 Concession 5 WHS*, Town of Caledon (Belfountain), Region of Peel.

2 Existing Site Conditions

The Site is approximately 70.28 hectares (ha) in area, Part of Lot 9, Concession 5 in Caledon, Ontario and is currently used for agricultural purposes.

It is generally bounded by Bush Street to the northwest, Shaws Creek Road to the southwest, Mississauga Road and Old Main Street to the north, and vacant lands to the southeast. The Belfountain Public School and several existing residential properties are located northwest of the Site. Refer to **Figure LP, Location Plan**, located in **Appendix A** for the proposed development location.

The topography of the site is hummocky with numerous depressions distributed across the site. Elevations of the site range from approximately 383 MASL to 407 MASL. Due to the hummocky, and rolling nature of the site, existing slopes range from relatively flat to approximately 20%. The agricultural portion of the site will also generally be the area of proposed development. A wooded area to the east, sloping down to Mississauga Road, will remain as Open Space.

Shaws Creek Road to the southwest is a gravel road with a rural cross section and ditch drainage with no specific drainage outlets for the ditches.

There is little to no stormwater runoff for the majority of the agricultural area of the site due to the hummocky topography and natural depressions which collect the majority of runoff. A narrow strip along the northern portion of the agricultural area has runoff to the adjacent properties to the north. There are catchment areas to the south that tend to convey surplus flow to the north, however similarly hummocky topography limits the total volume of runoff reaching the limit of the site.

Soils across the site are classified as sand to silty sand within hydrologic soil group A, providing excellent opportunities for infiltration and accounting for the existing condition of all runoff retained within the site and infiltrated.

The existing drainage pattern and depressions which currently collect runoff, are shown on **Figure ST, Pre-Development Drainage Area Plan**, located in **Appendix A**.

3 Proposed Development

The proposed development consists of 67 rural, individually serviced estates lots with an average lot size of 0.63ha. The layout is based on the **Draft Plan of Subdivision 21T-91015C**, located in **Appendix A,** dated December 5, 2017, prepared by Glen Schnarr & Associates Inc., **Figures GP-1, Functional Grading Plan and GP-2, Well Location Plan From High Nitrate Line**, located in **Appendix A**. Water supply will be provided by individual private wells and waste water servicing will be provided by individual septic systems with tertiary (Level IV) treatment. The stormwater management plan for the Site will rely on retention and infiltration to match existing conditions.

The internal road network of the site will have two road connections to the existing, Shaw's Creek Road, on the southwest side of the development.

The proposed road cross section is a standard paved rural road cross section with gravel shoulders and flat bottom ditches for stormwater infiltration as an LID (Low Impact Development) feature. The drawing showing the proposed Rural Road Cross Section in an 18m ROW, **Figure DET-1, 18.00m ROW Rural Cross Section**, is located in **Appendix A**.

4 Site Grading

4.1 Existing Grades

The portion of the site intended for development consists of agricultural lands with hedgerows separating the existing fields. Topography is described as hummocky, with depressions within the site. Areas of the site on which lots are proposed, range from nearly flat to grades of over 20%.

A drainage divide runs east-west across the site with drainage north of the line generally being conveyed north and south of the line being conveyed to the south.

There are 17 existing, defined depressions, where storm runoff accumulates and infiltrates. It is these features that create the condition of almost no storm runoff from the site.

Slopes to the north of the drainage divide generally slope north. Runoff from these areas flows either to detention area D4 and is retained within the site, or flows to adjacent lands to the north. Existing drainage directions and detention areas are shown on **Figure ST-1, Pre-Development Drainage Area Plan**, located in **Appendix C.**

4.2 Proposed Grading

Proposed grading for the site conforms to the objective that hedgerows and topographic features are retained as much as possible to maintain the overall character of the site under guidelines for *Scenic Resource and Landform Conservation*. The proposed road and lot pattern has been successful in retaining the majority of hedgerows and natural topography as required for Niagara Escarpment Commission, landform preservation criteria. Grading of localized high areas and filling of some of the deepest depressions on the site is required to achieve consistent road grades, and also to provide platforms for houses and septic systems within some of the lots.

Lot sizes are large, averaging 0.62ha with frontages averaging, allowing alternatives for placement of the houses and septic systems within the lot. The large lot sizes also allow creation of grading platforms if needed, and the distance to blend into steeper existing grades and also retain hedgerow features. Slopes within the lots can generally be maintained to 4:1, however some existing slopes within the agricultural area exceed 4:1 in areas. Detailed lot grading for each individual lot will be developed at the detailed design stage to suit the character and features of each individual lot and retain desired features such as existing hedgerows and hummocky topography, while adhering to Town grading standards and achieving controlled drainage on the lot.

The proposed site grading is constrained by existing grades along the perimeter. Detailed grading design, to ensure smooth transitions between proposed and existing ground will be observed, and any drainage alteration will not have a negative effect on the neighbouring properties.

House siting within the lots were prepared by Baker Turner Inc. as part of their Development Plan. The sitings take into account grading constraints.

Proposed roadways within the development total 2,930 meters (m) and all but one 60m section of proposed road grades are under 1.2%, with one 60m section of road at 5.7% grade, which is below the Town maximum criteria of 6%. Profiles of the proposed roads are shown on **Figures PP-A** though **PP-D**, corresponding to Roads "A" though Road "D" respectively, located in **Appendix A**.

For overall grading, including cut and fill limits, refer to the **Figure GP-1, Functional Grading Plan**, located in **Appendix A**.

5 Stormwater Management

5.1 Stormwater Management Approach

Applying standards and criteria of the Town of Caledon and Credit Valley Conservation (CVC), the stormwater management approach for the proposed site will address the following:

- The site soils and site groundwater conditions are conducive to a Low Impact Development (LID) approach. Both Town of Caledon and CVC policies encourage lot level and conveyance controls endorsing LID principles;
- Provide enhance level quality and quantity for control of all storm runoff up to and including the 100-year event, with generally, no runoff leaving the site;
- Preference is given to source (lot level) Stormwater Management controls; and,
- Stormwater management infrastructure choices selected have the lowest lifecycle maintenance and replacement costs.

5.2 Existing Conditions

The predominant existing condition of the property is that there is generally no existing runoff from the site for up to the 100 year storm event, for the area of the site proposed for development. An exception is the area to the northeast of the proposed developed area, approximately the rear of proposed Lots 46 to 55, where existing grades slope down to the north within approximately 100m of the north property or limit of proposed development.

Runoff accumulating in Detention Area D4, may overflow runoff for large storms exceeding the 100-year event. Overflow would go to the adjacent properties to the north and east at approximately the rear of lots 19 to 21. For the purposes of this Report, it is assumed that there is generally no surplus discharge for storm events up to the 100 year storm event, but there may be some discharge for events exceeding the 100 year event.

The exception to principle that the majority of runoff will be contained within the site occurs at the rear of proposed lots 19-21 and 46-55. It is noted that post development runoff will be less than the pre-development because the post-development catchment areas draining off the lots to the adjacent property are smaller than pre-development catchment areas because the proposed roadways intercept a portion of the pre-development areas. Post Development grading from most of the front of the lots will be conveyed to the road ROW. In addition, total flow and flow rates will be lower, as pre-development runoff is assumed from bare fields, and post development runoff is sheet flow from grassed lawns, which is lower.

There are five external catchment areas to the south of the site that may discharge surplus runoff onto the site. However the same hummocky topography exists to the south of the site, and there generally are no defined flow paths for most of the external area. Existing drainage and ponding areas are shown on **Figure ST-1, Pre-Development Drainage Area Plan**, and external areas are shown on **Figure ST-3, External Area Drainage Plan**, located in **Appendix C**.

5.3 Proposed Stormwater Management System

Infiltration measures will be utilized to ensure that pre-development infiltration on-site will be maintained post-development. There is essentially no significant runoff leaving the Site for up to the 100 year storm event.

Post development stormwater management strategy will utilize the following features:

- Detention and infiltration in roadside ditches;
- Detention and infiltration in rear or side yard detention swales;
- Detention storage will be created in ditches and swales through the use of check dams, and through the use of driveway culverts with orifice plates along the roadside ditches;
- Enhanced, rapid infiltration of runoff from storm events larger than approximately the 2 to 5 year storm event will be though Dry Wells located in the ditches and swales. Rapid infiltration reduces required storage volume;
- Runoff from storms smaller than the 2 year event will be infiltrated through the bottom of the roadside ditches and rear yard detention swales;
- Dry wells will have perched inlets so runoff from storm events smaller than the 5 year event will not enter;

- Use of Lot level LID features, such as soak-away pits for roof runoff to retain and infiltrate a minimum equivalent of 3mm depth from all impervious areas; and,
- Treatment of runoff will be though the vegetated ditches and swales.

Runoff from a storm event will be conveyed to the grassed roadside ditches or to a rear or side yard detention, infiltration swale. The ditches and swales will provide both infiltration and storage. In roadside ditches, driveway culverts with elevated orifice plates will detain runoff between ditch segments to enhance infiltration and provide quantity storage. Orifice plates are a contingency to provide conveyance for storm events larger than the 100 year event.

The runoff volume which can be stored in a ditch or swale segments varies with longitudinal slope, decreasing as slope increases. Typically the storage length for low slope sections will be on the order of 30m to 40m between driveway culverts and additional check dams in ditches or detention swales when distances between driveways are longer than 40m.

If runoff from a storm event exceeding the 100 year storm event, or the infiltrative and storage capacity of a particular roadside ditch, the stormwater will be conveyed downstream along the ditch or swale system.

Emergency overland flow, in the event of a blockage of drainage or extreme storm events, is provided including locating dwellings and design of finished grades to minimize potential property damage from flooding.

5.4 Enhanced Infiltration Ditches and Swales

The proposed enhanced ditches and swales will be used for detention of runoff, and provide infiltration for all runoff from storms less than the 2 year storm event. The general configuration is a 1m wide flat bottom, with 4:1 slide slopes to the property and 3:1 side slope to the shoulder of the road. The ditches and swales are conventionally constructed, with a minimum 100mm organic topsoil and sod. No subdrains or granular layers are needed as the sandy soils in the area have excellent infiltration characteristics.

Similar roadside ditches in sandy areas, with no outlet for ditches, with owner maintained front yards, have been observed to remain operational and continue to infiltrate runoff for more than 50 years.

5.5 Rapid Infiltration Dry Wells

A feature of the proposed stormwater management system is the use of enhanced infiltration techniques to rapidly and reliably infiltrate stormwater runoff. The proposed dry well network will effectively replicate the distributed infiltration pattern of depressions that was present on the site pre development. This distributed infiltration pattern, containing and infiltrating all runoff up to the 100-year event, will fully maintain the water balance to pre development levels.

Dry wells have been used where conditions are conducive to infiltration. They are a variation of standard infiltration practices and devices.

The developed area of the site is predominantly deep, sands extending 6m to 8m below the surface. The unsaturated zone within the proposed developed area is typically up to 6m below the surface.

The proposed dry well consists of a vertical perforated pipe extending approximately 3.6m deep, into a dug or drilled excavation backfilled with fine granular material, such as High Performance Bedding. The perforated vertical pipe proposed is 375mm diameter perforated drainage pipe, such Big “O” covered with a woven filter fabric sock. The surface inlet is a bottomless catchbasin and grate. The grate is perched

200mm above the surrounding bottom of ditch or swale so that runoff from the majority of annual storm events does not enter.

Figure DET-02, Infiltration Dry Well, in **Appendix B** shows the typical configuration of a Dry Well located just upstream of a driveway culvert used as a retention and control structure.

Surplus runoff exceeding the storage and infiltrative capacity of the ditches will enter the Dry Well, potentially, only once per year. Either for a rain on frozen ground event, or a summer storm event greater than the 2-year storm.

The purpose of limiting runoff entry to only large events is to provide treatment of runoff in the vegetated ditches and swales for the majority of runoff on an annual basis. It also reduces the potential for contaminants to enter the subsurface, and equally important, to ensure that the Dry Wells will retain their function for a very long time, since only clean water will enter the dry wells.

The system of surface detention and dry wells will typically consist of a surface storage ditch or swale, and one or more dry wells per storage segment. Segments are typically 20m to 40m long, approximately two storage, and infiltration segments per lot. The target rate of infiltration for each dry well is 30 L/s and is based on soil permeability found across much of the site. A report, **An Approach for Estimating Infiltration Rates for Stormwater Infiltration Dry Wells**, commenting on the potential infiltrative rates of dry wells is included in **Appendix B**. Soil hydraulic conductivity ranges from 1E-03 to 1E-04 m/s, resulting in infiltration rates of 37.3Ls to 3.67 L/s for a borehole radius of 300mm, representing a 600mm diameter borehole for installation of a 375mm perforated pipe backfilled with granular.

A design memo, **Infiltration Rate from Dry Wells**, calculating the infiltrative capacity of the proposed Dry Wells is included in **Appendix B**. Also included is a technical design approach document from Washington State Department of Transportation outlining design approach and testing results for Dry Wells they have installed.

5.6 Life Cycle Maintenance Costs

An important consideration for selection of infrastructure is cost and long term, life cycle costs. The primary method of storage and infiltration of runoff is through the roadside ditches with selected locations having rear year swale systems. Maintained, grassed infiltration swales in sandy soils have been demonstrated to have lifespans in excess of 50 years with no maintenance. The reason for this is there is because the grass is maintained as a residential lawn, there is limited accumulation of organic matter that typically occurs in an unmaintained ditch. Grass maintains surface porosity if any silt should accumulate.

The dry wells are designed so they are only needed for surplus runoff from greater than a 5 year storm event, and any runoff entering the Dry Wells is conveyed through the ditch or swale first, providing treatment. The result is the Dry Well system will have a very long life, with no expected maintenance for a period in excess of 50 years, other than periodic condition inspection.

5.7 Proposed Major Storm Drainage System

Generally, runoff from each lot will be stored and infiltrated in the roadside ditch or in rear yard detention swales adjacent to that lot, for up to the 100-year storm event resulting in little to no conveyance of runoff around the site. In the event of a very large storm event, individual retention / infiltration cells are designed to overflow and convey surplus runoff to cells downstream. If the storage and infiltration capacity of a large area is exceeded, the system is designed to convey surplus runoff to a ponding location or emergency overflow location. This can occur if a particular cell or cells have reduced storage volume due to geometry or higher slope, or reduced infiltration capacity due to soil permeability within a particular area of the site.

Rear and side yard storages and infiltration swales all have overflow connections to a road or other overflow or designated ponding area. There are two ponding areas along the southeast side of the site, a woodlot buffer between Lots 9 and 40 and a park between Lots 42 and 60. Emergency overflow from Street A is conveyed to Shaw's Creek Road, and an emergency overflow between Lots 19 and 20 to the north to an existing ponding area. As noted, the overflow to Shaw's Creek Road and to the northwest between Lots 19 and 20 would only occur for a greater than 100 year storm event. Ponding areas and overland flow routes are illustrated on **Figure ST-2, Proposed Drainage Area Plan**, located in **Appendix C**.

5.8 Quantity Control

Quantity control of stormwater runoff is through use of ditch and swale detention cells, and rapid infiltration thought use of Infiltration Dry Wells. The infiltrative capacity of Dry Wells is similar to a discharge from a conventional stormwater pond. However in this case, the discharge is through infiltration and rate is controlled by the number and capacity of the Dry Wells.

As noted, overflows of the system for storm events greater than the 100-year event would consist of the surplus flow beyond the capacity of the system to control the 100 year event.

Storage volumes vary with the slope of the ditch. At a 500mm depth at the downstream check dam, or driveway culvert with orifice plate, sample volumes are provided in Table 5.1.

Table 5.1 Ditch Storage Volume at 500mm Depth – Per 20m Detention Cell

Ditch Slope (%)	Storage Volume at 500mm Depth, 20m Long Cell (m3)	Length of Water Surface Upstream of Checkdam or Driveway Culvert (m)
0.5	21.3	20
1.0	18.2	20
2.0	13.8	20
3.0	10.4	16.7
5.0	6.3	10.0

Note that the storage volumes are per cell. A cascade of cells will multiply the volume of storage in the cascade. Typical lot frontages vary from 29.3m up to 97.0m, with the majority of frontages over 60.0m, providing an average of three detention cells per lot. In addition, there are areas of rear and side yard detention swales with similar detention volumes.

Detention ditches and swales have a depth of 200mm below the inlet to the Dry Well. The storage at this depth when there are two cells per lot, means that no runoff will enter the Dry Well for less than the 2-year or greater storm event, depending on storage available in the ditch or swale.

Table 5.2 Summary Ditch Storage at Maximum 200mm Depth – Per 20m Detention Cell

Ditch Slope (%)	Storage Volume at 200mm Depth, 20m Long Cell (m3)	Length of Water Surface Upstream of Checkdam (m)
0.5	4.2	20
1.0	3.2	20
2.0	1.6	20
3.0	1.1	6.7
5.0	0.6	4.0

5.9 Quality Control

Treatment of runoff from the lots will primarily be through detention, sedimentation and slow flow through the vegetated ditches and swales. Flow though vegetated swales is a well-known, effective and commonly used method for treating low flows.

The design used in the proposed development enhances the effectiveness of a vegetated swale by creating a series of detention areas with no flow between each area for the majority of storm events. The detention ditches and swales have a two stage design. An initial stage is storage and infiltration solely within the ditch to a depth of 200mm. As noted in the previous section, this depth of storage is sufficient to retain runoff from the 2-year storm event and will be fully infiltrated through the bottom of the ditch or swale, and not through the Infiltration Dry Wells.

This detained runoff will slowly infiltrate through the bottom of the ditch or swale, leaving any potential contaminates at the surface to break down or be retained. Given the small impervious area of an estate lot residential development, the contaminant loading of runoff will be low.

5.10 Stormwater Modeling

The pre development runoff for the development is effectively zero because of retention of all runoff within the identified 17 detention areas within the site. As such, pre-development stormwater modeling has not been presented.

The stormwater modeling for the proposed development has been developed so there is no runoff from the site for up to the 100-year storm event. The stormwater retention and infiltration measures are implemented on a lot by lot basis. There is more than sufficient storage and infiltration capacity on every lot within the development and adjacent roadway to retain and infiltrate all runoff from any selected lot. In the event of a storm greater than the 100-year event, or failure of a part of the system, surplus runoff be conveyed to adjacent, downstream retention and infiltration cells.

Modeling is based on a single lot, including half of the road right of way fronting the lot. This is an appropriate model as stormwater management will be implemented on a distributed basis throughout the development. The single lot model can be applied to every lot in the development and will work for every lot. It is based only on having storage and infiltration capacity along the road frontage with the assumption all runoff is from the lot is conveyed to the front. There are numerous rear and side yard detention and infiltration swales which add to the roadside ditch infiltration capacity. There is ample storage and infiltration capacity provided by the design to retain and infiltrate all runoff.

Subcatchments within the development are based on local grading, maintaining the hummocky character of the original site.

There is the capacity within the development and lot layout to provide additional capacity at all locations during the detailed design stage to accommodate localized adverse design conditions requiring additional storage or infiltration capacity.

During detailed design of the site, the individual lot model will be expanded to include multiple lots and catchment areas, rear and front. The individual catchment areas based on preliminary grading is shown on **Figure ST-1, Pre-Development Drainage Area Plan, and ST-2, Proposed Drainage Area Plan**, included in **Appendix C**.

Modelling using Visual OTTHYMO 5 was carried out for a single lot, including half the road ROW including asphalt.

Typical Lot

Area = 0.63 ha
Area road ROW = 0.07 ha
Total area = 0.70 ha

Impervious area on Lot = 0.06 ha
Impervious area ½ ROW= 0.06 ha

Percent impervious = 17%

The one lot model was run with one and two Dry Wells per lot with an infiltration rate set to 30 L/s. This selected infiltration rate is based on a calculate rate of 37.3 L/s for a borehole with a 304mm radius. Infiltration through the bottom of the ditch was not taken into account. The results of the modeling indicates the required storage volume in the ditches or swales per lot. Results are presented in **Table 5.3**.

Table 5.3 Required Storage Volume per Lot

Storm Event	Peak Flow into Ditch (m^3/s)	Storage Volume Required One Dry Well (m^3)	Storage Volume Required Two Dry Wells (m^3)
2 year, 6 hour SCS	0.006	2	1
5 year, 6 hour SCS	0.010	2	2
10 year, 6 hour SCS	0.014	5	2
25 year, 6 hour SCS	0.019	6	3
50 year, 6 hour SCS	0.024	8	4
100 year, 6 hour SCS	0.028	9	5
100 year, 24 hour SCS	0.064	44	13

The worst case is for the 100 year, 24 hour SCS storm which would require ditch and swale storage of 44 cubic meters if only one Dry Well per lot, with an infiltration capacity of 30 L/s were used. If two Dry Wells are used, then ditch storage required is reduced to $13m^3$. With the exception of one 60m section of road at 5.7% grade, all other road and ditch grades are less than 1.2%. As per Table 5.1, this provides over approximately $16m^3$ of storage per 20m long, ditch storage cell. For the single steeper segment of road, three cells at a grade of 5% provide $18.6m^3$ of storage which will provide sufficient storage capacity.

The individual lot model demonstrates there is sufficient storage and infiltration capacity within the road ROW only to achieve zero runoff for the site for the 100-year storm event. The final design will also utilize rear and side yard storage swales for substantially increased capacity per lot if needed.

The rear of Lots 19 to 22 and Lots 46 to 48 follow existing grading which slopes to the north and east onto adjacent properties. This will convey runoff onto those properties. The post development areas of these lots discharging onto adjacent property is smaller than pre development, and also the runoff coefficient is also reduced, going from agricultural bare ground or row crop, to grassed. To mitigate any potential future issues, a storage and infiltration swale will be located along the rear of this lots, to retain and infiltrate runoff.

5.11 External Catchment Areas

To the south of the site, four external catchment areas have been identified which may contribute runoff to the site. These catchments are forested to agricultural in use, and generally have the same hummocky topography as the site. Runoff from these catchments are conveyed generally as sheet flow with some areas of concentration because of topography.

Flow from these external catchments is intercepted through the use of detention and infiltration swales. Surplus runoff from large storm events, that exceeds the capacity of the swales and Dry Wells, is conveyed to two existing, natural ponding areas, one between Lots 9 and 40, and the other between Lots 42 and 60.

Surplus runoff from Catchment 100 is conveyed through swales to the natural ponding area between Lots 9 and 40. There is sufficient volume in the natural ponding area to accommodate runoff from the 100-year storm event. Surplus runoff from Catchments 101, 102 and 103 will be conveyed by swale to the natural ponding area between lots 42 and 60. There is more than enough existing volume in this natural ponding area to retain runoff from the three external catchment areas. The two ponding areas will naturally infiltrate the accumulate runoff. Runoff from typical storm events is not expected to be conveyed to the ponding areas. The ponding areas would only receive runoff for 2-year or greater storm events.

A summary of output is provided in **Table 5.4,** and Visual OTTHYMO output is included in **Appendix C**

Table 5.4 External Catchment Area Flow Summary

Catchment ID	Drainage Area	Number of Dry Wells	100YR 6HR Storm		100YR 12HR Storm		100YR 24HR Storm	
			Peak Flow	Storage	Peak Flow	Storage	Peak Flow	Storage
	[ha]	[-]	[L/s]	[m^3]	[L/s]	[m^3]	[L/s]	[m^3]
100	3.31	4	0.4	843	0.6	1226	0.9	1738
101	3.09	6	112.7	28.7	145.4	37.0	179.3	45.7
102	7.19	0	0.8	1305	34.7	1618	95.3	1655
103	13.55	10	1845	1755	239.1	2274	299.9	2852

2 Dry Wells per Lot with 10mm Initial Abstractions

6 Sanitary Servicing

6.1 Individual Septic Systems

There is no municipal sanitary system in the Belfountain area. The proposed development will be serviced through individual, private septic systems with tertiary treatment, meeting Ontario Building Code requirements. Hydrogeological reports indicate high permeability soil conditions and no groundwater approaching the surface, indicating that in-ground septic beds can be used.

Sloped sites can potentially use a Type B bed, which is a contour, or slope following trench type septic bed.

Proposed locations of Septic Systems are shown on **Figure GP-1, Functional Grading Plan**, included in **Appendix A**. Design of the individual septic systems will occur at the Building Permit stage for the individual site plans.

7 Water Servicing

7.1 Proposed Domestic Water Supply

Domestic water supply will be through the use of individual private wells for each lot. A hydrogeological report has been prepared by COLE addressing water supply.

Recommended locations for the wells within are lot include:

- Minimum clearance of 15m from the septic system, with 30m recommended clearance as a best practice;
- Minimum 30m to an adjacent well;
- Minimum 15m clearance to a stormwater infiltration Dry Well, with 30m recommended clearance as a best practice; and,
- 7m offset from the Elevated Nitrate Line as indicated in the Hydrogeological Report.

The report indicates there is sufficient water from each well in the development to simultaneously supply average domestic demand for each lot on continuous, long term, basis.

Ultraviolet water disinfection is recommended prior to distribution to the house.

7.2 Elevated Nitrate Level Line

An area of elevated nitrate in the groundwater has been identified at the east end of the site in the Hydrogeological Study. This limits location of water wells on five lots, 50 through 56. **Figure 14, Line of Higher Nitrate Concentrations**, included in **Appendix A**, from the COLE Hydrogeological Study, shows the nitrate line and offset line of the wells.

Recommendation from the Study is that water wells should be located a minimum of 7m west of the line of elevated nitrate in the groundwater. The high nitrate line is also 16m east of the property line at the ROW. This will locate the wells at 9m from the front property line, and approximately 11m from the roadside ditch.

In the area of Lots 50 through 56, infiltration Dry Wells will be located on the west side of the road, to provide greater than 15m clearance to any water well. Excess runoff accumulating in the ditch greater than a 200mm depth, will enter Ditch Inlet Catchbasins and be conveyed through a culvert under the road to an Infiltration Dry Well on the west side of the road. The location of water wells and relocated Infiltration Dry Wells is shown on **Figure GP-2, Well Location Plan From High Nitrate Line**, included in **Appendix A**.

8 Erosion and Sediment Control

An Erosion and Sediment Control Plan will be provided as part of the site alteration permit application. The plan will demonstrate how the construction activities will occur without impact to the protected areas, adjacent natural features, and agricultural lands. The plan will ensure that sediment control fencing is installed prior to grading, and that mud mats are utilized at locations where construction vehicles exit the site.

Within the site are 17 naturally occurring depressions within the agriculturally cultivated area that collect and infiltrate the majority of runoff within the site. These depressions will continue to collect and infiltrate the majority of runoff from the site during construction. During and after construction, sediment accumulations will be removed as necessary, and infiltration capability will be maintained. Vegetated areas and hedgerows will be protected with sediment traps to allow sedimentation of runoff, and detain runoff for infiltration. Slope breaks and other stabilization measures will be used to mitigate erosion along steep slopes. All temporary erosion and sediment control measures will be routinely inspected and repaired during construction. Temporary controls will not be removed until the areas they serve are stabilized or restored.

9 Conclusions and Recommendations

The proposed site servicing presented in this Report is appropriate and feasible based on grading, stormwater management, and servicing. The design is the best choice to preserve landforms and hedgerows. Stormwater management is unique as almost all runoff up to the 100 year storm event, is retained and infiltrated on a site wide basis, mimicking pre development conditions and pre development water balance. The proposed detention and infiltration swales, supplemented for larger storm events by rapid infiltration Dry Wells, provides a reliable, low maintenance, and low life cycle cost alternative for stormwater management. The proposed design follows Town of Caledon and CVC design standards. The site is readily serviceable, and our recommendations are summarized as follow:

9.1 Grading

The proposed road and lot grading scheme follows the Town’s Engineering Design Standards and respects the perimeter grades of the surrounding properties. The majority of topographic features and hedgerows can be maintained.

Emergency overland flow, in the event of a blockage of drainage or extreme storm events, is provided including locating dwellings and design of finished grades to minimize potential property damage from flooding.

9.2 Stormwater Management

Post development flow can be retained and infiltrated on site to maintain zero post development discharge for up to the 100 year storm event. This is accomplished through use of distributed ditch and swale storage and infiltration, and use of rapid infiltration Dry Wells as a secondary measure to infiltrate runoff from storms larger than the 2-year event.

9.3 Sanitary Servicing

Sanitary servicing will be though the use of individual private septic systems employing tertiary treatment and in ground septic beds. There is sufficient room on the lots to accommodate septic beds and maintain setbacks from domestic water wells.

9.4 Domestic Water Supply

The subject site can be serviced by individual private drilled wells. There is sufficient area within the lots to maintain 30m clearing to septic beds and adjacent wells.

S:\2017 Projects\SD\2017-0701 Belfountain_Pre Eng FSR_Caledon\300-Design-Engineering\312-Deliverables\Project Deliverables\FSR\Belfountain FSR Mar 4 - 2018.docx

APPENDIX A
Figures

COLE ENGINEERING

70 VALLEYWOOD DRIVE, MARKHAM, ON L3R 4T5
T:416.987.6161 / 905.940.6161 F:905.940.2064

LOCATION PLAN

THE MANORS OF BELFOUNTAIN CORP.

TOWN OF CALEDON

REGIONAL MUNICIPALITY OF PEEL

DATE:	JANUARY 2018	PROJECT No.	SD17-0701
SCALE:	NTS	FIGURE No.	LP

DRAFT PLAN OF SUBDIVISION
MANORS OF BELFOUNTAIN CORP.

FILE # 21T-91015C

PART OF EAST HALF AND WEST HALF LOT 9,
CONCESSION 5, W.H.S.
(HAMLET OF BELFOUNTAIN),
TOWN OF CALEDON
REGIONAL MUNICIPALITY OF PEEL

OWNERS CERTIFICATE

I HEREBY AUTHORIZE GLEN SCHNARR & ASSOCIATES INC. TO PREPARE AND SUBMIT THIS DRAFT PLAN OF SUBDIVISION TO THE TOWN OF CALEDON FOR APPROVAL.

SIGNED ____________________ DATE: ____________

JOHN SPINA, ASO
MANORS OF BELFOUNTAIN CORP.

SURVEYORS CERTIFICATE

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

SIGNED ____________________ DATE: ____________

ALISTER SANKEY, OLS
DAVID B. SEARLES SURVEYING LTD.
4255 SHERWOODTOWNE BLVD. SUITE 206
MISSISSAUGA, ON, L4Z 1Y5
PHONE: 905-273-6840
EMAIL: info@dbsearles.ca

ADDITIONAL INFORMATION

(UNDER SECTION 51(17) OF THE PLANNING ACT) INFORMATION REQUIRED BY CLAUSES A,B,C,D,E,F,G, & J ARE SHOWN ON THE DRAFT AND KEY PLANS.

H) MUNICIPAL AND PIPED WATER TO BE PROVIDED
I) SANDY LOAM AND CLAY LOAM
K) SANITARY AND STORM SEWERS TO BE PROVIDED

NOTES

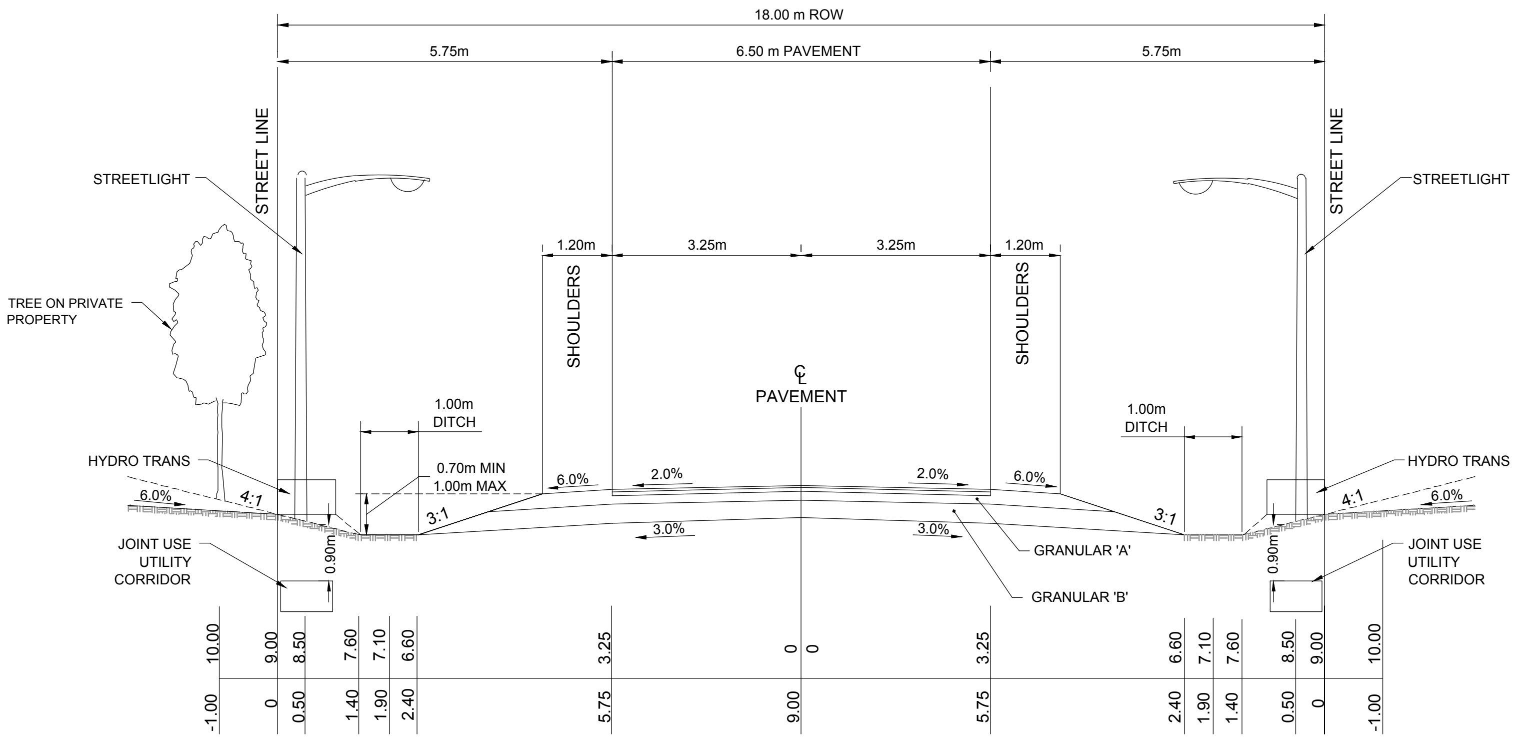
- Local to local radii - 5.0
- Streets 'A' & 'C' to Shaws Creek Rd. daylight triangles - 15.0 x 15.0
- Pavement illustration is diagrammatic only

LAND USE SCHEDULE

LAND USE	LOTS / BLOCKS	AREA (ha)	AREA (ac)	UNITS
ESTATE RESIDENTIAL	1-67	42.24	104.38	**67**
PARK	68-72	2.60	6.42	
OPEN SPACE	73-75	18.92	46.75	
10m BUFFER	76, 77	1.02	2.52	
ROAD WIDENING	78	0.18	0.44	
18.0m ROW - (2,886m LENGTH)		5.32	13.15	
TOTAL	**78**	**70.28**	**173.67**	**67**

Scale 1:2000
(24 x 36)
December 5, 2017

GLEN SCHNARR & ASSOCIATES INC.
URBAN & REGIONAL PLANNERS, LAND DEVELOPMENT CONSULTANTS
SUITE 700 10 KINGSBRIDGE GARDEN CIRCLE.
MISSISSAUGA, ONTARIO, L5R 3K6
TEL (905) 568-8888 FAX (905) 568-8894 www.gsai.ca



NOTES:

1. UTILITY CORRIDOR TO HAVE A MINIMUM COVER OF 0.90m.
2. THE FOLLOWING IS A MINIMUM ROAD BASE AND WILL REQUIRE A SOIL REPORT VERIFICATION:
40 mm HL3
65 mm HL8
150 mm GRANULAR 'A'
300 mm GRANULAR 'B'
3. TREES TO BE PLACED IN LOCATIONS PER APPROVED ARCHITECTURAL PLAN.
4. DITCHES AND SLOPES ARE REQUIRED MINIMUM OF 300mm TOPSOIL AND NURSERY SOD.
5. STREETLIGHT FIXTURE PER APPROVED TOWN STANDARDS.
6. SUB-GRADE SHALL BE COMPACTED TO A MINIMUM 95% OF S.P.D. AT OPTIMUM MOISTURE CONTENT.
7. LONG DIMENSION OF TRANSFORMER TO BE PARALLEL TO STREET LINE.

TOWN OF CALEDON

18.00m ROW RURAL CROSS SECTION
ROADWAY (6.5m PAVEMENT)

No.	REVISION	APR'D:	DATE:

APR'D: --
DATE: JANUARY 18
DRAWN: --
SCALE: NTS

DET-1

COLE ENGINEERING
70 VALLEYWOOD DRIVE, MARKHAM, ON L3R 4T5
T:416.987.6161 / 905.940.6161 F:905.940.2064

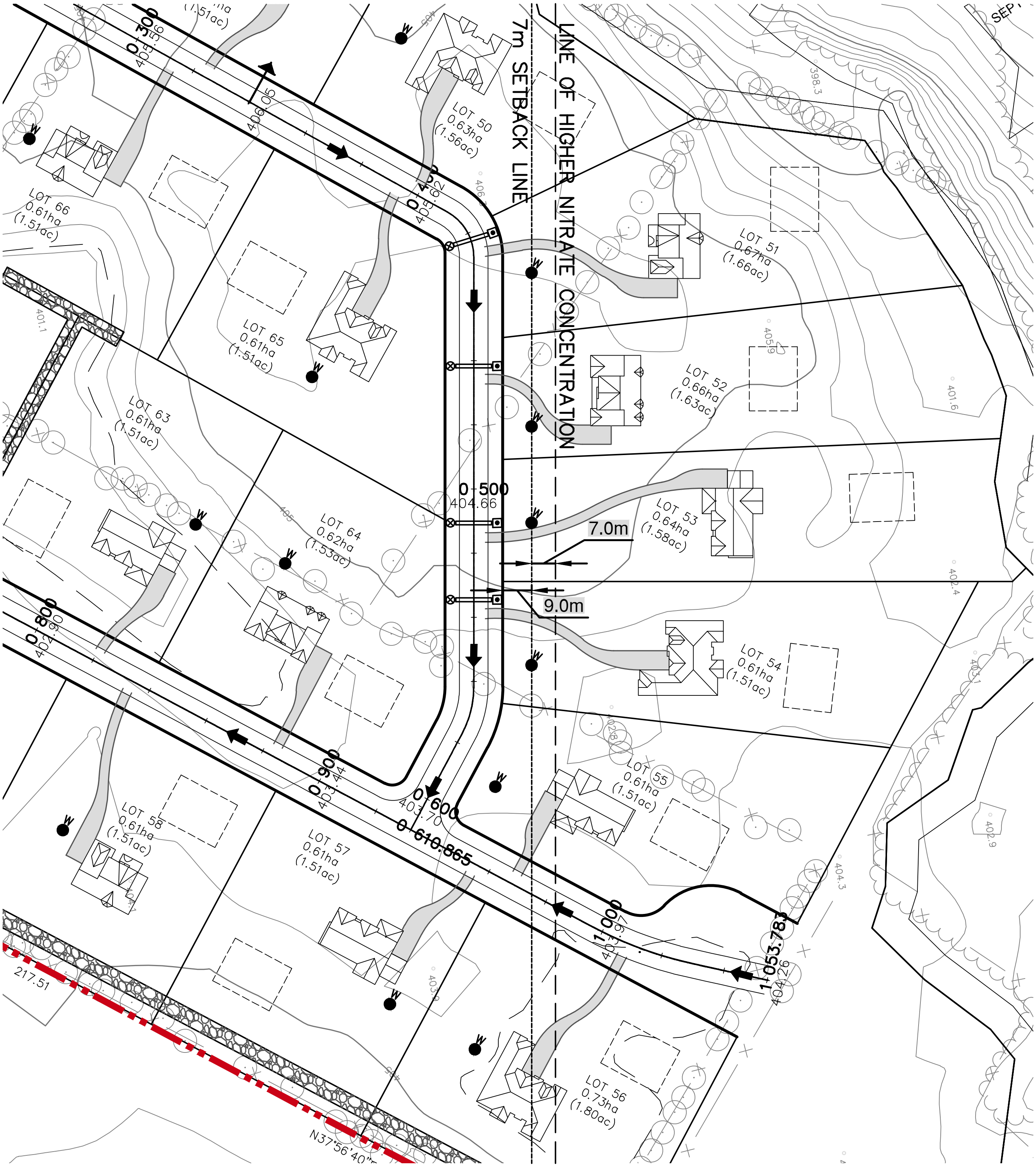
LEGEND

(red dash-dot line)	PROPERTY BOUNDARY	(red dashed line)	PROPOSED CUT LIMIT	(dashed box)	BUILDABLE AREA – INCLUDES HOUSE AND SEPTIC BED AREA
×404.45	EXISTING ELEVATION	(green dashed line)	PROPOSED FILL LIMIT	(dashed box)	SEPTIC LOCATION
×404.45	PROPOSED ELEVATION	(hatched bar)	PROPOSED STORAGE AND INFILTRATION SWALE	(house symbol)	HOUSE LOCATION
404.00	EXISTING CONTOURS	(arrow)	MINOR DRAINAGE DIRECTION		
(arrow)	MAJOR DRAINAGE DIRECTION	W ●	WELL		

THE MANORS OF BELFOUNTAIN CORP.
TOWN OF CALEDON
REGIONAL MUNICIPALITY OF PEEL
FUNCTIONAL GRADING PLAN

DATE:	JANUARY 2018	PROJECT No.:	SD17-0701
SCALE:	SCALE: 1:2000	FIGURE No.:	GP-1

File : S:\2017 Projects\SD\2017-0701 Belfountain_Pre Eng FSR_Caledon\400-CADD\401-CAD\402-Design\Sheets\SD2017-0701- GRADING PLAN.dwg, Date :Mar 02, 2018 – 4:03pm,



COLE ENGINEERING
70 VALLEYWOOD DR., MARKHAM, ON L3R 4T5
T:416.987.6161 / 905.940.6161 F:905.940.2064

LEGEND

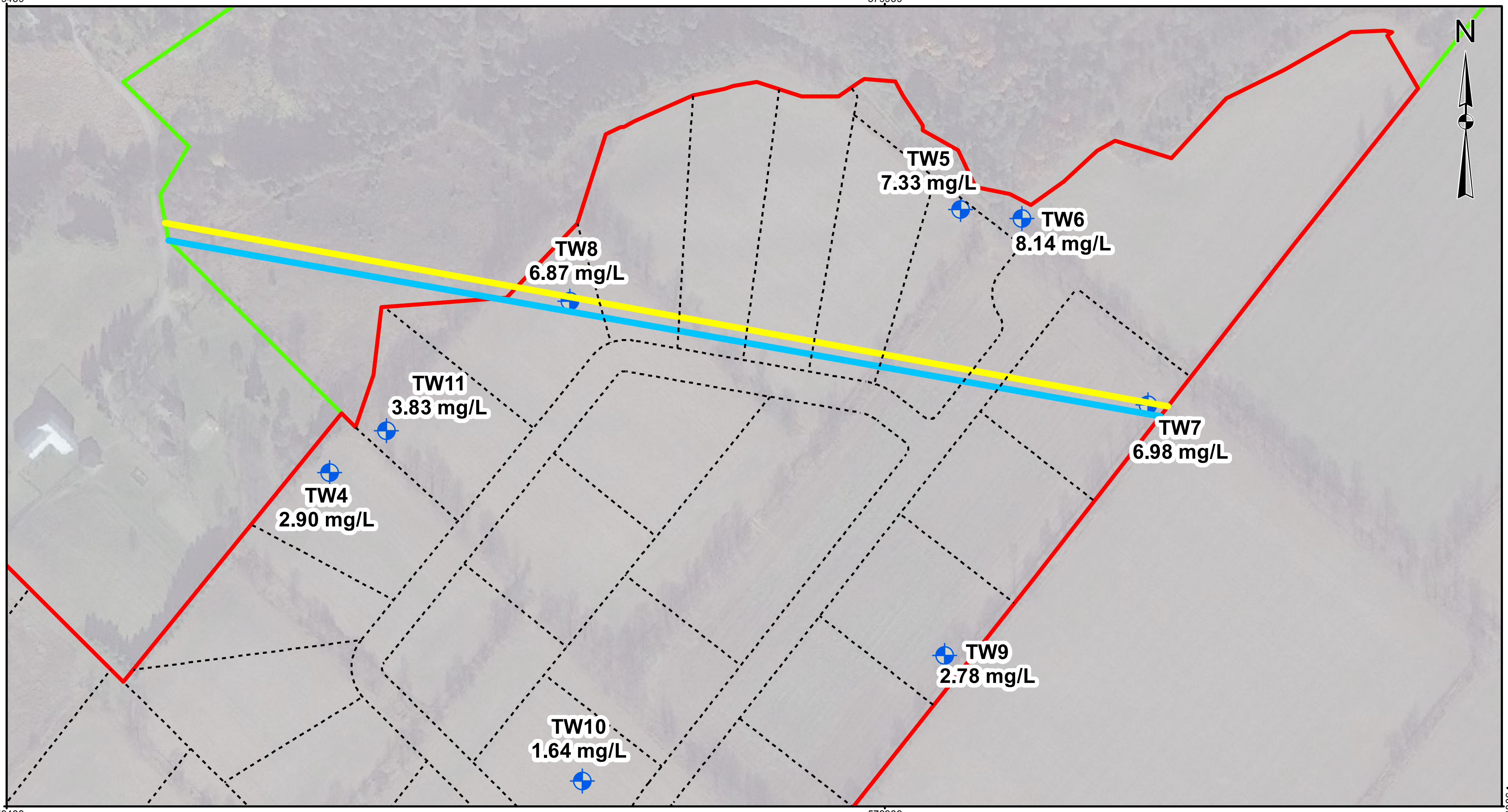
- W ● WELL
- ⊗ RELOCATED STORM WATER INFILTRATION DRY WELL
- ⊡ PERCHED DITCH INLET FOR EXCESS STORMWATER
- ▭ CULVERT

LOCATION PLAN

THE MANORS OF BELFOUNTIAN CORP.
TOWN OF CALEDON, REGIONAL MUNICIPALITY OF PEEL
WELL LOCATION FROM HIGHER NITRATE LINE

DATE:	JANUARY 2018	PROJECT No.:	2017-0701
SCALE:	N.T.S.	FIGURE No.:	GP-2

579439 579939



579439 579939 4848864

COORDINATES: UTM NAD 1983 CSRS ZONE 17.

LEGEND

- Site - Development Area
- Site - Open Space Area
- Lot Layouts
- Monitoring Wells
- Line of Higher Nitrate Concentrations
- 7 m Setback Line

REFERENCE

Service Layer Credits: © OpenStreetMap (and) contributors, CC-BY-SA

SCALE 1:3,350

30 0 30 60 90 120 Meters

PROJECT

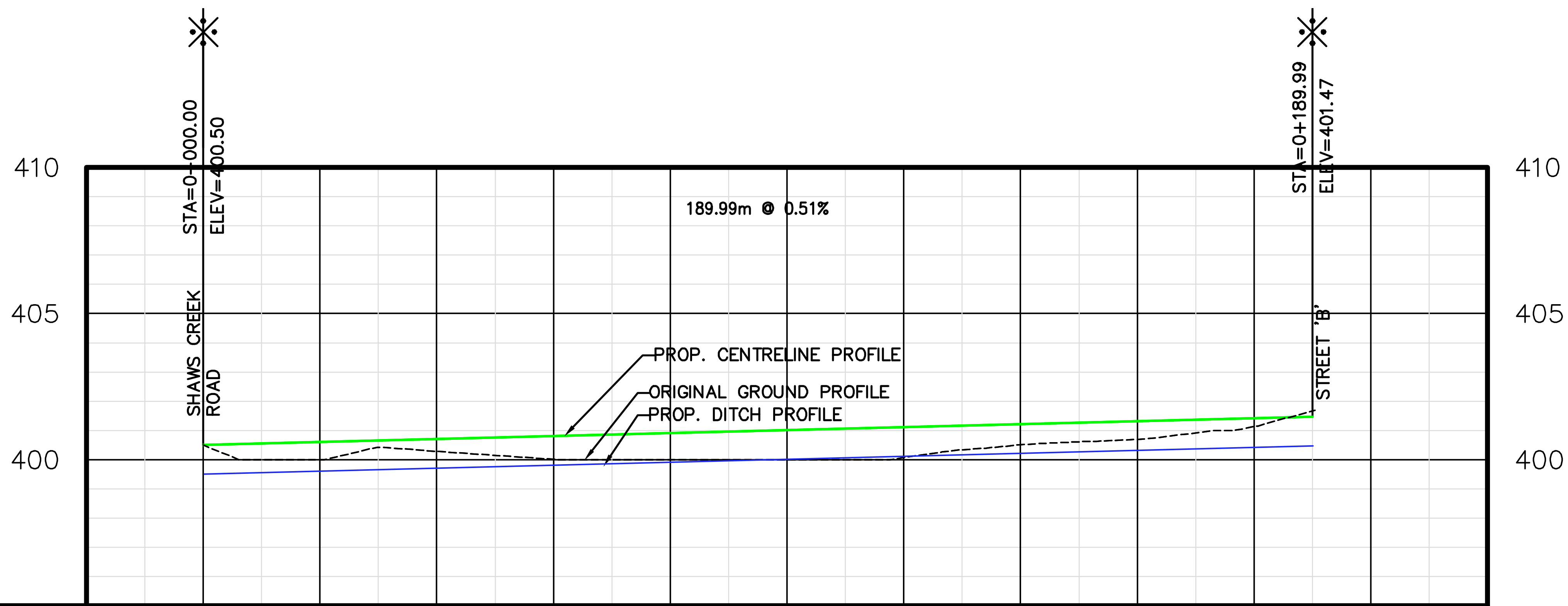
Hydrogeological Investigation
Manors of Belfountain
Caledon, ON

TITLE

Line of Higher Nitrate Concentrations

COLE ENGINEERING
Experience Enhancing Excellence

DATE:	10/18/2017		PROJECT: 2017-0646
GIS	C.C.	12/14/2017	REV. 0.0
DESIGN			**FIGURE 14**
CHECK	D.B.	12/14/2017	



PROPOSED C/L ROAD		400.50	400.60	400.70	400.81	400.91	401.01	401.11	401.22	401.32	401.42		
EXISTING C/L ROAD		*400.50*	*400.00*	*400.29*	*400.01*	*400.00*	*400.00*	*400.07*	*400.51*	*400.69*	*401.13*		
STATIONS	0+020	0+000	0+020	0+040	0+060	0+080	0+100	0+120	0+140	0+160	0+180	0+200	0+220

COLE ENGINEERING

70 VALLEYWOOD DRIVE, MARKHAM, ON L3R 4T5
T:416.987.6161 / 905.940.6161 F:905.940.2064

LEGEND

PROPOSED CENTRELINE PROFILE

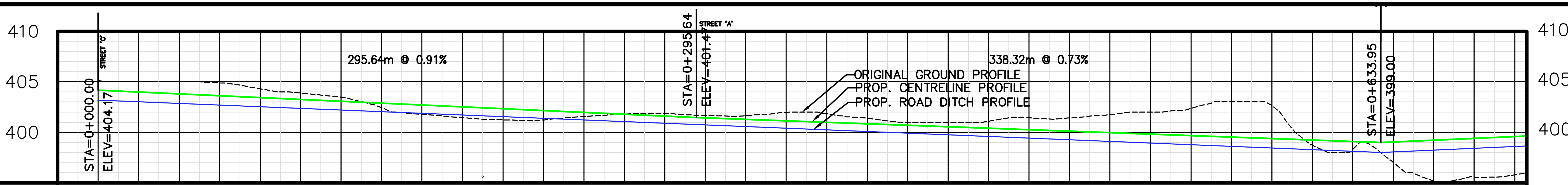
ORIGINAL GROUND PROFILE

PROPOSED DITCH PROFILE

THE MANORS OF BELFOUNTAIN CORP.
TOWN OF CALEDON
REGIONAL MUNICIPALITY OF PEEL
PROFILE
STREET 'A'

DATE:	JANUARY 2018	PROJECT No.:	SD17-0701
SCALE:	H 1:1000 , V 1:100	FIGURE No.: PP-A	

File : S:\2017 Projects\SD\2017-0701 Belfountain_Pre Eng FSR_Caledon\400-CADD\401-CAD\402-Design\Sheets\SD2017-0701- PP STREET A,B,C,D.dwg, Date :Mar 01, 2018 - 11:53am,



STATIONS	PROPOSED C/L ROAD	EXISTING C/L ROAD
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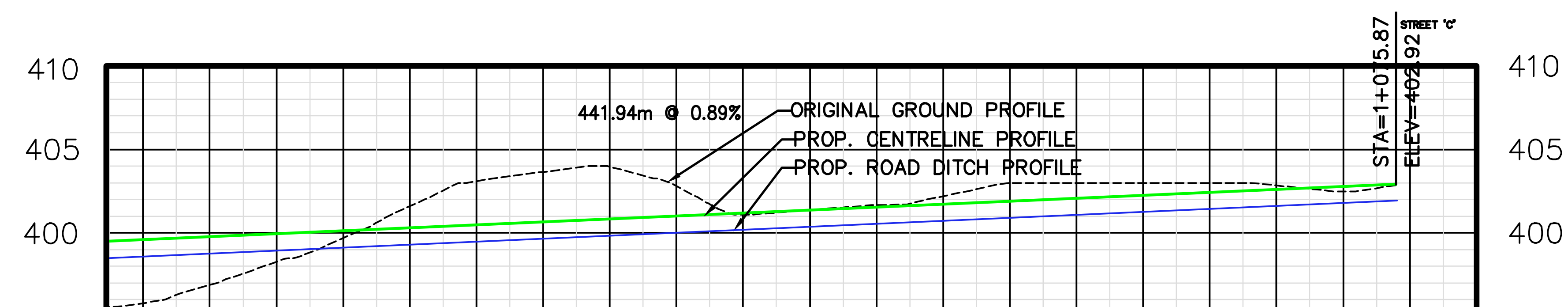
0+020	403.99	405.00
0+040	403.81	405.00
0+060	403.62	404.89
0+080	403.44	404.30
0+100	403.26	403.88
0+120	403.07	403.48
0+140	402.89	402.44
0+160	402.71	401.78
0+180	402.53	401.45
0+200	402.34	401.24
0+220	402.16	401.23
0+240	401.98	401.57
0+260	401.80	401.79
0+280	401.61	401.85
0+300	401.44	401.65
0+320	401.29	401.64
0+340	401.15	401.98
0+360	401.00	401.84
0+380	400.85	401.40
0+400	400.71	401.00
0+420	400.56	401.00
0+440	400.42	401.10
0+460	400.27	401.44
0+480	400.12	401.42
0+500	399.98	401.76
0+520	399.83	402.00
0+540	399.69	402.36
0+560	399.54	403.00
0+580	399.39	402.64
0+600	399.25	398.73
0+620	399.10	398.32
0+640	399.05	397.01
0+660	399.23	395.18
0+680	399.41	395.58
0+700	399.59	395.80



STATIONS	PROPOSED C/L ROAD	EXISTING C/L ROAD
0+700	399.59	395.80
0+720	399.76	396.88
0+740	399.94	398.27
0+760	400.12	399.70
0+780	400.30	401.62
0+800	400.47	403.10
0+820	400.65	403.65
0+840	400.83	403.97
0+860	401.01	402.79
0+880	401.18	401.09
0+900	401.36	401.38
0+920	401.54	401.66
0+940	401.72	402.20
0+960	401.89	402.98
0+980	402.07	403.00
1+000	402.25	403.00
1+020	402.43	403.00
1+040	402.60	402.84
1+060	402.78	402.48
1+080		
1+100		

SCALE: NTS

COLE ENGINEERING
70 VALLEYWOOD DRIVE, MARKHAM, ON L3R 4T5
T:416.987.6161 / 905.940.6161 F:905.940.2064

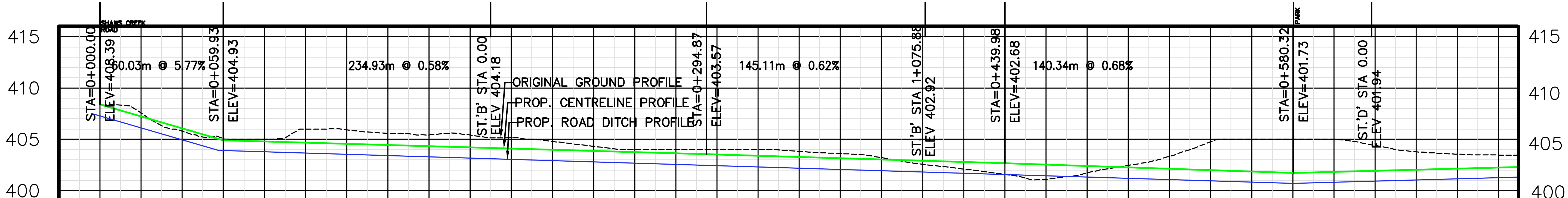
LEGEND

- PROPOSED CENTRELINE PROFILE
- ORIGINAL GROUND PROFILE
- PROPOSED ROAD DITCH PROFILE

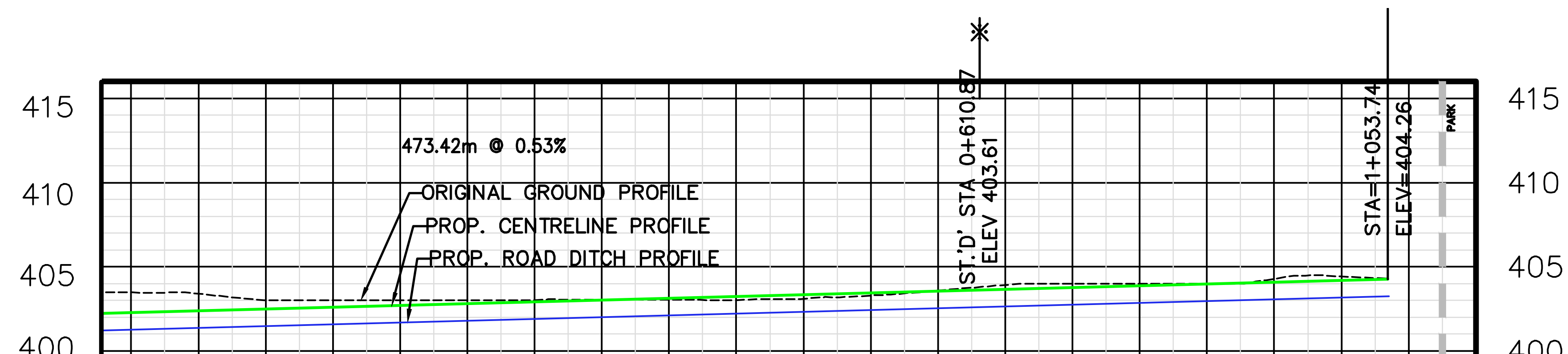
THE MANORS OF BELFOUNTAIN CORP.
TOWN OF CALEDON
REGIONAL MUNICIPALITY OF PEEL
PROFILE
STREET 'B'

DATE:	JANUARY 2018	PROJECT No.:	SD17-0701
SCALE:	H 1:2000 , V 1:200	FIGURE No.: PP-B	

File : S:\2017 Projects\SD\2017-0701 Belfountain_Pre Eng FSR_Caledon\400-CADD\401-CAD\402-Design\Sheets\SD2017-0701- PP STREET A,B,C,D.dwg, Date :Mar 01, 2018 - 11:53am,



PROPOSED C/L ROAD	408.39	407.23	406.08	404.93	404.81	404.70	404.58	404.47	404.35	404.24	404.12	404.00	403.89	403.77	403.66	403.54	403.42	403.29	403.17	403.05	402.92	402.80	402.68	402.54	402.41	402.27	402.14	402.00	401.87	401.73	401.83	401.94	402.05	402.15	402.26
EXISTING C/L ROAD	408.39	407.57	405.79	405.06	405.00	406.00	405.93	405.60	405.42	405.42	405.17	404.80	404.32	404.00	404.00	404.00	404.00	403.82	403.62	403.21	402.56	402.09	401.59	401.12	401.73	402.46	403.34	404.76	405.00	405.00	405.00	404.41	403.78	403.56	403.47
STATIONS 0+020	0+000	0+020	0+040	0+060	0+080	0+100	0+120	0+140	0+160	0+180	0+200	0+220	0+240	0+260	0+280	0+300	0+320	0+340	0+360	0+380	0+400	0+420	0+440	0+460	0+480	0+500	0+520	0+540	0+560	0+580	0+600	0+620	0+640	0+660	0+680



PROPOSED C/L ROAD	402.26	402.37	402.47	402.58	402.69	402.79	402.90	403.01	403.12	403.22	403.33	403.44	403.54	403.65	403.76	403.86	403.97	404.08	404.18		
EXISTING C/L ROAD	403.47	403.39	403.00	403.00	403.00	403.00	403.01	403.05	403.04	403.02	403.09	403.29	403.59	403.92	404.00	404.00	404.00	404.28	404.43		
STATIONS	0+680	0+700	0+720	0+740	0+760	0+780	0+800	0+820	0+840	0+860	0+880	0+900	0+920	0+940	0+960	0+980	1+000	1+020	1+040	1+060	1+080

COLE ENGINEERING
70 VALLEYWOOD DRIVE, MARKHAM, ON L3R 4T5
T:416.987.6161 / 905.940.6161 F:905.940.2064

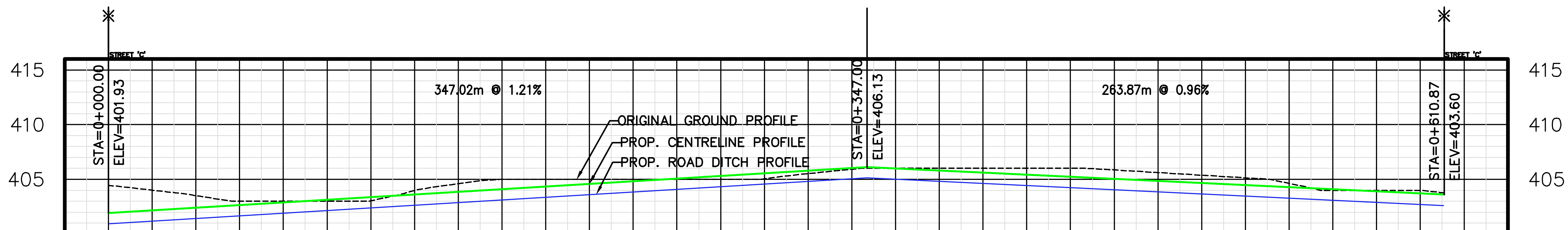
LEGEND

PROPOSED CENTRELINE PROFILE
ORIGINAL GROUND PROFILE
PROPOSED ROAD DITCH PROFILE

THE MANORS OF BELFOUNTAIN CORP.
TOWN OF CALEDON
REGIONAL MUNICIPALITY OF PEEL
PROFILE
STREET 'C'

DATE:	JANUARY 2018	PROJECT No.:	SD17-0701
SCALE:	H 1:2000 , V 1:200	FIGURE No.: PP-C	

File : S:\2017 Projects\SD\2017-0701 Belfountain_Pre Eng FSR_Caledon\400-CADD\401-CAD\402-Design\Sheets\SD2017-0701- PP STREET A,B,C,D.dwg, Date :Mar 01, 2018 - 11:54am,



PROPOSED C/L ROAD		401.93	402.17	402.42	402.66	402.90	403.14	403.38	403.63	403.87	404.11	404.35	404.60	404.84	405.08	405.32	405.56	405.81	406.05	406.01	405.82	405.62	405.43	405.24	405.05	404.85	404.66	404.47	404.28	404.09	403.89	403.70		
EXISTING C/L ROAD		*404.46*	*404.01*	*403.51*	*403.00*	*403.00*	*403.00*	*403.03*	*403.99*	*404.60*	*405.00*	*405.00*	*405.00*	*405.00*	*405.00*	*405.00*	*405.05*	*405.53*	*405.92*	*406.00*	*406.00*	*406.00*	*406.00*	*406.00*	*405.85*	*405.62*	*405.38*	*405.14*	*404.63*	*404.00*	*404.00*	*404.00*		
STATIONS	0+020	0+000	0+020	0+040	0+060	0+080	0+100	0+120	0+140	0+160	0+180	0+200	0+220	0+240	0+260	0+280	0+300	0+320	0+340	0+360	0+380	0+400	0+420	0+440	0+460	0+480	0+500	0+520	0+540	0+560	0+580	0+600	0+620	0+640

COLE ENGINEERING
70 VALLEYWOOD DRIVE, MARKHAM, ON L3R 4T5
T:416.987.6161 / 905.940.6161 F:905.940.2064

LEGEND

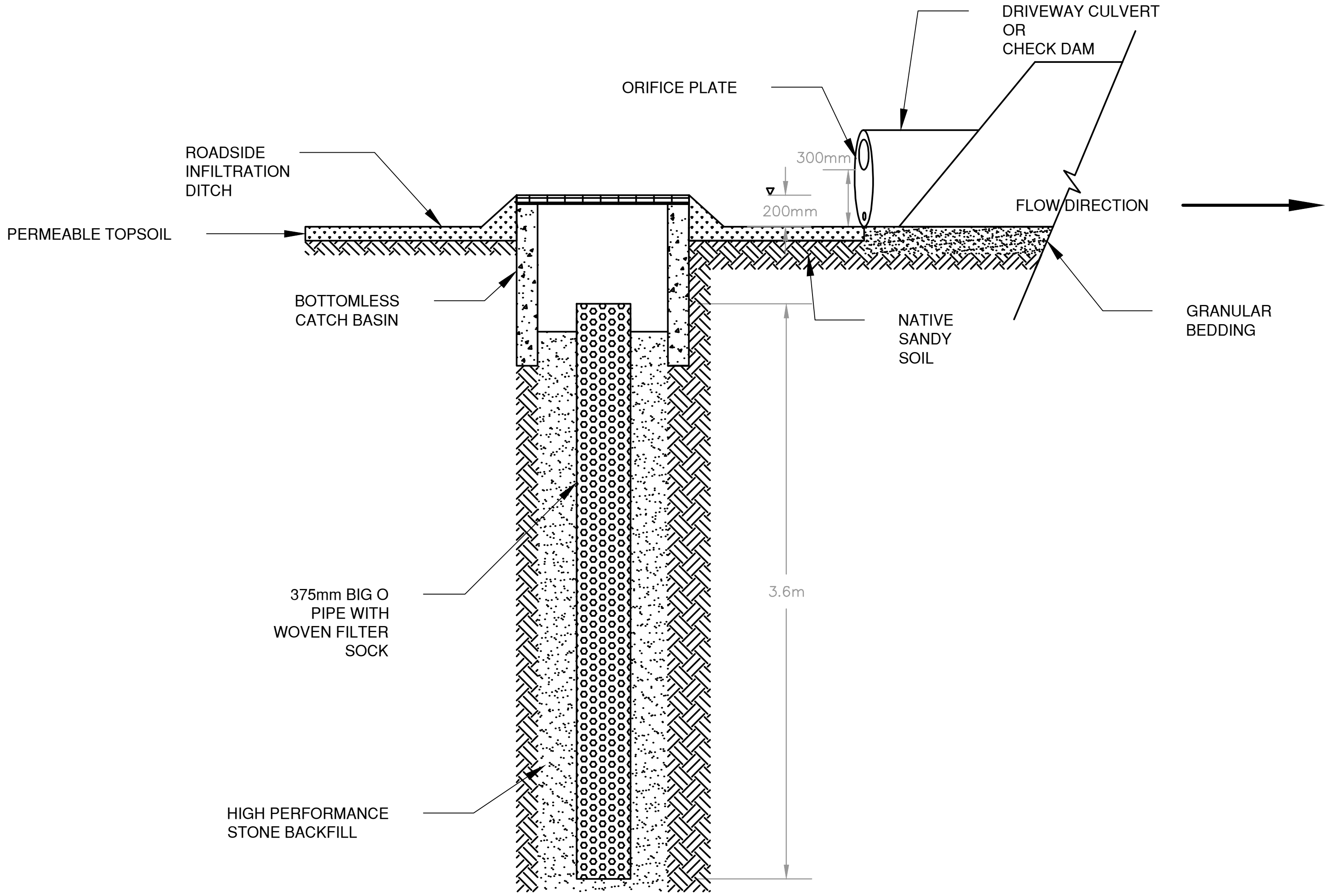
- PROPOSED CENTRELINE PROFILE (solid green line)
- ORIGINAL GROUND PROFILE (dashed line)
- PROPOSED ROAD DITCH PROFILE (solid blue line)

THE MANORS OF BELFOUNTAIN CORP.
TOWN OF CALEDON
REGIONAL MUNICIPALITY OF PEEL
PROFILE
STREET 'D'

DATE:	JANUARY 2018	PROJECT No.:	SD17-0701
SCALE:	H 1:2000 , V 1:200	FIGURE No.: PP-D	

File : S:\2017 Projects\SD\2017-0701 Belfountain_Pre Eng FSR_Caledon\400-CADD\401-CAD\402-Design\Sheets\SD2017-0701- PP STREET A,B,C,D.dwg, Date :Mar 01, 2018 - 11:54am,

APPENDIX B
Dry Well Details



STORMWATER INFILTRATION DRY WELL

COLE ENGINEERING
70 Valleywood Drive, Markham, ON Canada L3R 4T5
T:416.987.6161 / 905.940.6161 F:905.940.2064

THE MANORS OF BELFOUNTAIN CORP.
TOWN OF CALEDON
REGIONAL MUNICIPALITY OF PEEL

DATE:	FEBRUARY 2018	PROJECT No.:	2017-0701
SCALE:	N.T.S.	FIGURE No.:	DET-2

S:\2017 PROJECTS\SD\2017-0701 BELFOUNTAIN_PRE ENG FSR_CALEDON\400-CADD\401-CAD\402-DESIGN\SHEETS\2017-0701_FSR_DRYWELL.DWG

Memorandum

DATE:	January 18, 2018
TO:	Kevin Bobechko
FROM:	Alireza Hejazi, Ph.D., P.Eng.
CC:	Steve Davies, M.Sc., P.Geo.
OUR REF.#:	2017-0646
SUBJECT:	Infiltration Rates from Dry Wells – Manors of Belfountain

1.0 Background

It is understood that the Manors of Belfountain Corporation plans to develop a residential subdivision at part of Lot 9, Concession 5 in Caledon, ON. The development will include 67 rural estate lots with an average lot size of 0.63 ha. Water supply will be provided by private wells and waste water servicing will be provided by individual septic systems with tertiary (Level IV) treatment.

It is also our understanding that dry wells are proposed to promote infiltration of runoff and thereby avoid an increase in stormwater runoff from the proposed development. A dry well is a subsurface storage facility that receives and temporarily stores stormwater runoff from roofs of structures. Discharge of the stored runoff from a dry well occurs through infiltration into the surrounding soils.

In order to support the feasibility of the dry well infiltration measures, the following documents were reviewed:

- COLE 2018, Hydrogeological Investigation Report;
- EXP Canada Inc., 2017. Geotechnical Investigation, proposed Residential Subdivision Part of East Half and West Half Lot 9, Concession 5, W.H.S, Belfountain, Caledon, Ontario; and,
- Terraprobe Limited, 1990. Hydrogeological Investigation, Proposed Residential Subdivision Part Lot 9 Concession 5 WHS, Town of Caledon (Belfountain), Region of Peel.

Based on a review of the borehole logs available for the site, the overburden material at the site generally consists of coarse sand and gravel or glacial till soils. Sedimentary bedrock, comprising dolostone and shale, are found beneath the unconsolidated overburden material.

Conditions at the site generally favor infiltration of runoff. The groundwater levels across the site are relatively deep and generally above the bedrock surface. As noted above, the overburden materials over most of the Belfountain site consist of relatively permeable materials. Based on testing completed by R.J. Burnside, infiltration rates for the overburden materials at the site range from 420 mm/hr to 29 mm/hr with an average of approximately 152 mm/hr (Cole, 2018).

COLE ENGINEERING GROUP LTD.
HEAD OFFICE
70 Valleywood Drive
Markham, ON CANADA L3R 4T5
T. 905.940.6161 | 416.987.6161 F. 905.940.2064
www.ColeEngineering.ca

This memorandum is intended to provide the preliminary range of potential infiltration rates from dry wells at the site.

2.0 Hydraulic Conductivity

Grain size distribution analyses were conducted by Terraprobe and EXP (Terraprobe, 1990 and EXP, 2017) for samples collected from the boreholes located on-site. These results were used to estimate the in-situ hydraulic conductivity (K) of the screened overburden materials.

The K values were estimated using the Carman-Kozeny method. The Carman-Kozeny formula is a method developed to estimate the hydraulic conductivity of soils based on the soil particle size distribution (grain size analysis). The Carman-Kozeny formula is a semi-empirical, semi-theoretical method that relies on the entire particle size distribution, the particle shape and the void ratio. The general equation is shown below:

$$k = 1.99 \times 10^4 \left(100\% / \left[\sum_{i=0}^{n} \left[f_{i/(D_{li}^{0.404} \times D_{si}^{0.595})}\right]\right]\right)^2 (1/SF^2) \times [e^3/(1+e)]$$

Where:
f_i = the fraction of particles between two sieve sizes; larger (l) and smaller (s) (%)
SF = a shape factor to account for angularity in soil particles rather than a theoretical perfect sphere
e = the void ratio of the soils

The following assumptions apply to this equation:

- The calculated hydraulic conductivity is based on the viscosity of water at 20° C.
- Shape factors are as follows: spherical – 6.0, rounded – 6.1, worn – 6.4, rounded – 6.6, medium angularity – 7.5, and angular – 8.4.

The formula does not accurately calculate the hydraulic conductivity in coarse gravels, or extremely fine clay particles with a long “tail” at the end of the soil distribution.

The mean K value obtained from the grain size distribution is 3.9 x 10^{-4} m/s. The K values are considered representative of the sand and gravel material. Results from the K estimation analysis are summarized in **Table 1**. The location of boreholes are shown on **Figure 1**.

Table 2 Estimated Hydraulic Conductivity – Carman Kozeny Method

Well / Borehole ID	Depth (mbgs)	K (m/s)
BH1	2.3 to 2.9	1E-04
BH1	6.1 to 6.7	2.7E-04
BH2	4.5 to 6	2.1E-04
BH2	1.5 to 2	1.1E-03
BH3	1.5 to 2	9.4E-04
BH3	4.6 to 5.2	6.4E-04
BH105	-	2.1E-04
BH107	-	7.1E-04
	Geomean	**3.9E-04**

3.0 Steady-State Infiltration Rates

The U.S. Bureau of Reclamation (USBR) solution was used to estimate infiltration rates from dry wells. The USBR solution was developed specifically for open boreholes located above the water table.

The USBR solution is:

$$Q = \frac{2\pi K H^2}{ln\left[\frac{H}{r} + \sqrt{1 + \left(\frac{H}{r}\right)^2}\right] - \frac{\sqrt{1 + \left(\frac{H}{r}\right)^2}}{\frac{H}{r}} + \frac{1}{\frac{H}{r}}}$$

Where Q is the discharge rate, K is the saturated hydraulic conductivity value, H is the height of water in the borehole, and r is the radius of the borehole.

The groundwater table at the site ranges between approximately 10 to 15 m below the existing ground surface and therefore the water table is considered to be quite deep, which is suitable for use of the USBR solution (Massmann, 2014 –attached). This solution allows infiltration estimates to be developed as a function of the height of water in the dry well. The estimated infiltration rates from a 12 ft (3.6 m) dry well are summarized in **Table 2**.

Table 2 Estimated Infiltration Rate from Dry Well

Radius of the Borehole		Hydraulic Conductivity beneath the facility	Infiltration Rate from Dry Well	
(ft)	(mm)	(m/s)	cfs	L/s
0.5	152.4	1E-03	1.03	28.9
0.5	152.4	1E-04	0.1	2.85
1	304.8	1E-03	1.33	37.3
1	304.8	1E-04	0.13	3.67
2	609.6	1E-03	1.83	51.3
2	609.6	1E-04	0.18	5.05
3	914.4	1E-03	2.29	64.2
3	914.4	1E-04	0.22	6.3

The results show that infiltration rates are linearly-dependent upon hydraulic conductivity and the flows are directly proportional to the hydraulic conductivity values.

It should be noted that the USBR solution allows infiltration estimates to be developed as a function of the height of water in the dry well and the estimated infiltration rates represent the maximum values that would result when the dry well is completely filled with water.

4.0 Uncertainty Discussion

The USBR solution is sensitive to changes in the input variables such as hydraulic conductivity. Therefore, uncertainties in these values can present large variations in the infiltration rates results. The hydraulic conductivity values were estimated from grain size information using Carman-Kozeny equation. This equation and other equations based on grain-size relationships give order of magnitude estimates of hydraulic conductivity.

5.0 Conclusions

Based on the available grain size data and estimate the mean K of the overburden materials, and the depth to water table measurements at the site, dry wells appear to be a potentially effective measure to promote infiltration and maintain groundwater recharge at the site.

As the available data for estimating overburden hydraulic conductivity and infiltration rates at the site are somewhat limited, it is recommended that in-situ infiltration rate testing occur at the proposed locations of infiltration facilities to support detailed design of the site.

6.0 References

Cole Engineering Group Ltd., 2018. Hydrogeological Investigation Report, Manors of Belfountain, Caledon, ON.

Massmann, J. (2004). An Approach for Estimating Infiltration Rates for Stormwater Infiltration Dry Wells, Washington State Department of Transportation, Technical Monitor, Glorilyn Maw.

Terraprobe Limited, 1990. Hydrogeological Investigation, Proposed Residential Subdivision Part Lot 9 Concession 5 WHS, Town of Caledon (Belfountain), Region of Peel.

EXP Canada Inc., 2017. Geotechnical Investigation, proposed Residential Subdivision Part of East Half and West Half Lot 9, Concession 5, W.H.S, Belfountain, Caledon, Ontario.

Final Report
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Task Order AU

AN APPROACH FOR ESTIMATING INFILTRATION RATES FOR STORMWATER INFILTRATION DRY WELLS

by
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Technical Monitor
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Washington State Transportation Commission
Department of Transportation
and in cooperation with
U.S. Department of Transportation
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16. ABSTRACT

This report describes an approach for estimating infiltration rates for dry wells that are constructed using standard configurations developed by the Washington State Department of Transportation. The approach was developed recognizing that the performance of these dry wells depends upon a combination of subsurface geology, groundwater conditions, and dry well geometry. The report focuses on dry wells located in unconsolidated geologic materials.

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TABLE OF CONTENTS

TABLES

FIGURES

1. INTRODUCTION AND OBJECTIVES

This report describes an approach for estimating infiltration rates for dry wells that are constructed using standard configurations developed by the Washington State Department of Transportation. The approach was developed recognizing that the performance of these dry wells depends upon a combination of subsurface geology, groundwater conditions, and dry well geometry. The report focuses on dry wells located in unconsolidated geologic materials.

2. DESCRIPTION OF DRY WELL CONSTRUCTION

Figure 1 is an example of plans for pre-cast concrete dry wells similar to those used by the Washington State Department of Transportation (WSDOT) (G. Maw, WSDOT, unpublished, 2004). The concrete cylinders used to construct the dry wells are placed in excavations that are backfilled with gravel. The dry wells are typically constructed with either one or two sections of seepage ports. The most common construction in Eastern Washington is the "double-barrel" construction in which two concrete sections are used. This is the construction shown on Figure 1. A "single-barrel" construction, which includes only one concrete section, is also used in some instances. Table 1 summarizes the geometry used in this study to describe the double- and single-barrel dry wells.

The excavation used in constructing a dry well can be described as an inverted conical frustrum. The surface area of the sides and bottom of this excavation is given by the following expression (Beyer, 1987):

$$Area = \pi(R_1 + R_2)\sqrt{(R_1 - R_2)^2 + h^2} + \pi R_2^2 \qquad (1)$$

where R_1 is the radius at the ground surface, R_2 is the radius at bottom of the excavation, and h is the depth of the excavation. Surface areas calculated with Equation 1 for single- and double-barrel dry wells are included in Table 1. Table 1 also gives the radius for a right-circular cylinder with bottom and side area equal to the bottom and side area of the inverted conical frustrum. This equivalent radius will be used in subsequent sections with equations that describe flow from boreholes.

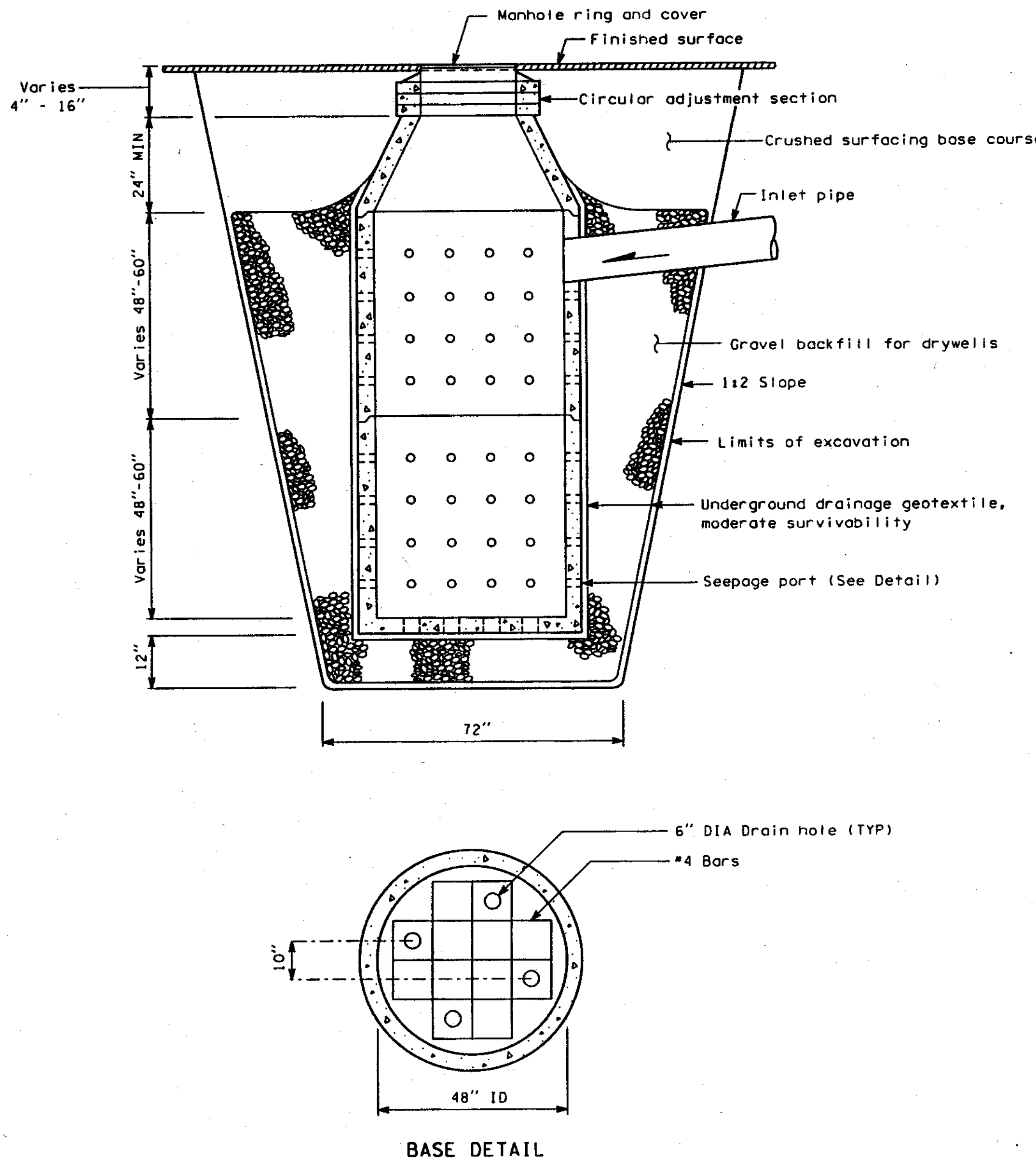

Figure 1. Example of plans for pre-cast concrete dry wells similar to those used by WSDOT (G. Maw, WSDOT, unpublished, 2004).

Table 1. Summary of geometry used to describe double- and single-barrel dry wells.

	Dry well construction	
	Double barrel	Single barrel
Excavation depth (ft)	12	8
Radius of bottom of excavation (ft)	4	3
Radius of top of excavation (ft)	10	8
Surface area of gravel-backfilled section (ft^2)	500	250
Equivalent radius of right circular cylinder (ft)	7.1	5.7

3. FLOW FROM DRY WELLS UNDER TRANSIENT CONDITIONS

Flow from dry wells under transient conditions can be described with the 2-dimensional, saturated-unsaturated, finite-difference model VS2DH 3.0 (Hsieh et al., 2000). This model, which was described in detail by Massmann (2003a), can be used to simulate radial flow systems similar to what would be developed near dry wells. Figure 2 presents example results for a dry well with a double-barrel geometry at a site where the depth to groundwater was 48 feet below the bottom of the dry well, and the saturated hydraulic conductivity was 0.02 feet per minute. (Note that the convention used in this report is to define depth as the distance below the bottom of the dry well and not the depth below the land surface.) The unsaturated soil parameters were defined by using the van Genuchten equation (van Genuchten, 1980). The vertical axis gives infiltration rate in cubic feet per second (cfs), and the horizontal axis is time in minutes. Figure 2 shows the typical response for flow in unsaturated systems where the infiltration rate decreases with time as the wetting front moves downward and eventually reaches a steady-state rate. (The somewhat jagged appearance of the curve during early times is a numerical artifact caused by the grid cells used to discretize the flow field.) For the geometry and soil properties used in the Figure 2 example, the steady-state infiltration rate was approximately 0.45 cfs and occurred after approximately 200 minutes. Note that the early-time infiltration rate was significantly higher than this steady-state value.

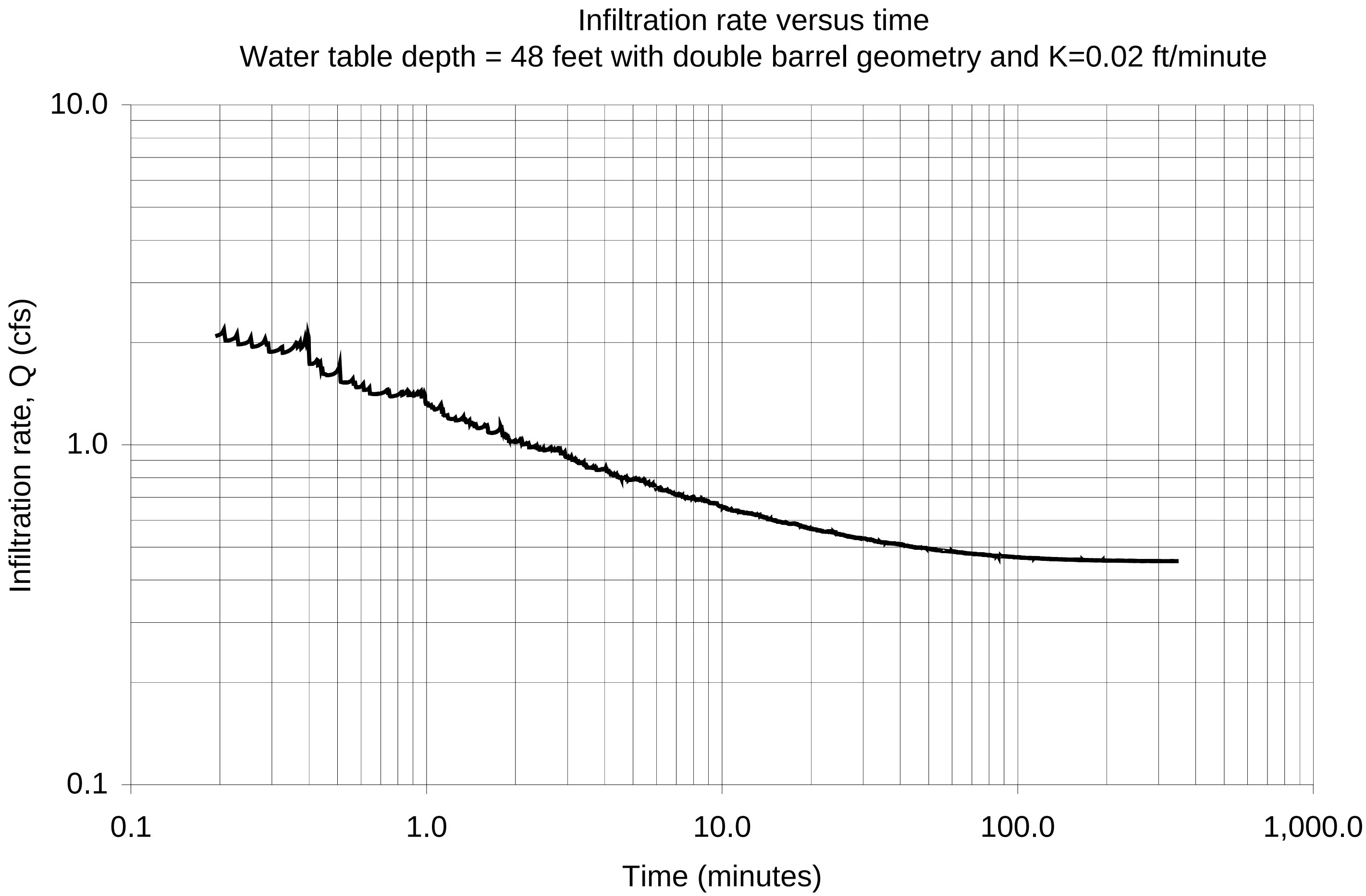

Figure 2. Infiltration rate versus time for a typical dry well with a double-barrel geometry, hydraulic conductivity equal to 0.02 ft/minute, and depth to water 48 feet below the bottom of the dry well.

Figure 3 shows the total volume of water that has been infiltrated as a function of time. This curve was derived by integrating the rate-versus-time curve shown in Figure 2. The curve—plotted on logarithmic scales—is approximately linear. Approximately 1,000 cubic feet of water was infiltrated after 20 minutes, and approximately 10,000 cubic feet was infiltrated after 200 minutes. (As a reference point, the runoff from a one-acre paved site with 1 inch of rainfall is 3,630 cubic feet.)

The results presented in figures 2 and 3 can be combined to develop a relationship between infiltration rate and the volume of water that has been infiltrated. This format for presenting the data is useful for comparing the performances of systems with different hydraulic conductivity values and is used in the design approach described below. Figure 4 shows the infiltration rate versus infiltrated volume for the example dry well. This curve can be approximated with two straight lines on logarithmic scales, as shown in Figure 5. The first line describes the transient portion of the infiltration process and the second horizontal line describes the steady-state infiltration rate. The transient curve can be described by using the following power-law expression:

$$Q = aV^{b} \tag{2}$$

where Q is the infiltration rate in cfs, V is the volume infiltrated in cubic feet, and "a" and "b" are coefficients. For the example shown in Figure 5, the "a" coefficient is equal to 3.8 and the "b" coefficient is equal to –0.29. The second horizontal line describes the steady-state part of the curve and is given by the following expression:

$$Q = c \tag{3}$$

where “c” is the steady-state infiltration rate. This steady-state rate is approximately 0.45 cfs for the example shown in Figure 5.

The point on the horizontal axis (the volume axis) where these two straight lines intersect, V^*, is given by the following equation:

$$V^* = e^{\frac{\ln(c/a)}{b}} \qquad (4)$$

The parameters a, b, c, and V^* will be used to describe the infiltration rate versus volume curves.

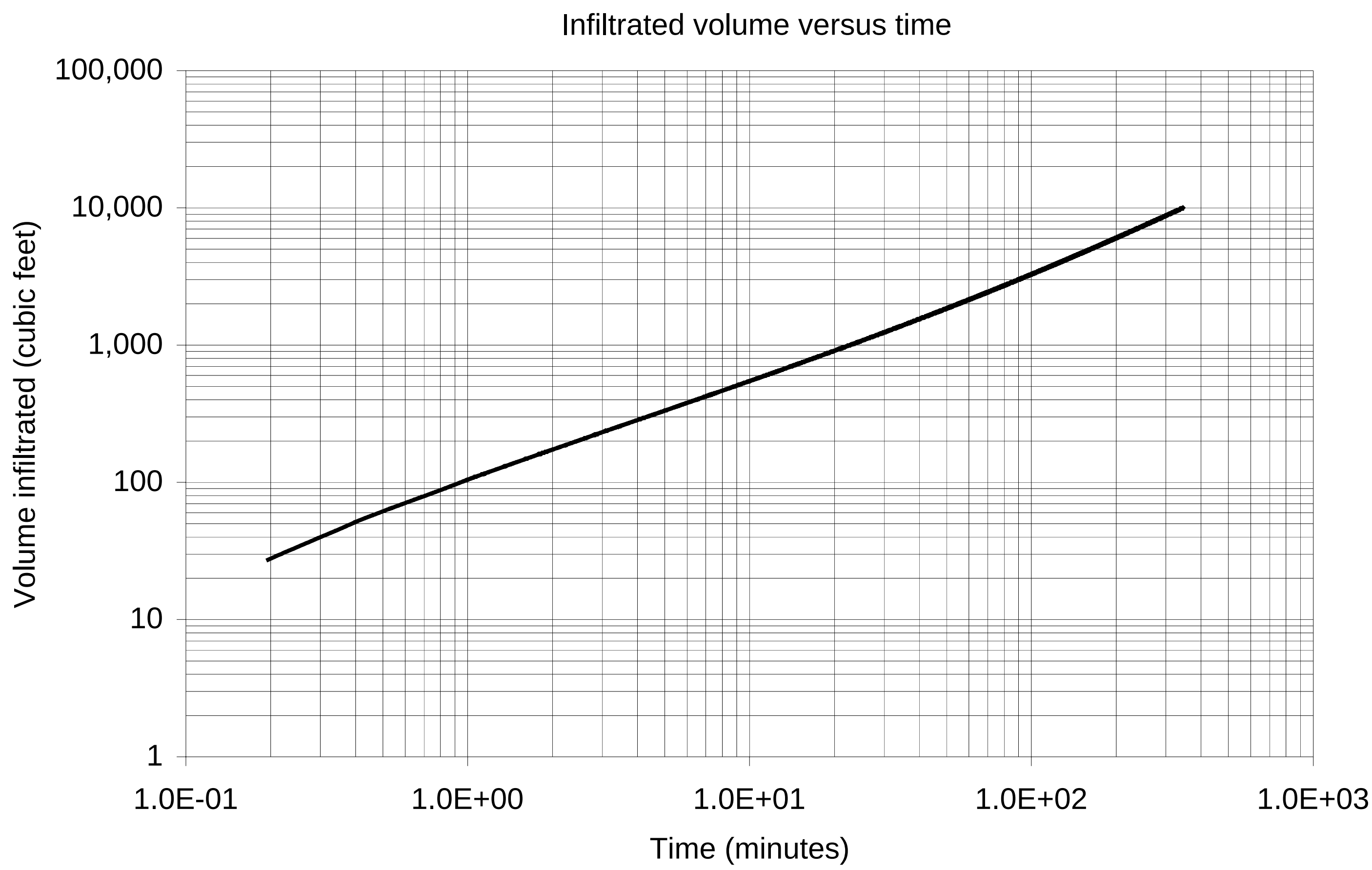

Figure 3. Infiltrated volume versus time for the double-barrel geometry used in Figure 2.

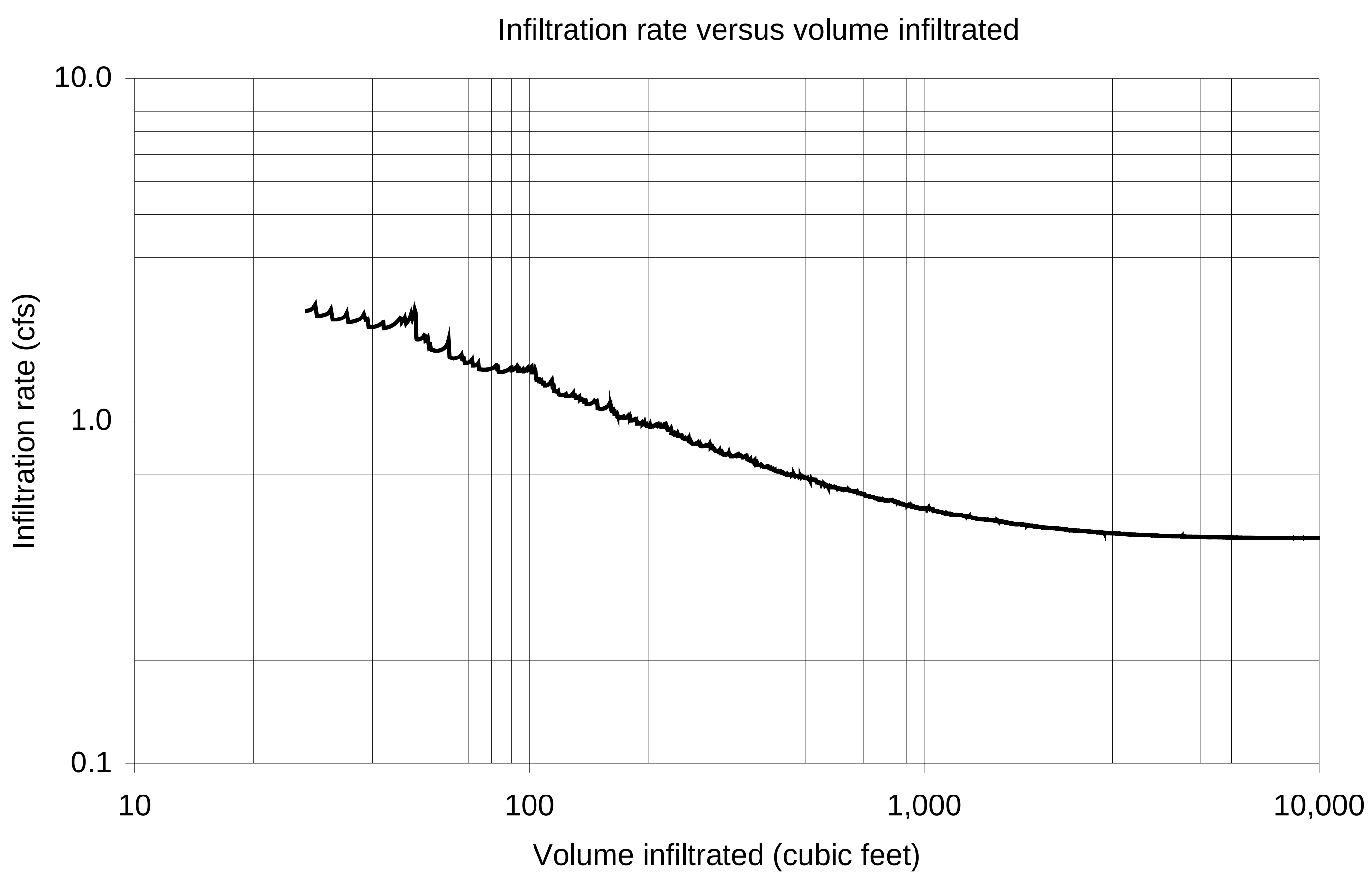

Figure 4. Infiltration rate versus volume infiltrated for the double-barrel geometry used in Figure 2

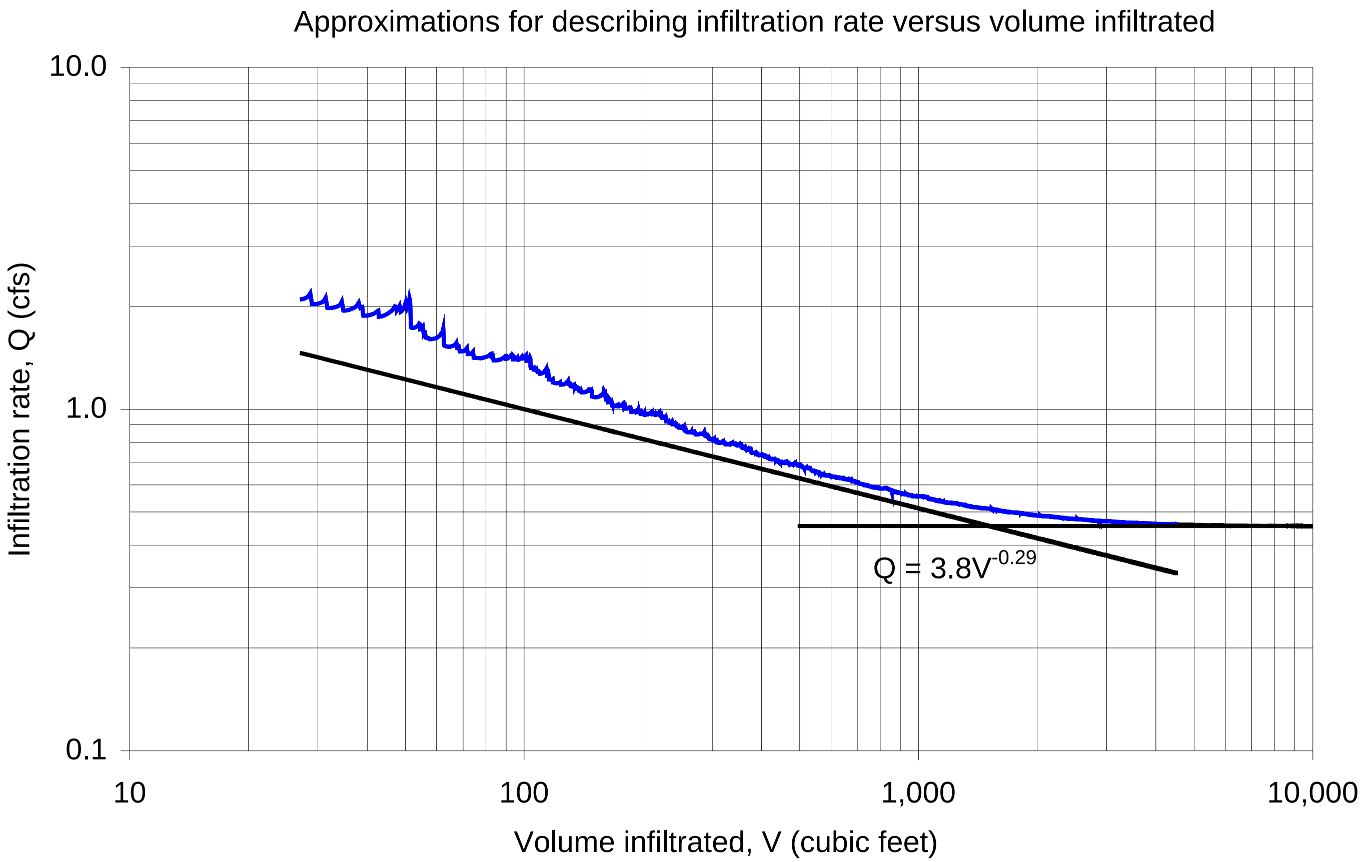

Figure 5. Approximations for describing infiltration rate versus volume infiltrated.

4. INFILTRATION RATES FOR DRY WELLS IN VARIOUS HYDROGEOLOGIC SYSTEMS

The VS2DH 3.0 model referenced above was used to estimate infiltration rates for single- and double-barrel dry wells in various hydrogeologic systems. These hydrogeologic systems were defined in terms of the depth to groundwater and the hydraulic conductivity of the unsaturated or vadose zone. The depth of water below the bottom of the dry well ranged from 3 feet to 48 feet, and the hydraulic conductivity values ranged from 0.005 ft/min to 0.20 ft/min. This range of hydraulic conductivity was selected because it results in discharge rates of between 0.1 to 10 cfs. This covers the range of typical field values. The water level in the dry well was held at a constant level equal to the elevation of the ground surface. The unsaturated hydraulic characteristics were represented by the van Genuchten equation (van Genuchten, 1980):

$$\theta = \frac{\theta_s - \theta_r}{[1 + (\alpha|\psi|)^{\beta}]^{1-\frac{1}{\beta}}} \tag{5}$$

where θ is the volumetric moisture content (dimensionless), θ_r is the residual moisture content (dimensionless), θ_s is the saturated moisture content (dimensionless), ψ is the suction head (L), α is the van Genuchten alpha parameter (L^{-1}), and β is the van Genuchten beta parameter (dimensionless). Table 2 gives values for these parameters. These values were held constant in all simulations. Note that the van Genuchten parameters are included in the report for completeness and full documentation of the computer model used to estimate the infiltration rates. Estimates of steady-state infiltration rates from dry wells are insensitive to these parameters, and these parameters are not required for the design equations that are presented in subsequent sections.

Table 2. Unsaturated soil parameters.

Parameter	Value
Saturated moisture content (θ_s)	0.25
Residual moisture content (θ_r)	0.075
α (ft^{-1})	7.5
α (cm^{-1})	0.25
β (dimensionless)	1.9

Appendix A gives the results of the computer simulations in terms of infiltration rate as a function of volume of water infiltrated. These results are summarized in tables 3 and 4. Table 3 gives steady-state infiltration rates for double-barrel configurations. The power-law coefficients given in Table 3 (a, b, and V^*) were defined in the previous section. The lines used to define these power-law coefficients are included with the results in Appendix A. Steady-state rates and power-law coefficients for single-barrel configurations are included in Table 4.

The combinations of water table depths and hydraulic conductivity values resulted in infiltration rates that ranged from more than 5 cfs to less than 0.1 cfs. The results show that the infiltration rates are linearly proportional to the hydraulic conductivity value if the depth to the water table is fixed (e.g., the infiltration rate for a hydraulic conductivity of 0.2 ft/minute is ten times larger than the infiltration rate for a hydraulic conductivity of 0.02 minute for all simulations).

Table 3. Infiltration rates and regression coefficients for different water table depths for the double-barrel configuration

Depth of water table (ft)	**Hydraulic conductivity beneath facility (ft/min)**	**Steady-state infiltration rate (cfs)**	**Power law coefficients**		
			a	**b**	**V***
3	0.005	0.084	0.44	-0.1903	6014
	0.02	0.32	1.98	-0.2015	8475
	0.05	0.81	5.21	-0.2076	7831
	0.10	1.62	11.2	-0.2173	7316
	0.20	3.24	24.3	-0.2296	6475
8	0.005	0.097	0.49	-0.1808	7774
	0.02	0.39	2.05	-0.1829	8717
	0.05	0.976	5.13	-0.1825	8889
	0.10	1.95	10.7	-0.1829	11025
	0.20	3.89	22.2	-0.1936	8073
28	0.005	0.125	0.52	-0.1722	3937
	0.02	0.50	1.99	-0.1670	3909
	0.05	1.25	4.84	-0.1649	3676
	0.10	2.50	9.25	-0.1582	3905
	0.20	5.00	18.4	-0.1577	3874
48	0.005	0.127	0.52	-0.1770	2876
	0.02	0.51	1.97	-0.1683	3070
	0.05	1.27	4.71	-0.1621	3247
	0.10	2.55	9.30	-0.1602	3219
	0.20	5.10	18.6	-0.1598	3285

Table 4. Infiltration rates and gradient for different water table depths for the single-barrel configuration

Depth of water table (ft)	Hydraulic conductivity beneath facility (ft/min)	Steady-state infiltration rate (cfs)	Power law coefficients		
			a	b	V^*
3	0.005	0.051	0.20	-0.1590	5401
	0.02	0.20	0.81	-0.1619	5650
	0.05	0.51	2.16	-0.1721	4391
	0.10	1.02	4.34	-0.1743	4056
	0.20	2.04	8.91	-0.1780	3953
8	0.005	0.058	0.20	-0.1477	4363
	0.02	0.23	0.81	-0.1502	4367
	0.05	0.59	2.03	-0.1512	3542
	0.10	1.18	4.09	-0.1534	3305
	0.20	2.34	8.02	-0.1509	3508
28	0.005	0.068	0.26	-0.1917	1092
	0.02	0.27	0.94	-0.1736	1321
	0.05	0.68	2.18	-0.1622	1316
	0.10	1.35	4.23	-0.1583	1359
	0.20	2.70	8.10	-0.1509	1452
48	0.005	0.068	0.25	-0.1864	1080
	0.02	0.28	0.88	-0.1650	1033
	0.05	0.69	2.06	-0.1543	1198
	0.10	1.36	3.97	-0.1482	1378
	0.20	2.72	7.80	-0.1455	1395

These results also show that as the depth to the groundwater decreases, the steady-state infiltration rate also decreases. This effect is most pronounced if the depth to the water table is less than 30 feet below the bottom of the dry well. The simulations suggest that if the depth to the groundwater table is greater than 30 feet, the water table has little effect on the steady-state infiltration rate. A comparison of tables 3 and 4 shows that the double barrel rates are between 1.5 and 2 times larger than the single-barrel rates.

The values for V* included in tables 3 and 4 are somewhat counter-intuitive in that simulations on systems with shallow water tables give larger values than simulations on systems with deep water tables. The V* values can be interpreted as the volume of water that must be infiltrated before infiltration rates become steady or nearly constant with time. For shallow water tables, the infiltration rates do not approach steady-state values until a groundwater mound has formed beneath the facility. For deep water tables, the infiltration rates approach steady-state before the groundwater mounds form because the deeper water table allows the wetting front to move deep enough for the gradient to approach 1 (as described in Massmann 2003a).

5. EQUATIONS FOR ESTIMATING STEADY-STATE INFILTRATION RATES

Several analytical solutions are available for estimating the discharge from boreholes. These solutions can be adopted to estimate the infiltration rates from dry wells. The estimates of infiltration rates from the unsaturated flow models described earlier were compared to the estimates derived from three analytical solutions to evaluate the magnitude of error associated with predictions from the more simplified approaches.

The following three analytical solutions were compared: 1) the U.S. Bureau of Reclamation (USBR) solution, 2) the Hvorslev solution for deep flow fields, and 3) the Hvorslev solution for shallow flow fields. All three of these solutions are empirically derived equations that were originally developed to describe flow from boreholes or wells. The USBR solution (Equation 6 below) was described by the U.S. Department of Interior (1990) and was developed specifically for open boreholes (boreholes without well screens or casings) located above the water table. The Hvorslev solutions for deep and shallow flow fields (equations (7) and (8), respectively) were described by Lambe and Whitman (1979) and were developed for well points in saturated systems.

The USBR solution is as follows:

$$Q = \frac{2\pi K H^2}{\ln\left[\frac{H}{r} + \sqrt{1 + \left(\frac{H}{r}\right)^2}\right] - \frac{\sqrt{1 + (H/r)^2}}{H/r} + \frac{1}{H/r}} \qquad (6)$$

where Q is the discharge rate (L^3/t), K is the saturated hydraulic conductivity value (L/t), H is the height of water in the borehole (L), r is the radius of the borehole (L).

The Hvorlsev deep flow field solution is as follows:

$$Q = \frac{2\pi KLH}{\ln\left[\frac{2L}{r} + \sqrt{1 + \left(\frac{2L}{r}\right)^2}\right]} \tag{7}$$

The Hvorslev shallow flow field solution is as follows:

$$Q = \frac{2\pi KLH}{\ln\left[\frac{4L}{r} + \sqrt{1 + \left(\frac{4L}{r}\right)^2}\right]} \tag{8}$$

where Q is the discharge rate (L^3/t), K is the saturated hydraulic conductivity value (L/t), H is the height of water in the well (L), L is the length of the screen portion of the well (L), and r is the radius of the well (L).

The values assigned to the parameters used in the USBR and Hvorslev equations to simulate flow from a dry well are described in Table 5. Table 6 compares the results from the analytical solutions with the estimates from the unsaturated model described above. This comparison is provided for the deep water table (depth to groundwater equal to 48 feet) and the shallow groundwater table (depth to groundwater equal to 3 feet) cases for both double-barrel and single-barrel configurations. For the deep water table case, the USBR and Hvorslev deep flow field solutions both produced results that were relatively close to the values from the unsaturated model. Both solutions were conservative in that they under-estimated the flow relative to the unsaturated model, with the Hvorslev solution giving slightly lower values.

Table 5. Values assigned to the parameters used in the USBR and Hvorlsev equations.

	USBR Solution		**Hvorslev solutions**	
	Double-barrel	**Single-barrel**	**Double-barrel**	**Single-barrel**
L (ft)	Not applicable	Not applicable	8	4
H (ft)	12	8	12	8
r (ft)	7.1	5.7	7.1	5.7

Table 6. Comparison of infiltration rates with unsaturated model and various analytical solutions.

Dry well Geometry	**Hydraulic conductivity beneath facility (ft/min)**	**Steady-state infiltration rate from unsaturated model (cfs)**	**Analytical solutions**		
			USBR solution for bore holes	**Hvorslev deep flow field**	**Hvorslev shallow flow field**
Double Barrel, water table at 3 feet	0.005	0.084	0.10	0.094	0.052
	0.02	0.32	0.42	0.37	0.21
	0.05	0.81	1.04	0.94	0.52
	0.10	1.62	2.08	1.87	1.04
	0.20	3.24	4.16	3.74	2.08
Double Barrel, water table at 48 feet	0.005	0.127	0.10	0.094	0.052
	0.02	0.51	0.42	0.37	0.21
	0.05	1.27	1.04	0.94	0.52
	0.10	2.55	2.08	1.87	1.04
	0.20	5.10	4.16	3.74	2.08
Single Barrel, water table at 3 feet	0.005	0.051	0.065	0.049	0.026
	0.02	0.20	0.26	0.20	0.10
	0.05	0.51	0.65	0.49	0.26
	0.10	1.02	1.29	0.97	0.51
	0.20	2.04	2.58	1.95	1.02
Single Barrel, water table at 48 feet	0.005	0.068	0.065	0.049	0.026
	0.02	0.28	0.26	0.20	0.10
	0.05	0.69	0.65	0.49	0.26
	0.10	1.36	1.29	0.97	0.51
	0.20	2.72	2.58	1.95	1.02

For the shallow water table case, the USBR solution over-estimated flow for both double-barrel and single-barrel configurations. The Hvorslev deep flow field solution overestimated flows for the double barrel configuration but gave reasonably close values for the single-barrel configuration when applied to the shallow water table case. The Hvorlsev shallow flow field solution under-estimated flows for both the single- and double-barrel configurations.

Table 7 gives suggested analytical solutions based on the comparisons included in Table 6. For single-barrel configurations with shallow water tables, both the Hvorslev deep and the Hvorslev shallow solutions underestimate flow relative to the computer simulations. Intermediate values between those calculated with the two Hvorslev solutions may be appropriate in these cases.

Table 7 –Suggested analytical solutions for estimating infiltration from dry wells.

	Deep water table (>35 feet)		**Shallow water table (<35 feet)**	
Solution	**Double-barrel**	**Single-barrel**	**Double-barrel**	**Single-barrel**
USBR	Yes	Yes	No	No
Hvorslev deep	Yes	Yes	No	Yes
Hvorslev shallow	No	No	Yes	Yes

The results of the computer simulations included in tables 3 and 4 can also be used to develop regression equations relating steady-state flow rates to saturated hydraulic conductivity values and the depth to groundwater. The following two regression equations were derived from the results in tables 3 and 4.

Double barrel wells: $Q = K[3.55\ln(D_{wt}) + 12.32]$ (9)

Single barrel wells: $Q = K[1.34\ln(D_{wt}) + 8.81]$ (10)

where Q is the infiltration rate in cfs, K is the saturated hydraulic conductivity value in ft/minute, and D_{wt} is the depth from the bottom of the dry well to groundwater in feet. The regressions given by equations (9) and (10) are shown in Figure 6. Figure 7 shows how these regressions match the data in Tables 3 and 4.

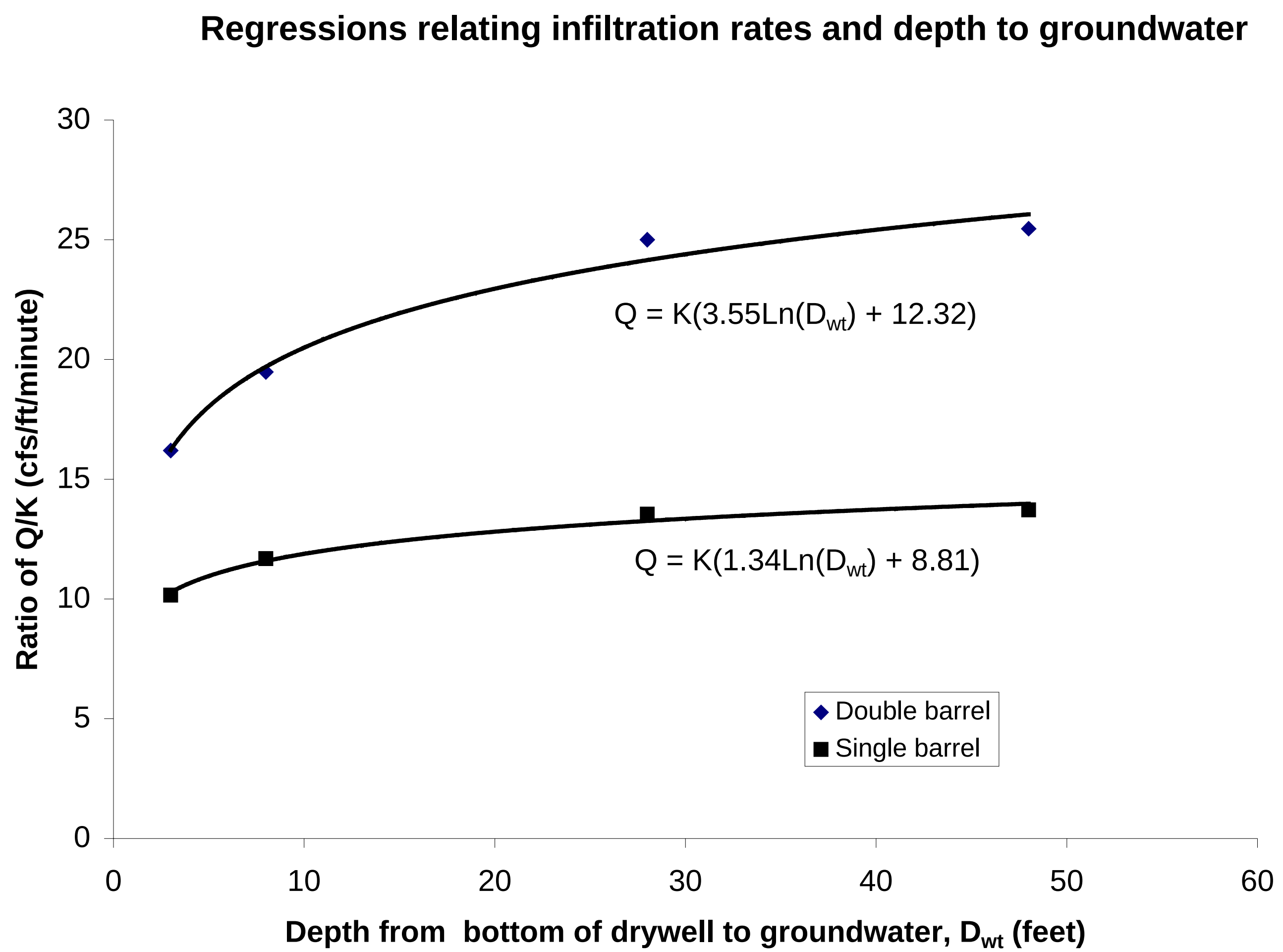

Figure 6. Regressions relating infiltration rates and depth to groundwater measured from below the bottom of the dry well.

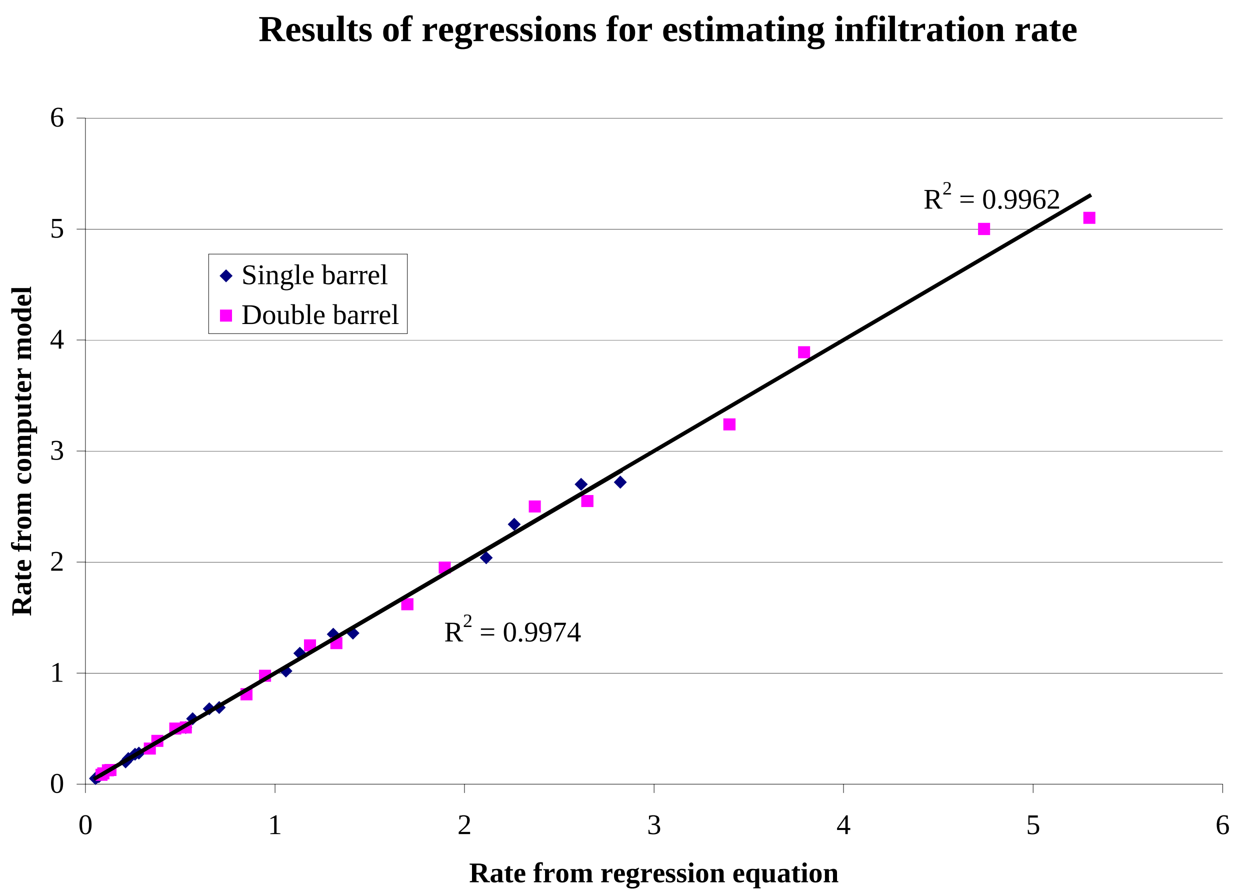

Figure 7. Results of regression equations (9) and (10) for estimating infiltration rates

The estimated infiltration rates given by equations (9) and (10) represent steady-state values. If the maximum volume or design volume of water that must be infiltrated is significantly less than the V^* values included in tables 3 and 4, then the average infiltration rate during the event may be significantly larger than the steady-state values. Using equations (9) and (10) to design dry wells provides a level of conservatism because of the higher infiltration rates that occur during the early transient part of the infiltration event. If the "design" rainfall runoff events are expected to occur only rarely, then it may be reasonable to assume that a significant portion of the water may infiltrate during the transient part of the curves that are shown in figures 2 and 4.

The power-law expressions described in tables 3 and 4 can be used to estimate an infiltration rate for different runoff volumes by using equation 2:

$$Q = aV^b \tag{2}$$

where the coefficients "a" and "b" are given in tables 3 and 4 and the volume of the run, V, is given in cubic feet. The flow rate in Equation (2), Q, is given in cfs. A comparison of this transient infiltration rate to the steady-state rates given by equations (9) and (10) will provide a measure of the conservatism inherent in using the steady-state values.

6. COMPARISONS BETWEEN ESTIMATED AND OBSERVED INFILTRATION RATES FROM DRY WELLS

The results of field measurements of infiltration rates from dry wells in Eastern Washington are included in Appendix B. These data were collected and compiled by GeoEngineers as part of its ongoing project with the City of Spokane (Geoengineers 2004). The data that are included in Appendix B were selected because they represent sites where estimates of hydraulic conductivity were available, as well as measured values of flow rates and water levels in the dry wells. Table 8 summarizes the data in terms of estimated hydraulic conductivity and observed dry well infiltration rates. The hydraulic conductivity estimates included in Table 8 were derived by using the geometric mean of the data that were collected at each site. At sites where only a single estimate for hydraulic conductivity was available, the geometric mean is equal to the observed value.

The relationship between the geometric mean of the hydraulic conductivity and the observed infiltration rate from the dry wells is shown in Figure 8. This figures shows that while the estimated hydraulic conductivity values ranged over approximately 3 orders of magnitude, the observed infiltration rates were in the range of 0.2 to 2 cfs. The apparent insensitivity of the flow rates to the estimated hydraulic conductivity was likely due to spatial variability and measurement error. Most of the hydraulic conductivity values were estimated from grain size information using the Hazen equation (discussed below and described in Massmann 2003b). The Hazen equation and other equations based on grain-size relationships give order-of-magnitude estimates of hydraulic conductivity. These values also represent estimates over relatively small areas or volumes. Infiltration from the dry wells will be dependent upon the hydraulic conductivity over a much larger area or volume. Furthermore, the flow from the dry wells will tend to be controlled by the higher conductivity areas intercepted by the dry well.

Table 8. Summary of results of field-scale dry well infiltration tests (unpublished data provided by J. Harakas, GeoEngineers, 2003)

	Hydraulic conductivity estimates				**Dry well flow rates (cfs)**		
Site	**Grain Size**	**Test Pits**	**Bore hole**	**Geometric mean**	**Observed**	**USBR Equation**	**Relative Error**
NW Tech Park	4	1		8.3E-04	0.568	0.08	86%
Hayford Plaza	4	1		5.9E-03	0.62	1.84	-197%
Shady Slope	3	2		1.3E-03	0.81	0.16	80%
Trickle Creek	1			1.6E-05	0.086	0.01	93%
Summer Crest	2			8.9E-05	0.52	0.04	93%
Midway A	1			1.1E-04	0.03	0.03	-14%
Midway B	1			1.1E-03	0.51	0.96	-87%
Mt. Spokane 1			1	4.6E-04	1.32	0.20	85%
Mt. Spokane 3			1	3.6E-04	1.17	0.15	87%
Westwood N. DW-2	1			2.0E-03	1.5	1.48	2%
Westwood N. DW-3	1			2.9E-03	1.42	1.75	-23%
Westwood N. DW-6	1			1.9E-03	1.11	0.12	89%
Westwood N. DW-7	1			6.1E-04	1.44	1.12	22%
Westwood N. DW-8	1			2.3E-03	0.9	0.92	-3%
Westwood N. DW-9	1			1.3E-04	0.62	0.04	94%
Westwood N. DW-10	1			4.2E-03	0.38	0.76	-100%
Westwood N. DW-12	1			3.4E-04	0.95	0.29	69%
Westwood N. DW-14	1			6.1E-04	0.79	0.54	32%
Westwood N. DW-15	1			6.1E-04	0.74	0.54	27%
Westwood N. DW-20	1			3.8E-05	0.87	0.03	96%
5 Mile Prairie	1			2.3E-03	1.31	1.93	-47%
Dartford	1			6.9E-04	0.28	0.66	-136%
Dartford	1			1.9E-04	0.26	0.07	73%
5 Mile Prairie	1			1.4E-03	0.22	0.84	-283%
5 Mile Prairie	1			4.6E-04	0.27	0.33	-23%
5 Mile Prairie			1	2.3E-05	0.29	0.02	92%
5 Mile Prairie			1	2.3E-04	0.58	0.25	57%

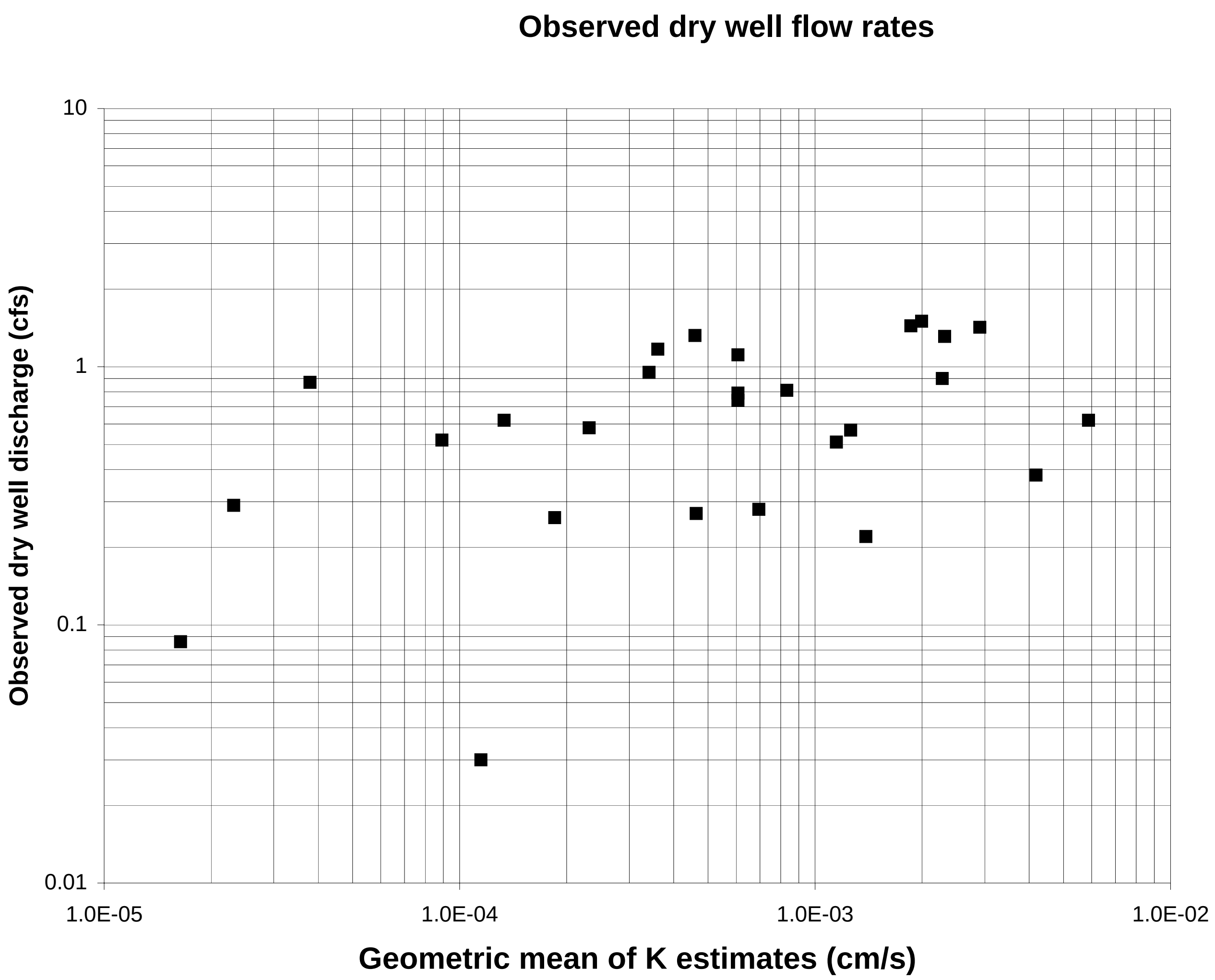

Figure 8. Observed dry well flow rates.

Table 8 also includes estimates of infiltration rates based on the USBR equation described above (Equation 6). A comparison of these estimates with observed flow rates is provided in Figure 9. Equation (6) was used because it allows infiltration estimates to be developed as a function of the height of water in the dry well. In most of the dry well tests described in Table 8 and Appendix B, the dry well was not full. In general, the estimated infiltration rate from the USBR equation was less than the observed rate from the field tests. Again, this difference was likely due to the spatial variability and measurement error in the hydraulic conductivity values. All of the models described earlier (the unsaturated model, the USBR equation, and the two Hvorslev equations) showed that infiltration rates are linearly dependent upon hydraulic conductivity value. The flows should be directly proportional to the hydraulic conductivity values.

Note that the estimates of infiltration rates developed with the computer simulations and included in tables 3 and 4 represent maximum values that would result when the dry well is completely filled with water. This was not the condition for most of the dry well tests described in Appendix B. It is not meaningful to compare the field data with the regression equations because of this difference in assumed and actual water levels. The USBR equation and the computer model or regression equation give very similar estimates for dry wells that are full, as demonstrated from the results included in Table 6. The regressions equations were developed to provide an easy-to-use and convenient approach to estimate the maximum infiltration rates for dry wells. These equations were not developed to evaluate field data.

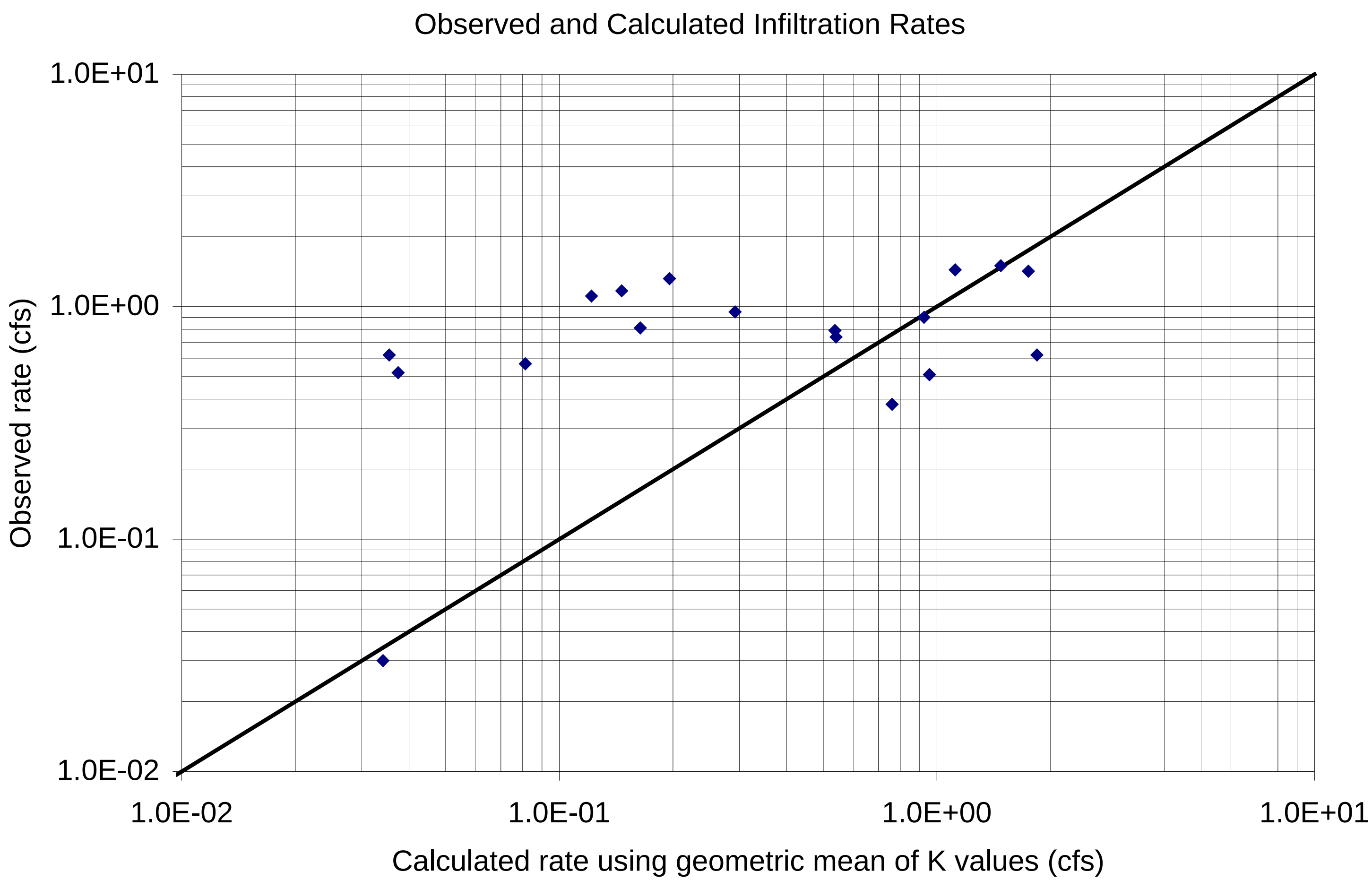

Figure 9. Observed and calculated infiltration rates.

The lack of proportionality in the results included in Figure 9 suggest that the geometric mean of the hydraulic conductivity values from the grain size curves under-estimates the effective hydraulic conductivity for the dry wells. This results in conservative estimates for infiltration from dry wells. Comparisons were also made by using the maximum hydraulic conductivity at each site (rather than the geometric mean included in Table 8). This approach gave a slightly better fit between estimated and observed infiltration rates, but the observed infiltration rates were generally still higher than the estimated rates. (Note that at most of the sites included in Table 8 only a single estimate of hydraulic conductivity was available, and so the geometric mean was the same as the maximum value. In general, geometric mean values will provide more reliable estimates of infiltration rates than maximum values.)

7. ESTIMATING DRAW-DOWN TIMES FOR DRY WELLS

As part of several of the dry well tests summarized in Appendix B, rates of water level declines were monitored after the inflow to the dry wells had been shut off. The results of these "falling-head" tests are described in Table 9. The hydraulic conductivity values given in the second column of Table 9 are based on the steady-state flow rates that were observed during the dry well tests. These values were derived by using the USBR equation (Equation 6) to calculate the hydraulic conductivity corresponding to the observed flow rate and water level during steady conditions. The fourth column in Table 9 gives the height of water in the dry well at the end of the steady-state portion of the test and at the beginning of the falling-head portion of the test. The fifth column gives the observed time for the height of water in the well to decline to a value equal to one-half of the initial, steady-state value. The last two columns give the height of water and the time at the end of the test.

Table 9. Summary of rates for water level declines during dry well infiltration tests (unpublished data provided by J. Harakas, GeoEngineers, 2003)

Site	Hydraulic conductivity (ft/min)	Steady-state flow rate (cfs)	Height of water at beginning of test (ft)	Time for height of water to reduce by one-half (minutes)	Height of water at end of test (ft)	Time for end of test (minutes)
Hayford Plaza	0.29	0.62	4.2	15.0	0.07	149
NW Technology Park	1.46	0.56	0.94	21.5	0.34	38.5
Trickle Creek	0.03	0.09	4.75	64	1.0	142.0
Summer Crest	0.17	0.52	5.5	4.0	0.1	28.0

The data shown in Table 9 show that water level decline occurred relatively quickly in these test wells. These observations are consistent with the rate of water level declines that are predicted with Hvorslev equations for falling head tests in well points (Lambe and Whitman, 1979). The following two equations can be used to estimate the rate of water level declines that correspond to the Hvorslev equations for deep and shallow flow fields (equations (7) and (8)):

$$t_2 - t_1 = \ln\left[\frac{2L}{r} + \sqrt{1 + \left(\frac{2L}{r}\right)^2}\right]\frac{r^2}{2LK}\ln\left(\frac{H_1}{H_2}\right) \quad (11)$$

where K is the saturated hydraulic conductivity value (L/t), H_1 and H_2 are the height of water in the well (L) at times t_1 and t_2, L is the length of the screen portion of the well (L), and r is the radius of the well (L). Although this equation was developed for saturated systems, the comparisons between the Hvorslev equation and the unsaturated model described earlier suggest that it will provide reasonable estimates for dry well performance. Table 10 gives the times required for the height of water in the dry wells to fall to 1 percent of their steady-state values for the double-barrel configuration. Although the Hvorslev equation was developed for well points in saturated systems, the results in Table 10 suggest that dry wells with infiltration rates in the range of 0.1 to 1 cfs will likely drain within the 72-hour (4,320-minute) period that is recommended or required by some regulatory agencies.

Table 10. Time required for the height of water to fall to 1% of their steady-state values for the double-barrel configuration.

K (ft/min)	Steady-state infiltration rate from Equation 7 (cfs)	Time for H_2/H_1=0.01from Equation 11 (minutes)
0.005	0.1	3900
0.02	0.4	1000
0.05	1	400
0.1	2	200
0.2	4	100

The times for water level declines given in tables 9 and 10 reflect the time for the water to drain from the dry wells. It is important to recognize that groundwater mounds that form beneath dry wells will likely take much longer to dissipate—perhaps on the order of weeks or months, depending upon the volume of water that was infiltrated and site-specific hydrogeological characteristics. An infiltration event that begins before the groundwater mound has fully dissipated will cause steady-state conditions to be achieved more quickly than the case with no initial mound or mound remnant. Because the steady-state infiltration rate is less than the transient rate (as described in figures 2 and 4), the net effect of the residual mound will be a reduction in average infiltration rate, as compared to the case with no initial mound.

The estimated infiltration rates given in tables 3 and 4 include the effects of groundwater mounding. The regression equations that were developed based on these results (equations (9) and (10)) also include these effects. Tables 6 and 7 describe when the Hvorslev and USBR equations are conservative, relative to the regression equations and the results of the computer simulations. Provided that the regression equations are used or that the recommendations included in Table 7 are used for the Hvorslev or USBR equations, the "correction factor" for mounding is built into the analysis and is not required.

8. RECOMMENDATIONS FOR THE SPACING OF DRY WELLS

The results of the unsaturated flow models described earlier can be used to suggest well spacing for sites with multiple dry wells. In general, sites with lower hydraulic conductivity values and sites with more shallow water tables will require greater spacing than sites with high hydraulic conductivity values and deep water tables. For sites with water tables deeper than 30 feet, the recommended spacing to prevent overlap of groundwater mounds is 5 times the radius of the excavation for the dry well, or approximately 50 feet. (This spacing is defined as the distance from center point to center point for the wells.) For sites with water tables shallower than 10 feet, the recommended spacing is 8 times the radius of the dry well, or approximately 80 feet. Dry wells spaced more closely than these recommended rates may still be effective, but some reduction in infiltration rates could be caused by overlapping mounds. The regression equations and the results in tables 3 and 4 were developed under the assumption of no overlap between mounds from adjacent dry wells. If wells are spaced more closely than the values described above, the design engineer should be aware that there could be some reduction in infiltration rates in comparison to the single-well scenario used to develop the regression equations.

9. RECOMMENDED DESIGN APPROACH

A flow chart with the recommended design approach is included as Figure 10. The steps included in this chart are described in the sections that follow.

9.1 Perform Subsurface Site Characterization and Data Collection

As a minimum, these site characterization activities should be used to define subsurface layering and the depth to groundwater, as well as to collect samples for grain size analyses (Massmann 2003b). Samples should be collected from each layer beneath the facility to the depth of groundwater or to approximately 40 feet below the ground surface (approximately 30 feet below the base of the dry well).

9.2 Estimate Saturated Hydraulic Conductivity from Soil Information, Laboratory Tests, or Field Measurements

A variety of methods can be used to estimate saturated hydraulic conductivity. These methods include estimates based on grain size information, laboratory permeameter tests, air conductivity measurements, infiltrometer tests, and pilot infiltration tests. The advantages and disadvantages of these various methods are described in Massmann (2003b).

Preliminary estimates may be derived by using grain size information, as described in Massmann (2003b). Two approaches include the Hazen equation and the log-based regression. The Hazen equation is as follows:

$$K_{sat} = CD_{10}^2 \qquad (12)$$

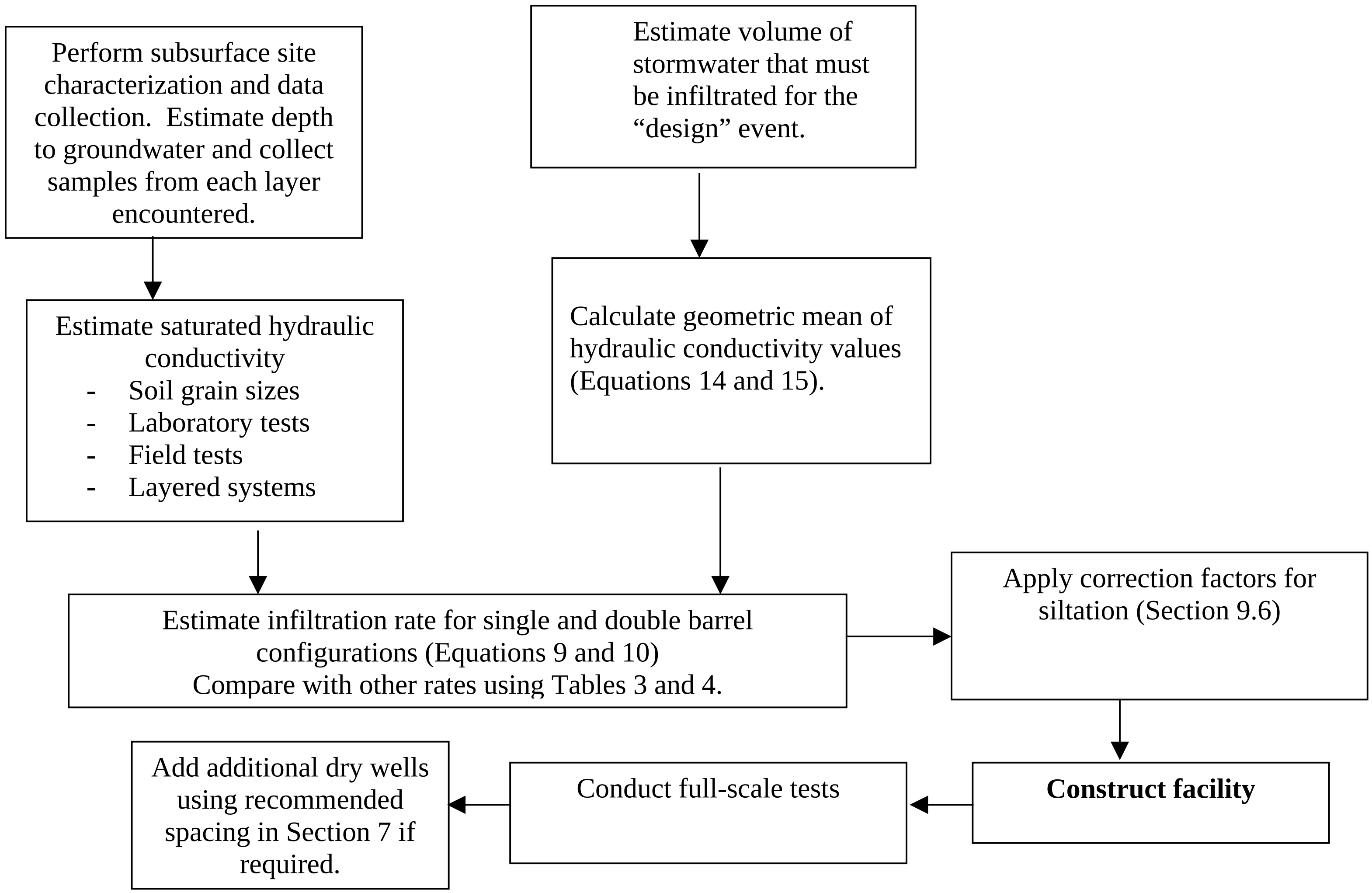

Figure 10. Flow chart of design approach.

where K_{sat} is the saturated hydraulic conductivity, C is a conversion coefficient, and D_{10} is the grain size for which 10 percent of the sample is more fine (10 percent of the soil particles have grain diameters smaller than D_{10}). For K_{sat} in units of cm/s and for D_{10} in units of mm, the coefficient, C, is approximately 1.

A second approach for estimating saturated hydraulic conductivities for soils was proposed by Massmann (2003b):

$$\log_{10}(K_{sat}) = -1.57 + 1.90D_{10} + 0.015D_{60} - 0.013D_{90} - 2.08\mathrm{f}_{\mathrm{fines}} \tag{13}$$

where D_{60} and D_{90} are the grain sizes for which 60 percent and 90 percent of the sample is more fine, and f_{fines} is the fraction of the soil (by weight) that passes the number 200 sieve. This approach is based on a comparison of hydraulic conductivity estimates from air permeability tests with grain size characteristics. Other regression relationships between saturated hydraulic conductivity and grain size distributions are available, as described in Massmann (2003b).

Note that the estimates given above should be viewed as "order-of-magnitude" estimates. If measurements of hydraulic conductivity are available from laboratory or field tests (as described below), these data should be weighed more heavily in selecting values of hydraulic conductivity for design purposes.

9.3 Calculate Geometric Mean Values for Sites with Multiple Hydraulic Conductivity Values

The geometric mean for hydraulic conductivity value is given by the following expressions:

$$K_{geometric} = e^{Y_{average}} \tag{14}$$

where $Y_{average}$ is the average of the natural logarithms of the hydraulic conductivity values:

$$Y_{average} = \frac{1}{n}\sum Y_i = \frac{1}{n}\sum \ln(K_i) \tag{15}$$

9.4 Estimate the Uncorrected, Steady-State Infiltration Rate for the Dry Wells

Uncorrected steady-state infiltration rates for single- and double-barrel configurations can be estimated by using the regression equations (9) and (10). The values from the regression equation can be compared with the results in tables 3 and 4 to ensure that there have not been errors in the calculation. The results derived with equations (9) and (10) should be in the range of the values included in tables 3 and 4.

9.5 Estimate the Volume of Stormwater and the Stormwater Inflow Rates That Must Be Infiltrated by the Proposed or Planned Dry Well

The volume of stormwater that must be infiltrated and the rate at which this must occur are generally specified by local, regional, or state requirements. In many cases, the volume and required rates of discharge are controlled by both water quality and water quantity concerns. The volume of storm water that must be infiltrated can be estimated by using the approaches summarized by Massmann (2003b).

9.6 Apply Corrections for Siltation

Although the comparison of calculated and observed infiltration rates shown in Figure 9 suggests that using the geometric mean of hydraulic conductivity values will generally result in conservative designs, these data were collected from relatively new dry wells. Siltation and plugging may reduce the equivalent hydraulic conductivity values of the facilities by an order of magnitude or more. This will result in a corresponding reduction in infiltration rate, as shown in tables 3 and 4. If pre-treatment cannot be provided, the design infiltration rates calculated in Section 9.4 should be reduced by a factor on the order of 0.5 or less.

9.7 Monitor Performance After Construction

Full-scale tests should be conducted at all sites on a periodic basis where possible. If a source of water is available (e.g., nearby fire hydrants or water trucks), these tests should be conducted using controlled and measured inflow rates. If water sources are not available, inflow rates should be monitored if at all possible. By monitoring inflow rates, relationships can be developed that give infiltration rates as a function of stage or water level in the dry well. These can be compared to the values estimated with the computer model or the analytical solutions.

When the full-scale tests indicate infiltration rates that are significantly less than the design rates, the facility may need to be modified. If the lower rates are expected to be caused by soil plugging, then remediation of the existing dry well may be possible. For some sites, particularly those where the lower rates are due to unexpectedly high groundwater levels, there may be little that can be done.

ACKNOWLEDGMENTS

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REFERENCES

Beyer, W.H. (editor), *CRC Standard Mathematical Tabl*es, CRC Press, Boca Raton, Florida, 1987.

Geoengineers Inc., Budinger & Associates, Cummings Geotechnology, Inc., “Infiltration Rate and Soil Classification Correlation, Spokane County, Washington,” May 2004.

Hsieh, P.A., Wingle, W., and Healy, R.W. “A graphical package for simulating fuid lfow and solute or energy transport in variably saturated porous media,” *U.S. Geological Survey Water-Resources Investigations* Report 99-4130, 2000.

Lambe, T.W. and R.V. Whitman, *Soil Mech*anics, SI version, John Wiley, New York, 1979.

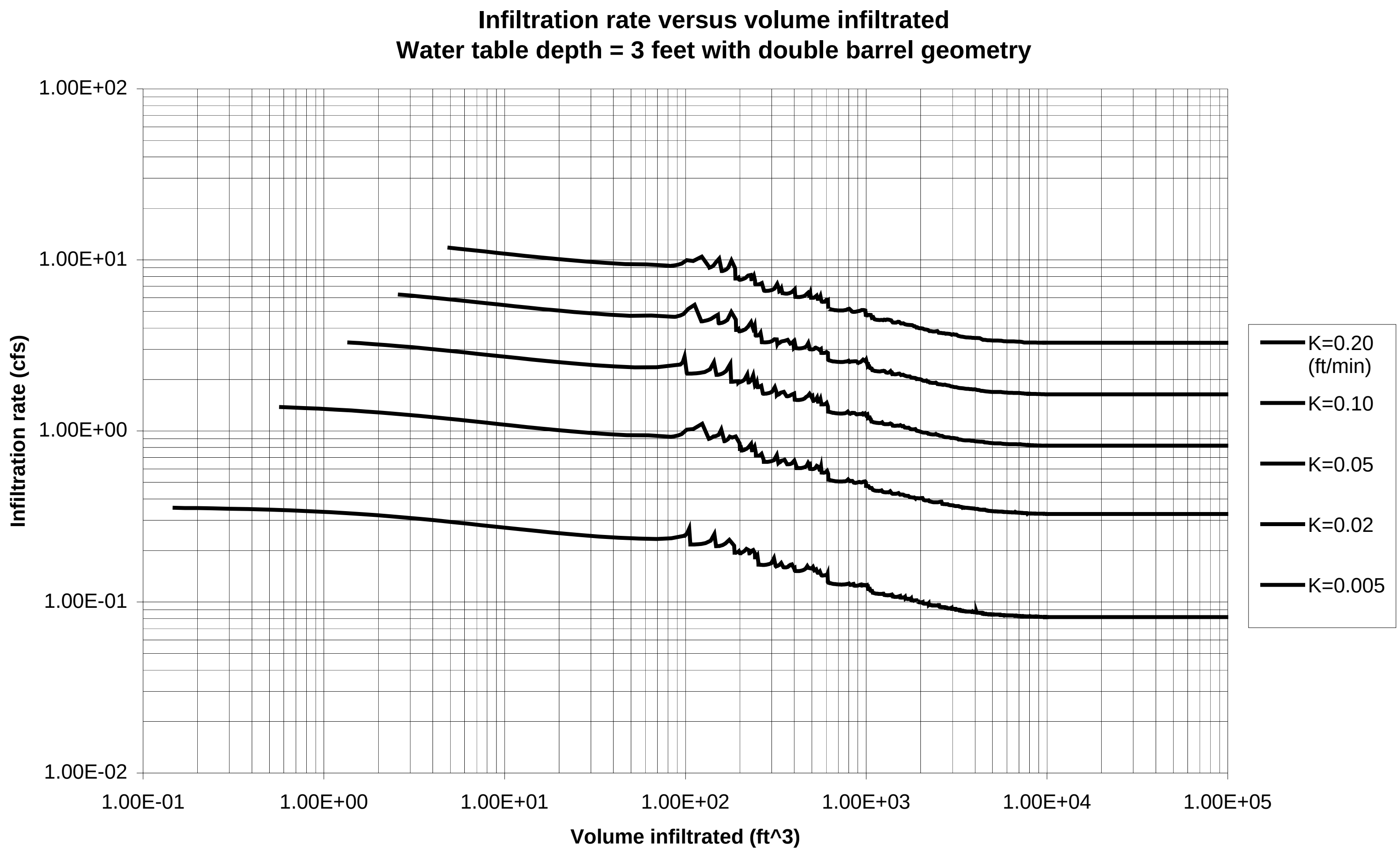
Massmann, J,. *Implementation of Infiltration Ponds Research*, WA-RD 578.1, October 2003a.

Massmann, J., *A Design Manual for Sizing Infiltration Ponds*, WA-RD 578.2, October 2003b

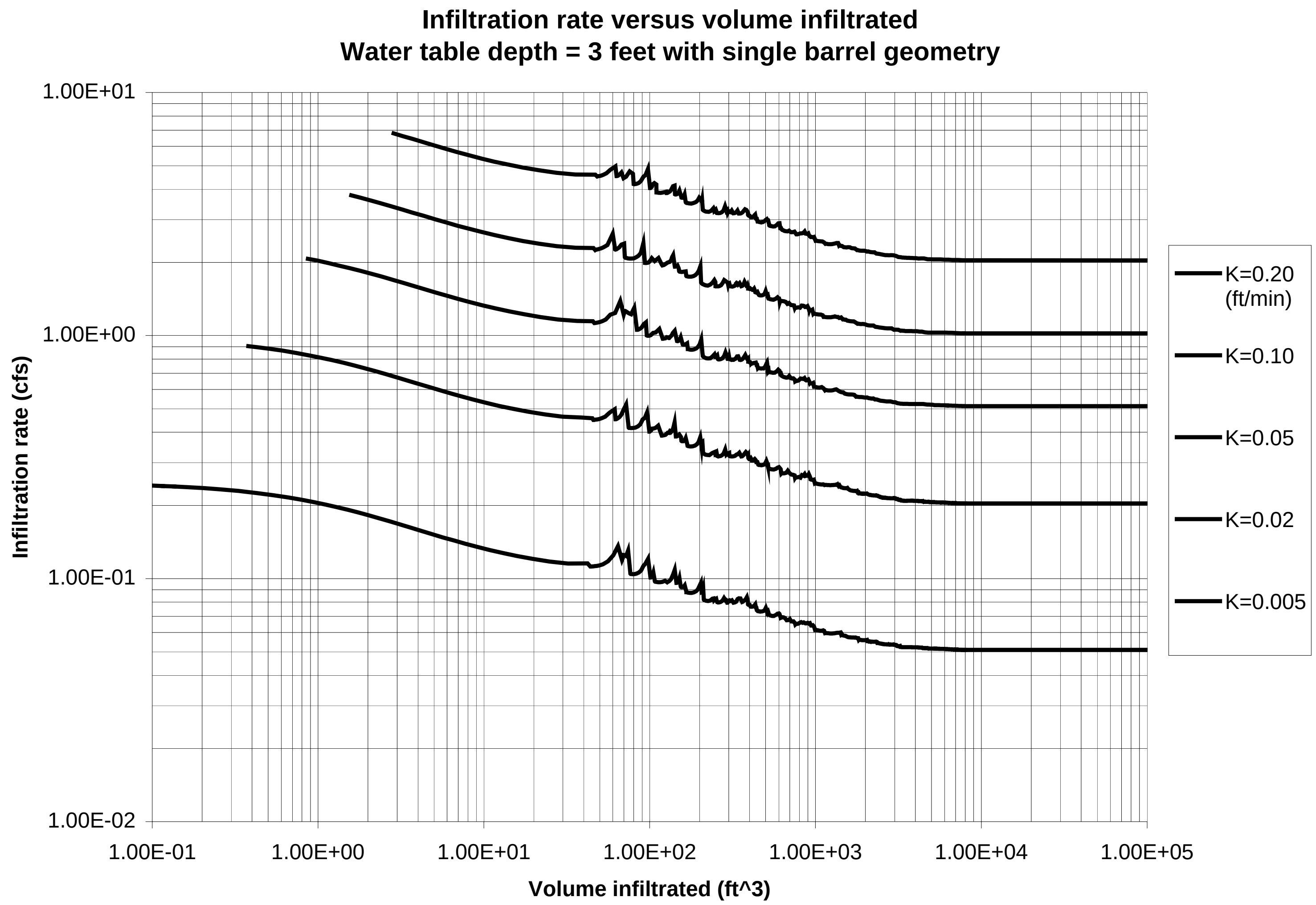
U.S. Department of the Interior, "Procedure for Performing Field Permeability Testing by the Well Permeameter Method (USBR 7300-89)," in *Earth Manual*, *Part 2*, A Water Resources Technical Publication, 3rd ed., Bureau of Reclamation, Denver, Colo., 1990.

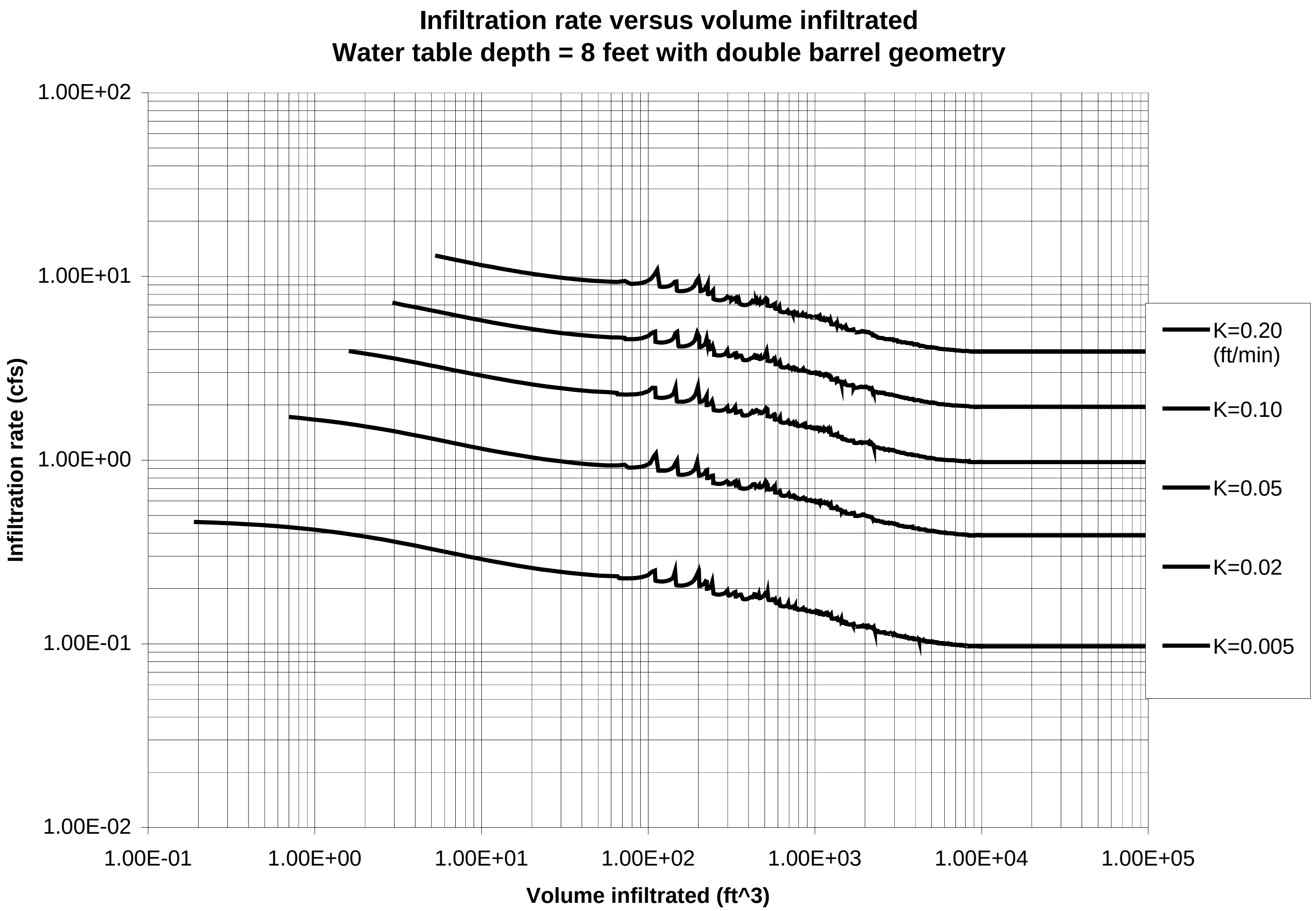
Van Genuchten, M. T., “A closed-form equation for predicting the hydraulic conductivity of unsaturated soils,” Soil Science Society of America Journal 44:892-898, 1980.

APPENDIX A.
RESULTS OF COMPUTER SIMULATIONS WITH TRANSIENT, UNSATURATED MODEL

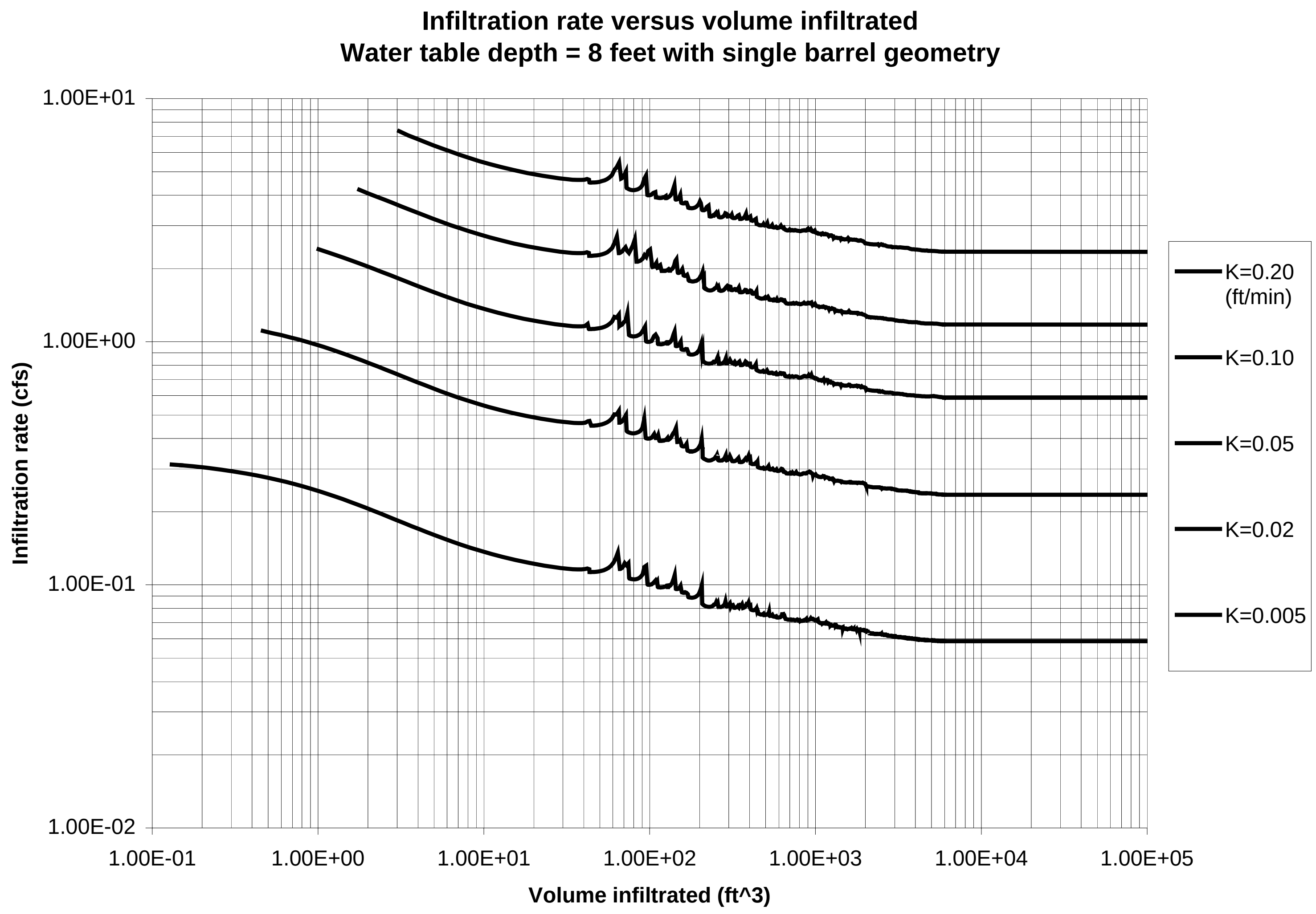


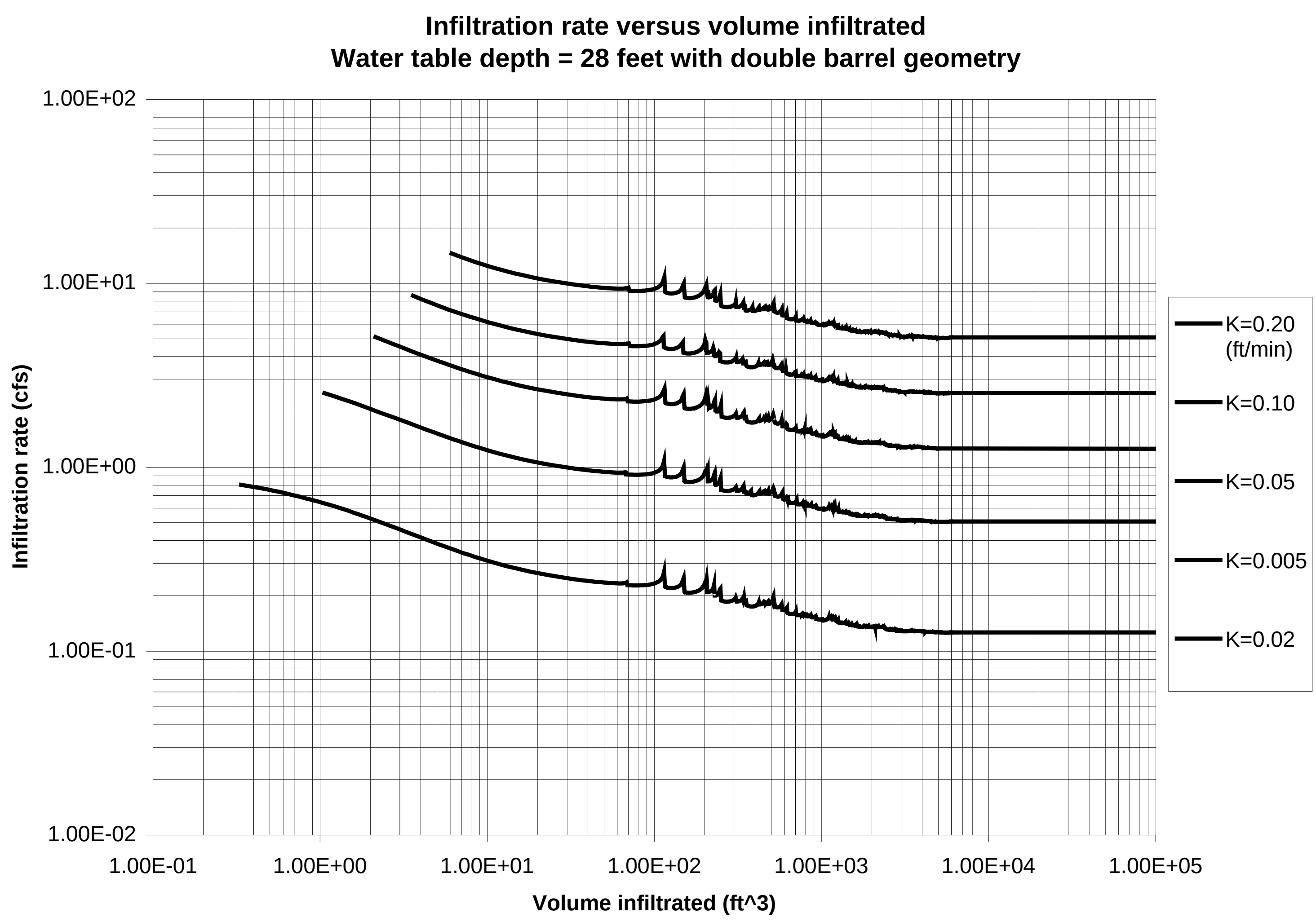
Infiltration rate versus volume infiltrated
Water table depth = 3 feet with double barrel geometry
Infiltration rate (cfs)
1.00E+02
1.00E+01
1.00E+00
1.00E-01
1.00E-02
1.00E-01
1.00E+00
1.00E+01
1.00E+02
1.00E+03
1.00E+04
1.00E+05
Volume infiltrated (ft^3)
K=0.20 (ft/min)
K=0.10
K=0.05
K=0.02
K=0.005

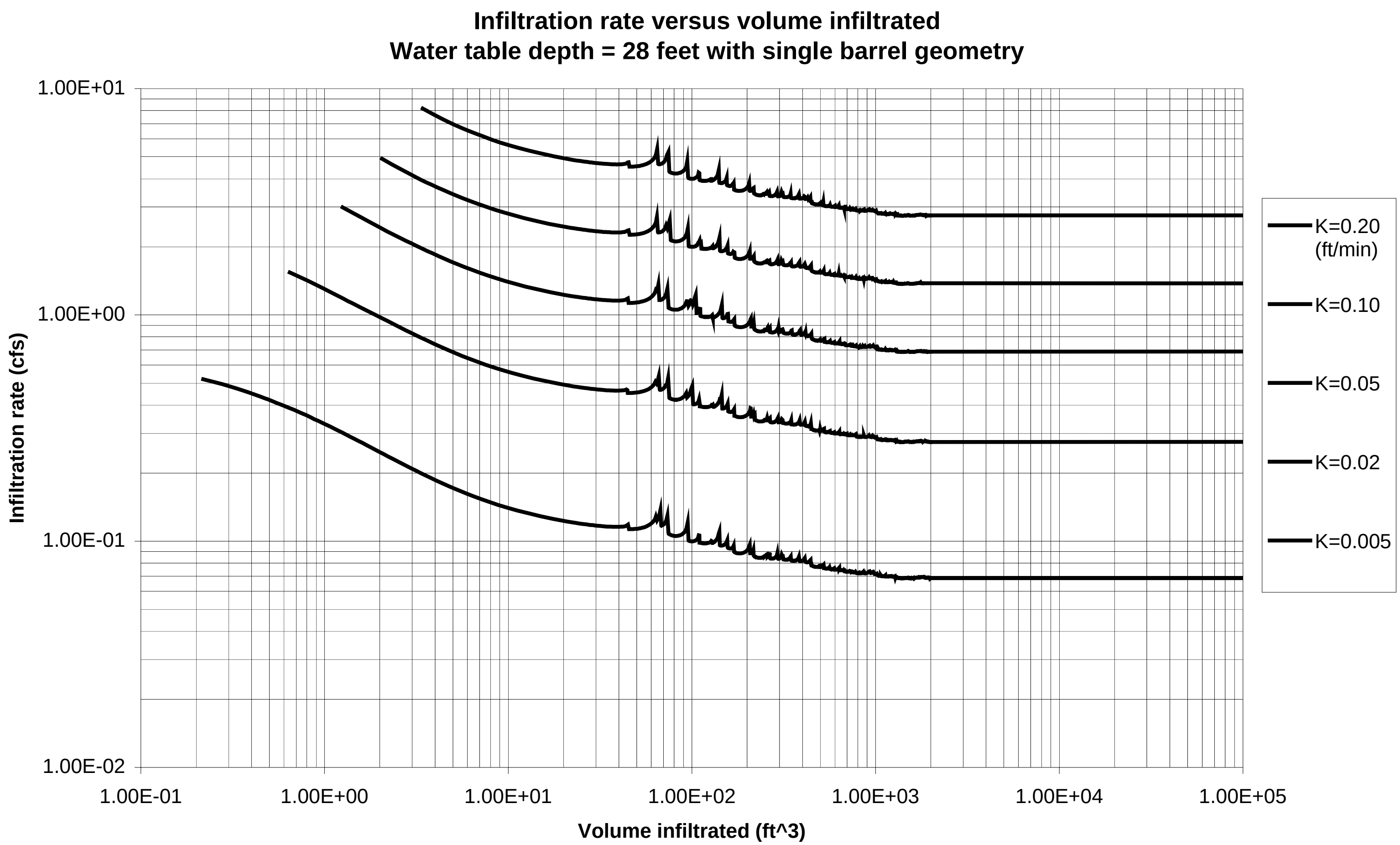

Infiltration rate versus volume infiltrated
Water table depth = 3 feet with single barrel geometry
1.00E+01
1.00E+00
1.00E-01
1.00E-02
Infiltration rate (cfs)
1.00E-01
1.00E+00
1.00E+01
1.00E+02
1.00E+03
1.00E+04
1.00E+05
Volume infiltrated (ft^3)
K=0.20 (ft/min)
K=0.10
K=0.05
K=0.02
K=0.005



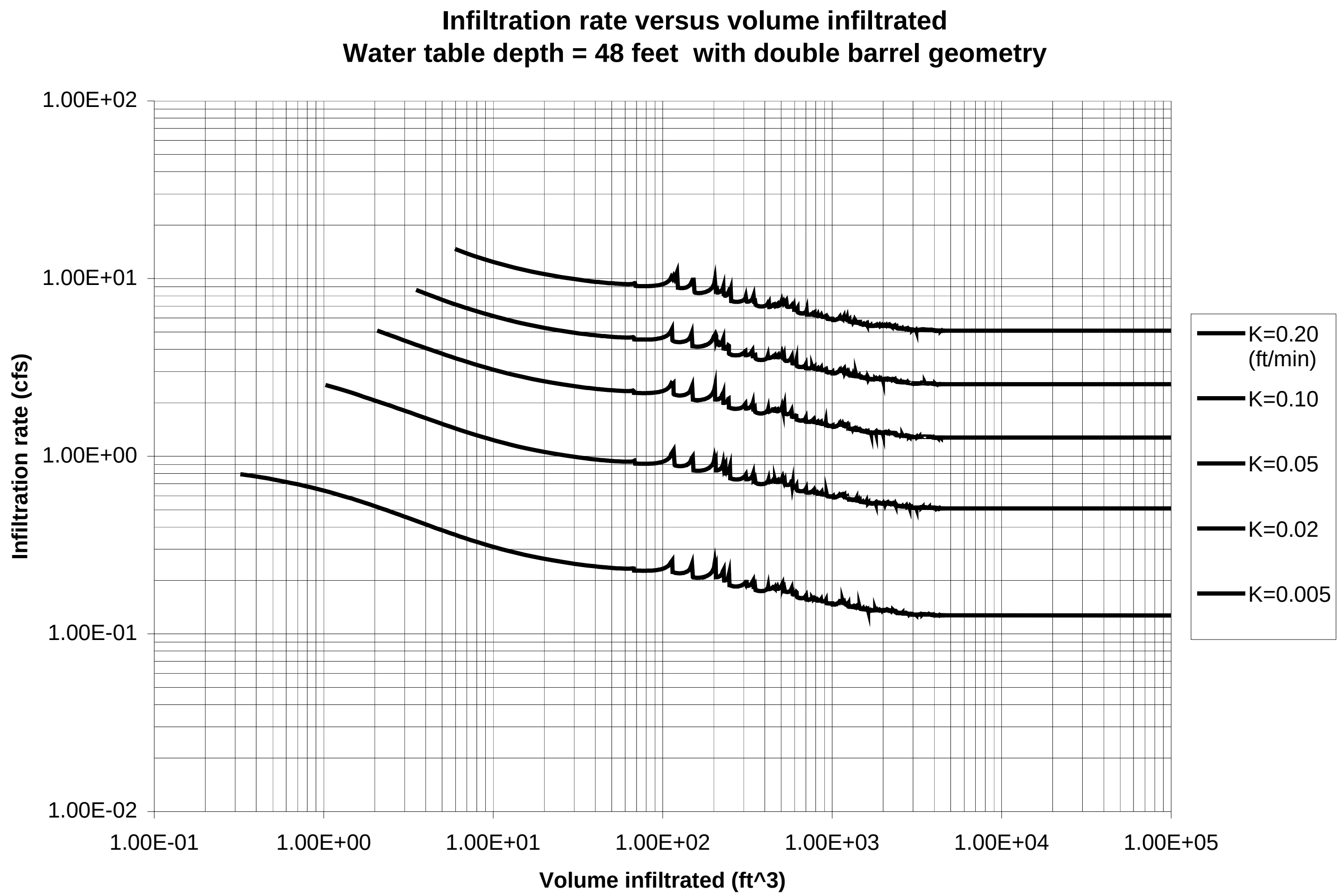
Infiltration rate versus volume infiltrated
Water table depth = 8 feet with double barrel geometry
Infiltration rate (cfs)
1.00E+02
1.00E+01
1.00E+00
1.00E-01
1.00E-02
1.00E-01
1.00E+00
1.00E+01
1.00E+02
1.00E+03
1.00E+04
1.00E+05
Volume infiltrated (ft^3)
K=0.20 (ft/min)
K=0.10
K=0.05
K=0.02
K=0.005


Infiltration rate versus volume infiltrated
Water table depth = 8 feet with single barrel geometry
1.00E+01
1.00E+00
1.00E-01
1.00E-02
Infiltration rate (cfs)
1.00E-01
1.00E+00
1.00E+01
1.00E+02
1.00E+03
1.00E+04
1.00E+05
Volume infiltrated (ft^3)
K=0.20 (ft/min)
K=0.10
K=0.05
K=0.02
K=0.005

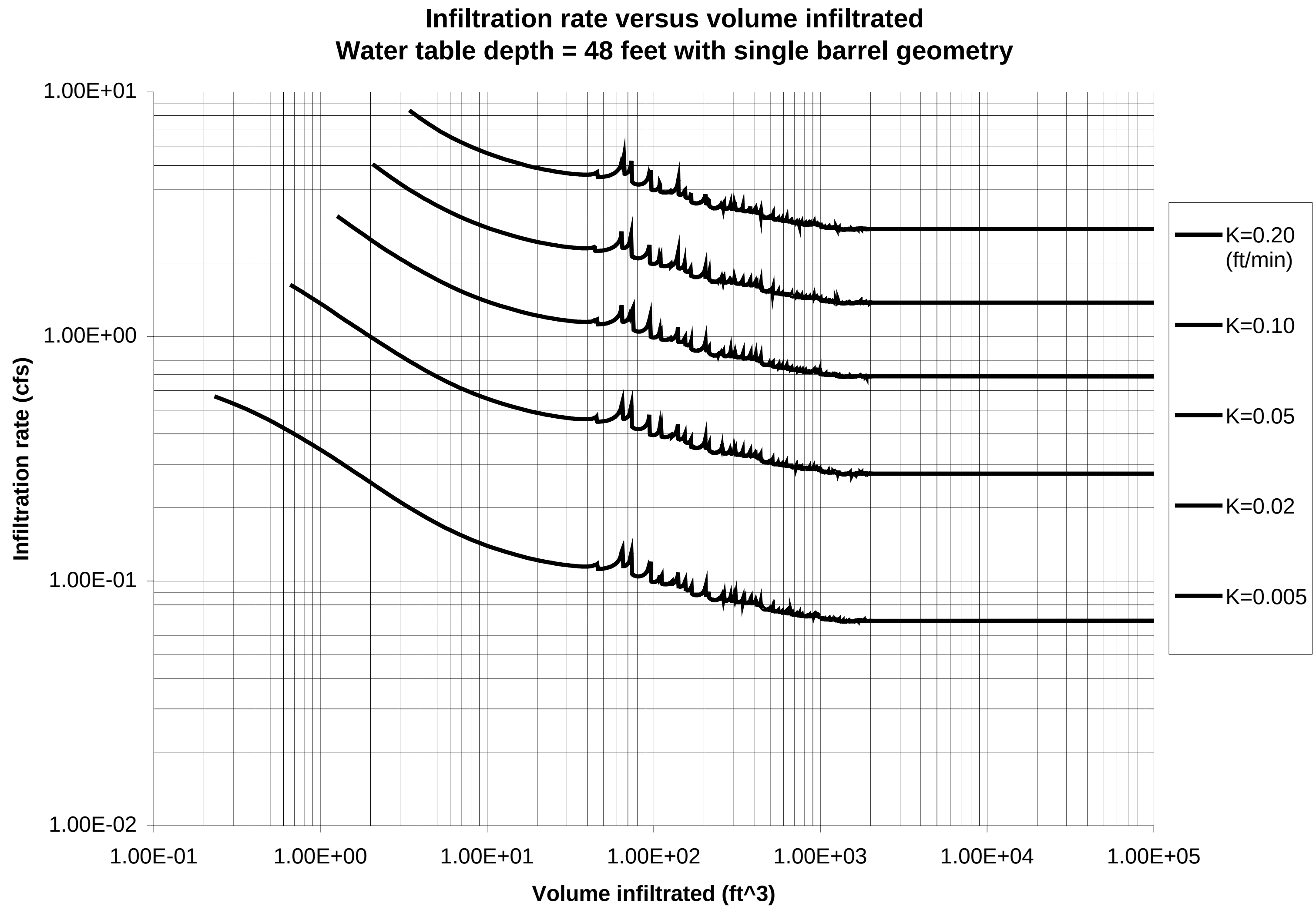

Infiltration rate versus volume infiltrated
Water table depth = 28 feet with double barrel geometry
Infiltration rate (cfs)
1.00E+02
1.00E+01
1.00E+00
1.00E-01
1.00E-02
1.00E-01
1.00E+00
1.00E+01
1.00E+02
1.00E+03
1.00E+04
1.00E+05
Volume infiltrated (ft^3)
K=0.20 (ft/min)
K=0.10
K=0.05
K=0.005
K=0.02



Infiltration rate versus volume infiltrated
Water table depth = 28 feet with single barrel geometry
1.00E+01
1.00E+00
1.00E-01
1.00E-02
Infiltration rate (cfs)
1.00E-01
1.00E+00
1.00E+01
1.00E+02
1.00E+03
1.00E+04
1.00E+05
Volume infiltrated (ft^3)
K=0.20 (ft/min)
K=0.10
K=0.05
K=0.02
K=0.005



Infiltration rate versus volume infiltrated
Water table depth = 48 feet with double barrel geometry
Infiltration rate (cfs)
1.00E+02
1.00E+01
1.00E+00
1.00E-01
1.00E-02
1.00E-01
1.00E+00
1.00E+01
1.00E+02
1.00E+03
1.00E+04
1.00E+05
Volume infiltrated (ft^3)
K=0.20 (ft/min)
K=0.10
K=0.05
K=0.02
K=0.005



Infiltration rate versus volume infiltrated
Water table depth = 48 feet with single barrel geometry
Infiltration rate (cfs)
1.00E+01
1.00E+00
1.00E-01
1.00E-02
1.00E-01
1.00E+00
1.00E+01
1.00E+02
1.00E+03
1.00E+04
1.00E+05
Volume infiltrated (ft^3)
K=0.20 (ft/min)
K=0.10
K=0.05
K=0.02
K=0.005

APPENDIX B
SUMMARY OF SPOKANE COUNTY DRY WELL TEST DATA
(unpublished data provided by J. Harakas, GeoEngineers, 2003)

			Hydraulic Conductivity Estimates					Drywell Tests				
	Site Location	Test Location/Depth	Soil Type Tested	Grain Size (cm/s)	Borehole Test (cm/s)	Test Pit K (cm/s)	Test Pit Discharge (cfs)	Drywell Type	Drywell Discharge (cfs)	Head (ft)	Water volume (ft^3)	Depth to Low Perm. Layer (ft)
Northwest Technology Park	Airway Heights, WA	AP-1/125	SP-SM	2.3E-02								
		AP-1/135	GW	2.1E-02								
		AP-1/140	SW	1.9E-02								
		DW-1	SW					single	0.56	0.9	5078	30
		TP-1/12	SP	3.0E-01		3.0E-02	0.57					
Hayford Plaza	Airway Heights, WA	TP-C7/4	SP	5.8E-01								
		TP-E4/8	SP	5.8E-01								
		TP-E8/4	SP	5.8E-01								
		DW-1	SP					single	0.62	4.2	4257	13
		TP-1/7	SP	7.7E-02		1.2E-02	0.38					
Shady Slope @ Farwell	Mead, WA	DW-1/6	SP	3.1E-01				single	0.81	2.7	6527	17
		TP-1/7	SP	2.5E-01		6.6E-02	0.29					16
		TP-2/2	SM	3.4E-04		6.0E-03	0.02					16
Trickle Creek	Spokane County, WA	DW-1/11	SM	5.0E-04				single	0.086	4.75		ND
Summer Crest	Spokane, WA	DW-1/8	SM	4.1E-05				single	0.52	5.5	3826	ND
			SP	1.8E-01								
Midway Elementary School	Colbert, WA	DW-1/10	SP-SM	3.5E-03				single	0.03			ND
		DW-2/8	SP	3.5E-02				double	0.51			13
Mount Spokane Plaza[2]	Spokane, WA	Drywell 1	NP		1.4E-02			double	1.32	4.3		ND
		Drywell 2	NP					double	1.34	4.2		ND
		Drywell 3	NP		1.1E-02			double	1.17	4.1		ND
Westwood	Spokane	Boring	SP		3.7E-02							ND

	Site Location	Test Location/Depth	Hydraulic Conductivity Estimates					Drywell Tests				
			Soil Type Tested	Grain Size (cm/s)	Borehole Test (cm/s)	Test Pit K (cm/s)	Test Pit Discharge (cfs)	Drywell Type	Drywell Discharge (cfs)	Head (ft)	Water volume (ft^3)	Depth to Low Perm. Layer (ft)
North	County, WA	DW-1	NP					single	0.87	2.6		ND
		DW-2	SP	6.1E-02				double	1.5	7.2		ND
		DW-3	SP	8.9E-02				double	1.42	5.95		ND
		DW-4	NP					double	1.27	3.3		ND
		DW-5	NP					double	1.05	6.5		ND
		DW-6	SP-SM	1.8E-02				double	1.11	2.06		ND
		DW-7	SP-SM	5.7E-02				double	1.44	5.95		ND
		DW-8	SP-SM	6.9E-02				double	0.9	4.1		ND
		DW-9	SP-SM	4.1E-03				single	0.62	3.6		ND
		DW-10	SP	1.3E-01				single	0.38	2.5		ND
		DW-11	NP					double	1.05	4.7		ND
		DW-12	SP-SM	1.0E-02				double	0.95	8.2		ND
		DW-13	NP					double	1.01	7.66		ND
		DW-14	SP-SM	1.8E-02				double	0.79	8.45		ND
		DW-15	SP-SM	1.8E-02				double	0.74	8.5		ND
		DW-16	NP					double	0.86	3.9		ND
		DW-17	NP					double	1.01	6.77		ND
		DW-18	NP					double	1.0	8.64		ND
		DW-19	NP					double	1.02	8.48		ND
		DW-20	SM	1.2E-03				double	0.87	8.63		ND
NP	5 Mile Prairie	Drywell	SP	7.1E-02				double	1.31	8		ND
NP	Dartford	Drywell	SP-SM	2.1E-02				double	0.28	9		22
NP	Dartford	Drywell	GP-GM	5.6E-03				single	0.26	5		9
NP	5 Mile	Drywell	SP	4.2E-02				3	0.22	6		ND

	Site Location	Test Location/Depth	Hydraulic Conductivity Estimates					Drywell Tests				
			Soil Type Tested	Grain Size (cm/s)	Borehole Test (cm/s)	Test Pit K (cm/s)	Test Pit Discharge (cfs)	Drywell Type	Drywell Discharge (cfs)	Head (ft)	Water volume (ft^3)	Depth to Low Perm. Layer (ft)
	Prairie							barrel				
NP	5 Mile Prairie	Drywell	SP-SM	1.4E-02				3 barrel	0.27	7		ND
NP	5 Mile Prairie	Drywell	SP		7.1E-04			3 barrel	0.29	9		ND
NP	5 Mile Prairie	Drywell	SP		7.1E-03			3 barrel	0.58	10		ND

APPENDIX C
WATER LEVEL VERSUS TIME DATA FOR DRY WELLS
(unpublished data provided by J. Harakas, GeoEngineers, 2003)

Table C-1 – Water level versus time for Hayford Plaza

Time (min.)	**Elapsed Time (min.)**	**Observed Head (ft)**	**Ho/H**
79.2	0.0	4.2	1.00
79.8	0.7	4.15	1.01
80.5	1.3	4.05	1.04
81.2	2.0	3.82	1.10
81.8	2.7	3.71	1.13
82.7	3.5	3.55	1.18
83.7	4.5	3.32	1.27
85.7	6.5	3.03	1.39
87.7	8.5	2.76	1.52
89.8	10.7	2.52	1.67
92.2	13.0	2.28	1.84
94.2	15.0	2.07	2.03
97.0	17.8	1.85	2.27
99.7	20.5	1.68	2.50
103.0	23.8	1.5	2.80
105.5	26.3	1.4	3.00
109.5	30.3	1.19	3.53
114.0	34.8	1.07	3.93
118.7	39.5	0.92	4.57
124.0	44.8	0.84	5.00
127.0	47.8	0.79	5.32
133.3	54.2	0.68	6.18
140.3	61.2	0.57	7.37
148.7	69.5	0.48	8.75
152.8	73.7	0.44	9.55
161.5	82.3	0.38	11.05
170.2	91.0	0.3	14.00
179.2	100.0	0.24	17.50
187.8	108.7	0.2	21.00
197.2	118.0	0.18	23.33
206.2	127.0	0.15	28.00
215.2	136.0	0.12	35.00
221.2	142.0	0.1	42.00
228.2	149.0	0.07	60.00

Table C-2 – Water level versus time for Summer Crest

Time (min.)	**Elapsed Time (min.)**	**Observed Head (ft)**	**Ho/H**
122.0	0.0	5.50	1.00
123.0	1.0	4.30	1.28
124.0	2.0	3.70	1.49
125.0	3.0	3.20	1.72
126.0	4.0	2.80	1.96
127.0	5.0	2.40	2.29
130.0	8.0	1.70	3.24
135.0	13.0	1.00	5.50
140.0	18.0	0.50	11.00
150.0	28.0	0.10	55.00

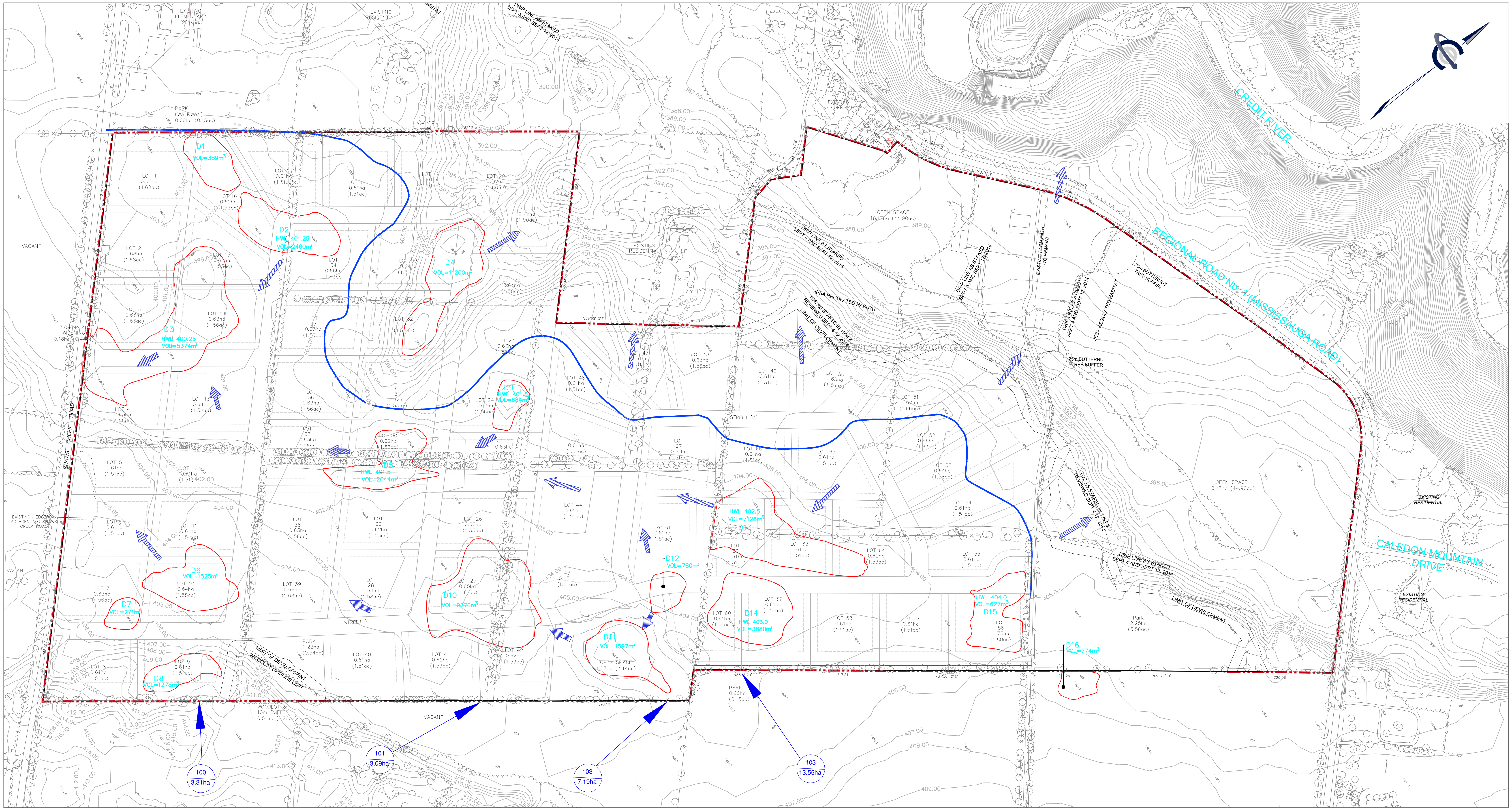
Table C-3 – Water level versus time for Trickle Creek

Time (min.)	**Elapsed Time (min.)**	**Observed Head (ft)**	**Ho/H**
186	0.0	4.8	1.00
188	2.0	4.7	1.02
190	4.0	4.6	1.04
192	6.0	4.5	1.07
195	9.0	4.3	1.12
202	16.0	3.9	1.23
210	24.0	3.5	1.37
220	34.0	3.2	1.50
230	44.0	2.9	1.66
240	54.0	2.6	1.85
250	64.0	2.4	2.00
260	74.0	2.1	2.29
270	84.0	1.9	2.53
280	94.0	1.7	2.82
298	112.0	1.4	3.43
308	122.0	1.2	4.00
328	142.0	1	4.80

Table C-4 – Water level versus time for Northwest Technology Park

Time (min.)	Elapsed Time (min.)	Observed Head (ft)	Ho/H
82.00	0.0	0.94	1.00
83.00	1.0	0.82	1.15
84.50	2.5	0.74	1.27
87.00	5.0	0.62	1.52
90.00	8.0	0.58	1.62
92.50	10.5	0.56	1.68
96.50	14.5	0.53	1.77
99.00	17.0	0.52	1.81
103.50	21.5	0.47	2.00
107.50	25.5	0.43	2.19
111.50	29.5	0.40	2.35
114.83	32.8	0.37	2.54
120.50	38.5	0.34	2.76

APPENDIX C
Stormwater Management Calculations



COLE ENGINEERING

70 VALLEYWOOD DRIVE, MARKHAM, ON L3R 4T5
T:416.987.6161 / 905.940.6161 F:905.940.2064

LEGEND

- PROPERTY BOUNDARY
- WATERSHED DIVIDE
- DIRECTION OF OVERLAND FLOW
- EXISTING DEPRESSION AREA OR SINKHOLE (HIGH INFILTRATION)
- EXISTING TREES & VEGETATION
- EXISTING DRAINAGE AREA (100 3.31ha)

NOTE:
DEPRESSION AND STORAGE AREAS FROM FALBY BURNSIDE ASSOCIATES, DWG 9659 SWM2, MAR/98.

THE MINOR OF BELFOUNTAIN CORP.
TOWN OF CALEDON
REGIONAL MUNICIPALITY OF PEEL
PRE-DEVELOPMENT DRAINAGE PLAN

DATE:	JANUARY 2018	PROJECT No.:	SD17-0701
SCALE:	1:2000	FIGURE No.:	ST-1

File : S:\2017 Projects\SD\2017-0701 Belfountain_Pre Eng FSR_Caledon\400-CADD\401-CAD\402-Design\Sheets\SD2017-0701- EXISTING DRAINAGE.dwg. Date :Mar 05, 2018 - 1:32pm.

COLE ENGINEERING

70 VALLEYWOOD DRIVE, MARKHAM, ON L3R 4T5
T:416.987.6161 / 905.940.6161 F:905.940.2064

LEGEND

Symbol	Description
(red dash-dot line)	PROPERTY BOUNDARY
(blue arrow)	PROPOSED DRAINAGE DIRECTION
200	CATCHMENT NUMBER
0.20ha	DRAINAGE AREA
(blue line)	DRAINAGE ROAD AREA BOUNDARY
(light blue arrow)	EXTERNAL DRAINAGE DIRECTION
100 / 3.31ha	EXTERNAL DRAINAGE AREA
(magenta dashed line)	EXTERNAL DRAINAGE AREA BOUNDARY

THE MANORS OF BELFOUNTAIN CORP.
TOWN OF CALEDON
REGIONAL MUNICIPALITY OF PEEL
PROPOSED DRAINAGE AREA PLAN

DATE:	JANUARY 2018	PROJECT No.:	SD17-0701
SCALE:	SCALE 1:2000	FIGURE No.:	ST-2

File : S:\2017 Projects\SD\2017-0701 Belfountain_Pre Eng FSR_Caledon\400-CADD\401-CAD\402-Design\Sheets\2017-0701 Prop STM.dwg, Date :Mar 05, 2018 - 12:16pm,

COLE
ENGINEERING
70 VALLEYWOOD DRIVE, MARKHAM, ON L3R 4T5
T:416.987.6161 / 905.940.6161 F:905.940.2064

LEGEND

- PROPERTY BOUNDARY
- PROPOSED DRAINAGE DIRECTION
- 201 — CATCHMENT NUMBER
- 4.34ha — DRAINAGE AREA
- DRAINAGE ROAD AREA BOUNDARY
- EXTERNAL DRAINAGE DIRECTION
- 100 / 3.31ha — EXTERNAL DRAINAGE AREA
- EXTERNAL DRAINAGE AREA BOUNDARY

THE MANORS OF BELFOUNTAIN CORP.
TOWN OF CALEDON
REGIONAL MUNICIPALITY OF PEEL
EXTERNAL AREA DRAINAGE AREA PLAN

DATE:	JANUARY 2018	PROJECT No.:	SD17-0701
SCALE:	SCALE 1:2000	FIGURE No.:	ST-3

COLE ENGINEERING
Experience Enhancing Excellence

2017-0701 Belfountain
2, 5, 10, 25, 50 & 100-Year 6 Hour SCS Storm, 100- Year 6 Hour SCS Storm, & 100- Year 24 Hour SCS Storm
1 Dry Well per Storage Cell
Proposed One Storage/Infiltration Cell Condition Model Output
February, 2018

Modeling with one Dry Well per Storage Cell
Total of 30 L/s infiltration rate

****
** SIMULATION:Run 01 **
****

| READ STORM | Filename: C:\Users\KBobechko\AppData\Local\Temp\bd65dfac-16e2-452a-9172-d731580b86b9\039183b4
| Ptotal= 36.00 mm | Comments: 2yr/6hr

TIME hrs	RAIN mm/hr	TIME hrs	RAIN mm/hr	TIME hrs	RAIN mm/hr	TIME hrs	RAIN mm/hr
0.25	0.00	2.00	12.24	3.75	5.04	5.50	0.72
0.50	0.72	2.25	12.24	4.00	2.88	5.75	0.72
0.75	0.72	2.50	33.12	4.25	2.88	6.00	0.72
1.00	0.72	2.75	33.12	4.50	1.44	6.25	0.72
1.25	0.72	3.00	9.36	4.75	1.44		
1.50	4.32	3.25	9.36	5.00	0.72		
1.75	4.32	3.50	5.04	5.25	0.72		

| CALIB |
| NASHYD (0004)| Area (ha)= 0.70 Curve Number (CN)= 50.0
|ID= 1 DT=10.0 min | Ia (mm)= 5.00 # of Linear Res.(N)= 3.00
U.H. Tp(hrs)= 0.20

NOTE: RAINFALL WAS TRANSFORMED TO 10.0 MIN. TIME STEP.

---- TRANSFORMED HYETOGRAPH ----

TIME hrs	RAIN mm/hr	TIME hrs	RAIN mm/hr	TIME hrs	RAIN mm/hr	TIME hrs	RAIN mm/hr
0.167	0.00	1.833	8.28	3.500	5.04	5.17	0.72
0.333	0.36	2.000	12.24	3.667	5.04	5.33	0.72
0.500	0.72	2.167	12.24	3.833	3.96	5.50	0.72
0.667	0.72	2.333	22.68	4.000	2.88	5.67	0.72
0.833	0.72	2.500	33.12	4.167	2.88	5.83	0.72
1.000	0.72	2.667	33.12	4.333	2.16	6.00	0.72
1.167	0.72	2.833	21.24	4.500	1.44	6.17	0.72
1.333	2.52	3.000	9.36	4.667	1.44	6.33	0.36
1.500	4.32	3.167	9.36	4.833	1.08		
1.667	4.32	3.333	7.20	5.000	0.72		

Unit Hyd Qpeak (cms)= 0.134

PEAK FLOW (cms)= 0.006 (i)
TIME TO PEAK (hrs)= 2.833
RUNOFF VOLUME (mm)= 3.284
TOTAL RAINFALL (mm)= 36.000
RUNOFF COEFFICIENT = 0.091

(i) PEAK FLOW DOES NOT INCLUDE BASEFLOW IF ANY.

| RESERVOIR(0006)|
| IN= 2---> OUT= 1 |
| DT= 10.0 min |

OUTFLOW (cms)	STORAGE (ha.m.)	OUTFLOW (cms)	STORAGE (ha.m.)
0.0000	0.0000	0.0310	0.0200
0.0300	0.0010	0.0000	0.0000

	AREA (ha)	QPEAK (cms)	TPEAK (hrs)	R.V. (mm)
INFLOW : ID= 2 (0004)	0.700	0.006	2.83	3.28
OUTFLOW: ID= 1 (0006)	0.700	0.005	2.83	3.28

PEAK FLOW REDUCTION [Qout/Qin](%)= 92.07
TIME SHIFT OF PEAK FLOW (min)= 0.00
MAXIMUM STORAGE USED (ha.m.)= 0.0002

****
** SIMULATION:Run 03 **
****

| READ STORM | Filename: C:\Users\KBobechko\AppData\Local\Temp\bd65dfac-16e2-452a-9172-d731580b86b9\46e582ec
| Ptotal= 47.81 mm | Comments: 5yr/6hr

TIME hrs	RAIN mm/hr	TIME hrs	RAIN mm/hr	TIME hrs	RAIN mm/hr	TIME hrs	RAIN mm/hr
0.25	0.00	2.00	16.25	3.75	6.69	5.50	0.96
0.50	0.96	2.25	16.25	4.00	3.82	5.75	0.96
0.75	0.96	2.50	43.98	4.25	3.82	6.00	0.96
1.00	0.96	2.75	43.98	4.50	1.91	6.25	0.96
1.25	0.96	3.00	12.43	4.75	1.91		
1.50	5.74	3.25	12.43	5.00	0.96		
1.75	5.74	3.50	6.69	5.25	0.96		

| CALIB |
| NASHYD (0004)| Area (ha)= 0.70 Curve Number (CN)= 50.0
|ID= 1 DT=10.0 min | Ia (mm)= 5.00 # of Linear Res.(N)= 3.00
U.H. Tp(hrs)= 0.20

NOTE: RAINFALL WAS TRANSFORMED TO 10.0 MIN. TIME STEP.

---- TRANSFORMED HYETOGRAPH ----

TIME hrs	RAIN mm/hr	TIME hrs	RAIN mm/hr	TIME hrs	RAIN mm/hr	TIME hrs	RAIN mm/hr
0.167	0.00	1.833	10.99	3.500	6.69	5.17	0.96
0.333	0.48	2.000	16.25	3.667	6.69	5.33	0.96
0.500	0.96	2.167	16.25	3.833	5.25	5.50	0.96
0.667	0.96	2.333	30.11	4.000	3.82	5.67	0.96
0.833	0.96	2.500	43.98	4.167	3.82	5.83	0.96
1.000	0.96	2.667	43.98	4.333	2.86	6.00	0.96
1.167	0.96	2.833	28.20	4.500	1.91	6.17	0.96
1.333	3.35	3.000	12.43	4.667	1.91	6.33	0.48
1.500	5.74	3.167	12.43	4.833	1.43		
1.667	5.74	3.333	9.56	5.000	0.96		

Unit Hyd Qpeak (cms)= 0.134

PEAK FLOW (cms)= 0.010 (i)
TIME TO PEAK (hrs)= 2.833
RUNOFF VOLUME (mm)= 6.014
TOTAL RAINFALL (mm)= 47.810
RUNOFF COEFFICIENT = 0.126

(i) PEAK FLOW DOES NOT INCLUDE BASEFLOW IF ANY.

| RESERVOIR(0006)|
| IN= 2---> OUT= 1 |
| DT= 10.0 min |

OUTFLOW (cms)	STORAGE (ha.m.)	OUTFLOW (cms)	STORAGE (ha.m.)
0.0000	0.0000	0.0310	0.0200
0.0300	0.0010	0.0000	0.0000

	AREA (ha)	QPEAK (cms)	TPEAK (hrs)	R.V. (mm)
INFLOW : ID= 2 (0004)	0.700	0.010	2.83	6.01
OUTFLOW: ID= 1 (0006)	0.700	0.009	2.83	6.01

PEAK FLOW REDUCTION [Qout/Qin](%)= 93.47
TIME SHIFT OF PEAK FLOW (min)= 0.00
MAXIMUM STORAGE USED (ha.m.)= 0.0003

****
** SIMULATION:Run 05 **
****

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```
--------------------
|    READ STORM     |    Filename: C:\Users\KBobechko\AppD
|                   |              ata\Local\Temp\
|                   |              bd65dfac-16e2-452a-9172-d731580b86b9\573b3d28
| Ptotal= 55.69 mm |    Comments: 10yr/6hr
--------------------
                 TIME    RAIN |  TIME    RAIN |'  TIME    RAIN |  TIME    RAIN
                  hrs   mm/hr |   hrs   mm/hr |'   hrs   mm/hr |   hrs   mm/hr
                 0.25    0.00 |  2.00   18.94 |  3.75    7.80 |  5.50    1.11
                 0.50    1.11 |  2.25   18.94 |  4.00    4.46 |  5.75    1.11
                 0.75    1.11 |  2.50   51.24 |  4.25    4.46 |  6.00    1.11
                 1.00    1.11 |  2.75   51.24 |  4.50    2.23 |  6.25    1.11
                 1.25    1.11 |  3.00   14.48 |  4.75    2.23 |
                 1.50    6.68 |  3.25   14.48 |  5.00    1.11 |
                 1.75    6.68 |  3.50    7.80 |  5.25    1.11 |

-------------------------------------------------------------------------------

--------------------
| CALIB             |
| NASHYD   (  0004)|   Area     (ha)=   0.70   Curve Number   (CN)= 50.0
|ID= 1 DT=10.0 min |   Ia       (mm)=   5.00   # of Linear Res.(N)= 3.00
--------------------   U.H. Tp(hrs)=    0.20

         NOTE:  RAINFALL WAS TRANSFORMED TO  10.0 MIN. TIME STEP.


                      ---- TRANSFORMED HYETOGRAPH ----
                 TIME    RAIN |  TIME    RAIN |'  TIME    RAIN |  TIME    RAIN
                  hrs   mm/hr |   hrs   mm/hr |'   hrs   mm/hr |   hrs   mm/hr
                0.167    0.00 | 1.833   12.81 | 3.500    7.80 |  5.17    1.11
                0.333    0.56 | 2.000   18.94 | 3.667    7.80 |  5.33    1.11
                0.500    1.11 | 2.167   18.94 | 3.833    6.13 |  5.50    1.11
                0.667    1.11 | 2.333   35.09 | 4.000    4.46 |  5.67    1.11
                0.833    1.11 | 2.500   51.24 | 4.167    4.46 |  5.83    1.11
                1.000    1.11 | 2.667   51.24 | 4.333    3.34 |  6.00    1.11
                1.167    1.11 | 2.833   32.86 | 4.500    2.23 |  6.17    1.11
                1.333    3.89 | 3.000   14.48 | 4.667    2.23 |  6.33    0.56
                1.500    6.68 | 3.167   14.48 | 4.833    1.67 |
                1.667    6.68 | 3.333   11.14 | 5.000    1.11 |

     Unit Hyd Qpeak  (cms)=   0.134

     PEAK FLOW       (cms)=   0.014 (i)
     TIME TO PEAK    (hrs)=   2.833
     RUNOFF VOLUME    (mm)=   8.213
     TOTAL RAINFALL   (mm)=  55.690
     RUNOFF COEFFICIENT   =   0.147

     (i) PEAK FLOW DOES NOT INCLUDE BASEFLOW IF ANY.

-------------------------------------------------------------------------------
--------------------
| RESERVOIR(  0006)|
| IN= 2---> OUT= 1 |
| DT= 10.0 min     |     OUTFLOW    STORAGE   |  OUTFLOW    STORAGE
--------------------      (cms)      (ha.m.)   |   (cms)      (ha.m.)
                          0.0000      0.0000   |   0.0310      0.0200
                          0.0300      0.0010   |   0.0000      0.0000

                                AREA     QPEAK     TPEAK       R.V.
                                (ha)     (cms)     (hrs)       (mm)
   INFLOW : ID= 2 (  0004)      0.700     0.014      2.83       8.21
   OUTFLOW: ID= 1 (  0006)      0.700     0.013      2.83       8.21

                  PEAK   FLOW   REDUCTION [Qout/Qin](%)= 94.09
                  TIME SHIFT OF PEAK FLOW         (min)=  0.00
                  MAXIMUM  STORAGE   USED       (ha.m.)=  0.0005

-------------------------------------------------------------------------------
********************************
** SIMULATION:Run 07          **
********************************

--------------------
|    READ STORM     |    Filename: C:\Users\KBobechko\AppD
|                   |              ata\Local\Temp\
|                   |              bd65dfac-16e2-452a-9172-d731580b86b9\60450938
| Ptotal= 65.59 mm |    Comments: 25yr/6hr
--------------------
                 TIME    RAIN |  TIME    RAIN |'  TIME    RAIN |  TIME    RAIN
                  hrs   mm/hr |   hrs   mm/hr |'   hrs   mm/hr |   hrs   mm/hr
                 0.25    0.00 |  2.00   22.30 |  3.75    9.18 |  5.50    1.31
                 0.50    1.31 |  2.25   22.30 |  4.00    5.25 |  5.75    1.31
                 0.75    1.31 |  2.50   60.35 |  4.25    5.25 |  6.00    1.31
                 1.00    1.31 |  2.75   60.35 |  4.50    2.62 |  6.25    1.31
                 1.25    1.31 |  3.00   17.06 |  4.75    2.62 |
                 1.50    7.87 |  3.25   17.06 |  5.00    1.31 |
                 1.75    7.87 |  3.50    9.18 |  5.25    1.31 |

-------------------------------------------------------------------------------

--------------------
| CALIB             |
| NASHYD   (  0004)|   Area     (ha)=   0.70   Curve Number   (CN)= 50.0
|ID= 1 DT=10.0 min |   Ia       (mm)=   5.00   # of Linear Res.(N)= 3.00
--------------------   U.H. Tp(hrs)=    0.20

         NOTE:  RAINFALL WAS TRANSFORMED TO  10.0 MIN. TIME STEP.


                      ---- TRANSFORMED HYETOGRAPH ----
                 TIME    RAIN |  TIME    RAIN |'  TIME    RAIN |  TIME    RAIN
                  hrs   mm/hr |   hrs   mm/hr |'   hrs   mm/hr |   hrs   mm/hr
                0.167    0.00 | 1.833   15.08 | 3.500    9.18 |  5.17    1.31
                0.333    0.65 | 2.000   22.30 | 3.667    9.18 |  5.33    1.31
                0.500    1.31 | 2.167   22.30 | 3.833    7.21 |  5.50    1.31
                0.667    1.31 | 2.333   41.32 | 4.000    5.25 |  5.67    1.31
                0.833    1.31 | 2.500   60.35 | 4.167    5.25 |  5.83    1.31
                1.000    1.31 | 2.667   60.35 | 4.333    3.93 |  6.00    1.31
                1.167    1.31 | 2.833   38.70 | 4.500    2.62 |  6.17    1.31
                1.333    4.59 | 3.000   17.06 | 4.667    2.62 |  6.33    0.66
                1.500    7.87 | 3.167   17.06 | 4.833    1.97 |
                1.667    7.87 | 3.333   13.12 | 5.000    1.31 |

     Unit Hyd Qpeak  (cms)=   0.134

     PEAK FLOW       (cms)=   0.019 (i)
     TIME TO PEAK    (hrs)=   2.833
     RUNOFF VOLUME    (mm)=  11.366
     TOTAL RAINFALL   (mm)=  65.590
     RUNOFF COEFFICIENT   =   0.173

     (i) PEAK FLOW DOES NOT INCLUDE BASEFLOW IF ANY.

-------------------------------------------------------------------------------
--------------------
| RESERVOIR(  0006)|
| IN= 2---> OUT= 1 |
| DT= 10.0 min     |     OUTFLOW    STORAGE   |  OUTFLOW    STORAGE
--------------------      (cms)      (ha.m.)   |   (cms)      (ha.m.)
                          0.0000      0.0000   |   0.0310      0.0200
                          0.0300      0.0010   |   0.0000      0.0000

                                AREA     QPEAK     TPEAK       R.V.
                                (ha)     (cms)     (hrs)       (mm)
   INFLOW : ID= 2 (  0004)      0.700     0.019      2.83      11.37
   OUTFLOW: ID= 1 (  0006)      0.700     0.018      2.83      11.37

                  PEAK   FLOW   REDUCTION [Qout/Qin](%)= 94.68
                  TIME SHIFT OF PEAK FLOW         (min)=  0.00
                  MAXIMUM  STORAGE   USED       (ha.m.)=  0.0006

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********************************
** SIMULATION:Run 09          **
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--------------------
|    READ STORM     |    Filename: C:\Users\KBobechko\AppD
|                   |              ata\Local\Temp\
|                   |              bd65dfac-16e2-452a-9172-d731580b86b9\ba6e9665
```

```
| Ptotal= 73.00 mm |    Comments: 50yr/6hr
--------------------
                 TIME    RAIN |  TIME    RAIN |'  TIME    RAIN |  TIME    RAIN
                  hrs   mm/hr |   hrs   mm/hr |'   hrs   mm/hr |   hrs   mm/hr
                 0.25    0.00 |  2.00   24.82 |  3.75   10.22 |  5.50    1.46
                 0.50    1.46 |  2.25   24.82 |  4.00    5.84 |  5.75    1.46
                 0.75    1.46 |  2.50   67.16 |  4.25    5.84 |  6.00    1.46
                 1.00    1.46 |  2.75   67.16 |  4.50    2.92 |  6.25    1.46
                 1.25    1.46 |  3.00   18.98 |  4.75    2.92 |
                 1.50    8.76 |  3.25   18.98 |  5.00    1.46 |
                 1.75    8.76 |  3.50   10.22 |  5.25    1.46 |

--------------------------------------------------------------------------------

--------------------
| CALIB            |
| NASHYD   ( 0004)|   Area    (ha)=   0.70   Curve Number   (CN)= 50.0
|ID= 1 DT=10.0 min |   Ia      (mm)=   5.00   # of Linear Res.(N)= 3.00
--------------------   U.H. Tp(hrs)=   0.20

         NOTE:  RAINFALL WAS TRANSFORMED TO  10.0 MIN. TIME STEP.


                              ---- TRANSFORMED HYETOGRAPH ----
                 TIME    RAIN |  TIME    RAIN |'  TIME    RAIN |  TIME    RAIN
                  hrs   mm/hr |   hrs   mm/hr |'   hrs   mm/hr |   hrs   mm/hr
                0.167    0.00 | 1.833   16.79 | 3.500   10.22 |  5.17    1.46
                0.333    0.73 | 2.000   24.82 | 3.667   10.22 |  5.33    1.46
                0.500    1.46 | 2.167   24.82 | 3.833    8.03 |  5.50    1.46
                0.667    1.46 | 2.333   45.99 | 4.000    5.84 |  5.67    1.46
                0.833    1.46 | 2.500   67.16 | 4.167    5.84 |  5.83    1.46
                1.000    1.46 | 2.667   67.16 | 4.333    4.38 |  6.00    1.46
                1.167    1.46 | 2.833   43.07 | 4.500    2.92 |  6.17    1.46
                1.333    5.11 | 3.000   18.98 | 4.667    2.92 |  6.33    0.73
                1.500    8.76 | 3.167   18.98 | 4.833    2.19 |
                1.667    8.76 | 3.333   14.60 | 5.000    1.46 |

     Unit Hyd Qpeak  (cms)=    0.134

     PEAK FLOW       (cms)=    0.024 (i)
     TIME TO PEAK    (hrs)=    2.833
     RUNOFF VOLUME    (mm)=   13.987
     TOTAL RAINFALL   (mm)=   73.000
     RUNOFF COEFFICIENT   =    0.192

     (i) PEAK FLOW DOES NOT INCLUDE BASEFLOW IF ANY.

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--------------------
| RESERVOIR(  0006)|
| IN= 2---> OUT= 1 |
| DT= 10.0 min     |     OUTFLOW    STORAGE   |  OUTFLOW    STORAGE
--------------------      (cms)      (ha.m.)   |   (cms)      (ha.m.)
                          0.0000      0.0000   |   0.0310      0.0200
                          0.0300      0.0010   |   0.0000      0.0000

                                AREA      QPEAK      TPEAK        R.V.
                                (ha)      (cms)      (hrs)        (mm)
   INFLOW : ID= 2 (  0004)      0.700      0.024       2.83       13.99
   OUTFLOW: ID= 1 (  0006)      0.700      0.023       2.83       13.99

                   PEAK   FLOW   REDUCTION [Qout/Qin](%)= 95.06
                   TIME SHIFT OF PEAK FLOW         (min)=  0.00
                   MAXIMUM  STORAGE   USED       (ha.m.)=  0.0008

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********************************
** SIMULATION:Run 11          **
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--------------------
|    READ STORM    |    Filename: C:\Users\KBobechko\AppD
|                  |              ata\Local\Temp\
|                  |              bd65dfac-16e2-452a-9172-d731580b86b9\ce314ca8
| Ptotal= 80.31 mm |    Comments: 100yr/6hr
--------------------
```

```
                 TIME    RAIN |  TIME    RAIN |'  TIME    RAIN |  TIME    RAIN
                  hrs   mm/hr |   hrs   mm/hr |'   hrs   mm/hr |   hrs   mm/hr
                 0.25    0.00 |  2.00   27.30 |  3.75   11.24 |  5.50    1.61
                 0.50    1.61 |  2.25   27.30 |  4.00    6.42 |  5.75    1.61
                 0.75    1.61 |  2.50   73.88 |  4.25    6.42 |  6.00    1.61
                 1.00    1.61 |  2.75   73.88 |  4.50    3.21 |  6.25    1.61
                 1.25    1.61 |  3.00   20.88 |  4.75    3.21 |
                 1.50    9.64 |  3.25   20.88 |  5.00    1.61 |
                 1.75    9.64 |  3.50   11.24 |  5.25    1.61 |

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--------------------
| CALIB            |
| NASHYD   ( 0004)|   Area    (ha)=   0.70   Curve Number   (CN)= 50.0
|ID= 1 DT=10.0 min |   Ia      (mm)=   5.00   # of Linear Res.(N)= 3.00
--------------------   U.H. Tp(hrs)=   0.20

         NOTE:  RAINFALL WAS TRANSFORMED TO  10.0 MIN. TIME STEP.

                              ---- TRANSFORMED HYETOGRAPH ----
                 TIME    RAIN |  TIME    RAIN |'  TIME    RAIN |  TIME    RAIN
                  hrs   mm/hr |   hrs   mm/hr |'   hrs   mm/hr |   hrs   mm/hr
                0.167    0.00 | 1.833   18.47 | 3.500   11.24 |  5.17    1.61
                0.333    0.81 | 2.000   27.30 | 3.667   11.24 |  5.33    1.61
                0.500    1.61 | 2.167   27.30 | 3.833    8.83 |  5.50    1.61
                0.667    1.61 | 2.333   50.59 | 4.000    6.42 |  5.67    1.61
                0.833    1.61 | 2.500   73.88 | 4.167    6.42 |  5.83    1.61
                1.000    1.61 | 2.667   73.88 | 4.333    4.81 |  6.00    1.61
                1.167    1.61 | 2.833   47.38 | 4.500    3.21 |  6.17    1.61
                1.333    5.62 | 3.000   20.88 | 4.667    3.21 |  6.33    0.81
                1.500    9.64 | 3.167   20.88 | 4.833    2.41 |
                1.667    9.64 | 3.333   16.06 | 5.000    1.61 |

     Unit Hyd Qpeak  (cms)=    0.134

     PEAK FLOW       (cms)=    0.028 (i)
     TIME TO PEAK    (hrs)=    2.833
     RUNOFF VOLUME    (mm)=   16.775
     TOTAL RAINFALL   (mm)=   80.310
     RUNOFF COEFFICIENT   =    0.209

     (i) PEAK FLOW DOES NOT INCLUDE BASEFLOW IF ANY.

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--------------------
| RESERVOIR(  0006)|
| IN= 2---> OUT= 1 |
| DT= 10.0 min     |     OUTFLOW    STORAGE   |  OUTFLOW    STORAGE
--------------------      (cms)      (ha.m.)   |   (cms)      (ha.m.)
                          0.0000      0.0000   |   0.0310      0.0200
                          0.0300      0.0010   |   0.0000      0.0000

                                AREA      QPEAK      TPEAK        R.V.
                                (ha)      (cms)      (hrs)        (mm)
   INFLOW : ID= 2 (  0004)      0.700      0.028       2.83       16.77
   OUTFLOW: ID= 1 (  0006)      0.700      0.027       2.83       16.77

                   PEAK   FLOW   REDUCTION [Qout/Qin](%)= 95.37
                   TIME SHIFT OF PEAK FLOW         (min)=  0.00
                   MAXIMUM  STORAGE   USED       (ha.m.)=  0.0009

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********************************
** SIMULATION:Run 12          **
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--------------------
|    READ STORM    |    Filename: C:\Users\KBobechko\AppD
|                  |              ata\Local\Temp\
|                  |              bd65dfac-16e2-452a-9172-d731580b86b9\28fded1b
| Ptotal= 88.54 mm |    Comments: 100yr/12hr
--------------------
                 TIME    RAIN |  TIME    RAIN |'  TIME    RAIN |  TIME    RAIN
                  hrs   mm/hr |   hrs   mm/hr |'   hrs   mm/hr |   hrs   mm/hr
```

```
         0.25    0.00 |  3.50   15.05 |  6.75    6.20 | 10.00    0.89
         0.50    0.89 |  3.75   15.05 |  7.00    6.20 | 10.25    0.89
         0.75    0.89 |  4.00   15.05 |  7.25    6.20 | 10.50    0.89
         1.00    0.89 |  4.25   15.05 |  7.50    3.54 | 10.75    0.89
         1.25    0.89 |  4.50   40.71 |  7.75    3.54 | 11.00    0.89
         1.50    0.89 |  4.75   40.71 |  8.00    3.54 | 11.25    0.89
         1.75    0.89 |  5.00   40.71 |  8.25    3.54 | 11.50    0.89
         2.00    0.89 |  5.25   40.71 |  8.50    1.77 | 11.75    0.89
         2.25    0.89 |  5.50   11.51 |  8.75    1.77 | 12.00    0.89
         2.50    5.31 |  5.75   11.51 |  9.00    1.77 | 12.25    0.89
         2.75    5.31 |  6.00   11.51 |  9.25    1.77 |
         3.00    5.31 |  6.25   11.51 |  9.50    0.89 |
         3.25    5.31 |  6.50    6.20 |  9.75    0.89 |

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--------------------
| CALIB              |
| NASHYD   (  0004)|   Area     (ha)=   0.70   Curve Number   (CN)= 50.0
|ID= 1 DT=10.0 min |   Ia       (mm)=   5.00   # of Linear Res.(N)= 3.00
--------------------   U.H. Tp(hrs)=    0.20

         NOTE:  RAINFALL WAS TRANSFORMED TO  10.0 MIN. TIME STEP.


                          ---- TRANSFORMED HYETOGRAPH ----
         TIME    RAIN |  TIME    RAIN |'  TIME    RAIN |  TIME    RAIN
          hrs   mm/hr |   hrs   mm/hr |'   hrs   mm/hr |   hrs   mm/hr
        0.167    0.00 | 3.333   10.18 | 6.500    6.20 |  9.67    0.89
        0.333    0.45 | 3.500   15.05 | 6.667    6.20 |  9.83    0.89
        0.500    0.89 | 3.667   15.05 | 6.833    6.20 | 10.00    0.89
        0.667    0.89 | 3.833   15.05 | 7.000    6.20 | 10.17    0.89
        0.833    0.89 | 4.000   15.05 | 7.167    6.20 | 10.33    0.89
        1.000    0.89 | 4.167   15.05 | 7.333    4.87 | 10.50    0.89
        1.167    0.89 | 4.333   27.88 | 7.500    3.54 | 10.67    0.89
        1.333    0.89 | 4.500   40.71 | 7.667    3.54 | 10.83    0.89
        1.500    0.89 | 4.667   40.71 | 7.833    3.54 | 11.00    0.89
        1.667    0.89 | 4.833   40.71 | 8.000    3.54 | 11.17    0.89
        1.833    0.89 | 5.000   40.71 | 8.167    3.54 | 11.33    0.89
        2.000    0.89 | 5.167   40.71 | 8.333    2.66 | 11.50    0.89
        2.167    0.89 | 5.333   26.11 | 8.500    1.77 | 11.67    0.89
        2.333    3.10 | 5.500   11.51 | 8.667    1.77 | 11.83    0.89
        2.500    5.31 | 5.667   11.51 | 8.833    1.77 | 12.00    0.89
        2.667    5.31 | 5.833   11.51 | 9.000    1.77 | 12.17    0.89
        2.833    5.31 | 6.000   11.51 | 9.167    1.77 | 12.33    0.44
        3.000    5.31 | 6.167   11.51 | 9.333    1.33 |
        3.167    5.31 | 6.333    8.86 | 9.500    0.89 |

    Unit Hyd Qpeak  (cms)=   0.134

    PEAK FLOW       (cms)=   0.021 (i)
    TIME TO PEAK    (hrs)=   5.167
    RUNOFF VOLUME    (mm)=  20.138
    TOTAL RAINFALL   (mm)=  88.540
    RUNOFF COEFFICIENT   =   0.227

    (i) PEAK FLOW DOES NOT INCLUDE BASEFLOW IF ANY.

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--------------------
| RESERVOIR( 0006)|
| IN= 2---> OUT= 1 |
| DT= 10.0 min     |     OUTFLOW    STORAGE   |  OUTFLOW    STORAGE
--------------------       (cms)     (ha.m.)   |   (cms)     (ha.m.)
                          0.0000     0.0000    |   0.0310     0.0200
                          0.0300     0.0010    |   0.0000     0.0000

                                AREA     QPEAK     TPEAK       R.V.
                                (ha)     (cms)     (hrs)       (mm)
   INFLOW : ID= 2 (  0004)      0.700     0.021      5.17      20.14
   OUTFLOW: ID= 1 (  0006)      0.700     0.020      5.33      20.14

                   PEAK   FLOW   REDUCTION [Qout/Qin](%)= 95.58
                   TIME SHIFT OF PEAK FLOW        (min)= 10.00
                   MAXIMUM  STORAGE   USED      (ha.m.)=  0.0007
```

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********************************
** SIMULATION:Run 13          **
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--------------------
|    READ STORM     |    Filename: C:\Users\KBobechko\AppD
|                   |              ata\Local\Temp\
|                   |              bd65dfac-16e2-452a-9172-d731580b86b9\f85a9fcc
| Ptotal=127.50 mm |    Comments: 100yr 24hr 5min SCS
--------------------
                 TIME    RAIN |  TIME    RAIN |'  TIME    RAIN |  TIME    RAIN
                  hrs   mm/hr |   hrs   mm/hr |'   hrs   mm/hr |   hrs   mm/hr
                 0.08    0.00 |  6.17    2.30 | 12.25   18.36 | 18.33    2.30
                 0.17    1.40 |  6.25    2.30 | 12.33   18.36 | 18.42    2.30
                 0.25    1.40 |  6.33    2.30 | 12.42   18.36 | 18.50    2.30
                 0.33    1.40 |  6.42    2.30 | 12.50   18.36 | 18.58    2.30
                 0.42    1.40 |  6.50    2.30 | 12.58   18.36 | 18.67    2.30
                 0.50    1.40 |  6.58    2.30 | 12.67    9.44 | 18.75    2.30
                 0.58    1.40 |  6.67    2.30 | 12.75    9.44 | 18.83    2.30
                 0.67    1.40 |  6.75    2.30 | 12.83    9.44 | 18.92    2.30
                 0.75    1.40 |  6.83    2.30 | 12.92    9.44 | 19.00    2.30
                 0.83    1.40 |  6.92    2.30 | 13.00    9.44 | 19.08    2.30
                 0.92    1.40 |  7.00    2.30 | 13.08    9.44 | 19.17    2.30
                 1.00    1.40 |  7.08    2.30 | 13.17    6.89 | 19.25    2.30
                 1.08    1.40 |  7.17    2.81 | 13.25    6.89 | 19.33    2.30
                 1.17    1.40 |  7.25    2.81 | 13.33    6.89 | 19.42    2.30
                 1.25    1.40 |  7.33    2.81 | 13.42    6.89 | 19.50    2.30
                 1.33    1.40 |  7.42    2.81 | 13.50    6.89 | 19.58    2.30
                 1.42    1.40 |  7.50    2.81 | 13.58    6.89 | 19.67    2.30
                 1.50    1.40 |  7.58    2.81 | 13.67    5.36 | 19.75    2.30
                 1.58    1.40 |  7.67    2.81 | 13.75    5.36 | 19.83    2.30
                 1.67    1.40 |  7.75    2.81 | 13.83    5.36 | 19.92    2.30
                 1.75    1.40 |  7.83    2.81 | 13.92    5.36 | 20.00    2.30
                 1.83    1.40 |  7.92    2.81 | 14.00    5.36 | 20.08    2.30
                 1.92    1.40 |  8.00    2.81 | 14.08    5.36 | 20.17    1.53
                 2.00    1.40 |  8.08    2.81 | 14.17    3.83 | 20.25    1.53
                 2.08    1.40 |  8.17    3.32 | 14.25    3.83 | 20.33    1.53
                 2.17    1.66 |  8.25    3.32 | 14.33    3.83 | 20.42    1.53
                 2.25    1.66 |  8.33    3.32 | 14.42    3.83 | 20.50    1.53
                 2.33    1.66 |  8.42    3.32 | 14.50    3.83 | 20.58    1.53
                 2.42    1.66 |  8.50    3.32 | 14.58    3.83 | 20.67    1.53
                 2.50    1.66 |  8.58    3.32 | 14.67    3.83 | 20.75    1.53
                 2.58    1.66 |  8.67    3.57 | 14.75    3.83 | 20.83    1.53
                 2.67    1.66 |  8.75    3.57 | 14.83    3.83 | 20.92    1.53
                 2.75    1.66 |  8.83    3.57 | 14.92    3.83 | 21.00    1.53
                 2.83    1.66 |  8.92    3.57 | 15.00    3.83 | 21.08    1.53
                 2.92    1.66 |  9.00    3.57 | 15.08    3.83 | 21.17    1.53
                 3.00    1.66 |  9.08    3.57 | 15.17    3.83 | 21.25    1.53
                 3.08    1.66 |  9.17    4.08 | 15.25    3.83 | 21.33    1.53
                 3.17    1.66 |  9.25    4.08 | 15.33    3.83 | 21.42    1.53
                 3.25    1.66 |  9.33    4.08 | 15.42    3.83 | 21.50    1.53
                 3.33    1.66 |  9.42    4.08 | 15.50    3.83 | 21.58    1.53
                 3.42    1.66 |  9.50    4.08 | 15.58    3.83 | 21.67    1.53
                 3.50    1.66 |  9.58    4.08 | 15.67    3.83 | 21.75    1.53
                 3.58    1.66 |  9.67    4.59 | 15.75    3.83 | 21.83    1.53
                 3.67    1.66 |  9.75    4.59 | 15.83    3.83 | 21.92    1.53
                 3.75    1.66 |  9.83    4.59 | 15.92    3.83 | 22.00    1.53
                 3.83    1.66 |  9.92    4.59 | 16.00    3.83 | 22.08    1.53
                 3.92    1.66 | 10.00    4.59 | 16.08    3.83 | 22.17    1.53
                 4.00    1.66 | 10.08    4.59 | 16.17    2.30 | 22.25    1.53
                 4.08    1.66 | 10.17    5.86 | 16.25    2.30 | 22.33    1.53
                 4.17    2.04 | 10.25    5.86 | 16.33    2.30 | 22.42    1.53
                 4.25    2.04 | 10.33    5.86 | 16.42    2.30 | 22.50    1.53
                 4.33    2.04 | 10.42    5.86 | 16.50    2.30 | 22.58    1.53
                 4.42    2.04 | 10.50    5.86 | 16.58    2.30 | 22.67    1.53
                 4.50    2.04 | 10.58    5.86 | 16.67    2.30 | 22.75    1.53
                 4.58    2.04 | 10.67    7.91 | 16.75    2.30 | 22.83    1.53
                 4.67    2.04 | 10.75    7.91 | 16.83    2.30 | 22.92    1.53
                 4.75    2.04 | 10.83    7.91 | 16.92    2.30 | 23.00    1.53
                 4.83    2.04 | 10.92    7.91 | 17.00    2.30 | 23.08    1.53
                 4.92    2.04 | 11.00    7.91 | 17.08    2.30 | 23.17    1.53
                 5.00    2.04 | 11.08    7.91 | 17.17    2.30 | 23.25    1.53
                 5.08    2.04 | 11.17   12.24 | 17.25    2.30 | 23.33    1.53
                 5.17    2.04 | 11.25   12.24 | 17.33    2.30 | 23.42    1.53
                 5.25    2.04 | 11.33   12.24 | 17.42    2.30 | 23.50    1.53
```

```
               5.33    2.04 | 11.42   12.24 | 17.50    2.30 | 23.58    1.53
               5.42    2.04 | 11.50   12.24 | 17.58    2.30 | 23.67    1.53
               5.50    2.04 | 11.58   12.24 | 17.67    2.30 | 23.75    1.53
               5.58    2.04 | 11.67   37.74 | 17.75    2.30 | 23.83    1.53
               5.67    2.04 | 11.75   37.74 | 17.83    2.30 | 23.92    1.53
               5.75    2.04 | 11.83   37.74 | 17.92    2.30 | 24.00    1.53
               5.83    2.04 | 11.92  156.06 | 18.00    2.30 | 24.08    1.53
               5.92    2.04 | 12.00  156.06 | 18.08    2.30 |
               6.00    2.04 | 12.08  156.06 | 18.17    2.30 |
               6.08    2.04 | 12.17   18.36 | 18.25    2.30 |

-------------------------------------------------------------------------------

--------------------
| CALIB              |
| NASHYD   (  0004)|   Area    (ha)=   0.70   Curve Number   (CN)= 50.0
|ID= 1 DT=10.0 min |   Ia      (mm)=   5.00   # of Linear Res.(N)= 3.00
--------------------   U.H. Tp(hrs)=   0.20

         NOTE:  RAINFALL WAS TRANSFORMED TO  10.0 MIN. TIME STEP.

                               ---- TRANSFORMED HYETOGRAPH ----
               TIME    RAIN |  TIME    RAIN |'  TIME    RAIN |  TIME    RAIN
                hrs   mm/hr |   hrs   mm/hr |'   hrs   mm/hr |   hrs   mm/hr
              0.167    0.70 | 6.333    2.29 |12.500   18.36 | 18.67    2.30
              0.333    1.40 | 6.500    2.29 |12.667   13.90 | 18.83    2.29
              0.500    1.40 | 6.667    2.30 |12.833    9.44 | 19.00    2.29
              0.667    1.40 | 6.833    2.29 |13.000    9.43 | 19.17    2.30
              0.833    1.40 | 7.000    2.29 |13.167    8.16 | 19.33    2.29
              1.000    1.40 | 7.167    2.55 |13.333    6.89 | 19.50    2.29
              1.167    1.40 | 7.333    2.80 |13.500    6.88 | 19.67    2.30
              1.333    1.40 | 7.500    2.80 |13.667    6.12 | 19.83    2.29
              1.500    1.40 | 7.667    2.81 |13.833    5.36 | 20.00    2.29
              1.667    1.40 | 7.833    2.80 |14.000    5.35 | 20.17    1.91
              1.833    1.40 | 8.000    2.80 |14.167    4.59 | 20.33    1.53
              2.000    1.40 | 8.167    3.06 |14.333    3.83 | 20.50    1.53
              2.167    1.53 | 8.333    3.32 |14.500    3.82 | 20.67    1.53
              2.333    1.66 | 8.500    3.31 |14.667    3.83 | 20.83    1.53
              2.500    1.66 | 8.667    3.44 |14.833    3.83 | 21.00    1.53
              2.667    1.66 | 8.833    3.57 |15.000    3.82 | 21.17    1.53
              2.833    1.66 | 9.000    3.57 |15.167    3.83 | 21.33    1.53
              3.000    1.66 | 9.167    3.83 |15.333    3.83 | 21.50    1.53
              3.167    1.66 | 9.333    4.08 |15.500    3.82 | 21.67    1.53
              3.333    1.66 | 9.500    4.08 |15.667    3.83 | 21.83    1.53
              3.500    1.66 | 9.667    4.34 |15.833    3.83 | 22.00    1.53
              3.667    1.66 | 9.833    4.59 |16.000    3.82 | 22.17    1.53
              3.833    1.66 |10.000    4.59 |16.167    3.06 | 22.33    1.53
              4.000    1.66 |10.167    5.23 |16.333    2.29 | 22.50    1.53
              4.167    1.85 |10.333    5.87 |16.500    2.29 | 22.67    1.53
              4.333    2.04 |10.500    5.86 |16.667    2.30 | 22.83    1.53
              4.500    2.04 |10.667    6.89 |16.833    2.29 | 23.00    1.53
              4.667    2.04 |10.833    7.91 |17.000    2.29 | 23.17    1.53
              4.833    2.04 |11.000    7.90 |17.167    2.30 | 23.33    1.53
              5.000    2.04 |11.167   10.07 |17.333    2.29 | 23.50    1.53
              5.167    2.04 |11.333   12.24 |17.500    2.29 | 23.67    1.53
              5.333    2.04 |11.500   12.24 |17.667    2.30 | 23.83    1.53
              5.500    2.04 |11.667   24.99 |17.833    2.29 | 24.00    1.53
              5.667    2.04 |11.833   37.75 |18.000    2.29 | 24.17    1.53
              5.833    2.04 |12.000  156.06 |18.167    2.30 |
              6.000    2.04 |12.167   87.20 |18.333    2.29 |
              6.167    2.17 |12.333   18.36 |18.500    2.29 |

     Unit Hyd Qpeak  (cms)=   0.134

     PEAK FLOW       (cms)=   0.064 (i)
     TIME TO PEAK    (hrs)=  12.167
     RUNOFF VOLUME    (mm)=  38.888
     TOTAL RAINFALL   (mm)= 127.627
     RUNOFF COEFFICIENT   =   0.305

     (i) PEAK FLOW DOES NOT INCLUDE BASEFLOW IF ANY.

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--------------------
| RESERVOIR(  0006)|
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```
| IN= 2---> OUT= 1 |
| DT= 10.0 min     |     OUTFLOW    STORAGE   |  OUTFLOW    STORAGE
--------------------      (cms)     (ha.m.)   |   (cms)     (ha.m.)
                          0.0000     0.0000   |   0.0310      0.0200
                          0.0300     0.0010   |   0.0000      0.0000

                                     AREA     QPEAK     TPEAK       R.V.
                                     (ha)     (cms)     (hrs)       (mm)
   INFLOW : ID= 2 (  0004)          0.700     0.064     12.17      38.89
   OUTFLOW: ID= 1 (  0006)          0.700     0.030     12.50      38.89

                PEAK   FLOW   REDUCTION [Qout/Qin](%)= 46.87
                TIME SHIFT OF PEAK FLOW         (min)= 20.00
                MAXIMUM  STORAGE   USED       (ha.m.)=  0.0044

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COLE ENGINEERING
Experience Enhancing Excellence

2017-0701 Belfountain
2, 5, 10, 25, 50 & 100-Year 6 Hour SCS Storm, 100- Year 6 Hour SCS Storm, & 100- Year 24 Hour SCS Storm
2 Dry Well per Storage Cell
Proposed Two Storage/Infiltration Cell Condition Model Output
February, 2018

Modeling with two Dry Wells per Storage Cell
Total of 60 L/s infiltration rate

```
*******************************
** SIMULATION:Run 01          **
*******************************

--------------------
|    READ STORM    |    Filename: C:\Users\KBobechko\AppD
|                  |              ata\Local\Temp\
|                  |              b4b0b1fa-7385-43bd-aff7-ed07ccb0daca\039183b4
| Ptotal= 36.00 mm |    Comments: 2yr/6hr
--------------------
                 TIME    RAIN |  TIME    RAIN |'  TIME    RAIN |  TIME    RAIN
                  hrs   mm/hr |   hrs   mm/hr |'   hrs   mm/hr |   hrs   mm/hr
                 0.25    0.00 |  2.00   12.24 |  3.75    5.04 |  5.50    0.72
                 0.50    0.72 |  2.25   12.24 |  4.00    2.88 |  5.75    0.72
                 0.75    0.72 |  2.50   33.12 |  4.25    2.88 |  6.00    0.72
                 1.00    0.72 |  2.75   33.12 |  4.50    1.44 |  6.25    0.72
                 1.25    0.72 |  3.00    9.36 |  4.75    1.44 |
                 1.50    4.32 |  3.25    9.36 |  5.00    0.72 |
                 1.75    4.32 |  3.50    5.04 |  5.25    0.72 |

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--------------------
| CALIB            |
| NASHYD   (  0004)|   Area    (ha)=   0.70   Curve Number   (CN)= 50.0
|ID= 1 DT=10.0 min |   Ia      (mm)=   5.00   # of Linear Res.(N)= 3.00
--------------------   U.H. Tp(hrs)=   0.20

         NOTE:  RAINFALL WAS TRANSFORMED TO  10.0 MIN. TIME STEP.

                               ---- TRANSFORMED HYETOGRAPH ----
                 TIME    RAIN |  TIME    RAIN |'  TIME    RAIN |  TIME    RAIN
                  hrs   mm/hr |   hrs   mm/hr |'   hrs   mm/hr |   hrs   mm/hr
                0.167    0.00 | 1.833    8.28 | 3.500    5.04 |  5.17    0.72
                0.333    0.36 | 2.000   12.24 | 3.667    5.04 |  5.33    0.72
                0.500    0.72 | 2.167   12.24 | 3.833    3.96 |  5.50    0.72
                0.667    0.72 | 2.333   22.68 | 4.000    2.88 |  5.67    0.72
                0.833    0.72 | 2.500   33.12 | 4.167    2.88 |  5.83    0.72
                1.000    0.72 | 2.667   33.12 | 4.333    2.16 |  6.00    0.72
                1.167    0.72 | 2.833   21.24 | 4.500    1.44 |  6.17    0.72
                1.333    2.52 | 3.000    9.36 | 4.667    1.44 |  6.33    0.36
                1.500    4.32 | 3.167    9.36 | 4.833    1.08 |
                1.667    4.32 | 3.333    7.20 | 5.000    0.72 |

     Unit Hyd Qpeak  (cms)=   0.134

     PEAK FLOW       (cms)=   0.006 (i)
     TIME TO PEAK    (hrs)=   2.833
     RUNOFF VOLUME    (mm)=   3.284
     TOTAL RAINFALL   (mm)=  36.000
     RUNOFF COEFFICIENT   =   0.091

     (i) PEAK FLOW DOES NOT INCLUDE BASEFLOW IF ANY.

--------------------------------------------------------------------------------
--------------------
| RESERVOIR(  0006)|
| IN= 2---> OUT= 1 |
| DT= 10.0 min     |     OUTFLOW    STORAGE   |  OUTFLOW    STORAGE
--------------------      (cms)     (ha.m.)   |   (cms)     (ha.m.)
                          0.0000     0.0000   |   0.0610     0.0200
                          0.0600     0.0010   |   0.0000     0.0000

                                AREA     QPEAK     TPEAK       R.V.
                                (ha)     (cms)     (hrs)       (mm)
   INFLOW : ID= 2 (  0004)      0.700     0.006      2.83       3.28
   OUTFLOW: ID= 1 (  0006)      0.700     0.005      2.83       3.28

                    PEAK   FLOW   REDUCTION [Qout/Qin](%)= 98.68
                    TIME SHIFT OF PEAK FLOW         (min)=  0.00
                    MAXIMUM  STORAGE   USED       (ha.m.)=  0.0001

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*******************************
** SIMULATION:Run 03          **
*******************************

--------------------
|    READ STORM    |    Filename: C:\Users\KBobechko\AppD
|                  |              ata\Local\Temp\
|                  |              b4b0b1fa-7385-43bd-aff7-ed07ccb0daca\46e582ec
| Ptotal= 47.81 mm |    Comments: 5yr/6hr
--------------------
                 TIME    RAIN |  TIME    RAIN |'  TIME    RAIN |  TIME    RAIN
                  hrs   mm/hr |   hrs   mm/hr |'   hrs   mm/hr |   hrs   mm/hr
                 0.25    0.00 |  2.00   16.25 |  3.75    6.69 |  5.50    0.96
                 0.50    0.96 |  2.25   16.25 |  4.00    3.82 |  5.75    0.96
                 0.75    0.96 |  2.50   43.98 |  4.25    3.82 |  6.00    0.96
                 1.00    0.96 |  2.75   43.98 |  4.50    1.91 |  6.25    0.96
                 1.25    0.96 |  3.00   12.43 |  4.75    1.91 |
                 1.50    5.74 |  3.25   12.43 |  5.00    0.96 |
                 1.75    5.74 |  3.50    6.69 |  5.25    0.96 |

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--------------------
| CALIB            |
| NASHYD   (  0004)|   Area    (ha)=   0.70   Curve Number   (CN)= 50.0
|ID= 1 DT=10.0 min |   Ia      (mm)=   5.00   # of Linear Res.(N)= 3.00
--------------------   U.H. Tp(hrs)=   0.20

         NOTE:  RAINFALL WAS TRANSFORMED TO  10.0 MIN. TIME STEP.

                               ---- TRANSFORMED HYETOGRAPH ----
                 TIME    RAIN |  TIME    RAIN |'  TIME    RAIN |  TIME    RAIN
                  hrs   mm/hr |   hrs   mm/hr |'   hrs   mm/hr |   hrs   mm/hr
                0.167    0.00 | 1.833   10.99 | 3.500    6.69 |  5.17    0.96
                0.333    0.48 | 2.000   16.25 | 3.667    6.69 |  5.33    0.96
                0.500    0.96 | 2.167   16.25 | 3.833    5.25 |  5.50    0.96
                0.667    0.96 | 2.333   30.11 | 4.000    3.82 |  5.67    0.96
                0.833    0.96 | 2.500   43.98 | 4.167    3.82 |  5.83    0.96
                1.000    0.96 | 2.667   43.98 | 4.333    2.86 |  6.00    0.96
                1.167    0.96 | 2.833   28.20 | 4.500    1.91 |  6.17    0.96
                1.333    3.35 | 3.000   12.43 | 4.667    1.91 |  6.33    0.48
                1.500    5.74 | 3.167   12.43 | 4.833    1.43 |
                1.667    5.74 | 3.333    9.56 | 5.000    0.96 |

     Unit Hyd Qpeak  (cms)=   0.134

     PEAK FLOW       (cms)=   0.010 (i)
     TIME TO PEAK    (hrs)=   2.833
     RUNOFF VOLUME    (mm)=   6.014
     TOTAL RAINFALL   (mm)=  47.810
     RUNOFF COEFFICIENT   =   0.126

     (i) PEAK FLOW DOES NOT INCLUDE BASEFLOW IF ANY.

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--------------------
| RESERVOIR(  0006)|
| IN= 2---> OUT= 1 |
| DT= 10.0 min     |     OUTFLOW    STORAGE   |  OUTFLOW    STORAGE
--------------------      (cms)     (ha.m.)   |   (cms)     (ha.m.)
                          0.0000     0.0000   |   0.0610     0.0200
                          0.0600     0.0010   |   0.0000     0.0000

                                AREA     QPEAK     TPEAK       R.V.
                                (ha)     (cms)     (hrs)       (mm)
   INFLOW : ID= 2 (  0004)      0.700     0.010      2.83       6.01
   OUTFLOW: ID= 1 (  0006)      0.700     0.010      2.83       6.01

                    PEAK   FLOW   REDUCTION [Qout/Qin](%)= 99.41
                    TIME SHIFT OF PEAK FLOW         (min)=  0.00
                    MAXIMUM  STORAGE   USED       (ha.m.)=  0.0002

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*******************************
** SIMULATION:Run 05          **
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--------------------
|    READ STORM     |    Filename: C:\Users\KBobechko\AppD
|                   |              ata\Local\Temp\
|                   |              b4b0b1fa-7385-43bd-aff7-ed07ccb0daca\573b3d28
| Ptotal= 55.69 mm |    Comments: 10yr/6hr
--------------------
                 TIME    RAIN |  TIME    RAIN |'  TIME    RAIN |  TIME    RAIN
                  hrs   mm/hr |   hrs   mm/hr |'   hrs   mm/hr |   hrs   mm/hr
                 0.25    0.00 |  2.00   18.94 |  3.75    7.80 |  5.50    1.11
                 0.50    1.11 |  2.25   18.94 |  4.00    4.46 |  5.75    1.11
                 0.75    1.11 |  2.50   51.24 |  4.25    4.46 |  6.00    1.11
                 1.00    1.11 |  2.75   51.24 |  4.50    2.23 |  6.25    1.11
                 1.25    1.11 |  3.00   14.48 |  4.75    2.23 |
                 1.50    6.68 |  3.25   14.48 |  5.00    1.11 |
                 1.75    6.68 |  3.50    7.80 |  5.25    1.11 |

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--------------------
| CALIB              |
| NASHYD   (  0004)|   Area     (ha)=    0.70   Curve Number    (CN)= 50.0
|ID= 1 DT=10.0 min |   Ia       (mm)=    5.00   # of Linear Res.(N)= 3.00
--------------------   U.H. Tp(hrs)=    0.20

         NOTE:  RAINFALL WAS TRANSFORMED TO  10.0 MIN. TIME STEP.

                              ---- TRANSFORMED HYETOGRAPH ----
                 TIME    RAIN |  TIME    RAIN |'  TIME    RAIN |  TIME    RAIN
                  hrs   mm/hr |   hrs   mm/hr |'   hrs   mm/hr |   hrs   mm/hr
                0.167    0.00 | 1.833   12.81 | 3.500    7.80 |  5.17    1.11
                0.333    0.56 | 2.000   18.94 | 3.667    7.80 |  5.33    1.11
                0.500    1.11 | 2.167   18.94 | 3.833    6.13 |  5.50    1.11
                0.667    1.11 | 2.333   35.09 | 4.000    4.46 |  5.67    1.11
                0.833    1.11 | 2.500   51.24 | 4.167    4.46 |  5.83    1.11
                1.000    1.11 | 2.667   51.24 | 4.333    3.34 |  6.00    1.11
                1.167    1.11 | 2.833   32.86 | 4.500    2.23 |  6.17    1.11
                1.333    3.89 | 3.000   14.48 | 4.667    2.23 |  6.33    0.56
                1.500    6.68 | 3.167   14.48 | 4.833    1.67 |
                1.667    6.68 | 3.333   11.14 | 5.000    1.11 |

     Unit Hyd Qpeak  (cms)=    0.134

     PEAK FLOW       (cms)=    0.014 (i)
     TIME TO PEAK    (hrs)=    2.833
     RUNOFF VOLUME    (mm)=    8.213
     TOTAL RAINFALL   (mm)=   55.690
     RUNOFF COEFFICIENT   =    0.147

     (i) PEAK FLOW DOES NOT INCLUDE BASEFLOW IF ANY.

-------------------------------------------------------------------------------
--------------------
| RESERVOIR(  0006)|
| IN= 2---> OUT= 1 |
| DT= 10.0 min      |      OUTFLOW    STORAGE   |  OUTFLOW    STORAGE
--------------------        (cms)     (ha.m.)   |   (cms)     (ha.m.)
                           0.0000      0.0000   |  0.0610      0.0200
                           0.0600      0.0010   |  0.0000      0.0000

                                 AREA      QPEAK      TPEAK        R.V.
                                 (ha)      (cms)      (hrs)        (mm)
   INFLOW : ID= 2 (  0004)      0.700      0.014       2.83        8.21
   OUTFLOW: ID= 1 (  0006)      0.700      0.014       2.83        8.21

                  PEAK   FLOW   REDUCTION [Qout/Qin](%)= 99.73
                  TIME SHIFT OF PEAK FLOW         (min)=  0.00
                  MAXIMUM  STORAGE   USED       (ha.m.)=  0.0002

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********************************
** SIMULATION:Run 07          **
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--------------------
|    READ STORM     |    Filename: C:\Users\KBobechko\AppD
```

```
|                   |              ata\Local\Temp\
|                   |              b4b0b1fa-7385-43bd-aff7-ed07ccb0daca\60450938
| Ptotal= 65.59 mm |    Comments: 25yr/6hr
--------------------
                 TIME    RAIN |  TIME    RAIN |'  TIME    RAIN |  TIME    RAIN
                  hrs   mm/hr |   hrs   mm/hr |'   hrs   mm/hr |   hrs   mm/hr
                 0.25    0.00 |  2.00   22.30 |  3.75    9.18 |  5.50    1.31
                 0.50    1.31 |  2.25   22.30 |  4.00    5.25 |  5.75    1.31
                 0.75    1.31 |  2.50   60.35 |  4.25    5.25 |  6.00    1.31
                 1.00    1.31 |  2.75   60.35 |  4.50    2.62 |  6.25    1.31
                 1.25    1.31 |  3.00   17.06 |  4.75    2.62 |
                 1.50    7.87 |  3.25   17.06 |  5.00    1.31 |
                 1.75    7.87 |  3.50    9.18 |  5.25    1.31 |

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--------------------
| CALIB              |
| NASHYD   (  0004)|   Area     (ha)=    0.70   Curve Number    (CN)= 50.0
|ID= 1 DT=10.0 min |   Ia       (mm)=    5.00   # of Linear Res.(N)= 3.00
--------------------   U.H. Tp(hrs)=    0.20

         NOTE:  RAINFALL WAS TRANSFORMED TO  10.0 MIN. TIME STEP.

                              ---- TRANSFORMED HYETOGRAPH ----
                 TIME    RAIN |  TIME    RAIN |'  TIME    RAIN |  TIME    RAIN
                  hrs   mm/hr |   hrs   mm/hr |'   hrs   mm/hr |   hrs   mm/hr
                0.167    0.00 | 1.833   15.08 | 3.500    9.18 |  5.17    1.31
                0.333    0.65 | 2.000   22.30 | 3.667    9.18 |  5.33    1.31
                0.500    1.31 | 2.167   22.30 | 3.833    7.21 |  5.50    1.31
                0.667    1.31 | 2.333   41.32 | 4.000    5.25 |  5.67    1.31
                0.833    1.31 | 2.500   60.35 | 4.167    5.25 |  5.83    1.31
                1.000    1.31 | 2.667   60.35 | 4.333    3.93 |  6.00    1.31
                1.167    1.31 | 2.833   38.70 | 4.500    2.62 |  6.17    1.31
                1.333    4.59 | 3.000   17.06 | 4.667    2.62 |  6.33    0.66
                1.500    7.87 | 3.167   17.06 | 4.833    1.97 |
                1.667    7.87 | 3.333   13.12 | 5.000    1.31 |

     Unit Hyd Qpeak  (cms)=    0.134

     PEAK FLOW       (cms)=    0.019 (i)
     TIME TO PEAK    (hrs)=    2.833
     RUNOFF VOLUME    (mm)=   11.366
     TOTAL RAINFALL   (mm)=   65.590
     RUNOFF COEFFICIENT   =    0.173

     (i) PEAK FLOW DOES NOT INCLUDE BASEFLOW IF ANY.

-------------------------------------------------------------------------------
--------------------
| RESERVOIR(  0006)|
| IN= 2---> OUT= 1 |
| DT= 10.0 min      |      OUTFLOW    STORAGE   |  OUTFLOW    STORAGE
--------------------        (cms)     (ha.m.)   |   (cms)     (ha.m.)
                           0.0000      0.0000   |  0.0610      0.0200
                           0.0600      0.0010   |  0.0000      0.0000

                                 AREA      QPEAK      TPEAK        R.V.
                                 (ha)      (cms)      (hrs)        (mm)
   INFLOW : ID= 2 (  0004)      0.700      0.019       2.83       11.37
   OUTFLOW: ID= 1 (  0006)      0.700      0.019       2.83       11.37

                  PEAK   FLOW   REDUCTION [Qout/Qin](%)=100.04
                  TIME SHIFT OF PEAK FLOW         (min)=  0.00
                  MAXIMUM  STORAGE   USED       (ha.m.)=  0.0003

     **** WARNING : HYDROGRAPH PEAK WAS NOT REDUCED.
                    CHECK OUTFLOW/STORAGE TABLE  OR REDUCE DT.
-------------------------------------------------------------------------------
********************************
** SIMULATION:Run 09          **
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--------------------
|    READ STORM     |    Filename: C:\Users\KBobechko\AppD
```

```
|                  |             ata\Local\Temp\
|                  |             b4b0b1fa-7385-43bd-aff7-ed07ccb0daca\ba6e9665
| Ptotal= 73.00 mm |    Comments: 50yr/6hr
--------------------
                 TIME    RAIN |  TIME    RAIN |'  TIME    RAIN |  TIME    RAIN
                  hrs   mm/hr |   hrs   mm/hr |'   hrs   mm/hr |   hrs   mm/hr
                 0.25    0.00 |  2.00   24.82 |  3.75   10.22 |  5.50    1.46
                 0.50    1.46 |  2.25   24.82 |  4.00    5.84 |  5.75    1.46
                 0.75    1.46 |  2.50   67.16 |  4.25    5.84 |  6.00    1.46
                 1.00    1.46 |  2.75   67.16 |  4.50    2.92 |  6.25    1.46
                 1.25    1.46 |  3.00   18.98 |  4.75    2.92 |
                 1.50    8.76 |  3.25   18.98 |  5.00    1.46 |
                 1.75    8.76 |  3.50   10.22 |  5.25    1.46 |

-------------------------------------------------------------------------------

--------------------
| CALIB            |
| NASHYD   (  0004)|   Area    (ha)=   0.70   Curve Number   (CN)= 50.0
|ID= 1 DT=10.0 min |   Ia      (mm)=   5.00   # of Linear Res.(N)= 3.00
--------------------   U.H. Tp(hrs)=    0.20

         NOTE:  RAINFALL WAS TRANSFORMED TO  10.0 MIN. TIME STEP.


                       ---- TRANSFORMED HYETOGRAPH ----
                 TIME    RAIN |  TIME    RAIN |'  TIME    RAIN |  TIME    RAIN
                  hrs   mm/hr |   hrs   mm/hr |'   hrs   mm/hr |   hrs   mm/hr
                0.167    0.00 | 1.833   16.79 | 3.500   10.22 |  5.17    1.46
                0.333    0.73 | 2.000   24.82 | 3.667   10.22 |  5.33    1.46
                0.500    1.46 | 2.167   24.82 | 3.833    8.03 |  5.50    1.46
                0.667    1.46 | 2.333   45.99 | 4.000    5.84 |  5.67    1.46
                0.833    1.46 | 2.500   67.16 | 4.167    5.84 |  5.83    1.46
                1.000    1.46 | 2.667   67.16 | 4.333    4.38 |  6.00    1.46
                1.167    1.46 | 2.833   43.07 | 4.500    2.92 |  6.17    1.46
                1.333    5.11 | 3.000   18.98 | 4.667    2.92 |  6.33    0.73
                1.500    8.76 | 3.167   18.98 | 4.833    2.19 |
                1.667    8.76 | 3.333   14.60 | 5.000    1.46 |

     Unit Hyd Qpeak  (cms)=   0.134

     PEAK FLOW       (cms)=   0.024 (i)
     TIME TO PEAK    (hrs)=   2.833
     RUNOFF VOLUME    (mm)=  13.987
     TOTAL RAINFALL   (mm)=  73.000
     RUNOFF COEFFICIENT   =   0.192

     (i) PEAK FLOW DOES NOT INCLUDE BASEFLOW IF ANY.

-------------------------------------------------------------------------------
--------------------
| RESERVOIR(  0006)|
| IN= 2---> OUT= 1 |
| DT= 10.0 min     |      OUTFLOW    STORAGE   |  OUTFLOW    STORAGE
--------------------       (cms)     (ha.m.)   |   (cms)     (ha.m.)
                          0.0000     0.0000    |  0.0610      0.0200
                          0.0600     0.0010    |  0.0000      0.0000

                                AREA     QPEAK     TPEAK        R.V.
                                (ha)     (cms)     (hrs)        (mm)
   INFLOW : ID= 2 (  0004)      0.700      0.024      2.83       13.99
   OUTFLOW: ID= 1 (  0006)      0.700      0.024      2.83       13.99

                  PEAK   FLOW   REDUCTION [Qout/Qin](%)=100.24
                  TIME SHIFT OF PEAK FLOW         (min)=  0.00
                  MAXIMUM  STORAGE   USED       (ha.m.)=  0.0004

     **** WARNING : HYDROGRAPH PEAK WAS NOT REDUCED.
                    CHECK OUTFLOW/STORAGE TABLE  OR REDUCE DT.
-------------------------------------------------------------------------------
********************************
** SIMULATION:Run 11          **
********************************

--------------------
|    READ STORM    |    Filename: C:\Users\KBobechko\AppD
```

```
|                  |             ata\Local\Temp\
|                  |             b4b0b1fa-7385-43bd-aff7-ed07ccb0daca\ce314ca8
| Ptotal= 80.31 mm |    Comments: 100yr/6hr
--------------------
                 TIME    RAIN |  TIME    RAIN |'  TIME    RAIN |  TIME    RAIN
                  hrs   mm/hr |   hrs   mm/hr |'   hrs   mm/hr |   hrs   mm/hr
                 0.25    0.00 |  2.00   27.30 |  3.75   11.24 |  5.50    1.61
                 0.50    1.61 |  2.25   27.30 |  4.00    6.42 |  5.75    1.61
                 0.75    1.61 |  2.50   73.88 |  4.25    6.42 |  6.00    1.61
                 1.00    1.61 |  2.75   73.88 |  4.50    3.21 |  6.25    1.61
                 1.25    1.61 |  3.00   20.88 |  4.75    3.21 |
                 1.50    9.64 |  3.25   20.88 |  5.00    1.61 |
                 1.75    9.64 |  3.50   11.24 |  5.25    1.61 |

-------------------------------------------------------------------------------

--------------------
| CALIB            |
| NASHYD   (  0004)|   Area    (ha)=   0.70   Curve Number   (CN)= 50.0
|ID= 1 DT=10.0 min |   Ia      (mm)=   5.00   # of Linear Res.(N)= 3.00
--------------------   U.H. Tp(hrs)=    0.20

         NOTE:  RAINFALL WAS TRANSFORMED TO  10.0 MIN. TIME STEP.


                       ---- TRANSFORMED HYETOGRAPH ----
                 TIME    RAIN |  TIME    RAIN |'  TIME    RAIN |  TIME    RAIN
                  hrs   mm/hr |   hrs   mm/hr |'   hrs   mm/hr |   hrs   mm/hr
                0.167    0.00 | 1.833   18.47 | 3.500   11.24 |  5.17    1.61
                0.333    0.81 | 2.000   27.30 | 3.667   11.24 |  5.33    1.61
                0.500    1.61 | 2.167   27.30 | 3.833    8.83 |  5.50    1.61
                0.667    1.61 | 2.333   50.59 | 4.000    6.42 |  5.67    1.61
                0.833    1.61 | 2.500   73.88 | 4.167    6.42 |  5.83    1.61
                1.000    1.61 | 2.667   73.88 | 4.333    4.81 |  6.00    1.61
                1.167    1.61 | 2.833   47.38 | 4.500    3.21 |  6.17    1.61
                1.333    5.62 | 3.000   20.88 | 4.667    3.21 |  6.33    0.81
                1.500    9.64 | 3.167   20.88 | 4.833    2.41 |
                1.667    9.64 | 3.333   16.06 | 5.000    1.61 |

     Unit Hyd Qpeak  (cms)=   0.134

     PEAK FLOW       (cms)=   0.028 (i)
     TIME TO PEAK    (hrs)=   2.833
     RUNOFF VOLUME    (mm)=  16.775
     TOTAL RAINFALL   (mm)=  80.310
     RUNOFF COEFFICIENT   =   0.209

     (i) PEAK FLOW DOES NOT INCLUDE BASEFLOW IF ANY.

-------------------------------------------------------------------------------
--------------------
| RESERVOIR(  0006)|
| IN= 2---> OUT= 1 |
| DT= 10.0 min     |      OUTFLOW    STORAGE   |  OUTFLOW    STORAGE
--------------------       (cms)     (ha.m.)   |   (cms)     (ha.m.)
                          0.0000     0.0000    |  0.0610      0.0200
                          0.0600     0.0010    |  0.0000      0.0000

                                AREA     QPEAK     TPEAK        R.V.
                                (ha)     (cms)     (hrs)        (mm)
   INFLOW : ID= 2 (  0004)      0.700      0.028      2.83       16.77
   OUTFLOW: ID= 1 (  0006)      0.700      0.029      2.83       16.77

                  PEAK   FLOW   REDUCTION [Qout/Qin](%)=100.41
                  TIME SHIFT OF PEAK FLOW         (min)=  0.00
                  MAXIMUM  STORAGE   USED       (ha.m.)=  0.0005

     **** WARNING : HYDROGRAPH PEAK WAS NOT REDUCED.
                    CHECK OUTFLOW/STORAGE TABLE  OR REDUCE DT.
-------------------------------------------------------------------------------
********************************
** SIMULATION:Run 12          **
********************************

--------------------
|    READ STORM    |    Filename: C:\Users\KBobechko\AppD
```

```
|                    |            ata\Local\Temp\
|                    |            b4b0b1fa-7385-43bd-aff7-ed07ccb0daca\28fded1b
| Ptotal= 88.54 mm |    Comments: 100yr/12hr
--------------------
```

TIME hrs	RAIN mm/hr	TIME hrs	RAIN mm/hr	TIME hrs	RAIN mm/hr	TIME hrs	RAIN mm/hr
0.25	0.00	3.50	15.05	6.75	6.20	10.00	0.89
0.50	0.89	3.75	15.05	7.00	6.20	10.25	0.89
0.75	0.89	4.00	15.05	7.25	6.20	10.50	0.89
1.00	0.89	4.25	15.05	7.50	3.54	10.75	0.89
1.25	0.89	4.50	40.71	7.75	3.54	11.00	0.89
1.50	0.89	4.75	40.71	8.00	3.54	11.25	0.89
1.75	0.89	5.00	40.71	8.25	3.54	11.50	0.89
2.00	0.89	5.25	40.71	8.50	1.77	11.75	0.89
2.25	0.89	5.50	11.51	8.75	1.77	12.00	0.89
2.50	5.31	5.75	11.51	9.00	1.77	12.25	0.89
2.75	5.31	6.00	11.51	9.25	1.77		
3.00	5.31	6.25	11.51	9.50	0.89		
3.25	5.31	6.50	6.20	9.75	0.89		

```
--------------------------------------------------------------------------------

--------------------
| CALIB              |
| NASHYD    (  0004)|   Area     (ha)=   0.70   Curve Number   (CN)= 50.0
|ID= 1 DT=10.0 min |   Ia       (mm)=   5.00   # of Linear Res.(N)= 3.00
--------------------   U.H. Tp(hrs)=   0.20

         NOTE:  RAINFALL WAS TRANSFORMED TO  10.0 MIN. TIME STEP.
```

---- TRANSFORMED HYETOGRAPH ----

TIME hrs	RAIN mm/hr	TIME hrs	RAIN mm/hr	TIME hrs	RAIN mm/hr	TIME hrs	RAIN mm/hr
0.167	0.00	3.333	10.18	6.500	6.20	9.67	0.89
0.333	0.45	3.500	15.05	6.667	6.20	9.83	0.89
0.500	0.89	3.667	15.05	6.833	6.20	10.00	0.89
0.667	0.89	3.833	15.05	7.000	6.20	10.17	0.89
0.833	0.89	4.000	15.05	7.167	6.20	10.33	0.89
1.000	0.89	4.167	15.05	7.333	4.87	10.50	0.89
1.167	0.89	4.333	27.88	7.500	3.54	10.67	0.89
1.333	0.89	4.500	40.71	7.667	3.54	10.83	0.89
1.500	0.89	4.667	40.71	7.833	3.54	11.00	0.89
1.667	0.89	4.833	40.71	8.000	3.54	11.17	0.89
1.833	0.89	5.000	40.71	8.167	3.54	11.33	0.89
2.000	0.89	5.167	40.71	8.333	2.66	11.50	0.89
2.167	0.89	5.333	26.11	8.500	1.77	11.67	0.89
2.333	3.10	5.500	11.51	8.667	1.77	11.83	0.89
2.500	5.31	5.667	11.51	8.833	1.77	12.00	0.89
2.667	5.31	5.833	11.51	9.000	1.77	12.17	0.89
2.833	5.31	6.000	11.51	9.167	1.77	12.33	0.44
3.000	5.31	6.167	11.51	9.333	1.33		
3.167	5.31	6.333	8.86	9.500	0.89		

```
    Unit Hyd Qpeak  (cms)=   0.134

    PEAK FLOW       (cms)=   0.021 (i)
    TIME TO PEAK    (hrs)=   5.167
    RUNOFF VOLUME    (mm)=  20.138
    TOTAL RAINFALL   (mm)=  88.540
    RUNOFF COEFFICIENT   =   0.227

    (i) PEAK FLOW DOES NOT INCLUDE BASEFLOW IF ANY.

--------------------------------------------------------------------------------
--------------------
| RESERVOIR(  0006)|
| IN= 2---> OUT= 1 |
| DT= 10.0 min     |
--------------------
```

OUTFLOW (cms)	STORAGE (ha.m.)	OUTFLOW (cms)	STORAGE (ha.m.)
0.0000	0.0000	0.0610	0.0200
0.0600	0.0010	0.0000	0.0000

	AREA (ha)	QPEAK (cms)	TPEAK (hrs)	R.V. (mm)
INFLOW : ID= 2 (0004)	0.700	0.021	5.17	20.14
OUTFLOW: ID= 1 (0006)	0.700	0.021	5.17	20.14

```
                 PEAK   FLOW   REDUCTION [Qout/Qin](%)= 96.63
                 TIME SHIFT OF PEAK FLOW          (min)=  0.00
                 MAXIMUM  STORAGE   USED       (ha.m.)=  0.0004

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********************************
** SIMULATION:Run 13          **
********************************

--------------------
|    READ STORM     |    Filename: C:\Users\KBobechko\AppD
|                   |              ata\Local\Temp\
|                   |              b4b0b1fa-7385-43bd-aff7-ed07ccb0daca\f85a9fcc
| Ptotal=127.50 mm |    Comments: 100yr 24hr 5min SCS
--------------------
```

TIME hrs	RAIN mm/hr	TIME hrs	RAIN mm/hr	TIME hrs	RAIN mm/hr	TIME hrs	RAIN mm/hr
0.08	0.00	6.17	2.30	12.25	18.36	18.33	2.30
0.17	1.40	6.25	2.30	12.33	18.36	18.42	2.30
0.25	1.40	6.33	2.30	12.42	18.36	18.50	2.30
0.33	1.40	6.42	2.30	12.50	18.36	18.58	2.30
0.42	1.40	6.50	2.30	12.58	18.36	18.67	2.30
0.50	1.40	6.58	2.30	12.67	9.44	18.75	2.30
0.58	1.40	6.67	2.30	12.75	9.44	18.83	2.30
0.67	1.40	6.75	2.30	12.83	9.44	18.92	2.30
0.75	1.40	6.83	2.30	12.92	9.44	19.00	2.30
0.83	1.40	6.92	2.30	13.00	9.44	19.08	2.30
0.92	1.40	7.00	2.30	13.08	9.44	19.17	2.30
1.00	1.40	7.08	2.30	13.17	6.89	19.25	2.30
1.08	1.40	7.17	2.81	13.25	6.89	19.33	2.30
1.17	1.40	7.25	2.81	13.33	6.89	19.42	2.30
1.25	1.40	7.33	2.81	13.42	6.89	19.50	2.30
1.33	1.40	7.42	2.81	13.50	6.89	19.58	2.30
1.42	1.40	7.50	2.81	13.58	6.89	19.67	2.30
1.50	1.40	7.58	2.81	13.67	5.36	19.75	2.30
1.58	1.40	7.67	2.81	13.75	5.36	19.83	2.30
1.67	1.40	7.75	2.81	13.83	5.36	19.92	2.30
1.75	1.40	7.83	2.81	13.92	5.36	20.00	2.30
1.83	1.40	7.92	2.81	14.00	5.36	20.08	2.30
1.92	1.40	8.00	2.81	14.08	5.36	20.17	1.53
2.00	1.40	8.08	2.81	14.17	3.83	20.25	1.53
2.08	1.40	8.17	3.32	14.25	3.83	20.33	1.53
2.17	1.66	8.25	3.32	14.33	3.83	20.42	1.53
2.25	1.66	8.33	3.32	14.42	3.83	20.50	1.53
2.33	1.66	8.42	3.32	14.50	3.83	20.58	1.53
2.42	1.66	8.50	3.32	14.58	3.83	20.67	1.53
2.50	1.66	8.58	3.32	14.67	3.83	20.75	1.53
2.58	1.66	8.67	3.57	14.75	3.83	20.83	1.53
2.67	1.66	8.75	3.57	14.83	3.83	20.92	1.53
2.75	1.66	8.83	3.57	14.92	3.83	21.00	1.53
2.83	1.66	8.92	3.57	15.00	3.83	21.08	1.53
2.92	1.66	9.00	3.57	15.08	3.83	21.17	1.53
3.00	1.66	9.08	3.57	15.17	3.83	21.25	1.53
3.08	1.66	9.17	4.08	15.25	3.83	21.33	1.53
3.17	1.66	9.25	4.08	15.33	3.83	21.42	1.53
3.25	1.66	9.33	4.08	15.42	3.83	21.50	1.53
3.33	1.66	9.42	4.08	15.50	3.83	21.58	1.53
3.42	1.66	9.50	4.08	15.58	3.83	21.67	1.53
3.50	1.66	9.58	4.08	15.67	3.83	21.75	1.53
3.58	1.66	9.67	4.59	15.75	3.83	21.83	1.53
3.67	1.66	9.75	4.59	15.83	3.83	21.92	1.53
3.75	1.66	9.83	4.59	15.92	3.83	22.00	1.53
3.83	1.66	9.92	4.59	16.00	3.83	22.08	1.53
3.92	1.66	10.00	4.59	16.08	3.83	22.17	1.53
4.00	1.66	10.08	4.59	16.17	2.30	22.25	1.53
4.08	1.66	10.17	5.86	16.25	2.30	22.33	1.53
4.17	2.04	10.25	5.86	16.33	2.30	22.42	1.53
4.25	2.04	10.33	5.86	16.42	2.30	22.50	1.53
4.33	2.04	10.42	5.86	16.50	2.30	22.58	1.53
4.42	2.04	10.50	5.86	16.58	2.30	22.67	1.53
4.50	2.04	10.58	5.86	16.67	2.30	22.75	1.53
4.58	2.04	10.67	7.91	16.75	2.30	22.83	1.53
4.67	2.04	10.75	7.91	16.83	2.30	22.92	1.53
4.75	2.04	10.83	7.91	16.92	2.30	23.00	1.53

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4.83	2.04	10.92	7.91	17.00	2.30	23.08	1.53
4.92	2.04	11.00	7.91	17.08	2.30	23.17	1.53
5.00	2.04	11.08	7.91	17.17	2.30	23.25	1.53
5.08	2.04	11.17	12.24	17.25	2.30	23.33	1.53
5.17	2.04	11.25	12.24	17.33	2.30	23.42	1.53
5.25	2.04	11.33	12.24	17.42	2.30	23.50	1.53
5.33	2.04	11.42	12.24	17.50	2.30	23.58	1.53
5.42	2.04	11.50	12.24	17.58	2.30	23.67	1.53
5.50	2.04	11.58	12.24	17.67	2.30	23.75	1.53
5.58	2.04	11.67	37.74	17.75	2.30	23.83	1.53
5.67	2.04	11.75	37.74	17.83	2.30	23.92	1.53
5.75	2.04	11.83	37.74	17.92	2.30	24.00	1.53
5.83	2.04	11.92	156.06	18.00	2.30	24.08	1.53
5.92	2.04	12.00	156.06	18.08	2.30		
6.00	2.04	12.08	156.06	18.17	2.30		
6.08	2.04	12.17	18.36	18.25	2.30		

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-------------------------------------------------------------------------------

--------------------
| CALIB              |
| NASHYD   (  0004)|   Area    (ha)=    0.70   Curve Number   (CN)= 50.0
|ID= 1 DT=10.0 min |   Ia      (mm)=    5.00   # of Linear Res.(N)= 3.00
--------------------   U.H. Tp(hrs)=    0.20
```

NOTE: RAINFALL WAS TRANSFORMED TO 10.0 MIN. TIME STEP.

---- TRANSFORMED HYETOGRAPH ----

TIME hrs	RAIN mm/hr	TIME hrs	RAIN mm/hr	TIME hrs	RAIN mm/hr	TIME hrs	RAIN mm/hr
0.167	0.70	6.333	2.29	12.500	18.36	18.67	2.30
0.333	1.40	6.500	2.29	12.667	13.90	18.83	2.29
0.500	1.40	6.667	2.30	12.833	9.44	19.00	2.29
0.667	1.40	6.833	2.29	13.000	9.43	19.17	2.30
0.833	1.40	7.000	2.29	13.167	8.16	19.33	2.29
1.000	1.40	7.167	2.55	13.333	6.89	19.50	2.29
1.167	1.40	7.333	2.80	13.500	6.88	19.67	2.30
1.333	1.40	7.500	2.80	13.667	6.12	19.83	2.29
1.500	1.40	7.667	2.81	13.833	5.36	20.00	2.29
1.667	1.40	7.833	2.80	14.000	5.35	20.17	1.91
1.833	1.40	8.000	2.80	14.167	4.59	20.33	1.53
2.000	1.40	8.167	3.06	14.333	3.83	20.50	1.53
2.167	1.53	8.333	3.32	14.500	3.82	20.67	1.53
2.333	1.66	8.500	3.31	14.667	3.83	20.83	1.53
2.500	1.66	8.667	3.44	14.833	3.83	21.00	1.53
2.667	1.66	8.833	3.57	15.000	3.82	21.17	1.53
2.833	1.66	9.000	3.57	15.167	3.83	21.33	1.53
3.000	1.66	9.167	3.83	15.333	3.83	21.50	1.53
3.167	1.66	9.333	4.08	15.500	3.82	21.67	1.53
3.333	1.66	9.500	4.08	15.667	3.83	21.83	1.53
3.500	1.66	9.667	4.34	15.833	3.83	22.00	1.53
3.667	1.66	9.833	4.59	16.000	3.82	22.17	1.53
3.833	1.66	10.000	4.59	16.167	3.06	22.33	1.53
4.000	1.66	10.167	5.23	16.333	2.29	22.50	1.53
4.167	1.85	10.333	5.87	16.500	2.29	22.67	1.53
4.333	2.04	10.500	5.86	16.667	2.30	22.83	1.53
4.500	2.04	10.667	6.89	16.833	2.29	23.00	1.53
4.667	2.04	10.833	7.91	17.000	2.29	23.17	1.53
4.833	2.04	11.000	7.90	17.167	2.30	23.33	1.53
5.000	2.04	11.167	10.07	17.333	2.29	23.50	1.53
5.167	2.04	11.333	12.24	17.500	2.29	23.67	1.53
5.333	2.04	11.500	12.24	17.667	2.30	23.83	1.53
5.500	2.04	11.667	24.99	17.833	2.29	24.00	1.53
5.667	2.04	11.833	37.75	18.000	2.29	24.17	1.53
5.833	2.04	12.000	156.06	18.167	2.30		
6.000	2.04	12.167	87.20	18.333	2.29		
6.167	2.17	12.333	18.36	18.500	2.29		

```
Unit Hyd Qpeak  (cms)=   0.134

PEAK FLOW       (cms)=   0.064 (i)
TIME TO PEAK    (hrs)=  12.167
RUNOFF VOLUME    (mm)=  38.888
TOTAL RAINFALL   (mm)= 127.627
RUNOFF COEFFICIENT   =   0.305
```

(i) PEAK FLOW DOES NOT INCLUDE BASEFLOW IF ANY.

```
-------------------------------------------------------------------------------
--------------------
| RESERVOIR(  0006)|
| IN= 2---> OUT= 1 |
| DT= 10.0 min     |     OUTFLOW    STORAGE   |  OUTFLOW    STORAGE
--------------------      (cms)      (ha.m.)  |   (cms)      (ha.m.)
                          0.0000     0.0000   |   0.0610      0.0200
                          0.0600     0.0010   |   0.0000      0.0000

                                 AREA     QPEAK     TPEAK       R.V.
                                 (ha)     (cms)     (hrs)       (mm)
   INFLOW : ID= 2 (  0004)      0.700     0.064     12.17      38.89
   OUTFLOW: ID= 1 (  0006)      0.700     0.060     12.17      38.89

                   PEAK   FLOW   REDUCTION [Qout/Qin](%)= 93.21
                   TIME SHIFT OF PEAK FLOW          (min)=  0.00
                   MAXIMUM  STORAGE   USED        (ha.m.)=  0.0013

-------------------------------------------------------------------------------
```

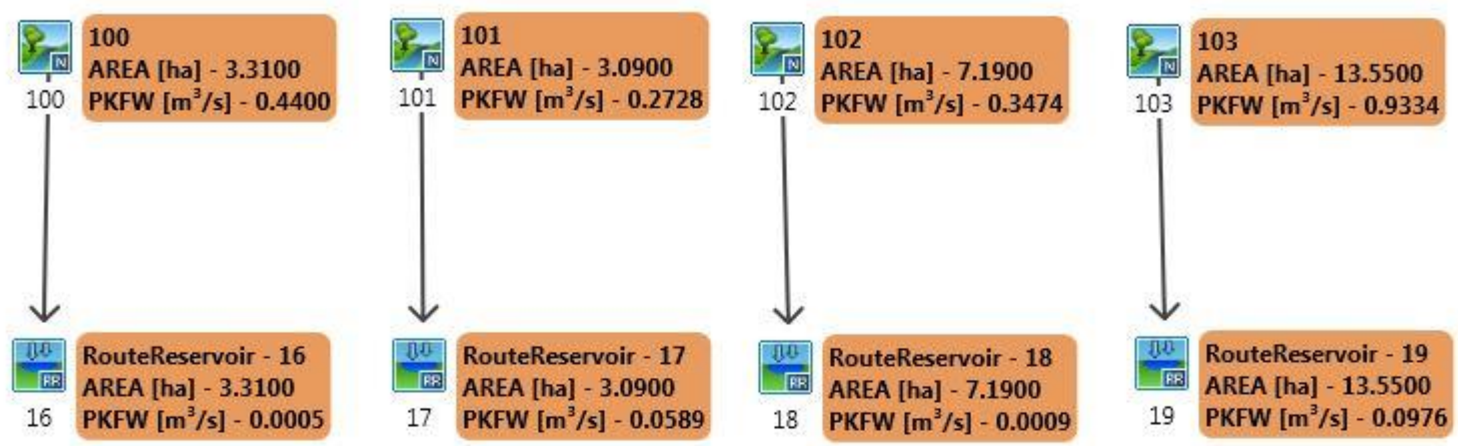
2017-0701 Belfountain
Model Parameters
External Catchments

Catchment ID	Model Parameters					
	Drainage Area	Curve Number	Time to Peak	Initial Abstractions	Number of Linear Reservoirs	Dry Weather Flow
	Area	CN	Tp	IA	N	DWF
	[ha]	[-]	[hour]	[mm]	[-]	[m^3/s]
100	3.31	65	0.117	5-10	3	0
101	3.09	65	0.234	5-10	3	0
102	7.19	53	0.326	5-10	3	0
103	13.55	61	0.283	5-10	3	0

Experience Enhancing Excellence

2017-0701 Belfountain
2, 5, 10, 25, 50 & 100-Year 12 Hour SCS Storm, 100- Year 6 Hour SCS Storm, & 100- Year 24 Hour SCS Storm
1 Dry Well per Lot with 5mm Initial Abstractions
Proposed External Conditions Model Output
February, 2018

VO5 Model Schematic



COLE ENGINEERING

Experience Enhancing Excellence

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==========================================================================================================
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      V    V   I    SSSSS  U    U    A    L
      V    V   I    SS     U    U   A A   L
       V  V    I     SS    U    U  AAAAA  L
       V  V    I      SS   U    U  A   A  L
        VV     I    SSSSS  UUUUU  A    A  LLLLL

       OOO    TTTTT  TTTTT  H   H  Y   Y  M   M   OOO    TM
      O   O     T      T    H   H   Y Y   MM MM  O   O
      O   O     T      T    H   H    Y    M   M  O   O
       OOO      T      T    H   H    Y    M   M   OOO
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```



```
                   ***** D E T A I L E D   O U T P U T *****

  Input   filename: C:\Program Files (x86)\Visual OTTHYMO 5.0\VO2\voin.dat
  Output  filename: C:\Users\JJohnston\AppData\Local\Civica\VH5\9f0d15d2-7934-48cd-bc46-
458c27b77161\e28e5b4e-0580-48cb-b49a-542d83bdc95c\sc
  Summary filename: C:\Users\JJohnston\AppData\Local\Civica\VH5\9f0d15d2-7934-48cd-bc46-
458c27b77161\e28e5b4e-0580-48cb-b49a-542d83bdc95c\sc

DATE: 02/13/2018                          TIME: 11:58:24

USER:

COMMENTS:

----------------------------------------------------------------------------------------------------------
-----
  **************************************************
  ** SIMULATION : Run 01- 2yr 12hr SCS           **
  **************************************************

--------------------
|    READ STORM    |     Filename: C:\Users\JJohnston\AppD
|                  |               ata\Local\Temp\
|                  |               e507d14d-1e21-497d-8202-bee55db2947a\2439c7bb
| Ptotal= 47.30 mm |     Comments: 2yr 12hr 5min SCS
--------------------
```

TIME hrs	RAIN mm/hr	TIME hrs	RAIN mm/hr	TIME hrs	RAIN mm/hr	TIME hrs	RAIN mm/hr
0.08	0.00	3.17	1.89	6.25	8.51	9.33	1.66
0.17	1.18	3.25	1.89	6.33	8.51	9.42	1.66
0.25	1.18	3.33	1.89	6.42	8.51	9.50	1.66
0.33	1.18	3.42	1.89	6.50	8.51	9.58	1.66
0.42	1.18	3.50	1.89	6.58	8.51	9.67	1.66
0.50	1.18	3.58	1.89	6.67	3.78	9.75	1.66
0.58	1.18	3.67	1.89	6.75	3.78	9.83	1.66
0.67	1.18	3.75	1.89	6.83	3.78	9.92	1.66
0.75	1.18	3.83	1.89	6.92	3.78	10.00	1.66
0.83	1.18	3.92	1.89	7.00	3.78	10.08	1.66
0.92	1.18	4.00	1.89	7.08	3.78	10.17	0.95
1.00	1.18	4.08	1.89	7.17	2.84	10.25	0.95
1.08	1.18	4.17	2.84	7.25	2.84	10.33	0.95
1.17	1.18	4.25	2.84	7.33	2.84	10.42	0.95
1.25	1.18	4.33	2.84	7.42	2.84	10.50	0.95
1.33	1.18	4.42	2.84	7.50	2.84	10.58	0.95
1.42	1.18	4.50	2.84	7.58	2.84	10.67	0.95
1.50	1.18	4.58	2.84	7.67	2.84	10.75	0.95
1.58	1.18	4.67	3.78	7.75	2.84	10.83	0.95
1.67	1.18	4.75	3.78	7.83	2.84	10.92	0.95
1.75	1.18	4.83	3.78	7.92	2.84	11.00	0.95
1.83	1.18	4.92	3.78	8.00	2.84	11.08	0.95
1.92	1.18	5.00	3.78	8.08	2.84	11.17	0.95
2.00	1.18	5.08	3.78	8.17	1.66	11.25	0.95
2.08	1.18	5.17	5.68	8.25	1.66	11.33	0.95
2.17	1.42	5.25	5.68	8.33	1.66	11.42	0.95
2.25	1.42	5.33	5.68	8.42	1.66	11.50	0.95
2.33	1.42	5.42	5.68	8.50	1.66	11.58	0.95
2.42	1.42	5.50	5.68	8.58	1.66	11.67	0.95
2.50	1.42	5.58	5.68	8.67	1.66	11.75	0.95
2.58	1.42	5.67	22.70	8.75	1.66	11.83	0.95
2.67	1.42	5.75	22.70	8.83	1.66	11.92	0.95
2.75	1.42	5.83	22.70	8.92	1.66	12.00	0.95
2.83	1.42	5.92	62.44	9.00	1.66	12.08	0.95
2.92	1.42	6.00	62.44	9.08	1.66		
3.00	1.42	6.08	62.44	9.17	1.66		
3.08	1.42	6.17	8.51	9.25	1.66		

```
------------------------------------------------------------------------------------

--------------------
| CALIB            |
| NASHYD  (  0100)|   Area    (ha)=   3.31   Curve Number   (CN)= 65.0
|ID= 1 DT= 5.0 min |   Ia      (mm)=   5.00   # of Linear Res.(N)= 3.00
--------------------   U.H. Tp(hrs)=   0.12

     Unit Hyd Qpeak  (cms)=   1.081

     PEAK FLOW       (cms)=   0.127 (i)
     TIME TO PEAK    (hrs)=   6.083
     RUNOFF VOLUME    (mm)=   9.846
     TOTAL RAINFALL   (mm)=  47.300
     RUNOFF COEFFICIENT   =   0.208

     (i) PEAK FLOW DOES NOT INCLUDE BASEFLOW IF ANY.

------------------------------------------------------------------------------------
--------------------
| RESERVOIR(  0016)|
| IN= 2---> OUT= 1 |
| DT=  5.0 min     |     OUTFLOW    STORAGE   |  OUTFLOW    STORAGE
--------------------      (cms)     (ha.m.)   |   (cms)     (ha.m.)
                          0.0000     0.0000   |   8.4600      0.2001
                          0.0010     0.2000   |   0.0000      0.0000

                                 AREA     QPEAK     TPEAK       R.V.
                                 (ha)     (cms)     (hrs)       (mm)
   INFLOW : ID= 2 (  0100)      3.310     0.127      6.08       9.85
   OUTFLOW: ID= 1 (  0016)      3.310     0.000     12.42       0.10

               PEAK   FLOW   REDUCTION [Qout/Qin](%)=  0.13
               TIME SHIFT OF PEAK FLOW         (min)=380.00
               MAXIMUM  STORAGE   USED       (ha.m.)=  0.0323

------------------------------------------------------------------------------------
--------------------
| CALIB            |
| NASHYD  (  0101)|   Area    (ha)=   3.09   Curve Number   (CN)= 65.0
|ID= 1 DT= 5.0 min |   Ia      (mm)=   5.00   # of Linear Res.(N)= 3.00
--------------------   U.H. Tp(hrs)=   0.23

     Unit Hyd Qpeak  (cms)=   0.504

     PEAK FLOW       (cms)=   0.078 (i)
     TIME TO PEAK    (hrs)=   6.167
     RUNOFF VOLUME    (mm)=   9.982
     TOTAL RAINFALL   (mm)=  47.300
     RUNOFF COEFFICIENT   =   0.211

     (i) PEAK FLOW DOES NOT INCLUDE BASEFLOW IF ANY.

------------------------------------------------------------------------------------
--------------------
| RESERVOIR(  0017)|
| IN= 2---> OUT= 1 |
| DT=  5.0 min     |     OUTFLOW    STORAGE   |  OUTFLOW    STORAGE
--------------------      (cms)     (ha.m.)   |   (cms)     (ha.m.)
                          0.0000     0.0000   |   0.0900      0.0757

                                 AREA     QPEAK     TPEAK       R.V.
                                 (ha)     (cms)     (hrs)       (mm)
   INFLOW : ID= 2 (  0101)      3.090     0.078      6.17       9.98
   OUTFLOW: ID= 1 (  0017)      3.090     0.017      6.92       9.92

               PEAK   FLOW   REDUCTION [Qout/Qin](%)= 21.81
               TIME SHIFT OF PEAK FLOW         (min)= 45.00
               MAXIMUM  STORAGE   USED       (ha.m.)=  0.0144

------------------------------------------------------------------------------------
--------------------
| CALIB            |
| NASHYD  (  0102)|   Area    (ha)=   7.19   Curve Number   (CN)= 53.0
|ID= 1 DT= 5.0 min |   Ia      (mm)=   5.00   # of Linear Res.(N)= 3.00
--------------------   U.H. Tp(hrs)=   0.33

     Unit Hyd Qpeak  (cms)=   0.842

     PEAK FLOW       (cms)=   0.094 (i)
     TIME TO PEAK    (hrs)=   6.333
     RUNOFF VOLUME    (mm)=   6.686
```

```
     TOTAL RAINFALL   (mm)=  47.300
     RUNOFF COEFFICIENT   =   0.141

     (i) PEAK FLOW DOES NOT INCLUDE BASEFLOW IF ANY.

--------------------------------------------------------------------------------
--------------------
| RESERVOIR(  0018)|
| IN= 2---> OUT= 1 |
| DT=  5.0 min     |     OUTFLOW    STORAGE   |  OUTFLOW    STORAGE
--------------------      (cms)     (ha.m.)   |   (cms)     (ha.m.)
                          0.0000     0.0000   |   5.6800      0.5001
                          0.0010     0.1598   |   0.0000      0.0000

                                AREA     QPEAK      TPEAK        R.V.
                                (ha)     (cms)      (hrs)        (mm)
   INFLOW : ID= 2 (  0102)      7.190      0.094       6.33        6.69
   OUTFLOW: ID= 1 (  0018)      7.190      0.000      13.08        1.02

                   PEAK   FLOW   REDUCTION [Qout/Qin](%)=  0.31
                   TIME SHIFT OF PEAK FLOW        (min)=405.00
                   MAXIMUM  STORAGE   USED       (ha.m.)=  0.0475

--------------------------------------------------------------------------------
--------------------
| CALIB            |
| NASHYD   (  0103)|   Area    (ha)=  13.55   Curve Number   (CN)= 61.0
|ID= 1 DT= 5.0 min |   Ia      (mm)=   5.00   # of Linear Res.(N)= 3.00
--------------------   U.H. Tp(hrs)=   0.28

     Unit Hyd Qpeak  (cms)=   1.829

     PEAK FLOW       (cms)=   0.263 (i)
     TIME TO PEAK    (hrs)=   6.250
     RUNOFF VOLUME    (mm)=   8.737
     TOTAL RAINFALL   (mm)=  47.300
     RUNOFF COEFFICIENT   =   0.185

     (i) PEAK FLOW DOES NOT INCLUDE BASEFLOW IF ANY.

--------------------------------------------------------------------------------
--------------------
| RESERVOIR(  0019)|
| IN= 2---> OUT= 1 |
| DT=  5.0 min     |     OUTFLOW    STORAGE   |  OUTFLOW    STORAGE
--------------------      (cms)     (ha.m.)   |   (cms)     (ha.m.)
                          0.0000     0.0000   |   0.1500      0.3892

                                AREA     QPEAK      TPEAK        R.V.
                                (ha)     (cms)      (hrs)        (mm)
   INFLOW : ID= 2 (  0103)     13.550      0.263       6.25        8.74
   OUTFLOW: ID= 1 (  0019)     13.550      0.028       8.42        8.69

                   PEAK   FLOW   REDUCTION [Qout/Qin](%)= 10.62
                   TIME SHIFT OF PEAK FLOW        (min)=130.00
                   MAXIMUM  STORAGE   USED       (ha.m.)=  0.0725

--------------------------------------------------------------------------------
====================================================================================================
=====

       V    V   I    SSSSS  U   U    A    L
       V    V   I    SS     U   U   A A   L
        V  V    I     SS    U   U  AAAAA  L
        V  V    I      SS   U   U  A   A  L
         VV     I    SSSSS  UUUUU  A   A  LLLLL

        OOO    TTTTT  TTTTT  H   H  Y   Y  M   M  OOO     TM
       O   O     T      T    H   H   Y Y   MM MM  O   O
       O   O     T      T    H   H    Y    M   M  O   O
        OOO      T      T    H   H    Y    M   M   OOO
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```


```
                   *****  D E T A I L E D   O U T P U T *****


  Input   filename: C:\Program Files (x86)\Visual OTTHYMO 5.0\VO2\voin.dat
  Output  filename: C:\Users\JJohnston\AppData\Local\Civica\VH5\9f0d15d2-7934-48cd-bc46-
458c27b77161\02c66750-d443-4337-a4e5-d53cdfb93fa8\sc
  Summary filename: C:\Users\JJohnston\AppData\Local\Civica\VH5\9f0d15d2-7934-48cd-bc46-
458c27b77161\02c66750-d443-4337-a4e5-d53cdfb93fa8\sc

DATE: 02/13/2018                                     TIME: 11:58:24

USER:


COMMENTS:


----------------------------------------------------------------------------------------------------
-----
  **********************************************
  ** SIMULATION : Run 02- 5yr 12hr SCS        **
  **********************************************


--------------------
|    READ STORM    |    Filename: C:\Users\JJohnston\AppD
|                  |              ata\Local\Temp\
|                  |              e507d14d-1e21-497d-8202-bee55db2947a\04f3f838
| Ptotal= 62.50 mm |    Comments: 5yr 12hr 5min SCS
--------------------
                 TIME    RAIN |  TIME    RAIN |'  TIME    RAIN |  TIME     RAIN
                  hrs   mm/hr |   hrs   mm/hr |'   hrs   mm/hr |   hrs    mm/hr
                 0.08    0.00 |  3.17    2.50 |  6.25   11.25 |  9.33     2.19
                 0.17    1.56 |  3.25    2.50 |  6.33   11.25 |  9.42     2.19
                 0.25    1.56 |  3.33    2.50 |  6.42   11.25 |  9.50     2.19
                 0.33    1.56 |  3.42    2.50 |  6.50   11.25 |  9.58     2.19
                 0.42    1.56 |  3.50    2.50 |  6.58   11.25 |  9.67     2.19
                 0.50    1.56 |  3.58    2.50 |  6.67    5.00 |  9.75     2.19
                 0.58    1.56 |  3.67    2.50 |  6.75    5.00 |  9.83     2.19
                 0.67    1.56 |  3.75    2.50 |  6.83    5.00 |  9.92     2.19
                 0.75    1.56 |  3.83    2.50 |  6.92    5.00 | 10.00     2.19
                 0.83    1.56 |  3.92    2.50 |  7.00    5.00 | 10.08     2.19
                 0.92    1.56 |  4.00    2.50 |  7.08    5.00 | 10.17     1.25
                 1.00    1.56 |  4.08    2.50 |  7.17    3.75 | 10.25     1.25
                 1.08    1.56 |  4.17    3.75 |  7.25    3.75 | 10.33     1.25
                 1.17    1.56 |  4.25    3.75 |  7.33    3.75 | 10.42     1.25
                 1.25    1.56 |  4.33    3.75 |  7.42    3.75 | 10.50     1.25
                 1.33    1.56 |  4.42    3.75 |  7.50    3.75 | 10.58     1.25
                 1.42    1.56 |  4.50    3.75 |  7.58    3.75 | 10.67     1.25
                 1.50    1.56 |  4.58    3.75 |  7.67    3.75 | 10.75     1.25
                 1.58    1.56 |  4.67    5.00 |  7.75    3.75 | 10.83     1.25
                 1.67    1.56 |  4.75    5.00 |  7.83    3.75 | 10.92     1.25
                 1.75    1.56 |  4.83    5.00 |  7.92    3.75 | 11.00     1.25
                 1.83    1.56 |  4.92    5.00 |  8.00    3.75 | 11.08     1.25
                 1.92    1.56 |  5.00    5.00 |  8.08    3.75 | 11.17     1.25
                 2.00    1.56 |  5.08    5.00 |  8.17    2.19 | 11.25     1.25
                 2.08    1.56 |  5.17    7.50 |  8.25    2.19 | 11.33     1.25
                 2.17    1.88 |  5.25    7.50 |  8.33    2.19 | 11.42     1.25
                 2.25    1.88 |  5.33    7.50 |  8.42    2.19 | 11.50     1.25
                 2.33    1.88 |  5.42    7.50 |  8.50    2.19 | 11.58     1.25
                 2.42    1.88 |  5.50    7.50 |  8.58    2.19 | 11.67     1.25
                 2.50    1.88 |  5.58    7.50 |  8.67    2.19 | 11.75     1.25
                 2.58    1.88 |  5.67   30.00 |  8.75    2.19 | 11.83     1.25
                 2.67    1.88 |  5.75   30.00 |  8.83    2.19 | 11.92     1.25
                 2.75    1.88 |  5.83   30.00 |  8.92    2.19 | 12.00     1.25
                 2.83    1.88 |  5.92   82.50 |  9.00    2.19 | 12.08     1.25
                 2.92    1.88 |  6.00   82.50 |  9.08    2.19 |
                 3.00    1.88 |  6.08   82.50 |  9.17    2.19 |
                 3.08    1.88 |  6.17   11.25 |  9.25    2.19 |

--------------------------------------------------------------------------------

--------------------
| CALIB            |
| NASHYD   (  0100)|   Area    (ha)=   3.31   Curve Number   (CN)= 65.0
|ID= 1 DT= 5.0 min |   Ia      (mm)=   5.00   # of Linear Res.(N)= 3.00
--------------------   U.H. Tp(hrs)=   0.12

     Unit Hyd Qpeak  (cms)=   1.081

     PEAK FLOW       (cms)=   0.218 (i)
     TIME TO PEAK    (hrs)=   6.083
     RUNOFF VOLUME    (mm)=  16.769
     TOTAL RAINFALL   (mm)=  62.500
     RUNOFF COEFFICIENT   =   0.268

     (i) PEAK FLOW DOES NOT INCLUDE BASEFLOW IF ANY.

--------------------------------------------------------------------------------
--------------------
| RESERVOIR(  0016)|
| IN= 2---> OUT= 1 |
| DT=  5.0 min     |     OUTFLOW    STORAGE   |  OUTFLOW    STORAGE
--------------------      (cms)     (ha.m.)   |   (cms)     (ha.m.)
```

```
                         0.0000     0.0000   |   8.4600      0.2001
                         0.0010     0.2000   |   0.0000      0.0000

                               AREA     QPEAK     TPEAK       R.V.
                               (ha)     (cms)     (hrs)       (mm)
   INFLOW : ID= 2 (  0100)     3.310     0.218      6.08      16.77
   OUTFLOW: ID= 1 (  0016)     3.310     0.000     12.42       1.37

                  PEAK   FLOW   REDUCTION [Qout/Qin](%)=  0.13
                  TIME SHIFT OF PEAK FLOW         (min)=380.00
                  MAXIMUM  STORAGE   USED       (ha.m.)=  0.0550

--------------------------------------------------------------------------------
--------------------
| CALIB              |
| NASHYD   (  0101)|   Area    (ha)=   3.09   Curve Number   (CN)= 65.0
|ID= 1 DT= 5.0 min |   Ia      (mm)=   5.00   # of Linear Res.(N)= 3.00
--------------------   U.H. Tp(hrs)=   0.23

     Unit Hyd Qpeak  (cms)=   0.504

     PEAK FLOW       (cms)=   0.136 (i)
     TIME TO PEAK    (hrs)=   6.167
     RUNOFF VOLUME    (mm)=  17.001
     TOTAL RAINFALL   (mm)=  62.500
     RUNOFF COEFFICIENT   =   0.272

     (i) PEAK FLOW DOES NOT INCLUDE BASEFLOW IF ANY.

--------------------------------------------------------------------------------
--------------------
| RESERVOIR(  0017)|
| IN= 2---> OUT= 1 |
| DT=  5.0 min     |     OUTFLOW    STORAGE   |  OUTFLOW    STORAGE
--------------------      (cms)     (ha.m.)   |   (cms)     (ha.m.)
                         0.0000     0.0000   |   0.0900      0.0757

                               AREA     QPEAK     TPEAK       R.V.
                               (ha)     (cms)     (hrs)       (mm)
   INFLOW : ID= 2 (  0101)     3.090     0.136      6.17      17.00
   OUTFLOW: ID= 1 (  0017)     3.090     0.030      6.92      16.93

                  PEAK   FLOW   REDUCTION [Qout/Qin](%)= 21.90
                  TIME SHIFT OF PEAK FLOW         (min)= 45.00
                  MAXIMUM  STORAGE   USED       (ha.m.)=  0.0250

--------------------------------------------------------------------------------
--------------------
| CALIB              |
| NASHYD   (  0102)|   Area    (ha)=   7.19   Curve Number   (CN)= 53.0
|ID= 1 DT= 5.0 min |   Ia      (mm)=   5.00   # of Linear Res.(N)= 3.00
--------------------   U.H. Tp(hrs)=   0.33

     Unit Hyd Qpeak  (cms)=   0.842

     PEAK FLOW       (cms)=   0.168 (i)
     TIME TO PEAK    (hrs)=   6.250
     RUNOFF VOLUME    (mm)=  11.690
     TOTAL RAINFALL   (mm)=  62.500
     RUNOFF COEFFICIENT   =   0.187

     (i) PEAK FLOW DOES NOT INCLUDE BASEFLOW IF ANY.

--------------------------------------------------------------------------------
--------------------
| RESERVOIR(  0018)|
| IN= 2---> OUT= 1 |
| DT=  5.0 min     |     OUTFLOW    STORAGE   |  OUTFLOW    STORAGE
--------------------      (cms)     (ha.m.)   |   (cms)     (ha.m.)
                         0.0000     0.0000   |   5.6800      0.5001
                         0.0010     0.1598   |   0.0000      0.0000

                               AREA     QPEAK     TPEAK       R.V.
                               (ha)     (cms)     (hrs)       (mm)
   INFLOW : ID= 2 (  0102)     7.190     0.168      6.25      11.69
   OUTFLOW: ID= 1 (  0018)     7.190     0.001     13.00       3.52

                  PEAK   FLOW   REDUCTION [Qout/Qin](%)=  0.31
                  TIME SHIFT OF PEAK FLOW         (min)=405.00
                  MAXIMUM  STORAGE   USED       (ha.m.)=  0.0830

--------------------------------------------------------------------------------
--------------------
| CALIB              |
| NASHYD   (  0103)|   Area    (ha)=  13.55   Curve Number   (CN)= 61.0
|ID= 1 DT= 5.0 min |   Ia      (mm)=   5.00   # of Linear Res.(N)= 3.00
--------------------   U.H. Tp(hrs)=   0.28

     Unit Hyd Qpeak  (cms)=   1.829

     PEAK FLOW       (cms)=   0.459 (i)
     TIME TO PEAK    (hrs)=   6.250
     RUNOFF VOLUME    (mm)=  15.028
     TOTAL RAINFALL   (mm)=  62.500
     RUNOFF COEFFICIENT   =   0.240

     (i) PEAK FLOW DOES NOT INCLUDE BASEFLOW IF ANY.

--------------------------------------------------------------------------------
--------------------
| RESERVOIR(  0019)|
| IN= 2---> OUT= 1 |
| DT=  5.0 min     |     OUTFLOW    STORAGE   |  OUTFLOW    STORAGE
--------------------      (cms)     (ha.m.)   |   (cms)     (ha.m.)
                         0.0000     0.0000   |   0.1500      0.3892

                               AREA     QPEAK     TPEAK       R.V.
                               (ha)     (cms)     (hrs)       (mm)
   INFLOW : ID= 2 (  0103)    13.550     0.459      6.25      15.03
   OUTFLOW: ID= 1 (  0019)    13.550     0.048      8.42      14.98

                  PEAK   FLOW   REDUCTION [Qout/Qin](%)= 10.57
                  TIME SHIFT OF PEAK FLOW         (min)=130.00
                  MAXIMUM  STORAGE   USED       (ha.m.)=  0.1258

--------------------------------------------------------------------------------
=============================================================================================
=====

      V    V   I    SSSSS  U   U    A    L
      V    V   I    SS     U   U   A A   L
       V  V    I     SS    U   U  AAAAA  L
       V  V    I      SS   U   U  A   A  L
        VV     I    SSSSS  UUUUU  A   A  LLLLL

       OOO   TTTTT  TTTTT  H   H  Y   Y  M   M   OOO    TM
      O   O    T      T    H   H   Y Y   MM MM  O   O
      O   O    T      T    H   H    Y    M   M  O   O
       OOO     T      T    H   H    Y    M   M   OOO
```



```
                    *****  D E T A I L E D   O U T P U T *****


  Input   filename: C:\Program Files (x86)\Visual OTTHYMO 5.0\VO2\voin.dat
  Output  filename: C:\Users\JJohnston\AppData\Local\Civica\VH5\9f0d15d2-7934-48cd-bc46-
458c27b77161\c6207f24-7a4f-44e0-9612-4c5a07d79041\sc
  Summary filename: C:\Users\JJohnston\AppData\Local\Civica\VH5\9f0d15d2-7934-48cd-bc46-
458c27b77161\c6207f24-7a4f-44e0-9612-4c5a07d79041\sc


DATE: 02/13/2018                          TIME: 11:58:24

USER:



COMMENTS:


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  ************************************************
  ** SIMULATION : Run 03- 10yr 12hr SCS          **
  ************************************************


--------------------
|    READ STORM     |    Filename: C:\Users\JJohnston\AppD
|                   |              ata\Local\Temp\
|                   |              e507d14d-1e21-497d-8202-bee55db2947a\2dee6a48
| Ptotal= 72.50 mm  |    Comments: 10yr 12hr 5min SCS
--------------------
                    TIME    RAIN |  TIME    RAIN |'  TIME    RAIN |  TIME    RAIN
                     hrs   mm/hr |   hrs   mm/hr |'   hrs   mm/hr |   hrs   mm/hr
                    0.08    0.00 |  3.17    2.90 |  6.25   13.05 |  9.33    2.54
                    0.17    1.81 |  3.25    2.90 |  6.33   13.05 |  9.42    2.54
                    0.25    1.81 |  3.33    2.90 |  6.42   13.05 |  9.50    2.54
                    0.33    1.81 |  3.42    2.90 |  6.50   13.05 |  9.58    2.54
```

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```
         0.42     1.81 |  3.50     2.90 |  6.58    13.05 |  9.67     2.54
         0.50     1.81 |  3.58     2.90 |  6.67     5.80 |  9.75     2.54
         0.58     1.81 |  3.67     2.90 |  6.75     5.80 |  9.83     2.54
         0.67     1.81 |  3.75     2.90 |  6.83     5.80 |  9.92     2.54
         0.75     1.81 |  3.83     2.90 |  6.92     5.80 | 10.00     2.54
         0.83     1.81 |  3.92     2.90 |  7.00     5.80 | 10.08     2.54
         0.92     1.81 |  4.00     2.90 |  7.08     5.80 | 10.17     1.45
         1.00     1.81 |  4.08     2.90 |  7.17     4.35 | 10.25     1.45
         1.08     1.81 |  4.17     4.35 |  7.25     4.35 | 10.33     1.45
         1.17     1.81 |  4.25     4.35 |  7.33     4.35 | 10.42     1.45
         1.25     1.81 |  4.33     4.35 |  7.42     4.35 | 10.50     1.45
         1.33     1.81 |  4.42     4.35 |  7.50     4.35 | 10.58     1.45
         1.42     1.81 |  4.50     4.35 |  7.58     4.35 | 10.67     1.45
         1.50     1.81 |  4.58     4.35 |  7.67     4.35 | 10.75     1.45
         1.58     1.81 |  4.67     5.80 |  7.75     4.35 | 10.83     1.45
         1.67     1.81 |  4.75     5.80 |  7.83     4.35 | 10.92     1.45
         1.75     1.81 |  4.83     5.80 |  7.92     4.35 | 11.00     1.45
         1.83     1.81 |  4.92     5.80 |  8.00     4.35 | 11.08     1.45
         1.92     1.81 |  5.00     5.80 |  8.08     4.35 | 11.17     1.45
         2.00     1.81 |  5.08     5.80 |  8.17     2.54 | 11.25     1.45
         2.08     1.81 |  5.17     8.70 |  8.25     2.54 | 11.33     1.45
         2.17     2.17 |  5.25     8.70 |  8.33     2.54 | 11.42     1.45
         2.25     2.17 |  5.33     8.70 |  8.42     2.54 | 11.50     1.45
         2.33     2.17 |  5.42     8.70 |  8.50     2.54 | 11.58     1.45
         2.42     2.17 |  5.50     8.70 |  8.58     2.54 | 11.67     1.45
         2.50     2.17 |  5.58     8.70 |  8.67     2.54 | 11.75     1.45
         2.58     2.17 |  5.67    34.80 |  8.75     2.54 | 11.83     1.45
         2.67     2.17 |  5.75    34.80 |  8.83     2.54 | 11.92     1.45
         2.75     2.17 |  5.83    34.80 |  8.92     2.54 | 12.00     1.45
         2.83     2.17 |  5.92    95.70 |  9.00     2.54 | 12.08     1.45
         2.92     2.17 |  6.00    95.70 |  9.08     2.54 |
         3.00     2.17 |  6.08    95.70 |  9.17     2.54 |
         3.08     2.17 |  6.17    13.05 |  9.25     2.54 |

--------------------------------------------------------------------------------

--------------------
| CALIB            |
| NASHYD   (  0100)|   Area    (ha)=   3.31   Curve Number   (CN)= 65.0
|ID= 1 DT= 5.0 min |   Ia      (mm)=   5.00   # of Linear Res.(N)= 3.00
--------------------   U.H. Tp(hrs)=   0.12

     Unit Hyd Qpeak  (cms)=   1.081

     PEAK FLOW       (cms)=   0.287 (i)
     TIME TO PEAK    (hrs)=   6.083
     RUNOFF VOLUME    (mm)=  21.978
     TOTAL RAINFALL   (mm)=  72.500
     RUNOFF COEFFICIENT   =   0.303

     (i) PEAK FLOW DOES NOT INCLUDE BASEFLOW IF ANY.

--------------------------------------------------------------------------------

--------------------
| RESERVOIR( 0016)|
| IN= 2---> OUT= 1 |
| DT=  5.0 min     |     OUTFLOW    STORAGE   |  OUTFLOW    STORAGE
--------------------      (cms)     (ha.m.)   |   (cms)     (ha.m.)
                          0.0000     0.0000   |   8.4600      0.2001
                          0.0010     0.2000   |   0.0000      0.0000

                                AREA     QPEAK     TPEAK       R.V.
                                (ha)     (cms)     (hrs)       (mm)
   INFLOW : ID= 2 (  0100)      3.310      0.287       6.08      21.98
   OUTFLOW: ID= 1 (  0016)      3.310      0.000      12.42       5.49

                 PEAK   FLOW   REDUCTION [Qout/Qin](%)=  0.13
                 TIME SHIFT OF PEAK FLOW         (min)=380.00
                 MAXIMUM  STORAGE   USED       (ha.m.)=  0.0720

--------------------------------------------------------------------------------

--------------------
| CALIB            |
| NASHYD   (  0101)|   Area    (ha)=   3.09   Curve Number   (CN)= 65.0
|ID= 1 DT= 5.0 min |   Ia      (mm)=   5.00   # of Linear Res.(N)= 3.00
--------------------   U.H. Tp(hrs)=   0.23

     Unit Hyd Qpeak  (cms)=   0.504

     PEAK FLOW       (cms)=   0.179 (i)
     TIME TO PEAK    (hrs)=   6.167
     RUNOFF VOLUME    (mm)=  22.282
     TOTAL RAINFALL   (mm)=  72.500
     RUNOFF COEFFICIENT   =   0.307

     (i) PEAK FLOW DOES NOT INCLUDE BASEFLOW IF ANY.

--------------------------------------------------------------------------------

--------------------
| RESERVOIR( 0017)|
| IN= 2---> OUT= 1 |
| DT=  5.0 min     |     OUTFLOW    STORAGE   |  OUTFLOW    STORAGE
--------------------      (cms)     (ha.m.)   |   (cms)     (ha.m.)
                          0.0000     0.0000   |   0.0900      0.0757

                                AREA     QPEAK     TPEAK       R.V.
                                (ha)     (cms)     (hrs)       (mm)
   INFLOW : ID= 2 (  0101)      3.090      0.179       6.17      22.28
   OUTFLOW: ID= 1 (  0017)      3.090      0.039       6.92      22.22

                 PEAK   FLOW   REDUCTION [Qout/Qin](%)= 21.94
                 TIME SHIFT OF PEAK FLOW         (min)= 45.00
                 MAXIMUM  STORAGE   USED       (ha.m.)=  0.0331

--------------------------------------------------------------------------------

--------------------
| CALIB            |
| NASHYD   (  0102)|   Area    (ha)=   7.19   Curve Number   (CN)= 53.0
|ID= 1 DT= 5.0 min |   Ia      (mm)=   5.00   # of Linear Res.(N)= 3.00
--------------------   U.H. Tp(hrs)=   0.33

     Unit Hyd Qpeak  (cms)=   0.842

     PEAK FLOW       (cms)=   0.225 (i)
     TIME TO PEAK    (hrs)=   6.250
     RUNOFF VOLUME    (mm)=  15.559
     TOTAL RAINFALL   (mm)=  72.500
     RUNOFF COEFFICIENT   =   0.215

     (i) PEAK FLOW DOES NOT INCLUDE BASEFLOW IF ANY.

--------------------------------------------------------------------------------

--------------------
| RESERVOIR( 0018)|
| IN= 2---> OUT= 1 |
| DT=  5.0 min     |     OUTFLOW    STORAGE   |  OUTFLOW    STORAGE
--------------------      (cms)     (ha.m.)   |   (cms)     (ha.m.)
                          0.0000     0.0000   |   5.6800      0.5001
                          0.0010     0.1598   |   0.0000      0.0000

                                AREA     QPEAK     TPEAK       R.V.
                                (ha)     (cms)     (hrs)       (mm)
   INFLOW : ID= 2 (  0102)      7.190      0.225       6.25      15.56
   OUTFLOW: ID= 1 (  0018)      7.190      0.001      13.00       4.69

                 PEAK   FLOW   REDUCTION [Qout/Qin](%)=  0.31
                 TIME SHIFT OF PEAK FLOW         (min)=405.00
                 MAXIMUM  STORAGE   USED       (ha.m.)=  0.1104

--------------------------------------------------------------------------------

--------------------
| CALIB            |
| NASHYD   (  0103)|   Area    (ha)=  13.55   Curve Number   (CN)= 61.0
|ID= 1 DT= 5.0 min |   Ia      (mm)=   5.00   # of Linear Res.(N)= 3.00
--------------------   U.H. Tp(hrs)=   0.28

     Unit Hyd Qpeak  (cms)=   1.829

     PEAK FLOW       (cms)=   0.609 (i)
     TIME TO PEAK    (hrs)=   6.250
     RUNOFF VOLUME    (mm)=  19.809
     TOTAL RAINFALL   (mm)=  72.500
     RUNOFF COEFFICIENT   =   0.273

     (i) PEAK FLOW DOES NOT INCLUDE BASEFLOW IF ANY.

--------------------------------------------------------------------------------

--------------------
| RESERVOIR( 0019)|
| IN= 2---> OUT= 1 |
| DT=  5.0 min     |     OUTFLOW    STORAGE   |  OUTFLOW    STORAGE
--------------------      (cms)     (ha.m.)   |   (cms)     (ha.m.)
                          0.0000     0.0000   |   0.1500      0.3892

                                AREA     QPEAK     TPEAK       R.V.
                                (ha)     (cms)     (hrs)       (mm)
   INFLOW : ID= 2 (  0103)     13.550      0.609       6.25      19.81
   OUTFLOW: ID= 1 (  0019)     13.550      0.064       8.33      19.76

                 PEAK   FLOW   REDUCTION [Qout/Qin](%)= 10.55
                 TIME SHIFT OF PEAK FLOW         (min)=125.00
                 MAXIMUM  STORAGE   USED       (ha.m.)=  0.1666
```

```
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==========================================================================================================
=====

      V    V   I    SSSSS  U   U    A    L
      V    V   I    SS     U   U   A A   L
       V  V    I     SS    U   U  AAAAA  L
       V  V    I      SS   U   U  A   A  L
        VV     I    SSSSS  UUUUU  A   A  LLLLL

       OOO    TTTTT  TTTTT  H   H  Y   Y  M   M   OOO     TM
      O   O     T      T    H   H   Y Y   MM MM  O   O
      O   O     T      T    H   H    Y    M   M  O   O
       OOO      T      T    H   H    Y    M   M   OOO
Developed and Distributed by Civica Infrastructure
```



```
                   *****  D E T A I L E D   O U T P U T *****


  Input   filename: C:\Program Files (x86)\Visual OTTHYMO 5.0\VO2\voin.dat
  Output  filename: C:\Users\JJohnston\AppData\Local\Civica\VH5\9f0d15d2-7934-48cd-bc46-
458c27b77161\d45da0d7-8732-419d-921a-6dfbb937765e\sc
  Summary filename: C:\Users\JJohnston\AppData\Local\Civica\VH5\9f0d15d2-7934-48cd-bc46-
458c27b77161\d45da0d7-8732-419d-921a-6dfbb937765e\sc


DATE: 02/13/2018                          TIME: 11:58:24

USER:


COMMENTS:


----------------------------------------------------------------------------------------------------------
-----
  ************************************************
  ** SIMULATION : Run 04- 25yr 12hr SCS         **
  ************************************************


--------------------
|    READ STORM    |    Filename: C:\Users\JJohnston\AppD
|                  |              ata\Local\Temp\
|                  |              e507d14d-1e21-497d-8202-bee55db2947a\868dc2b4
| Ptotal= 84.90 mm |    Comments: 25yr 12hr 5min SCS
--------------------
```

TIME hrs	RAIN mm/hr	TIME hrs	RAIN mm/hr	TIME hrs	RAIN mm/hr	TIME hrs	RAIN mm/hr
0.08	0.00	3.17	3.40	6.25	15.28	9.33	2.97
0.17	2.12	3.25	3.40	6.33	15.28	9.42	2.97
0.25	2.12	3.33	3.40	6.42	15.28	9.50	2.97
0.33	2.12	3.42	3.40	6.50	15.28	9.58	2.97
0.42	2.12	3.50	3.40	6.58	15.28	9.67	2.97
0.50	2.12	3.58	3.40	6.67	6.79	9.75	2.97
0.58	2.12	3.67	3.40	6.75	6.79	9.83	2.97
0.67	2.12	3.75	3.40	6.83	6.79	9.92	2.97
0.75	2.12	3.83	3.40	6.92	6.79	10.00	2.97
0.83	2.12	3.92	3.40	7.00	6.79	10.08	2.97
0.92	2.12	4.00	3.40	7.08	6.79	10.17	1.70
1.00	2.12	4.08	3.40	7.17	5.09	10.25	1.70
1.08	2.12	4.17	5.09	7.25	5.09	10.33	1.70
1.17	2.12	4.25	5.09	7.33	5.09	10.42	1.70
1.25	2.12	4.33	5.09	7.42	5.09	10.50	1.70
1.33	2.12	4.42	5.09	7.50	5.09	10.58	1.70
1.42	2.12	4.50	5.09	7.58	5.09	10.67	1.70
1.50	2.12	4.58	5.09	7.67	5.09	10.75	1.70
1.58	2.12	4.67	6.79	7.75	5.09	10.83	1.70
1.67	2.12	4.75	6.79	7.83	5.09	10.92	1.70
1.75	2.12	4.83	6.79	7.92	5.09	11.00	1.70
1.83	2.12	4.92	6.79	8.00	5.09	11.08	1.70
1.92	2.12	5.00	6.79	8.08	5.09	11.17	1.70
2.00	2.12	5.08	6.79	8.17	2.97	11.25	1.70
2.08	2.12	5.17	10.19	8.25	2.97	11.33	1.70
2.17	2.55	5.25	10.19	8.33	2.97	11.42	1.70
2.25	2.55	5.33	10.19	8.42	2.97	11.50	1.70
2.33	2.55	5.42	10.19	8.50	2.97	11.58	1.70
2.42	2.55	5.50	10.19	8.58	2.97	11.67	1.70
2.50	2.55	5.58	10.19	8.67	2.97	11.75	1.70
2.58	2.55	5.67	40.75	8.75	2.97	11.83	1.70
2.67	2.55	5.75	40.75	8.83	2.97	11.92	1.70
2.75	2.55	5.83	40.75	8.92	2.97	12.00	1.70
2.83	2.55	5.92	112.07	9.00	2.97	12.08	1.70
2.92	2.55	6.00	112.07	9.08	2.97		
3.00	2.55	6.08	112.07	9.17	2.97		
3.08	2.55	6.17	15.28	9.25	2.97		

```
--------------------------------------------------------------------------------

--------------------
| CALIB            |
| NASHYD  (  0100)|   Area    (ha)=   3.31   Curve Number   (CN)= 65.0
|ID= 1 DT= 5.0 min |   Ia      (mm)=   5.00   # of Linear Res.(N)= 3.00
--------------------   U.H. Tp(hrs)=   0.12

     Unit Hyd Qpeak  (cms)=   1.081

     PEAK FLOW       (cms)=   0.379 (i)
     TIME TO PEAK    (hrs)=   6.083
     RUNOFF VOLUME    (mm)=  29.032
     TOTAL RAINFALL   (mm)=  84.900
     RUNOFF COEFFICIENT   =   0.342

     (i) PEAK FLOW DOES NOT INCLUDE BASEFLOW IF ANY.

--------------------------------------------------------------------------------
--------------------
| RESERVOIR(  0016)|
| IN= 2---> OUT= 1 |
| DT=  5.0 min     |      OUTFLOW     STORAGE    |  OUTFLOW     STORAGE
--------------------       (cms)      (ha.m.)    |   (cms)      (ha.m.)
                          0.0000      0.0000     |   8.4600      0.2001
                          0.0010      0.2000     |   0.0000      0.0000

                                AREA      QPEAK      TPEAK        R.V.
                                (ha)      (cms)      (hrs)        (mm)
   INFLOW : ID= 2 (  0100)      3.310      0.379       6.08        29.03
   OUTFLOW: ID= 1 (  0016)      3.310      0.000      12.42         7.25

                   PEAK    FLOW    REDUCTION [Qout/Qin](%)=  0.13
                   TIME SHIFT OF PEAK FLOW          (min)=380.00
                   MAXIMUM   STORAGE    USED       (ha.m.)=  0.0952

--------------------------------------------------------------------------------
--------------------
| CALIB            |
| NASHYD  (  0101)|   Area    (ha)=   3.09   Curve Number   (CN)= 65.0
|ID= 1 DT= 5.0 min |   Ia      (mm)=   5.00   # of Linear Res.(N)= 3.00
--------------------   U.H. Tp(hrs)=   0.23

     Unit Hyd Qpeak  (cms)=   0.504

     PEAK FLOW       (cms)=   0.238 (i)
     TIME TO PEAK    (hrs)=   6.167
     RUNOFF VOLUME    (mm)=  29.434
     TOTAL RAINFALL   (mm)=  84.900
     RUNOFF COEFFICIENT   =   0.347

     (i) PEAK FLOW DOES NOT INCLUDE BASEFLOW IF ANY.

--------------------------------------------------------------------------------
--------------------
| RESERVOIR(  0017)|
| IN= 2---> OUT= 1 |
| DT=  5.0 min     |      OUTFLOW     STORAGE    |  OUTFLOW     STORAGE
--------------------       (cms)      (ha.m.)    |   (cms)      (ha.m.)
                          0.0000      0.0000     |   0.0900      0.0757

                                AREA      QPEAK      TPEAK        R.V.
                                (ha)      (cms)      (hrs)        (mm)
   INFLOW : ID= 2 (  0101)      3.090      0.238       6.17        29.43
   OUTFLOW: ID= 1 (  0017)      3.090      0.052       6.92        29.37

                   PEAK    FLOW    REDUCTION [Qout/Qin](%)= 21.98
                   TIME SHIFT OF PEAK FLOW          (min)= 45.00
                   MAXIMUM   STORAGE    USED       (ha.m.)=  0.0441

--------------------------------------------------------------------------------
--------------------
| CALIB            |
| NASHYD  (  0102)|   Area    (ha)=   7.19   Curve Number   (CN)= 53.0
|ID= 1 DT= 5.0 min |   Ia      (mm)=   5.00   # of Linear Res.(N)= 3.00
--------------------   U.H. Tp(hrs)=   0.33

     Unit Hyd Qpeak  (cms)=   0.842

     PEAK FLOW       (cms)=   0.305 (i)
```

```
     TIME TO PEAK     (hrs)=    6.250
     RUNOFF VOLUME     (mm)=   20.915
     TOTAL RAINFALL    (mm)=   84.900
     RUNOFF COEFFICIENT    =    0.246

     (i) PEAK FLOW DOES NOT INCLUDE BASEFLOW IF ANY.

-------------------------------------------------------------------------------
--------------------
| RESERVOIR(  0018)|
| IN= 2---> OUT= 1 |
| DT=  5.0 min     |     OUTFLOW    STORAGE   |  OUTFLOW    STORAGE
--------------------      (cms)     (ha.m.)   |   (cms)     (ha.m.)
                          0.0000     0.0000   |   5.6800     0.5001
                          0.0010     0.1598   |   0.0000     0.0000

                                AREA     QPEAK     TPEAK        R.V.
                                (ha)     (cms)     (hrs)        (mm)
   INFLOW : ID= 2 (  0102)      7.190     0.305      6.25        20.92
   OUTFLOW: ID= 1 (  0018)      7.190     0.001     13.00         6.31

                   PEAK   FLOW    REDUCTION [Qout/Qin](%)=  0.30
                   TIME SHIFT OF PEAK FLOW        (min)=405.00
                   MAXIMUM  STORAGE   USED       (ha.m.)=  0.1484

-------------------------------------------------------------------------------
--------------------
| CALIB            |
| NASHYD   (  0103)|   Area     (ha)=  13.55   Curve Number   (CN)= 61.0
|ID= 1 DT= 5.0 min |   Ia       (mm)=   5.00   # of Linear Res.(N)= 3.00
--------------------   U.H. Tp(hrs)=   0.28

     Unit Hyd Qpeak  (cms)=   1.829

     PEAK FLOW       (cms)=   0.814 (i)
     TIME TO PEAK    (hrs)=   6.250
     RUNOFF VOLUME    (mm)=  26.335
     TOTAL RAINFALL   (mm)=  84.900
     RUNOFF COEFFICIENT   =   0.310

     (i) PEAK FLOW DOES NOT INCLUDE BASEFLOW IF ANY.

-------------------------------------------------------------------------------
--------------------
| RESERVOIR(  0019)|
| IN= 2---> OUT= 1 |
| DT=  5.0 min     |     OUTFLOW    STORAGE   |  OUTFLOW    STORAGE
--------------------      (cms)     (ha.m.)   |   (cms)     (ha.m.)
                          0.0000     0.0000   |   0.1500     0.3892

                                AREA     QPEAK     TPEAK        R.V.
                                (ha)     (cms)     (hrs)        (mm)
   INFLOW : ID= 2 (  0103)     13.550     0.814      6.25        26.34
   OUTFLOW: ID= 1 (  0019)     13.550     0.086      8.33        26.29

                   PEAK   FLOW    REDUCTION [Qout/Qin](%)= 10.53
                   TIME SHIFT OF PEAK FLOW        (min)=125.00
                   MAXIMUM  STORAGE   USED       (ha.m.)=  0.2225

-------------------------------------------------------------------------------
===============================================================================
=====

       V    V   I    SSSSS  U   U    A    L
       V    V   I    SS     U   U   A A   L
        V  V    I     SS    U   U  AAAAA  L
        V  V    I      SS   U   U  A   A  L
         VV     I    SSSSS  UUUUU  A   A  LLLLL

        OOO    TTTTT  TTTTT  H   H  Y   Y  M   M   OOO     TM
       O   O     T      T    H   H   Y Y   MM MM  O   O
       O   O     T      T    H   H    Y    M   M  O   O
        OOO      T      T    H   H    Y    M   M   OOO
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```



```
                   *****  D E T A I L E D   O U T P U T *****


  Input   filename: C:\Program Files (x86)\Visual OTTHYMO 5.0\VO2\voin.dat
  Output  filename: C:\Users\JJohnston\AppData\Local\Civica\VH5\9f0d15d2-7934-48cd-bc46-
458c27b77161\3e28f7fd-c7ad-4c42-90a5-491d6e0bd907\sc
  Summary filename: C:\Users\JJohnston\AppData\Local\Civica\VH5\9f0d15d2-7934-48cd-bc46-
458c27b77161\3e28f7fd-c7ad-4c42-90a5-491d6e0bd907\sc


DATE: 02/13/2018                             TIME: 11:58:24

USER:


COMMENTS:

-------------------------------------------------------------------------------
-----
  **********************************************
  ** SIMULATION : Run 05- 50yr 12hr SCS        **
  **********************************************


--------------------
|    READ STORM    |    Filename: C:\Users\JJohnston\AppD
|                  |              ata\Local\Temp\
|                  |              e507d14d-1e21-497d-8202-bee55db2947a\598be94a
| Ptotal= 94.20 mm |    Comments: 50yr 12hr 5min SCS
--------------------
                 TIME    RAIN |  TIME    RAIN |'  TIME    RAIN |  TIME    RAIN
                  hrs   mm/hr |   hrs   mm/hr |'   hrs   mm/hr |   hrs   mm/hr
                 0.08    0.00 |  3.17    3.77 |  6.25   16.96 |  9.33    3.30
                 0.17    2.36 |  3.25    3.77 |  6.33   16.96 |  9.42    3.30
                 0.25    2.36 |  3.33    3.77 |  6.42   16.96 |  9.50    3.30
                 0.33    2.36 |  3.42    3.77 |  6.50   16.96 |  9.58    3.30
                 0.42    2.36 |  3.50    3.77 |  6.58   16.96 |  9.67    3.30
                 0.50    2.36 |  3.58    3.77 |  6.67    7.54 |  9.75    3.30
                 0.58    2.36 |  3.67    3.77 |  6.75    7.54 |  9.83    3.30
                 0.67    2.36 |  3.75    3.77 |  6.83    7.54 |  9.92    3.30
                 0.75    2.36 |  3.83    3.77 |  6.92    7.54 | 10.00    3.30
                 0.83    2.36 |  3.92    3.77 |  7.00    7.54 | 10.08    3.30
                 0.92    2.36 |  4.00    3.77 |  7.08    7.54 | 10.17    1.88
                 1.00    2.36 |  4.08    3.77 |  7.17    5.65 | 10.25    1.88
                 1.08    2.36 |  4.17    5.65 |  7.25    5.65 | 10.33    1.88
                 1.17    2.36 |  4.25    5.65 |  7.33    5.65 | 10.42    1.88
                 1.25    2.36 |  4.33    5.65 |  7.42    5.65 | 10.50    1.88
                 1.33    2.36 |  4.42    5.65 |  7.50    5.65 | 10.58    1.88
                 1.42    2.36 |  4.50    5.65 |  7.58    5.65 | 10.67    1.88
                 1.50    2.36 |  4.58    5.65 |  7.67    5.65 | 10.75    1.88
                 1.58    2.36 |  4.67    7.54 |  7.75    5.65 | 10.83    1.88
                 1.67    2.36 |  4.75    7.54 |  7.83    5.65 | 10.92    1.88
                 1.75    2.36 |  4.83    7.54 |  7.92    5.65 | 11.00    1.88
                 1.83    2.36 |  4.92    7.54 |  8.00    5.65 | 11.08    1.88
                 1.92    2.36 |  5.00    7.54 |  8.08    5.65 | 11.17    1.88
                 2.00    2.36 |  5.08    7.54 |  8.17    3.30 | 11.25    1.88
                 2.08    2.36 |  5.17   11.30 |  8.25    3.30 | 11.33    1.88
                 2.17    2.83 |  5.25   11.30 |  8.33    3.30 | 11.42    1.88
                 2.25    2.83 |  5.33   11.30 |  8.42    3.30 | 11.50    1.88
                 2.33    2.83 |  5.42   11.30 |  8.50    3.30 | 11.58    1.88
                 2.42    2.83 |  5.50   11.30 |  8.58    3.30 | 11.67    1.88
                 2.50    2.83 |  5.58   11.30 |  8.67    3.30 | 11.75    1.88
                 2.58    2.83 |  5.67   45.22 |  8.75    3.30 | 11.83    1.88
                 2.67    2.83 |  5.75   45.22 |  8.83    3.30 | 11.92    1.88
                 2.75    2.83 |  5.83   45.22 |  8.92    3.30 | 12.00    1.88
                 2.83    2.83 |  5.92  124.34 |  9.00    3.30 | 12.08    1.88
                 2.92    2.83 |  6.00  124.34 |  9.08    3.30 |
                 3.00    2.83 |  6.08  124.34 |  9.17    3.30 |
                 3.08    2.83 |  6.17   16.96 |  9.25    3.30 |

-------------------------------------------------------------------------------

--------------------
| CALIB            |
| NASHYD   (  0100)|   Area     (ha)=   3.31   Curve Number   (CN)= 65.0
|ID= 1 DT= 5.0 min |   Ia       (mm)=   5.00   # of Linear Res.(N)= 3.00
--------------------   U.H. Tp(hrs)=   0.12

     Unit Hyd Qpeak  (cms)=   1.081

     PEAK FLOW       (cms)=   0.454 (i)
     TIME TO PEAK    (hrs)=   6.083
     RUNOFF VOLUME    (mm)=  34.695
     TOTAL RAINFALL   (mm)=  94.200
     RUNOFF COEFFICIENT   =   0.368

     (i) PEAK FLOW DOES NOT INCLUDE BASEFLOW IF ANY.

-------------------------------------------------------------------------------
--------------------
| RESERVOIR(  0016)|
| IN= 2---> OUT= 1 |
```

```
| DT=  5.0 min     |     OUTFLOW    STORAGE   |  OUTFLOW    STORAGE
--------------------      (cms)      (ha.m.)   |   (cms)      (ha.m.)
                          0.0000     0.0000    |  8.4600      0.2001
                          0.0010     0.2000    |  0.0000      0.0000

                                AREA     QPEAK     TPEAK       R.V.
                                (ha)     (cms)     (hrs)       (mm)
   INFLOW : ID= 2 (  0100)     3.310      0.454      6.08       34.69
   OUTFLOW: ID= 1 (  0016)     3.310      0.001     12.42        8.67

                   PEAK   FLOW   REDUCTION [Qout/Qin](%)=  0.13
                   TIME SHIFT OF PEAK FLOW        (min)=380.00
                   MAXIMUM  STORAGE   USED       (ha.m.)=  0.1137

--------------------------------------------------------------------------------
--------------------
| CALIB            |
| NASHYD   (  0101)|   Area    (ha)=   3.09   Curve Number   (CN)= 65.0
|ID= 1 DT= 5.0 min |   Ia      (mm)=   5.00   # of Linear Res.(N)= 3.00
--------------------   U.H. Tp(hrs)=   0.23

     Unit Hyd Qpeak  (cms)=   0.504

     PEAK FLOW       (cms)=   0.286 (i)
     TIME TO PEAK    (hrs)=   6.167
     RUNOFF VOLUME    (mm)=  35.175
     TOTAL RAINFALL   (mm)=  94.200
     RUNOFF COEFFICIENT   =   0.373

     (i) PEAK FLOW DOES NOT INCLUDE BASEFLOW IF ANY.

--------------------------------------------------------------------------------
--------------------
| RESERVOIR(  0017)|
| IN= 2---> OUT= 1 |
| DT=  5.0 min     |     OUTFLOW    STORAGE   |  OUTFLOW    STORAGE
--------------------      (cms)      (ha.m.)   |   (cms)      (ha.m.)
                          0.0000     0.0000    |  0.0900      0.0757

                                AREA     QPEAK     TPEAK       R.V.
                                (ha)     (cms)     (hrs)       (mm)
   INFLOW : ID= 2 (  0101)     3.090      0.286      6.17       35.17
   OUTFLOW: ID= 1 (  0017)     3.090      0.063      6.92       35.11

                   PEAK   FLOW   REDUCTION [Qout/Qin](%)= 22.01
                   TIME SHIFT OF PEAK FLOW        (min)= 45.00
                   MAXIMUM  STORAGE   USED       (ha.m.)=  0.0530

--------------------------------------------------------------------------------
--------------------
| CALIB            |
| NASHYD   (  0102)|   Area    (ha)=   7.19   Curve Number   (CN)= 53.0
|ID= 1 DT= 5.0 min |   Ia      (mm)=   5.00   # of Linear Res.(N)= 3.00
--------------------   U.H. Tp(hrs)=   0.33

     Unit Hyd Qpeak  (cms)=   0.842

     PEAK FLOW       (cms)=   0.371 (i)
     TIME TO PEAK    (hrs)=   6.250
     RUNOFF VOLUME    (mm)=  25.297
     TOTAL RAINFALL   (mm)=  94.200
     RUNOFF COEFFICIENT   =   0.269

     (i) PEAK FLOW DOES NOT INCLUDE BASEFLOW IF ANY.

--------------------------------------------------------------------------------
--------------------
| RESERVOIR(  0018)|
| IN= 2---> OUT= 1 |
| DT=  5.0 min     |     OUTFLOW    STORAGE   |  OUTFLOW    STORAGE
--------------------      (cms)      (ha.m.)   |   (cms)      (ha.m.)
                          0.0000     0.0000    |  5.6800      0.5001
                          0.0010     0.1598    |  0.0000      0.0000

                                AREA     QPEAK     TPEAK       R.V.
                                (ha)     (cms)     (hrs)       (mm)
   INFLOW : ID= 2 (  0102)     7.190      0.371      6.25       25.30
   OUTFLOW: ID= 1 (  0018)     7.190      0.028     10.33        9.56

                   PEAK   FLOW   REDUCTION [Qout/Qin](%)=  7.63
                   TIME SHIFT OF PEAK FLOW        (min)=245.00
                   MAXIMUM  STORAGE   USED       (ha.m.)=  0.1614

--------------------------------------------------------------------------------
--------------------
| CALIB            |
```

```
| NASHYD   (  0103)|   Area    (ha)=  13.55   Curve Number   (CN)= 61.0
|ID= 1 DT= 5.0 min |   Ia      (mm)=   5.00   # of Linear Res.(N)= 3.00
--------------------   U.H. Tp(hrs)=   0.28

     Unit Hyd Qpeak  (cms)=   1.829

     PEAK FLOW       (cms)=   0.981 (i)
     TIME TO PEAK    (hrs)=   6.250
     RUNOFF VOLUME    (mm)=  31.609
     TOTAL RAINFALL   (mm)=  94.200
     RUNOFF COEFFICIENT   =   0.336

     (i) PEAK FLOW DOES NOT INCLUDE BASEFLOW IF ANY.

--------------------------------------------------------------------------------
--------------------
| RESERVOIR(  0019)|
| IN= 2---> OUT= 1 |
| DT=  5.0 min     |     OUTFLOW    STORAGE   |  OUTFLOW    STORAGE
--------------------      (cms)      (ha.m.)   |   (cms)      (ha.m.)
                          0.0000     0.0000    |  0.1500      0.3892

                                AREA     QPEAK     TPEAK       R.V.
                                (ha)     (cms)     (hrs)       (mm)
   INFLOW : ID= 2 (  0103)    13.550      0.981      6.25       31.61
   OUTFLOW: ID= 1 (  0019)    13.550      0.103      8.25       31.56

                   PEAK   FLOW   REDUCTION [Qout/Qin](%)= 10.52
                   TIME SHIFT OF PEAK FLOW        (min)=120.00
                   MAXIMUM  STORAGE   USED       (ha.m.)=  0.2679

--------------------------------------------------------------------------------
====================================================================================================
=====

       V    V   I    SSSSS  U   U    A    L
       V    V   I    SS     U   U   A A   L
        V  V    I     SS    U   U  AAAAA  L
        V  V    I      SS   U   U  A   A  L
         VV     I    SSSSS  UUUUU  A   A  LLLLL

        OOO   TTTTT  TTTTT  H   H  Y   Y  M   M   OOO     TM
       O   O    T      T    H   H   Y Y   MM MM  O   O
       O   O    T      T    H   H    Y    M   M  O   O
        OOO     T      T    H   H    Y    M   M   OOO
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```



```
                   *****  D E T A I L E D   O U T P U T *****


  Input   filename: C:\Program Files (x86)\Visual OTTHYMO 5.0\VO2\voin.dat
  Output  filename: C:\Users\JJohnston\AppData\Local\Civica\VH5\9f0d15d2-7934-48cd-bc46-
458c27b77161\38f761e0-f4fd-44c5-a34a-41c2ccee0d0c\sc
  Summary filename: C:\Users\JJohnston\AppData\Local\Civica\VH5\9f0d15d2-7934-48cd-bc46-
458c27b77161\38f761e0-f4fd-44c5-a34a-41c2ccee0d0c\sc


DATE: 02/13/2018                             TIME: 11:58:24

USER:



COMMENTS:


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-----
  **************************************************
  ** SIMULATION : Run 06- 100yr 12hr SCS          **
  **************************************************


--------------------
|    READ STORM    |    Filename: C:\Users\JJohnston\AppD
|                  |              ata\Local\Temp\
|                  |              e507d14d-1e21-497d-8202-bee55db2947a\2d772290
| Ptotal=103.50 mm |    Comments: 100yr 12hr 5min SCS
--------------------
                  TIME    RAIN |  TIME    RAIN |'  TIME    RAIN |  TIME    RAIN
                   hrs   mm/hr |   hrs   mm/hr |'   hrs   mm/hr |   hrs   mm/hr
                  0.08    0.00 |  3.17    4.14 |  6.25   18.63 |  9.33    3.62
                  0.17    2.59 |  3.25    4.14 |  6.33   18.63 |  9.42    3.62
```

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0.25	2.59	3.33	4.14	6.42	18.63	9.50	3.62
0.33	2.59	3.42	4.14	6.50	18.63	9.58	3.62
0.42	2.59	3.50	4.14	6.58	18.63	9.67	3.62
0.50	2.59	3.58	4.14	6.67	8.28	9.75	3.62
0.58	2.59	3.67	4.14	6.75	8.28	9.83	3.62
0.67	2.59	3.75	4.14	6.83	8.28	9.92	3.62
0.75	2.59	3.83	4.14	6.92	8.28	10.00	3.62
0.83	2.59	3.92	4.14	7.00	8.28	10.08	3.62
0.92	2.59	4.00	4.14	7.08	8.28	10.17	2.07
1.00	2.59	4.08	4.14	7.17	6.21	10.25	2.07
1.08	2.59	4.17	6.21	7.25	6.21	10.33	2.07
1.17	2.59	4.25	6.21	7.33	6.21	10.42	2.07
1.25	2.59	4.33	6.21	7.42	6.21	10.50	2.07
1.33	2.59	4.42	6.21	7.50	6.21	10.58	2.07
1.42	2.59	4.50	6.21	7.58	6.21	10.67	2.07
1.50	2.59	4.58	6.21	7.67	6.21	10.75	2.07
1.58	2.59	4.67	8.28	7.75	6.21	10.83	2.07
1.67	2.59	4.75	8.28	7.83	6.21	10.92	2.07
1.75	2.59	4.83	8.28	7.92	6.21	11.00	2.07
1.83	2.59	4.92	8.28	8.00	6.21	11.08	2.07
1.92	2.59	5.00	8.28	8.08	6.21	11.17	2.07
2.00	2.59	5.08	8.28	8.17	3.62	11.25	2.07
2.08	2.59	5.17	12.42	8.25	3.62	11.33	2.07
2.17	3.11	5.25	12.42	8.33	3.62	11.42	2.07
2.25	3.11	5.33	12.42	8.42	3.62	11.50	2.07
2.33	3.11	5.42	12.42	8.50	3.62	11.58	2.07
2.42	3.11	5.50	12.42	8.58	3.62	11.67	2.07
2.50	3.11	5.58	12.42	8.67	3.62	11.75	2.07
2.58	3.11	5.67	49.68	8.75	3.62	11.83	2.07
2.67	3.11	5.75	49.68	8.83	3.62	11.92	2.07
2.75	3.11	5.83	49.68	8.92	3.62	12.00	2.07
2.83	3.11	5.92	136.62	9.00	3.62	12.08	2.07
2.92	3.11	6.00	136.62	9.08	3.62		
3.00	3.11	6.08	136.62	9.17	3.62		
3.08	3.11	6.17	18.63	9.25	3.62		

```
--------------------------------------------------------------------------------
--------------------
| CALIB              |
| NASHYD   (  0100)|   Area     (ha)=    3.31   Curve Number   (CN)= 65.0
|ID= 1 DT= 5.0 min |   Ia       (mm)=    5.00   # of Linear Res.(N)= 3.00
--------------------   U.H. Tp(hrs)=    0.12

     Unit Hyd Qpeak  (cms)=    1.081

     PEAK FLOW       (cms)=    0.532 (i)
     TIME TO PEAK    (hrs)=    6.083
     RUNOFF VOLUME    (mm)=   40.634
     TOTAL RAINFALL   (mm)= 103.500
     RUNOFF COEFFICIENT   =    0.393

     (i) PEAK FLOW DOES NOT INCLUDE BASEFLOW IF ANY.

--------------------------------------------------------------------------------
--------------------
| RESERVOIR(  0016)|
| IN= 2---> OUT= 1 |
| DT=  5.0 min     |     OUTFLOW    STORAGE   |  OUTFLOW    STORAGE
--------------------      (cms)     (ha.m.)   |   (cms)     (ha.m.)
                          0.0000     0.0000   |   8.4600      0.2001
                          0.0010     0.2000   |   0.0000      0.0000

                                 AREA     QPEAK     TPEAK       R.V.
                                 (ha)     (cms)     (hrs)       (mm)
  INFLOW : ID= 2 (  0100)       3.310      0.532      6.08      40.63
  OUTFLOW: ID= 1 (  0016)       3.310      0.001     12.42      10.15

                   PEAK   FLOW   REDUCTION [Qout/Qin](%)=  0.13
                   TIME SHIFT OF PEAK FLOW         (min)=380.00
                   MAXIMUM  STORAGE   USED       (ha.m.)=  0.1332

--------------------------------------------------------------------------------
--------------------
| CALIB              |
| NASHYD   (  0101)|   Area     (ha)=    3.09   Curve Number   (CN)= 65.0
|ID= 1 DT= 5.0 min |   Ia       (mm)=    5.00   # of Linear Res.(N)= 3.00
--------------------   U.H. Tp(hrs)=    0.23

     Unit Hyd Qpeak  (cms)=    0.504

     PEAK FLOW       (cms)=    0.336 (i)
     TIME TO PEAK    (hrs)=    6.167
     RUNOFF VOLUME    (mm)=   41.196
     TOTAL RAINFALL   (mm)= 103.500
     RUNOFF COEFFICIENT   =    0.398

     (i) PEAK FLOW DOES NOT INCLUDE BASEFLOW IF ANY.

--------------------------------------------------------------------------------
--------------------
| RESERVOIR(  0017)|
| IN= 2---> OUT= 1 |
| DT=  5.0 min     |     OUTFLOW    STORAGE   |  OUTFLOW    STORAGE
--------------------      (cms)     (ha.m.)   |   (cms)     (ha.m.)
                          0.0000     0.0000   |   0.0900      0.0757

                                 AREA     QPEAK     TPEAK       R.V.
                                 (ha)     (cms)     (hrs)       (mm)
  INFLOW : ID= 2 (  0101)       3.090      0.336      6.17      41.20
  OUTFLOW: ID= 1 (  0017)       3.090      0.074      6.92      41.13

                   PEAK   FLOW   REDUCTION [Qout/Qin](%)= 22.04
                   TIME SHIFT OF PEAK FLOW         (min)= 45.00
                   MAXIMUM  STORAGE   USED       (ha.m.)=  0.0624

--------------------------------------------------------------------------------
--------------------
| CALIB              |
| NASHYD   (  0102)|   Area     (ha)=    7.19   Curve Number   (CN)= 53.0
|ID= 1 DT= 5.0 min |   Ia       (mm)=    5.00   # of Linear Res.(N)= 3.00
--------------------   U.H. Tp(hrs)=    0.33

     Unit Hyd Qpeak  (cms)=    0.842

     PEAK FLOW       (cms)=    0.441 (i)
     TIME TO PEAK    (hrs)=    6.250
     RUNOFF VOLUME    (mm)=   29.960
     TOTAL RAINFALL   (mm)= 103.500
     RUNOFF COEFFICIENT   =    0.289

     (i) PEAK FLOW DOES NOT INCLUDE BASEFLOW IF ANY.

--------------------------------------------------------------------------------
--------------------
| RESERVOIR(  0018)|
| IN= 2---> OUT= 1 |
| DT=  5.0 min     |     OUTFLOW    STORAGE   |  OUTFLOW    STORAGE
--------------------      (cms)     (ha.m.)   |   (cms)     (ha.m.)
                          0.0000     0.0000   |   5.6800      0.5001
                          0.0010     0.1598   |   0.0000      0.0000

                                 AREA     QPEAK     TPEAK       R.V.
                                 (ha)     (cms)     (hrs)       (mm)
  INFLOW : ID= 2 (  0102)       7.190      0.441      6.25      29.96
  OUTFLOW: ID= 1 (  0018)       7.190      0.054      8.33      14.22

                   PEAK   FLOW   REDUCTION [Qout/Qin](%)= 12.15
                   TIME SHIFT OF PEAK FLOW         (min)=125.00
                   MAXIMUM  STORAGE   USED       (ha.m.)=  0.1630

--------------------------------------------------------------------------------
--------------------
| CALIB              |
| NASHYD   (  0103)|   Area     (ha)=   13.55   Curve Number   (CN)= 61.0
|ID= 1 DT= 5.0 min |   Ia       (mm)=    5.00   # of Linear Res.(N)= 3.00
--------------------   U.H. Tp(hrs)=    0.28

     Unit Hyd Qpeak  (cms)=    1.829

     PEAK FLOW       (cms)=    1.158 (i)
     TIME TO PEAK    (hrs)=    6.250
     RUNOFF VOLUME    (mm)=   37.170
     TOTAL RAINFALL   (mm)= 103.500
     RUNOFF COEFFICIENT   =    0.359

     (i) PEAK FLOW DOES NOT INCLUDE BASEFLOW IF ANY.

--------------------------------------------------------------------------------
--------------------
| RESERVOIR(  0019)|
| IN= 2---> OUT= 1 |
| DT=  5.0 min     |     OUTFLOW    STORAGE   |  OUTFLOW    STORAGE
--------------------      (cms)     (ha.m.)   |   (cms)     (ha.m.)
                          0.0000     0.0000   |   0.1500      0.3892

                                 AREA     QPEAK     TPEAK       R.V.
                                 (ha)     (cms)     (hrs)       (mm)
  INFLOW : ID= 2 (  0103)      13.550      1.158      6.25      37.17
  OUTFLOW: ID= 1 (  0019)      13.550      0.122      8.25      37.12

                   PEAK   FLOW   REDUCTION [Qout/Qin](%)= 10.51
```

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```
                   TIME SHIFT OF PEAK FLOW         (min)=120.00
                   MAXIMUM  STORAGE   USED       (ha.m.)=  0.3159

 ------------------------------------------------------------------------------
 ====================================================================================================
 =====

       V    V   I    SSSSS  U   U    A    L
       V    V   I    SS     U   U   A A   L
        V  V    I     SS    U   U  AAAAA  L
        V  V    I      SS   U   U  A   A  L
         VV     I    SSSSS  UUUUU  A   A  LLLLL

        OOO   TTTTT  TTTTT  H   H  Y   Y  M   M   OOO    TM
       O   O    T      T    H   H   Y Y   MM MM  O   O
       O   O    T      T    H   H    Y    M   M  O   O
        OOO     T      T    H   H    Y    M   M   OOO
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                   *****  D E T A I L E D   O U T P U T *****


   Input   filename: C:\Program Files (x86)\Visual OTTHYMO 5.0\VO2\voin.dat
   Output  filename: C:\Users\JJohnston\AppData\Local\Civica\VH5\9f0d15d2-7934-48cd-bc46-
 458c27b77161\b7bf27cd-5395-43ce-9e17-c2d61f187eed\sc
   Summary filename: C:\Users\JJohnston\AppData\Local\Civica\VH5\9f0d15d2-7934-48cd-bc46-
 458c27b77161\b7bf27cd-5395-43ce-9e17-c2d61f187eed\sc


 DATE: 02/13/2018                          TIME: 11:58:24

 USER:


 COMMENTS:


 ----------------------------------------------------------------------------------------------------
 -----
   **************************************************
   ** SIMULATION : Run 07- 100yr 6hr SCS         **
   **************************************************


 --------------------
 |    READ STORM    |     Filename: C:\Users\JJohnston\AppD
 |                  |               ata\Local\Temp\
 |                  |               e507d14d-1e21-497d-8202-bee55db2947a\31522549
 | Ptotal= 84.00 mm |     Comments: 100yr 6hr 5min SCS
 --------------------
                  TIME    RAIN |  TIME    RAIN |'  TIME    RAIN |  TIME    RAIN
                   hrs   mm/hr |   hrs   mm/hr |'   hrs   mm/hr |   hrs   mm/hr
                  0.08    0.00 |  1.67    8.40 |  3.25   18.48 |  4.83    5.04
                  0.17    3.36 |  1.75    8.40 |  3.33   18.48 |  4.92    5.04
                  0.25    3.36 |  1.83    8.40 |  3.42   18.48 |  5.00    5.04
                  0.33    3.36 |  1.92    8.40 |  3.50   18.48 |  5.08    5.04
                  0.42    3.36 |  2.00    8.40 |  3.58   18.48 |  5.17    3.36
                  0.50    3.36 |  2.08    8.40 |  3.67    8.40 |  5.25    3.36
                  0.58    3.36 |  2.17   10.08 |  3.75    8.40 |  5.33    3.36
                  0.67    5.04 |  2.25   10.08 |  3.83    8.40 |  5.42    3.36
                  0.75    5.04 |  2.33   10.08 |  3.92    8.40 |  5.50    3.36
                  0.83    5.04 |  2.42   10.08 |  4.00    8.40 |  5.58    3.36
                  0.92    5.04 |  2.50   10.08 |  4.08    8.40 |  5.67    3.36
                  1.00    5.04 |  2.58   10.08 |  4.17    6.72 |  5.75    3.36
                  1.08    5.04 |  2.67   50.40 |  4.25    6.72 |  5.83    3.36
                  1.17    5.04 |  2.75   50.40 |  4.33    6.72 |  5.92    3.36
                  1.25    5.04 |  2.83   50.40 |  4.42    6.72 |  6.00    3.36
                  1.33    5.04 |  2.92  131.04 |  4.50    6.72 |  6.08    3.36
                  1.42    5.04 |  3.00  131.04 |  4.58    6.72 |
                  1.50    5.04 |  3.08  131.04 |  4.67    5.04 |
                  1.58    5.04 |  3.17   18.48 |  4.75    5.04 |

 ------------------------------------------------------------------------------

 --------------------
 | CALIB            |
 | NASHYD   (  0100)|   Area    (ha)=   3.31   Curve Number   (CN)= 65.0
 |ID= 1 DT= 5.0 min |   Ia      (mm)=   5.00   # of Linear Res.(N)= 3.00
 --------------------   U.H. Tp(hrs)=   0.12

      Unit Hyd Qpeak  (cms)=   1.081

      PEAK FLOW       (cms)=   0.440 (i)
      TIME TO PEAK    (hrs)=   3.083
      RUNOFF VOLUME    (mm)=  28.500
      TOTAL RAINFALL   (mm)=  84.000
      RUNOFF COEFFICIENT   =   0.339

      (i) PEAK FLOW DOES NOT INCLUDE BASEFLOW IF ANY.

 ------------------------------------------------------------------------------
 --------------------
 | RESERVOIR( 0016)|
 | IN= 2---> OUT= 1 |
 | DT=  5.0 min     |     OUTFLOW    STORAGE   |  OUTFLOW    STORAGE
 --------------------      (cms)     (ha.m.)   |   (cms)     (ha.m.)
                          0.0000      0.0000   |  8.4600      0.2001
                          0.0010      0.2000   |  0.0000      0.0000

                                    AREA     QPEAK     TPEAK       R.V.
                                    (ha)     (cms)     (hrs)       (mm)
    INFLOW : ID= 2 (  0100)        3.310      0.440      3.08      28.50
    OUTFLOW: ID= 1 (  0016)        3.310      0.000      6.50       7.25

                   PEAK   FLOW   REDUCTION [Qout/Qin](%)=  0.11
                   TIME SHIFT OF PEAK FLOW         (min)=205.00
                   MAXIMUM  STORAGE   USED       (ha.m.)=  0.0938

 ------------------------------------------------------------------------------
 --------------------
 | CALIB            |
 | NASHYD   (  0101)|   Area    (ha)=   3.09   Curve Number   (CN)= 65.0
 |ID= 1 DT= 5.0 min |   Ia      (mm)=   5.00   # of Linear Res.(N)= 3.00
 --------------------   U.H. Tp(hrs)=   0.23

      Unit Hyd Qpeak  (cms)=   0.504

      PEAK FLOW       (cms)=   0.273 (i)
      TIME TO PEAK    (hrs)=   3.167
      RUNOFF VOLUME    (mm)=  28.894
      TOTAL RAINFALL   (mm)=  84.000
      RUNOFF COEFFICIENT   =   0.344

      (i) PEAK FLOW DOES NOT INCLUDE BASEFLOW IF ANY.

 ------------------------------------------------------------------------------
 --------------------
 | RESERVOIR( 0017)|
 | IN= 2---> OUT= 1 |
 | DT=  5.0 min     |     OUTFLOW    STORAGE   |  OUTFLOW    STORAGE
 --------------------      (cms)     (ha.m.)   |   (cms)     (ha.m.)
                          0.0000      0.0000   |  0.0900      0.0757

                                    AREA     QPEAK     TPEAK       R.V.
                                    (ha)     (cms)     (hrs)       (mm)
    INFLOW : ID= 2 (  0101)        3.090      0.273      3.17      28.89
    OUTFLOW: ID= 1 (  0017)        3.090      0.059      3.92      28.83

                   PEAK   FLOW   REDUCTION [Qout/Qin](%)= 21.59
                   TIME SHIFT OF PEAK FLOW         (min)= 45.00
                   MAXIMUM  STORAGE   USED       (ha.m.)=  0.0496

 ------------------------------------------------------------------------------
 --------------------
 | CALIB            |
 | NASHYD   (  0102)|   Area    (ha)=   7.19   Curve Number   (CN)= 53.0
 |ID= 1 DT= 5.0 min |   Ia      (mm)=   5.00   # of Linear Res.(N)= 3.00
 --------------------   U.H. Tp(hrs)=   0.33

      Unit Hyd Qpeak  (cms)=   0.842

      PEAK FLOW       (cms)=   0.347 (i)
      TIME TO PEAK    (hrs)=   3.333
      RUNOFF VOLUME    (mm)=  20.507
      TOTAL RAINFALL   (mm)=  84.000
      RUNOFF COEFFICIENT   =   0.244

      (i) PEAK FLOW DOES NOT INCLUDE BASEFLOW IF ANY.

 ------------------------------------------------------------------------------
 --------------------
 | RESERVOIR( 0018)|
 | IN= 2---> OUT= 1 |
 | DT=  5.0 min     |     OUTFLOW    STORAGE   |  OUTFLOW    STORAGE
 --------------------      (cms)     (ha.m.)   |   (cms)     (ha.m.)
                          0.0000      0.0000   |  5.6800      0.5001
                          0.0010      0.1598   |  0.0000      0.0000
```

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```
                               AREA     QPEAK     TPEAK       R.V.
                               (ha)     (cms)     (hrs)       (mm)
   INFLOW : ID= 2 (  0102)     7.190      0.347      3.33       20.51
   OUTFLOW: ID= 1 (  0018)     7.190      0.001      7.17        6.29

                PEAK   FLOW   REDUCTION [Qout/Qin](%)=  0.26
                TIME SHIFT OF PEAK FLOW         (min)=230.00
                MAXIMUM  STORAGE   USED        (ha.m.)=  0.1463

-------------------------------------------------------------------------------
--------------------
| CALIB              |
| NASHYD    (  0103)|   Area    (ha)=  13.55   Curve Number   (CN)= 61.0
|ID= 1 DT= 5.0 min |    Ia      (mm)=   5.00   # of Linear Res.(N)= 3.00
--------------------    U.H. Tp(hrs)=   0.28

     Unit Hyd Qpeak  (cms)=   1.829

     PEAK FLOW       (cms)=   0.933 (i)
     TIME TO PEAK    (hrs)=   3.250
     RUNOFF VOLUME    (mm)=  25.841
     TOTAL RAINFALL   (mm)=  84.000
     RUNOFF COEFFICIENT   =   0.308

     (i) PEAK FLOW DOES NOT INCLUDE BASEFLOW IF ANY.

-------------------------------------------------------------------------------
--------------------
| RESERVOIR(  0019)|
| IN= 2---> OUT= 1 |
| DT=  5.0 min     |     OUTFLOW    STORAGE   |  OUTFLOW    STORAGE
--------------------      (cms)     (ha.m.)   |   (cms)     (ha.m.)
                          0.0000     0.0000   |   0.1500      0.3892

                               AREA     QPEAK     TPEAK       R.V.
                               (ha)     (cms)     (hrs)       (mm)
   INFLOW : ID= 2 (  0103)    13.550      0.933      3.25       25.84
   OUTFLOW: ID= 1 (  0019)    13.550      0.098      5.25       25.79

                PEAK   FLOW   REDUCTION [Qout/Qin](%)= 10.46
                TIME SHIFT OF PEAK FLOW         (min)=120.00
                MAXIMUM  STORAGE   USED        (ha.m.)=  0.2533

-------------------------------------------------------------------------------
====================================================================================================
=====

       V    V   I    SSSSS  U    U    A    L
       V    V   I    SS     U    U   A A   L
        V  V    I     SS    U    U  AAAAA  L
        V  V    I      SS   U    U  A   A  L
         VV     I    SSSSS  UUUUU  A    A  LLLLL

        OOO   TTTTT  TTTTT  H    H  Y    Y  M    M   OOO     TM
       O   O    T      T    H    H   Y  Y   MM MM   O   O
       O   O    T      T    H    H    Y     M    M  O   O
        OOO     T      T    H    H    Y     M    M   OOO
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                   *****  D E T A I L E D   O U T P U T *****


  Input   filename: C:\Program Files (x86)\Visual OTTHYMO 5.0\VO2\voin.dat
  Output  filename: C:\Users\JJohnston\AppData\Local\Civica\VH5\9f0d15d2-7934-48cd-bc46-
458c27b77161\f84ab312-6454-4d1a-983a-c299406cba77\sc
  Summary filename: C:\Users\JJohnston\AppData\Local\Civica\VH5\9f0d15d2-7934-48cd-bc46-
458c27b77161\f84ab312-6454-4d1a-983a-c299406cba77\sc


DATE: 02/13/2018                            TIME: 11:58:24

USER:



COMMENTS:


----------------------------------------------------------------------------------------------------
-----
  **********************************************
  ** SIMULATION : Run 08- 100yr 24hr SCS       **
  **********************************************
```

```
--------------------
|    READ STORM     |     Filename: C:\Users\JJohnston\AppD
|                   |               ata\Local\Temp\
|                   |               e507d14d-1e21-497d-8202-bee55db2947a\526453a5
| Ptotal=127.50 mm |     Comments: 100yr 24hr 5min SCS
--------------------
```

TIME hrs	RAIN mm/hr	TIME hrs	RAIN mm/hr	TIME hrs	RAIN mm/hr	TIME hrs	RAIN mm/hr
0.08	0.00	6.17	2.30	12.25	18.36	18.33	2.30
0.17	1.40	6.25	2.30	12.33	18.36	18.42	2.30
0.25	1.40	6.33	2.30	12.42	18.36	18.50	2.30
0.33	1.40	6.42	2.30	12.50	18.36	18.58	2.30
0.42	1.40	6.50	2.30	12.58	18.36	18.67	2.30
0.50	1.40	6.58	2.30	12.67	9.44	18.75	2.30
0.58	1.40	6.67	2.30	12.75	9.44	18.83	2.30
0.67	1.40	6.75	2.30	12.83	9.44	18.92	2.30
0.75	1.40	6.83	2.30	12.92	9.44	19.00	2.30
0.83	1.40	6.92	2.30	13.00	9.44	19.08	2.30
0.92	1.40	7.00	2.30	13.08	9.44	19.17	2.30
1.00	1.40	7.08	2.30	13.17	6.89	19.25	2.30
1.08	1.40	7.17	2.81	13.25	6.89	19.33	2.30
1.17	1.40	7.25	2.81	13.33	6.89	19.42	2.30
1.25	1.40	7.33	2.81	13.42	6.89	19.50	2.30
1.33	1.40	7.42	2.81	13.50	6.89	19.58	2.30
1.42	1.40	7.50	2.81	13.58	6.89	19.67	2.30
1.50	1.40	7.58	2.81	13.67	5.36	19.75	2.30
1.58	1.40	7.67	2.81	13.75	5.36	19.83	2.30
1.67	1.40	7.75	2.81	13.83	5.36	19.92	2.30
1.75	1.40	7.83	2.81	13.92	5.36	20.00	2.30
1.83	1.40	7.92	2.81	14.00	5.36	20.08	2.30
1.92	1.40	8.00	2.81	14.08	5.36	20.17	1.53
2.00	1.40	8.08	2.81	14.17	3.83	20.25	1.53
2.08	1.40	8.17	3.32	14.25	3.83	20.33	1.53
2.17	1.66	8.25	3.32	14.33	3.83	20.42	1.53
2.25	1.66	8.33	3.32	14.42	3.83	20.50	1.53
2.33	1.66	8.42	3.32	14.50	3.83	20.58	1.53
2.42	1.66	8.50	3.32	14.58	3.83	20.67	1.53
2.50	1.66	8.58	3.32	14.67	3.83	20.75	1.53
2.58	1.66	8.67	3.57	14.75	3.83	20.83	1.53
2.67	1.66	8.75	3.57	14.83	3.83	20.92	1.53
2.75	1.66	8.83	3.57	14.92	3.83	21.00	1.53
2.83	1.66	8.92	3.57	15.00	3.83	21.08	1.53
2.92	1.66	9.00	3.57	15.08	3.83	21.17	1.53
3.00	1.66	9.08	3.57	15.17	3.83	21.25	1.53
3.08	1.66	9.17	4.08	15.25	3.83	21.33	1.53
3.17	1.66	9.25	4.08	15.33	3.83	21.42	1.53
3.25	1.66	9.33	4.08	15.42	3.83	21.50	1.53
3.33	1.66	9.42	4.08	15.50	3.83	21.58	1.53
3.42	1.66	9.50	4.08	15.58	3.83	21.67	1.53
3.50	1.66	9.58	4.08	15.67	3.83	21.75	1.53
3.58	1.66	9.67	4.59	15.75	3.83	21.83	1.53
3.67	1.66	9.75	4.59	15.83	3.83	21.92	1.53
3.75	1.66	9.83	4.59	15.92	3.83	22.00	1.53
3.83	1.66	9.92	4.59	16.00	3.83	22.08	1.53
3.92	1.66	10.00	4.59	16.08	3.83	22.17	1.53
4.00	1.66	10.08	4.59	16.17	2.30	22.25	1.53
4.08	1.66	10.17	5.86	16.25	2.30	22.33	1.53
4.17	2.04	10.25	5.86	16.33	2.30	22.42	1.53
4.25	2.04	10.33	5.86	16.42	2.30	22.50	1.53
4.33	2.04	10.42	5.86	16.50	2.30	22.58	1.53
4.42	2.04	10.50	5.86	16.58	2.30	22.67	1.53
4.50	2.04	10.58	5.86	16.67	2.30	22.75	1.53
4.58	2.04	10.67	7.91	16.75	2.30	22.83	1.53
4.67	2.04	10.75	7.91	16.83	2.30	22.92	1.53
4.75	2.04	10.83	7.91	16.92	2.30	23.00	1.53
4.83	2.04	10.92	7.91	17.00	2.30	23.08	1.53
4.92	2.04	11.00	7.91	17.08	2.30	23.17	1.53
5.00	2.04	11.08	7.91	17.17	2.30	23.25	1.53
5.08	2.04	11.17	12.24	17.25	2.30	23.33	1.53
5.17	2.04	11.25	12.24	17.33	2.30	23.42	1.53
5.25	2.04	11.33	12.24	17.42	2.30	23.50	1.53
5.33	2.04	11.42	12.24	17.50	2.30	23.58	1.53
5.42	2.04	11.50	12.24	17.58	2.30	23.67	1.53
5.50	2.04	11.58	12.24	17.67	2.30	23.75	1.53
5.58	2.04	11.67	37.74	17.75	2.30	23.83	1.53
5.67	2.04	11.75	37.74	17.83	2.30	23.92	1.53
5.75	2.04	11.83	37.74	17.92	2.30	24.00	1.53
5.83	2.04	11.92	156.06	18.00	2.30	24.08	1.53
5.92	2.04	12.00	156.06	18.08	2.30		
6.00	2.04	12.08	156.06	18.17	2.30		
6.08	2.04	12.17	18.36	18.25	2.30		

```
--------------------
| CALIB            |
| NASHYD   ( 0100)|   Area    (ha)=   3.31   Curve Number   (CN)= 65.0
|ID= 1 DT= 5.0 min |   Ia      (mm)=   5.00   # of Linear Res.(N)= 3.00
--------------------   U.H. Tp(hrs)=   0.12

     Unit Hyd Qpeak  (cms)=   1.081

     PEAK FLOW       (cms)=   0.666 (i)
     TIME TO PEAK    (hrs)=  12.083
     RUNOFF VOLUME    (mm)=  57.030
     TOTAL RAINFALL   (mm)= 127.500
     RUNOFF COEFFICIENT   =   0.447

     (i) PEAK FLOW DOES NOT INCLUDE BASEFLOW IF ANY.

------------------------------------------------------------------------------
--------------------
| RESERVOIR( 0016)|
| IN= 2---> OUT= 1 |
| DT=  5.0 min     |     OUTFLOW    STORAGE   |  OUTFLOW    STORAGE
--------------------      (cms)     (ha.m.)   |   (cms)     (ha.m.)
                          0.0000     0.0000   |   8.4600      0.2001
                          0.0010     0.2000   |   0.0000      0.0000

                                 AREA     QPEAK     TPEAK       R.V.
                                 (ha)     (cms)     (hrs)       (mm)
   INFLOW : ID= 2 (  0100)      3.310      0.666     12.08      57.03
   OUTFLOW: ID= 1 (  0016)      3.310      0.001     24.33      13.71

                   PEAK   FLOW   REDUCTION [Qout/Qin](%)=  0.14
                   TIME SHIFT OF PEAK FLOW         (min)=735.00
                   MAXIMUM  STORAGE   USED       (ha.m.)=  0.1852

------------------------------------------------------------------------------
--------------------
| CALIB            |
| NASHYD   ( 0101)|   Area    (ha)=   3.09   Curve Number   (CN)= 65.0
|ID= 1 DT= 5.0 min |   Ia      (mm)=   5.00   # of Linear Res.(N)= 3.00
--------------------   U.H. Tp(hrs)=   0.23

     Unit Hyd Qpeak  (cms)=   0.504

     PEAK FLOW       (cms)=   0.412 (i)
     TIME TO PEAK    (hrs)=  12.167
     RUNOFF VOLUME    (mm)=  57.820
     TOTAL RAINFALL   (mm)= 127.500
     RUNOFF COEFFICIENT   =   0.453

     (i) PEAK FLOW DOES NOT INCLUDE BASEFLOW IF ANY.

------------------------------------------------------------------------------
--------------------
| RESERVOIR( 0017)|
| IN= 2---> OUT= 1 |
| DT=  5.0 min     |     OUTFLOW    STORAGE   |  OUTFLOW    STORAGE
--------------------      (cms)     (ha.m.)   |   (cms)     (ha.m.)
                          0.0000     0.0000   |   0.0900      0.0757

                                 AREA     QPEAK     TPEAK       R.V.
                                 (ha)     (cms)     (hrs)       (mm)
   INFLOW : ID= 2 (  0101)      3.090      0.412     12.17      57.82
   OUTFLOW: ID= 1 (  0017)      3.090      0.090     12.83      57.75

                   PEAK   FLOW   REDUCTION [Qout/Qin](%)= 21.82
                   TIME SHIFT OF PEAK FLOW         (min)= 40.00
                   MAXIMUM  STORAGE   USED       (ha.m.)=  0.0757

------------------------------------------------------------------------------
--------------------
| CALIB            |
| NASHYD   ( 0102)|   Area    (ha)=   7.19   Curve Number   (CN)= 53.0
|ID= 1 DT= 5.0 min |   Ia      (mm)=   5.00   # of Linear Res.(N)= 3.00
--------------------   U.H. Tp(hrs)=   0.33

     Unit Hyd Qpeak  (cms)=   0.842

     PEAK FLOW       (cms)=   0.549 (i)
     TIME TO PEAK    (hrs)=  12.250
     RUNOFF VOLUME    (mm)=  43.141
     TOTAL RAINFALL   (mm)= 127.500
     RUNOFF COEFFICIENT   =   0.338

     (i) PEAK FLOW DOES NOT INCLUDE BASEFLOW IF ANY.

------------------------------------------------------------------------------
```

```
--------------------
| RESERVOIR( 0018)|
| IN= 2---> OUT= 1 |
| DT=  5.0 min     |     OUTFLOW    STORAGE   |  OUTFLOW    STORAGE
--------------------      (cms)     (ha.m.)   |   (cms)     (ha.m.)
                          0.0000     0.0000   |   5.6800      0.5001
                          0.0010     0.1598   |   0.0000      0.0000

                                 AREA     QPEAK     TPEAK       R.V.
                                 (ha)     (cms)     (hrs)       (mm)
   INFLOW : ID= 2 (  0102)      7.190      0.549     12.25      43.14
   OUTFLOW: ID= 1 (  0018)      7.190      0.143     13.17      26.97

                   PEAK   FLOW   REDUCTION [Qout/Qin](%)= 25.96
                   TIME SHIFT OF PEAK FLOW         (min)= 55.00
                   MAXIMUM  STORAGE   USED       (ha.m.)=  0.1684

------------------------------------------------------------------------------
--------------------
| CALIB            |
| NASHYD   ( 0103)|   Area    (ha)=  13.55   Curve Number   (CN)= 61.0
|ID= 1 DT= 5.0 min |   Ia      (mm)=   5.00   # of Linear Res.(N)= 3.00
--------------------   U.H. Tp(hrs)=   0.28

     Unit Hyd Qpeak  (cms)=   1.829

     PEAK FLOW       (cms)=   1.424 (i)
     TIME TO PEAK    (hrs)=  12.250
     RUNOFF VOLUME    (mm)=  52.648
     TOTAL RAINFALL   (mm)= 127.500
     RUNOFF COEFFICIENT   =   0.413

     (i) PEAK FLOW DOES NOT INCLUDE BASEFLOW IF ANY.

------------------------------------------------------------------------------
--------------------
| RESERVOIR( 0019)|
| IN= 2---> OUT= 1 |
| DT=  5.0 min     |     OUTFLOW    STORAGE   |  OUTFLOW    STORAGE
--------------------      (cms)     (ha.m.)   |   (cms)     (ha.m.)
                          0.0000     0.0000   |   0.1500      0.3892
     **** WARNING : STORAGE-DISCHARGE TABLE WAS EXCEEDED.

                                 AREA     QPEAK     TPEAK       R.V.
                                 (ha)     (cms)     (hrs)       (mm)
   INFLOW : ID= 2 (  0103)     13.550      1.424     12.25      52.65
   OUTFLOW: ID= 1 (  0019)     13.550      0.150     13.83      52.60

                   PEAK   FLOW   REDUCTION [Qout/Qin](%)= 10.53
                   TIME SHIFT OF PEAK FLOW         (min)= 95.00
                   MAXIMUM  STORAGE   USED       (ha.m.)=  0.3892

------------------------------------------------------------------------------

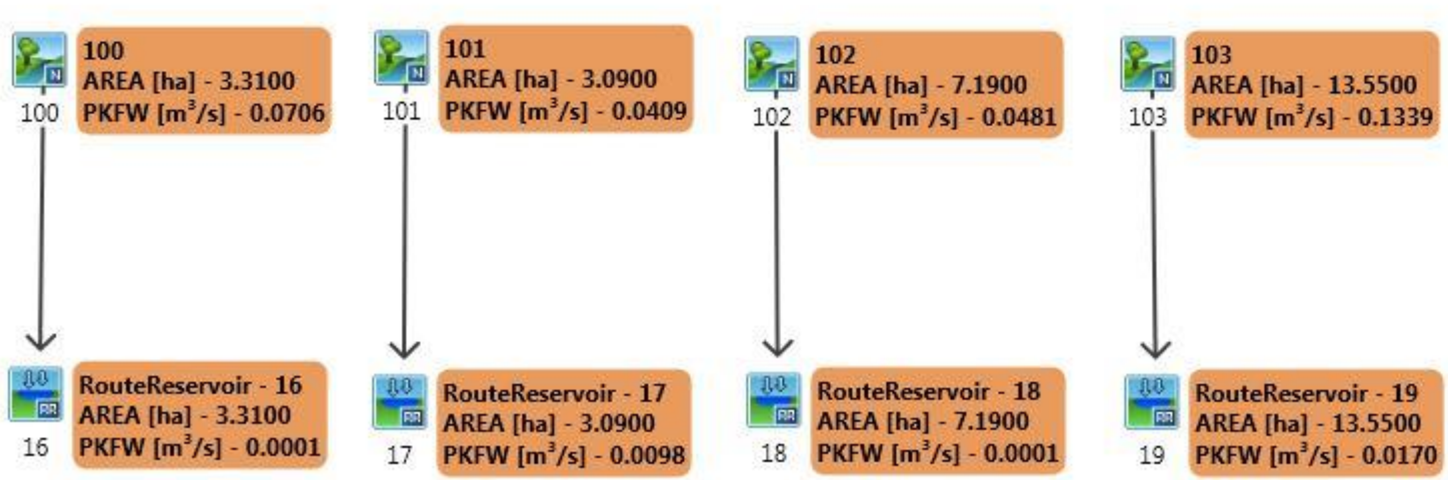
 FINISH
====================================================================================================
=====
```

Experience Enhancing Excellence

2017-0701 Belfountain

2, 5, 10, 25, 50 & 100-Year 12 Hour SCS Storm, 100- Year 6 Hour SCS Storm, & 100- Year 24 Hour SCS Storm
1 Dry Well per Lot with 10mm Initial Abstractions
Proposed External Conditions Model Output
February, 2018

VO5 Model Schematic



```
====================================================================================================
=====

      V    V   I    SSSSS  U   U    A    L
      V    V   I    SS     U   U   A A   L
       V  V    I     SS    U   U  AAAAA  L
       V  V    I      SS   U   U  A   A  L
        VV     I    SSSSS  UUUUU  A   A  LLLLL

       OOO   TTTTT  TTTTT  H   H  Y   Y  M   M   OOO    TM
      O   O    T      T    H   H   Y Y   MM MM  O   O
      O   O    T      T    H   H    Y    M   M  O   O
       OOO     T      T    H   H    Y    M   M   OOO
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                   ***** D E T A I L E D   O U T P U T *****


  Input   filename: C:\Program Files (x86)\Visual OTTHYMO 5.0\VO2\voin.dat
  Output  filename: C:\Users\JJohnston\AppData\Local\Civica\VH5\9f0d15d2-7934-48cd-bc46-
458c27b77161\3df95fb4-1f52-4895-8156-fe2f4c20e817\sc
  Summary filename: C:\Users\JJohnston\AppData\Local\Civica\VH5\9f0d15d2-7934-48cd-bc46-
458c27b77161\3df95fb4-1f52-4895-8156-fe2f4c20e817\sc


DATE: 02/13/2018                          TIME: 12:07:43

USER:


COMMENTS:


----------------------------------------------------------------------------------------------------
-----
  ************************************************
  ** SIMULATION : Run 01- 2yr 12hr SCS          **
  ************************************************


--------------------
|    READ STORM    |    Filename: C:\Users\JJohnston\AppD
|                  |              ata\Local\Temp\
|                  |              6babebd8-ac24-4f24-b7c1-0fcf37e6a2eb\2439c7bb
| Ptotal= 47.30 mm |    Comments: 2yr 12hr 5min SCS
--------------------
                 TIME    RAIN |  TIME    RAIN |'  TIME    RAIN |  TIME    RAIN
                  hrs   mm/hr |   hrs   mm/hr |'   hrs   mm/hr |   hrs   mm/hr
                 0.08    0.00 |  3.17    1.89 |  6.25    8.51 |  9.33    1.66
                 0.17    1.18 |  3.25    1.89 |  6.33    8.51 |  9.42    1.66
                 0.25    1.18 |  3.33    1.89 |  6.42    8.51 |  9.50    1.66
                 0.33    1.18 |  3.42    1.89 |  6.50    8.51 |  9.58    1.66
                 0.42    1.18 |  3.50    1.89 |  6.58    8.51 |  9.67    1.66
                 0.50    1.18 |  3.58    1.89 |  6.67    3.78 |  9.75    1.66
                 0.58    1.18 |  3.67    1.89 |  6.75    3.78 |  9.83    1.66
                 0.67    1.18 |  3.75    1.89 |  6.83    3.78 |  9.92    1.66
                 0.75    1.18 |  3.83    1.89 |  6.92    3.78 | 10.00    1.66
                 0.83    1.18 |  3.92    1.89 |  7.00    3.78 | 10.08    1.66
                 0.92    1.18 |  4.00    1.89 |  7.08    3.78 | 10.17    0.95
                 1.00    1.18 |  4.08    1.89 |  7.17    2.84 | 10.25    0.95
                 1.08    1.18 |  4.17    2.84 |  7.25    2.84 | 10.33    0.95
                 1.17    1.18 |  4.25    2.84 |  7.33    2.84 | 10.42    0.95
                 1.25    1.18 |  4.33    2.84 |  7.42    2.84 | 10.50    0.95
                 1.33    1.18 |  4.42    2.84 |  7.50    2.84 | 10.58    0.95
                 1.42    1.18 |  4.50    2.84 |  7.58    2.84 | 10.67    0.95
                 1.50    1.18 |  4.58    2.84 |  7.67    2.84 | 10.75    0.95
                 1.58    1.18 |  4.67    3.78 |  7.75    2.84 | 10.83    0.95
                 1.67    1.18 |  4.75    3.78 |  7.83    2.84 | 10.92    0.95
                 1.75    1.18 |  4.83    3.78 |  7.92    2.84 | 11.00    0.95
                 1.83    1.18 |  4.92    3.78 |  8.00    2.84 | 11.08    0.95
                 1.92    1.18 |  5.00    3.78 |  8.08    2.84 | 11.17    0.95
                 2.00    1.18 |  5.08    3.78 |  8.17    1.66 | 11.25    0.95
                 2.08    1.18 |  5.17    5.68 |  8.25    1.66 | 11.33    0.95
                 2.17    1.42 |  5.25    5.68 |  8.33    1.66 | 11.42    0.95
                 2.25    1.42 |  5.33    5.68 |  8.42    1.66 | 11.50    0.95
                 2.33    1.42 |  5.42    5.68 |  8.50    1.66 | 11.58    0.95
                 2.42    1.42 |  5.50    5.68 |  8.58    1.66 | 11.67    0.95
                 2.50    1.42 |  5.58    5.68 |  8.67    1.66 | 11.75    0.95
                 2.58    1.42 |  5.67   22.70 |  8.75    1.66 | 11.83    0.95
                 2.67    1.42 |  5.75   22.70 |  8.83    1.66 | 11.92    0.95
                 2.75    1.42 |  5.83   22.70 |  8.92    1.66 | 12.00    0.95
                 2.83    1.42 |  5.92   62.44 |  9.00    1.66 | 12.08    0.95
                 2.92    1.42 |  6.00   62.44 |  9.08    1.66 |
                 3.00    1.42 |  6.08   62.44 |  9.17    1.66 |
                 3.08    1.42 |  6.17    8.51 |  9.25    1.66 |

-----------------------------------------------------------------------------------

--------------------
| CALIB            |
| NASHYD  ( 0100)|   Area    (ha)=   3.31   Curve Number   (CN)= 65.0
|ID= 1 DT= 5.0 min |   Ia      (mm)=  10.00   # of Linear Res.(N)= 3.00
--------------------   U.H. Tp(hrs)=   0.12

     Unit Hyd Qpeak  (cms)=   1.081

     PEAK FLOW       (cms)=   0.101 (i)
     TIME TO PEAK    (hrs)=   6.083
     RUNOFF VOLUME    (mm)=   7.875
     TOTAL RAINFALL   (mm)=  47.300
     RUNOFF COEFFICIENT   =   0.167

     (i) PEAK FLOW DOES NOT INCLUDE BASEFLOW IF ANY.

-----------------------------------------------------------------------------------
--------------------
| RESERVOIR( 0016)|
| IN= 2---> OUT= 1 |
| DT=  5.0 min     |      OUTFLOW    STORAGE   |  OUTFLOW    STORAGE
--------------------       (cms)     (ha.m.)   |   (cms)     (ha.m.)
                           0.0000     0.0000   |  8.4600      0.2001
                           0.0010     0.2000   |  0.0000      0.0000

                                AREA     QPEAK     TPEAK       R.V.
                                (ha)     (cms)     (hrs)       (mm)
   INFLOW : ID= 2 ( 0100)      3.310     0.101      6.08       7.88
   OUTFLOW: ID= 1 ( 0016)      3.310     0.000     12.42       0.08

                  PEAK   FLOW   REDUCTION [Qout/Qin](%)=  0.13
                  TIME SHIFT OF PEAK FLOW         (min)=380.00
                  MAXIMUM  STORAGE   USED       (ha.m.)=  0.0258

-----------------------------------------------------------------------------------
--------------------
| CALIB            |
| NASHYD  ( 0101)|   Area    (ha)=   3.09   Curve Number   (CN)= 65.0
|ID= 1 DT= 5.0 min |   Ia      (mm)=  10.00   # of Linear Res.(N)= 3.00
--------------------   U.H. Tp(hrs)=   0.23

     Unit Hyd Qpeak  (cms)=   0.504

     PEAK FLOW       (cms)=   0.060 (i)
     TIME TO PEAK    (hrs)=   6.167
     RUNOFF VOLUME    (mm)=   7.984
     TOTAL RAINFALL   (mm)=  47.300
     RUNOFF COEFFICIENT   =   0.169

     (i) PEAK FLOW DOES NOT INCLUDE BASEFLOW IF ANY.

-----------------------------------------------------------------------------------
--------------------
| RESERVOIR( 0017)|
| IN= 2---> OUT= 1 |
| DT=  5.0 min     |      OUTFLOW    STORAGE   |  OUTFLOW    STORAGE
--------------------       (cms)     (ha.m.)   |   (cms)     (ha.m.)
                           0.0000     0.0000   |  0.0900      0.0688

                                AREA     QPEAK     TPEAK       R.V.
                                (ha)     (cms)     (hrs)       (mm)
   INFLOW : ID= 2 ( 0101)      3.090     0.060      6.17       7.98
   OUTFLOW: ID= 1 ( 0017)      3.090     0.014      7.00       7.92

                  PEAK   FLOW   REDUCTION [Qout/Qin](%)= 23.20
                  TIME SHIFT OF PEAK FLOW         (min)= 50.00
                  MAXIMUM  STORAGE   USED       (ha.m.)=  0.0106

-----------------------------------------------------------------------------------
--------------------
| CALIB            |
| NASHYD  ( 0102)|   Area    (ha)=   7.19   Curve Number   (CN)= 53.0
|ID= 1 DT= 5.0 min |   Ia      (mm)=  10.00   # of Linear Res.(N)= 3.00
--------------------   U.H. Tp(hrs)=   0.33

     Unit Hyd Qpeak  (cms)=   0.842

     PEAK FLOW       (cms)=   0.072 (i)
     TIME TO PEAK    (hrs)=   6.333
     RUNOFF VOLUME    (mm)=   5.298
```

```
     TOTAL RAINFALL   (mm)=  47.300
     RUNOFF COEFFICIENT   =   0.112

     (i) PEAK FLOW DOES NOT INCLUDE BASEFLOW IF ANY.

-------------------------------------------------------------------------------
--------------------
| RESERVOIR(  0018)|
| IN= 2---> OUT= 1 |
| DT=  5.0 min     |     OUTFLOW    STORAGE   |  OUTFLOW    STORAGE
--------------------      (cms)     (ha.m.)   |   (cms)     (ha.m.)
                          0.0000     0.0000   |  5.6800      0.5001
                          0.0010     0.1598   |  0.0000      0.0000

                                AREA     OPEAK     TPEAK       R.V.
                                (ha)     (cms)     (hrs)       (mm)
   INFLOW : ID= 2 (  0102)      7.190      0.072      6.33       5.30
   OUTFLOW: ID= 1 (  0018)      7.190      0.000     13.08       0.07

                  PEAK   FLOW   REDUCTION [Qout/Qin](%)=  0.33
                  TIME SHIFT OF PEAK FLOW        (min)=405.00
                  MAXIMUM  STORAGE   USED       (ha.m.)=  0.0376

-------------------------------------------------------------------------------
--------------------
| CALIB            |
| NASHYD   (  0103)|   Area     (ha)=  13.55   Curve Number   (CN)= 61.0
|ID= 1 DT= 5.0 min |   Ia       (mm)=  10.00   # of Linear Res.(N)= 3.00
--------------------   U.H. Tp(hrs)=   0.28

     Unit Hyd Qpeak  (cms)=   1.829

     PEAK FLOW       (cms)=   0.201 (i)
     TIME TO PEAK    (hrs)=   6.250
     RUNOFF VOLUME    (mm)=   6.964
     TOTAL RAINFALL   (mm)=  47.300
     RUNOFF COEFFICIENT   =   0.147

     (i) PEAK FLOW DOES NOT INCLUDE BASEFLOW IF ANY.

-------------------------------------------------------------------------------
--------------------
| RESERVOIR(  0019)|
| IN= 2---> OUT= 1 |
| DT=  5.0 min     |     OUTFLOW    STORAGE   |  OUTFLOW    STORAGE
--------------------      (cms)     (ha.m.)   |   (cms)     (ha.m.)
                          0.0000     0.0000   |  0.1500      0.3541

                                AREA     OPEAK     TPEAK       R.V.
                                (ha)     (cms)     (hrs)       (mm)
   INFLOW : ID= 2 (  0103)     13.550      0.201      6.25       6.96
   OUTFLOW: ID= 1 (  0019)     13.550      0.023      8.50       6.92

                  PEAK   FLOW   REDUCTION [Qout/Qin](%)= 11.63
                  TIME SHIFT OF PEAK FLOW        (min)=135.00
                  MAXIMUM  STORAGE   USED       (ha.m.)=  0.0551

-------------------------------------------------------------------------------
===============================================================================================
=====

       V    V   I    SSSSS  U   U    A    L
       V    V   I    SS     U   U   A A   L
        V  V    I     SS    U   U  AAAAA  L
        V  V    I      SS   U   U  A   A  L
         VV     I    SSSSS  UUUUU  A   A  LLLLL

        OOO   TTTTT  TTTTT  H   H  Y   Y  M   M   OOO    TM
       O   O    T      T    H   H   Y Y   MM MM  O   O
       O   O    T      T    H   H    Y    M   M  O   O
        OOO     T      T    H   H    Y    M   M   OOO
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                  *****  D E T A I L E D   O U T P U T *****


  Input   filename: C:\Program Files (x86)\Visual OTTHYMO 5.0\VO2\voin.dat
  Output  filename: C:\Users\JJohnston\AppData\Local\Civica\VH5\9f0d15d2-7934-48cd-bc46-
458c27b77161\cff17706-43aa-48cb-9be1-50fb936966e7\sc
  Summary filename: C:\Users\JJohnston\AppData\Local\Civica\VH5\9f0d15d2-7934-48cd-bc46-
458c27b77161\cff17706-43aa-48cb-9be1-50fb936966e7\sc
```

```
DATE: 02/13/2018                         TIME: 12:07:43

USER:


COMMENTS:


-----------------------------------------------------------------------------------------------
-----
  **********************************************
  ** SIMULATION : Run 02- 5yr 12hr SCS        **
  **********************************************


--------------------
|    READ STORM    |    Filename: C:\Users\JJohnston\AppD
|                  |              ata\Local\Temp\
|                  |              6babebd8-ac24-4f24-b7c1-0fcf37e6a2eb\04f3f838
| Ptotal= 62.50 mm |    Comments: 5yr 12hr 5min SCS
--------------------
```

TIME hrs	RAIN mm/hr	TIME hrs	RAIN mm/hr	TIME hrs	RAIN mm/hr	TIME hrs	RAIN mm/hr
0.08	0.00	3.17	2.50	6.25	11.25	9.33	2.19
0.17	1.56	3.25	2.50	6.33	11.25	9.42	2.19
0.25	1.56	3.33	2.50	6.42	11.25	9.50	2.19
0.33	1.56	3.42	2.50	6.50	11.25	9.58	2.19
0.42	1.56	3.50	2.50	6.58	11.25	9.67	2.19
0.50	1.56	3.58	2.50	6.67	5.00	9.75	2.19
0.58	1.56	3.67	2.50	6.75	5.00	9.83	2.19
0.67	1.56	3.75	2.50	6.83	5.00	9.92	2.19
0.75	1.56	3.83	2.50	6.92	5.00	10.00	2.19
0.83	1.56	3.92	2.50	7.00	5.00	10.08	2.19
0.92	1.56	4.00	2.50	7.08	5.00	10.17	1.25
1.00	1.56	4.08	2.50	7.17	3.75	10.25	1.25
1.08	1.56	4.17	3.75	7.25	3.75	10.33	1.25
1.17	1.56	4.25	3.75	7.33	3.75	10.42	1.25
1.25	1.56	4.33	3.75	7.42	3.75	10.50	1.25
1.33	1.56	4.42	3.75	7.50	3.75	10.58	1.25
1.42	1.56	4.50	3.75	7.58	3.75	10.67	1.25
1.50	1.56	4.58	3.75	7.67	3.75	10.75	1.25
1.58	1.56	4.67	5.00	7.75	3.75	10.83	1.25
1.67	1.56	4.75	5.00	7.83	3.75	10.92	1.25
1.75	1.56	4.83	5.00	7.92	3.75	11.00	1.25
1.83	1.56	4.92	5.00	8.00	3.75	11.08	1.25
1.92	1.56	5.00	5.00	8.08	3.75	11.17	1.25
2.00	1.56	5.08	5.00	8.17	2.19	11.25	1.25
2.08	1.56	5.17	7.50	8.25	2.19	11.33	1.25
2.17	1.88	5.25	7.50	8.33	2.19	11.42	1.25
2.25	1.88	5.33	7.50	8.42	2.19	11.50	1.25
2.33	1.88	5.42	7.50	8.50	2.19	11.58	1.25
2.42	1.88	5.50	7.50	8.58	2.19	11.67	1.25
2.50	1.88	5.58	7.50	8.67	2.19	11.75	1.25
2.58	1.88	5.67	30.00	8.75	2.19	11.83	1.25
2.67	1.88	5.75	30.00	8.83	2.19	11.92	1.25
2.75	1.88	5.83	30.00	8.92	2.19	12.00	1.25
2.83	1.88	5.92	82.50	9.00	2.19	12.08	1.25
2.92	1.88	6.00	82.50	9.08	2.19		
3.00	1.88	6.08	82.50	9.17	2.19		
3.08	1.88	6.17	11.25	9.25	2.19		

```
-------------------------------------------------------------------------------

--------------------
| CALIB            |
| NASHYD   (  0100)|   Area     (ha)=   3.31   Curve Number   (CN)= 65.0
|ID= 1 DT= 5.0 min |   Ia       (mm)=  10.00   # of Linear Res.(N)= 3.00
--------------------   U.H. Tp(hrs)=   0.12

     Unit Hyd Qpeak  (cms)=   1.081

     PEAK FLOW       (cms)=   0.188 (i)
     TIME TO PEAK    (hrs)=   6.083
     RUNOFF VOLUME    (mm)=  14.349
     TOTAL RAINFALL   (mm)=  62.500
     RUNOFF COEFFICIENT   =   0.230

     (i) PEAK FLOW DOES NOT INCLUDE BASEFLOW IF ANY.

-------------------------------------------------------------------------------
--------------------
| RESERVOIR(  0016)|
| IN= 2---> OUT= 1 |
| DT=  5.0 min     |     OUTFLOW    STORAGE   |  OUTFLOW    STORAGE
--------------------      (cms)     (ha.m.)   |   (cms)     (ha.m.)
```

```
                          0.0000      0.0000   |   8.4600      0.2001
                          0.0010      0.2000   |   0.0000      0.0000

                               AREA     QPEAK      TPEAK        R.V.
                               (ha)     (cms)      (hrs)        (mm)
   INFLOW : ID= 2 (  0100)     3.310     0.188      6.08        14.35
   OUTFLOW: ID= 1 (  0016)     3.310     0.000     12.42         0.14

                   PEAK   FLOW   REDUCTION [Qout/Qin](%)=  0.12
                   TIME SHIFT OF PEAK FLOW         (min)=380.00
                   MAXIMUM  STORAGE   USED       (ha.m.)=  0.0470

--------------------------------------------------------------------------------
--------------------
| CALIB            |
| NASHYD   (  0101)|   Area    (ha)=   3.09   Curve Number   (CN)= 65.0
|ID= 1 DT= 5.0 min |   Ia      (mm)=  10.00   # of Linear Res.(N)= 3.00
--------------------   U.H. Tp(hrs)=   0.23

     Unit Hyd Qpeak  (cms)=   0.504

     PEAK FLOW       (cms)=   0.114 (i)
     TIME TO PEAK    (hrs)=   6.167
     RUNOFF VOLUME    (mm)=  14.547
     TOTAL RAINFALL   (mm)=  62.500
     RUNOFF COEFFICIENT   =   0.233

     (i) PEAK FLOW DOES NOT INCLUDE BASEFLOW IF ANY.

--------------------------------------------------------------------------------
--------------------
| RESERVOIR(  0017)|
| IN= 2---> OUT= 1 |
| DT=  5.0 min     |     OUTFLOW    STORAGE   |  OUTFLOW    STORAGE
--------------------      (cms)     (ha.m.)   |   (cms)     (ha.m.)
                          0.0000      0.0000   |   0.0900      0.0688

                               AREA     QPEAK      TPEAK        R.V.
                               (ha)     (cms)      (hrs)        (mm)
   INFLOW : ID= 2 (  0101)     3.090     0.114      6.17        14.55
   OUTFLOW: ID= 1 (  0017)     3.090     0.026      6.92        14.49

                   PEAK   FLOW   REDUCTION [Qout/Qin](%)= 23.07
                   TIME SHIFT OF PEAK FLOW         (min)= 45.00
                   MAXIMUM  STORAGE   USED       (ha.m.)=  0.0202

--------------------------------------------------------------------------------
--------------------
| CALIB            |
| NASHYD   (  0102)|   Area    (ha)=   7.19   Curve Number   (CN)= 53.0
|ID= 1 DT= 5.0 min |   Ia      (mm)=  10.00   # of Linear Res.(N)= 3.00
--------------------   U.H. Tp(hrs)=   0.33

     Unit Hyd Qpeak  (cms)=   0.842

     PEAK FLOW       (cms)=   0.140 (i)
     TIME TO PEAK    (hrs)=   6.333
     RUNOFF VOLUME    (mm)=   9.921
     TOTAL RAINFALL   (mm)=  62.500
     RUNOFF COEFFICIENT   =   0.159

     (i) PEAK FLOW DOES NOT INCLUDE BASEFLOW IF ANY.

--------------------------------------------------------------------------------
--------------------
| RESERVOIR(  0018)|
| IN= 2---> OUT= 1 |
| DT=  5.0 min     |     OUTFLOW    STORAGE   |  OUTFLOW    STORAGE
--------------------      (cms)     (ha.m.)   |   (cms)     (ha.m.)
                          0.0000      0.0000   |   5.6800      0.5001
                          0.0010      0.1598   |   0.0000      0.0000

                               AREA     QPEAK      TPEAK        R.V.
                               (ha)     (cms)      (hrs)        (mm)
   INFLOW : ID= 2 (  0102)     7.190     0.140      6.33         9.92
   OUTFLOW: ID= 1 (  0018)     7.190     0.000     13.08         2.99

                   PEAK   FLOW   REDUCTION [Qout/Qin](%)=  0.32
                   TIME SHIFT OF PEAK FLOW         (min)=405.00
                   MAXIMUM  STORAGE   USED       (ha.m.)=  0.0704

--------------------------------------------------------------------------------
--------------------
| CALIB            |
| NASHYD   (  0103)|   Area    (ha)=  13.55   Curve Number   (CN)= 61.0
|ID= 1 DT= 5.0 min |   Ia      (mm)=  10.00   # of Linear Res.(N)= 3.00
--------------------   U.H. Tp(hrs)=   0.28

     Unit Hyd Qpeak  (cms)=   1.829

     PEAK FLOW       (cms)=   0.386 (i)
     TIME TO PEAK    (hrs)=   6.250
     RUNOFF VOLUME    (mm)=  12.820
     TOTAL RAINFALL   (mm)=  62.500
     RUNOFF COEFFICIENT   =   0.205

     (i) PEAK FLOW DOES NOT INCLUDE BASEFLOW IF ANY.

--------------------------------------------------------------------------------
--------------------
| RESERVOIR(  0019)|
| IN= 2---> OUT= 1 |
| DT=  5.0 min     |     OUTFLOW    STORAGE   |  OUTFLOW    STORAGE
--------------------      (cms)     (ha.m.)   |   (cms)     (ha.m.)
                          0.0000      0.0000   |   0.1500      0.3541

                               AREA     QPEAK      TPEAK        R.V.
                               (ha)     (cms)      (hrs)        (mm)
   INFLOW : ID= 2 (  0103)    13.550     0.386      6.25        12.82
   OUTFLOW: ID= 1 (  0019)    13.550     0.044      8.42        12.78

                   PEAK   FLOW   REDUCTION [Qout/Qin](%)= 11.34
                   TIME SHIFT OF PEAK FLOW         (min)=130.00
                   MAXIMUM  STORAGE   USED       (ha.m.)=  0.1032

--------------------------------------------------------------------------------
==================================================================================================
=====

       V    V   I   SSSSS  U   U    A    L
       V    V   I   SS     U   U   A A   L
        V  V    I    SS    U   U  AAAAA  L
        V  V    I     SS   U   U  A   A  L
         VV     I   SSSSS  UUUUU  A   A  LLLLL

        OOO   TTTTT  TTTTT  H   H  Y   Y  M   M  OOO     TM
       O   O    T      T    H   H   Y Y   MM MM  O   O
       O   O    T      T    H   H    Y    M   M  O   O
        OOO     T      T    H   H    Y    M   M   OOO
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                   *****  D E T A I L E D   O U T P U T *****


  Input   filename: C:\Program Files (x86)\Visual OTTHYMO 5.0\VO2\voin.dat
  Output  filename: C:\Users\JJohnston\AppData\Local\Civica\VH5\9f0d15d2-7934-48cd-bc46-
458c27b77161\e2a3d68c-5140-413c-9daa-6ca8dc2d7824\sc
  Summary filename: C:\Users\JJohnston\AppData\Local\Civica\VH5\9f0d15d2-7934-48cd-bc46-
458c27b77161\e2a3d68c-5140-413c-9daa-6ca8dc2d7824\sc


DATE: 02/13/2018                             TIME: 12:07:43

USER:


COMMENTS:

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-----
  **************************************************
  ** SIMULATION : Run 03- 10yr 12hr SCS           **
  **************************************************


--------------------
|    READ STORM    |     Filename: C:\Users\JJohnston\AppD
|                  |               ata\Local\Temp\
|                  |               6babebd8-ac24-4f24-b7c1-0fcf37e6a2eb\2dee6a48
| Ptotal= 72.50 mm |     Comments: 10yr 12hr 5min SCS
--------------------
                 TIME     RAIN |  TIME    RAIN |'  TIME    RAIN |  TIME    RAIN
                  hrs    mm/hr |   hrs    mm/hr |'   hrs    mm/hr |   hrs    mm/hr
                 0.08     0.00 |  3.17     2.90 |   6.25    13.05 |  9.33     2.54
                 0.17     1.81 |  3.25     2.90 |   6.33    13.05 |  9.42     2.54
                 0.25     1.81 |  3.33     2.90 |   6.42    13.05 |  9.50     2.54
                 0.33     1.81 |  3.42     2.90 |   6.50    13.05 |  9.58     2.54
```

```
      0.42    1.81 |  3.50    2.90 |  6.58   13.05 |  9.67    2.54
      0.50    1.81 |  3.58    2.90 |  6.67    5.80 |  9.75    2.54
      0.58    1.81 |  3.67    2.90 |  6.75    5.80 |  9.83    2.54
      0.67    1.81 |  3.75    2.90 |  6.83    5.80 |  9.92    2.54
      0.75    1.81 |  3.83    2.90 |  6.92    5.80 | 10.00    2.54
      0.83    1.81 |  3.92    2.90 |  7.00    5.80 | 10.08    2.54
      0.92    1.81 |  4.00    2.90 |  7.08    5.80 | 10.17    1.45
      1.00    1.81 |  4.08    2.90 |  7.17    4.35 | 10.25    1.45
      1.08    1.81 |  4.17    4.35 |  7.25    4.35 | 10.33    1.45
      1.17    1.81 |  4.25    4.35 |  7.33    4.35 | 10.42    1.45
      1.25    1.81 |  4.33    4.35 |  7.42    4.35 | 10.50    1.45
      1.33    1.81 |  4.42    4.35 |  7.50    4.35 | 10.58    1.45
      1.42    1.81 |  4.50    4.35 |  7.58    4.35 | 10.67    1.45
      1.50    1.81 |  4.58    4.35 |  7.67    4.35 | 10.75    1.45
      1.58    1.81 |  4.67    5.80 |  7.75    4.35 | 10.83    1.45
      1.67    1.81 |  4.75    5.80 |  7.83    4.35 | 10.92    1.45
      1.75    1.81 |  4.83    5.80 |  7.92    4.35 | 11.00    1.45
      1.83    1.81 |  4.92    5.80 |  8.00    4.35 | 11.08    1.45
      1.92    1.81 |  5.00    5.80 |  8.08    4.35 | 11.17    1.45
      2.00    1.81 |  5.08    5.80 |  8.17    2.54 | 11.25    1.45
      2.08    1.81 |  5.17    8.70 |  8.25    2.54 | 11.33    1.45
      2.17    2.17 |  5.25    8.70 |  8.33    2.54 | 11.42    1.45
      2.25    2.17 |  5.33    8.70 |  8.42    2.54 | 11.50    1.45
      2.33    2.17 |  5.42    8.70 |  8.50    2.54 | 11.58    1.45
      2.42    2.17 |  5.50    8.70 |  8.58    2.54 | 11.67    1.45
      2.50    2.17 |  5.58    8.70 |  8.67    2.54 | 11.75    1.45
      2.58    2.17 |  5.67   34.80 |  8.75    2.54 | 11.83    1.45
      2.67    2.17 |  5.75   34.80 |  8.83    2.54 | 11.92    1.45
      2.75    2.17 |  5.83   34.80 |  8.92    2.54 | 12.00    1.45
      2.83    2.17 |  5.92   95.70 |  9.00    2.54 | 12.08    1.45
      2.92    2.17 |  6.00   95.70 |  9.08    2.54 |
      3.00    2.17 |  6.08   95.70 |  9.17    2.54 |
      3.08    2.17 |  6.17   13.05 |  9.25    2.54 |

--------------------------------------------------------------------------------

--------------------
| CALIB            |
| NASHYD   (  0100)|   Area    (ha)=   3.31   Curve Number   (CN)= 65.0
|ID= 1 DT= 5.0 min |   Ia      (mm)=  10.00   # of Linear Res.(N)= 3.00
--------------------   U.H. Tp(hrs)=   0.12

     Unit Hyd Qpeak  (cms)=   1.081

     PEAK FLOW       (cms)=   0.255 (i)
     TIME TO PEAK    (hrs)=   6.083
     RUNOFF VOLUME    (mm)=  19.315
     TOTAL RAINFALL   (mm)=  72.500
     RUNOFF COEFFICIENT   =   0.266

     (i) PEAK FLOW DOES NOT INCLUDE BASEFLOW IF ANY.

--------------------------------------------------------------------------------

--------------------
| RESERVOIR( 0016)|
| IN= 2---> OUT= 1 |
| DT=  5.0 min     |     OUTFLOW    STORAGE   |  OUTFLOW    STORAGE
--------------------      (cms)     (ha.m.)   |   (cms)     (ha.m.)
                          0.0000     0.0000   |   8.4600      0.2001
                          0.0010     0.2000   |   0.0000      0.0000

                                 AREA     QPEAK     TPEAK       R.V.
                                 (ha)     (cms)     (hrs)       (mm)
   INFLOW : ID= 2 (  0100)      3.310      0.255      6.08      19.32
   OUTFLOW: ID= 1 (  0016)      3.310      0.000     12.42       3.92

                   PEAK   FLOW   REDUCTION [Qout/Qin](%)=  0.12
                   TIME SHIFT OF PEAK FLOW         (min)=380.00
                   MAXIMUM  STORAGE   USED       (ha.m.)=  0.0633

--------------------------------------------------------------------------------

--------------------
| CALIB            |
| NASHYD   (  0101)|   Area    (ha)=   3.09   Curve Number   (CN)= 65.0
|ID= 1 DT= 5.0 min |   Ia      (mm)=  10.00   # of Linear Res.(N)= 3.00
--------------------   U.H. Tp(hrs)=   0.23

     Unit Hyd Qpeak  (cms)=   0.504

     PEAK FLOW       (cms)=   0.157 (i)
     TIME TO PEAK    (hrs)=   6.167
     RUNOFF VOLUME    (mm)=  19.583
     TOTAL RAINFALL   (mm)=  72.500
     RUNOFF COEFFICIENT   =   0.270

     (i) PEAK FLOW DOES NOT INCLUDE BASEFLOW IF ANY.

--------------------------------------------------------------------------------

--------------------
| RESERVOIR( 0017)|
| IN= 2---> OUT= 1 |
| DT=  5.0 min     |     OUTFLOW    STORAGE   |  OUTFLOW    STORAGE
--------------------      (cms)     (ha.m.)   |   (cms)     (ha.m.)
                          0.0000     0.0000   |   0.0900      0.0688

                                 AREA     QPEAK     TPEAK       R.V.
                                 (ha)     (cms)     (hrs)       (mm)
   INFLOW : ID= 2 (  0101)      3.090      0.157      6.17      19.58
   OUTFLOW: ID= 1 (  0017)      3.090      0.036      6.92      19.52

                   PEAK   FLOW   REDUCTION [Qout/Qin](%)= 23.11
                   TIME SHIFT OF PEAK FLOW         (min)= 45.00
                   MAXIMUM  STORAGE   USED       (ha.m.)=  0.0277

--------------------------------------------------------------------------------

--------------------
| CALIB            |
| NASHYD   (  0102)|   Area    (ha)=   7.19   Curve Number   (CN)= 53.0
|ID= 1 DT= 5.0 min |   Ia      (mm)=  10.00   # of Linear Res.(N)= 3.00
--------------------   U.H. Tp(hrs)=   0.33

     Unit Hyd Qpeak  (cms)=   0.842

     PEAK FLOW       (cms)=   0.194 (i)
     TIME TO PEAK    (hrs)=   6.333
     RUNOFF VOLUME    (mm)=  13.571
     TOTAL RAINFALL   (mm)=  72.500
     RUNOFF COEFFICIENT   =   0.187

     (i) PEAK FLOW DOES NOT INCLUDE BASEFLOW IF ANY.

--------------------------------------------------------------------------------

--------------------
| RESERVOIR( 0018)|
| IN= 2---> OUT= 1 |
| DT=  5.0 min     |     OUTFLOW    STORAGE   |  OUTFLOW    STORAGE
--------------------      (cms)     (ha.m.)   |   (cms)     (ha.m.)
                          0.0000     0.0000   |   5.6800      0.5001
                          0.0010     0.1598   |   0.0000      0.0000

                                 AREA     QPEAK     TPEAK       R.V.
                                 (ha)     (cms)     (hrs)       (mm)
   INFLOW : ID= 2 (  0102)      7.190      0.194      6.33      13.57
   OUTFLOW: ID= 1 (  0018)      7.190      0.001     13.08       4.09

                   PEAK   FLOW   REDUCTION [Qout/Qin](%)=  0.31
                   TIME SHIFT OF PEAK FLOW         (min)=405.00
                   MAXIMUM  STORAGE   USED       (ha.m.)=  0.0963

--------------------------------------------------------------------------------

--------------------
| CALIB            |
| NASHYD   (  0103)|   Area    (ha)=  13.55   Curve Number   (CN)= 61.0
|ID= 1 DT= 5.0 min |   Ia      (mm)=  10.00   # of Linear Res.(N)= 3.00
--------------------   U.H. Tp(hrs)=   0.28

     Unit Hyd Qpeak  (cms)=   1.829

     PEAK FLOW       (cms)=   0.530 (i)
     TIME TO PEAK    (hrs)=   6.250
     RUNOFF VOLUME    (mm)=  17.361
     TOTAL RAINFALL   (mm)=  72.500
     RUNOFF COEFFICIENT   =   0.239

     (i) PEAK FLOW DOES NOT INCLUDE BASEFLOW IF ANY.

--------------------------------------------------------------------------------

--------------------
| RESERVOIR( 0019)|
| IN= 2---> OUT= 1 |
| DT=  5.0 min     |     OUTFLOW    STORAGE   |  OUTFLOW    STORAGE
--------------------      (cms)     (ha.m.)   |   (cms)     (ha.m.)
                          0.0000     0.0000   |   0.1500      0.3541

                                 AREA     QPEAK     TPEAK       R.V.
                                 (ha)     (cms)     (hrs)       (mm)
   INFLOW : ID= 2 (  0103)     13.550      0.530      6.25      17.36
   OUTFLOW: ID= 1 (  0019)     13.550      0.060      8.33      17.32

                   PEAK   FLOW   REDUCTION [Qout/Qin](%)= 11.26
                   TIME SHIFT OF PEAK FLOW         (min)=125.00
                   MAXIMUM  STORAGE   USED       (ha.m.)=  0.1410
```

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=============================================================================================================
=====

       V    V   I    SSSSS  U   U    A    L
       V    V   I    SS     U   U   A A   L
        V  V    I     SS    U   U  AAAAA  L
        V  V    I      SS   U   U  A   A  L
         VV     I    SSSSS  UUUUU  A   A  LLLLL

        OOO   TTTTT  TTTTT  H   H  Y   Y  M   M   OOO     TM
       O   O    T      T    H   H   Y Y   MM MM  O   O
       O   O    T      T    H   H    Y    M   M  O   O
        OOO     T      T    H   H    Y    M   M   OOO
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                    *****  D E T A I L E D   O U T P U T *****

  Input   filename: C:\Program Files (x86)\Visual OTTHYMO 5.0\VO2\voin.dat
  Output  filename: C:\Users\JJohnston\AppData\Local\Civica\VH5\9f0d15d2-7934-48cd-bc46-
458c27b77161\99dd7af2-7c81-4593-a0b3-d93458ef98df\sc
  Summary filename: C:\Users\JJohnston\AppData\Local\Civica\VH5\9f0d15d2-7934-48cd-bc46-
458c27b77161\99dd7af2-7c81-4593-a0b3-d93458ef98df\sc


DATE: 02/13/2018                          TIME: 12:07:43

USER:


COMMENTS:


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-----
  **********************************************
  ** SIMULATION : Run 04- 25yr 12hr SCS        **
  **********************************************


--------------------
|    READ STORM    |    Filename: C:\Users\JJohnston\AppD
|                  |              ata\Local\Temp\
|                  |              6babebd8-ac24-4f24-b7c1-0fcf37e6a2eb\868dc2b4
| Ptotal= 84.90 mm |    Comments: 25yr 12hr 5min SCS
--------------------
                 TIME    RAIN |  TIME    RAIN |'  TIME    RAIN |  TIME    RAIN
                  hrs   mm/hr |   hrs   mm/hr |'   hrs   mm/hr |   hrs   mm/hr
                 0.08    0.00 |  3.17    3.40 |  6.25   15.28 |  9.33    2.97
                 0.17    2.12 |  3.25    3.40 |  6.33   15.28 |  9.42    2.97
                 0.25    2.12 |  3.33    3.40 |  6.42   15.28 |  9.50    2.97
                 0.33    2.12 |  3.42    3.40 |  6.50   15.28 |  9.58    2.97
                 0.42    2.12 |  3.50    3.40 |  6.58   15.28 |  9.67    2.97
                 0.50    2.12 |  3.58    3.40 |  6.67    6.79 |  9.75    2.97
                 0.58    2.12 |  3.67    3.40 |  6.75    6.79 |  9.83    2.97
                 0.67    2.12 |  3.75    3.40 |  6.83    6.79 |  9.92    2.97
                 0.75    2.12 |  3.83    3.40 |  6.92    6.79 | 10.00    2.97
                 0.83    2.12 |  3.92    3.40 |  7.00    6.79 | 10.08    2.97
                 0.92    2.12 |  4.00    3.40 |  7.08    6.79 | 10.17    1.70
                 1.00    2.12 |  4.08    3.40 |  7.17    5.09 | 10.25    1.70
                 1.08    2.12 |  4.17    5.09 |  7.25    5.09 | 10.33    1.70
                 1.17    2.12 |  4.25    5.09 |  7.33    5.09 | 10.42    1.70
                 1.25    2.12 |  4.33    5.09 |  7.42    5.09 | 10.50    1.70
                 1.33    2.12 |  4.42    5.09 |  7.50    5.09 | 10.58    1.70
                 1.42    2.12 |  4.50    5.09 |  7.58    5.09 | 10.67    1.70
                 1.50    2.12 |  4.58    5.09 |  7.67    5.09 | 10.75    1.70
                 1.58    2.12 |  4.67    6.79 |  7.75    5.09 | 10.83    1.70
                 1.67    2.12 |  4.75    6.79 |  7.83    5.09 | 10.92    1.70
                 1.75    2.12 |  4.83    6.79 |  7.92    5.09 | 11.00    1.70
                 1.83    2.12 |  4.92    6.79 |  8.00    5.09 | 11.08    1.70
                 1.92    2.12 |  5.00    6.79 |  8.08    5.09 | 11.17    1.70
                 2.00    2.12 |  5.08    6.79 |  8.17    2.97 | 11.25    1.70
                 2.08    2.12 |  5.17   10.19 |  8.25    2.97 | 11.33    1.70
                 2.17    2.55 |  5.25   10.19 |  8.33    2.97 | 11.42    1.70
                 2.25    2.55 |  5.33   10.19 |  8.42    2.97 | 11.50    1.70
                 2.33    2.55 |  5.42   10.19 |  8.50    2.97 | 11.58    1.70
                 2.42    2.55 |  5.50   10.19 |  8.58    2.97 | 11.67    1.70
                 2.50    2.55 |  5.58   10.19 |  8.67    2.97 | 11.75    1.70
                 2.58    2.55 |  5.67   40.75 |  8.75    2.97 | 11.83    1.70
                 2.67    2.55 |  5.75   40.75 |  8.83    2.97 | 11.92    1.70
                 2.75    2.55 |  5.83   40.75 |  8.92    2.97 | 12.00    1.70
                 2.83    2.55 |  5.92  112.07 |  9.00    2.97 | 12.08    1.70
                 2.92    2.55 |  6.00  112.07 |  9.08    2.97 |
                 3.00    2.55 |  6.08  112.07 |  9.17    2.97 |
                 3.08    2.55 |  6.17   15.28 |  9.25    2.97 |

---------------------------------------------------------------------------------

--------------------
| CALIB            |
| NASHYD   (  0100)|   Area    (ha)=   3.31   Curve Number   (CN)= 65.0
|ID= 1 DT= 5.0 min |   Ia      (mm)=  10.00   # of Linear Res.(N)= 3.00
--------------------   U.H. Tp(hrs)=    0.12

     Unit Hyd Qpeak  (cms)=   1.081

     PEAK FLOW       (cms)=   0.347 (i)
     TIME TO PEAK    (hrs)=   6.083
     RUNOFF VOLUME    (mm)=  26.115
     TOTAL RAINFALL   (mm)=  84.900
     RUNOFF COEFFICIENT   =   0.308

     (i) PEAK FLOW DOES NOT INCLUDE BASEFLOW IF ANY.

---------------------------------------------------------------------------------
--------------------
| RESERVOIR(  0016)|
| IN= 2---> OUT= 1 |
| DT=  5.0 min     |     OUTFLOW    STORAGE   |  OUTFLOW    STORAGE
--------------------      (cms)     (ha.m.)   |   (cms)     (ha.m.)
                          0.0000     0.0000   |   8.4600     0.2001
                          0.0010     0.2000   |   0.0000     0.0000

                                AREA     QPEAK     TPEAK       R.V.
                                (ha)     (cms)     (hrs)       (mm)
   INFLOW : ID= 2 (  0100)      3.310     0.347      6.08      26.11
   OUTFLOW: ID= 1 (  0016)      3.310     0.000     12.42       6.52

                   PEAK   FLOW   REDUCTION [Qout/Qin](%)=  0.12
                   TIME SHIFT OF PEAK FLOW        (min)=380.00
                   MAXIMUM  STORAGE   USED       (ha.m.)=  0.0856

---------------------------------------------------------------------------------
--------------------
| CALIB            |
| NASHYD   (  0101)|   Area    (ha)=   3.09   Curve Number   (CN)= 65.0
|ID= 1 DT= 5.0 min |   Ia      (mm)=  10.00   # of Linear Res.(N)= 3.00
--------------------   U.H. Tp(hrs)=    0.23

     Unit Hyd Qpeak  (cms)=   0.504

     PEAK FLOW       (cms)=   0.215 (i)
     TIME TO PEAK    (hrs)=   6.167
     RUNOFF VOLUME    (mm)=  26.476
     TOTAL RAINFALL   (mm)=  84.900
     RUNOFF COEFFICIENT   =   0.312

     (i) PEAK FLOW DOES NOT INCLUDE BASEFLOW IF ANY.

---------------------------------------------------------------------------------
--------------------
| RESERVOIR(  0017)|
| IN= 2---> OUT= 1 |
| DT=  5.0 min     |     OUTFLOW    STORAGE   |  OUTFLOW    STORAGE
--------------------      (cms)     (ha.m.)   |   (cms)     (ha.m.)
                          0.0000     0.0000   |   0.0900     0.0688

                                AREA     QPEAK     TPEAK       R.V.
                                (ha)     (cms)     (hrs)       (mm)
   INFLOW : ID= 2 (  0101)      3.090     0.215      6.17      26.48
   OUTFLOW: ID= 1 (  0017)      3.090     0.050      6.92      26.42

                   PEAK   FLOW   REDUCTION [Qout/Qin](%)= 23.17
                   TIME SHIFT OF PEAK FLOW        (min)= 45.00
                   MAXIMUM  STORAGE   USED       (ha.m.)=  0.0380

---------------------------------------------------------------------------------
--------------------
| CALIB            |
| NASHYD   (  0102)|   Area    (ha)=   7.19   Curve Number   (CN)= 53.0
|ID= 1 DT= 5.0 min |   Ia      (mm)=  10.00   # of Linear Res.(N)= 3.00
--------------------   U.H. Tp(hrs)=    0.33

     Unit Hyd Qpeak  (cms)=   0.842

     PEAK FLOW       (cms)=   0.270 (i)
```

```
     TIME TO PEAK     (hrs)=    6.250
     RUNOFF VOLUME     (mm)=   18.686
     TOTAL RAINFALL    (mm)=   84.900
     RUNOFF COEFFICIENT   =     0.220

     (i) PEAK FLOW DOES NOT INCLUDE BASEFLOW IF ANY.

-------------------------------------------------------------------------------
--------------------
| RESERVOIR(  0018)|
| IN= 2---> OUT= 1 |
| DT=  5.0 min     |     OUTFLOW    STORAGE   |  OUTFLOW    STORAGE
--------------------       (cms)     (ha.m.)   |   (cms)     (ha.m.)
                          0.0000     0.0000    |  5.6800      0.5001
                          0.0010     0.1598    |  0.0000      0.0000

                                AREA     QPEAK     TPEAK        R.V.
                                (ha)     (cms)     (hrs)        (mm)
  INFLOW : ID= 2 (  0102)      7.190     0.270      6.25       18.69
  OUTFLOW: ID= 1 (  0018)      7.190     0.001     13.08        5.63

                   PEAK   FLOW   REDUCTION [Qout/Qin](%)=  0.31
                   TIME SHIFT OF PEAK FLOW        (min)=410.00
                   MAXIMUM  STORAGE   USED       (ha.m.)=  0.1326

-------------------------------------------------------------------------------
--------------------
| CALIB            |
| NASHYD   (  0103)|   Area     (ha)=  13.55   Curve Number   (CN)= 61.0
|ID= 1 DT= 5.0 min |   Ia       (mm)=  10.00   # of Linear Res.(N)= 3.00
--------------------   U.H. Tp(hrs)=    0.28

     Unit Hyd Qpeak  (cms)=    1.829

     PEAK FLOW       (cms)=    0.731 (i)
     TIME TO PEAK    (hrs)=    6.250
     RUNOFF VOLUME    (mm)=   23.630
     TOTAL RAINFALL   (mm)=   84.900
     RUNOFF COEFFICIENT   =     0.278

     (i) PEAK FLOW DOES NOT INCLUDE BASEFLOW IF ANY.

-------------------------------------------------------------------------------
--------------------
| RESERVOIR(  0019)|
| IN= 2---> OUT= 1 |
| DT=  5.0 min     |     OUTFLOW    STORAGE   |  OUTFLOW    STORAGE
--------------------       (cms)     (ha.m.)   |   (cms)     (ha.m.)
                          0.0000     0.0000    |  0.1500      0.3541

                                AREA     QPEAK     TPEAK        R.V.
                                (ha)     (cms)     (hrs)        (mm)
  INFLOW : ID= 2 (  0103)     13.550     0.731      6.25       23.63
  OUTFLOW: ID= 1 (  0019)     13.550     0.082      8.33       23.59

                   PEAK   FLOW   REDUCTION [Qout/Qin](%)= 11.21
                   TIME SHIFT OF PEAK FLOW        (min)=125.00
                   MAXIMUM  STORAGE   USED       (ha.m.)=  0.1933

-------------------------------------------------------------------------------
===============================================================================================
=====

       V    V   I    SSSSS  U   U    A    L
       V    V   I    SS     U   U   A A   L
        V  V    I     SS    U   U  AAAAA  L
        V  V    I      SS   U   U  A   A  L
         VV     I    SSSSS  UUUUU  A   A  LLLLL

        OOO    TTTTT  TTTTT  H   H  Y   Y  M   M   OOO     TM
       O   O     T      T    H   H   Y Y   MM MM  O   O
       O   O     T      T    H   H    Y    M   M  O   O
        OOO      T      T    H   H    Y    M   M   OOO
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```
                   *****  D E T A I L E D   O U T P U T *****


  Input   filename: C:\Program Files (x86)\Visual OTTHYMO 5.0\VO2\voin.dat
  Output  filename: C:\Users\JJohnston\AppData\Local\Civica\VH5\9f0d15d2-7934-48cd-bc46-
458c27b77161\571ff211-b0d1-47a5-a5bb-b1bb2ad57689\sc
  Summary filename: C:\Users\JJohnston\AppData\Local\Civica\VH5\9f0d15d2-7934-48cd-bc46-
458c27b77161\571ff211-b0d1-47a5-a5bb-b1bb2ad57689\sc


DATE: 02/13/2018                                    TIME: 12:07:43

USER:


COMMENTS:

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-----
  ************************************************
  ** SIMULATION : Run 05- 50yr 12hr SCS         **
  ************************************************


--------------------
|    READ STORM    |    Filename: C:\Users\JJohnston\AppD
|                  |              ata\Local\Temp\
|                  |              6babebd8-ac24-4f24-b7c1-0fcf37e6a2eb\598be94a
| Ptotal= 94.20 mm |    Comments: 50yr 12hr 5min SCS
--------------------
                 TIME    RAIN |  TIME    RAIN |'  TIME    RAIN |  TIME    RAIN
                  hrs   mm/hr |   hrs   mm/hr |'   hrs   mm/hr |   hrs   mm/hr
                 0.08    0.00 |  3.17    3.77 |  6.25   16.96 |  9.33    3.30
                 0.17    2.36 |  3.25    3.77 |  6.33   16.96 |  9.42    3.30
                 0.25    2.36 |  3.33    3.77 |  6.42   16.96 |  9.50    3.30
                 0.33    2.36 |  3.42    3.77 |  6.50   16.96 |  9.58    3.30
                 0.42    2.36 |  3.50    3.77 |  6.58   16.96 |  9.67    3.30
                 0.50    2.36 |  3.58    3.77 |  6.67    7.54 |  9.75    3.30
                 0.58    2.36 |  3.67    3.77 |  6.75    7.54 |  9.83    3.30
                 0.67    2.36 |  3.75    3.77 |  6.83    7.54 |  9.92    3.30
                 0.75    2.36 |  3.83    3.77 |  6.92    7.54 | 10.00    3.30
                 0.83    2.36 |  3.92    3.77 |  7.00    7.54 | 10.08    3.30
                 0.92    2.36 |  4.00    3.77 |  7.08    7.54 | 10.17    1.88
                 1.00    2.36 |  4.08    3.77 |  7.17    5.65 | 10.25    1.88
                 1.08    2.36 |  4.17    5.65 |  7.25    5.65 | 10.33    1.88
                 1.17    2.36 |  4.25    5.65 |  7.33    5.65 | 10.42    1.88
                 1.25    2.36 |  4.33    5.65 |  7.42    5.65 | 10.50    1.88
                 1.33    2.36 |  4.42    5.65 |  7.50    5.65 | 10.58    1.88
                 1.42    2.36 |  4.50    5.65 |  7.58    5.65 | 10.67    1.88
                 1.50    2.36 |  4.58    5.65 |  7.67    5.65 | 10.75    1.88
                 1.58    2.36 |  4.67    7.54 |  7.75    5.65 | 10.83    1.88
                 1.67    2.36 |  4.75    7.54 |  7.83    5.65 | 10.92    1.88
                 1.75    2.36 |  4.83    7.54 |  7.92    5.65 | 11.00    1.88
                 1.83    2.36 |  4.92    7.54 |  8.00    5.65 | 11.08    1.88
                 1.92    2.36 |  5.00    7.54 |  8.08    5.65 | 11.17    1.88
                 2.00    2.36 |  5.08    7.54 |  8.17    3.30 | 11.25    1.88
                 2.08    2.36 |  5.17   11.30 |  8.25    3.30 | 11.33    1.88
                 2.17    2.83 |  5.25   11.30 |  8.33    3.30 | 11.42    1.88
                 2.25    2.83 |  5.33   11.30 |  8.42    3.30 | 11.50    1.88
                 2.33    2.83 |  5.42   11.30 |  8.50    3.30 | 11.58    1.88
                 2.42    2.83 |  5.50   11.30 |  8.58    3.30 | 11.67    1.88
                 2.50    2.83 |  5.58   11.30 |  8.67    3.30 | 11.75    1.88
                 2.58    2.83 |  5.67   45.22 |  8.75    3.30 | 11.83    1.88
                 2.67    2.83 |  5.75   45.22 |  8.83    3.30 | 11.92    1.88
                 2.75    2.83 |  5.83   45.22 |  8.92    3.30 | 12.00    1.88
                 2.83    2.83 |  5.92  124.34 |  9.00    3.30 | 12.08    1.88
                 2.92    2.83 |  6.00  124.34 |  9.08    3.30 |
                 3.00    2.83 |  6.08  124.34 |  9.17    3.30 |
                 3.08    2.83 |  6.17   16.96 |  9.25    3.30 |

-------------------------------------------------------------------------------

--------------------
| CALIB            |
| NASHYD   (  0100)|   Area     (ha)=    3.31   Curve Number   (CN)= 65.0
|ID= 1 DT= 5.0 min |   Ia       (mm)=   10.00   # of Linear Res.(N)= 3.00
--------------------   U.H. Tp(hrs)=    0.12

     Unit Hyd Qpeak  (cms)=    1.081

     PEAK FLOW       (cms)=    0.420 (i)
     TIME TO PEAK    (hrs)=    6.083
     RUNOFF VOLUME    (mm)=   31.614
     TOTAL RAINFALL   (mm)=   94.200
     RUNOFF COEFFICIENT   =     0.336

     (i) PEAK FLOW DOES NOT INCLUDE BASEFLOW IF ANY.

-------------------------------------------------------------------------------
--------------------
| RESERVOIR(  0016)|
| IN= 2---> OUT= 1 |
```

```
| DT=  5.0 min      |      OUTFLOW    STORAGE   |  OUTFLOW    STORAGE
--------------------        (cms)     (ha.m.)   |   (cms)     (ha.m.)
                            0.0000     0.0000   |  8.4600      0.2001
                            0.0010     0.2000   |  0.0000      0.0000

                                  AREA     QPEAK     TPEAK       R.V.
                                  (ha)     (cms)     (hrs)       (mm)
   INFLOW : ID= 2 (  0100)       3.310     0.420      6.08       31.61
   OUTFLOW: ID= 1 (  0016)       3.310     0.001     12.42        7.89

                   PEAK   FLOW   REDUCTION [Qout/Qin](%)=  0.12
                   TIME SHIFT OF PEAK FLOW        (min)=380.00
                   MAXIMUM  STORAGE   USED       (ha.m.)=  0.1036

--------------------------------------------------------------------------------
--------------------
| CALIB             |
| NASHYD   (  0101)|   Area    (ha)=   3.09   Curve Number   (CN)= 65.0
|ID= 1 DT= 5.0 min |   Ia      (mm)=  10.00   # of Linear Res.(N)= 3.00
--------------------   U.H. Tp(hrs)=   0.23

     Unit Hyd Qpeak  (cms)=   0.504

     PEAK FLOW       (cms)=   0.262 (i)
     TIME TO PEAK    (hrs)=   6.167
     RUNOFF VOLUME    (mm)=  32.051
     TOTAL RAINFALL   (mm)=  94.200
     RUNOFF COEFFICIENT   =   0.340

     (i) PEAK FLOW DOES NOT INCLUDE BASEFLOW IF ANY.

--------------------------------------------------------------------------------
--------------------
| RESERVOIR(  0017)|
| IN= 2---> OUT= 1 |
| DT=  5.0 min      |      OUTFLOW    STORAGE   |  OUTFLOW    STORAGE
--------------------        (cms)     (ha.m.)   |   (cms)     (ha.m.)
                            0.0000     0.0000   |  0.0900      0.0688

                                  AREA     QPEAK     TPEAK       R.V.
                                  (ha)     (cms)     (hrs)       (mm)
   INFLOW : ID= 2 (  0101)       3.090     0.262      6.17       32.05
   OUTFLOW: ID= 1 (  0017)       3.090     0.061      6.92       31.99

                   PEAK   FLOW   REDUCTION [Qout/Qin](%)= 23.21
                   TIME SHIFT OF PEAK FLOW        (min)= 45.00
                   MAXIMUM  STORAGE   USED       (ha.m.)=  0.0465

--------------------------------------------------------------------------------
--------------------
| CALIB             |
| NASHYD   (  0102)|   Area    (ha)=   7.19   Curve Number   (CN)= 53.0
|ID= 1 DT= 5.0 min |   Ia      (mm)=  10.00   # of Linear Res.(N)= 3.00
--------------------   U.H. Tp(hrs)=   0.33

     Unit Hyd Qpeak  (cms)=   0.842

     PEAK FLOW       (cms)=   0.334 (i)
     TIME TO PEAK    (hrs)=   6.250
     RUNOFF VOLUME    (mm)=  22.904
     TOTAL RAINFALL   (mm)=  94.200
     RUNOFF COEFFICIENT   =   0.243

     (i) PEAK FLOW DOES NOT INCLUDE BASEFLOW IF ANY.

--------------------------------------------------------------------------------
--------------------
| RESERVOIR(  0018)|
| IN= 2---> OUT= 1 |
| DT=  5.0 min      |      OUTFLOW    STORAGE   |  OUTFLOW    STORAGE
--------------------        (cms)     (ha.m.)   |   (cms)     (ha.m.)
                            0.0000     0.0000   |  5.6800      0.5001
                            0.0010     0.1598   |  0.0000      0.0000

                                  AREA     QPEAK     TPEAK       R.V.
                                  (ha)     (cms)     (hrs)       (mm)
   INFLOW : ID= 2 (  0102)       7.190     0.334      6.25       22.90
   OUTFLOW: ID= 1 (  0018)       7.190     0.013     12.33        7.17

                   PEAK   FLOW   REDUCTION [Qout/Qin](%)=  3.93
                   TIME SHIFT OF PEAK FLOW        (min)=365.00
                   MAXIMUM  STORAGE   USED       (ha.m.)=  0.1605

--------------------------------------------------------------------------------
--------------------
| CALIB             |
| NASHYD   (  0103)|   Area    (ha)=  13.55   Curve Number   (CN)= 61.0
|ID= 1 DT= 5.0 min |   Ia      (mm)=  10.00   # of Linear Res.(N)= 3.00
--------------------   U.H. Tp(hrs)=   0.28

     Unit Hyd Qpeak  (cms)=   1.829

     PEAK FLOW       (cms)=   0.895 (i)
     TIME TO PEAK    (hrs)=   6.250
     RUNOFF VOLUME    (mm)=  28.736
     TOTAL RAINFALL   (mm)=  94.200
     RUNOFF COEFFICIENT   =   0.305

     (i) PEAK FLOW DOES NOT INCLUDE BASEFLOW IF ANY.

--------------------------------------------------------------------------------
--------------------
| RESERVOIR(  0019)|
| IN= 2---> OUT= 1 |
| DT=  5.0 min      |      OUTFLOW    STORAGE   |  OUTFLOW    STORAGE
--------------------        (cms)     (ha.m.)   |   (cms)     (ha.m.)
                            0.0000     0.0000   |  0.1500      0.3541

                                  AREA     QPEAK     TPEAK       R.V.
                                  (ha)     (cms)     (hrs)       (mm)
   INFLOW : ID= 2 (  0103)      13.550     0.895      6.25       28.74
   OUTFLOW: ID= 1 (  0019)      13.550     0.100      8.25       28.69

                   PEAK   FLOW   REDUCTION [Qout/Qin](%)= 11.18
                   TIME SHIFT OF PEAK FLOW        (min)=120.00
                   MAXIMUM  STORAGE   USED       (ha.m.)=  0.2362

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====================================================================================================
=====

       V    V   I   SSSSS  U   U    A    L
       V    V   I   SS     U   U   A A   L
        V  V    I    SS    U   U  AAAAA  L
        V  V    I     SS   U   U  A   A  L
         VV     I   SSSSS  UUUUU  A   A  LLLLL

        OOO   TTTTT  TTTTT  H   H  Y   Y  M   M   OOO    TM
       O   O    T      T    H   H   Y Y   MM MM  O   O
       O   O    T      T    H   H    Y    M   M  O   O
        OOO     T      T    H   H    Y    M   M   OOO
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                  *****  D E T A I L E D   O U T P U T *****


  Input   filename: C:\Program Files (x86)\Visual OTTHYMO 5.0\VO2\voin.dat
  Output  filename: C:\Users\JJohnston\AppData\Local\Civica\VH5\9f0d15d2-7934-48cd-bc46-
458c27b77161\3f4d40c8-9554-4f7f-8f54-aa7767d9cfd8\sc
  Summary filename: C:\Users\JJohnston\AppData\Local\Civica\VH5\9f0d15d2-7934-48cd-bc46-
458c27b77161\3f4d40c8-9554-4f7f-8f54-aa7767d9cfd8\sc


DATE: 02/13/2018                         TIME: 12:07:43

USER:


COMMENTS:


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-----
  ***********************************************
  ** SIMULATION : Run 06- 100yr 12hr SCS       **
  ***********************************************


--------------------
|    READ STORM     |    Filename: C:\Users\JJohnston\AppD
|                   |              ata\Local\Temp\
|                   |              6babebd8-ac24-4f24-b7c1-0fcf37e6a2eb\2d772290
| Ptotal=103.50 mm |    Comments: 100yr 12hr 5min SCS
--------------------
                 TIME    RAIN |  TIME    RAIN |'  TIME    RAIN |  TIME    RAIN
                  hrs   mm/hr |   hrs   mm/hr |'   hrs   mm/hr |   hrs   mm/hr
                 0.08    0.00 |  3.17    4.14 |  6.25   18.63 |  9.33    3.62
                 0.17    2.59 |  3.25    4.14 |  6.33   18.63 |  9.42    3.62
```

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0.25	2.59	3.33	4.14	6.42	18.63	9.50	3.62
0.33	2.59	3.42	4.14	6.50	18.63	9.58	3.62
0.42	2.59	3.50	4.14	6.58	18.63	9.67	3.62
0.50	2.59	3.58	4.14	6.67	8.28	9.75	3.62
0.58	2.59	3.67	4.14	6.75	8.28	9.83	3.62
0.67	2.59	3.75	4.14	6.83	8.28	9.92	3.62
0.75	2.59	3.83	4.14	6.92	8.28	10.00	3.62
0.83	2.59	3.92	4.14	7.00	8.28	10.08	3.62
0.92	2.59	4.00	4.14	7.08	8.28	10.17	2.07
1.00	2.59	4.08	4.14	7.17	6.21	10.25	2.07
1.08	2.59	4.17	6.21	7.25	6.21	10.33	2.07
1.17	2.59	4.25	6.21	7.33	6.21	10.42	2.07
1.25	2.59	4.33	6.21	7.42	6.21	10.50	2.07
1.33	2.59	4.42	6.21	7.50	6.21	10.58	2.07
1.42	2.59	4.50	6.21	7.58	6.21	10.67	2.07
1.50	2.59	4.58	6.21	7.67	6.21	10.75	2.07
1.58	2.59	4.67	8.28	7.75	6.21	10.83	2.07
1.67	2.59	4.75	8.28	7.83	6.21	10.92	2.07
1.75	2.59	4.83	8.28	7.92	6.21	11.00	2.07
1.83	2.59	4.92	8.28	8.00	6.21	11.08	2.07
1.92	2.59	5.00	8.28	8.08	6.21	11.17	2.07
2.00	2.59	5.08	8.28	8.17	3.62	11.25	2.07
2.08	2.59	5.17	12.42	8.25	3.62	11.33	2.07
2.17	3.11	5.25	12.42	8.33	3.62	11.42	2.07
2.25	3.11	5.33	12.42	8.42	3.62	11.50	2.07
2.33	3.11	5.42	12.42	8.50	3.62	11.58	2.07
2.42	3.11	5.50	12.42	8.58	3.62	11.67	2.07
2.50	3.11	5.58	12.42	8.67	3.62	11.75	2.07
2.58	3.11	5.67	49.68	8.75	3.62	11.83	2.07
2.67	3.11	5.75	49.68	8.83	3.62	11.92	2.07
2.75	3.11	5.83	49.68	8.92	3.62	12.00	2.07
2.83	3.11	5.92	136.62	9.00	3.62	12.08	2.07
2.92	3.11	6.00	136.62	9.08	3.62		
3.00	3.11	6.08	136.62	9.17	3.62		
3.08	3.11	6.17	18.63	9.25	3.62		

```
--------------------------------------------------------------------------------

--------------------
| CALIB            |
| NASHYD   (  0100)|   Area    (ha)=   3.31   Curve Number   (CN)= 65.0
|ID= 1 DT= 5.0 min |   Ia      (mm)=  10.00   # of Linear Res.(N)= 3.00
--------------------   U.H. Tp(hrs)=   0.12

     Unit Hyd Qpeak  (cms)=   1.081

     PEAK FLOW       (cms)=   0.498 (i)
     TIME TO PEAK    (hrs)=   6.083
     RUNOFF VOLUME    (mm)=  37.409
     TOTAL RAINFALL   (mm)= 103.500
     RUNOFF COEFFICIENT   =   0.361

     (i) PEAK FLOW DOES NOT INCLUDE BASEFLOW IF ANY.

--------------------------------------------------------------------------------

--------------------
| RESERVOIR(  0016)|
| IN= 2---> OUT= 1 |
| DT=  5.0 min     |     OUTFLOW    STORAGE   |  OUTFLOW    STORAGE
--------------------      (cms)     (ha.m.)   |   (cms)     (ha.m.)
                          0.0000     0.0000   |  8.4600      0.2001
                          0.0010     0.2000   |  0.0000      0.0000

                                AREA     QPEAK     TPEAK       R.V.
                                (ha)     (cms)     (hrs)       (mm)
  INFLOW : ID= 2 (  0100)      3.310      0.498      6.08       37.41
  OUTFLOW: ID= 1 (  0016)      3.310      0.001     12.42        9.34

                   PEAK   FLOW   REDUCTION [Qout/Qin](%)=  0.12
                   TIME SHIFT OF PEAK FLOW         (min)=380.00
                   MAXIMUM  STORAGE   USED       (ha.m.)=  0.1226

--------------------------------------------------------------------------------

--------------------
| CALIB            |
| NASHYD   (  0101)|   Area    (ha)=   3.09   Curve Number   (CN)= 65.0
|ID= 1 DT= 5.0 min |   Ia      (mm)=  10.00   # of Linear Res.(N)= 3.00
--------------------   U.H. Tp(hrs)=   0.23

     Unit Hyd Qpeak  (cms)=   0.504

     PEAK FLOW       (cms)=   0.311 (i)
     TIME TO PEAK    (hrs)=   6.167
     RUNOFF VOLUME    (mm)=  37.926
     TOTAL RAINFALL   (mm)= 103.500
     RUNOFF COEFFICIENT   =   0.366

     (i) PEAK FLOW DOES NOT INCLUDE BASEFLOW IF ANY.

--------------------------------------------------------------------------------

--------------------
| RESERVOIR(  0017)|
| IN= 2---> OUT= 1 |
| DT=  5.0 min     |     OUTFLOW    STORAGE   |  OUTFLOW    STORAGE
--------------------      (cms)     (ha.m.)   |   (cms)     (ha.m.)
                          0.0000     0.0000   |  0.0900      0.0688

                                AREA     QPEAK     TPEAK       R.V.
                                (ha)     (cms)     (hrs)       (mm)
  INFLOW : ID= 2 (  0101)      3.090      0.311      6.17       37.93
  OUTFLOW: ID= 1 (  0017)      3.090      0.072      6.92       37.86

                   PEAK   FLOW   REDUCTION [Qout/Qin](%)= 23.25
                   TIME SHIFT OF PEAK FLOW         (min)= 45.00
                   MAXIMUM  STORAGE   USED       (ha.m.)=  0.0554

--------------------------------------------------------------------------------

--------------------
| CALIB            |
| NASHYD   (  0102)|   Area    (ha)=   7.19   Curve Number   (CN)= 53.0
|ID= 1 DT= 5.0 min |   Ia      (mm)=  10.00   # of Linear Res.(N)= 3.00
--------------------   U.H. Tp(hrs)=   0.33

     Unit Hyd Qpeak  (cms)=   0.842

     PEAK FLOW       (cms)=   0.403 (i)
     TIME TO PEAK    (hrs)=   6.250
     RUNOFF VOLUME    (mm)=  27.419
     TOTAL RAINFALL   (mm)= 103.500
     RUNOFF COEFFICIENT   =   0.265

     (i) PEAK FLOW DOES NOT INCLUDE BASEFLOW IF ANY.

--------------------------------------------------------------------------------

--------------------
| RESERVOIR(  0018)|
| IN= 2---> OUT= 1 |
| DT=  5.0 min     |     OUTFLOW    STORAGE   |  OUTFLOW    STORAGE
--------------------      (cms)     (ha.m.)   |   (cms)     (ha.m.)
                          0.0000     0.0000   |  5.6800      0.5001
                          0.0010     0.1598   |  0.0000      0.0000

                                AREA     QPEAK     TPEAK       R.V.
                                (ha)     (cms)     (hrs)       (mm)
  INFLOW : ID= 2 (  0102)      7.190      0.403      6.25       27.42
  OUTFLOW: ID= 1 (  0018)      7.190      0.035     10.08       11.68

                   PEAK   FLOW   REDUCTION [Qout/Qin](%)=  8.63
                   TIME SHIFT OF PEAK FLOW         (min)=230.00
                   MAXIMUM  STORAGE   USED       (ha.m.)=  0.1618

--------------------------------------------------------------------------------

--------------------
| CALIB            |
| NASHYD   (  0103)|   Area    (ha)=  13.55   Curve Number   (CN)= 61.0
|ID= 1 DT= 5.0 min |   Ia      (mm)=  10.00   # of Linear Res.(N)= 3.00
--------------------   U.H. Tp(hrs)=   0.28

     Unit Hyd Qpeak  (cms)=   1.829

     PEAK FLOW       (cms)=   1.069 (i)
     TIME TO PEAK    (hrs)=   6.250
     RUNOFF VOLUME    (mm)=  34.147
     TOTAL RAINFALL   (mm)= 103.500
     RUNOFF COEFFICIENT   =   0.330

     (i) PEAK FLOW DOES NOT INCLUDE BASEFLOW IF ANY.

--------------------------------------------------------------------------------

--------------------
| RESERVOIR(  0019)|
| IN= 2---> OUT= 1 |
| DT=  5.0 min     |     OUTFLOW    STORAGE   |  OUTFLOW    STORAGE
--------------------      (cms)     (ha.m.)   |   (cms)     (ha.m.)
                          0.0000     0.0000   |  0.1500      0.3541

                                AREA     QPEAK     TPEAK       R.V.
                                (ha)     (cms)     (hrs)       (mm)
  INFLOW : ID= 2 (  0103)     13.550      1.069      6.25       34.15
  OUTFLOW: ID= 1 (  0019)     13.550      0.119      8.25       34.10

                   PEAK   FLOW   REDUCTION [Qout/Qin](%)= 11.17
```

```
                   TIME SHIFT OF PEAK FLOW          (min)=120.00
                   MAXIMUM  STORAGE   USED        (ha.m.)=  0.2818

 ------------------------------------------------------------------------------
 ====================================================================================================
 =====

      V    V   I    SSSSS  U   U    A    L
      V    V   I    SS     U   U   A A   L
       V  V    I     SS    U   U  AAAAA  L
       V  V    I      SS   U   U  A   A  L
        VV     I    SSSSS  UUUUU  A   A  LLLLL

       OOO    TTTTT  TTTTT  H   H  Y   Y  M   M   OOO     TM
      O   O     T      T    H   H   Y Y   MM MM  O   O
      O   O     T      T    H   H    Y    M   M  O   O
       OOO      T      T    H   H    Y    M   M   OOO
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                   *****  D E T A I L E D   O U T P U T *****


   Input   filename: C:\Program Files (x86)\Visual OTTHYMO 5.0\VO2\voin.dat
   Output  filename: C:\Users\JJohnston\AppData\Local\Civica\VH5\9f0d15d2-7934-48cd-bc46-
 458c27b77161\e2ab6dd2-806e-478c-9ac6-ba36c654301f\sc
   Summary filename: C:\Users\JJohnston\AppData\Local\Civica\VH5\9f0d15d2-7934-48cd-bc46-
 458c27b77161\e2ab6dd2-806e-478c-9ac6-ba36c654301f\sc


 DATE: 02/13/2018                          TIME: 12:07:43

 USER:


 COMMENTS:


 ----------------------------------------------------------------------------------------------------
 -----
   **************************************************
   ** SIMULATION : Run 07- 100yr 6hr SCS           **
   **************************************************


 --------------------
 |    READ STORM     |     Filename: C:\Users\JJohnston\AppD
 |                   |               ata\Local\Temp\
 |                   |               6babebd8-ac24-4f24-b7c1-0fcf37e6a2eb\31522549
 | Ptotal= 84.00 mm  |     Comments: 100yr 6hr 5min SCS
 --------------------
                 TIME    RAIN |  TIME    RAIN |'  TIME    RAIN |  TIME    RAIN
                  hrs   mm/hr |   hrs   mm/hr |'   hrs   mm/hr |   hrs   mm/hr
                 0.08    0.00 |  1.67    8.40 |   3.25   18.48 |  4.83    5.04
                 0.17    3.36 |  1.75    8.40 |   3.33   18.48 |  4.92    5.04
                 0.25    3.36 |  1.83    8.40 |   3.42   18.48 |  5.00    5.04
                 0.33    3.36 |  1.92    8.40 |   3.50   18.48 |  5.08    5.04
                 0.42    3.36 |  2.00    8.40 |   3.58   18.48 |  5.17    3.36
                 0.50    3.36 |  2.08    8.40 |   3.67    8.40 |  5.25    3.36
                 0.58    3.36 |  2.17   10.08 |   3.75    8.40 |  5.33    3.36
                 0.67    5.04 |  2.25   10.08 |   3.83    8.40 |  5.42    3.36
                 0.75    5.04 |  2.33   10.08 |   3.92    8.40 |  5.50    3.36
                 0.83    5.04 |  2.42   10.08 |   4.00    8.40 |  5.58    3.36
                 0.92    5.04 |  2.50   10.08 |   4.08    8.40 |  5.67    3.36
                 1.00    5.04 |  2.58   10.08 |   4.17    6.72 |  5.75    3.36
                 1.08    5.04 |  2.67   50.40 |   4.25    6.72 |  5.83    3.36
                 1.17    5.04 |  2.75   50.40 |   4.33    6.72 |  5.92    3.36
                 1.25    5.04 |  2.83   50.40 |   4.42    6.72 |  6.00    3.36
                 1.33    5.04 |  2.92  131.04 |   4.50    6.72 |  6.08    3.36
                 1.42    5.04 |  3.00  131.04 |   4.58    6.72 |
                 1.50    5.04 |  3.08  131.04 |   4.67    5.04 |
                 1.58    5.04 |  3.17   18.48 |   4.75    5.04 |

 ------------------------------------------------------------------------------

 --------------------
 | CALIB             |
 | NASHYD    (  0100)|   Area    (ha)=    3.31   Curve Number    (CN)= 65.0
 |ID= 1 DT= 5.0 min  |   Ia      (mm)=   10.00   # of Linear Res.(N)= 3.00
 --------------------    U.H. Tp(hrs)=    0.12

     Unit Hyd Qpeak  (cms)=   1.081
```

```
     PEAK FLOW       (cms)=   0.401 (i)
     TIME TO PEAK    (hrs)=   3.083
     RUNOFF VOLUME    (mm)=  25.600
     TOTAL RAINFALL   (mm)=  84.000
     RUNOFF COEFFICIENT   =   0.305

     (i) PEAK FLOW DOES NOT INCLUDE BASEFLOW IF ANY.

 ------------------------------------------------------------------------------
 --------------------
 | RESERVOIR(  0016)|
 | IN= 2---> OUT= 1 |
 | DT=  5.0 min     |      OUTFLOW    STORAGE   |  OUTFLOW    STORAGE
 --------------------       (cms)     (ha.m.)   |   (cms)     (ha.m.)
                            0.0000     0.0000   |   8.4600     0.2001
                            0.0010     0.2000   |   0.0000     0.0000

                                   AREA     QPEAK      TPEAK       R.V.
                                   (ha)     (cms)      (hrs)       (mm)
   INFLOW : ID= 2 (  0100)        3.310     0.401       3.08      25.60
   OUTFLOW: ID= 1 (  0016)        3.310     0.000       6.50       6.51

                 PEAK   FLOW   REDUCTION [Qout/Qin](%)=  0.11
                 TIME SHIFT OF PEAK FLOW        (min)=205.00
                 MAXIMUM  STORAGE   USED       (ha.m.)=  0.0843

 ------------------------------------------------------------------------------
 --------------------
 | CALIB             |
 | NASHYD    (  0101)|   Area    (ha)=    3.09   Curve Number    (CN)= 65.0
 |ID= 1 DT= 5.0 min  |   Ia      (mm)=   10.00   # of Linear Res.(N)= 3.00
 --------------------    U.H. Tp(hrs)=    0.23

     Unit Hyd Qpeak  (cms)=   0.504

     PEAK FLOW       (cms)=   0.244 (i)
     TIME TO PEAK    (hrs)=   3.167
     RUNOFF VOLUME    (mm)=  25.954
     TOTAL RAINFALL   (mm)=  84.000
     RUNOFF COEFFICIENT   =   0.309

     (i) PEAK FLOW DOES NOT INCLUDE BASEFLOW IF ANY.

 ------------------------------------------------------------------------------
 --------------------
 | RESERVOIR(  0017)|
 | IN= 2---> OUT= 1 |
 | DT=  5.0 min     |      OUTFLOW    STORAGE   |  OUTFLOW    STORAGE
 --------------------       (cms)     (ha.m.)   |   (cms)     (ha.m.)
                            0.0000     0.0000   |   0.0900     0.0688

                                   AREA     QPEAK      TPEAK       R.V.
                                   (ha)     (cms)      (hrs)       (mm)
   INFLOW : ID= 2 (  0101)        3.090     0.244       3.17      25.95
   OUTFLOW: ID= 1 (  0017)        3.090     0.056       3.92      25.89

                 PEAK   FLOW   REDUCTION [Qout/Qin](%)= 22.96
                 TIME SHIFT OF PEAK FLOW        (min)= 45.00
                 MAXIMUM  STORAGE   USED       (ha.m.)=  0.0429

 ------------------------------------------------------------------------------
 --------------------
 | CALIB             |
 | NASHYD    (  0102)|   Area    (ha)=    7.19   Curve Number    (CN)= 53.0
 |ID= 1 DT= 5.0 min  |   Ia      (mm)=   10.00   # of Linear Res.(N)= 3.00
 --------------------    U.H. Tp(hrs)=    0.33

     Unit Hyd Qpeak  (cms)=   0.842

     PEAK FLOW       (cms)=   0.308 (i)
     TIME TO PEAK    (hrs)=   3.333
     RUNOFF VOLUME    (mm)=  18.294
     TOTAL RAINFALL   (mm)=  84.000
     RUNOFF COEFFICIENT   =   0.218

     (i) PEAK FLOW DOES NOT INCLUDE BASEFLOW IF ANY.

 ------------------------------------------------------------------------------
 --------------------
 | RESERVOIR(  0018)|
 | IN= 2---> OUT= 1 |
 | DT=  5.0 min     |      OUTFLOW    STORAGE   |  OUTFLOW    STORAGE
 --------------------       (cms)     (ha.m.)   |   (cms)     (ha.m.)
                            0.0000     0.0000   |   5.6800     0.5001
                            0.0010     0.1598   |   0.0000     0.0000
```

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```
                               AREA     QPEAK     TPEAK       R.V.
                               (ha)     (cms)     (hrs)       (mm)
   INFLOW : ID= 2 (  0102)     7.190     0.308      3.33      18.29
   OUTFLOW: ID= 1 (  0018)     7.190     0.001      7.17       5.61

                  PEAK   FLOW   REDUCTION [Qout/Qin](%)=  0.26
                  TIME SHIFT OF PEAK FLOW          (min)=230.00
                  MAXIMUM  STORAGE   USED       (ha.m.)=  0.1305

------------------------------------------------------------------------------
--------------------
| CALIB              |
| NASHYD    (  0103)|   Area    (ha)=  13.55   Curve Number   (CN)= 61.0
|ID= 1 DT= 5.0 min |   Ia      (mm)=  10.00   # of Linear Res.(N)= 3.00
--------------------   U.H. Tp(hrs)=    0.28

     Unit Hyd Qpeak  (cms)=   1.829

     PEAK FLOW       (cms)=   0.832 (i)
     TIME TO PEAK    (hrs)=   3.250
     RUNOFF VOLUME    (mm)=  23.153
     TOTAL RAINFALL   (mm)=  84.000
     RUNOFF COEFFICIENT   =   0.276

     (i) PEAK FLOW DOES NOT INCLUDE BASEFLOW IF ANY.

------------------------------------------------------------------------------
--------------------
| RESERVOIR(  0019)|
| IN= 2---> OUT= 1 |
| DT=  5.0 min     |      OUTFLOW    STORAGE   |  OUTFLOW    STORAGE
--------------------        (cms)     (ha.m.)  |   (cms)     (ha.m.)
                           0.0000     0.0000   |   0.1500     0.3541

                               AREA     QPEAK     TPEAK       R.V.
                               (ha)     (cms)     (hrs)       (mm)
   INFLOW : ID= 2 (  0103)    13.550     0.832      3.25      23.15
   OUTFLOW: ID= 1 (  0019)    13.550     0.094      5.25      23.11

                  PEAK   FLOW   REDUCTION [Qout/Qin](%)= 11.29
                  TIME SHIFT OF PEAK FLOW          (min)=120.00
                  MAXIMUM  STORAGE   USED       (ha.m.)=  0.2218

------------------------------------------------------------------------------
====================================================================================================
=====

       V    V   I    SSSSS  U    U    A    L
       V    V   I    SS     U    U   A A   L
        V  V    I     SS    U    U  AAAAA  L
        V  V    I      SS   U    U  A   A  L
         VV     I    SSSSS  UUUUU  A    A  LLLLL

        OOO    TTTTT  TTTTT  H    H  Y   Y  M    M   OOO     TM
       O   O     T      T    H    H   Y Y   MM MM  O   O
       O   O     T      T    H    H    Y    M    M  O   O
        OOO      T      T    H    H    Y    M    M   OOO
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                   *****  D E T A I L E D   O U T P U T *****


  Input   filename: C:\Program Files (x86)\Visual OTTHYMO 5.0\VO2\voin.dat
  Output  filename: C:\Users\JJohnston\AppData\Local\Civica\VH5\9f0d15d2-7934-48cd-bc46-
458c27b77161\76038e9a-886c-4495-a052-e2b615ff8854\sc
  Summary filename: C:\Users\JJohnston\AppData\Local\Civica\VH5\9f0d15d2-7934-48cd-bc46-
458c27b77161\76038e9a-886c-4495-a052-e2b615ff8854\sc


DATE: 02/13/2018                          TIME: 12:07:43

USER:



COMMENTS:

----------------------------------------------------------------------------------------------------
-----
  **********************************************
  ** SIMULATION : Run 08- 100yr 24hr SCS        **
  **********************************************
```

```
--------------------
|    READ STORM    |     Filename: C:\Users\JJohnston\AppD
|                  |               ata\Local\Temp\
|                  |               6babebd8-ac24-4f24-b7c1-0fcf37e6a2eb\526453a5
| Ptotal=127.50 mm |     Comments: 100yr 24hr 5min SCS
--------------------
```

TIME hrs	RAIN mm/hr	TIME hrs	RAIN mm/hr	TIME hrs	RAIN mm/hr	TIME hrs	RAIN mm/hr
0.08	0.00	6.17	2.30	12.25	18.36	18.33	2.30
0.17	1.40	6.25	2.30	12.33	18.36	18.42	2.30
0.25	1.40	6.33	2.30	12.42	18.36	18.50	2.30
0.33	1.40	6.42	2.30	12.50	18.36	18.58	2.30
0.42	1.40	6.50	2.30	12.58	18.36	18.67	2.30
0.50	1.40	6.58	2.30	12.67	9.44	18.75	2.30
0.58	1.40	6.67	2.30	12.75	9.44	18.83	2.30
0.67	1.40	6.75	2.30	12.83	9.44	18.92	2.30
0.75	1.40	6.83	2.30	12.92	9.44	19.00	2.30
0.83	1.40	6.92	2.30	13.00	9.44	19.08	2.30
0.92	1.40	7.00	2.30	13.08	9.44	19.17	2.30
1.00	1.40	7.08	2.30	13.17	6.89	19.25	2.30
1.08	1.40	7.17	2.81	13.25	6.89	19.33	2.30
1.17	1.40	7.25	2.81	13.33	6.89	19.42	2.30
1.25	1.40	7.33	2.81	13.42	6.89	19.50	2.30
1.33	1.40	7.42	2.81	13.50	6.89	19.58	2.30
1.42	1.40	7.50	2.81	13.58	6.89	19.67	2.30
1.50	1.40	7.58	2.81	13.67	5.36	19.75	2.30
1.58	1.40	7.67	2.81	13.75	5.36	19.83	2.30
1.67	1.40	7.75	2.81	13.83	5.36	19.92	2.30
1.75	1.40	7.83	2.81	13.92	5.36	20.00	2.30
1.83	1.40	7.92	2.81	14.00	5.36	20.08	2.30
1.92	1.40	8.00	2.81	14.08	5.36	20.17	1.53
2.00	1.40	8.08	2.81	14.17	3.83	20.25	1.53
2.08	1.40	8.17	3.32	14.25	3.83	20.33	1.53
2.17	1.66	8.25	3.32	14.33	3.83	20.42	1.53
2.25	1.66	8.33	3.32	14.42	3.83	20.50	1.53
2.33	1.66	8.42	3.32	14.50	3.83	20.58	1.53
2.42	1.66	8.50	3.32	14.58	3.83	20.67	1.53
2.50	1.66	8.58	3.32	14.67	3.83	20.75	1.53
2.58	1.66	8.67	3.57	14.75	3.83	20.83	1.53
2.67	1.66	8.75	3.57	14.83	3.83	20.92	1.53
2.75	1.66	8.83	3.57	14.92	3.83	21.00	1.53
2.83	1.66	8.92	3.57	15.00	3.83	21.08	1.53
2.92	1.66	9.00	3.57	15.08	3.83	21.17	1.53
3.00	1.66	9.08	3.57	15.17	3.83	21.25	1.53
3.08	1.66	9.17	4.08	15.25	3.83	21.33	1.53
3.17	1.66	9.25	4.08	15.33	3.83	21.42	1.53
3.25	1.66	9.33	4.08	15.42	3.83	21.50	1.53
3.33	1.66	9.42	4.08	15.50	3.83	21.58	1.53
3.42	1.66	9.50	4.08	15.58	3.83	21.67	1.53
3.50	1.66	9.58	4.08	15.67	3.83	21.75	1.53
3.58	1.66	9.67	4.59	15.75	3.83	21.83	1.53
3.67	1.66	9.75	4.59	15.83	3.83	21.92	1.53
3.75	1.66	9.83	4.59	15.92	3.83	22.00	1.53
3.83	1.66	9.92	4.59	16.00	3.83	22.08	1.53
3.92	1.66	10.00	4.59	16.08	3.83	22.17	1.53
4.00	1.66	10.08	4.59	16.17	2.30	22.25	1.53
4.08	1.66	10.17	5.86	16.25	2.30	22.33	1.53
4.17	2.04	10.25	5.86	16.33	2.30	22.42	1.53
4.25	2.04	10.33	5.86	16.42	2.30	22.50	1.53
4.33	2.04	10.42	5.86	16.50	2.30	22.58	1.53
4.42	2.04	10.50	5.86	16.58	2.30	22.67	1.53
4.50	2.04	10.58	5.86	16.67	2.30	22.75	1.53
4.58	2.04	10.67	7.91	16.75	2.30	22.83	1.53
4.67	2.04	10.75	7.91	16.83	2.30	22.92	1.53
4.75	2.04	10.83	7.91	16.92	2.30	23.00	1.53
4.83	2.04	10.92	7.91	17.00	2.30	23.08	1.53
4.92	2.04	11.00	7.91	17.08	2.30	23.17	1.53
5.00	2.04	11.08	7.91	17.17	2.30	23.25	1.53
5.08	2.04	11.17	12.24	17.25	2.30	23.33	1.53
5.17	2.04	11.25	12.24	17.33	2.30	23.42	1.53
5.25	2.04	11.33	12.24	17.42	2.30	23.50	1.53
5.33	2.04	11.42	12.24	17.50	2.30	23.58	1.53
5.42	2.04	11.50	12.24	17.58	2.30	23.67	1.53
5.50	2.04	11.58	12.24	17.67	2.30	23.75	1.53
5.58	2.04	11.67	37.74	17.75	2.30	23.83	1.53
5.67	2.04	11.75	37.74	17.83	2.30	23.92	1.53
5.75	2.04	11.83	37.74	17.92	2.30	24.00	1.53
5.83	2.04	11.92	156.06	18.00	2.30	24.08	1.53
5.92	2.04	12.00	156.06	18.08	2.30		
6.00	2.04	12.08	156.06	18.17	2.30		
6.08	2.04	12.17	18.36	18.25	2.30		

```
--------------------
| CALIB             |
| NASHYD   ( 0100)|   Area    (ha)=   3.31   Curve Number   (CN)= 65.0
|ID= 1 DT= 5.0 min |   Ia      (mm)=  10.00   # of Linear Res.(N)= 3.00
--------------------   U.H. Tp(hrs)=   0.12

     Unit Hyd Qpeak  (cms)=   1.081

     PEAK FLOW       (cms)=   0.634 (i)
     TIME TO PEAK    (hrs)=  12.083
     RUNOFF VOLUME    (mm)=  53.502
     TOTAL RAINFALL   (mm)= 127.500
     RUNOFF COEFFICIENT   =   0.420

     (i) PEAK FLOW DOES NOT INCLUDE BASEFLOW IF ANY.

--------------------------------------------------------------------------------
--------------------
| RESERVOIR( 0016)|
| IN= 2---> OUT= 1 |
| DT=  5.0 min     |     OUTFLOW    STORAGE   |  OUTFLOW    STORAGE
--------------------      (cms)     (ha.m.)   |   (cms)     (ha.m.)
                          0.0000     0.0000   |   8.4600      0.2001
                          0.0010     0.2000   |   0.0000      0.0000

                                AREA     QPEAK     TPEAK       R.V.
                                (ha)     (cms)     (hrs)       (mm)
   INFLOW : ID= 2 (  0100)      3.310      0.634     12.08      53.50
   OUTFLOW: ID= 1 (  0016)      3.310      0.001     24.33      12.85

                   PEAK   FLOW   REDUCTION [Qout/Qin](%)=  0.14
                   TIME SHIFT OF PEAK FLOW         (min)=735.00
                   MAXIMUM  STORAGE   USED       (ha.m.)=  0.1738

--------------------------------------------------------------------------------
--------------------
| CALIB             |
| NASHYD   ( 0101)|   Area    (ha)=   3.09   Curve Number   (CN)= 65.0
|ID= 1 DT= 5.0 min |   Ia      (mm)=  10.00   # of Linear Res.(N)= 3.00
--------------------   U.H. Tp(hrs)=   0.23

     Unit Hyd Qpeak  (cms)=   0.504

     PEAK FLOW       (cms)=   0.390 (i)
     TIME TO PEAK    (hrs)=  12.167
     RUNOFF VOLUME    (mm)=  54.242
     TOTAL RAINFALL   (mm)= 127.500
     RUNOFF COEFFICIENT   =   0.425

     (i) PEAK FLOW DOES NOT INCLUDE BASEFLOW IF ANY.

--------------------------------------------------------------------------------
--------------------
| RESERVOIR( 0017)|
| IN= 2---> OUT= 1 |
| DT=  5.0 min     |     OUTFLOW    STORAGE   |  OUTFLOW    STORAGE
--------------------      (cms)     (ha.m.)   |   (cms)     (ha.m.)
                          0.0000     0.0000   |   0.0900      0.0688
     **** WARNING : STORAGE-DISCHARGE TABLE WAS EXCEEDED.

                                AREA     QPEAK     TPEAK       R.V.
                                (ha)     (cms)     (hrs)       (mm)
   INFLOW : ID= 2 (  0101)      3.090      0.390     12.17      54.24
   OUTFLOW: ID= 1 (  0017)      3.090      0.090     12.83      54.18

                   PEAK   FLOW   REDUCTION [Qout/Qin](%)= 23.10
                   TIME SHIFT OF PEAK FLOW         (min)= 40.00
                   MAXIMUM  STORAGE   USED       (ha.m.)=  0.0688

--------------------------------------------------------------------------------
--------------------
| CALIB             |
| NASHYD   ( 0102)|   Area    (ha)=   7.19   Curve Number   (CN)= 53.0
|ID= 1 DT= 5.0 min |   Ia      (mm)=  10.00   # of Linear Res.(N)= 3.00
--------------------   U.H. Tp(hrs)=   0.33

     Unit Hyd Qpeak  (cms)=   0.842

     PEAK FLOW       (cms)=   0.512 (i)
     TIME TO PEAK    (hrs)=  12.250
     RUNOFF VOLUME    (mm)=  40.270
     TOTAL RAINFALL   (mm)= 127.500
     RUNOFF COEFFICIENT   =   0.316

     (i) PEAK FLOW DOES NOT INCLUDE BASEFLOW IF ANY.

--------------------------------------------------------------------------------
--------------------
| RESERVOIR( 0018)|
| IN= 2---> OUT= 1 |
| DT=  5.0 min     |     OUTFLOW    STORAGE   |  OUTFLOW    STORAGE
--------------------      (cms)     (ha.m.)   |   (cms)     (ha.m.)
                          0.0000     0.0000   |   5.6800      0.5001
                          0.0010     0.1598   |   0.0000      0.0000

                                AREA     QPEAK     TPEAK       R.V.
                                (ha)     (cms)     (hrs)       (mm)
   INFLOW : ID= 2 (  0102)      7.190      0.512     12.25      40.27
   OUTFLOW: ID= 1 (  0018)      7.190      0.095     13.42      24.10

                   PEAK   FLOW   REDUCTION [Qout/Qin](%)= 18.59
                   TIME SHIFT OF PEAK FLOW         (min)= 70.00
                   MAXIMUM  STORAGE   USED       (ha.m.)=  0.1655

--------------------------------------------------------------------------------
--------------------
| CALIB             |
| NASHYD   ( 0103)|   Area    (ha)=  13.55   Curve Number   (CN)= 61.0
|ID= 1 DT= 5.0 min |   Ia      (mm)=  10.00   # of Linear Res.(N)= 3.00
--------------------   U.H. Tp(hrs)=   0.28

     Unit Hyd Qpeak  (cms)=   1.829

     PEAK FLOW       (cms)=   1.342 (i)
     TIME TO PEAK    (hrs)=  12.250
     RUNOFF VOLUME    (mm)=  49.303
     TOTAL RAINFALL   (mm)= 127.500
     RUNOFF COEFFICIENT   =   0.387

     (i) PEAK FLOW DOES NOT INCLUDE BASEFLOW IF ANY.

--------------------------------------------------------------------------------
--------------------
| RESERVOIR( 0019)|
| IN= 2---> OUT= 1 |
| DT=  5.0 min     |     OUTFLOW    STORAGE   |  OUTFLOW    STORAGE
--------------------      (cms)     (ha.m.)   |   (cms)     (ha.m.)
                          0.0000     0.0000   |   0.1500      0.3541

                                AREA     QPEAK     TPEAK       R.V.
                                (ha)     (cms)     (hrs)       (mm)
   INFLOW : ID= 2 (  0103)     13.550      1.342     12.25      49.30
   OUTFLOW: ID= 1 (  0019)     13.550      0.150     13.83      49.26

                   PEAK   FLOW   REDUCTION [Qout/Qin](%)= 11.18
                   TIME SHIFT OF PEAK FLOW         (min)= 95.00
                   MAXIMUM  STORAGE   USED       (ha.m.)=  0.3541

--------------------------------------------------------------------------------

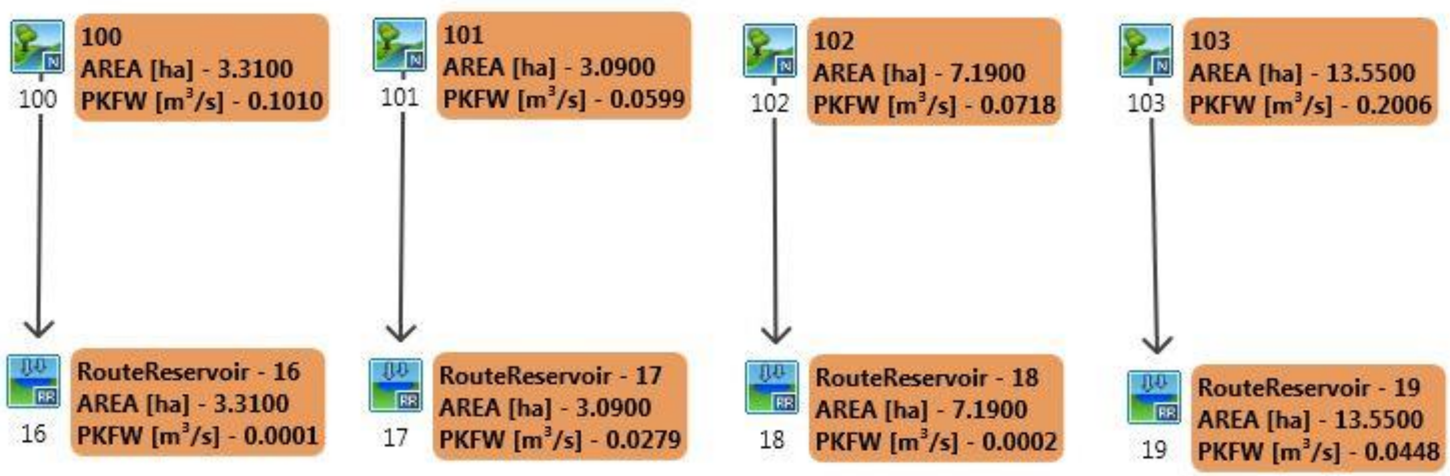
 FINISH
====================================================================================================
=====
```

Experience Enhancing Excellence

2017-0701 Belfountain

2, 5, 10, 25, 50 & 100-Year 12 Hour SCS Storm, 100- Year 6 Hour SCS Storm, & 100- Year 24 Hour SCS Storm
2 Dry Wells per Lot with 10mm Initial Abstractions
Proposed External Conditions Model Output
February, 2018

VO5 Model Schematic



```
===================================================================================================
=====

      V    V   I    SSSSS  U   U    A    L
      V    V   I    SS     U   U   A A   L
       V  V    I     SS    U   U  AAAAA  L
       V  V    I      SS   U   U  A   A  L
        VV     I    SSSSS  UUUUU  A   A  LLLLL

       OOO    TTTTT  TTTTT  H   H  Y   Y  M   M   OOO     TM
      O   O     T      T    H   H   Y Y   MM MM  O   O
      O   O     T      T    H   H    Y    M   M  O   O
       OOO      T      T    H   H    Y    M   M   OOO
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                    ***** D E T A I L E D   O U T P U T *****


  Input   filename: C:\Program Files (x86)\Visual OTTHYMO 5.0\VO2\voin.dat
  Output  filename: C:\Users\JJohnston\AppData\Local\Civica\VH5\9f0d15d2-7934-48cd-bc46-
458c27b77161\d66c5b3c-f8aa-4832-97d2-97b2f3a76cdc\sc
  Summary filename: C:\Users\JJohnston\AppData\Local\Civica\VH5\9f0d15d2-7934-48cd-bc46-
458c27b77161\d66c5b3c-f8aa-4832-97d2-97b2f3a76cdc\sc


DATE: 02/13/2018                          TIME: 12:10:52

USER:


COMMENTS:


---------------------------------------------------------------------------------------------------
-----
  **************************************************
  ** SIMULATION : Run 01- 2yr 12hr SCS           **
  **************************************************


--------------------
|    READ STORM     |     Filename: C:\Users\JJohnston\AppD
|                   |               ata\Local\Temp\
|                   |               3ecfa3ff-1a79-42a3-9f8d-422d0209edf1\2439c7bb
| Ptotal= 47.30 mm |     Comments: 2yr 12hr 5min SCS
--------------------
```

TIME hrs	RAIN mm/hr	TIME hrs	RAIN mm/hr	TIME hrs	RAIN mm/hr	TIME hrs	RAIN mm/hr
0.08	0.00	3.17	1.89	6.25	8.51	9.33	1.66
0.17	1.18	3.25	1.89	6.33	8.51	9.42	1.66
0.25	1.18	3.33	1.89	6.42	8.51	9.50	1.66
0.33	1.18	3.42	1.89	6.50	8.51	9.58	1.66
0.42	1.18	3.50	1.89	6.58	8.51	9.67	1.66
0.50	1.18	3.58	1.89	6.67	3.78	9.75	1.66
0.58	1.18	3.67	1.89	6.75	3.78	9.83	1.66
0.67	1.18	3.75	1.89	6.83	3.78	9.92	1.66
0.75	1.18	3.83	1.89	6.92	3.78	10.00	1.66
0.83	1.18	3.92	1.89	7.00	3.78	10.08	1.66
0.92	1.18	4.00	1.89	7.08	3.78	10.17	0.95
1.00	1.18	4.08	1.89	7.17	2.84	10.25	0.95
1.08	1.18	4.17	2.84	7.25	2.84	10.33	0.95
1.17	1.18	4.25	2.84	7.33	2.84	10.42	0.95
1.25	1.18	4.33	2.84	7.42	2.84	10.50	0.95
1.33	1.18	4.42	2.84	7.50	2.84	10.58	0.95
1.42	1.18	4.50	2.84	7.58	2.84	10.67	0.95
1.50	1.18	4.58	2.84	7.67	2.84	10.75	0.95
1.58	1.18	4.67	3.78	7.75	2.84	10.83	0.95
1.67	1.18	4.75	3.78	7.83	2.84	10.92	0.95
1.75	1.18	4.83	3.78	7.92	2.84	11.00	0.95
1.83	1.18	4.92	3.78	8.00	2.84	11.08	0.95
1.92	1.18	5.00	3.78	8.08	2.84	11.17	0.95
2.00	1.18	5.08	3.78	8.17	1.66	11.25	0.95
2.08	1.18	5.17	5.68	8.25	1.66	11.33	0.95
2.17	1.42	5.25	5.68	8.33	1.66	11.42	0.95
2.25	1.42	5.33	5.68	8.42	1.66	11.50	0.95
2.33	1.42	5.42	5.68	8.50	1.66	11.58	0.95
2.42	1.42	5.50	5.68	8.58	1.66	11.67	0.95
2.50	1.42	5.58	5.68	8.67	1.66	11.75	0.95
2.58	1.42	5.67	22.70	8.75	1.66	11.83	0.95
2.67	1.42	5.75	22.70	8.83	1.66	11.92	0.95
2.75	1.42	5.83	22.70	8.92	1.66	12.00	0.95
2.83	1.42	5.92	62.44	9.00	1.66	12.08	0.95
2.92	1.42	6.00	62.44	9.08	1.66		
3.00	1.42	6.08	62.44	9.17	1.66		
3.08	1.42	6.17	8.51	9.25	1.66		

```
----------------------------------------------------------------------------------------

--------------------
| CALIB             |
| NASHYD   (  0100)|   Area     (ha)=    3.31   Curve Number   (CN)= 65.0
|ID= 1 DT= 5.0 min |   Ia       (mm)=   10.00   # of Linear Res.(N)= 3.00
--------------------   U.H. Tp(hrs)=    0.12

     Unit Hyd Qpeak  (cms)=   1.081

     PEAK FLOW        (cms)=   0.101 (i)
     TIME TO PEAK     (hrs)=   6.083
     RUNOFF VOLUME     (mm)=   7.875
     TOTAL RAINFALL    (mm)=  47.300
     RUNOFF COEFFICIENT   =    0.167

     (i) PEAK FLOW DOES NOT INCLUDE BASEFLOW IF ANY.

----------------------------------------------------------------------------------------
--------------------
| RESERVOIR(  0016)|
| IN= 2---> OUT= 1 |
| DT=  5.0 min     |      OUTFLOW    STORAGE   |  OUTFLOW    STORAGE
--------------------       (cms)     (ha.m.)   |   (cms)     (ha.m.)
                          0.0000     0.0000    |   8.4600      0.2001
                          0.0010     0.2000    |   0.0000      0.0000

                                AREA     QPEAK     TPEAK       R.V.
                                (ha)     (cms)     (hrs)       (mm)
   INFLOW : ID= 2 (   0100)     3.310      0.101      6.08        7.88
   OUTFLOW: ID= 1 (   0016)     3.310      0.000     12.42        0.08

               PEAK   FLOW   REDUCTION [Qout/Qin](%)=  0.13
               TIME SHIFT OF PEAK FLOW         (min)=380.00
               MAXIMUM  STORAGE   USED       (ha.m.)=  0.0258

----------------------------------------------------------------------------------------
--------------------
| CALIB             |
| NASHYD   (  0101)|   Area     (ha)=    3.09   Curve Number   (CN)= 65.0
|ID= 1 DT= 5.0 min |   Ia       (mm)=   10.00   # of Linear Res.(N)= 3.00
--------------------   U.H. Tp(hrs)=    0.23

     Unit Hyd Qpeak  (cms)=   0.504

     PEAK FLOW        (cms)=   0.060 (i)
     TIME TO PEAK     (hrs)=   6.167
     RUNOFF VOLUME     (mm)=   7.984
     TOTAL RAINFALL    (mm)=  47.300
     RUNOFF COEFFICIENT   =    0.169

     (i) PEAK FLOW DOES NOT INCLUDE BASEFLOW IF ANY.

----------------------------------------------------------------------------------------
--------------------
| RESERVOIR(  0017)|
| IN= 2---> OUT= 1 |
| DT=  5.0 min     |      OUTFLOW    STORAGE   |  OUTFLOW    STORAGE
--------------------       (cms)     (ha.m.)   |   (cms)     (ha.m.)
                          0.0000     0.0000    |   0.1800      0.0457

                                AREA     QPEAK     TPEAK       R.V.
                                (ha)     (cms)     (hrs)       (mm)
   INFLOW : ID= 2 (   0101)     3.090      0.060      6.17        7.98
   OUTFLOW: ID= 1 (   0017)     3.090      0.028      6.67        7.97

               PEAK   FLOW   REDUCTION [Qout/Qin](%)= 46.57
               TIME SHIFT OF PEAK FLOW         (min)= 30.00
               MAXIMUM  STORAGE   USED       (ha.m.)=  0.0071

----------------------------------------------------------------------------------------
--------------------
| CALIB             |
| NASHYD   (  0102)|   Area     (ha)=    7.19   Curve Number   (CN)= 53.0
|ID= 1 DT= 5.0 min |   Ia       (mm)=   10.00   # of Linear Res.(N)= 3.00
--------------------   U.H. Tp(hrs)=    0.33

     Unit Hyd Qpeak  (cms)=   0.842

     PEAK FLOW        (cms)=   0.072 (i)
     TIME TO PEAK     (hrs)=   6.333
     RUNOFF VOLUME     (mm)=   5.298
```

```
     TOTAL RAINFALL   (mm)=  47.300
     RUNOFF COEFFICIENT   =   0.112

     (i) PEAK FLOW DOES NOT INCLUDE BASEFLOW IF ANY.

--------------------------------------------------------------------------------
--------------------
| RESERVOIR(  0018)|
| IN= 2---> OUT= 1 |
| DT=  5.0 min     |     OUTFLOW    STORAGE   |  OUTFLOW    STORAGE
--------------------      (cms)     (ha.m.)   |   (cms)     (ha.m.)
                          0.0000     0.0000   |   5.6800     0.5001
                          0.0010     0.1598   |   0.0000     0.0000

                                AREA     QPEAK     TPEAK        R.V.
                                (ha)     (cms)     (hrs)        (mm)
   INFLOW : ID= 2 (  0102)      7.190      0.072      6.33        5.30
   OUTFLOW: ID= 1 (  0018)      7.190      0.000     13.08        0.07

                   PEAK   FLOW   REDUCTION [Qout/Qin](%)=  0.33
                   TIME SHIFT OF PEAK FLOW         (min)=405.00
                   MAXIMUM  STORAGE   USED       (ha.m.)=  0.0376

--------------------------------------------------------------------------------
--------------------
| CALIB            |
| NASHYD   (  0103)|   Area     (ha)=  13.55   Curve Number   (CN)= 61.0
|ID= 1 DT= 5.0 min |   Ia       (mm)=  10.00   # of Linear Res.(N)= 3.00
--------------------   U.H. Tp(hrs)=    0.28

     Unit Hyd Qpeak  (cms)=   1.829

     PEAK FLOW       (cms)=   0.201 (i)
     TIME TO PEAK    (hrs)=   6.250
     RUNOFF VOLUME    (mm)=   6.964
     TOTAL RAINFALL   (mm)=  47.300
     RUNOFF COEFFICIENT   =   0.147

     (i) PEAK FLOW DOES NOT INCLUDE BASEFLOW IF ANY.

--------------------------------------------------------------------------------
--------------------
| RESERVOIR(  0019)|
| IN= 2---> OUT= 1 |
| DT=  5.0 min     |     OUTFLOW    STORAGE   |  OUTFLOW    STORAGE
--------------------      (cms)     (ha.m.)   |   (cms)     (ha.m.)
                          0.0000     0.0000   |   0.3000     0.2852

                                AREA     QPEAK     TPEAK        R.V.
                                (ha)     (cms)     (hrs)        (mm)
   INFLOW : ID= 2 (  0103)     13.550      0.201      6.25        6.96
   OUTFLOW: ID= 1 (  0019)     13.550      0.045      7.25        6.95

                   PEAK   FLOW   REDUCTION [Qout/Qin](%)= 22.33
                   TIME SHIFT OF PEAK FLOW         (min)= 60.00
                   MAXIMUM  STORAGE   USED       (ha.m.)=  0.0426

--------------------------------------------------------------------------------
=========================================================================================================
=====

       V    V   I    SSSSS  U   U    A    L
       V    V   I    SS     U   U   A A   L
        V  V    I     SS    U   U  AAAAA  L
        V  V    I      SS   U   U  A   A  L
         VV     I    SSSSS  UUUUU  A   A  LLLLL

        OOO   TTTTT  TTTTT  H   H  Y   Y  M   M  OOO    TM
       O   O    T      T    H   H   Y Y   MM MM  O   O
       O   O    T      T    H   H    Y    M   M  O   O
        OOO     T      T    H   H    Y    M   M  OOO
Developed and Distributed by Civica Infrastructure
```



```
                   *****  D E T A I L E D   O U T P U T *****


  Input   filename: C:\Program Files (x86)\Visual OTTHYMO 5.0\VO2\voin.dat
  Output  filename: C:\Users\JJohnston\AppData\Local\Civica\VH5\9f0d15d2-7934-48cd-bc46-
458c27b77161\c7f6835d-e123-4645-9f02-3d727a4befcd\sc
  Summary filename: C:\Users\JJohnston\AppData\Local\Civica\VH5\9f0d15d2-7934-48cd-bc46-
458c27b77161\c7f6835d-e123-4645-9f02-3d727a4befcd\sc
```

```
DATE: 02/13/2018                             TIME: 12:10:52

USER:


COMMENTS:


----------------------------------------------------------------------------------------------------
-----
  **************************************************
  ** SIMULATION : Run 02- 5yr 12hr SCS           **
  **************************************************


--------------------
|    READ STORM    |    Filename: C:\Users\JJohnston\AppD
|                  |              ata\Local\Temp\
|                  |              3ecfa3ff-1a79-42a3-9f8d-422d0209edf1\04f3f838
| Ptotal= 62.50 mm |    Comments: 5yr 12hr 5min SCS
--------------------
```

TIME hrs	RAIN mm/hr	TIME hrs	RAIN mm/hr	TIME hrs	RAIN mm/hr	TIME hrs	RAIN mm/hr
0.08	0.00	3.17	2.50	6.25	11.25	9.33	2.19
0.17	1.56	3.25	2.50	6.33	11.25	9.42	2.19
0.25	1.56	3.33	2.50	6.42	11.25	9.50	2.19
0.33	1.56	3.42	2.50	6.50	11.25	9.58	2.19
0.42	1.56	3.50	2.50	6.58	11.25	9.67	2.19
0.50	1.56	3.58	2.50	6.67	5.00	9.75	2.19
0.58	1.56	3.67	2.50	6.75	5.00	9.83	2.19
0.67	1.56	3.75	2.50	6.83	5.00	9.92	2.19
0.75	1.56	3.83	2.50	6.92	5.00	10.00	2.19
0.83	1.56	3.92	2.50	7.00	5.00	10.08	2.19
0.92	1.56	4.00	2.50	7.08	5.00	10.17	1.25
1.00	1.56	4.08	2.50	7.17	3.75	10.25	1.25
1.08	1.56	4.17	3.75	7.25	3.75	10.33	1.25
1.17	1.56	4.25	3.75	7.33	3.75	10.42	1.25
1.25	1.56	4.33	3.75	7.42	3.75	10.50	1.25
1.33	1.56	4.42	3.75	7.50	3.75	10.58	1.25
1.42	1.56	4.50	3.75	7.58	3.75	10.67	1.25
1.50	1.56	4.58	3.75	7.67	3.75	10.75	1.25
1.58	1.56	4.67	5.00	7.75	3.75	10.83	1.25
1.67	1.56	4.75	5.00	7.83	3.75	10.92	1.25
1.75	1.56	4.83	5.00	7.92	3.75	11.00	1.25
1.83	1.56	4.92	5.00	8.00	3.75	11.08	1.25
1.92	1.56	5.00	5.00	8.08	3.75	11.17	1.25
2.00	1.56	5.08	5.00	8.17	2.19	11.25	1.25
2.08	1.56	5.17	7.50	8.25	2.19	11.33	1.25
2.17	1.88	5.25	7.50	8.33	2.19	11.42	1.25
2.25	1.88	5.33	7.50	8.42	2.19	11.50	1.25
2.33	1.88	5.42	7.50	8.50	2.19	11.58	1.25
2.42	1.88	5.50	7.50	8.58	2.19	11.67	1.25
2.50	1.88	5.58	7.50	8.67	2.19	11.75	1.25
2.58	1.88	5.67	30.00	8.75	2.19	11.83	1.25
2.67	1.88	5.75	30.00	8.83	2.19	11.92	1.25
2.75	1.88	5.83	30.00	8.92	2.19	12.00	1.25
2.83	1.88	5.92	82.50	9.00	2.19	12.08	1.25
2.92	1.88	6.00	82.50	9.08	2.19		
3.00	1.88	6.08	82.50	9.17	2.19		
3.08	1.88	6.17	11.25	9.25	2.19		

```
--------------------------------------------------------------------------------

--------------------
| CALIB            |
| NASHYD   (  0100)|   Area     (ha)=    3.31   Curve Number   (CN)= 65.0
|ID= 1 DT= 5.0 min |   Ia       (mm)=  10.00   # of Linear Res.(N)= 3.00
--------------------   U.H. Tp(hrs)=    0.12

     Unit Hyd Qpeak  (cms)=   1.081

     PEAK FLOW       (cms)=   0.188 (i)
     TIME TO PEAK    (hrs)=   6.083
     RUNOFF VOLUME    (mm)=  14.349
     TOTAL RAINFALL   (mm)=  62.500
     RUNOFF COEFFICIENT   =   0.230

     (i) PEAK FLOW DOES NOT INCLUDE BASEFLOW IF ANY.

--------------------------------------------------------------------------------
--------------------
| RESERVOIR(  0016)|
| IN= 2---> OUT= 1 |
| DT=  5.0 min     |     OUTFLOW    STORAGE   |  OUTFLOW    STORAGE
--------------------      (cms)     (ha.m.)   |   (cms)     (ha.m.)
```

```
                     0.0000     0.0000   |   8.4600      0.2001
                     0.0010     0.2000   |   0.0000      0.0000

                          AREA     QPEAK     TPEAK       R.V.
                          (ha)     (cms)     (hrs)       (mm)
   INFLOW : ID= 2 (  0100)      3.310      0.188      6.08      14.35
   OUTFLOW: ID= 1 (  0016)      3.310      0.000     12.42       0.14

                  PEAK   FLOW   REDUCTION [Qout/Qin](%)=  0.12
                  TIME SHIFT OF PEAK FLOW         (min)=380.00
                  MAXIMUM  STORAGE   USED       (ha.m.)=  0.0470

--------------------------------------------------------------------------------
--------------------
| CALIB              |
| NASHYD   (  0101)|   Area    (ha)=   3.09   Curve Number   (CN)= 65.0
|ID= 1 DT= 5.0 min |   Ia      (mm)=  10.00   # of Linear Res.(N)= 3.00
--------------------   U.H. Tp(hrs)=   0.23

     Unit Hyd Qpeak  (cms)=   0.504

     PEAK FLOW       (cms)=   0.114 (i)
     TIME TO PEAK    (hrs)=   6.167
     RUNOFF VOLUME    (mm)=  14.547
     TOTAL RAINFALL   (mm)=  62.500
     RUNOFF COEFFICIENT   =   0.233

     (i) PEAK FLOW DOES NOT INCLUDE BASEFLOW IF ANY.

--------------------------------------------------------------------------------
--------------------
| RESERVOIR(  0017)|
| IN= 2---> OUT= 1 |
| DT=  5.0 min     |     OUTFLOW    STORAGE   |  OUTFLOW    STORAGE
--------------------      (cms)     (ha.m.)   |   (cms)     (ha.m.)
                         0.0000     0.0000   |   0.1800      0.0457

                          AREA     QPEAK     TPEAK       R.V.
                          (ha)     (cms)     (hrs)       (mm)
   INFLOW : ID= 2 (  0101)      3.090      0.114      6.17      14.55
   OUTFLOW: ID= 1 (  0017)      3.090      0.053      6.58      14.53

                  PEAK   FLOW   REDUCTION [Qout/Qin](%)= 46.38
                  TIME SHIFT OF PEAK FLOW         (min)= 25.00
                  MAXIMUM  STORAGE   USED       (ha.m.)=  0.0135

--------------------------------------------------------------------------------
--------------------
| CALIB              |
| NASHYD   (  0102)|   Area    (ha)=   7.19   Curve Number   (CN)= 53.0
|ID= 1 DT= 5.0 min |   Ia      (mm)=  10.00   # of Linear Res.(N)= 3.00
--------------------   U.H. Tp(hrs)=   0.33

     Unit Hyd Qpeak  (cms)=   0.842

     PEAK FLOW       (cms)=   0.140 (i)
     TIME TO PEAK    (hrs)=   6.333
     RUNOFF VOLUME    (mm)=   9.921
     TOTAL RAINFALL   (mm)=  62.500
     RUNOFF COEFFICIENT   =   0.159

     (i) PEAK FLOW DOES NOT INCLUDE BASEFLOW IF ANY.

--------------------------------------------------------------------------------
--------------------
| RESERVOIR(  0018)|
| IN= 2---> OUT= 1 |
| DT=  5.0 min     |     OUTFLOW    STORAGE   |  OUTFLOW    STORAGE
--------------------      (cms)     (ha.m.)   |   (cms)     (ha.m.)
                         0.0000     0.0000   |   5.6800      0.5001
                         0.0010     0.1598   |   0.0000      0.0000

                          AREA     QPEAK     TPEAK       R.V.
                          (ha)     (cms)     (hrs)       (mm)
   INFLOW : ID= 2 (  0102)      7.190      0.140      6.33       9.92
   OUTFLOW: ID= 1 (  0018)      7.190      0.000     13.08       2.99

                  PEAK   FLOW   REDUCTION [Qout/Qin](%)=  0.32
                  TIME SHIFT OF PEAK FLOW         (min)=405.00
                  MAXIMUM  STORAGE   USED       (ha.m.)=  0.0704

--------------------------------------------------------------------------------
--------------------
| CALIB              |
| NASHYD   (  0103)|   Area    (ha)=  13.55   Curve Number   (CN)= 61.0
|ID= 1 DT= 5.0 min |   Ia      (mm)=  10.00   # of Linear Res.(N)= 3.00
```

```
--------------------   U.H. Tp(hrs)=   0.28

     Unit Hyd Qpeak  (cms)=   1.829

     PEAK FLOW       (cms)=   0.386 (i)
     TIME TO PEAK    (hrs)=   6.250
     RUNOFF VOLUME    (mm)=  12.820
     TOTAL RAINFALL   (mm)=  62.500
     RUNOFF COEFFICIENT   =   0.205

     (i) PEAK FLOW DOES NOT INCLUDE BASEFLOW IF ANY.

--------------------------------------------------------------------------------
--------------------
| RESERVOIR(  0019)|
| IN= 2---> OUT= 1 |
| DT=  5.0 min     |     OUTFLOW    STORAGE   |  OUTFLOW    STORAGE
--------------------      (cms)     (ha.m.)   |   (cms)     (ha.m.)
                         0.0000     0.0000   |   0.3000      0.2852

                          AREA     QPEAK     TPEAK       R.V.
                          (ha)     (cms)     (hrs)       (mm)
   INFLOW : ID= 2 (  0103)     13.550      0.386      6.25      12.82
   OUTFLOW: ID= 1 (  0019)     13.550      0.086      7.17      12.80

                  PEAK   FLOW   REDUCTION [Qout/Qin](%)= 22.20
                  TIME SHIFT OF PEAK FLOW         (min)= 55.00
                  MAXIMUM  STORAGE   USED       (ha.m.)=  0.0815

--------------------------------------------------------------------------------
=========================================================================================================
=====

       V    V   I    SSSSS  U   U    A    L
       V    V   I    SS     U   U   A A   L
        V  V    I     SS    U   U  AAAAA  L
        V  V    I      SS   U   U  A   A  L
         VV     I    SSSSS  UUUUU  A   A  LLLLL

        OOO    TTTTT  TTTTT  H   H  Y   Y  M   M   OOO     TM
       O   O     T      T    H   H   Y Y   MM MM  O   O
       O   O     T      T    H   H    Y    M   M  O   O
        OOO      T      T    H   H    Y    M   M   OOO
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                   *****  D E T A I L E D   O U T P U T *****


  Input   filename: C:\Program Files (x86)\Visual OTTHYMO 5.0\VO2\voin.dat
  Output  filename: C:\Users\JJohnston\AppData\Local\Civica\VH5\9f0d15d2-7934-48cd-bc46-
458c27b77161\7e111ef7-d628-4e6c-8eb4-1dce6cbce122\sc
  Summary filename: C:\Users\JJohnston\AppData\Local\Civica\VH5\9f0d15d2-7934-48cd-bc46-
458c27b77161\7e111ef7-d628-4e6c-8eb4-1dce6cbce122\sc


DATE: 02/13/2018                         TIME: 12:10:52

USER:



COMMENTS:


---------------------------------------------------------------------------------------------------------
-----
  ************************************************
  ** SIMULATION : Run 03- 10yr 12hr SCS          **
  ************************************************


--------------------
|    READ STORM     |    Filename: C:\Users\JJohnston\AppD
|                   |              ata\Local\Temp\
|                   |              3ecfa3ff-1a79-42a3-9f8d-422d0209edf1\2dee6a48
| Ptotal= 72.50 mm |    Comments: 10yr 12hr 5min SCS
--------------------
                 TIME    RAIN |  TIME    RAIN |' TIME    RAIN |  TIME    RAIN
                  hrs   mm/hr |   hrs   mm/hr |'  hrs   mm/hr |   hrs   mm/hr
                 0.08    0.00 |  3.17    2.90 |  6.25   13.05 |  9.33    2.54
                 0.17    1.81 |  3.25    2.90 |  6.33   13.05 |  9.42    2.54
                 0.25    1.81 |  3.33    2.90 |  6.42   13.05 |  9.50    2.54
                 0.33    1.81 |  3.42    2.90 |  6.50   13.05 |  9.58    2.54
```

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0.42	1.81	3.50	2.90	6.58	13.05	9.67	2.54
0.50	1.81	3.58	2.90	6.67	5.80	9.75	2.54
0.58	1.81	3.67	2.90	6.75	5.80	9.83	2.54
0.67	1.81	3.75	2.90	6.83	5.80	9.92	2.54
0.75	1.81	3.83	2.90	6.92	5.80	10.00	2.54
0.83	1.81	3.92	2.90	7.00	5.80	10.08	2.54
0.92	1.81	4.00	2.90	7.08	5.80	10.17	1.45
1.00	1.81	4.08	2.90	7.17	4.35	10.25	1.45
1.08	1.81	4.17	4.35	7.25	4.35	10.33	1.45
1.17	1.81	4.25	4.35	7.33	4.35	10.42	1.45
1.25	1.81	4.33	4.35	7.42	4.35	10.50	1.45
1.33	1.81	4.42	4.35	7.50	4.35	10.58	1.45
1.42	1.81	4.50	4.35	7.58	4.35	10.67	1.45
1.50	1.81	4.58	4.35	7.67	4.35	10.75	1.45
1.58	1.81	4.67	5.80	7.75	4.35	10.83	1.45
1.67	1.81	4.75	5.80	7.83	4.35	10.92	1.45
1.75	1.81	4.83	5.80	7.92	4.35	11.00	1.45
1.83	1.81	4.92	5.80	8.00	4.35	11.08	1.45
1.92	1.81	5.00	5.80	8.08	4.35	11.17	1.45
2.00	1.81	5.08	5.80	8.17	2.54	11.25	1.45
2.08	1.81	5.17	8.70	8.25	2.54	11.33	1.45
2.17	2.17	5.25	8.70	8.33	2.54	11.42	1.45
2.25	2.17	5.33	8.70	8.42	2.54	11.50	1.45
2.33	2.17	5.42	8.70	8.50	2.54	11.58	1.45
2.42	2.17	5.50	8.70	8.58	2.54	11.67	1.45
2.50	2.17	5.58	8.70	8.67	2.54	11.75	1.45
2.58	2.17	5.67	34.80	8.75	2.54	11.83	1.45
2.67	2.17	5.75	34.80	8.83	2.54	11.92	1.45
2.75	2.17	5.83	34.80	8.92	2.54	12.00	1.45
2.83	2.17	5.92	95.70	9.00	2.54	12.08	1.45
2.92	2.17	6.00	95.70	9.08	2.54		
3.00	2.17	6.08	95.70	9.17	2.54		
3.08	2.17	6.17	13.05	9.25	2.54		

```
-------------------------------------------------------------------------------
--------------------
| CALIB              |
| NASHYD   ( 0100)|   Area    (ha)=   3.31   Curve Number   (CN)= 65.0
|ID= 1 DT= 5.0 min |   Ia      (mm)=  10.00   # of Linear Res.(N)= 3.00
--------------------   U.H. Tp(hrs)=   0.12

     Unit Hyd Qpeak  (cms)=   1.081

     PEAK FLOW       (cms)=   0.255 (i)
     TIME TO PEAK    (hrs)=   6.083
     RUNOFF VOLUME    (mm)=  19.315
     TOTAL RAINFALL   (mm)=  72.500
     RUNOFF COEFFICIENT   =   0.266

     (i) PEAK FLOW DOES NOT INCLUDE BASEFLOW IF ANY.

-------------------------------------------------------------------------------
--------------------
| RESERVOIR( 0016)|
| IN= 2---> OUT= 1 |
| DT=  5.0 min     |     OUTFLOW    STORAGE   |  OUTFLOW    STORAGE
--------------------       (cms)     (ha.m.)   |   (cms)     (ha.m.)
                          0.0000     0.0000   |   8.4600      0.2001
                          0.0010     0.2000   |   0.0000      0.0000

                                AREA     QPEAK      TPEAK       R.V.
                                (ha)     (cms)      (hrs)       (mm)
   INFLOW : ID= 2 (  0100)      3.310      0.255       6.08       19.32
   OUTFLOW: ID= 1 (  0016)      3.310      0.000      12.42        3.92

                   PEAK   FLOW   REDUCTION [Qout/Qin](%)=  0.12
                   TIME SHIFT OF PEAK FLOW         (min)=380.00
                   MAXIMUM  STORAGE   USED       (ha.m.)=  0.0633

-------------------------------------------------------------------------------
--------------------
| CALIB              |
| NASHYD   ( 0101)|   Area    (ha)=   3.09   Curve Number   (CN)= 65.0
|ID= 1 DT= 5.0 min |   Ia      (mm)=  10.00   # of Linear Res.(N)= 3.00
--------------------   U.H. Tp(hrs)=   0.23

     Unit Hyd Qpeak  (cms)=   0.504

     PEAK FLOW       (cms)=   0.157 (i)
     TIME TO PEAK    (hrs)=   6.167
     RUNOFF VOLUME    (mm)=  19.583
     TOTAL RAINFALL   (mm)=  72.500
     RUNOFF COEFFICIENT   =   0.270

     (i) PEAK FLOW DOES NOT INCLUDE BASEFLOW IF ANY.
```

```
-------------------------------------------------------------------------------
--------------------
| RESERVOIR( 0017)|
| IN= 2---> OUT= 1 |
| DT=  5.0 min     |     OUTFLOW    STORAGE   |  OUTFLOW    STORAGE
--------------------       (cms)     (ha.m.)   |   (cms)     (ha.m.)
                          0.0000     0.0000   |   0.1800      0.0457

                                AREA     QPEAK      TPEAK       R.V.
                                (ha)     (cms)      (hrs)       (mm)
   INFLOW : ID= 2 (  0101)      3.090      0.157       6.17       19.58
   OUTFLOW: ID= 1 (  0017)      3.090      0.073       6.58       19.56

                   PEAK   FLOW   REDUCTION [Qout/Qin](%)= 46.48
                   TIME SHIFT OF PEAK FLOW         (min)= 25.00
                   MAXIMUM  STORAGE   USED       (ha.m.)=  0.0185

-------------------------------------------------------------------------------
--------------------
| CALIB              |
| NASHYD   ( 0102)|   Area    (ha)=   7.19   Curve Number   (CN)= 53.0
|ID= 1 DT= 5.0 min |   Ia      (mm)=  10.00   # of Linear Res.(N)= 3.00
--------------------   U.H. Tp(hrs)=   0.33

     Unit Hyd Qpeak  (cms)=   0.842

     PEAK FLOW       (cms)=   0.194 (i)
     TIME TO PEAK    (hrs)=   6.333
     RUNOFF VOLUME    (mm)=  13.571
     TOTAL RAINFALL   (mm)=  72.500
     RUNOFF COEFFICIENT   =   0.187

     (i) PEAK FLOW DOES NOT INCLUDE BASEFLOW IF ANY.

-------------------------------------------------------------------------------
--------------------
| RESERVOIR( 0018)|
| IN= 2---> OUT= 1 |
| DT=  5.0 min     |     OUTFLOW    STORAGE   |  OUTFLOW    STORAGE
--------------------       (cms)     (ha.m.)   |   (cms)     (ha.m.)
                          0.0000     0.0000   |   5.6800      0.5001
                          0.0010     0.1598   |   0.0000      0.0000

                                AREA     QPEAK      TPEAK       R.V.
                                (ha)     (cms)      (hrs)       (mm)
   INFLOW : ID= 2 (  0102)      7.190      0.194       6.33       13.57
   OUTFLOW: ID= 1 (  0018)      7.190      0.001      13.08        4.09

                   PEAK   FLOW   REDUCTION [Qout/Qin](%)=  0.31
                   TIME SHIFT OF PEAK FLOW         (min)=405.00
                   MAXIMUM  STORAGE   USED       (ha.m.)=  0.0963

-------------------------------------------------------------------------------
--------------------
| CALIB              |
| NASHYD   ( 0103)|   Area    (ha)=  13.55   Curve Number   (CN)= 61.0
|ID= 1 DT= 5.0 min |   Ia      (mm)=  10.00   # of Linear Res.(N)= 3.00
--------------------   U.H. Tp(hrs)=   0.28

     Unit Hyd Qpeak  (cms)=   1.829

     PEAK FLOW       (cms)=   0.530 (i)
     TIME TO PEAK    (hrs)=   6.250
     RUNOFF VOLUME    (mm)=  17.361
     TOTAL RAINFALL   (mm)=  72.500
     RUNOFF COEFFICIENT   =   0.239

     (i) PEAK FLOW DOES NOT INCLUDE BASEFLOW IF ANY.

-------------------------------------------------------------------------------
--------------------
| RESERVOIR( 0019)|
| IN= 2---> OUT= 1 |
| DT=  5.0 min     |     OUTFLOW    STORAGE   |  OUTFLOW    STORAGE
--------------------       (cms)     (ha.m.)   |   (cms)     (ha.m.)
                          0.0000     0.0000   |   0.3000      0.2852

                                AREA     QPEAK      TPEAK       R.V.
                                (ha)     (cms)      (hrs)       (mm)
   INFLOW : ID= 2 (  0103)     13.550      0.530       6.25       17.36
   OUTFLOW: ID= 1 (  0019)     13.550      0.118       7.17       17.34

                   PEAK   FLOW   REDUCTION [Qout/Qin](%)= 22.23
                   TIME SHIFT OF PEAK FLOW         (min)= 55.00
                   MAXIMUM  STORAGE   USED       (ha.m.)=  0.1121
```

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=====

      V    V   I    SSSSS  U   U    A    L
      V    V   I    SS     U   U   A A   L
       V  V    I     SS    U   U  AAAAA  L
       V  V    I      SS   U   U  A   A  L
        VV     I    SSSSS  UUUUU  A   A  LLLLL

       OOO   TTTTT  TTTTT  H   H  Y   Y  M   M   OOO     TM
      O   O    T      T    H   H   Y Y   MM MM  O   O
      O   O    T      T    H   H    Y    M   M  O   O
       OOO     T      T    H   H    Y    M   M   OOO
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                   ***** D E T A I L E D   O U T P U T *****

  Input   filename: C:\Program Files (x86)\Visual OTTHYMO 5.0\VO2\voin.dat
  Output  filename: C:\Users\JJohnston\AppData\Local\Civica\VH5\9f0d15d2-7934-48cd-bc46-
458c27b77161\a0d9a273-f556-42fe-a93f-7e6c6161b0b1\sc
  Summary filename: C:\Users\JJohnston\AppData\Local\Civica\VH5\9f0d15d2-7934-48cd-bc46-
458c27b77161\a0d9a273-f556-42fe-a93f-7e6c6161b0b1\sc

DATE: 02/13/2018                          TIME: 12:10:52

USER:

COMMENTS:

----------------------------------------------------------------------------------------------------
-----
  ************************************************
  ** SIMULATION : Run 04- 25yr 12hr SCS         **
  ************************************************

 --------------------
 |    READ STORM    |    Filename: C:\Users\JJohnston\AppD
 |                  |              ata\Local\Temp\
 |                  |              3ecfa3ff-1a79-42a3-9f8d-422d0209edf1\868dc2b4
 | Ptotal= 84.90 mm |    Comments: 25yr 12hr 5min SCS
 --------------------
```

TIME hrs	RAIN mm/hr	TIME hrs	RAIN mm/hr	TIME hrs	RAIN mm/hr	TIME hrs	RAIN mm/hr
0.08	0.00	3.17	3.40	6.25	15.28	9.33	2.97
0.17	2.12	3.25	3.40	6.33	15.28	9.42	2.97
0.25	2.12	3.33	3.40	6.42	15.28	9.50	2.97
0.33	2.12	3.42	3.40	6.50	15.28	9.58	2.97
0.42	2.12	3.50	3.40	6.58	15.28	9.67	2.97
0.50	2.12	3.58	3.40	6.67	6.79	9.75	2.97
0.58	2.12	3.67	3.40	6.75	6.79	9.83	2.97
0.67	2.12	3.75	3.40	6.83	6.79	9.92	2.97
0.75	2.12	3.83	3.40	6.92	6.79	10.00	2.97
0.83	2.12	3.92	3.40	7.00	6.79	10.08	2.97
0.92	2.12	4.00	3.40	7.08	6.79	10.17	1.70
1.00	2.12	4.08	3.40	7.17	5.09	10.25	1.70
1.08	2.12	4.17	5.09	7.25	5.09	10.33	1.70
1.17	2.12	4.25	5.09	7.33	5.09	10.42	1.70
1.25	2.12	4.33	5.09	7.42	5.09	10.50	1.70
1.33	2.12	4.42	5.09	7.50	5.09	10.58	1.70
1.42	2.12	4.50	5.09	7.58	5.09	10.67	1.70
1.50	2.12	4.58	5.09	7.67	5.09	10.75	1.70
1.58	2.12	4.67	6.79	7.75	5.09	10.83	1.70
1.67	2.12	4.75	6.79	7.83	5.09	10.92	1.70
1.75	2.12	4.83	6.79	7.92	5.09	11.00	1.70
1.83	2.12	4.92	6.79	8.00	5.09	11.08	1.70
1.92	2.12	5.00	6.79	8.08	5.09	11.17	1.70
2.00	2.12	5.08	6.79	8.17	2.97	11.25	1.70
2.08	2.12	5.17	10.19	8.25	2.97	11.33	1.70
2.17	2.55	5.25	10.19	8.33	2.97	11.42	1.70
2.25	2.55	5.33	10.19	8.42	2.97	11.50	1.70
2.33	2.55	5.42	10.19	8.50	2.97	11.58	1.70
2.42	2.55	5.50	10.19	8.58	2.97	11.67	1.70
2.50	2.55	5.58	10.19	8.67	2.97	11.75	1.70
2.58	2.55	5.67	40.75	8.75	2.97	11.83	1.70
2.67	2.55	5.75	40.75	8.83	2.97	11.92	1.70
2.75	2.55	5.83	40.75	8.92	2.97	12.00	1.70
2.83	2.55	5.92	112.07	9.00	2.97	12.08	1.70
2.92	2.55	6.00	112.07	9.08	2.97		
3.00	2.55	6.08	112.07	9.17	2.97		
3.08	2.55	6.17	15.28	9.25	2.97		

```
-------------------------------------------------------------------------------

 --------------------
 | CALIB            |
 | NASHYD   (  0100)|   Area    (ha)=   3.31   Curve Number   (CN)= 65.0
 |ID= 1 DT= 5.0 min |   Ia      (mm)=  10.00   # of Linear Res.(N)= 3.00
 --------------------   U.H. Tp(hrs)=   0.12

     Unit Hyd Qpeak  (cms)=   1.081

     PEAK FLOW       (cms)=   0.347 (i)
     TIME TO PEAK    (hrs)=   6.083
     RUNOFF VOLUME    (mm)=  26.115
     TOTAL RAINFALL   (mm)=  84.900
     RUNOFF COEFFICIENT   =   0.308

     (i) PEAK FLOW DOES NOT INCLUDE BASEFLOW IF ANY.

-------------------------------------------------------------------------------
 --------------------
 | RESERVOIR(  0016)|
 | IN= 2---> OUT= 1 |
 | DT=  5.0 min     |     OUTFLOW    STORAGE   |  OUTFLOW    STORAGE
 --------------------      (cms)     (ha.m.)   |   (cms)     (ha.m.)
                           0.0000     0.0000   |   8.4600     0.2001
                           0.0010     0.2000   |   0.0000     0.0000

                                  AREA     QPEAK     TPEAK       R.V.
                                  (ha)     (cms)     (hrs)       (mm)
    INFLOW : ID= 2 (  0100)      3.310      0.347      6.08      26.11
    OUTFLOW: ID= 1 (  0016)      3.310      0.000     12.42       6.52

                   PEAK   FLOW   REDUCTION [Qout/Qin](%)=  0.12
                   TIME SHIFT OF PEAK FLOW         (min)=380.00
                   MAXIMUM  STORAGE   USED       (ha.m.)=  0.0856

-------------------------------------------------------------------------------
 --------------------
 | CALIB            |
 | NASHYD   (  0101)|   Area    (ha)=   3.09   Curve Number   (CN)= 65.0
 |ID= 1 DT= 5.0 min |   Ia      (mm)=  10.00   # of Linear Res.(N)= 3.00
 --------------------   U.H. Tp(hrs)=   0.23

     Unit Hyd Qpeak  (cms)=   0.504

     PEAK FLOW       (cms)=   0.215 (i)
     TIME TO PEAK    (hrs)=   6.167
     RUNOFF VOLUME    (mm)=  26.476
     TOTAL RAINFALL   (mm)=  84.900
     RUNOFF COEFFICIENT   =   0.312

     (i) PEAK FLOW DOES NOT INCLUDE BASEFLOW IF ANY.

-------------------------------------------------------------------------------
 --------------------
 | RESERVOIR(  0017)|
 | IN= 2---> OUT= 1 |
 | DT=  5.0 min     |     OUTFLOW    STORAGE   |  OUTFLOW    STORAGE
 --------------------      (cms)     (ha.m.)   |   (cms)     (ha.m.)
                           0.0000     0.0000   |   0.1800     0.0457

                                  AREA     QPEAK     TPEAK       R.V.
                                  (ha)     (cms)     (hrs)       (mm)
    INFLOW : ID= 2 (  0101)      3.090      0.215      6.17      26.48
    OUTFLOW: ID= 1 (  0017)      3.090      0.100      6.58      26.46

                   PEAK   FLOW   REDUCTION [Qout/Qin](%)= 46.58
                   TIME SHIFT OF PEAK FLOW         (min)= 25.00
                   MAXIMUM  STORAGE   USED       (ha.m.)=  0.0254

-------------------------------------------------------------------------------
 --------------------
 | CALIB            |
 | NASHYD   (  0102)|   Area    (ha)=   7.19   Curve Number   (CN)= 53.0
 |ID= 1 DT= 5.0 min |   Ia      (mm)=  10.00   # of Linear Res.(N)= 3.00
 --------------------   U.H. Tp(hrs)=   0.33

     Unit Hyd Qpeak  (cms)=   0.842

     PEAK FLOW       (cms)=   0.270 (i)
```

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```
     TIME TO PEAK     (hrs)=   6.250
     RUNOFF VOLUME     (mm)=  18.686
     TOTAL RAINFALL    (mm)=  84.900
     RUNOFF COEFFICIENT    =   0.220

     (i) PEAK FLOW DOES NOT INCLUDE BASEFLOW IF ANY.

--------------------------------------------------------------------------------
--------------------
| RESERVOIR(  0018)|
| IN= 2---> OUT= 1 |
| DT=  5.0 min     |      OUTFLOW    STORAGE   |  OUTFLOW    STORAGE
--------------------       (cms)     (ha.m.)   |   (cms)     (ha.m.)
                          0.0000     0.0000    |   5.6800      0.5001
                          0.0010     0.1598    |   0.0000      0.0000

                                AREA     QPEAK      TPEAK        R.V.
                                (ha)     (cms)      (hrs)        (mm)
   INFLOW : ID= 2 (  0102)      7.190     0.270       6.25        18.69
   OUTFLOW: ID= 1 (  0018)      7.190     0.001      13.08         5.63

                    PEAK   FLOW   REDUCTION [Qout/Qin](%)=  0.31
                    TIME SHIFT OF PEAK FLOW        (min)=410.00
                    MAXIMUM  STORAGE   USED       (ha.m.)=  0.1326

--------------------------------------------------------------------------------
--------------------
| CALIB            |
| NASHYD   (  0103)|   Area     (ha)=  13.55   Curve Number   (CN)= 61.0
|ID= 1 DT= 5.0 min |   Ia       (mm)=  10.00   # of Linear Res.(N)= 3.00
--------------------   U.H. Tp(hrs)=    0.28

     Unit Hyd Qpeak  (cms)=   1.829

     PEAK FLOW       (cms)=   0.731 (i)
     TIME TO PEAK    (hrs)=   6.250
     RUNOFF VOLUME    (mm)=  23.630
     TOTAL RAINFALL   (mm)=  84.900
     RUNOFF COEFFICIENT   =   0.278

     (i) PEAK FLOW DOES NOT INCLUDE BASEFLOW IF ANY.

--------------------------------------------------------------------------------
--------------------
| RESERVOIR(  0019)|
| IN= 2---> OUT= 1 |
| DT=  5.0 min     |      OUTFLOW    STORAGE   |  OUTFLOW    STORAGE
--------------------       (cms)     (ha.m.)   |   (cms)     (ha.m.)
                          0.0000     0.0000    |   0.3000      0.2852

                                AREA     QPEAK      TPEAK        R.V.
                                (ha)     (cms)      (hrs)        (mm)
   INFLOW : ID= 2 (  0103)     13.550     0.731       6.25        23.63
   OUTFLOW: ID= 1 (  0019)     13.550     0.163       7.17        23.61

                    PEAK   FLOW   REDUCTION [Qout/Qin](%)= 22.27
                    TIME SHIFT OF PEAK FLOW        (min)= 55.00
                    MAXIMUM  STORAGE   USED       (ha.m.)=  0.1549

--------------------------------------------------------------------------------
================================================================================
=====

       V    V   I    SSSSS  U   U    A    L
       V    V   I    SS     U   U   A A   L
        V  V    I     SS    U   U  AAAAA  L
        V  V    I      SS   U   U  A   A  L
         VV     I    SSSSS  UUUUU  A   A  LLLLL

        OOO    TTTTT  TTTTT  H   H  Y   Y  M   M   OOO     TM
       O   O     T      T    H   H   Y Y   MM MM  O   O
       O   O     T      T    H   H    Y    M   M  O   O
        OOO      T      T    H   H    Y    M   M   OOO
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                    *****  D E T A I L E D   O U T P U T *****

  Input   filename: C:\Program Files (x86)\Visual OTTHYMO 5.0\VO2\voin.dat
  Output  filename: C:\Users\JJohnston\AppData\Local\Civica\VH5\9f0d15d2-7934-48cd-bc46-
458c27b77161\0c996bc2-84a6-49b5-b5a6-90219611cbe7\sc
  Summary filename: C:\Users\JJohnston\AppData\Local\Civica\VH5\9f0d15d2-7934-48cd-bc46-
458c27b77161\0c996bc2-84a6-49b5-b5a6-90219611cbe7\sc
```

```
DATE: 02/13/2018                               TIME: 12:10:52

USER:


COMMENTS:


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-----
  **********************************************
  ** SIMULATION : Run 05- 50yr 12hr SCS       **
  **********************************************


--------------------
|    READ STORM    |    Filename: C:\Users\JJohnston\AppD
|                  |              ata\Local\Temp\
|                  |              3ecfa3ff-1a79-42a3-9f8d-422d0209edf1\598be94a
| Ptotal= 94.20 mm |    Comments: 50yr 12hr 5min SCS
--------------------
                  TIME    RAIN |  TIME    RAIN |'  TIME    RAIN |  TIME     RAIN
                   hrs   mm/hr |   hrs   mm/hr |'   hrs   mm/hr |   hrs    mm/hr
                  0.08    0.00 |  3.17    3.77 |  6.25   16.96 |  9.33     3.30
                  0.17    2.36 |  3.25    3.77 |  6.33   16.96 |  9.42     3.30
                  0.25    2.36 |  3.33    3.77 |  6.42   16.96 |  9.50     3.30
                  0.33    2.36 |  3.42    3.77 |  6.50   16.96 |  9.58     3.30
                  0.42    2.36 |  3.50    3.77 |  6.58   16.96 |  9.67     3.30
                  0.50    2.36 |  3.58    3.77 |  6.67    7.54 |  9.75     3.30
                  0.58    2.36 |  3.67    3.77 |  6.75    7.54 |  9.83     3.30
                  0.67    2.36 |  3.75    3.77 |  6.83    7.54 |  9.92     3.30
                  0.75    2.36 |  3.83    3.77 |  6.92    7.54 | 10.00     3.30
                  0.83    2.36 |  3.92    3.77 |  7.00    7.54 | 10.08     3.30
                  0.92    2.36 |  4.00    3.77 |  7.08    7.54 | 10.17     1.88
                  1.00    2.36 |  4.08    3.77 |  7.17    5.65 | 10.25     1.88
                  1.08    2.36 |  4.17    5.65 |  7.25    5.65 | 10.33     1.88
                  1.17    2.36 |  4.25    5.65 |  7.33    5.65 | 10.42     1.88
                  1.25    2.36 |  4.33    5.65 |  7.42    5.65 | 10.50     1.88
                  1.33    2.36 |  4.42    5.65 |  7.50    5.65 | 10.58     1.88
                  1.42    2.36 |  4.50    5.65 |  7.58    5.65 | 10.67     1.88
                  1.50    2.36 |  4.58    5.65 |  7.67    5.65 | 10.75     1.88
                  1.58    2.36 |  4.67    7.54 |  7.75    5.65 | 10.83     1.88
                  1.67    2.36 |  4.75    7.54 |  7.83    5.65 | 10.92     1.88
                  1.75    2.36 |  4.83    7.54 |  7.92    5.65 | 11.00     1.88
                  1.83    2.36 |  4.92    7.54 |  8.00    5.65 | 11.08     1.88
                  1.92    2.36 |  5.00    7.54 |  8.08    5.65 | 11.17     1.88
                  2.00    2.36 |  5.08    7.54 |  8.17    3.30 | 11.25     1.88
                  2.08    2.36 |  5.17   11.30 |  8.25    3.30 | 11.33     1.88
                  2.17    2.83 |  5.25   11.30 |  8.33    3.30 | 11.42     1.88
                  2.25    2.83 |  5.33   11.30 |  8.42    3.30 | 11.50     1.88
                  2.33    2.83 |  5.42   11.30 |  8.50    3.30 | 11.58     1.88
                  2.42    2.83 |  5.50   11.30 |  8.58    3.30 | 11.67     1.88
                  2.50    2.83 |  5.58   11.30 |  8.67    3.30 | 11.75     1.88
                  2.58    2.83 |  5.67   45.22 |  8.75    3.30 | 11.83     1.88
                  2.67    2.83 |  5.75   45.22 |  8.83    3.30 | 11.92     1.88
                  2.75    2.83 |  5.83   45.22 |  8.92    3.30 | 12.00     1.88
                  2.83    2.83 |  5.92  124.34 |  9.00    3.30 | 12.08     1.88
                  2.92    2.83 |  6.00  124.34 |  9.08    3.30 |
                  3.00    2.83 |  6.08  124.34 |  9.17    3.30 |
                  3.08    2.83 |  6.17   16.96 |  9.25    3.30 |

--------------------------------------------------------------------------------

--------------------
| CALIB            |
| NASHYD   (  0100)|   Area     (ha)=    3.31   Curve Number   (CN)= 65.0
|ID= 1 DT= 5.0 min |   Ia       (mm)=  10.00   # of Linear Res.(N)= 3.00
--------------------   U.H. Tp(hrs)=    0.12

     Unit Hyd Qpeak  (cms)=   1.081

     PEAK FLOW       (cms)=   0.420 (i)
     TIME TO PEAK    (hrs)=   6.083
     RUNOFF VOLUME    (mm)=  31.614
     TOTAL RAINFALL   (mm)=  94.200
     RUNOFF COEFFICIENT   =   0.336

     (i) PEAK FLOW DOES NOT INCLUDE BASEFLOW IF ANY.

--------------------------------------------------------------------------------
--------------------
| RESERVOIR(  0016)|
| IN= 2---> OUT= 1 |
```

```
| DT=  5.0 min     |      OUTFLOW    STORAGE   |  OUTFLOW    STORAGE
--------------------       (cms)     (ha.m.)   |   (cms)     (ha.m.)
                          0.0000      0.0000   |  8.4600      0.2001
                          0.0010      0.2000   |  0.0000      0.0000

                                AREA     QPEAK     TPEAK       R.V.
                                (ha)     (cms)     (hrs)       (mm)
   INFLOW : ID= 2 (  0100)      3.310      0.420      6.08       31.61
   OUTFLOW: ID= 1 (  0016)      3.310      0.001     12.42        7.89

                   PEAK   FLOW   REDUCTION [Qout/Qin](%)=  0.12
                   TIME SHIFT OF PEAK FLOW         (min)=380.00
                   MAXIMUM  STORAGE   USED       (ha.m.)=  0.1036

--------------------------------------------------------------------------------
--------------------
| CALIB            |
| NASHYD   (  0101)|   Area    (ha)=   3.09   Curve Number   (CN)= 65.0
|ID= 1 DT= 5.0 min |   Ia      (mm)=  10.00   # of Linear Res.(N)= 3.00
--------------------   U.H. Tp(hrs)=   0.23

     Unit Hyd Qpeak  (cms)=   0.504

     PEAK FLOW       (cms)=   0.262 (i)
     TIME TO PEAK    (hrs)=   6.167
     RUNOFF VOLUME    (mm)=  32.051
     TOTAL RAINFALL   (mm)=  94.200
     RUNOFF COEFFICIENT   =   0.340

     (i) PEAK FLOW DOES NOT INCLUDE BASEFLOW IF ANY.

--------------------------------------------------------------------------------
--------------------
| RESERVOIR(  0017)|
| IN= 2---> OUT= 1 |
| DT=  5.0 min     |      OUTFLOW    STORAGE   |  OUTFLOW    STORAGE
--------------------       (cms)     (ha.m.)   |   (cms)     (ha.m.)
                          0.0000      0.0000   |  0.1800      0.0457

                                AREA     QPEAK     TPEAK       R.V.
                                (ha)     (cms)     (hrs)       (mm)
   INFLOW : ID= 2 (  0101)      3.090      0.262      6.17       32.05
   OUTFLOW: ID= 1 (  0017)      3.090      0.122      6.58       32.03

                   PEAK   FLOW   REDUCTION [Qout/Qin](%)= 46.65
                   TIME SHIFT OF PEAK FLOW         (min)= 25.00
                   MAXIMUM  STORAGE   USED       (ha.m.)=  0.0310

--------------------------------------------------------------------------------
--------------------
| CALIB            |
| NASHYD   (  0102)|   Area    (ha)=   7.19   Curve Number   (CN)= 53.0
|ID= 1 DT= 5.0 min |   Ia      (mm)=  10.00   # of Linear Res.(N)= 3.00
--------------------   U.H. Tp(hrs)=   0.33

     Unit Hyd Qpeak  (cms)=   0.842

     PEAK FLOW       (cms)=   0.334 (i)
     TIME TO PEAK    (hrs)=   6.250
     RUNOFF VOLUME    (mm)=  22.904
     TOTAL RAINFALL   (mm)=  94.200
     RUNOFF COEFFICIENT   =   0.243

     (i) PEAK FLOW DOES NOT INCLUDE BASEFLOW IF ANY.

--------------------------------------------------------------------------------
--------------------
| RESERVOIR(  0018)|
| IN= 2---> OUT= 1 |
| DT=  5.0 min     |      OUTFLOW    STORAGE   |  OUTFLOW    STORAGE
--------------------       (cms)     (ha.m.)   |   (cms)     (ha.m.)
                          0.0000      0.0000   |  5.6800      0.5001
                          0.0010      0.1598   |  0.0000      0.0000

                                AREA     QPEAK     TPEAK       R.V.
                                (ha)     (cms)     (hrs)       (mm)
   INFLOW : ID= 2 (  0102)      7.190      0.334      6.25       22.90
   OUTFLOW: ID= 1 (  0018)      7.190      0.013     12.33        7.17

                   PEAK   FLOW   REDUCTION [Qout/Qin](%)=  3.93
                   TIME SHIFT OF PEAK FLOW         (min)=365.00
                   MAXIMUM  STORAGE   USED       (ha.m.)=  0.1605

--------------------------------------------------------------------------------
--------------------
| CALIB            |
```

```
| NASHYD   (  0103)|   Area    (ha)=  13.55   Curve Number   (CN)= 61.0
|ID= 1 DT= 5.0 min |   Ia      (mm)=  10.00   # of Linear Res.(N)= 3.00
--------------------   U.H. Tp(hrs)=   0.28

     Unit Hyd Qpeak  (cms)=   1.829

     PEAK FLOW       (cms)=   0.895 (i)
     TIME TO PEAK    (hrs)=   6.250
     RUNOFF VOLUME    (mm)=  28.736
     TOTAL RAINFALL   (mm)=  94.200
     RUNOFF COEFFICIENT   =   0.305

     (i) PEAK FLOW DOES NOT INCLUDE BASEFLOW IF ANY.

--------------------------------------------------------------------------------
--------------------
| RESERVOIR(  0019)|
| IN= 2---> OUT= 1 |
| DT=  5.0 min     |      OUTFLOW    STORAGE   |  OUTFLOW    STORAGE
--------------------       (cms)     (ha.m.)   |   (cms)     (ha.m.)
                          0.0000      0.0000   |  0.3000      0.2852

                                AREA     QPEAK     TPEAK       R.V.
                                (ha)     (cms)     (hrs)       (mm)
   INFLOW : ID= 2 (  0103)     13.550      0.895      6.25       28.74
   OUTFLOW: ID= 1 (  0019)     13.550      0.200      7.08       28.72

                   PEAK   FLOW   REDUCTION [Qout/Qin](%)= 22.33
                   TIME SHIFT OF PEAK FLOW         (min)= 50.00
                   MAXIMUM  STORAGE   USED       (ha.m.)=  0.1900

--------------------------------------------------------------------------------
=========================================================================================================
=====

       V    V   I    SSSSS  U   U    A    L
       V    V   I    SS     U   U   A A   L
        V  V    I     SS    U   U  AAAAA  L
        V  V    I      SS   U   U  A   A  L
         VV     I    SSSSS  UUUUU  A   A  LLLLL

        OOO    TTTTT  TTTTT  H   H  Y   Y  M   M   OOO     TM
       O   O     T      T    H   H   Y Y   MM MM  O   O
       O   O     T      T    H   H    Y    M   M  O   O
        OOO      T      T    H   H    Y    M   M   OOO
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                   *****  D E T A I L E D   O U T P U T *****


  Input   filename: C:\Program Files (x86)\Visual OTTHYMO 5.0\VO2\voin.dat
  Output  filename: C:\Users\JJohnston\AppData\Local\Civica\VH5\9f0d15d2-7934-48cd-bc46-
458c27b77161\66565110-6c61-48d1-a6c7-97a56cc87f6c\sc
  Summary filename: C:\Users\JJohnston\AppData\Local\Civica\VH5\9f0d15d2-7934-48cd-bc46-
458c27b77161\66565110-6c61-48d1-a6c7-97a56cc87f6c\sc


DATE: 02/13/2018                           TIME: 12:10:52

USER:


COMMENTS:


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-----
  ************************************************
  ** SIMULATION : Run 06- 100yr 12hr SCS        **
  ************************************************


--------------------
|   READ STORM     |     Filename: C:\Users\JJohnston\AppD
|                  |               ata\Local\Temp\
|                  |               3ecfa3ff-1a79-42a3-9f8d-422d0209edf1\2d772290
| Ptotal=103.50 mm |     Comments: 100yr 12hr 5min SCS
--------------------
                 TIME    RAIN |  TIME    RAIN |'  TIME    RAIN |  TIME    RAIN
                  hrs   mm/hr |   hrs   mm/hr |'   hrs   mm/hr |   hrs   mm/hr
                 0.08    0.00 |  3.17    4.14 |  6.25   18.63 |  9.33    3.62
                 0.17    2.59 |  3.25    4.14 |  6.33   18.63 |  9.42    3.62
```

0.25	2.59	3.33	4.14	6.42	18.63	9.50	3.62
0.33	2.59	3.42	4.14	6.50	18.63	9.58	3.62
0.42	2.59	3.50	4.14	6.58	18.63	9.67	3.62
0.50	2.59	3.58	4.14	6.67	8.28	9.75	3.62
0.58	2.59	3.67	4.14	6.75	8.28	9.83	3.62
0.67	2.59	3.75	4.14	6.83	8.28	9.92	3.62
0.75	2.59	3.83	4.14	6.92	8.28	10.00	3.62
0.83	2.59	3.92	4.14	7.00	8.28	10.08	3.62
0.92	2.59	4.00	4.14	7.08	8.28	10.17	2.07
1.00	2.59	4.08	4.14	7.17	6.21	10.25	2.07
1.08	2.59	4.17	6.21	7.25	6.21	10.33	2.07
1.17	2.59	4.25	6.21	7.33	6.21	10.42	2.07
1.25	2.59	4.33	6.21	7.42	6.21	10.50	2.07
1.33	2.59	4.42	6.21	7.50	6.21	10.58	2.07
1.42	2.59	4.50	6.21	7.58	6.21	10.67	2.07
1.50	2.59	4.58	6.21	7.67	6.21	10.75	2.07
1.58	2.59	4.67	8.28	7.75	6.21	10.83	2.07
1.67	2.59	4.75	8.28	7.83	6.21	10.92	2.07
1.75	2.59	4.83	8.28	7.92	6.21	11.00	2.07
1.83	2.59	4.92	8.28	8.00	6.21	11.08	2.07
1.92	2.59	5.00	8.28	8.08	6.21	11.17	2.07
2.00	2.59	5.08	8.28	8.17	3.62	11.25	2.07
2.08	2.59	5.17	12.42	8.25	3.62	11.33	2.07
2.17	3.11	5.25	12.42	8.33	3.62	11.42	2.07
2.25	3.11	5.33	12.42	8.42	3.62	11.50	2.07
2.33	3.11	5.42	12.42	8.50	3.62	11.58	2.07
2.42	3.11	5.50	12.42	8.58	3.62	11.67	2.07
2.50	3.11	5.58	12.42	8.67	3.62	11.75	2.07
2.58	3.11	5.67	49.68	8.75	3.62	11.83	2.07
2.67	3.11	5.75	49.68	8.83	3.62	11.92	2.07
2.75	3.11	5.83	49.68	8.92	3.62	12.00	2.07
2.83	3.11	5.92	136.62	9.00	3.62	12.08	2.07
2.92	3.11	6.00	136.62	9.08	3.62		
3.00	3.11	6.08	136.62	9.17	3.62		
3.08	3.11	6.17	18.63	9.25	3.62		

```
------------------------------------------------------------------------------

--------------------
| CALIB            |
| NASHYD   (  0100)|   Area    (ha)=    3.31   Curve Number   (CN)= 65.0
|ID= 1 DT= 5.0 min |   Ia      (mm)=  10.00   # of Linear Res.(N)= 3.00
--------------------   U.H. Tp(hrs)=    0.12

     Unit Hyd Qpeak  (cms)=    1.081

     PEAK FLOW       (cms)=    0.498 (i)
     TIME TO PEAK    (hrs)=    6.083
     RUNOFF VOLUME    (mm)=  37.409
     TOTAL RAINFALL   (mm)= 103.500
     RUNOFF COEFFICIENT   =    0.361

     (i) PEAK FLOW DOES NOT INCLUDE BASEFLOW IF ANY.

------------------------------------------------------------------------------

--------------------
| RESERVOIR(  0016)|
| IN= 2---> OUT= 1 |
| DT=  5.0 min     |     OUTFLOW    STORAGE   |  OUTFLOW    STORAGE
--------------------      (cms)      (ha.m.)   |   (cms)      (ha.m.)
                          0.0000      0.0000   |   8.4600      0.2001
                          0.0010      0.2000   |   0.0000      0.0000

                                   AREA     QPEAK     TPEAK       R.V.
                                   (ha)     (cms)     (hrs)       (mm)
   INFLOW : ID= 2 (  0100)        3.310      0.498      6.08      37.41
   OUTFLOW: ID= 1 (  0016)        3.310      0.001     12.42       9.34

                   PEAK   FLOW   REDUCTION [Qout/Qin](%)=  0.12
                   TIME SHIFT OF PEAK FLOW         (min)=380.00
                   MAXIMUM  STORAGE   USED       (ha.m.)=  0.1226

------------------------------------------------------------------------------

--------------------
| CALIB            |
| NASHYD   (  0101)|   Area    (ha)=    3.09   Curve Number   (CN)= 65.0
|ID= 1 DT= 5.0 min |   Ia      (mm)=  10.00   # of Linear Res.(N)= 3.00
--------------------   U.H. Tp(hrs)=    0.23

     Unit Hyd Qpeak  (cms)=    0.504

     PEAK FLOW       (cms)=    0.311 (i)
     TIME TO PEAK    (hrs)=    6.167
     RUNOFF VOLUME    (mm)=  37.926
     TOTAL RAINFALL   (mm)= 103.500
     RUNOFF COEFFICIENT   =    0.366

     (i) PEAK FLOW DOES NOT INCLUDE BASEFLOW IF ANY.

------------------------------------------------------------------------------

--------------------
| RESERVOIR(  0017)|
| IN= 2---> OUT= 1 |
| DT=  5.0 min     |     OUTFLOW    STORAGE   |  OUTFLOW    STORAGE
--------------------      (cms)      (ha.m.)   |   (cms)      (ha.m.)
                          0.0000      0.0000   |   0.1800      0.0457

                                   AREA     QPEAK     TPEAK       R.V.
                                   (ha)     (cms)     (hrs)       (mm)
   INFLOW : ID= 2 (  0101)        3.090      0.311      6.17      37.93
   OUTFLOW: ID= 1 (  0017)        3.090      0.145      6.58      37.91

                   PEAK   FLOW   REDUCTION [Qout/Qin](%)= 46.70
                   TIME SHIFT OF PEAK FLOW         (min)= 25.00
                   MAXIMUM  STORAGE   USED       (ha.m.)=  0.0370

------------------------------------------------------------------------------

--------------------
| CALIB            |
| NASHYD   (  0102)|   Area    (ha)=    7.19   Curve Number   (CN)= 53.0
|ID= 1 DT= 5.0 min |   Ia      (mm)=  10.00   # of Linear Res.(N)= 3.00
--------------------   U.H. Tp(hrs)=    0.33

     Unit Hyd Qpeak  (cms)=    0.842

     PEAK FLOW       (cms)=    0.403 (i)
     TIME TO PEAK    (hrs)=    6.250
     RUNOFF VOLUME    (mm)=  27.419
     TOTAL RAINFALL   (mm)= 103.500
     RUNOFF COEFFICIENT   =    0.265

     (i) PEAK FLOW DOES NOT INCLUDE BASEFLOW IF ANY.

------------------------------------------------------------------------------

--------------------
| RESERVOIR(  0018)|
| IN= 2---> OUT= 1 |
| DT=  5.0 min     |     OUTFLOW    STORAGE   |  OUTFLOW    STORAGE
--------------------      (cms)      (ha.m.)   |   (cms)      (ha.m.)
                          0.0000      0.0000   |   5.6800      0.5001
                          0.0010      0.1598   |   0.0000      0.0000

                                   AREA     QPEAK     TPEAK       R.V.
                                   (ha)     (cms)     (hrs)       (mm)
   INFLOW : ID= 2 (  0102)        7.190      0.403      6.25      27.42
   OUTFLOW: ID= 1 (  0018)        7.190      0.035     10.08      11.68

                   PEAK   FLOW   REDUCTION [Qout/Qin](%)=  8.63
                   TIME SHIFT OF PEAK FLOW         (min)=230.00
                   MAXIMUM  STORAGE   USED       (ha.m.)=  0.1618

------------------------------------------------------------------------------

--------------------
| CALIB            |
| NASHYD   (  0103)|   Area    (ha)=   13.55   Curve Number   (CN)= 61.0
|ID= 1 DT= 5.0 min |   Ia      (mm)=  10.00   # of Linear Res.(N)= 3.00
--------------------   U.H. Tp(hrs)=    0.28

     Unit Hyd Qpeak  (cms)=    1.829

     PEAK FLOW       (cms)=    1.069 (i)
     TIME TO PEAK    (hrs)=    6.250
     RUNOFF VOLUME    (mm)=  34.147
     TOTAL RAINFALL   (mm)= 103.500
     RUNOFF COEFFICIENT   =    0.330

     (i) PEAK FLOW DOES NOT INCLUDE BASEFLOW IF ANY.

------------------------------------------------------------------------------

--------------------
| RESERVOIR(  0019)|
| IN= 2---> OUT= 1 |
| DT=  5.0 min     |     OUTFLOW    STORAGE   |  OUTFLOW    STORAGE
--------------------      (cms)      (ha.m.)   |   (cms)      (ha.m.)
                          0.0000      0.0000   |   0.3000      0.2852

                                   AREA     QPEAK     TPEAK       R.V.
                                   (ha)     (cms)     (hrs)       (mm)
   INFLOW : ID= 2 (  0103)       13.550      1.069      6.25      34.15
   OUTFLOW: ID= 1 (  0019)       13.550      0.239      7.08      34.13

                   PEAK   FLOW   REDUCTION [Qout/Qin](%)= 22.37
```

```
                   TIME SHIFT OF PEAK FLOW         (min)= 50.00
                   MAXIMUM  STORAGE   USED       (ha.m.)=  0.2274

--------------------------------------------------------------------------------
====================================================================================================
=====

       V    V   I    SSSSS  U   U    A    L
       V    V   I    SS     U   U   A A   L
        V  V    I     SS    U   U  AAAAA  L
        V  V    I      SS   U   U  A   A  L
         VV     I    SSSSS  UUUUU  A   A  LLLLL

        OOO   TTTTT  TTTTT  H   H  Y   Y  M   M   OOO    TM
       O   O    T      T    H   H   Y Y   MM MM  O   O
       O   O    T      T    H   H    Y    M   M  O   O
        OOO     T      T    H   H    Y    M   M   OOO
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                   *****  D E T A I L E D   O U T P U T *****


  Input   filename: C:\Program Files (x86)\Visual OTTHYMO 5.0\VO2\voin.dat
  Output  filename: C:\Users\JJohnston\AppData\Local\Civica\VH5\9f0d15d2-7934-48cd-bc46-
458c27b77161\9c821499-7fdf-48e7-993c-025f08b13c24\sc
  Summary filename: C:\Users\JJohnston\AppData\Local\Civica\VH5\9f0d15d2-7934-48cd-bc46-
458c27b77161\9c821499-7fdf-48e7-993c-025f08b13c24\sc


DATE: 02/13/2018                           TIME: 12:10:52

USER:


COMMENTS:


----------------------------------------------------------------------------------------------------
-----
  ************************************************
  ** SIMULATION : Run 07- 100yr 6hr SCS         **
  ************************************************


--------------------
|    READ STORM    |    Filename: C:\Users\JJohnston\AppD
|                  |              ata\Local\Temp\
|                  |              3ecfa3ff-1a79-42a3-9f8d-422d0209edf1\31522549
| Ptotal= 84.00 mm |    Comments: 100yr 6hr 5min SCS
--------------------
                 TIME    RAIN |  TIME    RAIN |'  TIME    RAIN |  TIME    RAIN
                  hrs   mm/hr |   hrs   mm/hr |'   hrs   mm/hr |   hrs   mm/hr
                 0.08    0.00 | 1.67     8.40 | 3.25    18.48 | 4.83     5.04
                 0.17    3.36 | 1.75     8.40 | 3.33    18.48 | 4.92     5.04
                 0.25    3.36 | 1.83     8.40 | 3.42    18.48 | 5.00     5.04
                 0.33    3.36 | 1.92     8.40 | 3.50    18.48 | 5.08     5.04
                 0.42    3.36 | 2.00     8.40 | 3.58    18.48 | 5.17     3.36
                 0.50    3.36 | 2.08     8.40 | 3.67     8.40 | 5.25     3.36
                 0.58    3.36 | 2.17    10.08 | 3.75     8.40 | 5.33     3.36
                 0.67    5.04 | 2.25    10.08 | 3.83     8.40 | 5.42     3.36
                 0.75    5.04 | 2.33    10.08 | 3.92     8.40 | 5.50     3.36
                 0.83    5.04 | 2.42    10.08 | 4.00     8.40 | 5.58     3.36
                 0.92    5.04 | 2.50    10.08 | 4.08     8.40 | 5.67     3.36
                 1.00    5.04 | 2.58    10.08 | 4.17     6.72 | 5.75     3.36
                 1.08    5.04 | 2.67    50.40 | 4.25     6.72 | 5.83     3.36
                 1.17    5.04 | 2.75    50.40 | 4.33     6.72 | 5.92     3.36
                 1.25    5.04 | 2.83    50.40 | 4.42     6.72 | 6.00     3.36
                 1.33    5.04 | 2.92   131.04 | 4.50     6.72 | 6.08     3.36
                 1.42    5.04 | 3.00   131.04 | 4.58     6.72 |
                 1.50    5.04 | 3.08   131.04 | 4.67     5.04 |
                 1.58    5.04 | 3.17    18.48 | 4.75     5.04 |

--------------------------------------------------------------------------------

--------------------
| CALIB            |
| NASHYD   (  0100)|   Area    (ha)=   3.31   Curve Number   (CN)= 65.0
|ID= 1 DT= 5.0 min |   Ia      (mm)=  10.00   # of Linear Res.(N)= 3.00
--------------------   U.H. Tp(hrs)=   0.12

     Unit Hyd Qpeak  (cms)=   1.081

     PEAK FLOW       (cms)=   0.401 (i)
     TIME TO PEAK    (hrs)=   3.083
     RUNOFF VOLUME    (mm)=  25.600
     TOTAL RAINFALL   (mm)=  84.000
     RUNOFF COEFFICIENT   =   0.305

     (i) PEAK FLOW DOES NOT INCLUDE BASEFLOW IF ANY.

--------------------------------------------------------------------------------
--------------------
| RESERVOIR(  0016)|
| IN= 2---> OUT= 1 |
| DT=  5.0 min     |     OUTFLOW    STORAGE   |  OUTFLOW    STORAGE
--------------------      (cms)     (ha.m.)   |   (cms)     (ha.m.)
                          0.0000     0.0000   |  8.4600      0.2001
                          0.0010     0.2000   |  0.0000      0.0000

                                 AREA     QPEAK      TPEAK        R.V.
                                 (ha)     (cms)      (hrs)        (mm)
   INFLOW : ID= 2 (  0100)      3.310      0.401       3.08       25.60
   OUTFLOW: ID= 1 (  0016)      3.310      0.000       6.50        6.51

                   PEAK   FLOW   REDUCTION [Qout/Qin](%)=  0.11
                   TIME SHIFT OF PEAK FLOW         (min)=205.00
                   MAXIMUM  STORAGE   USED       (ha.m.)=  0.0843

--------------------------------------------------------------------------------
--------------------
| CALIB            |
| NASHYD   (  0101)|   Area    (ha)=   3.09   Curve Number   (CN)= 65.0
|ID= 1 DT= 5.0 min |   Ia      (mm)=  10.00   # of Linear Res.(N)= 3.00
--------------------   U.H. Tp(hrs)=   0.23

     Unit Hyd Qpeak  (cms)=   0.504

     PEAK FLOW       (cms)=   0.244 (i)
     TIME TO PEAK    (hrs)=   3.167
     RUNOFF VOLUME    (mm)=  25.954
     TOTAL RAINFALL   (mm)=  84.000
     RUNOFF COEFFICIENT   =   0.309

     (i) PEAK FLOW DOES NOT INCLUDE BASEFLOW IF ANY.

--------------------------------------------------------------------------------
--------------------
| RESERVOIR(  0017)|
| IN= 2---> OUT= 1 |
| DT=  5.0 min     |     OUTFLOW    STORAGE   |  OUTFLOW    STORAGE
--------------------      (cms)     (ha.m.)   |   (cms)     (ha.m.)
                          0.0000     0.0000   |  0.1800      0.0457

                                 AREA     QPEAK      TPEAK        R.V.
                                 (ha)     (cms)      (hrs)        (mm)
   INFLOW : ID= 2 (  0101)      3.090      0.244       3.17       25.95
   OUTFLOW: ID= 1 (  0017)      3.090      0.113       3.58       25.94

                   PEAK   FLOW   REDUCTION [Qout/Qin](%)= 46.20
                   TIME SHIFT OF PEAK FLOW         (min)= 25.00
                   MAXIMUM  STORAGE   USED       (ha.m.)=  0.0287

--------------------------------------------------------------------------------
--------------------
| CALIB            |
| NASHYD   (  0102)|   Area    (ha)=   7.19   Curve Number   (CN)= 53.0
|ID= 1 DT= 5.0 min |   Ia      (mm)=  10.00   # of Linear Res.(N)= 3.00
--------------------   U.H. Tp(hrs)=   0.33

     Unit Hyd Qpeak  (cms)=   0.842

     PEAK FLOW       (cms)=   0.308 (i)
     TIME TO PEAK    (hrs)=   3.333
     RUNOFF VOLUME    (mm)=  18.294
     TOTAL RAINFALL   (mm)=  84.000
     RUNOFF COEFFICIENT   =   0.218

     (i) PEAK FLOW DOES NOT INCLUDE BASEFLOW IF ANY.

--------------------------------------------------------------------------------
--------------------
| RESERVOIR(  0018)|
| IN= 2---> OUT= 1 |
| DT=  5.0 min     |     OUTFLOW    STORAGE   |  OUTFLOW    STORAGE
--------------------      (cms)     (ha.m.)   |   (cms)     (ha.m.)
                          0.0000     0.0000   |  5.6800      0.5001
                          0.0010     0.1598   |  0.0000      0.0000
```

```
                          AREA    QPEAK    TPEAK      R.V.
                          (ha)    (cms)    (hrs)      (mm)
   INFLOW : ID= 2 (  0102)   7.190    0.308    3.33     18.29
   OUTFLOW: ID= 1 (  0018)   7.190    0.001    7.17      5.61

                PEAK   FLOW   REDUCTION [Qout/Qin](%)=  0.26
                TIME SHIFT OF PEAK FLOW         (min)=230.00
                MAXIMUM  STORAGE   USED       (ha.m.)=  0.1305

 --------------------------------------------------------------------------------
 --------------------
 | CALIB              |
 | NASHYD   (  0103)|   Area    (ha)=  13.55   Curve Number   (CN)= 61.0
 |ID= 1 DT= 5.0 min |   Ia      (mm)=  10.00   # of Linear Res.(N)= 3.00
 --------------------   U.H. Tp(hrs)=   0.28

     Unit Hyd Qpeak  (cms)=   1.829

     PEAK FLOW       (cms)=   0.832 (i)
     TIME TO PEAK    (hrs)=   3.250
     RUNOFF VOLUME    (mm)=  23.153
     TOTAL RAINFALL   (mm)=  84.000
     RUNOFF COEFFICIENT   =   0.276

     (i) PEAK FLOW DOES NOT INCLUDE BASEFLOW IF ANY.

 --------------------------------------------------------------------------------
 --------------------
 | RESERVOIR(  0019)|
 | IN= 2---> OUT= 1 |
 | DT=  5.0 min     |      OUTFLOW    STORAGE   |  OUTFLOW    STORAGE
 --------------------       (cms)     (ha.m.)   |   (cms)     (ha.m.)
                           0.0000     0.0000    |  0.3000      0.2852

                          AREA    QPEAK    TPEAK      R.V.
                          (ha)    (cms)    (hrs)      (mm)
   INFLOW : ID= 2 (  0103)  13.550    0.832    3.25     23.15
   OUTFLOW: ID= 1 (  0019)  13.550    0.184    4.25     23.14

                PEAK   FLOW   REDUCTION [Qout/Qin](%)= 22.16
                TIME SHIFT OF PEAK FLOW         (min)= 60.00
                MAXIMUM  STORAGE   USED       (ha.m.)=  0.1755

 --------------------------------------------------------------------------------
 ====================================================================================================
 =====

        V    V   I    SSSSS  U   U    A    L
        V    V   I    SS     U   U   A A   L
         V  V    I     SS    U   U  AAAAA  L
         V  V    I      SS   U   U  A   A  L
          VV     I    SSSSS  UUUUU  A   A  LLLLL

         OOO   TTTTT  TTTTT  H   H  Y   Y  M   M   OOO     TM
        O   O    T      T    H   H   Y Y   MM MM  O   O
        O   O    T      T    H   H    Y    M   M  O   O
         OOO     T      T    H   H    Y    M   M   OOO
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                    *****  D E T A I L E D   O U T P U T *****


   Input   filename: C:\Program Files (x86)\Visual OTTHYMO 5.0\VO2\voin.dat
   Output  filename: C:\Users\JJohnston\AppData\Local\Civica\VH5\9f0d15d2-7934-48cd-bc46-
 458c27b77161\de7e4068-15c9-4c5d-908e-5432b45d7439\sc
   Summary filename: C:\Users\JJohnston\AppData\Local\Civica\VH5\9f0d15d2-7934-48cd-bc46-
 458c27b77161\de7e4068-15c9-4c5d-908e-5432b45d7439\sc


 DATE: 02/13/2018                          TIME: 12:10:52

 USER:



 COMMENTS:


 ----------------------------------------------------------------------------------------------------
 -----
   **********************************************
   ** SIMULATION : Run 08- 100yr 24hr SCS        **
   **********************************************
```

```
 --------------------
 |   READ STORM      |     Filename: C:\Users\JJohnston\AppD
 |                   |               ata\Local\Temp\
 |                   |               3ecfa3ff-1a79-42a3-9f8d-422d0209edf1\526453a5
 | Ptotal=127.50 mm  |     Comments: 100yr 24hr 5min SCS
 --------------------
```

TIME hrs	RAIN mm/hr	TIME hrs	RAIN mm/hr	TIME hrs	RAIN mm/hr	TIME hrs	RAIN mm/hr
0.08	0.00	6.17	2.30	12.25	18.36	18.33	2.30
0.17	1.40	6.25	2.30	12.33	18.36	18.42	2.30
0.25	1.40	6.33	2.30	12.42	18.36	18.50	2.30
0.33	1.40	6.42	2.30	12.50	18.36	18.58	2.30
0.42	1.40	6.50	2.30	12.58	18.36	18.67	2.30
0.50	1.40	6.58	2.30	12.67	9.44	18.75	2.30
0.58	1.40	6.67	2.30	12.75	9.44	18.83	2.30
0.67	1.40	6.75	2.30	12.83	9.44	18.92	2.30
0.75	1.40	6.83	2.30	12.92	9.44	19.00	2.30
0.83	1.40	6.92	2.30	13.00	9.44	19.08	2.30
0.92	1.40	7.00	2.30	13.08	9.44	19.17	2.30
1.00	1.40	7.08	2.30	13.17	6.89	19.25	2.30
1.08	1.40	7.17	2.81	13.25	6.89	19.33	2.30
1.17	1.40	7.25	2.81	13.33	6.89	19.42	2.30
1.25	1.40	7.33	2.81	13.42	6.89	19.50	2.30
1.33	1.40	7.42	2.81	13.50	6.89	19.58	2.30
1.42	1.40	7.50	2.81	13.58	6.89	19.67	2.30
1.50	1.40	7.58	2.81	13.67	5.36	19.75	2.30
1.58	1.40	7.67	2.81	13.75	5.36	19.83	2.30
1.67	1.40	7.75	2.81	13.83	5.36	19.92	2.30
1.75	1.40	7.83	2.81	13.92	5.36	20.00	2.30
1.83	1.40	7.92	2.81	14.00	5.36	20.08	2.30
1.92	1.40	8.00	2.81	14.08	5.36	20.17	1.53
2.00	1.40	8.08	2.81	14.17	3.83	20.25	1.53
2.08	1.40	8.17	3.32	14.25	3.83	20.33	1.53
2.17	1.66	8.25	3.32	14.33	3.83	20.42	1.53
2.25	1.66	8.33	3.32	14.42	3.83	20.50	1.53
2.33	1.66	8.42	3.32	14.50	3.83	20.58	1.53
2.42	1.66	8.50	3.32	14.58	3.83	20.67	1.53
2.50	1.66	8.58	3.32	14.67	3.83	20.75	1.53
2.58	1.66	8.67	3.57	14.75	3.83	20.83	1.53
2.67	1.66	8.75	3.57	14.83	3.83	20.92	1.53
2.75	1.66	8.83	3.57	14.92	3.83	21.00	1.53
2.83	1.66	8.92	3.57	15.00	3.83	21.08	1.53
2.92	1.66	9.00	3.57	15.08	3.83	21.17	1.53
3.00	1.66	9.08	3.57	15.17	3.83	21.25	1.53
3.08	1.66	9.17	4.08	15.25	3.83	21.33	1.53
3.17	1.66	9.25	4.08	15.33	3.83	21.42	1.53
3.25	1.66	9.33	4.08	15.42	3.83	21.50	1.53
3.33	1.66	9.42	4.08	15.50	3.83	21.58	1.53
3.42	1.66	9.50	4.08	15.58	3.83	21.67	1.53
3.50	1.66	9.58	4.08	15.67	3.83	21.75	1.53
3.58	1.66	9.67	4.59	15.75	3.83	21.83	1.53
3.67	1.66	9.75	4.59	15.83	3.83	21.92	1.53
3.75	1.66	9.83	4.59	15.92	3.83	22.00	1.53
3.83	1.66	9.92	4.59	16.00	3.83	22.08	1.53
3.92	1.66	10.00	4.59	16.08	3.83	22.17	1.53
4.00	1.66	10.08	4.59	16.17	2.30	22.25	1.53
4.08	1.66	10.17	5.86	16.25	2.30	22.33	1.53
4.17	2.04	10.25	5.86	16.33	2.30	22.42	1.53
4.25	2.04	10.33	5.86	16.42	2.30	22.50	1.53
4.33	2.04	10.42	5.86	16.50	2.30	22.58	1.53
4.42	2.04	10.50	5.86	16.58	2.30	22.67	1.53
4.50	2.04	10.58	5.86	16.67	2.30	22.75	1.53
4.58	2.04	10.67	7.91	16.75	2.30	22.83	1.53
4.67	2.04	10.75	7.91	16.83	2.30	22.92	1.53
4.75	2.04	10.83	7.91	16.92	2.30	23.00	1.53
4.83	2.04	10.92	7.91	17.00	2.30	23.08	1.53
4.92	2.04	11.00	7.91	17.08	2.30	23.17	1.53
5.00	2.04	11.08	7.91	17.17	2.30	23.25	1.53
5.08	2.04	11.17	12.24	17.25	2.30	23.33	1.53
5.17	2.04	11.25	12.24	17.33	2.30	23.42	1.53
5.25	2.04	11.33	12.24	17.42	2.30	23.50	1.53
5.33	2.04	11.42	12.24	17.50	2.30	23.58	1.53
5.42	2.04	11.50	12.24	17.58	2.30	23.67	1.53
5.50	2.04	11.58	12.24	17.67	2.30	23.75	1.53
5.58	2.04	11.67	37.74	17.75	2.30	23.83	1.53
5.67	2.04	11.75	37.74	17.83	2.30	23.92	1.53
5.75	2.04	11.83	37.74	17.92	2.30	24.00	1.53
5.83	2.04	11.92	156.06	18.00	2.30	24.08	1.53
5.92	2.04	12.00	156.06	18.08	2.30		
6.00	2.04	12.08	156.06	18.17	2.30		
6.08	2.04	12.17	18.36	18.25	2.30		

```
 --------------------------------------------------------------------------------
```

```
--------------------
| CALIB             |
| NASHYD   (  0100)|   Area    (ha)=   3.31   Curve Number   (CN)= 65.0
|ID= 1 DT= 5.0 min |   Ia      (mm)=  10.00   # of Linear Res.(N)= 3.00
--------------------   U.H. Tp(hrs)=   0.12

     Unit Hyd Qpeak  (cms)=   1.081

     PEAK FLOW       (cms)=   0.634 (i)
     TIME TO PEAK    (hrs)=  12.083
     RUNOFF VOLUME    (mm)=  53.502
     TOTAL RAINFALL   (mm)= 127.500
     RUNOFF COEFFICIENT   =   0.420

     (i) PEAK FLOW DOES NOT INCLUDE BASEFLOW IF ANY.

------------------------------------------------------------------------------
--------------------
| RESERVOIR(  0016)|
| IN= 2---> OUT= 1 |
| DT=  5.0 min     |     OUTFLOW    STORAGE   |  OUTFLOW    STORAGE
--------------------      (cms)     (ha.m.)   |   (cms)     (ha.m.)
                          0.0000     0.0000   |   8.4600      0.2001
                          0.0010     0.2000   |   0.0000      0.0000

                                AREA     QPEAK     TPEAK       R.V.
                                (ha)     (cms)     (hrs)       (mm)
   INFLOW : ID= 2 (  0100)      3.310      0.634     12.08      53.50
   OUTFLOW: ID= 1 (  0016)      3.310      0.001     24.33      12.85

                   PEAK   FLOW   REDUCTION [Qout/Qin](%)=  0.14
                   TIME SHIFT OF PEAK FLOW         (min)=735.00
                   MAXIMUM  STORAGE   USED       (ha.m.)=  0.1738

------------------------------------------------------------------------------
--------------------
| CALIB             |
| NASHYD   (  0101)|   Area    (ha)=   3.09   Curve Number   (CN)= 65.0
|ID= 1 DT= 5.0 min |   Ia      (mm)=  10.00   # of Linear Res.(N)= 3.00
--------------------   U.H. Tp(hrs)=   0.23

     Unit Hyd Qpeak  (cms)=   0.504

     PEAK FLOW       (cms)=   0.390 (i)
     TIME TO PEAK    (hrs)=  12.167
     RUNOFF VOLUME    (mm)=  54.242
     TOTAL RAINFALL   (mm)= 127.500
     RUNOFF COEFFICIENT   =   0.425

     (i) PEAK FLOW DOES NOT INCLUDE BASEFLOW IF ANY.

------------------------------------------------------------------------------
--------------------
| RESERVOIR(  0017)|
| IN= 2---> OUT= 1 |
| DT=  5.0 min     |     OUTFLOW    STORAGE   |  OUTFLOW    STORAGE
--------------------      (cms)     (ha.m.)   |   (cms)     (ha.m.)
                          0.0000     0.0000   |   0.1800      0.0457

                                AREA     QPEAK     TPEAK       R.V.
                                (ha)     (cms)     (hrs)       (mm)
   INFLOW : ID= 2 (  0101)      3.090      0.390     12.17      54.24
   OUTFLOW: ID= 1 (  0017)      3.090      0.179     12.58      54.22

                   PEAK   FLOW   REDUCTION [Qout/Qin](%)= 46.01
                   TIME SHIFT OF PEAK FLOW         (min)= 25.00
                   MAXIMUM  STORAGE   USED       (ha.m.)=  0.0457

------------------------------------------------------------------------------
--------------------
| CALIB             |
| NASHYD   (  0102)|   Area    (ha)=   7.19   Curve Number   (CN)= 53.0
|ID= 1 DT= 5.0 min |   Ia      (mm)=  10.00   # of Linear Res.(N)= 3.00
--------------------   U.H. Tp(hrs)=   0.33

     Unit Hyd Qpeak  (cms)=   0.842

     PEAK FLOW       (cms)=   0.512 (i)
     TIME TO PEAK    (hrs)=  12.250
     RUNOFF VOLUME    (mm)=  40.270
     TOTAL RAINFALL   (mm)= 127.500
     RUNOFF COEFFICIENT   =   0.316

     (i) PEAK FLOW DOES NOT INCLUDE BASEFLOW IF ANY.

------------------------------------------------------------------------------
```

```
--------------------
| RESERVOIR(  0018)|
| IN= 2---> OUT= 1 |
| DT=  5.0 min     |     OUTFLOW    STORAGE   |  OUTFLOW    STORAGE
--------------------      (cms)     (ha.m.)   |   (cms)     (ha.m.)
                          0.0000     0.0000   |   5.6800      0.5001
                          0.0010     0.1598   |   0.0000      0.0000

                                AREA     QPEAK     TPEAK       R.V.
                                (ha)     (cms)     (hrs)       (mm)
   INFLOW : ID= 2 (  0102)      7.190      0.512     12.25      40.27
   OUTFLOW: ID= 1 (  0018)      7.190      0.095     13.42      24.10

                   PEAK   FLOW   REDUCTION [Qout/Qin](%)= 18.59
                   TIME SHIFT OF PEAK FLOW         (min)= 70.00
                   MAXIMUM  STORAGE   USED       (ha.m.)=  0.1655

------------------------------------------------------------------------------
--------------------
| CALIB             |
| NASHYD   (  0103)|   Area    (ha)=  13.55   Curve Number   (CN)= 61.0
|ID= 1 DT= 5.0 min |   Ia      (mm)=  10.00   # of Linear Res.(N)= 3.00
--------------------   U.H. Tp(hrs)=   0.28

     Unit Hyd Qpeak  (cms)=   1.829

     PEAK FLOW       (cms)=   1.342 (i)
     TIME TO PEAK    (hrs)=  12.250
     RUNOFF VOLUME    (mm)=  49.303
     TOTAL RAINFALL   (mm)= 127.500
     RUNOFF COEFFICIENT   =   0.387

     (i) PEAK FLOW DOES NOT INCLUDE BASEFLOW IF ANY.

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| RESERVOIR(  0019)|
| IN= 2---> OUT= 1 |
| DT=  5.0 min     |     OUTFLOW    STORAGE   |  OUTFLOW    STORAGE
--------------------      (cms)     (ha.m.)   |   (cms)     (ha.m.)
                          0.0000     0.0000   |   0.3000      0.2852

                                AREA     QPEAK     TPEAK       R.V.
                                (ha)     (cms)     (hrs)       (mm)
   INFLOW : ID= 2 (  0103)     13.550      1.342     12.25      49.30
   OUTFLOW: ID= 1 (  0019)     13.550      0.300     13.08      49.29

                   PEAK   FLOW   REDUCTION [Qout/Qin](%)= 22.35
                   TIME SHIFT OF PEAK FLOW         (min)= 50.00
                   MAXIMUM  STORAGE   USED       (ha.m.)=  0.2852

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 FINISH
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APPENDIX D
Statement of Limiting Conditions and Assumptions

Statement of Limiting Conditions and Assumptions

1. This Report/Study (the "Work") has been prepared at the request of, and for the exclusive use of, the Owner, and its affiliates (the "Intended Users"). No one other than the Intended Users has the right to use and rely on the Work without first obtaining the written authorization of Cole Engineering Group Ltd. (Cole Engineering) and its Owner.

2. Cole Engineering expressly excludes liability to any party except the Intended Users for any use of, and/or reliance upon, the Work.

3. Cole Engineering notes that the following assumptions were made in completing the Work:

   a) the land use description(s) supplied to us are correct;
   b) the surveys and data supplied to Cole Engineering by the Owner are accurate;
   c) market timing, approval delivery and secondary source information is within the control of Parties other than Cole Engineering; and
   d) there are no encroachments, leases, covenants, binding agreements, restrictions, pledges, charges, liens or special assessments outstanding, or encumbrances which would significantly affect the use or servicing.

   Investigations have not been carried out to verify these assumptions. Cole Engineering deems the sources of data and statistical information contained herein to be reliable, but we extend no guarantee of accuracy in these respects.

4. Cole Engineering accepts no responsibility for legal interpretations, questions of survey, opinion of title, hidden or inconspicuous conditions of the property, toxic wastes or contaminated materials, soil or sub-soil conditions, environmental, engineering or other factual and technical matters disclosed by the Owner, the Client, or any public agency, which by their nature, may change the outcome of the Work. Such factors, beyond the scope of this Work, could affect the findings, conclusions and opinions rendered in the Work. We have made disclosure of related potential problems that have come to our attention. Responsibility for diligence with respect to all matters of fact reported herein rests with the Intended Users.

5. Cole Engineering practices engineering in the general areas of infrastructure and transportation. It is not qualified to and is not providing legal or planning advice in this Work.

6. The legal description of the property and the area of the site were based upon surveys and data supplied to us by the Owner. The plans, photographs, and sketches contained in this report are included solely to aide in visualizing the location of the property, the configuration and boundaries of the site, and the relative position of the improvements on the said lands.

7. We have made investigations from secondary sources as documented in the Work, but we have not checked for compliance with by-laws, codes, agency and governmental regulations, etc., unless specifically noted in the Work.

8. Because conditions, including capacity, allocation, economic, social, and political factors change rapidly and, on occasion, without notice or warning, the findings of the Work expressed herein, are as of the date of the Work and cannot necessarily be relied upon as of any other date without subsequent advice from Cole Engineering.

9. The value of proposed improvements should be applied only with regard to the purpose and function of the Work, as outlined in the body of this Work. Any cost estimates set out in the Work are based on construction averages and subject to change.

10. Neither possession of the Work, nor a copy of it, carries the right of publication. All copyright in the Work is reserved to Cole Engineering. The Work shall not be disclosed, produced or reproduced, quoted from, or referred to, in whole or in part, or published in any manner, without the express written consent of Cole Engineering and the Owner.

11. The Work is only valid if it bears the professional engineer's seal and original signature of the author, and if considered in its entirety. Responsibility for unauthorized alteration to the Work is denied.