DRAINAGE STUDY

For

TERRACE HILL DRIVE

EL CAJON, CA 92020
PDS 2015-TM-5599

Prepared for**:**

Sky Terrace
1000 Pioneer Way
El Cajon, Ca 92020
(619) 977-1552

Prepared by:

Bruce Robertson
REC Consultants, Inc
2442 Second Avenue
San Diego, CA 92101
Telephone: 619-232-9200

Report Prepared:

October 7, 2016

Table of Contents

CHAPTER 1 - EXECUTIVE SUMMARY 1
1.1 – Introduction 1
1.2 – Summary of Existing Conditions 2
1.3 – Summary of Developed Conditions 3
1.4 – Summary of Results 5
1.5 – Conclusions 6
1.6 – References 8
1.7 – Declaration of Responsible Charge 9
CHAPTER 2 - METHODOLOGY 10
2.1 – County of San Diego Design Criteria 10
2.2 – Design Rainfall Determination 11
2.2.1 – 100-Year, 6-Hour Rainfall Isopluvial Map 11
2.2.2 – 100-Year, 24-Hour Rainfall Isopluvial Map 12
2.3 – Runoff Coefficient Determination 13
2.4 – Urban Watershed Overland Time of Flow Nomograph 16
2.5 – County of San Diego Intensity- Duration Curve 18
2.6 – Model Development Summary (from County of San Diego Hydrology Manual) 19
CHAPTER 3 - 100 YEAR HYDROLOGIC ANALYSIS FOR EXISTING CONDITIONS 25
CHAPTER 4 - 100 YEAR HYDROLOGIC ANALYSIS FOR DEVELOPED CONDITIONS - UNMITIGATED . 31
CHAPTER 5 - 100 YEAR HYDROLOGIC ANALYSIS FOR DEVELOPED CONDITIONS - MITIGATED 51
CHAPTER 6 - MODIFIED-PULS DETENTION ROUTING 71
6.1 – Rational Method Hydrograph 71
6.2 – Stage-Storage & Stage-Discharge Relationships 73
6.3 – HEC-HMS Modified-Puls Routing Results 76
CHAPTER 7 - HYDROLOGY MAPS 107
CHAPTER 8 - APPENDICES 110

List of Tables

Table 1 – SUMMARY OF EXISTING CONDITIONS FLOWS 2
Table 2 – SUMMARY OF DEVELOPED CONDITIONS FLOWS 3
Table 3 – SUMMARY OF BMP BASIN DIMENSIONS 4
Table 4 – SUMMARY OF OUTLET DETAILS 4
Table 5 – SUMMARY OF DETENTION BASIN ROUTING 4
Table 7 – SUMMARY OF PEAK FLOWS 5

CHAPTER 1 - EXECUTIVE SUMMARY

1.1 – Introduction

The Terrace Hill Drive project site is located at the end of Terrace Hill Drive in the City of El Cajon, County of San Diego, California.

Runoff from the site drains to two (2) locations. For drainage analysis, two (2) points of discharge (POD) have been designated within the project site for hydrologic analysis purposes.

This study analyzes existing and developed condition 100-year peak flowrates from the development to the PODs-from the project site.

The project site lies outside any FEMA 100-year floodplain zones. Therefore, no Letters of Map Revision will be required. The corresponding FEMA map is provided.

Treatment of storm water runoff from the site has been addressed in a separate report - the “Storm Water Quality Management Plan for Terrace Hill Drive”, dated June 2016 by REC.

Per County of San Diego drainage criteria, the Modified Rational Method should be used to determine peak design flowrates when the contributing drainage area is less than 1.0 square mile. Since the total watershed area discharging from the site is less than 1.0 square mile, CivilD computer software was used to model the pre & post developed condition runoff response per the Modified Rational Method.

Methodology used for the computation of design rainfall events, runoff coefficients, and rainfall intensity values are consistent with criteria set forth in the “County of San Diego Drainage Design Manual”. A more detailed explanation of methodology used for this analysis is listed in Chapter 2 of this report.

Developed condition peak flows were calculated using CivilD. The corresponding hydrographs were generated using the RickRat Hydro program by Rick Engineering. Hydraulic Modified-Puls detention basin routing of the CivilD rational method hydrology was performed using the Army Corps of Engineers HEC-HMS 4.0 software.

1.2 – Summary of Existing Conditions

In existing conditions, the Terrace Hill Drive project site is primarily undeveloped and vacant. The project site also receives run on from a portion of an offsite road/cul-de-sac.

Runoff from the existing site drains to two (2) PODs. POD-1 is a natural drainage path at the northwest corner of the project site. POD-2 is an existing 12" CMP stormdrain located at the southern boundary. The project site ultimately drains to the receiving Forester Creek located approximately 1 mile south of the project site.

Per County of San Diego criteria: 0.25 (Type B soils, undeveloped) was the assumed runoff coefficient assumed for the area tributary to POD-1. 0.25 (Type B soils, undeveloped) and 0.95 (street) were the assumed runoff coefficients for the area tributary to POD-1. Per County of San Diego rainfall isopluvial maps, the design 100-year rainfall depth for the project site is 2.70 inches.

Table 1 below summarizes the existing condition design 100-year peak flow from the project site.

Table 1 – SUMMARY OF EXISTING CONDITIONS FLOWS

Discharge Location	Drainage Area (Ac)	Runoff Coefficient (C)	100-Year Peak Flow (cfs)
POD-1	0.61	0.25	0.74
POD-2	2.18	0.25	2.47*
POD-2-OFFSITE	0.08	0.95	0.50
Total**	**2.87**	**-**	**3.21**

*=Value includes the flow from POD-2-OFFSITE.
**=Total does not include the 0.50cfs in order to avoid double counting.

1.3 – Summary of Developed Conditions

The Terrace Hill Drive project proposes the construction of multiple-single family residences, roads and associated landscaping. The adjacent cul-de-sac will drain as in existing conditions.

The tributary areas draining to POD-1 and POD-2 will remain as in existing conditions. Runoff from tributary area to POD-1 will overland flow to a multiple purpose onsite biofiltration best management practice (BMP) detention facility. Runoff from tributary area to POD-2 will be conveyed to a proposed BMP via a proposed stormdrain network. These basins serve to meet water quality and peak flow reduction requirements for the project site.

The project proposes a total of nine (9) dwelling units (DU) over the 2.3 acre (A) for a ratio of 3.9 DU/A. Per County of San Diego criteria: 0.45 (Type B soils, 4.3 DU/A or less) was the assumed runoff coefficient. Per County of San Diego rainfall isopluvial maps, the design 100-year rainfall depth for the project site is 2.70 inches.

Table 2 below summarizes the developed condition design 100-year peak flow from the project site.

Table 2 – SUMMARY OF UNMITIGATED - DEVELOPED CONDITIONS FLOWS

Discharge Location	Drainage Area (Ac)	Runoff Coefficient (C)	100-Year Peak Flow (cfs)
POD-1	0.61	0.45	1.61
POD-2	2.18	0.45	4.05*
POD-2-OFFSITE	0.08	0.95	0.50
Total**	**2.87**	**-**	**5.66**

*=Value includes the flow from POD-2-OFFSITE.
**=Total does not include the 0.50cfs in order to avoid double counting.

Prior to discharging from the project site, first flush runoff will be treated via one (1) infiltration and one (1) biofiltration based BMP in accordance with standards set forth by the Regional Water Quality Control Board and the County of San Diego's BMP Design Manual (see "Storm Water Quality Management Plan for Terrace Hill Drive").

One LID infiltration basin and one biofiltration basin (for a total of 2 BMPs) are located within the project site and are responsible for handling hydromodification requirements for the project. In developed conditions, the basins will have a surface depth and a riser spillway structure (see dimensions in Table 3). For the infiltration basin, flows will infiltrate the permeable soil and high flows will then discharge from the basins via the outlet structure. For the biofiltration basin, flows will infiltrate through the surface of the facility to the receiving amended soil and low flow orifice. The riser structure will act as a spillway such that peak flows can be safely discharged to the receiving storm drain system.

In regards to BMP-2, beneath the basin's invert lays the proposed LID biofiltration portion of the drainage facility. This portion of the basin is comprised of a 3-inch layer of mulch, an 18-inch layer of amended soil (a highly sandy, organic rich composite with an infiltration capacity of at least 5 inches/hr) and a layer of gravel. BMP 2 will be lined to prevent infiltration due to geotechnical concerns.

Table 3 – SUMMARY OF BMP BASIN DIMENSIONS

BMP	Tributary Area (Ac)	DIMENSIONS					
		BMP Area[(1)], (ft^2)	Low Flow Orifice (in)	Gravel Depth (in)	Depth to Riser Invert (ft)[(2)]	Weir Perimeter Length[(3)] (ft)	Total Surface Depth[(4)] (ft)
BMP 1	0.59	1086	n/a	2	2.25	8	3.00
BMP 2	2.07	1866	0.75	12	2.33	8	3.00

Notes: (1): Area of amended soil = area of gravel = area of the BMP
(2): Depth of ponding beneath riser structure's surface spillway.
(3): Overflow length, the internal perimeter of the riser is 8 ft (2 ft x 2 ft internal dimensions)
(4): Total surface depth of BMP from top crest elevation to surface invert.

Table 4 – SUMMARY OF OUTLET DETAILS

BMP	Low Orifices			Lower Slot		Top Riser	
	#	Dia. (ft)	Elev.[(1)] (ft)	B x h [(3)] (in)	Elev.[(1)] (ft)	Length[(2)] (ft)	Elev.[(1)] (ft)
BMP-1	n/a	n/a	n/a	12 x 1.5	0.75	8	2.25
BMP-2	3	0.50	0.50	24 x 2	1.75	8	2.33

Notes: (1): Basin ground surface elevation assumed to be 0.00 ft elevation.
(2): Overflow length is the internal perimeter of the riser structure.
(3): Slot width B, can be distribute along two sides of square outlet structure.

The developed condition peak flows were calculated using the modified rational. The corresponding hydrographs were generated using the RickRat Hydro program by Rick Engineering. These hydrographs were then routed through the proposed on-site detention facilities in HEC-HMS. The HMS Modified-Puls results are summarized in Table 5.

Table 5 – SUMMARY OF DETENTION BASIN ROUTING

Detention Basin	100-Year Peak Inflow (cfs)	100-Year Peak Outflow (cfs)	Peak Water Surface Elevation (ft)[(1)]
Basin 1	1.58	0.53	0.56
Basin 2	3.90	2.32	1.81

(1) : Biofiltration layer included as part of basin depth – volume reduced by voids accordingly

It should be noted that as a conservative design approach, it has been assumed that the design capture volume was stored in the detention facilities prior to the routing of the 100-year event storm. The volumes are a conservative hydraulic design methodology only – for water quality discussion and BMP sizing analysis, please refer to the site specific SWQMP.

Additionally, as the detention facilities are multiple-purpose water quality BMPs, there is available storage provided in the biofiltration layers of the basins – namely the engineered fill soil layer and the underlying gravel base layer. As HEC-HMS uses an elevation-storage-discharge function to model the basin volume (stage-storage) and basin discharge (stage-discharge) relationships, the available storage volume provided by these aforementioned sub-layers is accounted for by reducing the total sub-basin volume by the corresponding void ratio for each layer (0.4 for gravel and 0.3 for soil respectively).

Rational method hydrographs, stage-storage, stage-discharge relationships and HEC-HMS model output is provided in Chapter 6 of this report

1.4 – Summary of Results

Table 6 summarizes developed and existing condition drainage areas and resultant 100-year peak flow rates at the POD-discharge locations from the Terrace Hills site. Per County of San Diego rainfall isopluvial maps, the design 100-year rainfall depth for the site area is 2.70 inches.

Table 6 – SUMMARY OF PEAK FLOWS

Discharge Location	Area (ac)			100 Year Peak Flow (cfs)		
	Existing	Developed	Difference	Existing	Developed	Difference
POD-1	0.61	0.61	-	0.74	0.55	-0.19
POD-2	2.26	2.26	-	2.47	2.44	-0.03
Total	**2.87**	**2.87**	-	3.21	2.99	-0.22

As shown in the above table, the proposed Terrace Hill Drive project site will result in a net decrease of peak flow discharged from the project site by approximately 0.22 cfs.

All developed runoff will receive water quality treatment in accordance with the site specific SWQMP.

Final design details will be provided at the final engineering phase of the development.

1.5 – Conclusions

This report has been prepared in accordance with the County of San Diego Hydrology Manual. This report has evaluated and addressed the potential impacts and proposed mitigation measures. A summary of the facts and findings associated with this project and the measures addressed by this report is as follows:

- The project will not alter drainage patterns on the site or increase runoff after development.
- The ultimate discharge points will not be changed.
- Graded areas and slopes will be hydroseeded to reduce or eliminate sediment discharge.
- Identify and discuss, with appropriate backup/research information, the following question item by item for CEQA purposes. Would the project:

A. Substantially alter the existing drainage patterns of the site or area, including through the alteration if the course of a stream or river, in a manner which would result in substantial erosion or siltation on – or off-site?

The project does not substantially alter the existing drainage pattern of the area and does not alter the course of a stream or river.
The storm drain system for the entire project is designed to route and convey all resulting runoff from developed conditions to existing points of discharge.

B. Substantially alter the existing drainage patterns of the site or area, including through the alteration of the course of a stream or river, or substantially increase the rate or amount of surface runoff in a manner which would result in flooding on- or off-site?

The project will not substantially alter the existing drainage pattern of the area as it will not alter the course of a stream or river, and also will not substantially increase the rate or amount of surface runoff in a manner which would result in on- or off-site flooding.

C. Create or contribute runoff water which would exceed the capacity of existing or planned storm water drainage systems?

No. All project discharge points release water at rates less than or equal to existing conditions.

D. Place housing within a 100-year flood hazard area as mapped on a federal Flood Hazard Boundary or Flood insurance Rate Map or other flood hazard delineation map, including County Floodplain Maps? For example; research the foregoing and provide same (to indicate applicability or not) in the study?

The project does not place any housing within a 100-year flood hazard area.

E. Place within a 100-year flood hazard area structures which would impede or redirect flood flows?

There are no structures proposed within a 100-year flood hazard area.

F. Expose people or structures to a significant risk of loss, injury or death involving flooding, including flooding as a result of the failure of a levee or dam on-sit or off-site?

NA

1.6 – References

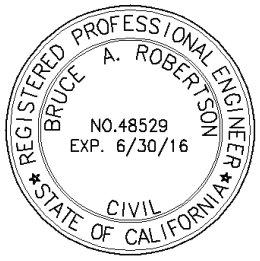
"*County of San Diego Hydrology Manual*", June 2003

"*Stormwater Quality Management Plan for Terrace Hill Drive*", dated June 2016 by REC Consultants.

"*Technical Memorandum: SWMM Modeling for Terrace Hill Drive*", dated June 2016 by REC Consultants

1.7 – Declaration of Responsible Charge

THIS PRELIMINARY DRAINAGE STUDY HAS BEEN PREPARED UNDER THE DIRECTION OF THE FOLLOWING REGISTERED CIVIL ENGINEER. THE REGISTERED ENGINEER ATTESTS TO THE TECHNICAL INFORMATION CONTAINED HEREIN AND THE ENGINEERING DATA UPON WHICH RECOMMENDATIONS, CONCLUSIONS, AND DECISIONS ARE BASED.



Bruce A. Robertson R.C.E. 48529

CHAPTER 2 - METHODOLOGY

2.1 – County of San Diego Design Criteria

SECTION 3
RATIONAL METHOD AND MODIFIED RATIONAL METHOD

3.1 THE RATIONAL METHOD

The Rational Method (RM) is a mathematical formula used to determine the maximum runoff rate from a given rainfall. It has particular application in urban storm drainage, where it is used to estimate peak runoff rates from small urban and rural watersheds for the design of storm drains and small drainage structures. The RM is recommended for analyzing the runoff response from drainage areas up to approximately 1 square mile in size. It should not be used in instances where there is a junction of independent drainage systems or for drainage areas greater than approximately 1 square mile in size. In these instances, the Modified Rational Method (MRM) should be used for junctions of independent drainage systems in watersheds up to approximately 1 square mile in size (see Section 3.4); or the NRCS Hydrologic Method should be used for watersheds greater than approximately 1 square mile in size (see Section 4).

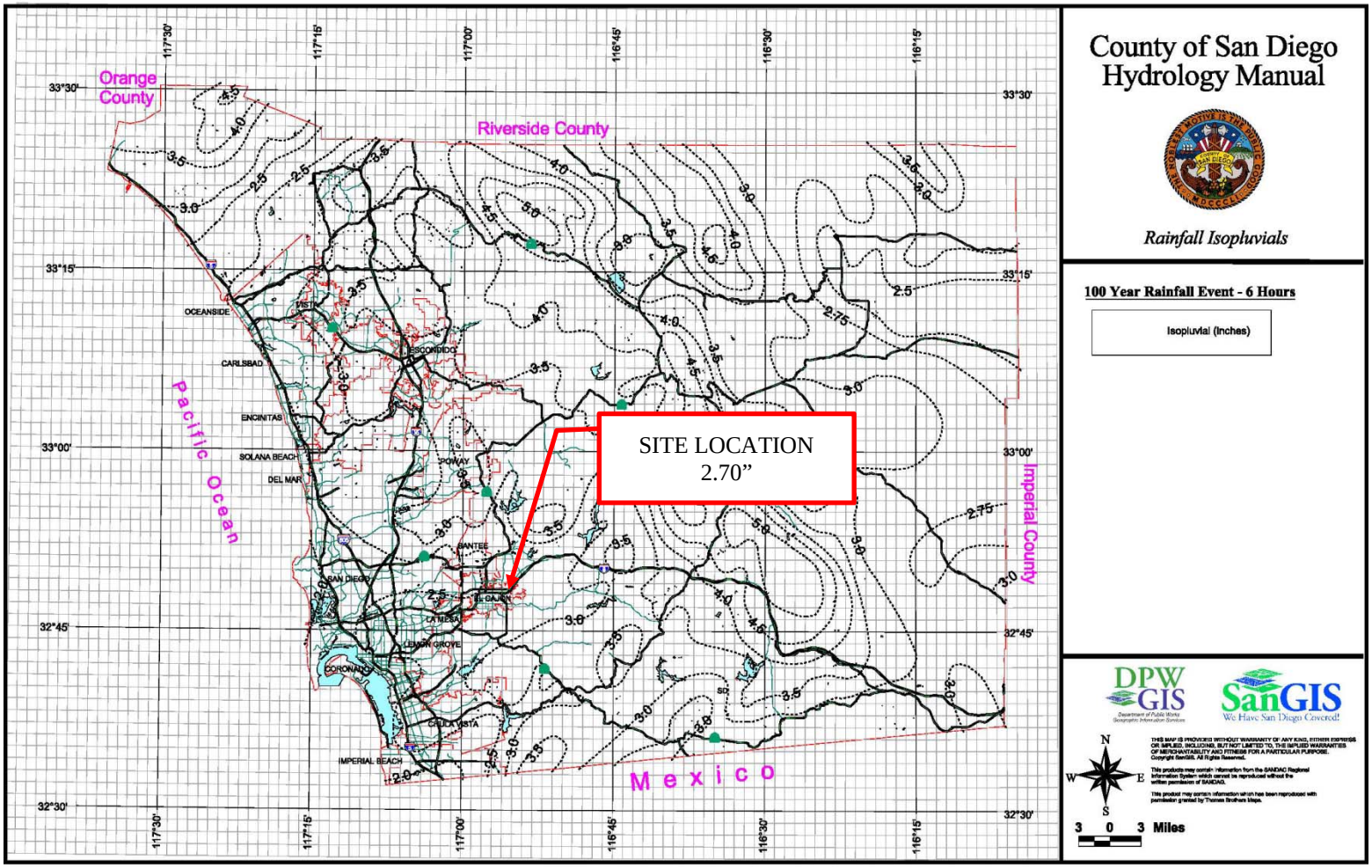
The RM can be applied using any design storm frequency (e.g., 100-year, 50-year, 10-year, etc.). The local agency determines the design storm frequency that must be used based on the type of project and specific local requirements. A discussion of design storm frequency is provided in Section 2.3 of this manual. A procedure has been developed that converts the 6-hour and 24-hour precipitation isopluvial map data to an Intensity-Duration curve that can be used for the rainfall intensity in the RM formula as shown in Figure 3-1. The RM is applicable to a 6-hour storm duration because the procedure uses Intensity-Duration Design Charts that are based on a 6-hour storm duration.

3.1.1 Rational Method Formula

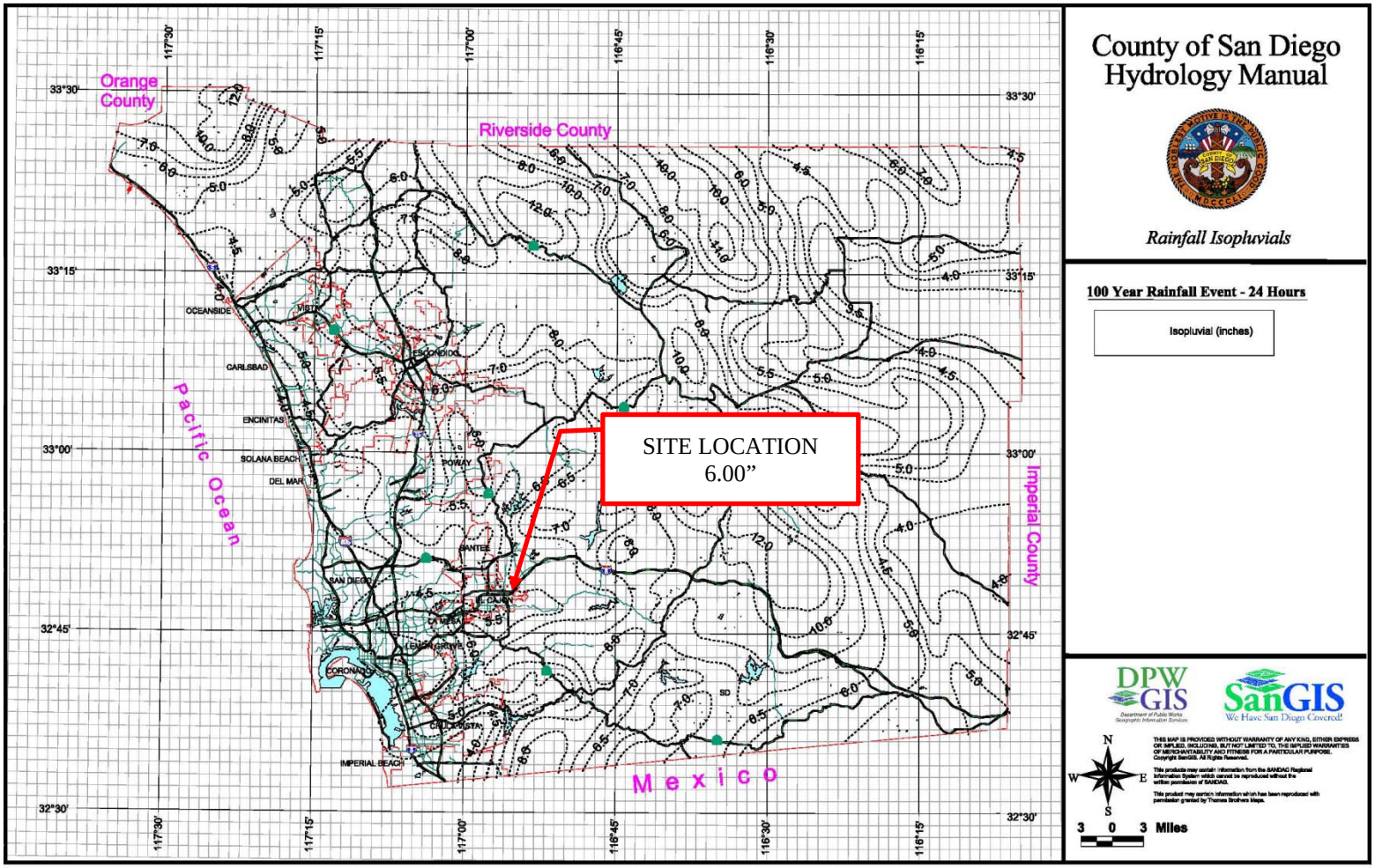
The RM formula estimates the peak rate of runoff at any location in a watershed as a function of the drainage area (A), runoff coefficient (C), and rainfall intensity (I) for a duration equal to the time of concentration (T_c), which is the time required for water to

2.2 – Design Rainfall Determination

2.2.1 – 100-Year, 6-Hour Rainfall Isopluvial Map



2.2.2 – 100-Year, 24-Hour Rainfall Isopluvial Map



2.3 – Runoff Coefficient Determination

Table 3-1
RUNOFF COEFFICIENTS FOR URBAN AREAS

Land Use		Runoff Coefficient "C"				
			Soil Type			
NRCS Elements	County Elements	% IMPER.	A	B	C	D
Undisturbed Natural Terrain (Natural)	Permanent Open Space	0*	0.20	0.25	0.30	0.35
Low Density Residential (LDR)	Residential, 1.0 DU/A or less	10	0.27	0.32	0.36	0.41
Low Density Residential (LDR)	Residential, 2.0 DU/A or less	20	0.34	0.38	0.42	0.46
Low Density Residential (LDR)	Residential, 2.9 DU/A or less	25	0.38	0.41	0.45	0.49
Medium Density Residential (MDR)	Residential, 4.3 DU/A or less	30	0.41	0.45	0.48	0.52
Medium Density Residential (MDR)	Residential, 7.3 DU/A or less	40	0.48	0.51	0.54	0.57
Medium Density Residential (MDR)	Residential, 10.9 DU/A or less	45	0.52	0.54	0.57	0.60
Medium Density Residential (MDR)	Residential, 14.5 DU/A or less	50	0.55	0.58	0.60	0.63
High Density Residential (HDR)	Residential, 24.0 DU/A or less	65	0.66	0.67	0.69	0.71
High Density Residential (HDR)	Residential, 43.0 DU/A or less	80	0.76	0.77	0.78	0.79
Commercial/Industrial (N. Com)	Neighborhood Commercial	80	0.76	0.77	0.78	0.79
Commercial/Industrial (G. Com)	General Commercial	85	0.80	0.80	0.81	0.82
Commercial/Industrial (O.P. Com)	Office Professional/Commercial	90	0.83	0.84	0.84	0.85
Commercial/Industrial (Limited I.)	Limited Industrial	90	0.83	0.84	0.84	0.85
Commercial/Industrial (General I.)	General Industrial	95	0.87	0.87	0.87	0.87

*The values associated with 0% impervious may be used for direct calculation of the runoff coefficient as described in Section 3.1.2 (representing the pervious runoff coefficient, Cp, for the soil type), or for areas that will remain undisturbed in perpetuity. Justification must be given that the area will remain natural forever (e.g., the area is located in Cleveland National Forest).
DU/A = dwelling units per acre
NRCS = National Resources Conservation Service

- The storm frequency of peak discharges is the same as that of I for the given T_c.

- The fraction of rainfall that becomes runoff (or the runoff coefficient, C) is independent of I or precipitation zone number (PZN) condition (PZN Condition is discussed in Section 4.1.2.4).

- The peak rate of runoff is the only information produced by using the RM.

3.1.2 Runoff Coefficient

Table 3-1 lists the estimated runoff coefficients for urban areas. The concepts related to the runoff coefficient were evaluated in a report entitled *Evaluation, Rational Method "C" Values* (Hill, 2002) that was reviewed by the Hydrology Manual Committee. The Report is available at San Diego County Department of Public Works, Flood Control Section and on the San Diego County Department of Public Works web page.

The runoff coefficients are based on land use and soil type. Soil type can be determined from the soil type map provided in Appendix A. An appropriate runoff coefficient (C) for each type of land use in the subarea should be selected from this table and multiplied by the percentage of the total area (A) included in that class. The sum of the products for all land uses is the weighted runoff coefficient (Σ[CA]). Good engineering judgment should be used when applying the values presented in Table 3-1, as adjustments to these values may be appropriate based on site-specific characteristics. In any event, the impervious percentage (% Impervious) as given in the table, for any area, shall govern the selected value for C. The runoff coefficient can also be calculated for an area based on soil type and impervious percentage using the following formula:

$$C = 0.90 \times (\% \text{ Impervious}) + C_p \times (1 - \% \text{ Impervious})$$

Where: C_p = Pervious Coefficient Runoff Value for the soil type (shown in Table 3-1 as Undisturbed Natural Terrain/Permanent Open Space, 0% Impervious). Soil type can be determined from the soil type map provided in Appendix A.

The values in Table 3-1 are typical for most urban areas. However, if the basin contains rural or agricultural land use, parks, golf courses, or other types of nonurban land use that are expected to be permanent, the appropriate value should be selected based upon the soil and cover and approved by the local agency.

2.4 – Urban Watershed Overland Time of Flow Nomograph

Note that the Initial Time of Concentration should be reflective of the general land-use at the upstream end of a drainage basin. A single lot with an area of two or less acres does not have a significant effect where the drainage basin area is 20 to 600 acres.

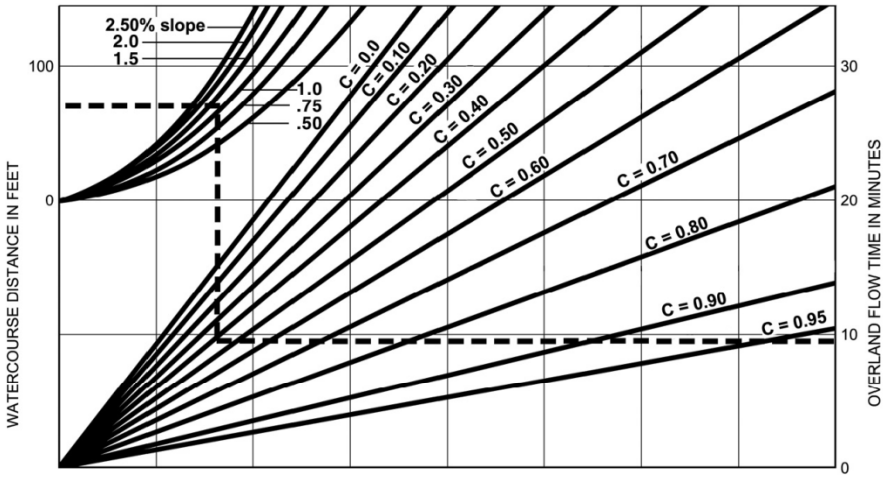
Table 3-2 provides limits of the length (Maximum Length (L_M)) of sheet flow to be used in hydrology studies. Initial T_i values based on average C values for the Land Use Element are also included. These values can be used in planning and design applications as described below. Exceptions may be approved by the "Regulating Agency" when submitted with a detailed study.

Table 3-2

MAXIMUM OVERLAND FLOW LENGTH (L_M)
& INITIAL TIME OF CONCENTRATION (T_i)

Element*	DU/	.5%		1%		2%		3%		5%		10%	
	Acre	L_M	T_i	L_M	T_i	L_M	T_i	L_M	T_i	L_M	T_i	L_M	T_i
Natural		50	13.2	70	12.5	85	10.9	100	10.3	100	8.7	100	6.9
LDR	1	50	12.2	70	11.5	85	10.0	100	9.5	100	8.0	100	6.4
LDR	2	50	11.3	70	10.5	85	9.2	100	8.8	100	7.4	100	5.8
LDR	2.9	50	10.7	70	10.0	85	8.8	95	8.1	100	7.0	100	5.6
MDR	4.3	50	10.2	70	9.6	80	8.1	95	7.8	100	6.7	100	5.3
MDR	7.3	50	9.2	65	8.4	80	7.4	95	7.0	100	6.0	100	4.8
MDR	10.9	50	8.7	65	7.9	80	6.9	90	6.4	100	5.7	100	4.5
MDR	14.5	50	8.2	65	7.4	80	6.5	90	6.0	100	5.4	100	4.3
HDR	24	50	6.7	65	6.1	75	5.1	90	4.9	95	4.3	100	3.5
HDR	43	50	5.3	65	4.7	75	4.0	85	3.8	95	3.4	100	2.7
N. Com		50	5.3	60	4.5	75	4.0	85	3.8	95	3.4	100	2.7
G. Com		50	4.7	60	4.1	75	3.6	85	3.4	90	2.9	100	2.4
O.P./Com		50	4.2	60	3.7	70	3.1	80	2.9	90	2.6	100	2.2
Limited I.		50	4.2	60	3.7	70	3.1	80	2.9	90	2.6	100	2.2
General I.		50	3.7	60	3.2	70	2.7	80	2.6	90	2.3	100	1.9

*See Table 3-1 for more detailed description



EXAMPLE:
Given: Watercourse Distance (D) = 70 Feet
Slope (s) = 1.3%
Runoff Coefficient (C) = 0.41
Overland Flow Time (T) = 9.5 Minutes

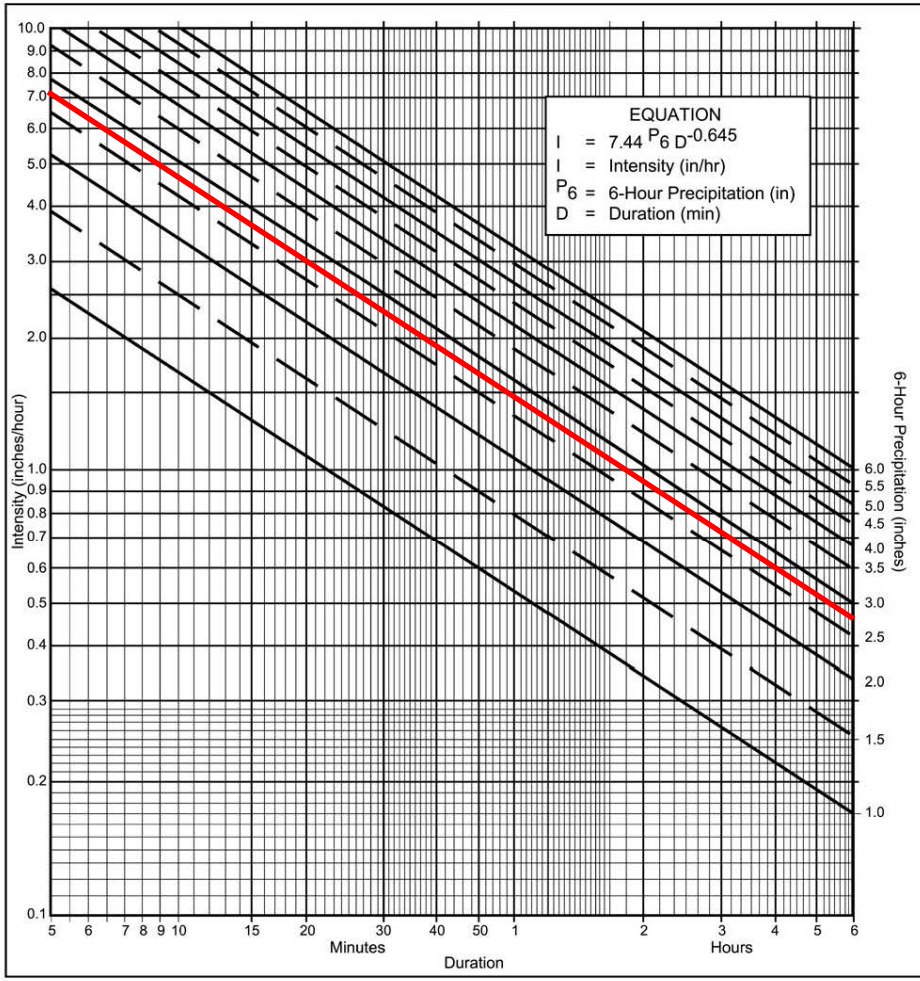
$$T = \frac{1.8\,(1.1-C)\sqrt{D}}{\sqrt[3]{s}}$$

SOURCE: Airport Drainage, Federal Aviation Administration, 1965

Rational Formula - Overland Time of Flow Nomograph

FIGURE 3-3

2.5 – County of San Diego Intensity- Duration Curve



Directions for Application:

(1) From precipitation maps determine 6 hr and 24 hr amounts for the selected frequency. These maps are included in the County Hydrology Manual (10, 50, and 100 yr maps included in the Design and Procedure Manual).

(2) Adjust 6 hr precipitation (if necessary) so that it is within the range of 45% to 65% of the 24 hr precipitation (not applicaple to Desert).

(3) Plot 6 hr precipitation on the right side of the chart.

(4) Draw a line through the point parallel to the plotted lines.

(5) This line is the intensity-duration curve for the location being analyzed.

Application Form:

(a) Selected frequency 100 year

(b) P_6 = 2.7 in., P_{24} = 6.0, $\frac{P_6}{P_{24}}$ = 45 %(2)

(c) Adjusted P_6(2) = _____ in.

(d) t_x = _____ min.

(e) I = _____ in./hr.

Note: This chart replaces the Intensity-Duration-Frequency curves used since 1965.

P6	1	1.5	2	2.5	3	3.5	4	4.5	5	5.5	6
Duration	I	I	I	I	I	I	I	I	I	I	I
5	2.63	3.95	5.27	6.59	7.90	9.22	10.54	11.86	13.17	14.49	15.81
7	2.12	3.18	4.24	5.30	6.36	7.42	8.48	9.54	10.60	11.66	12.72
10	1.68	2.53	3.37	4.21	5.05	5.90	6.74	7.58	8.42	9.27	10.11
15	1.30	1.95	2.59	3.24	3.89	4.54	5.19	5.84	6.49	7.13	7.78
20	1.08	1.62	2.15	2.69	3.23	3.77	4.31	4.85	5.39	5.93	6.46
25	0.93	1.40	1.87	2.33	2.80	3.27	3.73	4.20	4.67	5.13	5.60
30	0.83	1.24	1.66	2.07	2.49	2.90	3.32	3.73	4.15	4.56	4.98
40	0.69	1.03	1.38	1.72	2.07	2.41	2.76	3.10	3.45	3.79	4.13
50	0.60	0.90	1.19	1.49	1.79	2.09	2.39	2.69	2.98	3.28	3.58
60	0.53	0.80	1.06	1.33	1.59	1.86	2.12	2.39	2.65	2.92	3.18
90	0.41	0.61	0.82	1.02	1.23	1.43	1.63	1.84	2.04	2.25	2.45
120	0.34	0.51	0.68	0.85	1.02	1.19	1.36	1.53	1.70	1.87	2.04
150	0.29	0.44	0.59	0.73	0.88	1.03	1.18	1.32	1.47	1.62	1.76
180	0.26	0.39	0.52	0.65	0.78	0.91	1.04	1.18	1.31	1.44	1.57
240	0.22	0.33	0.43	0.54	0.65	0.76	0.87	0.98	1.08	1.19	1.30
300	0.19	0.28	0.38	0.47	0.56	0.66	0.75	0.85	0.94	1.03	1.13
360	0.17	0.25	0.33	0.42	0.50	0.58	0.67	0.75	0.84	0.92	1.00

Intensity-Duration Design Chart - Template

FIGURE 3-1

2.6 – Model Development Summary (from County of San Diego Hydrology Manual)

3.2 DEVELOPING INPUT DATA FOR THE RATIONAL METHOD

This section describes the development of the necessary data to perform RM calculations. Section 3.3 describes the RM calculation process. Input data for calculating peak flows and T_c's with the RM should be developed as follows:

1. On a topographic base map, outline the overall drainage area boundary, showing adjacent drains, existing and proposed drains, and overland flow paths.

2. Verify the accuracy of the drainage map in the field.

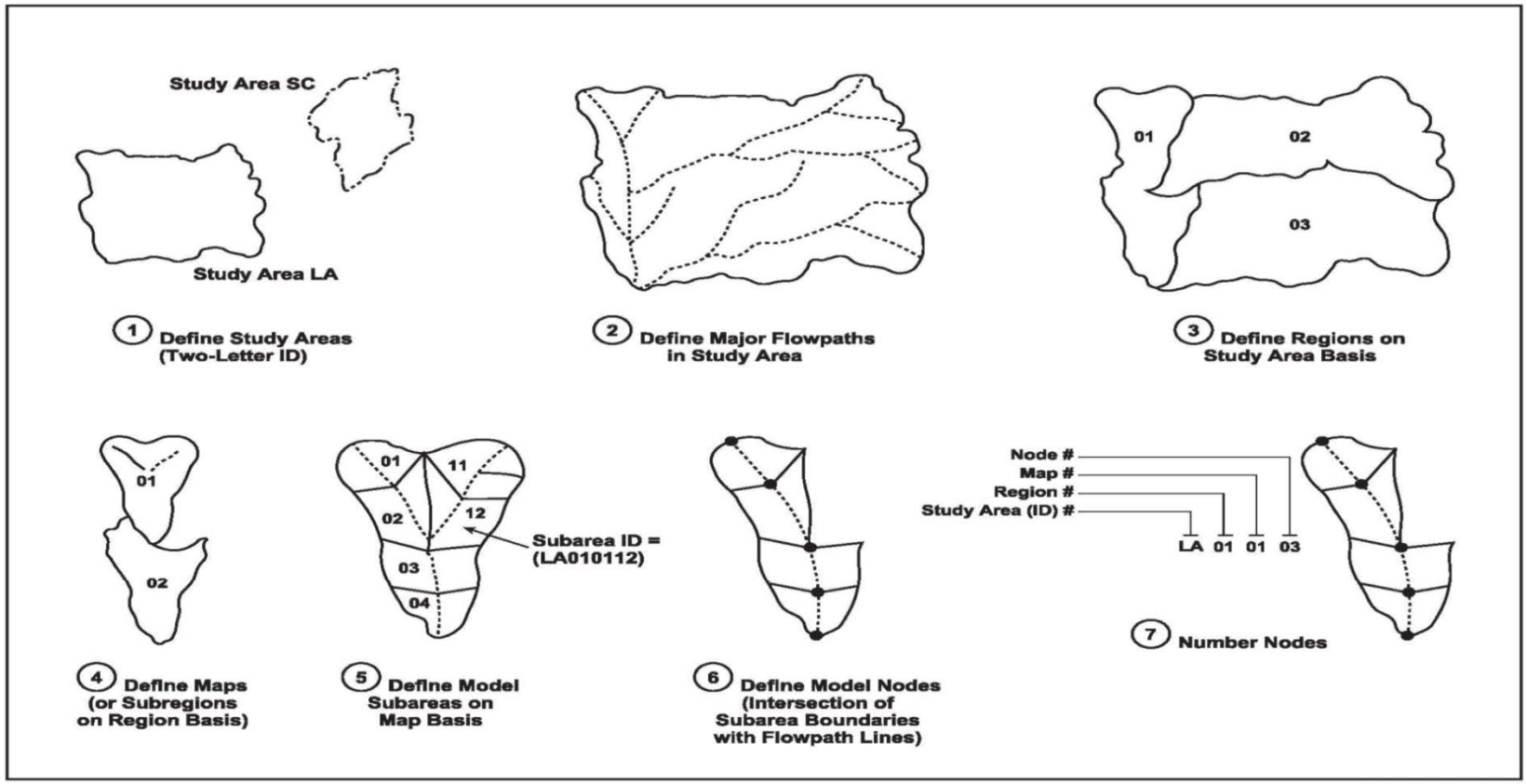
3. Divide the drainage area into subareas by locating significant points of interest. These divisions should be based on topography, soil type, and land use. Ensure that an appropriate first subarea is delineated. For natural areas, the first subarea flow path length should be less than or equal to 4,000 feet plus the overland flow length (Table 3-2). For developed areas, the initial subarea flow path length should be consistent with Table 3-2. The topography and slope within the initial subarea should be generally uniform.

4. Working from upstream to downstream, assign a number representing each subarea in the drainage system to each point of interest. Figure 3-8 provides guidelines for node numbers for geographic information system (GIS)-based studies.

5. Measure each subarea in the drainage area to determine its size in acres (A).

6. Determine the length and effective slope of the flow path in each subarea.

7. Identify the soil type for each subarea.



GIS/Hydrologic Model
Data Base Linkage Setup:
Nodes, Subareas, Links

FIGURE
3-8

8. Determine the runoff coefficient (C) for each subarea based on Table 3-1. If the subarea contains more than one type of development classification, use a proportionate average for C. In determining C for the subarea, use future land use taken from the applicable community plan, Multiple Species Conservation Plan, National Forest land use plan, etc.

9. Calculate the CA value for the subarea.

10. Calculate the Σ(CA) value(s) for the subareas upstream of the point(s) of interest.

11. Determine P_6 and P_{24} for the study using the isopluvial maps provided in Appendix B. If necessary, adjust the value for P_6 to be within 45% to 65% of the value for P_{24}.

See Section 3.3 for a description of the RM calculation process.

3.3 Performing Rational Method Calculations

This section describes the RM calculation process. Using the input data, calculation of peak flows and T_c's should be performed as follows:

1. Determine T_i for the first subarea. Use Table 3-2 or Figure 3-3 as discussed in Section 3.1.4. If the watershed is natural, the travel time to the downstream end of the first subarea can be added to T_i to obtain the T_c. Refer to paragraph 3.1.4.2 (a).

2. Determine I for the subarea using Figure 3-1. If T_i was less than 5 minutes, use the 5 minute time to determine intensity for calculating the flow.

3. Calculate the peak discharge flow rate for the subarea, where $Q_p = \Sigma(CA)\, I$.
In case that the downstream flow rate is less than the upstream flow rate, due to the long travel time that is not offset by the additional subarea runoff, use the upstream peak flow for design purposes until downstream flows increase again.

4. Estimate the T_t to the next point of interest.

5. Add the T_t to the previous T_c to obtain a new T_c.

6. Continue with step 2, above, until the final point of interest is reached.

Note: The MRM should be used to calculate the peak discharge when there is a junction from independent subareas into the drainage system.

3.4 MODIFIED RATIONAL METHOD (FOR JUNCTION ANALYSIS)

The purpose of this section is to describe the steps necessary to develop a hydrology report for a small watershed using the MRM. It is necessary to use the MRM if the watershed contains junctions of independent drainage systems. The process is based on the design manuals of the City/County of San Diego. The general process description for using this method, including an example of the application of this method, is described below.

The engineer should only use the MRM for drainage areas up to approximately 1 square mile in size. If the watershed will significantly exceed 1 square mile then the NRCS method described in Section 4 should be used. The engineer may choose to use either the RM or the MRM for calculations for up to an approximately 1-square-mile area and then transition the study to the NRCS method for additional downstream areas that exceed approximately 1 square mile. The transition process is described in Section 4.

3.4.1 Modified Rational Method General Process Description

The general process for the MRM differs from the RM only when a junction of independent drainage systems is reached. The peak Q, T_c, and I for each of the independent drainage systems at the point of the junction are calculated by the RM. The independent drainage systems are then combined using the MRM procedure described below. The peak Q, T_c, and I for each of the independent drainage systems at the point of the junction must be calculated prior to using the MRM procedure to combine the independent drainage systems, as these

values will be used for the MRM calculations. After the independent drainage systems have been combined, RM calculations are continued to the next point of interest.

3.4.2 Procedure for Combining Independent Drainage Systems at a Junction

Calculate the peak Q, T_c, and I for each of the independent drainage systems at the point of the junction. These values will be used for the MRM calculations.

At the junction of two or more independent drainage systems, the respective peak flows are combined to obtain the maximum flow out of the junction at T_c. Based on the approximation that total runoff increases directly in proportion to time, a general equation may be written to determine the maximum Q and its corresponding T_c using the peak Q, T_c, and I for each of the independent drainage systems at the point immediately before the junction. The general equation requires that contributing Q's be numbered in order of increasing T_c.

Let Q_1, T_1, and I_1 correspond to the tributary area with the shortest T_c. Likewise, let Q_2, T_2, and I_2 correspond to the tributary area with the next longer T_c; Q_3, T_3, and I_3 correspond to the tributary area with the next longer T_c; and so on. When only two independent drainage systems are combined, leave Q_3, T_3, and I_3 out of the equation. Combine the independent drainage systems using the junction equation below:

Junction Equation: $T_1 < T_2 < T_3$

$$Q_{T1} = Q_1 + \frac{T_1}{T_2} Q_2 + \frac{T_1}{T_3} Q_3$$

$$Q_{T2} = Q_2 + \frac{I_2}{I_1} Q_1 + \frac{T_2}{T_3} Q_3$$

$$Q_{T3} = Q_3 + \frac{I_3}{I_1} Q_1 + \frac{I_3}{I_2} Q_2$$

Calculate Q_{T1}, Q_{T2}, and Q_{T3}. Select the largest Q and use the T_c associated with that Q for further calculations (see the three Notes for options). If the largest calculated Q's are equal (e.g., $Q_{T1} = Q_{T2} > Q_{T3}$), use the shorter of the T_c's associated with that Q.

This equation may be expanded for a junction of more than three independent drainage systems using the same concept. The concept is that when Q from a selected subarea (e.g., Q_2) is combined with Q from another subarea with a shorter T_c (e.g., Q_1), the Q from the subarea with the shorter T_c is reduced by the ratio of the I's (I_2/I_1); and when Q from a selected subarea (e.g., Q_2) is combined with Q from another subarea with a longer T_c (e.g., Q_3), the Q from the subarea with the longer T_c is reduced by the ratio of the T_c's (T_2/T_3).

Note #1: At a junction of two independent drainage systems that have the same T_c, the tributary flows may be added to obtain the Q_p.

$$Q_p = Q_1 + Q_2 \text{; when } T_1 = T_2 \text{; and } T_c = T_1 = T_2$$

This can be verified by using the junction equation above. Let Q_3, T_3, and $I_3 = 0$. When T_1 and T_2 are the same, I_1 and I_2 are also the same, and T_1/T_2 and $I_2/I_1 = 1$. T_1/T_2 and I_2/I_1 are cancelled from the equations. At this point, $Q_{T1} = Q_{T2} = Q_1 + Q_2$.

Note #2: In the upstream part of a watershed, a conservative computation is acceptable. When the times of concentration (T_c's) are relatively close in magnitude (within 10%), use the shorter T_c for the intensity and the equation $Q = \Sigma(CA)I$.

Note #3: . An optional method of determining the T_c is to use the equation
$T_c = [(\Sigma (CA)7.44\ P_6)/Q]^{1.55}$

This equation is from $Q = \Sigma(CA)I = \Sigma(CA)(7.44\ P_6/T_c^{.645})$ and solving for T_c. The advantage in this option is that the T_c is consistent with the peak flow Q, and avoids inappropriate fluctuation in downstream flows in some cases.

CHAPTER 3 - 100 YEAR HYDROLOGIC ANALYSIS FOR EXISTING CONDITIONS

```
              San Diego County Rational Hydrology Program

CIVILCADD/CIVILDESIGN Engineering Software,(c)1991-2005 Version 7.5

Rational method hydrology  program based on
San Diego County Flood Control Division 2003 hydrology manual
       Rational Hydrology Study        Date: 10/05/16
------------------------------------------------------------------------
Existing Conditions Hydrology
100 Year Storm
Terrace Hill

------------------------------------------------------------------------
 *********   Hydrology Study Control Information **********

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


Program License Serial Number 4085

------------------------------------------------------------------------
Rational hydrology study storm event year is   100.0
English (in-lb) input data Units used

Map data precipitation entered:
6 hour,  precipitation(inches) =  2.700
24 hour precipitation(inches) =  6.000
P6/P24 =    45.0%
San Diego hydrology manual 'C' values used


++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++
Process from Point/Station        5.000 to Point/Station       10.000
**** INITIAL AREA EVALUATION ****
________________________________________________________________________
Decimal fraction soil group A = 0.000
Decimal fraction soil group B = 1.000
Decimal fraction soil group C = 0.000
Decimal fraction soil group D = 0.000
[UNDISTURBED NATURAL TERRAIN                ]
(Permanent Open Space   )
Impervious value, Ai = 0.000
Sub-Area C Value = 0.250
Initial subarea total flow distance  =   50.000(Ft.)
Highest elevation =  763.600(Ft.)
Lowest elevation =  758.000(Ft.)
Elevation difference =    5.600(Ft.) Slope = 11.200 %
INITIAL AREA TIME OF CONCENTRATION CALCULATIONS:
The maximum overland flow distance is 100.00 (Ft)
for the top area slope value of  11.20 %, in a development type of
 Permanent Open Space
In Accordance With Figure 3-3
Initial Area Time of Concentration =   6.84 minutes
TC = [1.8*(1.1-C)*distance(Ft.)^.5)/(% slope^(1/3)]
TC = [1.8*(1.1-0.2500)*( 100.000^.5)/(  11.200^(1/3)]=   6.84
Rainfall intensity (I) =      5.813(In/Hr) for a   100.0 year storm
Effective runoff coefficient used for area (Q=KCIA) is C = 0.250
Subarea runoff =      0.102(CFS)
Total initial stream area =        0.070(Ac.)
```

```
++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++
Process from Point/Station       10.000 to Point/Station       15.000
**** IMPROVED CHANNEL TRAVEL TIME ****
______________________________________________________________________________
Upstream point elevation =   758.000(Ft.)
Downstream point elevation =   730.500(Ft.)
Channel length thru subarea  =   203.000(Ft.)
Channel base width  =   10.000(Ft.)
Slope or 'Z' of left channel bank =   5.000
Slope or 'Z' of right channel bank =   5.000
Estimated mean flow rate at midpoint of channel =      0.458(CFS)
Manning's 'N'    = 0.035
Maximum depth of channel  =    2.000(Ft.)
Flow(q) thru subarea =      0.458(CFS)
Depth of flow =   0.030(Ft.), Average velocity =   1.497(Ft/s)
Channel flow top width =   10.301(Ft.)
Flow Velocity =    1.50(Ft/s)
Travel time  =    2.26 min.
Time of concentration =    9.10 min.
Critical depth =      0.040(Ft.)
 Adding area flow to channel
Decimal fraction soil group A = 0.000
Decimal fraction soil group B = 1.000
Decimal fraction soil group C = 0.000
Decimal fraction soil group D = 0.000
[UNDISTURBED NATURAL TERRAIN                ]
(Permanent Open Space   )
Impervious value, Ai = 0.000
Sub-Area C Value = 0.250
Rainfall intensity =      4.835(In/Hr) for a   100.0 year storm
Effective runoff coefficient used for total area
(Q=KCIA) is C = 0.250  CA =      0.153
Subarea runoff =      0.636(CFS) for      0.540(Ac.)
Total runoff =      0.737(CFS)   Total area =       0.610(Ac.)
Depth of flow =   0.040(Ft.), Average velocity =   1.805(Ft/s)
Critical depth =      0.055(Ft.)


++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++
Process from Point/Station       15.000 to Point/Station       15.000
**** CONFLUENCE OF MAIN STREAMS ****
______________________________________________________________________________
The following data inside Main Stream is listed:
In Main Stream number: 1
Stream flow area =      0.610(Ac.)
Runoff from this stream =      0.737(CFS)
Time of concentration =    9.10 min.
Rainfall intensity =     4.835(In/Hr)
Summary of stream data:

Stream   Flow rate      TC            Rainfall Intensity
 No.       (CFS)       (min)                (In/Hr)


1        0.737      9.10           4.835
Qmax(1) =
          1.000 *    1.000 *     0.737) + =       0.737

Total of 1 main streams to confluence:
Flow rates before confluence point:
       0.737
Maximum flow rates at confluence using above data:
        0.737
Area of streams before confluence:
        0.610
```

```
Results of confluence:
Total flow rate =      0.737(CFS)
Time of concentration =     9.098 min.
Effective stream area after confluence  =      0.610(Ac.)


++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++
Process from Point/Station       20.000 to Point/Station       25.000
**** INITIAL AREA EVALUATION ****
------------------------------------------------------------------------
Decimal fraction soil group A = 0.000
Decimal fraction soil group B = 1.000
Decimal fraction soil group C = 0.000
Decimal fraction soil group D = 0.000
[UNDISTURBED NATURAL TERRAIN                ]
(Permanent Open Space   )
Impervious value, Ai = 0.000
Sub-Area C Value = 0.250
Initial subarea total flow distance  =   50.000(Ft.)
Highest elevation =  763.500(Ft.)
Lowest elevation =  759.700(Ft.)
Elevation difference =    3.800(Ft.) Slope =  7.600 %
INITIAL AREA TIME OF CONCENTRATION CALCULATIONS:
The maximum overland flow distance is 100.00 (Ft)
for the top area slope value of   7.60 %, in a development type of
 Permanent Open Space
In Accordance With Figure 3-3
Initial Area Time of Concentration =   7.78 minutes
TC = [1.8*(1.1-C)*distance(Ft.)^.5)/(% slope^(1/3)]
TC = [1.8*(1.1-0.2500)*( 100.000^.5)/(   7.600^(1/3)]=   7.78
Rainfall intensity (I) =      5.348(In/Hr) for a   100.0 year storm
Effective runoff coefficient used for area (Q=KCIA) is C = 0.250
Subarea runoff =      0.040(CFS)
Total initial stream area =        0.030(Ac.)


++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++
Process from Point/Station       25.000 to Point/Station       45.000
**** IMPROVED CHANNEL TRAVEL TIME ****
------------------------------------------------------------------------
Upstream point elevation =   759.700(Ft.)
Downstream point elevation =   717.400(Ft.)
Channel length thru subarea  =   494.000(Ft.)
Channel base width  =   10.000(Ft.)
Slope or 'Z' of left channel bank =   5.000
Slope or 'Z' of right channel bank =   5.000
Estimated mean flow rate at midpoint of channel =      1.139(CFS)
Manning's 'N'    = 0.035
Maximum depth of channel  =    2.000(Ft.)
Flow(q) thru subarea =      1.139(CFS)
Depth of flow =   0.060(Ft.), Average velocity =   1.857(Ft/s)
Channel flow top width =   10.595(Ft.)
Flow Velocity =    1.86(Ft/s)
Travel time  =    4.43 min.
Time of concentration =   12.22 min.
Critical depth =      0.073(Ft.)
 Adding area flow to channel
Decimal fraction soil group A = 0.000
Decimal fraction soil group B = 1.000
Decimal fraction soil group C = 0.000
Decimal fraction soil group D = 0.000
[UNDISTURBED NATURAL TERRAIN                ]
(Permanent Open Space   )
Impervious value, Ai = 0.000
Sub-Area C Value = 0.250
```

```
Rainfall intensity =      3.998(In/Hr) for a   100.0 year storm
Effective runoff coefficient used for total area
(Q=KCIA) is C = 0.250  CA =      0.545
Subarea runoff =      2.139(CFS) for      2.150(Ac.)
Total runoff =      2.179(CFS)   Total area =       2.180(Ac.)
Depth of flow =   0.088(Ft.), Average velocity =   2.382(Ft/s)
Critical depth =      0.111(Ft.)


++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++
Process from Point/Station       45.000 to Point/Station       45.000
**** CONFLUENCE OF MINOR STREAMS ****
----------------------------------------------------------------------
Along Main Stream number: 1 in normal stream number 1
Stream flow area =      2.180(Ac.)
Runoff from this stream =      2.179(CFS)
Time of concentration =   12.22 min.
Rainfall intensity =     3.998(In/Hr)


++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++
Process from Point/Station       30.000 to Point/Station       35.000
**** INITIAL AREA EVALUATION ****
----------------------------------------------------------------------
Decimal fraction soil group A = 0.000
Decimal fraction soil group B = 1.000
Decimal fraction soil group C = 0.000
Decimal fraction soil group D = 0.000
[INDUSTRIAL area type                        ]
(General Industrial       )
Impervious value, Ai = 0.950
Sub-Area C Value = 0.870
Initial subarea total flow distance  =   50.000(Ft.)
Highest elevation =  750.200(Ft.)
Lowest elevation =  747.500(Ft.)
Elevation difference =    2.700(Ft.) Slope =  5.400 %
INITIAL AREA TIME OF CONCENTRATION CALCULATIONS:
The maximum overland flow distance is 90.00 (Ft)
for the top area slope value of   5.40 %, in a development type of
 General Industrial
In Accordance With Figure 3-3
Initial Area Time of Concentration =   2.24 minutes
TC = [1.8*(1.1-C)*distance(Ft.)^.5)/(% slope^(1/3)]
TC = [1.8*(1.1-0.8700)*(  90.000^.5)/(   5.400^(1/3)]=   2.24
Calculated TC of    2.239 minutes is less than 5 minutes,
 resetting TC to 5.0 minutes for rainfall intensity calculations
Rainfall intensity (I) =      7.114(In/Hr) for a   100.0 year storm
Effective runoff coefficient used for area (Q=KCIA) is C = 0.870
Subarea runoff =      0.062(CFS)
Total initial stream area =        0.010(Ac.)


++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++
Process from Point/Station       35.000 to Point/Station       40.000
**** STREET FLOW TRAVEL TIME + SUBAREA FLOW ADDITION ****
----------------------------------------------------------------------
Top of street segment elevation =   747.500(Ft.)
End of street segment elevation =   740.100(Ft.)
Length of street segment  =   124.000(Ft.)
Height of curb above gutter flowline  =    6.0(In.)
Width of half street (curb to crown)  =  22.000(Ft.)
Distance from crown to crossfall grade break  =  18.000(Ft.)
Slope from gutter to grade break (v/hz) =   0.020
Slope from grade break to crown (v/hz)  =   0.020
Street flow is on [2] side(s) of the street
Distance from curb to property line  =  10.000(Ft.)
```

```
Slope from curb to property line (v/hz) =   0.025
Gutter width =   2.000(Ft.)
Gutter hike from flowline =  2.000(In.)
 Manning's N in gutter =  0.0150
 Manning's N from gutter to grade break =  0.0150
 Manning's N from grade break to crown =  0.0150
Estimated mean flow rate at midpoint of street =      0.225(CFS)
Depth of flow =   0.083(Ft.), Average velocity =   2.738(Ft/s)
Streetflow hydraulics at midpoint of street travel:
Halfstreet flow width =   2.000(Ft.)
Flow velocity =   2.74(Ft/s)
Travel time =    0.75 min.     TC =    2.99  min.
 Adding area flow to street
Decimal fraction soil group A = 0.000
Decimal fraction soil group B = 1.000
Decimal fraction soil group C = 0.000
Decimal fraction soil group D = 0.000
[INDUSTRIAL area type                        ]
(General Industrial       )
Impervious value, Ai = 0.950
Sub-Area C Value = 0.870
Rainfall intensity =      7.114(In/Hr) for a   100.0 year storm
Effective runoff coefficient used for total area
(Q=KCIA) is C = 0.870  CA =      0.070
Subarea runoff =      0.433(CFS) for      0.070(Ac.)
Total runoff =      0.495(CFS)   Total area =       0.080(Ac.)
Street flow at end of street =      0.495(CFS)
Half street flow at end of street =      0.248(CFS)
Depth of flow =   0.111(Ft.), Average velocity =   3.335(Ft/s)
Flow width (from curb towards crown)=   2.000(Ft.)


++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++
Process from Point/Station       40.000 to Point/Station       45.000
**** IMPROVED CHANNEL TRAVEL TIME ****
------------------------------------------------------------------------------
Upstream point elevation =   740.100(Ft.)
Downstream point elevation =   717.400(Ft.)
Channel length thru subarea  =   200.000(Ft.)
Channel base width  =   10.000(Ft.)
Slope or 'Z' of left channel bank =   5.000
Slope or 'Z' of right channel bank =   5.000
Manning's 'N'    = 0.035
Maximum depth of channel  =    2.000(Ft.)
Flow(q) thru subarea =      0.495(CFS)
Depth of flow =   0.033(Ft.), Average velocity =   1.463(Ft/s)
Channel flow top width =   10.333(Ft.)
Flow Velocity =    1.46(Ft/s)
Travel time  =    2.28 min.
Time of concentration =    5.27 min.
Critical depth =      0.042(Ft.)


++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++
Process from Point/Station       40.000 to Point/Station       45.000
**** CONFLUENCE OF MINOR STREAMS ****
------------------------------------------------------------------------------
Along Main Stream number: 1 in normal stream number 2
Stream flow area =      0.080(Ac.)
Runoff from this stream =      0.495(CFS)
Time of concentration =    5.27 min.
Rainfall intensity =     6.875(In/Hr)
Summary of stream data:

Stream   Flow rate      TC            Rainfall Intensity
 No.       (CFS)       (min)                 (In/Hr)
```

```
1        2.179     12.22            3.998
2        0.495      5.27            6.875
Qmax(1) =
          1.000 *    1.000 *     2.179) +
          0.582 *    1.000 *     0.495) + =       2.467
Qmax(2) =
          1.000 *    0.432 *     2.179) +
          1.000 *    1.000 *     0.495) + =       1.435

Total of 2 streams to confluence:
Flow rates before confluence point:
       2.179       0.495
Maximum flow rates at confluence using above data:
        2.467        1.435
Area of streams before confluence:
        2.180        0.080
Results of confluence:
Total flow rate =      2.467(CFS)
Time of concentration =    12.215 min.
Effective stream area after confluence =      2.260(Ac.)
End of computations, total study area =           2.870 (Ac.)
```

CHAPTER 4 - 100 YEAR HYDROLOGIC ANALYSIS FOR DEVELOPED CONDITIONS - UNMITIGATED

```
             San Diego County Rational Hydrology Program

CIVILCADD/CIVILDESIGN Engineering Software,(c)1991-2005 Version 7.5

Rational method hydrology  program based on
San Diego County Flood Control Division 2003 hydrology manual
       Rational Hydrology Study        Date: 10/05/16
--------------------------------------------------------------------------
Proposed Conditions Hydrology - Unmitigated
100 Year Storm
Terrace Hill Drive

--------------------------------------------------------------------------
 *********   Hydrology Study Control Information **********

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


Program License Serial Number 4085

--------------------------------------------------------------------------
Rational hydrology study storm event year is   100.0
English (in-lb) input data Units used

Map data precipitation entered:
6 hour,  precipitation(inches) =  2.700
24 hour precipitation(inches) =  6.000
P6/P24 =    45.0%
San Diego hydrology manual 'C' values used


++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++
Process from Point/Station        5.000 to Point/Station       10.000
**** INITIAL AREA EVALUATION ****
__________________________________________________________________________
Decimal fraction soil group A = 0.000
Decimal fraction soil group B = 1.000
Decimal fraction soil group C = 0.000
Decimal fraction soil group D = 0.000
[MEDIUM DENSITY RESIDENTIAL                  ]
(4.3 DU/A or Less       )
Impervious value, Ai = 0.300
Sub-Area C Value = 0.450
Initial subarea total flow distance  =   50.000(Ft.)
Highest elevation =  756.500(Ft.)
Lowest elevation =  750.000(Ft.)
Elevation difference =    6.500(Ft.) Slope = 13.000 %
INITIAL AREA TIME OF CONCENTRATION CALCULATIONS:
The maximum overland flow distance is 100.00 (Ft)
for the top area slope value of  13.00 %, in a development type of
 4.3 DU/A or Less
In Accordance With Figure 3-3
Initial Area Time of Concentration =   4.98 minutes
TC = [1.8*(1.1-C)*distance(Ft.)^.5)/(% slope^(1/3)]
TC = [1.8*(1.1-0.4500)*( 100.000^.5)/(  13.000^(1/3)]=   4.98
Calculated TC of    4.976 minutes is less than 5 minutes,
 resetting TC to 5.0 minutes for rainfall intensity calculations
Rainfall intensity (I) =      7.114(In/Hr) for a   100.0 year storm
Effective runoff coefficient used for area (Q=KCIA) is C = 0.450
Subarea runoff =      0.064(CFS)
```

```
Total initial stream area =        0.020(Ac.)


++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++
Process from Point/Station       10.000 to Point/Station       15.000
**** STREET FLOW TRAVEL TIME + SUBAREA FLOW ADDITION ****
______________________________________________________________________________
Top of street segment elevation =   750.000(Ft.)
End of street segment elevation =   734.000(Ft.)
Length of street segment  =   329.000(Ft.)
Height of curb above gutter flowline  =    6.0(In.)
Width of half street (curb to crown)  =  22.000(Ft.)
Distance from crown to crossfall grade break  =  18.000(Ft.)
Slope from gutter to grade break (v/hz) =   0.020
Slope from grade break to crown (v/hz)  =   0.020
Street flow is on [2] side(s) of the street
Distance from curb to property line  =  10.000(Ft.)
Slope from curb to property line (v/hz) =   0.025
Gutter width =   2.000(Ft.)
Gutter hike from flowline =  2.000(In.)
 Manning's N in gutter =  0.0150
 Manning's N from gutter to grade break =  0.0150
 Manning's N from grade break to crown =  0.0150
Estimated mean flow rate at midpoint of street =      0.767(CFS)
Depth of flow =   0.136(Ft.), Average velocity =   3.447(Ft/s)
Streetflow hydraulics at midpoint of street travel:
Halfstreet flow width =   2.000(Ft.)
Flow velocity =   3.45(Ft/s)
Travel time =    1.59 min.     TC =    6.57  min.
 Adding area flow to street
Decimal fraction soil group A = 0.000
Decimal fraction soil group B = 1.000
Decimal fraction soil group C = 0.000
Decimal fraction soil group D = 0.000
[MEDIUM DENSITY RESIDENTIAL                 ]
(4.3 DU/A or Less       )
Impervious value, Ai = 0.300
Sub-Area C Value = 0.450
Rainfall intensity =      5.967(In/Hr) for a   100.0 year storm
Effective runoff coefficient used for total area
(Q=KCIA) is C = 0.450  CA =      0.266
Subarea runoff =      1.520(CFS) for      0.570(Ac.)
Total runoff =      1.584(CFS)   Total area =       0.590(Ac.)
Street flow at end of street =      1.584(CFS)
Half street flow at end of street =      0.792(CFS)
Depth of flow =   0.187(Ft.), Average velocity =   3.632(Ft/s)
Flow width (from curb towards crown)=   3.024(Ft.)


++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++
Process from Point/Station       20.000 to Point/Station       25.000
**** PIPEFLOW TRAVEL TIME (User specified size) ****
______________________________________________________________________________
Upstream point/station elevation =   731.700(Ft.)
Downstream point/station elevation =   731.500(Ft.)
Pipe length  =    30.00(Ft.)   Manning's N = 0.013
No. of pipes = 1  Required pipe flow  =     1.584(CFS)
Given pipe size =     12.00(In.)
Calculated individual pipe flow  =     1.584(CFS)
Normal flow depth in pipe =    6.32(In.)
Flow top width inside pipe =   11.98(In.)
Critical Depth =    6.40(In.)
Pipe flow velocity =      3.78(Ft/s)
Travel time through pipe =    0.13 min.
Time of concentration (TC) =     6.70 min.
```

```
++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++
Process from Point/Station       25.000 to Point/Station       25.000
**** CONFLUENCE OF MINOR STREAMS ****
____________________________________________________________________________
Along Main Stream number: 1 in normal stream number 1
Stream flow area =      0.590(Ac.)
Runoff from this stream =      1.584(CFS)
Time of concentration =    6.70 min.
Rainfall intensity =     5.891(In/Hr)


++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++
Process from Point/Station       21.000 to Point/Station       25.000
**** INITIAL AREA EVALUATION ****
____________________________________________________________________________
Decimal fraction soil group A = 0.000
Decimal fraction soil group B = 1.000
Decimal fraction soil group C = 0.000
Decimal fraction soil group D = 0.000
[UNDISTURBED NATURAL TERRAIN                ]
(Permanent Open Space   )
Impervious value, Ai = 0.000
Sub-Area C Value = 0.250
Initial subarea total flow distance  =   58.000(Ft.)
Highest elevation =  740.000(Ft.)
Lowest elevation =  731.500(Ft.)
Elevation difference =    8.500(Ft.) Slope = 14.655 %
Top of Initial Area Slope adjusted by User to 14.600 %
INITIAL AREA TIME OF CONCENTRATION CALCULATIONS:
The maximum overland flow distance is 100.00 (Ft)
for the top area slope value of  14.60 %, in a development type of
 Permanent Open Space
In Accordance With Figure 3-3
Initial Area Time of Concentration =   6.26 minutes
TC = [1.8*(1.1-C)*distance(Ft.)^.5)/(% slope^(1/3)]
TC = [1.8*(1.1-0.2500)*( 100.000^.5)/(  14.600^(1/3)]=   6.26
Rainfall intensity (I) =      6.154(In/Hr) for a   100.0 year storm
Effective runoff coefficient used for area (Q=KCIA) is C = 0.250
Subarea runoff =      0.031(CFS)
Total initial stream area =        0.020(Ac.)


++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++
Process from Point/Station       25.000 to Point/Station       25.000
**** CONFLUENCE OF MINOR STREAMS ****
____________________________________________________________________________
Along Main Stream number: 1 in normal stream number 2
Stream flow area =      0.020(Ac.)
Runoff from this stream =      0.031(CFS)
Time of concentration =    6.26 min.
Rainfall intensity =     6.154(In/Hr)
Summary of stream data:

Stream   Flow rate      TC            Rainfall Intensity
 No.       (CFS)       (min)                 (In/Hr)


1        1.584      6.70           5.891
2        0.031      6.26           6.154
Qmax(1) =
          1.000 *    1.000 *     1.584) +
          0.957 *    1.000 *     0.031) + =       1.614
Qmax(2) =
          1.000 *    0.934 *     1.584) +
          1.000 *    1.000 *     0.031) + =       1.511
```

```
Total of 2 streams to confluence:
Flow rates before confluence point:
       1.584       0.031
Maximum flow rates at confluence using above data:
        1.614        1.511
Area of streams before confluence:
        0.590        0.020
Results of confluence:
Total flow rate =      1.614(CFS)
Time of concentration =     6.699 min.
Effective stream area after confluence =      0.610(Ac.)


++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++
Process from Point/Station       25.000 to Point/Station       25.000
**** CONFLUENCE OF MAIN STREAMS ****
________________________________________________________________________
The following data inside Main Stream is listed:
In Main Stream number: 1
Stream flow area =      0.610(Ac.)
Runoff from this stream =      1.614(CFS)
Time of concentration =    6.70 min.
Rainfall intensity =     5.891(In/Hr)
Summary of stream data:

Stream   Flow rate      TC            Rainfall Intensity
 No.       (CFS)       (min)                (In/Hr)


1        1.614      6.70           5.891
Qmax(1) =
          1.000 *    1.000 *     1.614) + =       1.614

Total of 1 main streams to confluence:
Flow rates before confluence point:
       1.614
Maximum flow rates at confluence using above data:
        1.614
Area of streams before confluence:
        0.610


Results of confluence:
Total flow rate =      1.614(CFS)
Time of concentration =     6.699 min.
Effective stream area after confluence  =      0.610(Ac.)


++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++
Process from Point/Station        5.000 to Point/Station       30.000
**** INITIAL AREA EVALUATION ****
________________________________________________________________________
Decimal fraction soil group A = 0.000
Decimal fraction soil group B = 1.000
Decimal fraction soil group C = 0.000
Decimal fraction soil group D = 0.000
[MEDIUM DENSITY RESIDENTIAL                  ]
(4.3 DU/A or Less       )
Impervious value, Ai = 0.300
Sub-Area C Value = 0.450
Initial subarea total flow distance  =   50.000(Ft.)
Highest elevation =  756.500(Ft.)
Lowest elevation =  750.000(Ft.)
Elevation difference =    6.500(Ft.) Slope = 13.000 %
Top of Initial Area Slope adjusted by User to  9.000 %
```

```
INITIAL AREA TIME OF CONCENTRATION CALCULATIONS:
The maximum overland flow distance is 100.00 (Ft)
for the top area slope value of   9.00 %, in a development type of
 4.3 DU/A or Less
In Accordance With Figure 3-3
Initial Area Time of Concentration =   5.62 minutes
TC = [1.8*(1.1-C)*distance(Ft.)^.5)/(% slope^(1/3)]
TC = [1.8*(1.1-0.4500)*( 100.000^.5)/(   9.000^(1/3)]=   5.62
Rainfall intensity (I) =      6.594(In/Hr) for a   100.0 year storm
Effective runoff coefficient used for area (Q=KCIA) is C = 0.450
Subarea runoff =      0.059(CFS)
Total initial stream area =        0.020(Ac.)


++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++
Process from Point/Station       30.000 to Point/Station       35.000
**** STREET FLOW TRAVEL TIME + SUBAREA FLOW ADDITION ****
________________________________________________________________________
Top of street segment elevation =   752.000(Ft.)
End of street segment elevation =   748.700(Ft.)
Length of street segment  =   178.000(Ft.)
Height of curb above gutter flowline  =    6.0(In.)
Width of half street (curb to crown)  =  22.000(Ft.)
Distance from crown to crossfall grade break  =  18.000(Ft.)
Slope from gutter to grade break (v/hz) =   0.020
Slope from grade break to crown (v/hz)  =   0.020
Street flow is on [2] side(s) of the street
Distance from curb to property line  =  10.000(Ft.)
Slope from curb to property line (v/hz) =   0.025
Gutter width =   2.000(Ft.)
Gutter hike from flowline =  2.000(In.)
 Manning's N in gutter =  0.0150
 Manning's N from gutter to grade break =  0.0150
 Manning's N from grade break to crown =  0.0150
Estimated mean flow rate at midpoint of street =      0.386(CFS)
Depth of flow =   0.126(Ft.), Average velocity =   2.022(Ft/s)
Streetflow hydraulics at midpoint of street travel:
Halfstreet flow width =   2.000(Ft.)
Flow velocity =   2.02(Ft/s)
Travel time =    1.47 min.     TC =    7.09  min.
 Adding area flow to street
Decimal fraction soil group A = 0.000
Decimal fraction soil group B = 1.000
Decimal fraction soil group C = 0.000
Decimal fraction soil group D = 0.000
[MEDIUM DENSITY RESIDENTIAL                 ]
(4.3 DU/A or Less       )
Impervious value, Ai = 0.300
Sub-Area C Value = 0.450
Rainfall intensity =      5.678(In/Hr) for a   100.0 year storm
Effective runoff coefficient used for total area
(Q=KCIA) is C = 0.450  CA =      0.144
Subarea runoff =      0.758(CFS) for      0.300(Ac.)
Total runoff =      0.818(CFS)   Total area =       0.320(Ac.)
Street flow at end of street =      0.818(CFS)
Half street flow at end of street =      0.409(CFS)
Depth of flow =   0.168(Ft.), Average velocity =   2.407(Ft/s)
Flow width (from curb towards crown)=   2.077(Ft.)


++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++
Process from Point/Station       35.000 to Point/Station       40.000
**** PIPEFLOW TRAVEL TIME (User specified size) ****
________________________________________________________________________
Upstream point/station elevation =   744.700(Ft.)
Downstream point/station elevation =   742.200(Ft.)
```

```
Pipe length  =   166.00(Ft.)   Manning's N = 0.013
No. of pipes = 1  Required pipe flow  =     0.818(CFS)
Given pipe size =     12.00(In.)
Calculated individual pipe flow  =     0.818(CFS)
Normal flow depth in pipe =    3.52(In.)
Flow top width inside pipe =   10.92(In.)
Critical Depth =    4.54(In.)
Pipe flow velocity =      4.26(Ft/s)
Travel time through pipe =    0.65 min.
Time of concentration (TC) =     7.74 min.


++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++
Process from Point/Station       40.000 to Point/Station       40.000
**** CONFLUENCE OF MINOR STREAMS ****
------------------------------------------------------------------------------
Along Main Stream number: 1 in normal stream number 1
Stream flow area =      0.320(Ac.)
Runoff from this stream =      0.818(CFS)
Time of concentration =    7.74 min.
Rainfall intensity =     5.366(In/Hr)


++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++
Process from Point/Station       45.000 to Point/Station       50.000
**** INITIAL AREA EVALUATION ****
------------------------------------------------------------------------------
Decimal fraction soil group A = 0.000
Decimal fraction soil group B = 1.000
Decimal fraction soil group C = 0.000
Decimal fraction soil group D = 0.000
[MEDIUM DENSITY RESIDENTIAL                  ]
(4.3 DU/A or Less       )
Impervious value, Ai = 0.300
Sub-Area C Value = 0.450
Initial subarea total flow distance  =   50.000(Ft.)
Highest elevation =  750.100(Ft.)
Lowest elevation =  749.300(Ft.)
Elevation difference =    0.800(Ft.) Slope =  1.600 %
INITIAL AREA TIME OF CONCENTRATION CALCULATIONS:
The maximum overland flow distance is 80.00 (Ft)
for the top area slope value of   1.60 %, in a development type of
 4.3 DU/A or Less
In Accordance With Figure 3-3
Initial Area Time of Concentration =   8.95 minutes
TC = [1.8*(1.1-C)*distance(Ft.)^.5)/(% slope^(1/3)]
TC = [1.8*(1.1-0.4500)*(  80.000^.5)/(   1.600^(1/3)]=   8.95
Rainfall intensity (I) =      4.888(In/Hr) for a   100.0 year storm
Effective runoff coefficient used for area (Q=KCIA) is C = 0.450
Subarea runoff =      0.110(CFS)
Total initial stream area =        0.050(Ac.)


++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++
Process from Point/Station       50.000 to Point/Station       40.000
**** IMPROVED CHANNEL TRAVEL TIME ****
------------------------------------------------------------------------------
Upstream point elevation =   749.300(Ft.)
Downstream point elevation =   748.000(Ft.)
Channel length thru subarea  =   170.000(Ft.)
Channel base width  =    2.000(Ft.)
Slope or 'Z' of left channel bank =   5.000
Slope or 'Z' of right channel bank =   5.000
Estimated mean flow rate at midpoint of channel =      0.561(CFS)
Manning's 'N'    = 0.035
Maximum depth of channel  =    1.000(Ft.)
```

```
Flow(q) thru subarea =      0.561(CFS)
Depth of flow =   0.189(Ft.), Average velocity =   1.009(Ft/s)
Channel flow top width =    3.889(Ft.)
Flow Velocity =    1.01(Ft/s)
Travel time  =    2.81 min.
Time of concentration =   11.76 min.
Critical depth =      0.121(Ft.)
 Adding area flow to channel
Decimal fraction soil group A = 0.000
Decimal fraction soil group B = 1.000
Decimal fraction soil group C = 0.000
Decimal fraction soil group D = 0.000
[MEDIUM DENSITY RESIDENTIAL                 ]
(4.3 DU/A or Less       )
Impervious value, Ai = 0.300
Sub-Area C Value = 0.450
Rainfall intensity =      4.099(In/Hr) for a   100.0 year storm
Effective runoff coefficient used for total area
(Q=KCIA) is C = 0.450  CA =      0.225
Subarea runoff =      0.812(CFS) for      0.450(Ac.)
Total runoff =      0.922(CFS)   Total area =       0.500(Ac.)
Depth of flow =   0.245(Ft.), Average velocity =   1.165(Ft/s)
Critical depth =      0.162(Ft.)


++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++
Process from Point/Station       40.000 to Point/Station       40.000
**** CONFLUENCE OF MINOR STREAMS ****
________________________________________________________________________
Along Main Stream number: 1 in normal stream number 2
Stream flow area =      0.500(Ac.)
Runoff from this stream =      0.922(CFS)
Time of concentration =   11.76 min.
Rainfall intensity =     4.099(In/Hr)
Summary of stream data:

Stream   Flow rate      TC            Rainfall Intensity
 No.       (CFS)       (min)                 (In/Hr)


1        0.818      7.74           5.366
2        0.922     11.76           4.099
Qmax(1) =
          1.000 *    1.000 *     0.818) +
          1.000 *    0.658 *     0.922) + =       1.425
Qmax(2) =
          0.764 *    1.000 *     0.818) +
          1.000 *    1.000 *     0.922) + =       1.547

Total of 2 streams to confluence:
Flow rates before confluence point:
       0.818       0.922
Maximum flow rates at confluence using above data:
        1.425        1.547
Area of streams before confluence:
        0.320        0.500
Results of confluence:
Total flow rate =      1.547(CFS)
Time of concentration =    11.755 min.
Effective stream area after confluence =      0.820(Ac.)


++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++
Process from Point/Station       40.000 to Point/Station       55.000
**** PIPEFLOW TRAVEL TIME (User specified size) ****
________________________________________________________________________
```

```
Upstream point/station elevation =   742.200(Ft.)
Downstream point/station elevation =   734.920(Ft.)
Pipe length  =    91.00(Ft.)   Manning's N = 0.013
No. of pipes = 1  Required pipe flow  =     1.547(CFS)
Given pipe size =     12.00(In.)
Calculated individual pipe flow  =     1.547(CFS)
Normal flow depth in pipe =    3.18(In.)
Flow top width inside pipe =   10.59(In.)
Critical Depth =    6.33(In.)
Pipe flow velocity =      9.29(Ft/s)
Travel time through pipe =    0.16 min.
Time of concentration (TC) =    11.92 min.


++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++
Process from Point/Station       55.000 to Point/Station       55.000
**** CONFLUENCE OF MINOR STREAMS ****
------------------------------------------------------------------------
Along Main Stream number: 1 in normal stream number 1
Stream flow area =      0.820(Ac.)
Runoff from this stream =      1.547(CFS)
Time of concentration =   11.92 min.
Rainfall intensity =     4.062(In/Hr)


++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++
Process from Point/Station       60.000 to Point/Station       65.000
**** INITIAL AREA EVALUATION ****
------------------------------------------------------------------------
Decimal fraction soil group A = 0.000
Decimal fraction soil group B = 1.000
Decimal fraction soil group C = 0.000
Decimal fraction soil group D = 0.000
[MEDIUM DENSITY RESIDENTIAL                 ]
(4.3 DU/A or Less       )
Impervious value, Ai = 0.300
Sub-Area C Value = 0.450
Initial subarea total flow distance  =   50.000(Ft.)
Highest elevation =  744.000(Ft.)
Lowest elevation =  739.000(Ft.)
Elevation difference =    5.000(Ft.) Slope = 10.000 %
INITIAL AREA TIME OF CONCENTRATION CALCULATIONS:
The maximum overland flow distance is 100.00 (Ft)
for the top area slope value of  10.00 %, in a development type of
 4.3 DU/A or Less
In Accordance With Figure 3-3
Initial Area Time of Concentration =   5.43 minutes
TC = [1.8*(1.1-C)*distance(Ft.)^.5)/(% slope^(1/3)]
TC = [1.8*(1.1-0.4500)*( 100.000^.5)/(  10.000^(1/3)]=   5.43
Rainfall intensity (I) =      6.745(In/Hr) for a   100.0 year storm
Effective runoff coefficient used for area (Q=KCIA) is C = 0.450
Subarea runoff =      0.121(CFS)
Total initial stream area =        0.040(Ac.)


++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++
Process from Point/Station       65.000 to Point/Station       55.000
**** IMPROVED CHANNEL TRAVEL TIME ****
------------------------------------------------------------------------
Upstream point elevation =   739.000(Ft.)
Downstream point elevation =   738.500(Ft.)
Channel length thru subarea  =   215.000(Ft.)
Channel base width  =   10.000(Ft.)
Slope or 'Z' of left channel bank =   5.000
Slope or 'Z' of right channel bank =   5.000
Estimated mean flow rate at midpoint of channel =      0.342(CFS)
```

```
Manning's 'N'    = 0.035
Maximum depth of channel  =    2.000(Ft.)
Flow(q) thru subarea =      0.342(CFS)
Depth of flow =   0.085(Ft.), Average velocity =   0.385(Ft/s)
Channel flow top width =   10.851(Ft.)
Flow Velocity =    0.39(Ft/s)
Travel time  =    9.30 min.
Time of concentration =   14.73 min.
Critical depth =      0.033(Ft.)
 Adding area flow to channel
Decimal fraction soil group A = 0.000
Decimal fraction soil group B = 1.000
Decimal fraction soil group C = 0.000
Decimal fraction soil group D = 0.000
[MEDIUM DENSITY RESIDENTIAL                 ]
(4.3 DU/A or Less       )
Impervious value, Ai = 0.300
Sub-Area C Value = 0.450
Rainfall intensity =      3.543(In/Hr) for a   100.0 year storm
Effective runoff coefficient used for total area
(Q=KCIA) is C = 0.450  CA =      0.140
Subarea runoff =      0.373(CFS) for      0.270(Ac.)
Total runoff =      0.494(CFS)   Total area =       0.310(Ac.)
Depth of flow =   0.106(Ft.), Average velocity =   0.443(Ft/s)
Critical depth =      0.042(Ft.)


++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++
Process from Point/Station       55.000 to Point/Station       55.000
**** CONFLUENCE OF MINOR STREAMS ****
________________________________________________________________________
Along Main Stream number: 1 in normal stream number 2
Stream flow area =      0.310(Ac.)
Runoff from this stream =      0.494(CFS)
Time of concentration =   14.73 min.
Rainfall intensity =     3.543(In/Hr)
Summary of stream data:

Stream   Flow rate      TC            Rainfall Intensity
 No.       (CFS)       (min)                 (In/Hr)


1        1.547     11.92           4.062
2        0.494     14.73           3.543
Qmax(1) =
          1.000 *    1.000 *     1.547) +
          1.000 *    0.809 *     0.494) + =       1.947
Qmax(2) =
          0.872 *    1.000 *     1.547) +
          1.000 *    1.000 *     0.494) + =       1.843

Total of 2 streams to confluence:
Flow rates before confluence point:
       1.547       0.494
Maximum flow rates at confluence using above data:
        1.947        1.843
Area of streams before confluence:
        0.820        0.310
Results of confluence:
Total flow rate =      1.947(CFS)
Time of concentration =    11.919 min.
Effective stream area after confluence =      1.130(Ac.)


++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++
Process from Point/Station       55.000 to Point/Station       70.000
```

```
**** PIPEFLOW TRAVEL TIME (User specified size) ****
------------------------------------------------------------------------
Upstream point/station elevation =   734.920(Ft.)
Downstream point/station elevation =   727.000(Ft.)
Pipe length  =    50.00(Ft.)   Manning's N = 0.013
No. of pipes = 1  Required pipe flow  =     1.947(CFS)
Given pipe size =     12.00(In.)
Calculated individual pipe flow  =     1.947(CFS)
Normal flow depth in pipe =    3.00(In.)
Flow top width inside pipe =   10.40(In.)
Critical Depth =    7.13(In.)
Pipe flow velocity =     12.66(Ft/s)
Travel time through pipe =    0.07 min.
Time of concentration (TC) =    11.98 min.


++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++
Process from Point/Station       70.000 to Point/Station       70.000
**** CONFLUENCE OF MAIN STREAMS ****
------------------------------------------------------------------------
The following data inside Main Stream is listed:
In Main Stream number: 1
Stream flow area =      1.130(Ac.)
Runoff from this stream =      1.947(CFS)
Time of concentration =   11.98 min.
Rainfall intensity =     4.048(In/Hr)
Program is now starting with Main Stream No. 2


++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++
Process from Point/Station       75.000 to Point/Station       80.000
**** INITIAL AREA EVALUATION ****
------------------------------------------------------------------------
Decimal fraction soil group A = 0.000
Decimal fraction soil group B = 1.000
Decimal fraction soil group C = 0.000
Decimal fraction soil group D = 0.000
[MEDIUM DENSITY RESIDENTIAL                 ]
(4.3 DU/A or Less       )
Impervious value, Ai = 0.300
Sub-Area C Value = 0.450
Initial subarea total flow distance  =   50.000(Ft.)
Highest elevation =  749.500(Ft.)
Lowest elevation =  744.000(Ft.)
Elevation difference =    5.500(Ft.) Slope = 11.000 %
INITIAL AREA TIME OF CONCENTRATION CALCULATIONS:
The maximum overland flow distance is 100.00 (Ft)
for the top area slope value of  11.00 %, in a development type of
 4.3 DU/A or Less
In Accordance With Figure 3-3
Initial Area Time of Concentration =   5.26 minutes
TC = [1.8*(1.1-C)*distance(Ft.)^.5)/(% slope^(1/3)]
TC = [1.8*(1.1-0.4500)*( 100.000^.5)/(  11.000^(1/3)]=   5.26
Rainfall intensity (I) =      6.884(In/Hr) for a   100.0 year storm
Effective runoff coefficient used for area (Q=KCIA) is C = 0.450
Subarea runoff =      0.217(CFS)
Total initial stream area =        0.070(Ac.)


++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++
Process from Point/Station       80.000 to Point/Station       85.000
**** IMPROVED CHANNEL TRAVEL TIME ****
------------------------------------------------------------------------
Upstream point elevation =   744.000(Ft.)
Downstream point elevation =   740.500(Ft.)
Channel length thru subarea  =   137.000(Ft.)
```

```
Channel base width  =   10.000(Ft.)
Slope or 'Z' of left channel bank =   5.000
Slope or 'Z' of right channel bank =   5.000
Estimated mean flow rate at midpoint of channel =      0.467(CFS)
Manning's 'N'    = 0.035
Maximum depth of channel  =    2.000(Ft.)
Flow(q) thru subarea =      0.467(CFS)
Depth of flow =   0.050(Ft.), Average velocity =   0.908(Ft/s)
Channel flow top width =   10.502(Ft.)
Flow Velocity =    0.91(Ft/s)
Travel time  =    2.51 min.
Time of concentration =    7.77 min.
Critical depth =      0.041(Ft.)
 Adding area flow to channel
Decimal fraction soil group A = 0.000
Decimal fraction soil group B = 1.000
Decimal fraction soil group C = 0.000
Decimal fraction soil group D = 0.000
[MEDIUM DENSITY RESIDENTIAL                 ]
(4.3 DU/A or Less       )
Impervious value, Ai = 0.300
Sub-Area C Value = 0.450
Rainfall intensity =      5.351(In/Hr) for a   100.0 year storm
Effective runoff coefficient used for total area
(Q=KCIA) is C = 0.450  CA =      0.117
Subarea runoff =      0.409(CFS) for      0.190(Ac.)
Total runoff =      0.626(CFS)   Total area =       0.260(Ac.)
Depth of flow =   0.060(Ft.), Average velocity =   1.017(Ft/s)
Critical depth =      0.049(Ft.)


++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++
Process from Point/Station       85.000 to Point/Station       85.000
**** CONFLUENCE OF MINOR STREAMS ****
________________________________________________________________________
Along Main Stream number: 2 in normal stream number 1
Stream flow area =      0.260(Ac.)
Runoff from this stream =      0.626(CFS)
Time of concentration =    7.77 min.
Rainfall intensity =     5.351(In/Hr)


++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++
Process from Point/Station      140.000 to Point/Station      145.000
**** INITIAL AREA EVALUATION ****
________________________________________________________________________
Decimal fraction soil group A = 0.000
Decimal fraction soil group B = 1.000
Decimal fraction soil group C = 0.000
Decimal fraction soil group D = 0.000
[INDUSTRIAL area type                       ]
(General Industrial       )
Impervious value, Ai = 0.950
Sub-Area C Value = 0.870
Initial subarea total flow distance  =   50.000(Ft.)
Highest elevation =  750.200(Ft.)
Lowest elevation =  747.500(Ft.)
Elevation difference =    2.700(Ft.) Slope =  5.400 %
INITIAL AREA TIME OF CONCENTRATION CALCULATIONS:
The maximum overland flow distance is 90.00 (Ft)
for the top area slope value of   5.40 %, in a development type of
 General Industrial
In Accordance With Figure 3-3
Initial Area Time of Concentration =   2.24 minutes
TC = [1.8*(1.1-C)*distance(Ft.)^.5)/(% slope^(1/3)]
TC = [1.8*(1.1-0.8700)*(  90.000^.5)/(   5.400^(1/3)]=   2.24
```

```
Calculated TC of    2.239 minutes is less than 5 minutes,
 resetting TC to 5.0 minutes for rainfall intensity calculations
Rainfall intensity (I) =      7.114(In/Hr) for a   100.0 year storm
Effective runoff coefficient used for area (Q=KCIA) is C = 0.870
Subarea runoff =      0.062(CFS)
Total initial stream area =        0.010(Ac.)


++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++
Process from Point/Station      145.000 to Point/Station       85.000
**** STREET FLOW TRAVEL TIME + SUBAREA FLOW ADDITION ****
________________________________________________________________________
Top of street segment elevation =   747.500(Ft.)
End of street segment elevation =   740.100(Ft.)
Length of street segment  =   124.000(Ft.)
Height of curb above gutter flowline  =    6.0(In.)
Width of half street (curb to crown)  =  22.000(Ft.)
Distance from crown to crossfall grade break  =  18.000(Ft.)
Slope from gutter to grade break (v/hz) =   0.020
Slope from grade break to crown (v/hz)  =   0.020
Street flow is on [2] side(s) of the street
Distance from curb to property line  =  10.000(Ft.)
Slope from curb to property line (v/hz) =   0.025
Gutter width =   2.000(Ft.)
Gutter hike from flowline =  2.000(In.)
 Manning's N in gutter =  0.0150
 Manning's N from gutter to grade break =  0.0150
 Manning's N from grade break to crown =  0.0150
Estimated mean flow rate at midpoint of street =      0.225(CFS)
Depth of flow =   0.083(Ft.), Average velocity =   2.738(Ft/s)
Streetflow hydraulics at midpoint of street travel:
Halfstreet flow width =   2.000(Ft.)
Flow velocity =   2.74(Ft/s)
Travel time =    0.75 min.     TC =    2.99  min.
 Adding area flow to street
Decimal fraction soil group A = 0.000
Decimal fraction soil group B = 1.000
Decimal fraction soil group C = 0.000
Decimal fraction soil group D = 0.000
[INDUSTRIAL area type                        ]
(General Industrial       )
Impervious value, Ai = 0.950
Sub-Area C Value = 0.870
Rainfall intensity =      7.114(In/Hr) for a   100.0 year storm
Effective runoff coefficient used for total area
(Q=KCIA) is C = 0.870  CA =      0.070
Subarea runoff =      0.433(CFS) for      0.070(Ac.)
Total runoff =      0.495(CFS)   Total area =       0.080(Ac.)
Street flow at end of street =      0.495(CFS)
Half street flow at end of street =      0.248(CFS)
Depth of flow =   0.111(Ft.), Average velocity =   3.335(Ft/s)
Flow width (from curb towards crown)=   2.000(Ft.)


++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++
Process from Point/Station       85.000 to Point/Station       85.000
**** CONFLUENCE OF MINOR STREAMS ****
________________________________________________________________________
Along Main Stream number: 2 in normal stream number 2
Stream flow area =      0.080(Ac.)
Runoff from this stream =      0.495(CFS)
Time of concentration =    2.99 min.
Rainfall intensity =     7.114(In/Hr)
Summary of stream data:

Stream   Flow rate      TC            Rainfall Intensity
```

```
 No.       (CFS)       (min)                 (In/Hr)


1        0.626      7.77            5.351
2        0.495      2.99            7.114
Qmax(1) =
          1.000 *    1.000 *     0.626) +
          0.752 *    1.000 *     0.495) + =       0.999
Qmax(2) =
          1.000 *    0.385 *     0.626) +
          1.000 *    1.000 *     0.495) + =       0.736

Total of 2 streams to confluence:
Flow rates before confluence point:
       0.626       0.495
Maximum flow rates at confluence using above data:
        0.999        0.736
Area of streams before confluence:
        0.260        0.080
Results of confluence:
Total flow rate =      0.999(CFS)
Time of concentration =     7.775 min.
Effective stream area after confluence =      0.340(Ac.)


++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++
Process from Point/Station       85.000 to Point/Station       90.000
**** PIPEFLOW TRAVEL TIME (User specified size) ****
________________________________________________________________________
Upstream point/station elevation =   740.500(Ft.)
Downstream point/station elevation =   733.000(Ft.)
Pipe length  =   135.00(Ft.)   Manning's N = 0.013
No. of pipes = 1  Required pipe flow  =     0.999(CFS)
Given pipe size =      8.00(In.)
Calculated individual pipe flow  =     0.999(CFS)
Normal flow depth in pipe =    3.27(In.)
Flow top width inside pipe =    7.87(In.)
Critical Depth =    5.69(In.)
Pipe flow velocity =      7.44(Ft/s)
Travel time through pipe =    0.30 min.
Time of concentration (TC) =     8.08 min.


++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++
Process from Point/Station       90.000 to Point/Station       90.000
**** CONFLUENCE OF MINOR STREAMS ****
________________________________________________________________________
Along Main Stream number: 2 in normal stream number 1
Stream flow area =      0.340(Ac.)
Runoff from this stream =      0.999(CFS)
Time of concentration =    8.08 min.
Rainfall intensity =     5.221(In/Hr)


++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++
Process from Point/Station      100.000 to Point/Station      105.000
**** INITIAL AREA EVALUATION ****
________________________________________________________________________
Decimal fraction soil group A = 0.000
Decimal fraction soil group B = 1.000
Decimal fraction soil group C = 0.000
Decimal fraction soil group D = 0.000
[MEDIUM DENSITY RESIDENTIAL                 ]
(4.3 DU/A or Less       )
Impervious value, Ai = 0.300
Sub-Area C Value = 0.450
```

```
Initial subarea total flow distance  =   50.000(Ft.)
Highest elevation =  740.600(Ft.)
Lowest elevation =  735.000(Ft.)
Elevation difference =    5.600(Ft.) Slope = 11.200 %
INITIAL AREA TIME OF CONCENTRATION CALCULATIONS:
The maximum overland flow distance is 100.00 (Ft)
for the top area slope value of  11.20 %, in a development type of
 4.3 DU/A or Less
In Accordance With Figure 3-3
Initial Area Time of Concentration =   5.23 minutes
TC = [1.8*(1.1-C)*distance(Ft.)^.5)/(% slope^(1/3)]
TC = [1.8*(1.1-0.4500)*( 100.000^.5)/(  11.200^(1/3)]=   5.23
Rainfall intensity (I) =      6.911(In/Hr) for a   100.0 year storm
Effective runoff coefficient used for area (Q=KCIA) is C = 0.450
Subarea runoff =      0.155(CFS)
Total initial stream area =        0.050(Ac.)


++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++
Process from Point/Station      105.000 to Point/Station       90.000
**** IMPROVED CHANNEL TRAVEL TIME ****
________________________________________________________________________
Upstream point elevation =   735.000(Ft.)
Downstream point elevation =   734.900(Ft.)
Channel length thru subarea  =    92.000(Ft.)
Channel base width  =   10.000(Ft.)
Slope or 'Z' of left channel bank =   5.000
Slope or 'Z' of right channel bank =   5.000
Estimated mean flow rate at midpoint of channel =      0.554(CFS)
Manning's 'N'    = 0.035
Maximum depth of channel  =    2.000(Ft.)
Flow(q) thru subarea =      0.554(CFS)
Depth of flow =   0.142(Ft.), Average velocity =   0.364(Ft/s)
Channel flow top width =   11.420(Ft.)
Flow Velocity =    0.36(Ft/s)
Travel time  =    4.21 min.
Time of concentration =    9.44 min.
Critical depth =      0.045(Ft.)
 Adding area flow to channel
Decimal fraction soil group A = 0.000
Decimal fraction soil group B = 1.000
Decimal fraction soil group C = 0.000
Decimal fraction soil group D = 0.000
[MEDIUM DENSITY RESIDENTIAL                 ]
(4.3 DU/A or Less       )
Impervious value, Ai = 0.300
Sub-Area C Value = 0.450
Rainfall intensity =      4.723(In/Hr) for a   100.0 year storm
Effective runoff coefficient used for total area
(Q=KCIA) is C = 0.450  CA =      0.189
Subarea runoff =      0.737(CFS) for      0.370(Ac.)
Total runoff =      0.893(CFS)   Total area =       0.420(Ac.)
Depth of flow =   0.188(Ft.), Average velocity =   0.434(Ft/s)
Critical depth =      0.063(Ft.)


++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++
Process from Point/Station       90.000 to Point/Station       90.000
**** CONFLUENCE OF MINOR STREAMS ****
________________________________________________________________________
Along Main Stream number: 2 in normal stream number 2
Stream flow area =      0.420(Ac.)
Runoff from this stream =      0.893(CFS)
Time of concentration =    9.44 min.
Rainfall intensity =     4.723(In/Hr)
Summary of stream data:
```

```
Stream   Flow rate      TC            Rainfall Intensity
 No.       (CFS)       (min)                (In/Hr)


1        0.999      8.08           5.221
2        0.893      9.44           4.723
Qmax(1) =
          1.000 *    1.000 *     0.999) +
          1.000 *    0.856 *     0.893) + =       1.762
Qmax(2) =
          0.905 *    1.000 *     0.999) +
          1.000 *    1.000 *     0.893) + =       1.796

Total of 2 streams to confluence:
Flow rates before confluence point:
       0.999       0.893
Maximum flow rates at confluence using above data:
        1.762        1.796
Area of streams before confluence:
        0.340        0.420
Results of confluence:
Total flow rate =      1.796(CFS)
Time of concentration =     9.437 min.
Effective stream area after confluence =      0.760(Ac.)


++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++
Process from Point/Station       90.000 to Point/Station       95.000
**** PIPEFLOW TRAVEL TIME (User specified size) ****
________________________________________________________________________
Upstream point/station elevation =   732.500(Ft.)
Downstream point/station elevation =   729.000(Ft.)
Pipe length  =    20.00(Ft.)   Manning's N = 0.013
No. of pipes = 1  Required pipe flow  =     1.796(CFS)
Given pipe size =      8.00(In.)
Calculated individual pipe flow  =     1.796(CFS)
Normal flow depth in pipe =    3.29(In.)
Flow top width inside pipe =    7.87(In.)
Critical Depth =    7.31(In.)
Pipe flow velocity =     13.25(Ft/s)
Travel time through pipe =    0.03 min.
Time of concentration (TC) =     9.46 min.


++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++
Process from Point/Station       95.000 to Point/Station       95.000
**** CONFLUENCE OF MINOR STREAMS ****
________________________________________________________________________
Along Main Stream number: 2 in normal stream number 1
Stream flow area =      0.760(Ac.)
Runoff from this stream =      1.796(CFS)
Time of concentration =    9.46 min.
Rainfall intensity =     4.714(In/Hr)


++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++
Process from Point/Station      110.000 to Point/Station      115.000
**** INITIAL AREA EVALUATION ****
________________________________________________________________________
Decimal fraction soil group A = 0.000
Decimal fraction soil group B = 1.000
Decimal fraction soil group C = 0.000
Decimal fraction soil group D = 0.000
[MEDIUM DENSITY RESIDENTIAL                 ]
(4.3 DU/A or Less       )
```

```
Impervious value, Ai = 0.300
Sub-Area C Value = 0.450
Initial subarea total flow distance  =   50.000(Ft.)
Highest elevation =  739.500(Ft.)
Lowest elevation =  734.000(Ft.)
Elevation difference =    5.500(Ft.) Slope = 11.000 %
INITIAL AREA TIME OF CONCENTRATION CALCULATIONS:
The maximum overland flow distance is 100.00 (Ft)
for the top area slope value of  11.00 %, in a development type of
 4.3 DU/A or Less
In Accordance With Figure 3-3
Initial Area Time of Concentration =   5.26 minutes
TC = [1.8*(1.1-C)*distance(Ft.)^.5)/(% slope^(1/3)]
TC = [1.8*(1.1-0.4500)*( 100.000^.5)/(  11.000^(1/3)]=   5.26
Rainfall intensity (I) =      6.884(In/Hr) for a   100.0 year storm
Effective runoff coefficient used for area (Q=KCIA) is C = 0.450
Subarea runoff =      0.155(CFS)
Total initial stream area =        0.050(Ac.)


++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++
Process from Point/Station      115.000 to Point/Station      120.000
**** IMPROVED CHANNEL TRAVEL TIME ****
------------------------------------------------------------------------
Upstream point elevation =   734.000(Ft.)
Downstream point elevation =   730.000(Ft.)
Channel length thru subarea  =   106.000(Ft.)
Channel base width  =   10.000(Ft.)
Slope or 'Z' of left channel bank =   5.000
Slope or 'Z' of right channel bank =   5.000
Estimated mean flow rate at midpoint of channel =      0.389(CFS)
Manning's 'N'    = 0.035
Maximum depth of channel  =    2.000(Ft.)
Flow(q) thru subarea =      0.389(CFS)
Depth of flow =   0.040(Ft.), Average velocity =   0.952(Ft/s)
Channel flow top width =   10.400(Ft.)
Flow Velocity =    0.95(Ft/s)
Travel time  =    1.86 min.
Time of concentration =    7.12 min.
Critical depth =      0.036(Ft.)
 Adding area flow to channel
Decimal fraction soil group A = 0.000
Decimal fraction soil group B = 1.000
Decimal fraction soil group C = 0.000
Decimal fraction soil group D = 0.000
[MEDIUM DENSITY RESIDENTIAL                 ]
(4.3 DU/A or Less       )
Impervious value, Ai = 0.300
Sub-Area C Value = 0.450
Rainfall intensity =      5.665(In/Hr) for a   100.0 year storm
Effective runoff coefficient used for total area
(Q=KCIA) is C = 0.450  CA =      0.099
Subarea runoff =      0.406(CFS) for      0.170(Ac.)
Total runoff =      0.561(CFS)   Total area =       0.220(Ac.)
Depth of flow =   0.050(Ft.), Average velocity =   1.098(Ft/s)
Critical depth =      0.046(Ft.)


++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++
Process from Point/Station      120.000 to Point/Station       95.000
**** PIPEFLOW TRAVEL TIME (User specified size) ****
------------------------------------------------------------------------
Upstream point/station elevation =   730.000(Ft.)
Downstream point/station elevation =   729.000(Ft.)
Pipe length  =    12.00(Ft.)   Manning's N = 0.013
No. of pipes = 1  Required pipe flow  =     0.561(CFS)
```

```
Given pipe size =      8.00(In.)
Calculated individual pipe flow  =     0.561(CFS)
Normal flow depth in pipe =    2.17(In.)
Flow top width inside pipe =    7.11(In.)
Critical Depth =    4.22(In.)
Pipe flow velocity =      7.33(Ft/s)
Travel time through pipe =    0.03 min.
Time of concentration (TC) =     7.14 min.


++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++
Process from Point/Station       95.000 to Point/Station       95.000
**** CONFLUENCE OF MINOR STREAMS ****
________________________________________________________________________
Along Main Stream number: 2 in normal stream number 2
Stream flow area =      0.220(Ac.)
Runoff from this stream =      0.561(CFS)
Time of concentration =    7.14 min.
Rainfall intensity =     5.651(In/Hr)
Summary of stream data:

Stream   Flow rate      TC            Rainfall Intensity
 No.       (CFS)       (min)                 (In/Hr)


1        1.796      9.46           4.714
2        0.561      7.14           5.651
Qmax(1) =
          1.000 *    1.000 *     1.796) +
          0.834 *    1.000 *     0.561) + =       2.264
Qmax(2) =
          1.000 *    0.755 *     1.796) +
          1.000 *    1.000 *     0.561) + =       1.917

Total of 2 streams to confluence:
Flow rates before confluence point:
       1.796       0.561
Maximum flow rates at confluence using above data:
        2.264        1.917
Area of streams before confluence:
        0.760        0.220
Results of confluence:
Total flow rate =      2.264(CFS)
Time of concentration =     9.462 min.
Effective stream area after confluence =      0.980(Ac.)


++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++
Process from Point/Station       95.000 to Point/Station      125.000
**** PIPEFLOW TRAVEL TIME (User specified size) ****
________________________________________________________________________
Upstream point/station elevation =   729.000(Ft.)
Downstream point/station elevation =   727.000(Ft.)
Pipe length  =    25.00(Ft.)   Manning's N = 0.013
No. of pipes = 1  Required pipe flow  =     2.264(CFS)
Given pipe size =      8.00(In.)
Calculated individual pipe flow  =     2.264(CFS)
Normal flow depth in pipe =    4.76(In.)
Flow top width inside pipe =    7.86(In.)
Critical depth could not be calculated.
Pipe flow velocity =     10.47(Ft/s)
Travel time through pipe =    0.04 min.
Time of concentration (TC) =     9.50 min.


++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++
```

```
Process from Point/Station       70.000 to Point/Station      125.000
**** CONFLUENCE OF MAIN STREAMS ****
--------------------------------------------------------------------------------
The following data inside Main Stream is listed:
In Main Stream number: 2
Stream flow area =      0.980(Ac.)
Runoff from this stream =      2.264(CFS)
Time of concentration =    9.50 min.
Rainfall intensity =     4.702(In/Hr)
Summary of stream data:

Stream   Flow rate      TC            Rainfall Intensity
 No.       (CFS)       (min)                 (In/Hr)


1        1.947     11.98            4.048
2        2.264      9.50            4.702
Qmax(1) =
          1.000 *    1.000 *     1.947) +
          0.861 *    1.000 *     2.264) + =       3.895
Qmax(2) =
          1.000 *    0.793 *     1.947) +
          1.000 *    1.000 *     2.264) + =       3.807

Total of 2 main streams to confluence:
Flow rates before confluence point:
       1.947       2.264
Maximum flow rates at confluence using above data:
        3.895        3.807
Area of streams before confluence:
        1.130        0.980


Results of confluence:
Total flow rate =      3.895(CFS)
Time of concentration =    11.985 min.
Effective stream area after confluence  =      2.110(Ac.)


++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++
Process from Point/Station      130.000 to Point/Station      135.000
**** PIPEFLOW TRAVEL TIME (User specified size) ****
--------------------------------------------------------------------------------
Upstream point/station elevation =   721.500(Ft.)
Downstream point/station elevation =   713.140(Ft.)
Pipe length  =    72.00(Ft.)   Manning's N = 0.013
No. of pipes = 1  Required pipe flow  =     3.895(CFS)
Given pipe size =     12.00(In.)
Calculated individual pipe flow  =     3.895(CFS)
Normal flow depth in pipe =    4.68(In.)
Flow top width inside pipe =   11.70(In.)
Critical Depth =   10.06(In.)
Pipe flow velocity =     13.77(Ft/s)
Travel time through pipe =    0.09 min.
Time of concentration (TC) =    12.07 min.


++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++
Process from Point/Station      135.000 to Point/Station      135.000
**** CONFLUENCE OF MINOR STREAMS ****
--------------------------------------------------------------------------------
Along Main Stream number: 1 in normal stream number 1
Stream flow area =      2.110(Ac.)
Runoff from this stream =      3.895(CFS)
Time of concentration =   12.07 min.
Rainfall intensity =     4.029(In/Hr)
```

```
++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++
Process from Point/Station      150.000 to Point/Station      155.000
**** INITIAL AREA EVALUATION ****
------------------------------------------------------------------------------
Decimal fraction soil group A = 0.000
Decimal fraction soil group B = 1.000
Decimal fraction soil group C = 0.000
Decimal fraction soil group D = 0.000
[UNDISTURBED NATURAL TERRAIN                ]
(Permanent Open Space   )
Impervious value, Ai = 0.000
Sub-Area C Value = 0.250
Initial subarea total flow distance  =   75.000(Ft.)
Highest elevation =  730.000(Ft.)
Lowest elevation =  724.000(Ft.)
Elevation difference =    6.000(Ft.) Slope =  8.000 %
INITIAL AREA TIME OF CONCENTRATION CALCULATIONS:
The maximum overland flow distance is 100.00 (Ft)
for the top area slope value of   8.00 %, in a development type of
 Permanent Open Space
In Accordance With Figure 3-3
Initial Area Time of Concentration =   7.65 minutes
TC = [1.8*(1.1-C)*distance(Ft.)^.5)/(% slope^(1/3)]
TC = [1.8*(1.1-0.2500)*( 100.000^.5)/(   8.000^(1/3)]=   7.65
Rainfall intensity (I) =      5.407(In/Hr) for a   100.0 year storm
Effective runoff coefficient used for area (Q=KCIA) is C = 0.250
Subarea runoff =      0.014(CFS)
Total initial stream area =        0.010(Ac.)


++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++
Process from Point/Station      155.000 to Point/Station      135.000
**** IMPROVED CHANNEL TRAVEL TIME ****
------------------------------------------------------------------------------
Upstream point elevation =   724.000(Ft.)
Downstream point elevation =   713.140(Ft.)
Channel length thru subarea  =   110.000(Ft.)
Channel base width  =   10.000(Ft.)
Slope or 'Z' of left channel bank =   5.000
Slope or 'Z' of right channel bank =   5.000
Estimated mean flow rate at midpoint of channel =      0.108(CFS)
Manning's 'N'    = 0.035
Maximum depth of channel  =    2.000(Ft.)
Flow(q) thru subarea =      0.108(CFS)
Depth of flow =   0.014(Ft.), Average velocity =   0.770(Ft/s)
Channel flow top width =   10.140(Ft.)
Flow Velocity =    0.77(Ft/s)
Travel time  =    2.38 min.
Time of concentration =   10.03 min.
Critical depth =      0.015(Ft.)
 Adding area flow to channel
Decimal fraction soil group A = 0.000
Decimal fraction soil group B = 1.000
Decimal fraction soil group C = 0.000
Decimal fraction soil group D = 0.000
[UNDISTURBED NATURAL TERRAIN                ]
(Permanent Open Space   )
Impervious value, Ai = 0.000
Sub-Area C Value = 0.250
Rainfall intensity =      4.540(In/Hr) for a   100.0 year storm
Effective runoff coefficient used for total area
(Q=KCIA) is C = 0.250  CA =      0.038
Subarea runoff =      0.157(CFS) for      0.140(Ac.)
Total runoff =      0.170(CFS)   Total area =       0.150(Ac.)
```

```
Depth of flow =   0.018(Ft.), Average velocity =   0.921(Ft/s)
Critical depth =      0.021(Ft.)


++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++
Process from Point/Station      135.000 to Point/Station      135.000
**** CONFLUENCE OF MINOR STREAMS ****
________________________________________________________________________
Along Main Stream number: 1 in normal stream number 2
Stream flow area =      0.150(Ac.)
Runoff from this stream =      0.170(CFS)
Time of concentration =   10.03 min.
Rainfall intensity =     4.540(In/Hr)
Summary of stream data:

Stream   Flow rate      TC            Rainfall Intensity
 No.       (CFS)       (min)                 (In/Hr)


1        3.895     12.07           4.029
2        0.170     10.03           4.540
Qmax(1) =
          1.000 *    1.000 *     3.895) +
          0.887 *    1.000 *     0.170) + =       4.046
Qmax(2) =
          1.000 *    0.831 *     3.895) +
          1.000 *    1.000 *     0.170) + =       3.408

Total of 2 streams to confluence:
Flow rates before confluence point:
       3.895       0.170
Maximum flow rates at confluence using above data:
        4.046        3.408
Area of streams before confluence:
        2.110        0.150
Results of confluence:
Total flow rate =      4.046(CFS)
Time of concentration =    12.072 min.
Effective stream area after confluence =      2.260(Ac.)
End of computations, total study area =          2.870 (Ac.)
```

CHAPTER 5 - 100 YEAR HYDROLOGIC ANALYSIS FOR DEVELOPED CONDITIONS - MITIGATED

```
             San Diego County Rational Hydrology Program

CIVILCADD/CIVILDESIGN Engineering Software,(c)1991-2005 Version 7.5

Rational method hydrology  program based on
San Diego County Flood Control Division 2003 hydrology manual
       Rational Hydrology Study        Date: 10/05/16
------------------------------------------------------------------------
Proposed Conditions Hydrology - Unmitigated
100 Year Storm
Terrace Hill Drive

------------------------------------------------------------------------
 *********   Hydrology Study Control Information **********

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


Program License Serial Number 4085

------------------------------------------------------------------------
Rational hydrology study storm event year is   100.0
English (in-lb) input data Units used

Map data precipitation entered:
6 hour,  precipitation(inches) =  2.700
24 hour precipitation(inches) =  6.000
P6/P24 =    45.0%
San Diego hydrology manual 'C' values used


++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++
Process from Point/Station        5.000 to Point/Station       10.000
**** INITIAL AREA EVALUATION ****
________________________________________________________________________
Decimal fraction soil group A = 0.000
Decimal fraction soil group B = 1.000
Decimal fraction soil group C = 0.000
Decimal fraction soil group D = 0.000
[MEDIUM DENSITY RESIDENTIAL                  ]
(4.3 DU/A or Less       )
Impervious value, Ai = 0.300
Sub-Area C Value = 0.450
Initial subarea total flow distance  =   50.000(Ft.)
Highest elevation =  756.500(Ft.)
Lowest elevation =  750.000(Ft.)
Elevation difference =    6.500(Ft.) Slope = 13.000 %
INITIAL AREA TIME OF CONCENTRATION CALCULATIONS:
The maximum overland flow distance is 100.00 (Ft)
for the top area slope value of  13.00 %, in a development type of
 4.3 DU/A or Less
In Accordance With Figure 3-3
Initial Area Time of Concentration =   4.98 minutes
TC = [1.8*(1.1-C)*distance(Ft.)^.5)/(% slope^(1/3)]
TC = [1.8*(1.1-0.4500)*( 100.000^.5)/(  13.000^(1/3)]=   4.98
Calculated TC of    4.976 minutes is less than 5 minutes,
 resetting TC to 5.0 minutes for rainfall intensity calculations
Rainfall intensity (I) =      7.114(In/Hr) for a   100.0 year storm
Effective runoff coefficient used for area (Q=KCIA) is C = 0.450
Subarea runoff =      0.064(CFS)
```

```
Total initial stream area =        0.020(Ac.)


++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++
Process from Point/Station       10.000 to Point/Station       15.000
**** STREET FLOW TRAVEL TIME + SUBAREA FLOW ADDITION ****
______________________________________________________________________________
Top of street segment elevation =   750.000(Ft.)
End of street segment elevation =   734.000(Ft.)
Length of street segment  =   329.000(Ft.)
Height of curb above gutter flowline  =    6.0(In.)
Width of half street (curb to crown)  =  22.000(Ft.)
Distance from crown to crossfall grade break  =  18.000(Ft.)
Slope from gutter to grade break (v/hz) =   0.020
Slope from grade break to crown (v/hz)  =   0.020
Street flow is on [2] side(s) of the street
Distance from curb to property line  =  10.000(Ft.)
Slope from curb to property line (v/hz) =   0.025
Gutter width =   2.000(Ft.)
Gutter hike from flowline =  2.000(In.)
 Manning's N in gutter =  0.0150
 Manning's N from gutter to grade break =  0.0150
 Manning's N from grade break to crown =  0.0150
Estimated mean flow rate at midpoint of street =      0.767(CFS)
Depth of flow =   0.136(Ft.), Average velocity =   3.447(Ft/s)
Streetflow hydraulics at midpoint of street travel:
Halfstreet flow width =   2.000(Ft.)
Flow velocity =   3.45(Ft/s)
Travel time =    1.59 min.     TC =    6.57  min.
 Adding area flow to street
Decimal fraction soil group A = 0.000
Decimal fraction soil group B = 1.000
Decimal fraction soil group C = 0.000
Decimal fraction soil group D = 0.000
[MEDIUM DENSITY RESIDENTIAL                 ]
(4.3 DU/A or Less       )
Impervious value, Ai = 0.300
Sub-Area C Value = 0.450
Rainfall intensity =      5.967(In/Hr) for a   100.0 year storm
Effective runoff coefficient used for total area
(Q=KCIA) is C = 0.450  CA =      0.266
Subarea runoff =      1.520(CFS) for      0.570(Ac.)
Total runoff =      1.584(CFS)   Total area =       0.590(Ac.)
Street flow at end of street =      1.584(CFS)
Half street flow at end of street =      0.792(CFS)
Depth of flow =   0.187(Ft.), Average velocity =   3.632(Ft/s)
Flow width (from curb towards crown)=   3.024(Ft.)


++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++
Process from Point/Station       20.000 to Point/Station       20.000
**** USER DEFINED FLOW INFORMATION AT A POINT ****
______________________________________________________________________________
User specified 'C' value of 0.450 given for subarea
Rainfall intensity (I) =      4.044(In/Hr) for a   100.0 year storm
User specified values are as follows:
TC =  12.00 min.  Rain intensity =       4.04(In/Hr)
Total area =       0.590(Ac.)  Total runoff =     0.530(CFS)


++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++
Process from Point/Station       20.000 to Point/Station       25.000
**** PIPEFLOW TRAVEL TIME (User specified size) ****
______________________________________________________________________________
Upstream point/station elevation =   731.700(Ft.)
Downstream point/station elevation =   731.500(Ft.)
```

```
Pipe length  =    30.00(Ft.)   Manning's N = 0.013
No. of pipes = 1  Required pipe flow  =     0.530(CFS)
Given pipe size =     12.00(In.)
Calculated individual pipe flow  =     0.530(CFS)
Normal flow depth in pipe =    3.47(In.)
Flow top width inside pipe =   10.88(In.)
Critical Depth =    3.62(In.)
Pipe flow velocity =      2.82(Ft/s)
Travel time through pipe =    0.18 min.
Time of concentration (TC) =    12.18 min.


++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++
Process from Point/Station       25.000 to Point/Station       25.000
**** CONFLUENCE OF MINOR STREAMS ****
______________________________________________________________________________
Along Main Stream number: 1 in normal stream number 1
Stream flow area =      0.590(Ac.)
Runoff from this stream =      0.530(CFS)
Time of concentration =   12.18 min.
Rainfall intensity =     4.006(In/Hr)


++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++
Process from Point/Station       21.000 to Point/Station       25.000
**** INITIAL AREA EVALUATION ****
______________________________________________________________________________
Decimal fraction soil group A = 0.000
Decimal fraction soil group B = 1.000
Decimal fraction soil group C = 0.000
Decimal fraction soil group D = 0.000
[UNDISTURBED NATURAL TERRAIN                ]
(Permanent Open Space   )
Impervious value, Ai = 0.000
Sub-Area C Value = 0.250
Initial subarea total flow distance  =   58.000(Ft.)
Highest elevation =  740.000(Ft.)
Lowest elevation =  731.500(Ft.)
Elevation difference =    8.500(Ft.) Slope = 14.655 %
Top of Initial Area Slope adjusted by User to 14.600 %
INITIAL AREA TIME OF CONCENTRATION CALCULATIONS:
The maximum overland flow distance is 100.00 (Ft)
for the top area slope value of  14.60 %, in a development type of
 Permanent Open Space
In Accordance With Figure 3-3
Initial Area Time of Concentration =   6.26 minutes
TC = [1.8*(1.1-C)*distance(Ft.)^.5)/(% slope^(1/3)]
TC = [1.8*(1.1-0.2500)*( 100.000^.5)/(  14.600^(1/3)]=   6.26
Rainfall intensity (I) =      6.154(In/Hr) for a   100.0 year storm
Effective runoff coefficient used for area (Q=KCIA) is C = 0.250
Subarea runoff =      0.031(CFS)
Total initial stream area =        0.020(Ac.)


++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++
Process from Point/Station       25.000 to Point/Station       25.000
**** CONFLUENCE OF MINOR STREAMS ****
______________________________________________________________________________
Along Main Stream number: 1 in normal stream number 2
Stream flow area =      0.020(Ac.)
Runoff from this stream =      0.031(CFS)
Time of concentration =    6.26 min.
Rainfall intensity =     6.154(In/Hr)
Summary of stream data:

Stream   Flow rate      TC            Rainfall Intensity
```

```
 No.       (CFS)       (min)                (In/Hr)


1        0.530     12.18           4.006
2        0.031      6.26           6.154
Qmax(1) =
          1.000 *    1.000 *     0.530) +
          0.651 *    1.000 *     0.031) + =       0.550
Qmax(2) =
          1.000 *    0.514 *     0.530) +
          1.000 *    1.000 *     0.031) + =       0.303

Total of 2 streams to confluence:
Flow rates before confluence point:
       0.530       0.031
Maximum flow rates at confluence using above data:
        0.550        0.303
Area of streams before confluence:
        0.590        0.020
Results of confluence:
Total flow rate =      0.550(CFS)
Time of concentration =    12.178 min.
Effective stream area after confluence =      0.610(Ac.)


++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++
Process from Point/Station       25.000 to Point/Station       25.000
**** CONFLUENCE OF MAIN STREAMS ****
________________________________________________________________________
The following data inside Main Stream is listed:
In Main Stream number: 1
Stream flow area =      0.610(Ac.)
Runoff from this stream =      0.550(CFS)
Time of concentration =   12.18 min.
Rainfall intensity =     4.006(In/Hr)
Summary of stream data:

Stream   Flow rate      TC            Rainfall Intensity
 No.       (CFS)       (min)                (In/Hr)


1        0.550     12.18           4.006
Qmax(1) =
          1.000 *    1.000 *     0.550) + =       0.550

Total of 1 main streams to confluence:
Flow rates before confluence point:
       0.550
Maximum flow rates at confluence using above data:
        0.550
Area of streams before confluence:
        0.610


Results of confluence:
Total flow rate =      0.550(CFS)
Time of concentration =    12.178 min.
Effective stream area after confluence  =      0.610(Ac.)


++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++
Process from Point/Station        5.000 to Point/Station       30.000
**** INITIAL AREA EVALUATION ****
________________________________________________________________________
Decimal fraction soil group A = 0.000
Decimal fraction soil group B = 1.000
```

```
Decimal fraction soil group C = 0.000
Decimal fraction soil group D = 0.000
[MEDIUM DENSITY RESIDENTIAL                 ]
(4.3 DU/A or Less       )
Impervious value, Ai = 0.300
Sub-Area C Value = 0.450
Initial subarea total flow distance  =   50.000(Ft.)
Highest elevation =  756.500(Ft.)
Lowest elevation =  750.000(Ft.)
Elevation difference =    6.500(Ft.) Slope = 13.000 %
Top of Initial Area Slope adjusted by User to  9.000 %
INITIAL AREA TIME OF CONCENTRATION CALCULATIONS:
The maximum overland flow distance is 100.00 (Ft)
for the top area slope value of   9.00 %, in a development type of
 4.3 DU/A or Less
In Accordance With Figure 3-3
Initial Area Time of Concentration =   5.62 minutes
TC = [1.8*(1.1-C)*distance(Ft.)^.5)/(% slope^(1/3)]
TC = [1.8*(1.1-0.4500)*( 100.000^.5)/(   9.000^(1/3)]=   5.62
Rainfall intensity (I) =      6.594(In/Hr) for a   100.0 year storm
Effective runoff coefficient used for area (Q=KCIA) is C = 0.450
Subarea runoff =      0.059(CFS)
Total initial stream area =        0.020(Ac.)


++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++
Process from Point/Station       30.000 to Point/Station       35.000
**** STREET FLOW TRAVEL TIME + SUBAREA FLOW ADDITION ****
________________________________________________________________________
Top of street segment elevation =   752.000(Ft.)
End of street segment elevation =   748.700(Ft.)
Length of street segment  =   178.000(Ft.)
Height of curb above gutter flowline  =    6.0(In.)
Width of half street (curb to crown)  =  22.000(Ft.)
Distance from crown to crossfall grade break  =  18.000(Ft.)
Slope from gutter to grade break (v/hz) =   0.020
Slope from grade break to crown (v/hz)  =   0.020
Street flow is on [2] side(s) of the street
Distance from curb to property line  =  10.000(Ft.)
Slope from curb to property line (v/hz) =   0.025
Gutter width =   2.000(Ft.)
Gutter hike from flowline =  2.000(In.)
 Manning's N in gutter =  0.0150
 Manning's N from gutter to grade break =  0.0150
 Manning's N from grade break to crown =  0.0150
Estimated mean flow rate at midpoint of street =      0.386(CFS)
Depth of flow =   0.126(Ft.), Average velocity =   2.022(Ft/s)
Streetflow hydraulics at midpoint of street travel:
Halfstreet flow width =   2.000(Ft.)
Flow velocity =   2.02(Ft/s)
Travel time =    1.47 min.     TC =    7.09  min.
 Adding area flow to street
Decimal fraction soil group A = 0.000
Decimal fraction soil group B = 1.000
Decimal fraction soil group C = 0.000
Decimal fraction soil group D = 0.000
[MEDIUM DENSITY RESIDENTIAL                 ]
(4.3 DU/A or Less       )
Impervious value, Ai = 0.300
Sub-Area C Value = 0.450
Rainfall intensity =      5.678(In/Hr) for a   100.0 year storm
Effective runoff coefficient used for total area
(Q=KCIA) is C = 0.450  CA =      0.144
Subarea runoff =      0.758(CFS) for      0.300(Ac.)
Total runoff =      0.818(CFS)   Total area =       0.320(Ac.)
Street flow at end of street =      0.818(CFS)
```

```
Half street flow at end of street =      0.409(CFS)
Depth of flow =   0.168(Ft.), Average velocity =   2.407(Ft/s)
Flow width (from curb towards crown)=   2.077(Ft.)


++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++
Process from Point/Station       35.000 to Point/Station       40.000
**** PIPEFLOW TRAVEL TIME (User specified size) ****
________________________________________________________________________
Upstream point/station elevation =   744.700(Ft.)
Downstream point/station elevation =   742.200(Ft.)
Pipe length  =   166.00(Ft.)   Manning's N = 0.013
No. of pipes = 1  Required pipe flow  =     0.818(CFS)
Given pipe size =     12.00(In.)
Calculated individual pipe flow  =     0.818(CFS)
Normal flow depth in pipe =    3.52(In.)
Flow top width inside pipe =   10.92(In.)
Critical Depth =    4.54(In.)
Pipe flow velocity =      4.26(Ft/s)
Travel time through pipe =    0.65 min.
Time of concentration (TC) =     7.74 min.


++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++
Process from Point/Station       40.000 to Point/Station       40.000
**** CONFLUENCE OF MINOR STREAMS ****
________________________________________________________________________
Along Main Stream number: 1 in normal stream number 1
Stream flow area =      0.320(Ac.)
Runoff from this stream =      0.818(CFS)
Time of concentration =    7.74 min.
Rainfall intensity =     5.366(In/Hr)


++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++
Process from Point/Station       45.000 to Point/Station       50.000
**** INITIAL AREA EVALUATION ****
________________________________________________________________________
Decimal fraction soil group A = 0.000
Decimal fraction soil group B = 1.000
Decimal fraction soil group C = 0.000
Decimal fraction soil group D = 0.000
[MEDIUM DENSITY RESIDENTIAL                 ]
(4.3 DU/A or Less       )
Impervious value, Ai = 0.300
Sub-Area C Value = 0.450
Initial subarea total flow distance  =   50.000(Ft.)
Highest elevation =  750.100(Ft.)
Lowest elevation =  749.300(Ft.)
Elevation difference =    0.800(Ft.) Slope =  1.600 %
INITIAL AREA TIME OF CONCENTRATION CALCULATIONS:
The maximum overland flow distance is 80.00 (Ft)
for the top area slope value of   1.60 %, in a development type of
 4.3 DU/A or Less
In Accordance With Figure 3-3
Initial Area Time of Concentration =   8.95 minutes
TC = [1.8*(1.1-C)*distance(Ft.)^.5)/(% slope^(1/3)]
TC = [1.8*(1.1-0.4500)*(  80.000^.5)/(   1.600^(1/3)]=   8.95
Rainfall intensity (I) =      4.888(In/Hr) for a   100.0 year storm
Effective runoff coefficient used for area (Q=KCIA) is C = 0.450
Subarea runoff =      0.110(CFS)
Total initial stream area =        0.050(Ac.)


++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++
Process from Point/Station       50.000 to Point/Station       40.000
```

```
**** IMPROVED CHANNEL TRAVEL TIME ****
____________________________________________________________________
Upstream point elevation =   749.300(Ft.)
Downstream point elevation =   748.000(Ft.)
Channel length thru subarea  =   170.000(Ft.)
Channel base width  =    2.000(Ft.)
Slope or 'Z' of left channel bank =   5.000
Slope or 'Z' of right channel bank =   5.000
Estimated mean flow rate at midpoint of channel =      0.561(CFS)
Manning's 'N'    = 0.035
Maximum depth of channel  =    1.000(Ft.)
Flow(q) thru subarea =      0.561(CFS)
Depth of flow =   0.189(Ft.), Average velocity =   1.009(Ft/s)
Channel flow top width =    3.889(Ft.)
Flow Velocity =    1.01(Ft/s)
Travel time  =    2.81 min.
Time of concentration =   11.76 min.
Critical depth =      0.121(Ft.)
 Adding area flow to channel
Decimal fraction soil group A = 0.000
Decimal fraction soil group B = 1.000
Decimal fraction soil group C = 0.000
Decimal fraction soil group D = 0.000
[MEDIUM DENSITY RESIDENTIAL                 ]
(4.3 DU/A or Less       )
Impervious value, Ai = 0.300
Sub-Area C Value = 0.450
Rainfall intensity =      4.099(In/Hr) for a   100.0 year storm
Effective runoff coefficient used for total area
(Q=KCIA) is C = 0.450  CA =      0.225
Subarea runoff =      0.812(CFS) for      0.450(Ac.)
Total runoff =      0.922(CFS)   Total area =       0.500(Ac.)
Depth of flow =   0.245(Ft.), Average velocity =   1.165(Ft/s)
Critical depth =      0.162(Ft.)


++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++
Process from Point/Station       40.000 to Point/Station       40.000
**** CONFLUENCE OF MINOR STREAMS ****
____________________________________________________________________
Along Main Stream number: 1 in normal stream number 2
Stream flow area =      0.500(Ac.)
Runoff from this stream =      0.922(CFS)
Time of concentration =   11.76 min.
Rainfall intensity =     4.099(In/Hr)
Summary of stream data:

Stream   Flow rate      TC            Rainfall Intensity
 No.       (CFS)       (min)                 (In/Hr)


1        0.818      7.74           5.366
2        0.922     11.76           4.099
Qmax(1) =
          1.000 *    1.000 *     0.818) +
          1.000 *    0.658 *     0.922) + =       1.425
Qmax(2) =
          0.764 *    1.000 *     0.818) +
          1.000 *    1.000 *     0.922) + =       1.547

Total of 2 streams to confluence:
Flow rates before confluence point:
       0.818       0.922
Maximum flow rates at confluence using above data:
        1.425        1.547
Area of streams before confluence:
```

```
        0.320        0.500
Results of confluence:
Total flow rate =      1.547(CFS)
Time of concentration =    11.755 min.
Effective stream area after confluence =      0.820(Ac.)


++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++
Process from Point/Station       40.000 to Point/Station       55.000
**** PIPEFLOW TRAVEL TIME (User specified size) ****
________________________________________________________________________
Upstream point/station elevation =   742.200(Ft.)
Downstream point/station elevation =   734.920(Ft.)
Pipe length  =    91.00(Ft.)   Manning's N = 0.013
No. of pipes = 1  Required pipe flow  =     1.547(CFS)
Given pipe size =     12.00(In.)
Calculated individual pipe flow  =     1.547(CFS)
Normal flow depth in pipe =    3.18(In.)
Flow top width inside pipe =   10.59(In.)
Critical Depth =    6.33(In.)
Pipe flow velocity =      9.29(Ft/s)
Travel time through pipe =    0.16 min.
Time of concentration (TC) =    11.92 min.


++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++
Process from Point/Station       55.000 to Point/Station       55.000
**** CONFLUENCE OF MINOR STREAMS ****
________________________________________________________________________
Along Main Stream number: 1 in normal stream number 1
Stream flow area =      0.820(Ac.)
Runoff from this stream =      1.547(CFS)
Time of concentration =   11.92 min.
Rainfall intensity =     4.062(In/Hr)


++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++
Process from Point/Station       60.000 to Point/Station       65.000
**** INITIAL AREA EVALUATION ****
________________________________________________________________________
Decimal fraction soil group A = 0.000
Decimal fraction soil group B = 1.000
Decimal fraction soil group C = 0.000
Decimal fraction soil group D = 0.000
[MEDIUM DENSITY RESIDENTIAL                 ]
(4.3 DU/A or Less       )
Impervious value, Ai = 0.300
Sub-Area C Value = 0.450
Initial subarea total flow distance  =   50.000(Ft.)
Highest elevation =  744.000(Ft.)
Lowest elevation =  739.000(Ft.)
Elevation difference =    5.000(Ft.) Slope = 10.000 %
INITIAL AREA TIME OF CONCENTRATION CALCULATIONS:
The maximum overland flow distance is 100.00 (Ft)
for the top area slope value of  10.00 %, in a development type of
 4.3 DU/A or Less
In Accordance With Figure 3-3
Initial Area Time of Concentration =   5.43 minutes
TC = [1.8*(1.1-C)*distance(Ft.)^.5)/(% slope^(1/3)]
TC = [1.8*(1.1-0.4500)*( 100.000^.5)/(  10.000^(1/3)]=   5.43
Rainfall intensity (I) =      6.745(In/Hr) for a   100.0 year storm
Effective runoff coefficient used for area (Q=KCIA) is C = 0.450
Subarea runoff =      0.121(CFS)
Total initial stream area =        0.040(Ac.)
```

```
++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++
Process from Point/Station       65.000 to Point/Station       55.000
**** IMPROVED CHANNEL TRAVEL TIME ****
______________________________________________________________________________
Upstream point elevation =   739.000(Ft.)
Downstream point elevation =   738.500(Ft.)
Channel length thru subarea  =   215.000(Ft.)
Channel base width  =   10.000(Ft.)
Slope or 'Z' of left channel bank =   5.000
Slope or 'Z' of right channel bank =   5.000
Estimated mean flow rate at midpoint of channel =      0.342(CFS)
Manning's 'N'    = 0.035
Maximum depth of channel  =    2.000(Ft.)
Flow(q) thru subarea =      0.342(CFS)
Depth of flow =   0.085(Ft.), Average velocity =   0.385(Ft/s)
Channel flow top width =   10.851(Ft.)
Flow Velocity =    0.39(Ft/s)
Travel time  =    9.30 min.
Time of concentration =   14.73 min.
Critical depth =      0.033(Ft.)
 Adding area flow to channel
Decimal fraction soil group A = 0.000
Decimal fraction soil group B = 1.000
Decimal fraction soil group C = 0.000
Decimal fraction soil group D = 0.000
[MEDIUM DENSITY RESIDENTIAL                 ]
(4.3 DU/A or Less       )
Impervious value, Ai = 0.300
Sub-Area C Value = 0.450
Rainfall intensity =      3.543(In/Hr) for a   100.0 year storm
Effective runoff coefficient used for total area
(Q=KCIA) is C = 0.450  CA =      0.140
Subarea runoff =      0.373(CFS) for      0.270(Ac.)
Total runoff =      0.494(CFS)   Total area =       0.310(Ac.)
Depth of flow =   0.106(Ft.), Average velocity =   0.443(Ft/s)
Critical depth =      0.042(Ft.)


++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++
Process from Point/Station       55.000 to Point/Station       55.000
**** CONFLUENCE OF MINOR STREAMS ****
______________________________________________________________________________
Along Main Stream number: 1 in normal stream number 2
Stream flow area =      0.310(Ac.)
Runoff from this stream =      0.494(CFS)
Time of concentration =   14.73 min.
Rainfall intensity =     3.543(In/Hr)
Summary of stream data:

Stream   Flow rate      TC            Rainfall Intensity
 No.       (CFS)       (min)                 (In/Hr)


1        1.547     11.92           4.062
2        0.494     14.73           3.543
Qmax(1) =
          1.000 *    1.000 *     1.547) +
          1.000 *    0.809 *     0.494) + =       1.947
Qmax(2) =
          0.872 *    1.000 *     1.547) +
          1.000 *    1.000 *     0.494) + =       1.843

Total of 2 streams to confluence:
Flow rates before confluence point:
       1.547       0.494
Maximum flow rates at confluence using above data:
```

```
        1.947        1.843
Area of streams before confluence:
        0.820        0.310
Results of confluence:
Total flow rate =      1.947(CFS)
Time of concentration =    11.919 min.
Effective stream area after confluence =      1.130(Ac.)


++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++
Process from Point/Station       55.000 to Point/Station       70.000
**** PIPEFLOW TRAVEL TIME (User specified size) ****
________________________________________________________________________
Upstream point/station elevation =   734.920(Ft.)
Downstream point/station elevation =   727.000(Ft.)
Pipe length  =    50.00(Ft.)   Manning's N = 0.013
No. of pipes = 1  Required pipe flow  =     1.947(CFS)
Given pipe size =     12.00(In.)
Calculated individual pipe flow  =     1.947(CFS)
Normal flow depth in pipe =    3.00(In.)
Flow top width inside pipe =   10.40(In.)
Critical Depth =    7.13(In.)
Pipe flow velocity =     12.66(Ft/s)
Travel time through pipe =    0.07 min.
Time of concentration (TC) =    11.98 min.


++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++
Process from Point/Station       70.000 to Point/Station       70.000
**** CONFLUENCE OF MAIN STREAMS ****
________________________________________________________________________
The following data inside Main Stream is listed:
In Main Stream number: 1
Stream flow area =      1.130(Ac.)
Runoff from this stream =      1.947(CFS)
Time of concentration =   11.98 min.
Rainfall intensity =     4.048(In/Hr)
Program is now starting with Main Stream No. 2


++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++
Process from Point/Station       75.000 to Point/Station       80.000
**** INITIAL AREA EVALUATION ****
________________________________________________________________________
Decimal fraction soil group A = 0.000
Decimal fraction soil group B = 1.000
Decimal fraction soil group C = 0.000
Decimal fraction soil group D = 0.000
[MEDIUM DENSITY RESIDENTIAL                 ]
(4.3 DU/A or Less       )
Impervious value, Ai = 0.300
Sub-Area C Value = 0.450
Initial subarea total flow distance  =   50.000(Ft.)
Highest elevation =  749.500(Ft.)
Lowest elevation =  744.000(Ft.)
Elevation difference =    5.500(Ft.) Slope = 11.000 %
INITIAL AREA TIME OF CONCENTRATION CALCULATIONS:
The maximum overland flow distance is 100.00 (Ft)
for the top area slope value of  11.00 %, in a development type of
 4.3 DU/A or Less
In Accordance With Figure 3-3
Initial Area Time of Concentration =   5.26 minutes
TC = [1.8*(1.1-C)*distance(Ft.)^.5)/(% slope^(1/3)]
TC = [1.8*(1.1-0.4500)*( 100.000^.5)/(  11.000^(1/3)]=   5.26
Rainfall intensity (I) =      6.884(In/Hr) for a   100.0 year storm
Effective runoff coefficient used for area (Q=KCIA) is C = 0.450
```

```
Subarea runoff =      0.217(CFS)
Total initial stream area =        0.070(Ac.)


++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++
Process from Point/Station       80.000 to Point/Station       85.000
**** IMPROVED CHANNEL TRAVEL TIME ****
________________________________________________________________________
Upstream point elevation =   744.000(Ft.)
Downstream point elevation =   740.500(Ft.)
Channel length thru subarea  =   137.000(Ft.)
Channel base width  =   10.000(Ft.)
Slope or 'Z' of left channel bank =   5.000
Slope or 'Z' of right channel bank =   5.000
Estimated mean flow rate at midpoint of channel =      0.467(CFS)
Manning's 'N'    = 0.035
Maximum depth of channel  =    2.000(Ft.)
Flow(q) thru subarea =      0.467(CFS)
Depth of flow =   0.050(Ft.), Average velocity =   0.908(Ft/s)
Channel flow top width =   10.502(Ft.)
Flow Velocity =    0.91(Ft/s)
Travel time  =    2.51 min.
Time of concentration =    7.77 min.
Critical depth =      0.041(Ft.)
 Adding area flow to channel
Decimal fraction soil group A = 0.000
Decimal fraction soil group B = 1.000
Decimal fraction soil group C = 0.000
Decimal fraction soil group D = 0.000
[MEDIUM DENSITY RESIDENTIAL                 ]
(4.3 DU/A or Less       )
Impervious value, Ai = 0.300
Sub-Area C Value = 0.450
Rainfall intensity =      5.351(In/Hr) for a   100.0 year storm
Effective runoff coefficient used for total area
(Q=KCIA) is C = 0.450  CA =      0.117
Subarea runoff =      0.409(CFS) for      0.190(Ac.)
Total runoff =      0.626(CFS)   Total area =       0.260(Ac.)
Depth of flow =   0.060(Ft.), Average velocity =   1.017(Ft/s)
Critical depth =      0.049(Ft.)


++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++
Process from Point/Station       85.000 to Point/Station       85.000
**** CONFLUENCE OF MINOR STREAMS ****
________________________________________________________________________
Along Main Stream number: 2 in normal stream number 1
Stream flow area =      0.260(Ac.)
Runoff from this stream =      0.626(CFS)
Time of concentration =    7.77 min.
Rainfall intensity =     5.351(In/Hr)


++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++
Process from Point/Station      140.000 to Point/Station      145.000
**** INITIAL AREA EVALUATION ****
________________________________________________________________________
Decimal fraction soil group A = 0.000
Decimal fraction soil group B = 1.000
Decimal fraction soil group C = 0.000
Decimal fraction soil group D = 0.000
[INDUSTRIAL area type                       ]
(General Industrial       )
Impervious value, Ai = 0.950
Sub-Area C Value = 0.870
Initial subarea total flow distance  =   50.000(Ft.)
```

```
Highest elevation =  750.200(Ft.)
Lowest elevation =  747.500(Ft.)
Elevation difference =    2.700(Ft.) Slope =  5.400 %
INITIAL AREA TIME OF CONCENTRATION CALCULATIONS:
The maximum overland flow distance is 90.00 (Ft)
for the top area slope value of   5.40 %, in a development type of
 General Industrial
In Accordance With Figure 3-3
Initial Area Time of Concentration =   2.24 minutes
TC = [1.8*(1.1-C)*distance(Ft.)^.5)/(% slope^(1/3)]
TC = [1.8*(1.1-0.8700)*(  90.000^.5)/(   5.400^(1/3)]=   2.24
Calculated TC of    2.239 minutes is less than 5 minutes,
 resetting TC to 5.0 minutes for rainfall intensity calculations
Rainfall intensity (I) =      7.114(In/Hr) for a   100.0 year storm
Effective runoff coefficient used for area (Q=KCIA) is C = 0.870
Subarea runoff =      0.062(CFS)
Total initial stream area =        0.010(Ac.)


++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++
Process from Point/Station      145.000 to Point/Station       85.000
**** STREET FLOW TRAVEL TIME + SUBAREA FLOW ADDITION ****
________________________________________________________________________
Top of street segment elevation =   747.500(Ft.)
End of street segment elevation =   740.100(Ft.)
Length of street segment  =   124.000(Ft.)
Height of curb above gutter flowline  =    6.0(In.)
Width of half street (curb to crown)  =  22.000(Ft.)
Distance from crown to crossfall grade break  =  18.000(Ft.)
Slope from gutter to grade break (v/hz) =   0.020
Slope from grade break to crown (v/hz)  =   0.020
Street flow is on [2] side(s) of the street
Distance from curb to property line  =  10.000(Ft.)
Slope from curb to property line (v/hz) =   0.025
Gutter width =   2.000(Ft.)
Gutter hike from flowline =  2.000(In.)
 Manning's N in gutter =  0.0150
 Manning's N from gutter to grade break =  0.0150
 Manning's N from grade break to crown =  0.0150
Estimated mean flow rate at midpoint of street =      0.225(CFS)
Depth of flow =   0.083(Ft.), Average velocity =   2.738(Ft/s)
Streetflow hydraulics at midpoint of street travel:
Halfstreet flow width =   2.000(Ft.)
Flow velocity =   2.74(Ft/s)
Travel time =    0.75 min.     TC =    2.99  min.
 Adding area flow to street
Decimal fraction soil group A = 0.000
Decimal fraction soil group B = 1.000
Decimal fraction soil group C = 0.000
Decimal fraction soil group D = 0.000
[INDUSTRIAL area type                        ]
(General Industrial       )
Impervious value, Ai = 0.950
Sub-Area C Value = 0.870
Rainfall intensity =      7.114(In/Hr) for a   100.0 year storm
Effective runoff coefficient used for total area
(Q=KCIA) is C = 0.870  CA =      0.070
Subarea runoff =      0.433(CFS) for      0.070(Ac.)
Total runoff =      0.495(CFS)   Total area =       0.080(Ac.)
Street flow at end of street =      0.495(CFS)
Half street flow at end of street =      0.248(CFS)
Depth of flow =   0.111(Ft.), Average velocity =   3.335(Ft/s)
Flow width (from curb towards crown)=   2.000(Ft.)


++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++
```

```
Process from Point/Station       85.000 to Point/Station       85.000
**** CONFLUENCE OF MINOR STREAMS ****
____________________________________________________________________
Along Main Stream number: 2 in normal stream number 2
Stream flow area =      0.080(Ac.)
Runoff from this stream =      0.495(CFS)
Time of concentration =    2.99 min.
Rainfall intensity =     7.114(In/Hr)
Summary of stream data:

Stream   Flow rate      TC            Rainfall Intensity
 No.       (CFS)       (min)                (In/Hr)


1        0.626      7.77           5.351
2        0.495      2.99           7.114
Qmax(1) =
          1.000 *    1.000 *     0.626) +
          0.752 *    1.000 *     0.495) + =       0.999
Qmax(2) =
          1.000 *    0.385 *     0.626) +
          1.000 *    1.000 *     0.495) + =       0.736

Total of 2 streams to confluence:
Flow rates before confluence point:
       0.626       0.495
Maximum flow rates at confluence using above data:
        0.999        0.736
Area of streams before confluence:
        0.260        0.080
Results of confluence:
Total flow rate =      0.999(CFS)
Time of concentration =     7.775 min.
Effective stream area after confluence =      0.340(Ac.)


++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++
Process from Point/Station       85.000 to Point/Station       90.000
**** PIPEFLOW TRAVEL TIME (User specified size) ****
____________________________________________________________________
Upstream point/station elevation =   740.500(Ft.)
Downstream point/station elevation =   733.000(Ft.)
Pipe length  =   135.00(Ft.)   Manning's N = 0.013
No. of pipes = 1  Required pipe flow  =     0.999(CFS)
Given pipe size =      8.00(In.)
Calculated individual pipe flow  =     0.999(CFS)
Normal flow depth in pipe =    3.27(In.)
Flow top width inside pipe =    7.87(In.)
Critical Depth =    5.69(In.)
Pipe flow velocity =      7.44(Ft/s)
Travel time through pipe =    0.30 min.
Time of concentration (TC) =     8.08 min.


++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++
Process from Point/Station       90.000 to Point/Station       90.000
**** CONFLUENCE OF MINOR STREAMS ****
____________________________________________________________________
Along Main Stream number: 2 in normal stream number 1
Stream flow area =      0.340(Ac.)
Runoff from this stream =      0.999(CFS)
Time of concentration =    8.08 min.
Rainfall intensity =     5.221(In/Hr)


++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++
```

```
Process from Point/Station      100.000 to Point/Station      105.000
**** INITIAL AREA EVALUATION ****
----------------------------------------------------------------------
Decimal fraction soil group A = 0.000
Decimal fraction soil group B = 1.000
Decimal fraction soil group C = 0.000
Decimal fraction soil group D = 0.000
[MEDIUM DENSITY RESIDENTIAL                 ]
(4.3 DU/A or Less       )
Impervious value, Ai = 0.300
Sub-Area C Value = 0.450
Initial subarea total flow distance  =   50.000(Ft.)
Highest elevation =  740.600(Ft.)
Lowest elevation =  735.000(Ft.)
Elevation difference =    5.600(Ft.) Slope = 11.200 %
INITIAL AREA TIME OF CONCENTRATION CALCULATIONS:
The maximum overland flow distance is 100.00 (Ft)
for the top area slope value of  11.20 %, in a development type of
 4.3 DU/A or Less
In Accordance With Figure 3-3
Initial Area Time of Concentration =   5.23 minutes
TC = [1.8*(1.1-C)*distance(Ft.)^.5)/(% slope^(1/3)]
TC = [1.8*(1.1-0.4500)*( 100.000^.5)/(  11.200^(1/3)]=   5.23
Rainfall intensity (I) =      6.911(In/Hr) for a   100.0 year storm
Effective runoff coefficient used for area (Q=KCIA) is C = 0.450
Subarea runoff =      0.155(CFS)
Total initial stream area =        0.050(Ac.)


++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++
Process from Point/Station      105.000 to Point/Station       90.000
**** IMPROVED CHANNEL TRAVEL TIME ****
----------------------------------------------------------------------
Upstream point elevation =   735.000(Ft.)
Downstream point elevation =   734.900(Ft.)
Channel length thru subarea  =    92.000(Ft.)
Channel base width  =   10.000(Ft.)
Slope or 'Z' of left channel bank =   5.000
Slope or 'Z' of right channel bank =   5.000
Estimated mean flow rate at midpoint of channel =      0.554(CFS)
Manning's 'N'    = 0.035
Maximum depth of channel  =    2.000(Ft.)
Flow(q) thru subarea =      0.554(CFS)
Depth of flow =   0.142(Ft.), Average velocity =   0.364(Ft/s)
Channel flow top width =   11.420(Ft.)
Flow Velocity =    0.36(Ft/s)
Travel time  =    4.21 min.
Time of concentration =    9.44 min.
Critical depth =      0.045(Ft.)
 Adding area flow to channel
Decimal fraction soil group A = 0.000
Decimal fraction soil group B = 1.000
Decimal fraction soil group C = 0.000
Decimal fraction soil group D = 0.000
[MEDIUM DENSITY RESIDENTIAL                 ]
(4.3 DU/A or Less       )
Impervious value, Ai = 0.300
Sub-Area C Value = 0.450
Rainfall intensity =      4.723(In/Hr) for a   100.0 year storm
Effective runoff coefficient used for total area
(Q=KCIA) is C = 0.450  CA =      0.189
Subarea runoff =      0.737(CFS) for      0.370(Ac.)
Total runoff =      0.893(CFS)   Total area =       0.420(Ac.)
Depth of flow =   0.188(Ft.), Average velocity =   0.434(Ft/s)
Critical depth =      0.063(Ft.)
```

```
++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++
Process from Point/Station       90.000 to Point/Station       90.000
**** CONFLUENCE OF MINOR STREAMS ****
______________________________________________________________________________
Along Main Stream number: 2 in normal stream number 2
Stream flow area =      0.420(Ac.)
Runoff from this stream =      0.893(CFS)
Time of concentration =    9.44 min.
Rainfall intensity =     4.723(In/Hr)
Summary of stream data:

Stream   Flow rate      TC            Rainfall Intensity
 No.       (CFS)       (min)                (In/Hr)


1        0.999      8.08            5.221
2        0.893      9.44            4.723
Qmax(1) =
          1.000 *    1.000 *     0.999) +
          1.000 *    0.856 *     0.893) + =       1.762
Qmax(2) =
          0.905 *    1.000 *     0.999) +
          1.000 *    1.000 *     0.893) + =       1.796

Total of 2 streams to confluence:
Flow rates before confluence point:
       0.999       0.893
Maximum flow rates at confluence using above data:
        1.762        1.796
Area of streams before confluence:
        0.340        0.420
Results of confluence:
Total flow rate =      1.796(CFS)
Time of concentration =     9.437 min.
Effective stream area after confluence =      0.760(Ac.)


++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++
Process from Point/Station       90.000 to Point/Station       95.000
**** PIPEFLOW TRAVEL TIME (User specified size) ****
______________________________________________________________________________
Upstream point/station elevation =   732.500(Ft.)
Downstream point/station elevation =   729.000(Ft.)
Pipe length  =    20.00(Ft.)   Manning's N = 0.013
No. of pipes = 1  Required pipe flow  =     1.796(CFS)
Given pipe size =      8.00(In.)
Calculated individual pipe flow  =     1.796(CFS)
Normal flow depth in pipe =    3.29(In.)
Flow top width inside pipe =    7.87(In.)
Critical Depth =    7.31(In.)
Pipe flow velocity =     13.25(Ft/s)
Travel time through pipe =    0.03 min.
Time of concentration (TC) =     9.46 min.


++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++
Process from Point/Station       95.000 to Point/Station       95.000
**** CONFLUENCE OF MINOR STREAMS ****
______________________________________________________________________________
Along Main Stream number: 2 in normal stream number 1
Stream flow area =      0.760(Ac.)
Runoff from this stream =      1.796(CFS)
Time of concentration =    9.46 min.
Rainfall intensity =     4.714(In/Hr)
```

```
++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++
Process from Point/Station      110.000 to Point/Station      115.000
**** INITIAL AREA EVALUATION ****
------------------------------------------------------------------------------
Decimal fraction soil group A = 0.000
Decimal fraction soil group B = 1.000
Decimal fraction soil group C = 0.000
Decimal fraction soil group D = 0.000
[MEDIUM DENSITY RESIDENTIAL                 ]
(4.3 DU/A or Less       )
Impervious value, Ai = 0.300
Sub-Area C Value = 0.450
Initial subarea total flow distance  =   50.000(Ft.)
Highest elevation =  739.500(Ft.)
Lowest elevation =  734.000(Ft.)
Elevation difference =    5.500(Ft.) Slope = 11.000 %
INITIAL AREA TIME OF CONCENTRATION CALCULATIONS:
The maximum overland flow distance is 100.00 (Ft)
for the top area slope value of  11.00 %, in a development type of
 4.3 DU/A or Less
In Accordance With Figure 3-3
Initial Area Time of Concentration =   5.26 minutes
TC = [1.8*(1.1-C)*distance(Ft.)^.5)/(% slope^(1/3)]
TC = [1.8*(1.1-0.4500)*( 100.000^.5)/(  11.000^(1/3)]=   5.26
Rainfall intensity (I) =      6.884(In/Hr) for a   100.0 year storm
Effective runoff coefficient used for area (Q=KCIA) is C = 0.450
Subarea runoff =      0.155(CFS)
Total initial stream area =        0.050(Ac.)


++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++
Process from Point/Station      115.000 to Point/Station      120.000
**** IMPROVED CHANNEL TRAVEL TIME ****
------------------------------------------------------------------------------
Upstream point elevation =   734.000(Ft.)
Downstream point elevation =   730.000(Ft.)
Channel length thru subarea  =   106.000(Ft.)
Channel base width  =   10.000(Ft.)
Slope or 'Z' of left channel bank =   5.000
Slope or 'Z' of right channel bank =   5.000
Estimated mean flow rate at midpoint of channel =      0.389(CFS)
Manning's 'N'    = 0.035
Maximum depth of channel  =    2.000(Ft.)
Flow(q) thru subarea =      0.389(CFS)
Depth of flow =   0.040(Ft.), Average velocity =   0.952(Ft/s)
Channel flow top width =   10.400(Ft.)
Flow Velocity =    0.95(Ft/s)
Travel time  =    1.86 min.
Time of concentration =    7.12 min.
Critical depth =      0.036(Ft.)
 Adding area flow to channel
Decimal fraction soil group A = 0.000
Decimal fraction soil group B = 1.000
Decimal fraction soil group C = 0.000
Decimal fraction soil group D = 0.000
[MEDIUM DENSITY RESIDENTIAL                 ]
(4.3 DU/A or Less       )
Impervious value, Ai = 0.300
Sub-Area C Value = 0.450
Rainfall intensity =      5.665(In/Hr) for a   100.0 year storm
Effective runoff coefficient used for total area
(Q=KCIA) is C = 0.450  CA =      0.099
Subarea runoff =      0.406(CFS) for      0.170(Ac.)
Total runoff =      0.561(CFS)   Total area =       0.220(Ac.)
Depth of flow =   0.050(Ft.), Average velocity =   1.098(Ft/s)
```

```
Critical depth =      0.046(Ft.)


++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++
Process from Point/Station      120.000 to Point/Station       95.000
**** PIPEFLOW TRAVEL TIME (User specified size) ****
________________________________________________________________________
Upstream point/station elevation =   730.000(Ft.)
Downstream point/station elevation =   729.000(Ft.)
Pipe length  =    12.00(Ft.)   Manning's N = 0.013
No. of pipes = 1  Required pipe flow  =     0.561(CFS)
Given pipe size =      8.00(In.)
Calculated individual pipe flow  =     0.561(CFS)
Normal flow depth in pipe =    2.17(In.)
Flow top width inside pipe =    7.11(In.)
Critical Depth =    4.22(In.)
Pipe flow velocity =      7.33(Ft/s)
Travel time through pipe =    0.03 min.
Time of concentration (TC) =     7.14 min.


++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++
Process from Point/Station       95.000 to Point/Station       95.000
**** CONFLUENCE OF MINOR STREAMS ****
________________________________________________________________________
Along Main Stream number: 2 in normal stream number 2
Stream flow area =      0.220(Ac.)
Runoff from this stream =      0.561(CFS)
Time of concentration =    7.14 min.
Rainfall intensity =     5.651(In/Hr)
Summary of stream data:

Stream   Flow rate      TC            Rainfall Intensity
 No.       (CFS)       (min)                 (In/Hr)


1        1.796      9.46           4.714
2        0.561      7.14           5.651
Qmax(1) =
          1.000 *    1.000 *     1.796) +
          0.834 *    1.000 *     0.561) + =       2.264
Qmax(2) =
          1.000 *    0.755 *     1.796) +
          1.000 *    1.000 *     0.561) + =       1.917

Total of 2 streams to confluence:
Flow rates before confluence point:
       1.796       0.561
Maximum flow rates at confluence using above data:
        2.264        1.917
Area of streams before confluence:
        0.760        0.220
Results of confluence:
Total flow rate =      2.264(CFS)
Time of concentration =     9.462 min.
Effective stream area after confluence =      0.980(Ac.)


++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++
Process from Point/Station       95.000 to Point/Station      125.000
**** PIPEFLOW TRAVEL TIME (User specified size) ****
________________________________________________________________________
Upstream point/station elevation =   729.000(Ft.)
Downstream point/station elevation =   727.000(Ft.)
Pipe length  =    25.00(Ft.)   Manning's N = 0.013
No. of pipes = 1  Required pipe flow  =     2.264(CFS)
```

```
Given pipe size =      8.00(In.)
Calculated individual pipe flow  =     2.264(CFS)
Normal flow depth in pipe =    4.76(In.)
Flow top width inside pipe =    7.86(In.)
Critical depth could not be calculated.
Pipe flow velocity =     10.47(Ft/s)
Travel time through pipe =    0.04 min.
Time of concentration (TC) =     9.50 min.


++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++
Process from Point/Station       70.000 to Point/Station      125.000
**** CONFLUENCE OF MAIN STREAMS ****
------------------------------------------------------------------------
The following data inside Main Stream is listed:
In Main Stream number: 2
Stream flow area =      0.980(Ac.)
Runoff from this stream =      2.264(CFS)
Time of concentration =    9.50 min.
Rainfall intensity =     4.702(In/Hr)
Summary of stream data:

Stream   Flow rate      TC            Rainfall Intensity
 No.       (CFS)       (min)                 (In/Hr)


1        1.947     11.98           4.048
2        2.264      9.50           4.702
Qmax(1) =
          1.000 *    1.000 *     1.947) +
          0.861 *    1.000 *     2.264) + =       3.895
Qmax(2) =
          1.000 *    0.793 *     1.947) +
          1.000 *    1.000 *     2.264) + =       3.807

Total of 2 main streams to confluence:
Flow rates before confluence point:
       1.947       2.264
Maximum flow rates at confluence using above data:
        3.895        3.807
Area of streams before confluence:
        1.130        0.980


Results of confluence:
Total flow rate =      3.895(CFS)
Time of concentration =    11.985 min.
Effective stream area after confluence  =      2.110(Ac.)


++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++
Process from Point/Station      125.000 to Point/Station      130.000
**** USER DEFINED FLOW INFORMATION AT A POINT ****
------------------------------------------------------------------------
User specified 'C' value of 0.470 given for subarea
Rainfall intensity (I) =      3.231(In/Hr) for a   100.0 year storm
User specified values are as follows:
TC =  17.00 min.  Rain intensity =       3.23(In/Hr)
Total area =        2.110(Ac.)  Total runoff =     2.320(CFS)


++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++
Process from Point/Station      130.000 to Point/Station      135.000
**** PIPEFLOW TRAVEL TIME (User specified size) ****
------------------------------------------------------------------------
Upstream point/station elevation =   721.500(Ft.)
```

```
Downstream point/station elevation =   713.140(Ft.)
Pipe length  =    72.00(Ft.)   Manning's N = 0.013
No. of pipes = 1  Required pipe flow  =     2.320(CFS)
Given pipe size =     12.00(In.)
Calculated individual pipe flow  =     2.320(CFS)
Normal flow depth in pipe =    3.56(In.)
Flow top width inside pipe =   10.96(In.)
Critical Depth =    7.82(In.)
Pipe flow velocity =     11.92(Ft/s)
Travel time through pipe =    0.10 min.
Time of concentration (TC) =    17.10 min.


++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++
Process from Point/Station      135.000 to Point/Station      135.000
**** CONFLUENCE OF MINOR STREAMS ****
________________________________________________________________________
Along Main Stream number: 1 in normal stream number 1
Stream flow area =      2.110(Ac.)
Runoff from this stream =      2.320(CFS)
Time of concentration =   17.10 min.
Rainfall intensity =     3.218(In/Hr)


++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++
Process from Point/Station      150.000 to Point/Station      155.000
**** INITIAL AREA EVALUATION ****
________________________________________________________________________
Decimal fraction soil group A = 0.000
Decimal fraction soil group B = 1.000
Decimal fraction soil group C = 0.000
Decimal fraction soil group D = 0.000
[UNDISTURBED NATURAL TERRAIN                ]
(Permanent Open Space   )
Impervious value, Ai = 0.000
Sub-Area C Value = 0.250
Initial subarea total flow distance  =   75.000(Ft.)
Highest elevation =  730.000(Ft.)
Lowest elevation =  724.000(Ft.)
Elevation difference =    6.000(Ft.) Slope =  8.000 %
INITIAL AREA TIME OF CONCENTRATION CALCULATIONS:
The maximum overland flow distance is 100.00 (Ft)
for the top area slope value of   8.00 %, in a development type of
 Permanent Open Space
In Accordance With Figure 3-3
Initial Area Time of Concentration =   7.65 minutes
TC = [1.8*(1.1-C)*distance(Ft.)^.5)/(% slope^(1/3)]
TC = [1.8*(1.1-0.2500)*( 100.000^.5)/(   8.000^(1/3)]=   7.65
Rainfall intensity (I) =      5.407(In/Hr) for a   100.0 year storm
Effective runoff coefficient used for area (Q=KCIA) is C = 0.250
Subarea runoff =      0.014(CFS)
Total initial stream area =        0.010(Ac.)


++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++
Process from Point/Station      155.000 to Point/Station      135.000
**** IMPROVED CHANNEL TRAVEL TIME ****
________________________________________________________________________
Upstream point elevation =   724.000(Ft.)
Downstream point elevation =   713.140(Ft.)
Channel length thru subarea  =   110.000(Ft.)
Channel base width  =   10.000(Ft.)
Slope or 'Z' of left channel bank =   5.000
Slope or 'Z' of right channel bank =   5.000
Estimated mean flow rate at midpoint of channel =      0.108(CFS)
Manning's 'N'    = 0.035
```

```
Maximum depth of channel  =    2.000(Ft.)
Flow(q) thru subarea =      0.108(CFS)
Depth of flow =   0.014(Ft.), Average velocity =   0.770(Ft/s)
Channel flow top width =   10.140(Ft.)
Flow Velocity =    0.77(Ft/s)
Travel time  =    2.38 min.
Time of concentration =   10.03 min.
Critical depth =      0.015(Ft.)
 Adding area flow to channel
Decimal fraction soil group A = 0.000
Decimal fraction soil group B = 1.000
Decimal fraction soil group C = 0.000
Decimal fraction soil group D = 0.000
[UNDISTURBED NATURAL TERRAIN                ]
(Permanent Open Space   )
Impervious value, Ai = 0.000
Sub-Area C Value = 0.250
Rainfall intensity =      4.540(In/Hr) for a   100.0 year storm
Effective runoff coefficient used for total area
(Q=KCIA) is C = 0.250  CA =      0.038
Subarea runoff =      0.157(CFS) for      0.140(Ac.)
Total runoff =      0.170(CFS)   Total area =       0.150(Ac.)
Depth of flow =   0.018(Ft.), Average velocity =   0.921(Ft/s)
Critical depth =      0.021(Ft.)


++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++
Process from Point/Station      135.000 to Point/Station      135.000
**** CONFLUENCE OF MINOR STREAMS ****
________________________________________________________________________
Along Main Stream number: 1 in normal stream number 2
Stream flow area =      0.150(Ac.)
Runoff from this stream =      0.170(CFS)
Time of concentration =   10.03 min.
Rainfall intensity =     4.540(In/Hr)
Summary of stream data:

Stream   Flow rate      TC            Rainfall Intensity
 No.       (CFS)       (min)                 (In/Hr)


1        2.320     17.10           3.218
2        0.170     10.03           4.540
Qmax(1) =
          1.000 *    1.000 *     2.320) +
          0.709 *    1.000 *     0.170) + =       2.441
Qmax(2) =
          1.000 *    0.587 *     2.320) +
          1.000 *    1.000 *     0.170) + =       1.531

Total of 2 streams to confluence:
Flow rates before confluence point:
       2.320       0.170
Maximum flow rates at confluence using above data:
        2.441        1.531
Area of streams before confluence:
        2.110        0.150
Results of confluence:
Total flow rate =      2.441(CFS)
Time of concentration =    17.101 min.
Effective stream area after confluence =      2.260(Ac.)
End of computations, total study area =           5.570 (Ac.)
```

CHAPTER 6 - MODIFIED-PULS DETENTION ROUTING

6.1 – Rational Method Hydrograph

RATIONAL METHOD HYDROGRAPH PROGRAM
COPYRIGHT 1992, 2001 RICK ENGINEERING COMPANY

RUN DATE 6/29/2016
HYDROGRAPH FILE NAME BMP-1
TIME OF CONCENTRATION 7 MIN.
6 HOUR RAINFALL 2.7 INCHES
BASIN AREA 0.59 ACRES
RUNOFF COEFFICIENT 0.45
PEAK DISCHARGE 1.58 CFS

TIME (MIN) = 0	DISCHARGE (CFS) = 0
TIME (MIN) = 7	DISCHARGE (CFS) = 0
TIME (MIN) = 14	DISCHARGE (CFS) = 0
TIME (MIN) = 21	DISCHARGE (CFS) = 0
TIME (MIN) = 28	DISCHARGE (CFS) = 0
TIME (MIN) = 35	DISCHARGE (CFS) = 0
TIME (MIN) = 42	DISCHARGE (CFS) = 0
TIME (MIN) = 49	DISCHARGE (CFS) = 0
TIME (MIN) = 56	DISCHARGE (CFS) = 0
TIME (MIN) = 63	DISCHARGE (CFS) = 0.1
TIME (MIN) = 70	DISCHARGE (CFS) = 0.1
TIME (MIN) = 77	DISCHARGE (CFS) = 0.1
TIME (MIN) = 84	DISCHARGE (CFS) = 0.1
TIME (MIN) = 91	DISCHARGE (CFS) = 0.1
TIME (MIN) = 98	DISCHARGE (CFS) = 0.1
TIME (MIN) = 105	DISCHARGE (CFS) = 0.1
TIME (MIN) = 112	DISCHARGE (CFS) = 0.1
TIME (MIN) = 119	DISCHARGE (CFS) = 0.1
TIME (MIN) = 126	DISCHARGE (CFS) = 0.1
TIME (MIN) = 133	DISCHARGE (CFS) = 0.1
TIME (MIN) = 140	DISCHARGE (CFS) = 0.1
TIME (MIN) = 147	DISCHARGE (CFS) = 0.1
TIME (MIN) = 154	DISCHARGE (CFS) = 0.1
TIME (MIN) = 161	DISCHARGE (CFS) = 0.1
TIME (MIN) = 168	DISCHARGE (CFS) = 0.1
TIME (MIN) = 175	DISCHARGE (CFS) = 0.1
TIME (MIN) = 182	DISCHARGE (CFS) = 0.1
TIME (MIN) = 189	DISCHARGE (CFS) = 0.1
TIME (MIN) = 196	DISCHARGE (CFS) = 0.1
TIME (MIN) = 203	DISCHARGE (CFS) = 0.1
TIME (MIN) = 210	DISCHARGE (CFS) = 0.1
TIME (MIN) = 217	DISCHARGE (CFS) = 0.2
TIME (MIN) = 224	DISCHARGE (CFS) = 0.2
TIME (MIN) = 231	DISCHARGE (CFS) = 0.3
TIME (MIN) = 238	DISCHARGE (CFS) = 0.4
TIME (MIN) = 245	DISCHARGE (CFS) = 1.58
TIME (MIN) = 252	DISCHARGE (CFS) = 0.2
TIME (MIN) = 259	DISCHARGE (CFS) = 0.2
TIME (MIN) = 266	DISCHARGE (CFS) = 0.1
TIME (MIN) = 273	DISCHARGE (CFS) = 0.1
TIME (MIN) = 280	DISCHARGE (CFS) = 0.1
TIME (MIN) = 287	DISCHARGE (CFS) = 0.1
TIME (MIN) = 294	DISCHARGE (CFS) = 0.1
TIME (MIN) = 301	DISCHARGE (CFS) = 0.1
TIME (MIN) = 308	DISCHARGE (CFS) = 0.1
TIME (MIN) = 315	DISCHARGE (CFS) = 0.1
TIME (MIN) = 322	DISCHARGE (CFS) = 0.1
TIME (MIN) = 329	DISCHARGE (CFS) = 0.1
TIME (MIN) = 336	DISCHARGE (CFS) = 0.1
TIME (MIN) = 343	DISCHARGE (CFS) = 0
TIME (MIN) = 350	DISCHARGE (CFS) = 0
TIME (MIN) = 357	DISCHARGE (CFS) = 0
TIME (MIN) = 364	DISCHARGE (CFS) = 0

RATIONAL METHOD HYDROGRAPH PROGRAM

RUN DATE 10/5/2016
HYDROGRAPH FILE NAME BMP-2
TIME OF CONCENTRATION 12 MIN.
6 HOUR RAINFALL 2.7 INCHES
BASIN AREA 2.11 ACRES
RUNOFF COEFFICIENT 0.47
PEAK DISCHARGE 3.9 CFS

TIME (MIN) = 0	DISCHARGE (CFS) = 0
TIME (MIN) = 12	DISCHARGE (CFS) = 0.2
TIME (MIN) = 24	DISCHARGE (CFS) = 0.2
TIME (MIN) = 36	DISCHARGE (CFS) = 0.2
TIME (MIN) = 48	DISCHARGE (CFS) = 0.2
TIME (MIN) = 60	DISCHARGE (CFS) = 0.2
TIME (MIN) = 72	DISCHARGE (CFS) = 0.2
TIME (MIN) = 84	DISCHARGE (CFS) = 0.2
TIME (MIN) = 96	DISCHARGE (CFS) = 0.2
TIME (MIN) = 108	DISCHARGE (CFS) = 0.2
TIME (MIN) = 120	DISCHARGE (CFS) = 0.2
TIME (MIN) = 132	DISCHARGE (CFS) = 0.3
TIME (MIN) = 144	DISCHARGE (CFS) = 0.3
TIME (MIN) = 156	DISCHARGE (CFS) = 0.3
TIME (MIN) = 168	DISCHARGE (CFS) = 0.3
TIME (MIN) = 180	DISCHARGE (CFS) = 0.4
TIME (MIN) = 192	DISCHARGE (CFS) = 0.4
TIME (MIN) = 204	DISCHARGE (CFS) = 0.5
TIME (MIN) = 216	DISCHARGE (CFS) = 0.5
TIME (MIN) = 228	DISCHARGE (CFS) = 0.8
TIME (MIN) = 240	DISCHARGE (CFS) = 1.2
TIME (MIN) = 252	DISCHARGE (CFS) = 3.9
TIME (MIN) = 264	DISCHARGE (CFS) = 0.6
TIME (MIN) = 276	DISCHARGE (CFS) = 0.4
TIME (MIN) = 288	DISCHARGE (CFS) = 0.3
TIME (MIN) = 300	DISCHARGE (CFS) = 0.3
TIME (MIN) = 312	DISCHARGE (CFS) = 0.2
TIME (MIN) = 324	DISCHARGE (CFS) = 0.2
TIME (MIN) = 336	DISCHARGE (CFS) = 0.2
TIME (MIN) = 348	DISCHARGE (CFS) = 0.2
TIME (MIN) = 360	DISCHARGE (CFS) = 0.2
TIME (MIN) = 372	DISCHARGE (CFS) = 0

6.2 – Stage-Storage & Stage-Discharge Relationships

BMP 1		**BMP Area**	1085
Elev	Area (sq-ft)	Volume (AC-FT)	
0	1086	0	
1.50	1132.00	0.03818	
3.00	1172.00	0.07785	

BMP 2		**BMP Area**	1866
Elev	Area	Volume AC-FT	
0	1866.00	0	
1.00	2400.00	0.04884	
2.00	2960.00	0.11025	
3.00	3546.00	0.18483	

Outlet structure for Discharge of BMP 1

Discharge vs Elevation Table

Low orifice	0.500	"	Lower slot			Lower Weir							
Number of orif:	0		Number of slots	1		Number of weirs:	0			Ele:	1.500		
Cg-low:	0.61		Invert:	0.00	ft	Invert:	0.000	ft		Q:	0.734		
			B	1.00	ft	B:	0.000	ft					
Middle orifice	2.500	"	hslot	0.125	ft								
Number of orif:	0.000												
Cg-middle:	0.61		Upper slot			Upper Weir				Emergency weir			
invert elev:	0	ft	Number of slots	0		Number of weirs:	0			Invert:	1.500	ft	
			Invert:	0.00	ft	Invert:	0.000	ft		W:	8.00	ft	
*Note: h = head above the invert of the lowest surface discharge opening			B:	0.00	ft	B:	0.00	ft					
			hslot	0.000	ft								

h* (ft)	H/D-low -	H/D-mid -	Qlow-orif (cfs)	Qlow-weir (cfs)	Qtot-low (cfs)	Qmid-orif (cfs)	Qmid-weir (cfs)	Qtot-med (cfs)	Qslot-low (cfs)	Qslot-upp (cfs)	Qlweir (cfs)	Quweir (cfs)	Qemerg (cfs)	Qtot (cfs)
0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
0.042	1.000	0.200	0.000	0.000	0.000	0.000	0.000	0.000	0.026	0.000	0.000	0.000	0.000	0.026
0.083	2.000	0.400	0.000	0.000	0.000	0.000	0.000	0.000	0.075	0.000	0.000	0.000	0.000	0.075
0.125	3.000	0.600	0.000	0.000	0.000	0.000	0.000	0.000	0.137	0.000	0.000	0.000	0.000	0.137
0.167	4.000	0.800	0.000	0.000	0.000	0.000	0.000	0.000	0.197	0.000	0.000	0.000	0.000	0.197
0.208	5.000	1.000	0.000	0.000	0.000	0.000	0.000	0.000	0.234	0.000	0.000	0.000	0.000	0.234
0.250	6.000	1.200	0.000	0.000	0.000	0.000	0.000	0.000	0.265	0.000	0.000	0.000	0.000	0.265
0.292	7.000	1.400	0.000	0.000	0.000	0.000	0.000	0.000	0.293	0.000	0.000	0.000	0.000	0.293
0.333	8.000	1.600	0.000	0.000	0.000	0.000	0.000	0.000	0.318	0.000	0.000	0.000	0.000	0.318
0.375	9.000	1.800	0.000	0.000	0.000	0.000	0.000	0.000	0.342	0.000	0.000	0.000	0.000	0.342
0.417	10.000	2.000	0.000	0.000	0.000	0.000	0.000	0.000	0.364	0.000	0.000	0.000	0.000	0.364
0.458	11.000	2.200	0.000	0.000	0.000	0.000	0.000	0.000	0.385	0.000	0.000	0.000	0.000	0.385
0.500	12.000	2.400	0.000	0.000	0.000	0.000	0.000	0.000	0.405	0.000	0.000	0.000	0.000	0.405
0.542	13.000	2.600	0.000	0.000	0.000	0.000	0.000	0.000	0.424	0.000	0.000	0.000	0.000	0.424
0.583	14.000	2.800	0.000	0.000	0.000	0.000	0.000	0.000	0.442	0.000	0.000	0.000	0.000	0.442
0.625	15.000	3.000	0.000	0.000	0.000	0.000	0.000	0.000	0.459	0.000	0.000	0.000	0.000	0.459
0.667	16.000	3.200	0.000	0.000	0.000	0.000	0.000	0.000	0.476	0.000	0.000	0.000	0.000	0.476
0.708	17.000	3.400	0.000	0.000	0.000	0.000	0.000	0.000	0.492	0.000	0.000	0.000	0.000	0.492
0.750	18.000	3.600	0.000	0.000	0.000	0.000	0.000	0.000	0.507	0.000	0.000	0.000	0.000	0.507
0.792	19.000	3.800	0.000	0.000	0.000	0.000	0.000	0.000	0.523	0.000	0.000	0.000	0.000	0.523
0.833	20.000	4.000	0.000	0.000	0.000	0.000	0.000	0.000	0.537	0.000	0.000	0.000	0.000	0.537
0.875	21.000	4.200	0.000	0.000	0.000	0.000	0.000	0.000	0.552	0.000	0.000	0.000	0.000	0.552
0.917	22.000	4.400	0.000	0.000	0.000	0.000	0.000	0.000	0.566	0.000	0.000	0.000	0.000	0.566
0.958	23.000	4.600	0.000	0.000	0.000	0.000	0.000	0.000	0.579	0.000	0.000	0.000	0.000	0.579
1.000	24.000	4.800	0.000	0.000	0.000	0.000	0.000	0.000	0.592	0.000	0.000	0.000	0.000	0.592
1.042	25.000	5.000	0.000	0.000	0.000	0.000	0.000	0.000	0.605	0.000	0.000	0.000	0.000	0.605
1.083	26.000	5.200	0.000	0.000	0.000	0.000	0.000	0.000	0.618	0.000	0.000	0.000	0.000	0.618
1.125	27.000	5.400	0.000	0.000	0.000	0.000	0.000	0.000	0.631	0.000	0.000	0.000	0.000	0.631
1.167	28.000	5.600	0.000	0.000	0.000	0.000	0.000	0.000	0.643	0.000	0.000	0.000	0.000	0.643
1.208	29.000	5.800	0.000	0.000	0.000	0.000	0.000	0.000	0.655	0.000	0.000	0.000	0.000	0.655
1.250	30.000	6.000	0.000	0.000	0.000	0.000	0.000	0.000	0.667	0.000	0.000	0.000	0.000	0.667
1.292	31.000	6.200	0.000	0.000	0.000	0.000	0.000	0.000	0.678	0.000	0.000	0.000	0.000	0.678
1.333	32.000	6.400	0.000	0.000	0.000	0.000	0.000	0.000	0.690	0.000	0.000	0.000	0.000	0.690
1.375	33.000	6.600	0.000	0.000	0.000	0.000	0.000	0.000	0.701	0.000	0.000	0.000	0.000	0.701
1.417	34.000	6.800	0.000	0.000	0.000	0.000	0.000	0.000	0.712	0.000	0.000	0.000	0.000	0.712
1.458	35.000	7.000	0.000	0.000	0.000	0.000	0.000	0.000	0.723	0.000	0.000	0.000	0.000	0.723
1.500	36.000	7.200	0.000	0.000	0.000	0.000	0.000	0.000	0.734	0.000	0.000	0.000	0.000	0.734
1.542	37.000	7.400	0.000	0.000	0.000	0.000	0.000	0.000	0.744	0.000	0.000	0.000	0.211	0.955
1.583	38.000	7.600	0.000	0.000	0.000	0.000	0.000	0.000	0.755	0.000	0.000	0.000	0.596	1.351
1.625	39.000	7.800	0.000	0.000	0.000	0.000	0.000	0.000	0.765	0.000	0.000	0.000	1.096	1.861
1.667	40.000	8.000	0.000	0.000	0.000	0.000	0.000	0.000	0.775	0.000	0.000	0.000	1.687	2.462
1.708	41.000	8.200	0.000	0.000	0.000	0.000	0.000	0.000	0.785	0.000	0.000	0.000	2.358	3.143
1.750	42.000	8.400	0.000	0.000	0.000	0.000	0.000	0.000	0.795	0.000	0.000	0.000	3.100	3.895
1.792	43.000	8.600	0.000	0.000	0.000	0.000	0.000	0.000	0.805	0.000	0.000	0.000	3.906	4.711
1.833	44.000	8.800	0.000	0.000	0.000	0.000	0.000	0.000	0.814	0.000	0.000	0.000	4.773	5.587
1.875	45.000	9.000	0.000	0.000	0.000	0.000	0.000	0.000	0.824	0.000	0.000	0.000	5.695	6.519
1.917	46.000	9.200	0.000	0.000	0.000	0.000	0.000	0.000	0.833	0.000	0.000	0.000	6.670	7.503
1.958	47.000	9.400	0.000	0.000	0.000	0.000	0.000	0.000	0.843	0.000	0.000	0.000	7.695	8.538
2.000	48.000	9.600	0.000	0.000	0.000	0.000	0.000	0.000	0.852	0.000	0.000	0.000	8.768	9.620
2.042	49.000	9.800	0.000	0.000	0.000	0.000	0.000	0.000	0.861	0.000	0.000	0.000	9.886	10.747
2.083	50.000	10.000	0.000	0.000	0.000	0.000	0.000	0.000	0.870	0.000	0.000	0.000	11.049	11.919
2.125	51.000	10.200	0.000	0.000	0.000	0.000	0.000	0.000	0.879	0.000	0.000	0.000	12.254	13.132
2.167	52.000	10.400	0.000	0.000	0.000	0.000	0.000	0.000	0.888	0.000	0.000	0.000	13.499	14.387
2.208	53.000	10.600	0.000	0.000	0.000	0.000	0.000	0.000	0.896	0.000	0.000	0.000	14.784	15.681
2.250	54.000	10.800	0.000	0.000	0.000	0.000	0.000	0.000	0.905	0.000	0.000	0.000	16.108	17.013

Outlet structure for Discharge of BMP 2

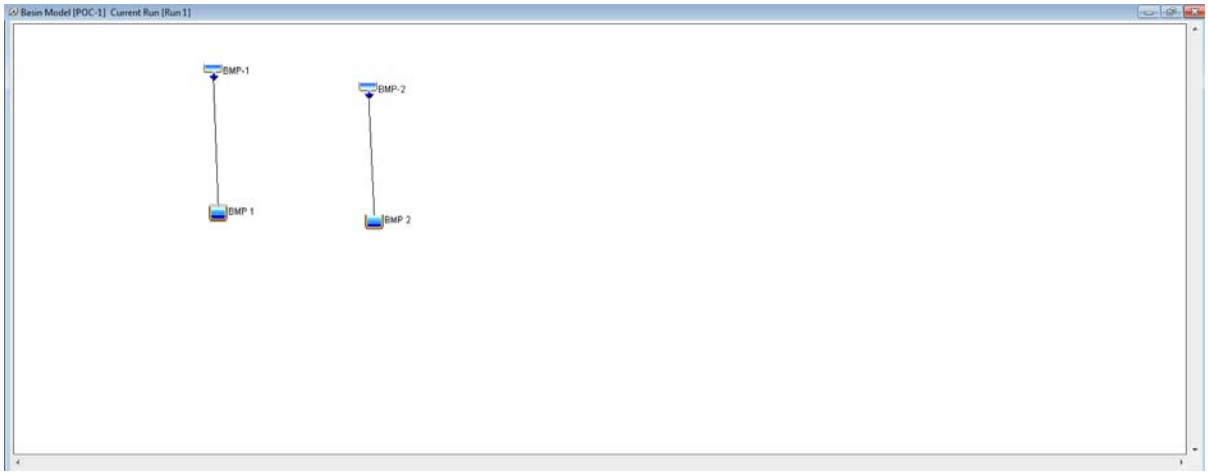
Discharge vs Elevation Table

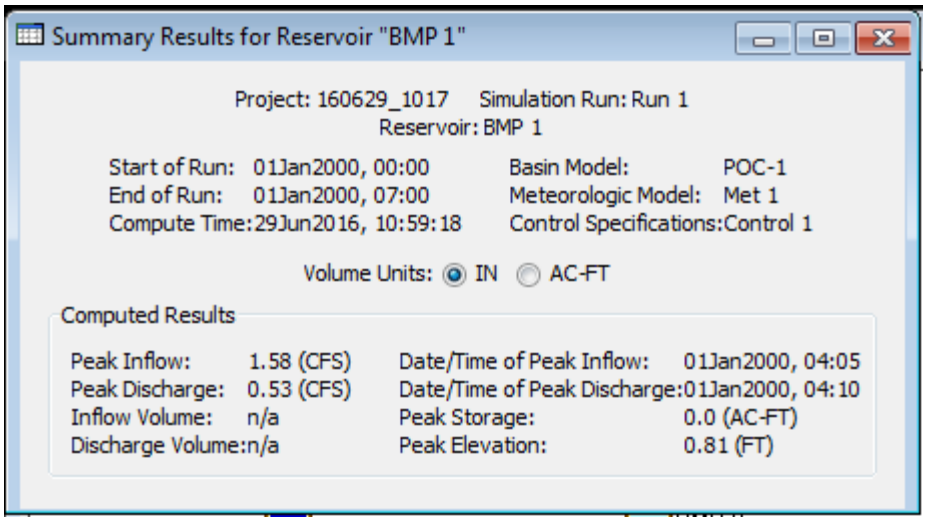
Low orifice	0.500	"	Lower slot			Lower Weir	
Number of orif:	3		Number of slots	1		Number of weirs:	0
Cg-low:	0.61		Invert:	1.25	ft	Invert:	0.000
			B	4.00	ft	B:	0.00
Middle orifice	3	"	h_{slot}	0.167	ft		
Number of orif:	0						
Cg-middle:	0.61		Upper slot			Emergency weir	
invert elev:	0.000	ft	Number of slots	0		Invert:	1.833 ft
			Invert:	0.00	ft	W:	8.00 ft
*Note: h = head above the invert of the lowest surface discharge opening.			B:	0.00	ft		
			h_{slot}	0.000	ft		

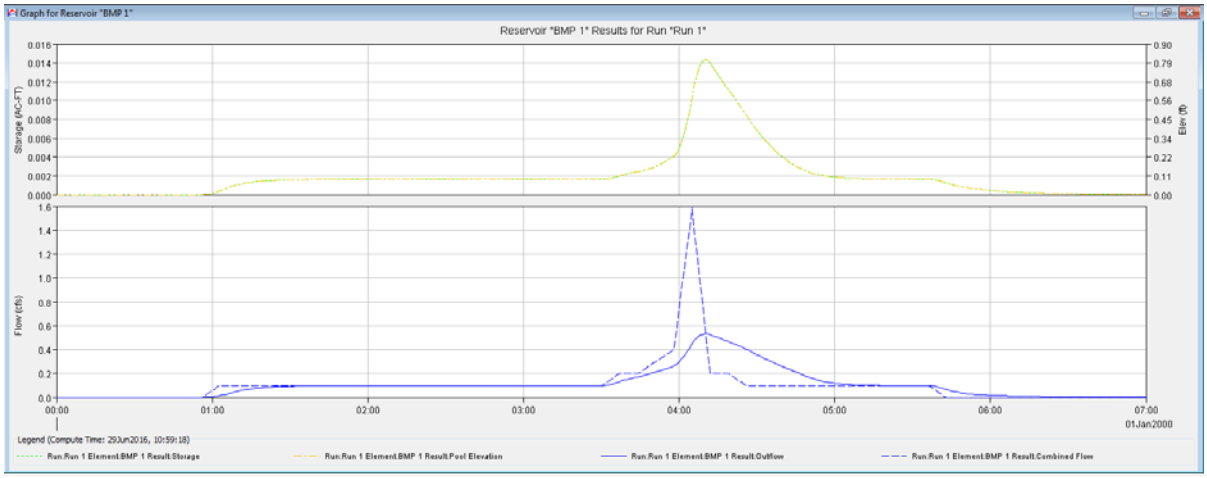
h* (ft)	H/D-low -	H/D-mid -	Qlow-orif (cfs)	Qlow-weir (cfs)	Qtot-low (cfs)	Qmid-orif (cfs)	Qmid-weir (cfs)	Qtot-med (cfs)	Qslot-low (cfs)	Qslot-upp (cfs)	Qweir (cfs)	Qemerg (cfs)	Qtot (cfs)
0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.0000
0.042	1.000	0.200	0.003	0.003	0.003	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.0028
0.083	2.000	0.400	0.005	0.007	0.005	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.0050
0.125	3.000	0.600	0.006	0.008	0.006	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.0065
0.167	4.000	0.800	0.008	0.013	0.008	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.0076
0.208	5.000	1.000	0.009	0.051	0.009	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.0087
0.250	6.000	1.200	0.010	0.096	0.010	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.0096
0.292	7.000	1.400	0.010	0.104	0.010	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.0104
0.333	8.000	1.600	0.011	0.112	0.011	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.0112
0.375	9.000	1.800	0.012	0.119	0.012	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.0119
0.417	10.000	2.000	0.013	0.126	0.013	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.0126
0.458	11.000	2.200	0.013	0.132	0.013	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.0132
0.500	12.000	2.400	0.014	0.139	0.014	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.0139
0.542	13.000	2.600	0.014	0.145	0.014	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.0145
0.583	14.000	2.800	0.015	0.150	0.015	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.0150
0.625	15.000	3.000	0.016	0.156	0.016	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.0156
0.667	16.000	3.200	0.016	0.161	0.016	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.0161
0.708	17.000	3.400	0.017	0.166	0.017	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.0166
0.750	18.000	3.600	0.017	0.171	0.017	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.0171
0.792	19.000	3.800	0.018	0.176	0.018	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.0176
0.833	20.000	4.000	0.018	0.180	0.018	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.0180
0.875	21.000	4.200	0.019	0.185	0.019	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.0185
0.917	22.000	4.400	0.019	0.190	0.019	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.0190
0.958	23.000	4.600	0.019	0.194	0.019	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.0194
1.000	24.000	4.800	0.020	0.198	0.020	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.0198
1.042	25.000	5.000	0.020	0.202	0.020	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.0202
1.083	26.000	5.200	0.021	0.206	0.021	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.0206
1.125	27.000	5.400	0.021	0.210	0.021	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.0210
1.167	28.000	5.600	0.021	0.214	0.021	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.0214
1.208	29.000	5.800	0.022	0.218	0.022	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.0218
1.250	30.000	6.000	0.022	0.222	0.022	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.0222
1.292	31.000	6.200	0.023	0.226	0.023	0.000	0.000	0.000	0.105	0.000	0.000	0.000	0.1280
1.333	32.000	6.400	0.023	0.229	0.023	0.000	0.000	0.000	0.298	0.000	0.000	0.000	0.3212
1.375	33.000	6.600	0.023	0.233	0.023	0.000	0.000	0.000	0.548	0.000	0.000	0.000	0.5712
1.417	34.000	6.800	0.024	0.237	0.024	0.000	0.000	0.000	0.844	0.000	0.000	0.000	0.8673
1.458	35.000	7.000	0.024	0.240	0.024	0.000	0.000	0.000	1.154	0.000	0.000	0.000	1.1778
1.500	36.000	7.200	0.024	0.244	0.024	0.000	0.000	0.000	1.332	0.000	0.000	0.000	1.3566
1.542	37.000	7.400	0.025	0.247	0.025	0.000	0.000	0.000	1.490	0.000	0.000	0.000	1.5142
1.583	38.000	7.600	0.025	0.250	0.025	0.000	0.000	0.000	1.632	0.000	0.000	0.000	1.6567
1.625	39.000	7.800	0.025	0.254	0.025	0.000	0.000	0.000	1.762	0.000	0.000	0.000	1.7878
1.667	40.000	8.000	0.026	0.257	0.026	0.000	0.000	0.000	1.884	0.000	0.000	0.000	1.9098
1.708	41.000	8.200	0.026	0.260	0.026	0.000	0.000	0.000	1.998	0.000	0.000	0.000	2.0245
1.750	42.000	8.400	0.026	0.263	0.026	0.000	0.000	0.000	2.107	0.000	0.000	0.000	2.1329
1.792	43.000	8.600	0.027	0.266	0.027	0.000	0.000	0.000	2.209	0.000	0.000	0.000	2.2360
1.833	44.000	8.800	0.027	0.270	0.027	0.000	0.000	0.000	2.308	0.000	0.000	0.000	2.3346
1.875	45.000	9.000	0.027	0.273	0.027	0.000	0.000	0.000	2.402	0.000	0.000	0.211	2.6403
1.917	46.000	9.200	0.028	0.276	0.028	0.000	0.000	0.000	2.493	0.000	0.000	0.597	3.1170
1.958	47.000	9.400	0.028	0.279	0.028	0.000	0.000	0.000	2.580	0.000	0.000	1.096	3.7043
2.000	48.000	9.600	0.028	0.282	0.028	0.000	0.000	0.000	2.665	0.000	0.000	1.688	4.3807
2.042	49.000	9.800	0.028	0.285	0.028	0.000	0.000	0.000	2.747	0.000	0.000	2.359	5.1339
2.083	50.000	10.000	0.029	0.288	0.029	0.000	0.000	0.000	2.826	0.000	0.000	3.101	5.9556
2.125	51.000	10.200	0.029	0.290	0.029	0.000	0.000	0.000	2.904	0.000	0.000	3.907	6.8399
2.167	52.000	10.400	0.029	0.293	0.029	0.000	0.000	0.000	2.979	0.000	0.000	4.773	7.7819
2.208	53.000	10.600	0.030	0.296	0.030	0.000	0.000	0.000	3.053	0.000	0.000	5.696	8.7781
2.250	54.000	10.800	0.030	0.299	0.030	0.000	0.000	0.000	3.125	0.000	0.000	6.671	9.8254
2.292	55.000	11.000	0.030	0.302	0.030	0.000	0.000	0.000	3.195	0.000	0.000	7.696	10.9210
2.333	56.000	11.200	0.030	0.305	0.030	0.000	0.000	0.000	3.263	0.000	0.000	8.769	12.0629
2.375	57.000	11.400	0.031	0.307	0.031	0.000	0.000	0.000	3.331	0.000	0.000	9.888	13.2491
2.417	58.000	11.600	0.031	0.310	0.031	0.000	0.000	0.000	3.397	0.000	0.000	11.050	14.4778
2.458	59.000	11.800	0.031	0.313	0.031	0.000	0.000	0.000	3.461	0.000	0.000	12.255	15.7475
2.500	60.000	12.000	0.032	0.315	0.032	0.000	0.000	0.000	3.525	0.000	0.000	13.500	17.0569

6.3 – HEC-HMS Modified-Puls Routing Results

HEC-HMS Post Development




Summary Results for Reservoir "BMP 1"
Project: 160629_1017 Simulation Run: Run 1
Reservoir: BMP 1
Start of Run: 01Jan2000, 00:00
End of Run: 01Jan2000, 07:00
Compute Time: 29Jun2016, 10:59:18
Basin Model: POC-1
Meteorologic Model: Met 1
Control Specifications: Control 1
Volume Units: IN AC-FT
Computed Results
Peak Inflow: 1.58 (CFS)
Peak Discharge: 0.53 (CFS)
Inflow Volume: n/a
Discharge Volume: n/a
Date/Time of Peak Inflow: 01Jan2000, 04:05
Date/Time of Peak Discharge: 01Jan2000, 04:10
Peak Storage: 0.0 (AC-FT)
Peak Elevation: 0.81 (FT)


Graph for Reservoir "BMP 1"
Reservoir "BMP 1" Results for Run "Run 1"
Storage (AC-FT)
Elev (ft)
Flow (cfs)
00:00
01:00
02:00
03:00
04:00
05:00
06:00
07:00
01Jan2000
Legend (Compute Time: 29Jun2016, 10:59:18)
Run:Run 1 Element:BMP 1 Result:Storage
Run:Run 1 Element:BMP 1 Result:Pool Elevation
Run:Run 1 Element:BMP 1 Result:Outflow
Run:Run 1 Element:BMP 1 Result:Combined Flow

Project: 160629_1017 Simulation Run: Run 1
Reservoir: BMP 1

Start of Run: 01Jan2000, 00:00 Basin Model: POC-1
End of Run: 01Jan2000, 07:00 Meteorologic Model: Met 1
Compute Time: 29Jun2016, 10:59:18 Control Specifications: Control 1

Date	Time	Inflow (CFS)	Storage (AC-FT)	Elevation (FT)	Outflow (CFS)
01Jan2000	00:00	0.00	0.0	0.00	0.00
01Jan2000	00:01	0.00	0.0	0.00	0.00
01Jan2000	00:02	0.00	0.0	0.00	0.00
01Jan2000	00:03	0.00	0.0	0.00	0.00
01Jan2000	00:04	0.00	0.0	0.00	0.00
01Jan2000	00:05	0.00	0.0	0.00	0.00
01Jan2000	00:06	0.00	0.0	0.00	0.00
01Jan2000	00:07	0.00	0.0	0.00	0.00
01Jan2000	00:08	0.00	0.0	0.00	0.00
01Jan2000	00:09	0.00	0.0	0.00	0.00
01Jan2000	00:10	0.00	0.0	0.00	0.00
01Jan2000	00:11	0.00	0.0	0.00	0.00
01Jan2000	00:12	0.00	0.0	0.00	0.00
01Jan2000	00:13	0.00	0.0	0.00	0.00
01Jan2000	00:14	0.00	0.0	0.00	0.00
01Jan2000	00:15	0.00	0.0	0.00	0.00
01Jan2000	00:16	0.00	0.0	0.00	0.00
01Jan2000	00:17	0.00	0.0	0.00	0.00
01Jan2000	00:18	0.00	0.0	0.00	0.00
01Jan2000	00:19	0.00	0.0	0.00	0.00
01Jan2000	00:20	0.00	0.0	0.00	0.00
01Jan2000	00:21	0.00	0.0	0.00	0.00
01Jan2000	00:22	0.00	0.0	0.00	0.00
01Jan2000	00:23	0.00	0.0	0.00	0.00
01Jan2000	00:24	0.00	0.0	0.00	0.00
01Jan2000	00:25	0.00	0.0	0.00	0.00

Date	Time	Inflow (CFS)	Storage (AC-FT)	Elevation (FT)	Outflow (CFS)
01Jan2000	00:26	0.00	0.0	0.00	0.00
01Jan2000	00:27	0.00	0.0	0.00	0.00
01Jan2000	00:28	0.00	0.0	0.00	0.00
01Jan2000	00:29	0.00	0.0	0.00	0.00
01Jan2000	00:30	0.00	0.0	0.00	0.00
01Jan2000	00:31	0.00	0.0	0.00	0.00
01Jan2000	00:32	0.00	0.0	0.00	0.00
01Jan2000	00:33	0.00	0.0	0.00	0.00
01Jan2000	00:34	0.00	0.0	0.00	0.00
01Jan2000	00:35	0.00	0.0	0.00	0.00
01Jan2000	00:36	0.00	0.0	0.00	0.00
01Jan2000	00:37	0.00	0.0	0.00	0.00
01Jan2000	00:38	0.00	0.0	0.00	0.00
01Jan2000	00:39	0.00	0.0	0.00	0.00
01Jan2000	00:40	0.00	0.0	0.00	0.00
01Jan2000	00:41	0.00	0.0	0.00	0.00
01Jan2000	00:42	0.00	0.0	0.00	0.00
01Jan2000	00:43	0.00	0.0	0.00	0.00
01Jan2000	00:44	0.00	0.0	0.00	0.00
01Jan2000	00:45	0.00	0.0	0.00	0.00
01Jan2000	00:46	0.00	0.0	0.00	0.00
01Jan2000	00:47	0.00	0.0	0.00	0.00
01Jan2000	00:48	0.00	0.0	0.00	0.00
01Jan2000	00:49	0.00	0.0	0.00	0.00
01Jan2000	00:50	0.00	0.0	0.00	0.00
01Jan2000	00:51	0.00	0.0	0.00	0.00
01Jan2000	00:52	0.00	0.0	0.00	0.00
01Jan2000	00:53	0.00	0.0	0.00	0.00
01Jan2000	00:54	0.00	0.0	0.00	0.00
01Jan2000	00:55	0.00	0.0	0.00	0.00
01Jan2000	00:56	0.00	0.0	0.00	0.00

Date	Time	Inflow (CFS)	Storage (AC-FT)	Elevation (FT)	Outflow (CFS)
01Jan2000	00:57	0.01	0.0	0.00	0.00
01Jan2000	00:58	0.03	0.0	0.00	0.00
01Jan2000	00:59	0.04	0.0	0.00	0.00
01Jan2000	01:00	0.06	0.0	0.01	0.01
01Jan2000	01:01	0.07	0.0	0.01	0.01
01Jan2000	01:02	0.09	0.0	0.02	0.01
01Jan2000	01:03	0.10	0.0	0.02	0.02
01Jan2000	01:04	0.10	0.0	0.03	0.02
01Jan2000	01:05	0.10	0.0	0.04	0.02
01Jan2000	01:06	0.10	0.0	0.04	0.03
01Jan2000	01:07	0.10	0.0	0.05	0.04
01Jan2000	01:08	0.10	0.0	0.05	0.04
01Jan2000	01:09	0.10	0.0	0.06	0.05
01Jan2000	01:10	0.10	0.0	0.06	0.05
01Jan2000	01:11	0.10	0.0	0.06	0.06
01Jan2000	01:12	0.10	0.0	0.07	0.06
01Jan2000	01:13	0.10	0.0	0.07	0.07
01Jan2000	01:14	0.10	0.0	0.07	0.07
01Jan2000	01:15	0.10	0.0	0.07	0.07
01Jan2000	01:16	0.10	0.0	0.08	0.07
01Jan2000	01:17	0.10	0.0	0.08	0.08
01Jan2000	01:18	0.10	0.0	0.08	0.08
01Jan2000	01:19	0.10	0.0	0.08	0.08
01Jan2000	01:20	0.10	0.0	0.08	0.08
01Jan2000	01:21	0.10	0.0	0.08	0.09
01Jan2000	01:22	0.10	0.0	0.08	0.09
01Jan2000	01:23	0.10	0.0	0.09	0.09
01Jan2000	01:24	0.10	0.0	0.09	0.09
01Jan2000	01:25	0.10	0.0	0.09	0.09
01Jan2000	01:26	0.10	0.0	0.09	0.09
01Jan2000	01:27	0.10	0.0	0.09	0.09

Date	Time	Inflow (CFS)	Storage (AC-FT)	Elevation (FT)	Outflow (CFS)
01Jan2000	01:28	0.10	0.0	0.09	0.09
01Jan2000	01:29	0.10	0.0	0.09	0.09
01Jan2000	01:30	0.10	0.0	0.09	0.10
01Jan2000	01:31	0.10	0.0	0.09	0.10
01Jan2000	01:32	0.10	0.0	0.09	0.10
01Jan2000	01:33	0.10	0.0	0.09	0.10
01Jan2000	01:34	0.10	0.0	0.09	0.10
01Jan2000	01:35	0.10	0.0	0.09	0.10
01Jan2000	01:36	0.10	0.0	0.09	0.10
01Jan2000	01:37	0.10	0.0	0.09	0.10
01Jan2000	01:38	0.10	0.0	0.09	0.10
01Jan2000	01:39	0.10	0.0	0.09	0.10
01Jan2000	01:40	0.10	0.0	0.09	0.10
01Jan2000	01:41	0.10	0.0	0.09	0.10
01Jan2000	01:42	0.10	0.0	0.09	0.10
01Jan2000	01:43	0.10	0.0	0.09	0.10
01Jan2000	01:44	0.10	0.0	0.09	0.10
01Jan2000	01:45	0.10	0.0	0.09	0.10
01Jan2000	01:46	0.10	0.0	0.09	0.10
01Jan2000	01:47	0.10	0.0	0.09	0.10
01Jan2000	01:48	0.10	0.0	0.09	0.10
01Jan2000	01:49	0.10	0.0	0.09	0.10
01Jan2000	01:50	0.10	0.0	0.09	0.10
01Jan2000	01:51	0.10	0.0	0.09	0.10
01Jan2000	01:52	0.10	0.0	0.09	0.10
01Jan2000	01:53	0.10	0.0	0.09	0.10
01Jan2000	01:54	0.10	0.0	0.09	0.10
01Jan2000	01:55	0.10	0.0	0.09	0.10
01Jan2000	01:56	0.10	0.0	0.09	0.10
01Jan2000	01:57	0.10	0.0	0.09	0.10
01Jan2000	01:58	0.10	0.0	0.09	0.10

Date	Time	Inflow (CFS)	Storage (AC-FT)	Elevation (FT)	Outflow (CFS)
01Jan2000	01:59	0.10	0.0	0.09	0.10
01Jan2000	02:00	0.10	0.0	0.09	0.10
01Jan2000	02:01	0.10	0.0	0.09	0.10
01Jan2000	02:02	0.10	0.0	0.09	0.10
01Jan2000	02:03	0.10	0.0	0.09	0.10
01Jan2000	02:04	0.10	0.0	0.09	0.10
01Jan2000	02:05	0.10	0.0	0.09	0.10
01Jan2000	02:06	0.10	0.0	0.09	0.10
01Jan2000	02:07	0.10	0.0	0.09	0.10
01Jan2000	02:08	0.10	0.0	0.09	0.10
01Jan2000	02:09	0.10	0.0	0.09	0.10
01Jan2000	02:10	0.10	0.0	0.09	0.10
01Jan2000	02:11	0.10	0.0	0.09	0.10
01Jan2000	02:12	0.10	0.0	0.09	0.10
01Jan2000	02:13	0.10	0.0	0.09	0.10
01Jan2000	02:14	0.10	0.0	0.09	0.10
01Jan2000	02:15	0.10	0.0	0.09	0.10
01Jan2000	02:16	0.10	0.0	0.09	0.10
01Jan2000	02:17	0.10	0.0	0.09	0.10
01Jan2000	02:18	0.10	0.0	0.09	0.10
01Jan2000	02:19	0.10	0.0	0.09	0.10
01Jan2000	02:20	0.10	0.0	0.09	0.10
01Jan2000	02:21	0.10	0.0	0.09	0.10
01Jan2000	02:22	0.10	0.0	0.09	0.10
01Jan2000	02:23	0.10	0.0	0.09	0.10
01Jan2000	02:24	0.10	0.0	0.09	0.10
01Jan2000	02:25	0.10	0.0	0.09	0.10
01Jan2000	02:26	0.10	0.0	0.09	0.10
01Jan2000	02:27	0.10	0.0	0.09	0.10
01Jan2000	02:28	0.10	0.0	0.09	0.10
01Jan2000	02:29	0.10	0.0	0.09	0.10

Date	Time	Inflow (CFS)	Storage (AC-FT)	Elevation (FT)	Outflow (CFS)
01Jan2000	02:30	0.10	0.0	0.09	0.10
01Jan2000	02:31	0.10	0.0	0.09	0.10
01Jan2000	02:32	0.10	0.0	0.09	0.10
01Jan2000	02:33	0.10	0.0	0.09	0.10
01Jan2000	02:34	0.10	0.0	0.09	0.10
01Jan2000	02:35	0.10	0.0	0.09	0.10
01Jan2000	02:36	0.10	0.0	0.09	0.10
01Jan2000	02:37	0.10	0.0	0.09	0.10
01Jan2000	02:38	0.10	0.0	0.09	0.10
01Jan2000	02:39	0.10	0.0	0.09	0.10
01Jan2000	02:40	0.10	0.0	0.09	0.10
01Jan2000	02:41	0.10	0.0	0.09	0.10
01Jan2000	02:42	0.10	0.0	0.09	0.10
01Jan2000	02:43	0.10	0.0	0.09	0.10
01Jan2000	02:44	0.10	0.0	0.09	0.10
01Jan2000	02:45	0.10	0.0	0.09	0.10
01Jan2000	02:46	0.10	0.0	0.09	0.10
01Jan2000	02:47	0.10	0.0	0.09	0.10
01Jan2000	02:48	0.10	0.0	0.09	0.10
01Jan2000	02:49	0.10	0.0	0.09	0.10
01Jan2000	02:50	0.10	0.0	0.09	0.10
01Jan2000	02:51	0.10	0.0	0.09	0.10
01Jan2000	02:52	0.10	0.0	0.09	0.10
01Jan2000	02:53	0.10	0.0	0.09	0.10
01Jan2000	02:54	0.10	0.0	0.09	0.10
01Jan2000	02:55	0.10	0.0	0.09	0.10
01Jan2000	02:56	0.10	0.0	0.09	0.10
01Jan2000	02:57	0.10	0.0	0.09	0.10
01Jan2000	02:58	0.10	0.0	0.09	0.10
01Jan2000	02:59	0.10	0.0	0.09	0.10
01Jan2000	03:00	0.10	0.0	0.09	0.10

Date	Time	Inflow (CFS)	Storage (AC-FT)	Elevation (FT)	Outflow (CFS)
01Jan2000	03:01	0.10	0.0	0.09	0.10
01Jan2000	03:02	0.10	0.0	0.09	0.10
01Jan2000	03:03	0.10	0.0	0.09	0.10
01Jan2000	03:04	0.10	0.0	0.09	0.10
01Jan2000	03:05	0.10	0.0	0.09	0.10
01Jan2000	03:06	0.10	0.0	0.09	0.10
01Jan2000	03:07	0.10	0.0	0.09	0.10
01Jan2000	03:08	0.10	0.0	0.09	0.10
01Jan2000	03:09	0.10	0.0	0.09	0.10
01Jan2000	03:10	0.10	0.0	0.09	0.10
01Jan2000	03:11	0.10	0.0	0.09	0.10
01Jan2000	03:12	0.10	0.0	0.09	0.10
01Jan2000	03:13	0.10	0.0	0.09	0.10
01Jan2000	03:14	0.10	0.0	0.09	0.10
01Jan2000	03:15	0.10	0.0	0.09	0.10
01Jan2000	03:16	0.10	0.0	0.09	0.10
01Jan2000	03:17	0.10	0.0	0.09	0.10
01Jan2000	03:18	0.10	0.0	0.09	0.10
01Jan2000	03:19	0.10	0.0	0.09	0.10
01Jan2000	03:20	0.10	0.0	0.09	0.10
01Jan2000	03:21	0.10	0.0	0.09	0.10
01Jan2000	03:22	0.10	0.0	0.09	0.10
01Jan2000	03:23	0.10	0.0	0.09	0.10
01Jan2000	03:24	0.10	0.0	0.09	0.10
01Jan2000	03:25	0.10	0.0	0.09	0.10
01Jan2000	03:26	0.10	0.0	0.09	0.10
01Jan2000	03:27	0.10	0.0	0.09	0.10
01Jan2000	03:28	0.10	0.0	0.09	0.10
01Jan2000	03:29	0.10	0.0	0.09	0.10
01Jan2000	03:30	0.10	0.0	0.09	0.10
01Jan2000	03:31	0.11	0.0	0.09	0.10

Date	Time	Inflow (CFS)	Storage (AC-FT)	Elevation (FT)	Outflow (CFS)
01Jan2000	03:32	0.13	0.0	0.09	0.10
01Jan2000	03:33	0.14	0.0	0.10	0.11
01Jan2000	03:34	0.16	0.0	0.10	0.11
01Jan2000	03:35	0.17	0.0	0.10	0.12
01Jan2000	03:36	0.19	0.0	0.11	0.13
01Jan2000	03:37	0.20	0.0	0.11	0.13
01Jan2000	03:38	0.20	0.0	0.12	0.14
01Jan2000	03:39	0.20	0.0	0.12	0.15
01Jan2000	03:40	0.20	0.0	0.13	0.15
01Jan2000	03:41	0.20	0.0	0.13	0.16
01Jan2000	03:42	0.20	0.0	0.13	0.16
01Jan2000	03:43	0.20	0.0	0.14	0.17
01Jan2000	03:44	0.20	0.0	0.14	0.17
01Jan2000	03:45	0.21	0.0	0.14	0.17
01Jan2000	03:46	0.23	0.0	0.14	0.18
01Jan2000	03:47	0.24	0.0	0.15	0.19
01Jan2000	03:48	0.26	0.0	0.15	0.19
01Jan2000	03:49	0.27	0.0	0.16	0.20
01Jan2000	03:50	0.29	0.0	0.16	0.21
01Jan2000	03:51	0.30	0.0	0.17	0.21
01Jan2000	03:52	0.31	0.0	0.18	0.22
01Jan2000	03:53	0.33	0.0	0.19	0.23
01Jan2000	03:54	0.34	0.0	0.19	0.23
01Jan2000	03:55	0.36	0.0	0.20	0.24
01Jan2000	03:56	0.37	0.0	0.21	0.25
01Jan2000	03:57	0.39	0.0	0.22	0.26
01Jan2000	03:58	0.40	0.0	0.23	0.26
01Jan2000	03:59	0.57	0.0	0.25	0.28
01Jan2000	04:00	0.74	0.0	0.28	0.30
01Jan2000	04:01	0.91	0.0	0.32	0.32
01Jan2000	04:02	1.07	0.0	0.37	0.35

Date	Time	Inflow (CFS)	Storage (AC-FT)	Elevation (FT)	Outflow (CFS)
01Jan2000	04:03	1.24	0.0	0.43	0.38
01Jan2000	04:04	1.41	0.0	0.50	0.42
01Jan2000	04:05	1.58	0.0	0.58	0.45
01Jan2000	04:06	1.38	0.0	0.66	0.48
01Jan2000	04:07	1.19	0.0	0.72	0.50
01Jan2000	04:08	0.99	0.0	0.77	0.52
01Jan2000	04:09	0.79	0.0	0.80	0.53
01Jan2000	04:10	0.59	0.0	0.81	0.53
01Jan2000	04:11	0.40	0.0	0.81	0.53
01Jan2000	04:12	0.20	0.0	0.79	0.53
01Jan2000	04:13	0.20	0.0	0.76	0.52
01Jan2000	04:14	0.20	0.0	0.74	0.51
01Jan2000	04:15	0.20	0.0	0.72	0.50
01Jan2000	04:16	0.20	0.0	0.69	0.49
01Jan2000	04:17	0.20	0.0	0.67	0.48
01Jan2000	04:18	0.20	0.0	0.65	0.48
01Jan2000	04:19	0.20	0.0	0.63	0.47
01Jan2000	04:20	0.19	0.0	0.61	0.46
01Jan2000	04:21	0.17	0.0	0.59	0.45
01Jan2000	04:22	0.16	0.0	0.56	0.44
01Jan2000	04:23	0.14	0.0	0.54	0.43
01Jan2000	04:24	0.13	0.0	0.52	0.42
01Jan2000	04:25	0.11	0.0	0.50	0.41
01Jan2000	04:26	0.10	0.0	0.47	0.40
01Jan2000	04:27	0.10	0.0	0.45	0.39
01Jan2000	04:28	0.10	0.0	0.43	0.38
01Jan2000	04:29	0.10	0.0	0.41	0.37
01Jan2000	04:30	0.10	0.0	0.39	0.36
01Jan2000	04:31	0.10	0.0	0.37	0.35
01Jan2000	04:32	0.10	0.0	0.35	0.34
01Jan2000	04:33	0.10	0.0	0.33	0.33

Date	Time	Inflow (CFS)	Storage (AC-FT)	Elevation (FT)	Outflow (CFS)
01Jan2000	04:34	0.10	0.0	0.31	0.32
01Jan2000	04:35	0.10	0.0	0.30	0.31
01Jan2000	04:36	0.10	0.0	0.28	0.30
01Jan2000	04:37	0.10	0.0	0.26	0.29
01Jan2000	04:38	0.10	0.0	0.25	0.28
01Jan2000	04:39	0.10	0.0	0.24	0.27
01Jan2000	04:40	0.10	0.0	0.22	0.26
01Jan2000	04:41	0.10	0.0	0.21	0.25
01Jan2000	04:42	0.10	0.0	0.20	0.24
01Jan2000	04:43	0.10	0.0	0.19	0.23
01Jan2000	04:44	0.10	0.0	0.18	0.22
01Jan2000	04:45	0.10	0.0	0.17	0.21
01Jan2000	04:46	0.10	0.0	0.16	0.21
01Jan2000	04:47	0.10	0.0	0.16	0.20
01Jan2000	04:48	0.10	0.0	0.15	0.19
01Jan2000	04:49	0.10	0.0	0.14	0.18
01Jan2000	04:50	0.10	0.0	0.14	0.17
01Jan2000	04:51	0.10	0.0	0.13	0.16
01Jan2000	04:52	0.10	0.0	0.13	0.15
01Jan2000	04:53	0.10	0.0	0.12	0.15
01Jan2000	04:54	0.10	0.0	0.12	0.14
01Jan2000	04:55	0.10	0.0	0.12	0.14
01Jan2000	04:56	0.10	0.0	0.11	0.13
01Jan2000	04:57	0.10	0.0	0.11	0.13
01Jan2000	04:58	0.10	0.0	0.11	0.13
01Jan2000	04:59	0.10	0.0	0.11	0.12
01Jan2000	05:00	0.10	0.0	0.11	0.12
01Jan2000	05:01	0.10	0.0	0.10	0.12
01Jan2000	05:02	0.10	0.0	0.10	0.12
01Jan2000	05:03	0.10	0.0	0.10	0.11
01Jan2000	05:04	0.10	0.0	0.10	0.11

Date	Time	Inflow (CFS)	Storage (AC-FT)	Elevation (FT)	Outflow (CFS)
01Jan2000	05:05	0.10	0.0	0.10	0.11
01Jan2000	05:06	0.10	0.0	0.10	0.11
01Jan2000	05:07	0.10	0.0	0.10	0.11
01Jan2000	05:08	0.10	0.0	0.10	0.11
01Jan2000	05:09	0.10	0.0	0.10	0.11
01Jan2000	05:10	0.10	0.0	0.10	0.11
01Jan2000	05:11	0.10	0.0	0.10	0.11
01Jan2000	05:12	0.10	0.0	0.10	0.10
01Jan2000	05:13	0.10	0.0	0.10	0.10
01Jan2000	05:14	0.10	0.0	0.09	0.10
01Jan2000	05:15	0.10	0.0	0.09	0.10
01Jan2000	05:16	0.10	0.0	0.09	0.10
01Jan2000	05:17	0.10	0.0	0.09	0.10
01Jan2000	05:18	0.10	0.0	0.09	0.10
01Jan2000	05:19	0.10	0.0	0.09	0.10
01Jan2000	05:20	0.10	0.0	0.09	0.10
01Jan2000	05:21	0.10	0.0	0.09	0.10
01Jan2000	05:22	0.10	0.0	0.09	0.10
01Jan2000	05:23	0.10	0.0	0.09	0.10
01Jan2000	05:24	0.10	0.0	0.09	0.10
01Jan2000	05:25	0.10	0.0	0.09	0.10
01Jan2000	05:26	0.10	0.0	0.09	0.10
01Jan2000	05:27	0.10	0.0	0.09	0.10
01Jan2000	05:28	0.10	0.0	0.09	0.10
01Jan2000	05:29	0.10	0.0	0.09	0.10
01Jan2000	05:30	0.10	0.0	0.09	0.10
01Jan2000	05:31	0.10	0.0	0.09	0.10
01Jan2000	05:32	0.10	0.0	0.09	0.10
01Jan2000	05:33	0.10	0.0	0.09	0.10
01Jan2000	05:34	0.10	0.0	0.09	0.10
01Jan2000	05:35	0.10	0.0	0.09	0.10

Date	Time	Inflow (CFS)	Storage (AC-FT)	Elevation (FT)	Outflow (CFS)
01Jan2000	05:36	0.10	0.0	0.09	0.10
01Jan2000	05:37	0.09	0.0	0.09	0.10
01Jan2000	05:38	0.07	0.0	0.09	0.10
01Jan2000	05:39	0.06	0.0	0.09	0.09
01Jan2000	05:40	0.04	0.0	0.09	0.09
01Jan2000	05:41	0.03	0.0	0.08	0.08
01Jan2000	05:42	0.01	0.0	0.08	0.07
01Jan2000	05:43	0.00	0.0	0.07	0.07
01Jan2000	05:44	0.00	0.0	0.07	0.06
01Jan2000	05:45	0.00	0.0	0.06	0.06
01Jan2000	05:46	0.00	0.0	0.06	0.05
01Jan2000	05:47	0.00	0.0	0.05	0.05
01Jan2000	05:48	0.00	0.0	0.05	0.04
01Jan2000	05:49	0.00	0.0	0.05	0.04
01Jan2000	05:50	0.00	0.0	0.04	0.03
01Jan2000	05:51	0.00	0.0	0.04	0.03
01Jan2000	05:52	0.00	0.0	0.04	0.03
01Jan2000	05:53	0.00	0.0	0.04	0.03
01Jan2000	05:54	0.00	0.0	0.04	0.02
01Jan2000	05:55	0.00	0.0	0.03	0.02
01Jan2000	05:56	0.00	0.0	0.03	0.02
01Jan2000	05:57	0.00	0.0	0.03	0.02
01Jan2000	05:58	0.00	0.0	0.03	0.02
01Jan2000	05:59	0.00	0.0	0.03	0.02
01Jan2000	06:00	0.00	0.0	0.03	0.02
01Jan2000	06:01	0.00	0.0	0.02	0.02
01Jan2000	06:02	0.00	0.0	0.02	0.02
01Jan2000	06:03	0.00	0.0	0.02	0.02
01Jan2000	06:04	0.00	0.0	0.02	0.01
01Jan2000	06:05	0.00	0.0	0.02	0.01
01Jan2000	06:06	0.00	0.0	0.02	0.01

Date	Time	Inflow (CFS)	Storage (AC-FT)	Elevation (FT)	Outflow (CFS)
01Jan2000	06:07	0.00	0.0	0.02	0.01
01Jan2000	06:08	0.00	0.0	0.02	0.01
01Jan2000	06:09	0.00	0.0	0.02	0.01
01Jan2000	06:10	0.00	0.0	0.02	0.01
01Jan2000	06:11	0.00	0.0	0.01	0.01
01Jan2000	06:12	0.00	0.0	0.01	0.01
01Jan2000	06:13	0.00	0.0	0.01	0.01
01Jan2000	06:14	0.00	0.0	0.01	0.01
01Jan2000	06:15	0.00	0.0	0.01	0.01
01Jan2000	06:16	0.00	0.0	0.01	0.01
01Jan2000	06:17	0.00	0.0	0.01	0.01
01Jan2000	06:18	0.00	0.0	0.01	0.01
01Jan2000	06:19	0.00	0.0	0.01	0.01
01Jan2000	06:20	0.00	0.0	0.01	0.01
01Jan2000	06:21	0.00	0.0	0.01	0.01
01Jan2000	06:22	0.00	0.0	0.01	0.01
01Jan2000	06:23	0.00	0.0	0.01	0.01
01Jan2000	06:24	0.00	0.0	0.01	0.01
01Jan2000	06:25	0.00	0.0	0.01	0.00
01Jan2000	06:26	0.00	0.0	0.01	0.00
01Jan2000	06:27	0.00	0.0	0.01	0.00
01Jan2000	06:28	0.00	0.0	0.01	0.00
01Jan2000	06:29	0.00	0.0	0.01	0.00
01Jan2000	06:30	0.00	0.0	0.01	0.00
01Jan2000	06:31	0.00	0.0	0.01	0.00
01Jan2000	06:32	0.00	0.0	0.00	0.00
01Jan2000	06:33	0.00	0.0	0.00	0.00
01Jan2000	06:34	0.00	0.0	0.00	0.00
01Jan2000	06:35	0.00	0.0	0.00	0.00
01Jan2000	06:36	0.00	0.0	0.00	0.00
01Jan2000	06:37	0.00	0.0	0.00	0.00

Date	Time	Inflow (CFS)	Storage (AC-FT)	Elevation (FT)	Outflow (CFS)
01Jan2000	06:38	0.00	0.0	0.00	0.00
01Jan2000	06:39	0.00	0.0	0.00	0.00
01Jan2000	06:40	0.00	0.0	0.00	0.00
01Jan2000	06:41	0.00	0.0	0.00	0.00
01Jan2000	06:42	0.00	0.0	0.00	0.00
01Jan2000	06:43	0.00	0.0	0.00	0.00
01Jan2000	06:44	0.00	0.0	0.00	0.00
01Jan2000	06:45	0.00	0.0	0.00	0.00
01Jan2000	06:46	0.00	0.0	0.00	0.00
01Jan2000	06:47	0.00	0.0	0.00	0.00
01Jan2000	06:48	0.00	0.0	0.00	0.00
01Jan2000	06:49	0.00	0.0	0.00	0.00
01Jan2000	06:50	0.00	0.0	0.00	0.00
01Jan2000	06:51	0.00	0.0	0.00	0.00
01Jan2000	06:52	0.00	0.0	0.00	0.00
01Jan2000	06:53	0.00	0.0	0.00	0.00
01Jan2000	06:54	0.00	0.0	0.00	0.00
01Jan2000	06:55	0.00	0.0	0.00	0.00
01Jan2000	06:56	0.00	0.0	0.00	0.00
01Jan2000	06:57	0.00	0.0	0.00	0.00
01Jan2000	06:58	0.00	0.0	0.00	0.00
01Jan2000	06:59	0.00	0.0	0.00	0.00
01Jan2000	07:00	0.00	0.0	0.00	0.00

Summary Results for Reservoir "BMP 2"

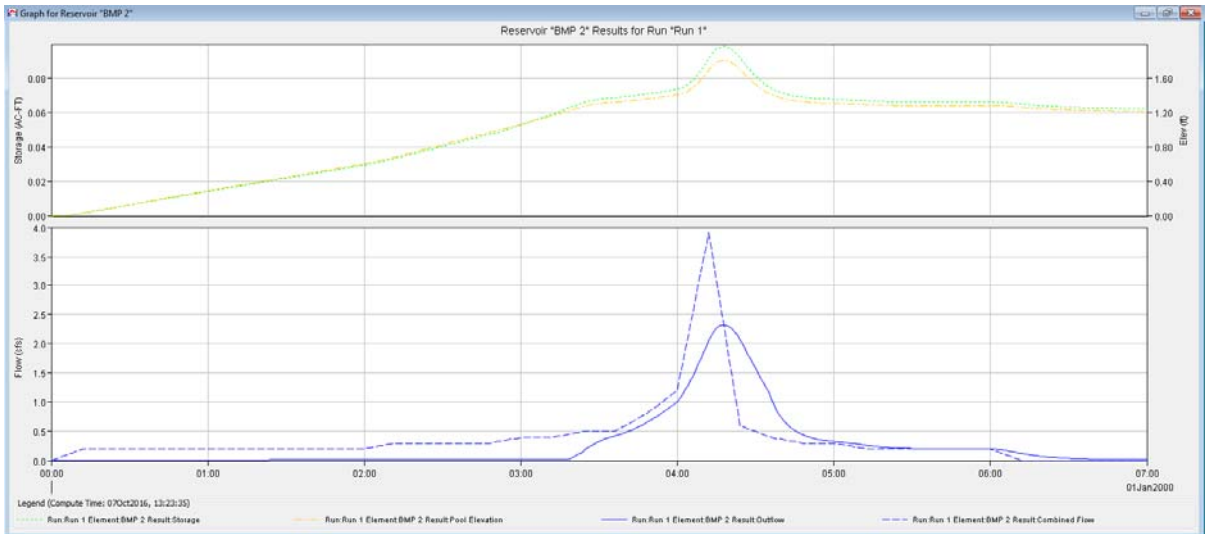
Project: 160629_1017 Simulation Run: Run 1
Reservoir: BMP 2

Start of Run:	01Jan2000, 00:00	Basin Model:	POC-1
End of Run:	01Jan2000, 07:00	Meteorologic Model:	Met 1
Compute Time:	07Oct2016, 13:23:35	Control Specifications:	Control 1

Volume Units: (•) IN ( ) AC-FT

Computed Results

Peak Inflow:	3.90 (CFS)	Date/Time of Peak Inflow:	01Jan2000, 04:12
Peak Discharge:	2.32 (CFS)	Date/Time of Peak Discharge:	01Jan2000, 04:18
Inflow Volume:	n/a	Peak Storage:	0.1 (AC-FT)
Discharge Volume:	n/a	Peak Elevation:	1.81 (FT)



Project: 160629_1017 Simulation Run: Run 1
Reservoir: BMP 2

Start of Run: 01Jan2000, 00:00 Basin Model: POC-1
End of Run: 01Jan2000, 07:00 Meteorologic Model: Met 1
Compute Time: 07Oct2016, 13:23:35 Control Specifications: Control 1

Date	Time	Inflow (CFS)	Storage (AC-FT)	Elevation (FT)	Outflow (CFS)
01Jan2000	00:00	0.00	0.0	0.00	0.00
01Jan2000	00:01	0.02	0.0	0.00	0.00
01Jan2000	00:02	0.03	0.0	0.00	0.00
01Jan2000	00:03	0.05	0.0	0.00	0.00
01Jan2000	00:04	0.07	0.0	0.00	0.00
01Jan2000	00:05	0.08	0.0	0.01	0.00
01Jan2000	00:06	0.10	0.0	0.01	0.00
01Jan2000	00:07	0.12	0.0	0.01	0.00
01Jan2000	00:08	0.13	0.0	0.02	0.00
01Jan2000	00:09	0.15	0.0	0.02	0.00
01Jan2000	00:10	0.17	0.0	0.02	0.00
01Jan2000	00:11	0.18	0.0	0.03	0.00
01Jan2000	00:12	0.20	0.0	0.03	0.00
01Jan2000	00:13	0.20	0.0	0.04	0.00
01Jan2000	00:14	0.20	0.0	0.04	0.00
01Jan2000	00:15	0.20	0.0	0.05	0.00
01Jan2000	00:16	0.20	0.0	0.06	0.00
01Jan2000	00:17	0.20	0.0	0.06	0.00
01Jan2000	00:18	0.20	0.0	0.07	0.00
01Jan2000	00:19	0.20	0.0	0.07	0.00
01Jan2000	00:20	0.20	0.0	0.08	0.01
01Jan2000	00:21	0.20	0.0	0.08	0.01
01Jan2000	00:22	0.20	0.0	0.09	0.01
01Jan2000	00:23	0.20	0.0	0.09	0.01
01Jan2000	00:24	0.20	0.0	0.10	0.01
01Jan2000	00:25	0.20	0.0	0.11	0.01

Date	Time	Inflow (CFS)	Storage (AC-FT)	Elevation (FT)	Outflow (CFS)
01Jan2000	00:26	0.20	0.0	0.11	0.01
01Jan2000	00:27	0.20	0.0	0.12	0.01
01Jan2000	00:28	0.20	0.0	0.12	0.01
01Jan2000	00:29	0.20	0.0	0.13	0.01
01Jan2000	00:30	0.20	0.0	0.13	0.01
01Jan2000	00:31	0.20	0.0	0.14	0.01
01Jan2000	00:32	0.20	0.0	0.14	0.01
01Jan2000	00:33	0.20	0.0	0.15	0.01
01Jan2000	00:34	0.20	0.0	0.15	0.01
01Jan2000	00:35	0.20	0.0	0.16	0.01
01Jan2000	00:36	0.20	0.0	0.17	0.01
01Jan2000	00:37	0.20	0.0	0.17	0.01
01Jan2000	00:38	0.20	0.0	0.18	0.01
01Jan2000	00:39	0.20	0.0	0.18	0.01
01Jan2000	00:40	0.20	0.0	0.19	0.01
01Jan2000	00:41	0.20	0.0	0.19	0.01
01Jan2000	00:42	0.20	0.0	0.20	0.01
01Jan2000	00:43	0.20	0.0	0.20	0.01
01Jan2000	00:44	0.20	0.0	0.21	0.01
01Jan2000	00:45	0.20	0.0	0.21	0.01
01Jan2000	00:46	0.20	0.0	0.22	0.01
01Jan2000	00:47	0.20	0.0	0.22	0.01
01Jan2000	00:48	0.20	0.0	0.23	0.01
01Jan2000	00:49	0.20	0.0	0.24	0.01
01Jan2000	00:50	0.20	0.0	0.24	0.01
01Jan2000	00:51	0.20	0.0	0.25	0.01
01Jan2000	00:52	0.20	0.0	0.25	0.01
01Jan2000	00:53	0.20	0.0	0.26	0.01
01Jan2000	00:54	0.20	0.0	0.26	0.01
01Jan2000	00:55	0.20	0.0	0.27	0.01
01Jan2000	00:56	0.20	0.0	0.27	0.01

Date	Time	Inflow (CFS)	Storage (AC-FT)	Elevation (FT)	Outflow (CFS)
01Jan2000	00:57	0.20	0.0	0.28	0.01
01Jan2000	00:58	0.20	0.0	0.28	0.01
01Jan2000	00:59	0.20	0.0	0.29	0.01
01Jan2000	01:00	0.20	0.0	0.29	0.01
01Jan2000	01:01	0.20	0.0	0.30	0.01
01Jan2000	01:02	0.20	0.0	0.30	0.01
01Jan2000	01:03	0.20	0.0	0.31	0.01
01Jan2000	01:04	0.20	0.0	0.32	0.01
01Jan2000	01:05	0.20	0.0	0.32	0.01
01Jan2000	01:06	0.20	0.0	0.33	0.01
01Jan2000	01:07	0.20	0.0	0.33	0.01
01Jan2000	01:08	0.20	0.0	0.34	0.01
01Jan2000	01:09	0.20	0.0	0.34	0.01
01Jan2000	01:10	0.20	0.0	0.35	0.01
01Jan2000	01:11	0.20	0.0	0.35	0.01
01Jan2000	01:12	0.20	0.0	0.36	0.01
01Jan2000	01:13	0.20	0.0	0.36	0.01
01Jan2000	01:14	0.20	0.0	0.37	0.01
01Jan2000	01:15	0.20	0.0	0.37	0.01
01Jan2000	01:16	0.20	0.0	0.38	0.01
01Jan2000	01:17	0.20	0.0	0.38	0.01
01Jan2000	01:18	0.20	0.0	0.39	0.01
01Jan2000	01:19	0.20	0.0	0.39	0.01
01Jan2000	01:20	0.20	0.0	0.40	0.01
01Jan2000	01:21	0.20	0.0	0.41	0.01
01Jan2000	01:22	0.20	0.0	0.41	0.01
01Jan2000	01:23	0.20	0.0	0.42	0.01
01Jan2000	01:24	0.20	0.0	0.42	0.01
01Jan2000	01:25	0.20	0.0	0.43	0.01
01Jan2000	01:26	0.20	0.0	0.43	0.01
01Jan2000	01:27	0.20	0.0	0.44	0.01

Date	Time	Inflow (CFS)	Storage (AC-FT)	Elevation (FT)	Outflow (CFS)
01Jan2000	01:28	0.20	0.0	0.44	0.01
01Jan2000	01:29	0.20	0.0	0.45	0.01
01Jan2000	01:30	0.20	0.0	0.45	0.01
01Jan2000	01:31	0.20	0.0	0.46	0.01
01Jan2000	01:32	0.20	0.0	0.46	0.01
01Jan2000	01:33	0.20	0.0	0.47	0.01
01Jan2000	01:34	0.20	0.0	0.47	0.01
01Jan2000	01:35	0.20	0.0	0.48	0.01
01Jan2000	01:36	0.20	0.0	0.48	0.01
01Jan2000	01:37	0.20	0.0	0.49	0.01
01Jan2000	01:38	0.20	0.0	0.49	0.01
01Jan2000	01:39	0.20	0.0	0.50	0.01
01Jan2000	01:40	0.20	0.0	0.51	0.01
01Jan2000	01:41	0.20	0.0	0.51	0.01
01Jan2000	01:42	0.20	0.0	0.52	0.01
01Jan2000	01:43	0.20	0.0	0.52	0.01
01Jan2000	01:44	0.20	0.0	0.53	0.01
01Jan2000	01:45	0.20	0.0	0.53	0.01
01Jan2000	01:46	0.20	0.0	0.54	0.01
01Jan2000	01:47	0.20	0.0	0.54	0.01
01Jan2000	01:48	0.20	0.0	0.55	0.01
01Jan2000	01:49	0.20	0.0	0.55	0.02
01Jan2000	01:50	0.20	0.0	0.56	0.02
01Jan2000	01:51	0.20	0.0	0.56	0.02
01Jan2000	01:52	0.20	0.0	0.57	0.02
01Jan2000	01:53	0.20	0.0	0.57	0.02
01Jan2000	01:54	0.20	0.0	0.58	0.02
01Jan2000	01:55	0.20	0.0	0.58	0.02
01Jan2000	01:56	0.20	0.0	0.59	0.02
01Jan2000	01:57	0.20	0.0	0.59	0.02
01Jan2000	01:58	0.20	0.0	0.60	0.02

Date	Time	Inflow (CFS)	Storage (AC-FT)	Elevation (FT)	Outflow (CFS)
01Jan2000	01:59	0.20	0.0	0.60	0.02
01Jan2000	02:00	0.20	0.0	0.61	0.02
01Jan2000	02:01	0.21	0.0	0.61	0.02
01Jan2000	02:02	0.22	0.0	0.62	0.02
01Jan2000	02:03	0.23	0.0	0.63	0.02
01Jan2000	02:04	0.23	0.0	0.63	0.02
01Jan2000	02:05	0.24	0.0	0.64	0.02
01Jan2000	02:06	0.25	0.0	0.64	0.02
01Jan2000	02:07	0.26	0.0	0.65	0.02
01Jan2000	02:08	0.27	0.0	0.66	0.02
01Jan2000	02:09	0.28	0.0	0.67	0.02
01Jan2000	02:10	0.28	0.0	0.67	0.02
01Jan2000	02:11	0.29	0.0	0.68	0.02
01Jan2000	02:12	0.30	0.0	0.69	0.02
01Jan2000	02:13	0.30	0.0	0.70	0.02
01Jan2000	02:14	0.30	0.0	0.70	0.02
01Jan2000	02:15	0.30	0.0	0.71	0.02
01Jan2000	02:16	0.30	0.0	0.72	0.02
01Jan2000	02:17	0.30	0.0	0.73	0.02
01Jan2000	02:18	0.30	0.0	0.74	0.02
01Jan2000	02:19	0.30	0.0	0.74	0.02
01Jan2000	02:20	0.30	0.0	0.75	0.02
01Jan2000	02:21	0.30	0.0	0.76	0.02
01Jan2000	02:22	0.30	0.0	0.77	0.02
01Jan2000	02:23	0.30	0.0	0.78	0.02
01Jan2000	02:24	0.30	0.0	0.78	0.02
01Jan2000	02:25	0.30	0.0	0.79	0.02
01Jan2000	02:26	0.30	0.0	0.80	0.02
01Jan2000	02:27	0.30	0.0	0.81	0.02
01Jan2000	02:28	0.30	0.0	0.82	0.02
01Jan2000	02:29	0.30	0.0	0.82	0.02

Date	Time	Inflow (CFS)	Storage (AC-FT)	Elevation (FT)	Outflow (CFS)
01Jan2000	02:30	0.30	0.0	0.83	0.02
01Jan2000	02:31	0.30	0.0	0.84	0.02
01Jan2000	02:32	0.30	0.0	0.85	0.02
01Jan2000	02:33	0.30	0.0	0.86	0.02
01Jan2000	02:34	0.30	0.0	0.86	0.02
01Jan2000	02:35	0.30	0.0	0.87	0.02
01Jan2000	02:36	0.30	0.0	0.88	0.02
01Jan2000	02:37	0.30	0.0	0.89	0.02
01Jan2000	02:38	0.30	0.0	0.90	0.02
01Jan2000	02:39	0.30	0.0	0.90	0.02
01Jan2000	02:40	0.30	0.0	0.91	0.02
01Jan2000	02:41	0.30	0.0	0.92	0.02
01Jan2000	02:42	0.30	0.0	0.93	0.02
01Jan2000	02:43	0.30	0.0	0.94	0.02
01Jan2000	02:44	0.30	0.0	0.94	0.02
01Jan2000	02:45	0.30	0.0	0.95	0.02
01Jan2000	02:46	0.30	0.0	0.96	0.02
01Jan2000	02:47	0.30	0.0	0.97	0.02
01Jan2000	02:48	0.30	0.0	0.97	0.02
01Jan2000	02:49	0.31	0.0	0.98	0.02
01Jan2000	02:50	0.32	0.0	0.99	0.02
01Jan2000	02:51	0.33	0.0	1.00	0.02
01Jan2000	02:52	0.33	0.0	1.01	0.02
01Jan2000	02:53	0.34	0.0	1.01	0.02
01Jan2000	02:54	0.35	0.1	1.02	0.02
01Jan2000	02:55	0.36	0.1	1.03	0.02
01Jan2000	02:56	0.37	0.1	1.04	0.02
01Jan2000	02:57	0.38	0.1	1.04	0.02
01Jan2000	02:58	0.38	0.1	1.05	0.02
01Jan2000	02:59	0.39	0.1	1.06	0.02
01Jan2000	03:00	0.40	0.1	1.07	0.02

Date	Time	Inflow (CFS)	Storage (AC-FT)	Elevation (FT)	Outflow (CFS)
01Jan2000	03:01	0.40	0.1	1.08	0.02
01Jan2000	03:02	0.40	0.1	1.09	0.02
01Jan2000	03:03	0.40	0.1	1.09	0.02
01Jan2000	03:04	0.40	0.1	1.10	0.02
01Jan2000	03:05	0.40	0.1	1.11	0.02
01Jan2000	03:06	0.40	0.1	1.12	0.02
01Jan2000	03:07	0.40	0.1	1.13	0.02
01Jan2000	03:08	0.40	0.1	1.14	0.02
01Jan2000	03:09	0.40	0.1	1.15	0.02
01Jan2000	03:10	0.40	0.1	1.15	0.02
01Jan2000	03:11	0.40	0.1	1.16	0.02
01Jan2000	03:12	0.40	0.1	1.17	0.02
01Jan2000	03:13	0.41	0.1	1.18	0.02
01Jan2000	03:14	0.42	0.1	1.19	0.02
01Jan2000	03:15	0.43	0.1	1.20	0.02
01Jan2000	03:16	0.43	0.1	1.21	0.02
01Jan2000	03:17	0.44	0.1	1.22	0.02
01Jan2000	03:18	0.45	0.1	1.23	0.02
01Jan2000	03:19	0.46	0.1	1.23	0.04
01Jan2000	03:20	0.47	0.1	1.24	0.06
01Jan2000	03:21	0.48	0.1	1.25	0.09
01Jan2000	03:22	0.48	0.1	1.26	0.11
01Jan2000	03:23	0.49	0.1	1.27	0.13
01Jan2000	03:24	0.50	0.1	1.28	0.17
01Jan2000	03:25	0.50	0.1	1.28	0.20
01Jan2000	03:26	0.50	0.1	1.29	0.23
01Jan2000	03:27	0.50	0.1	1.30	0.26
01Jan2000	03:28	0.50	0.1	1.30	0.28
01Jan2000	03:29	0.50	0.1	1.31	0.31
01Jan2000	03:30	0.50	0.1	1.31	0.33
01Jan2000	03:31	0.50	0.1	1.31	0.35

Date	Time	Inflow (CFS)	Storage (AC-FT)	Elevation (FT)	Outflow (CFS)
01Jan2000	03:32	0.50	0.1	1.32	0.37
01Jan2000	03:33	0.50	0.1	1.32	0.39
01Jan2000	03:34	0.50	0.1	1.32	0.40
01Jan2000	03:35	0.50	0.1	1.32	0.41
01Jan2000	03:36	0.50	0.1	1.33	0.43
01Jan2000	03:37	0.53	0.1	1.33	0.44
01Jan2000	03:38	0.55	0.1	1.33	0.45
01Jan2000	03:39	0.58	0.1	1.33	0.46
01Jan2000	03:40	0.60	0.1	1.34	0.48
01Jan2000	03:41	0.63	0.1	1.34	0.50
01Jan2000	03:42	0.65	0.1	1.34	0.52
01Jan2000	03:43	0.68	0.1	1.34	0.54
01Jan2000	03:44	0.70	0.1	1.35	0.56
01Jan2000	03:45	0.73	0.1	1.35	0.58
01Jan2000	03:46	0.75	0.1	1.35	0.60
01Jan2000	03:47	0.78	0.1	1.36	0.63
01Jan2000	03:48	0.80	0.1	1.36	0.65
01Jan2000	03:49	0.83	0.1	1.36	0.68
01Jan2000	03:50	0.87	0.1	1.37	0.70
01Jan2000	03:51	0.90	0.1	1.37	0.73
01Jan2000	03:52	0.93	0.1	1.38	0.76
01Jan2000	03:53	0.97	0.1	1.38	0.79
01Jan2000	03:54	1.00	0.1	1.38	0.82
01Jan2000	03:55	1.03	0.1	1.39	0.85
01Jan2000	03:56	1.07	0.1	1.39	0.88
01Jan2000	03:57	1.10	0.1	1.40	0.91
01Jan2000	03:58	1.13	0.1	1.40	0.94
01Jan2000	03:59	1.17	0.1	1.41	0.97
01Jan2000	04:00	1.20	0.1	1.41	1.01
01Jan2000	04:01	1.43	0.1	1.42	1.05
01Jan2000	04:02	1.65	0.1	1.43	1.13

Date	Time	Inflow (CFS)	Storage (AC-FT)	Elevation (FT)	Outflow (CFS)
01Jan2000	04:03	1.88	0.1	1.44	1.21
01Jan2000	04:04	2.10	0.1	1.46	1.28
01Jan2000	04:05	2.33	0.1	1.48	1.36
01Jan2000	04:06	2.55	0.1	1.50	1.45
01Jan2000	04:07	2.78	0.1	1.53	1.55
01Jan2000	04:08	3.00	0.1	1.55	1.64
01Jan2000	04:09	3.23	0.1	1.59	1.74
01Jan2000	04:10	3.45	0.1	1.62	1.84
01Jan2000	04:11	3.68	0.1	1.66	1.95
01Jan2000	04:12	3.90	0.1	1.70	2.05
01Jan2000	04:13	3.63	0.1	1.74	2.14
01Jan2000	04:14	3.35	0.1	1.77	2.21
01Jan2000	04:15	3.08	0.1	1.79	2.26
01Jan2000	04:16	2.80	0.1	1.80	2.30
01Jan2000	04:17	2.53	0.1	1.81	2.31
01Jan2000	04:18	2.25	0.1	1.81	2.32
01Jan2000	04:19	1.98	0.1	1.81	2.31
01Jan2000	04:20	1.70	0.1	1.80	2.28
01Jan2000	04:21	1.43	0.1	1.78	2.25
01Jan2000	04:22	1.15	0.1	1.76	2.20
01Jan2000	04:23	0.88	0.1	1.73	2.14
01Jan2000	04:24	0.60	0.1	1.70	2.07
01Jan2000	04:25	0.58	0.1	1.67	1.98
01Jan2000	04:26	0.57	0.1	1.64	1.90
01Jan2000	04:27	0.55	0.1	1.61	1.82
01Jan2000	04:28	0.53	0.1	1.58	1.74
01Jan2000	04:29	0.52	0.1	1.56	1.66
01Jan2000	04:30	0.50	0.1	1.53	1.57
01Jan2000	04:31	0.48	0.1	1.51	1.49
01Jan2000	04:32	0.47	0.1	1.49	1.41
01Jan2000	04:33	0.45	0.1	1.47	1.33

Date	Time	Inflow (CFS)	Storage (AC-FT)	Elevation (FT)	Outflow (CFS)
01Jan2000	04:34	0.43	0.1	1.45	1.25
01Jan2000	04:35	0.42	0.1	1.43	1.17
01Jan2000	04:36	0.40	0.1	1.42	1.05
01Jan2000	04:37	0.39	0.1	1.40	0.95
01Jan2000	04:38	0.38	0.1	1.39	0.86
01Jan2000	04:39	0.38	0.1	1.38	0.79
01Jan2000	04:40	0.37	0.1	1.37	0.73
01Jan2000	04:41	0.36	0.1	1.36	0.67
01Jan2000	04:42	0.35	0.1	1.36	0.62
01Jan2000	04:43	0.34	0.1	1.35	0.58
01Jan2000	04:44	0.33	0.1	1.35	0.55
01Jan2000	04:45	0.33	0.1	1.34	0.52
01Jan2000	04:46	0.32	0.1	1.34	0.50
01Jan2000	04:47	0.31	0.1	1.33	0.47
01Jan2000	04:48	0.30	0.1	1.33	0.45
01Jan2000	04:49	0.30	0.1	1.33	0.43
01Jan2000	04:50	0.30	0.1	1.32	0.41
01Jan2000	04:51	0.30	0.1	1.32	0.40
01Jan2000	04:52	0.30	0.1	1.32	0.39
01Jan2000	04:53	0.30	0.1	1.32	0.38
01Jan2000	04:54	0.30	0.1	1.32	0.37
01Jan2000	04:55	0.30	0.1	1.32	0.36
01Jan2000	04:56	0.30	0.1	1.31	0.35
01Jan2000	04:57	0.30	0.1	1.31	0.34
01Jan2000	04:58	0.30	0.1	1.31	0.34
01Jan2000	04:59	0.30	0.1	1.31	0.33
01Jan2000	05:00	0.30	0.1	1.31	0.33
01Jan2000	05:01	0.29	0.1	1.31	0.32
01Jan2000	05:02	0.28	0.1	1.31	0.32
01Jan2000	05:03	0.28	0.1	1.31	0.32
01Jan2000	05:04	0.27	0.1	1.31	0.31

Date	Time	Inflow (CFS)	Storage (AC-FT)	Elevation (FT)	Outflow (CFS)
01Jan2000	05:05	0.26	0.1	1.31	0.31
01Jan2000	05:06	0.25	0.1	1.31	0.30
01Jan2000	05:07	0.24	0.1	1.30	0.30
01Jan2000	05:08	0.23	0.1	1.30	0.29
01Jan2000	05:09	0.23	0.1	1.30	0.28
01Jan2000	05:10	0.22	0.1	1.30	0.28
01Jan2000	05:11	0.21	0.1	1.30	0.27
01Jan2000	05:12	0.20	0.1	1.30	0.26
01Jan2000	05:13	0.20	0.1	1.30	0.26
01Jan2000	05:14	0.20	0.1	1.30	0.25
01Jan2000	05:15	0.20	0.1	1.29	0.25
01Jan2000	05:16	0.20	0.1	1.29	0.24
01Jan2000	05:17	0.20	0.1	1.29	0.24
01Jan2000	05:18	0.20	0.1	1.29	0.23
01Jan2000	05:19	0.20	0.1	1.29	0.23
01Jan2000	05:20	0.20	0.1	1.29	0.23
01Jan2000	05:21	0.20	0.1	1.29	0.22
01Jan2000	05:22	0.20	0.1	1.29	0.22
01Jan2000	05:23	0.20	0.1	1.29	0.22
01Jan2000	05:24	0.20	0.1	1.29	0.22
01Jan2000	05:25	0.20	0.1	1.29	0.22
01Jan2000	05:26	0.20	0.1	1.29	0.21
01Jan2000	05:27	0.20	0.1	1.29	0.21
01Jan2000	05:28	0.20	0.1	1.29	0.21
01Jan2000	05:29	0.20	0.1	1.29	0.21
01Jan2000	05:30	0.20	0.1	1.29	0.21
01Jan2000	05:31	0.20	0.1	1.29	0.21
01Jan2000	05:32	0.20	0.1	1.29	0.21
01Jan2000	05:33	0.20	0.1	1.29	0.21
01Jan2000	05:34	0.20	0.1	1.29	0.21
01Jan2000	05:35	0.20	0.1	1.29	0.21

Date	Time	Inflow (CFS)	Storage (AC-FT)	Elevation (FT)	Outflow (CFS)
01Jan2000	05:36	0.20	0.1	1.29	0.20
01Jan2000	05:37	0.20	0.1	1.29	0.20
01Jan2000	05:38	0.20	0.1	1.29	0.20
01Jan2000	05:39	0.20	0.1	1.29	0.20
01Jan2000	05:40	0.20	0.1	1.29	0.20
01Jan2000	05:41	0.20	0.1	1.28	0.20
01Jan2000	05:42	0.20	0.1	1.28	0.20
01Jan2000	05:43	0.20	0.1	1.28	0.20
01Jan2000	05:44	0.20	0.1	1.28	0.20
01Jan2000	05:45	0.20	0.1	1.28	0.20
01Jan2000	05:46	0.20	0.1	1.28	0.20
01Jan2000	05:47	0.20	0.1	1.28	0.20
01Jan2000	05:48	0.20	0.1	1.28	0.20
01Jan2000	05:49	0.20	0.1	1.28	0.20
01Jan2000	05:50	0.20	0.1	1.28	0.20
01Jan2000	05:51	0.20	0.1	1.28	0.20
01Jan2000	05:52	0.20	0.1	1.28	0.20
01Jan2000	05:53	0.20	0.1	1.28	0.20
01Jan2000	05:54	0.20	0.1	1.28	0.20
01Jan2000	05:55	0.20	0.1	1.28	0.20
01Jan2000	05:56	0.20	0.1	1.28	0.20
01Jan2000	05:57	0.20	0.1	1.28	0.20
01Jan2000	05:58	0.20	0.1	1.28	0.20
01Jan2000	05:59	0.20	0.1	1.28	0.20
01Jan2000	06:00	0.20	0.1	1.28	0.20
01Jan2000	06:01	0.18	0.1	1.28	0.20
01Jan2000	06:02	0.17	0.1	1.28	0.20
01Jan2000	06:03	0.15	0.1	1.28	0.19
01Jan2000	06:04	0.13	0.1	1.28	0.19
01Jan2000	06:05	0.12	0.1	1.28	0.18
01Jan2000	06:06	0.10	0.1	1.28	0.17

Date	Time	Inflow (CFS)	Storage (AC-FT)	Elevation (FT)	Outflow (CFS)
01Jan2000	06:07	0.08	0.1	1.28	0.17
01Jan2000	06:08	0.07	0.1	1.28	0.16
01Jan2000	06:09	0.05	0.1	1.27	0.15
01Jan2000	06:10	0.03	0.1	1.27	0.14
01Jan2000	06:11	0.02	0.1	1.27	0.13
01Jan2000	06:12	0.00	0.1	1.27	0.12
01Jan2000	06:13	0.00	0.1	1.26	0.11
01Jan2000	06:14	0.00	0.1	1.26	0.11
01Jan2000	06:15	0.00	0.1	1.26	0.10
01Jan2000	06:16	0.00	0.1	1.26	0.09
01Jan2000	06:17	0.00	0.1	1.25	0.09
01Jan2000	06:18	0.00	0.1	1.25	0.08
01Jan2000	06:19	0.00	0.1	1.25	0.08
01Jan2000	06:20	0.00	0.1	1.25	0.07
01Jan2000	06:21	0.00	0.1	1.25	0.07
01Jan2000	06:22	0.00	0.1	1.25	0.07
01Jan2000	06:23	0.00	0.1	1.24	0.06
01Jan2000	06:24	0.00	0.1	1.24	0.06
01Jan2000	06:25	0.00	0.1	1.24	0.05
01Jan2000	06:26	0.00	0.1	1.24	0.05
01Jan2000	06:27	0.00	0.1	1.24	0.05
01Jan2000	06:28	0.00	0.1	1.24	0.05
01Jan2000	06:29	0.00	0.1	1.24	0.04
01Jan2000	06:30	0.00	0.1	1.24	0.04
01Jan2000	06:31	0.00	0.1	1.24	0.04
01Jan2000	06:32	0.00	0.1	1.23	0.04
01Jan2000	06:33	0.00	0.1	1.23	0.03
01Jan2000	06:34	0.00	0.1	1.23	0.03
01Jan2000	06:35	0.00	0.1	1.23	0.03
01Jan2000	06:36	0.00	0.1	1.23	0.03
01Jan2000	06:37	0.00	0.1	1.23	0.03

Date	Time	Inflow (CFS)	Storage (AC-FT)	Elevation (FT)	Outflow (CFS)
01Jan2000	06:38	0.00	0.1	1.23	0.03
01Jan2000	06:39	0.00	0.1	1.23	0.02
01Jan2000	06:40	0.00	0.1	1.23	0.02
01Jan2000	06:41	0.00	0.1	1.23	0.02
01Jan2000	06:42	0.00	0.1	1.23	0.02
01Jan2000	06:43	0.00	0.1	1.23	0.02
01Jan2000	06:44	0.00	0.1	1.23	0.02
01Jan2000	06:45	0.00	0.1	1.23	0.02
01Jan2000	06:46	0.00	0.1	1.23	0.02
01Jan2000	06:47	0.00	0.1	1.23	0.02
01Jan2000	06:48	0.00	0.1	1.23	0.02
01Jan2000	06:49	0.00	0.1	1.23	0.02
01Jan2000	06:50	0.00	0.1	1.22	0.02
01Jan2000	06:51	0.00	0.1	1.22	0.02
01Jan2000	06:52	0.00	0.1	1.22	0.02
01Jan2000	06:53	0.00	0.1	1.22	0.02
01Jan2000	06:54	0.00	0.1	1.22	0.02
01Jan2000	06:55	0.00	0.1	1.22	0.02
01Jan2000	06:56	0.00	0.1	1.22	0.02
01Jan2000	06:57	0.00	0.1	1.22	0.02
01Jan2000	06:58	0.00	0.1	1.22	0.02
01Jan2000	06:59	0.00	0.1	1.22	0.02
01Jan2000	07:00	0.00	0.1	1.22	0.02

CHAPTER 7 - HYDROLOGY MAPS

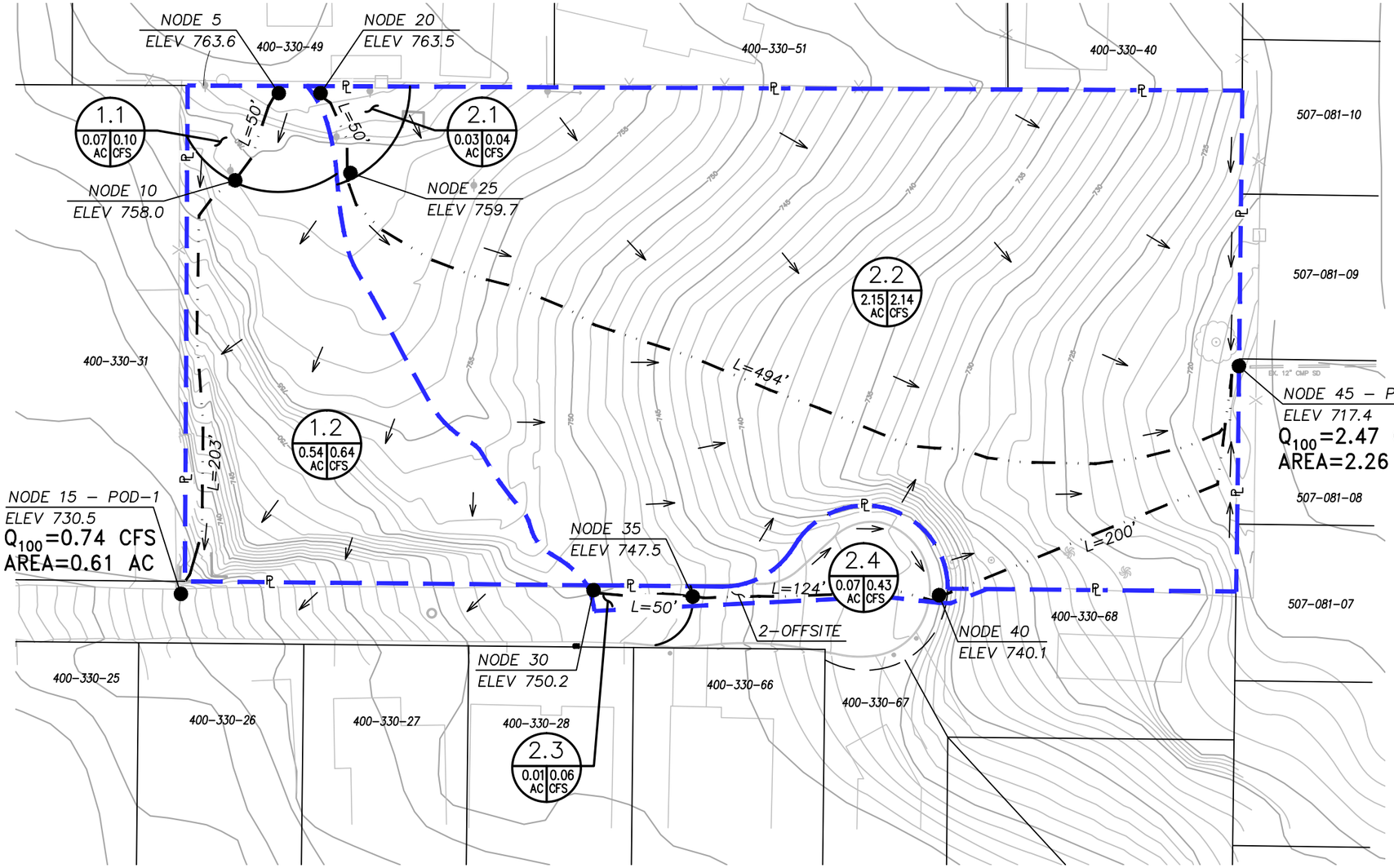
LEGEND

BASIN LIMITS

SUB BASIN LIMITS

FLOW–LINE

BASIN DESIGNATOR
AREA (AC)
Q (CFS)



60 30 0 60 120 180

SCALE: 1" = 60'

Civil Engineering • Environmental
Land Surveying
2442 Second Avenue
San Diego, CA 92101
(619)232–9200 (619)232–9210 Fax
R.E.C. Consultants, Inc.

DATE: 06–20–16
SCALE: 1" = 60'
DRAWN:
CHECKED:

SHEET TITLE: EXISTING CONDITIONS HYDROLOGY

PROJECT: TERRACE HILL DRIVE
EL CAJON, CA 92020

SHEET 1 OF 1 SHEETS

LEGEND

BASIN LIMITS

SUB BASIN LIMITS

FLOW–LINE

BASIN DESIGNATOR
AREA (AC)
Q (CFS)

NODE 5
ELEV 756.5

NODE 10
ELEV 750.0

NODE 20
ELEV 731.7

NODE 25 – POD–1
ELEV 731.5
Q_{100}=0.55 CFS
AREA=0.61 AC

NODE 15
ELEV 734.2

NODE 21
ELEV 740.0

NODE 30
ELEV 752.0

NODE 35
ELEV 748.7
IE 744.7

NODE 40
ELEV 748.0

NODE 45
ELEV 750.1

NODE 50
ELEV 749.3

NODE 55
ELEV 738.5
IE 734.92

NODE 60
ELEV 744.0

NODE 65
ELEV 739.0

NODE 70
ELEV 727.0

NODE 75
ELEV 749.5

NODE 80
ELEV 744.0

NODE 85
ELEV 740.5

NODE 90
ELEV 734.9
IE 733.0

NODE 95
IE 729.0

NODE 100
ELEV 740.6

NODE 105
ELEV 735.0

NODE 110
ELEV 739.5

NODE 115
ELEV 734.0

NODE 120
ELEV 734.0
IE 730.0

NODE 125
ELEV 727.0

NODE 130
ELEV 724.0
IE 721.5

NODE 135 – POD–2
ELEV 713.14
Q_{100}=2.47 CFS
AREA=2.26 AC

NODE 140
ELEV 750.2

NODE 145
ELEV 747.5

NODE 150
ELEV 740.1

400–330–25
400–330–26
400–330–27
400–330–28
400–330–31
400–330–40
400–330–49
400–330–51
400–330–66
400–330–67
400–330–68
507–081–07
507–081–08
507–081–09
507–081–10

	AC	CFS
1.1	0.02	0.06
1.2	0.57	1.52
1.3	0.02	0.03
2.1	0.02	0.06
2.2	0.30	0.76
3.1	0.05	0.11
3.2	0.45	0.81
4.1	0.04	0.12
4.2	0.27	0.37
5.1	0.07	0.22
5.2	0.19	0.41
6.1	0.05	0.12
6.2	0.37	0.82
7.1	0.05	0.16
7.2	0.17	0.41
8.1	0.01	0.08
8.2	0.07	0.22
8.3	0.13	0.21
9.3	1.17	2.66

L=50' L=178' L=329' L=170' L=215' L=50' L=50' L=50' L=92' L=135' L=106' L=50' L=137' L=50' L=50' L=50' L=124' L=230'

IE 742.2

60 30 0 60 120 180
SCALE: 1" = 60'

Civil Engineering Environmental
Land Surveying
2442 Second Avenue
San Diego, CA 92101
(619)232–9200 (619)232–9210 Fax
R·E·C
Consultants, Inc.

DATE: 06–20–16
SCALE: 1" = 60'
DRAWN:
CHECKED:

SHEET TITLE: PROPOSED CONDITIONS HYDROLOGY

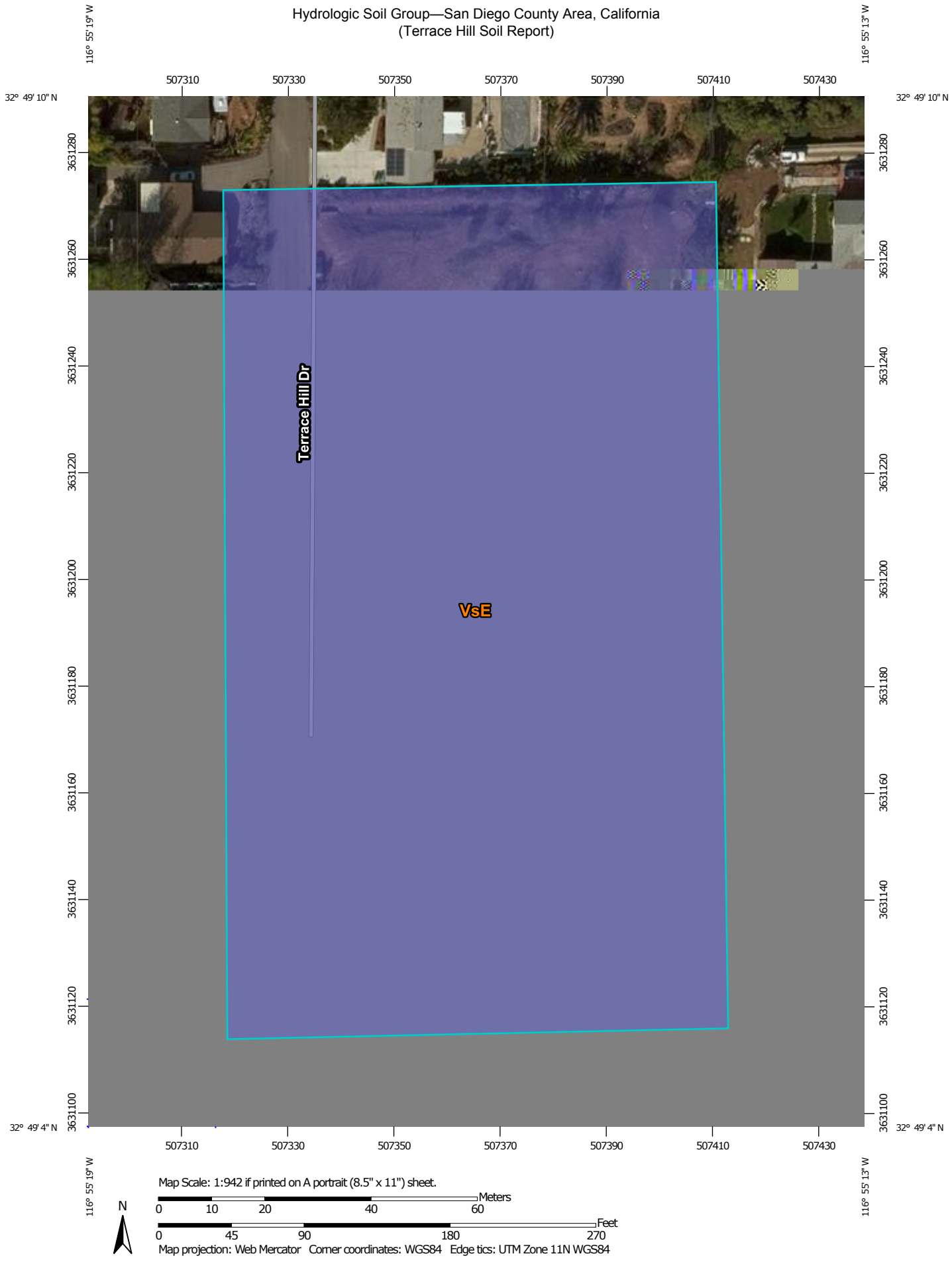
PROJECT: TERRACE HILL DRIVE
EL CAJON, CA 92020

SHEET 1 OF 1 SHEETS

SAVE DATE: 10/5/2016 ~ PLOT DATE: 1/13/2017 ~ FILE NAME: P:\Acad\1017 Terrace Hill\Reports\Drainage Study\161005_1017–Drainage–Post.dwg

CHAPTER 8 - APPENDICES

Hydrologic Soil Group—San Diego County Area, California
(Terrace Hill Soil Report)



MAP LEGEND

Area of Interest (AOI)
- Area of Interest (AOI)

Soils

Soil Rating Polygons
- A
- A/D
- B
- B/D
- C
- C/D
- D
- Not rated or not available

Soil Rating Lines
- A
- A/D
- B
- B/D
- C
- C/D
- D
- Not rated or not available

Soil Rating Points
- A
- A/D
- B
- B/D
- C
- C/D
- D
- Not rated or not available

Water Features
- Streams and Canals

Transportation
- Rails
- Interstate Highways
- US Routes
- Major Roads
- Local Roads

Background
- Aerial Photography

MAP INFORMATION

The soil surveys that comprise your AOI were mapped at 1:24,000.

Warning: Soil Map may not be valid at this scale.

Enlargement of maps beyond the scale of mapping can cause misunderstanding of the detail of mapping and accuracy of soil line placement. The maps do not show the small areas of contrasting soils that could have been shown at a more detailed scale.

Please rely on the bar scale on each map sheet for map measurements.

Source of Map: Natural Resources Conservation Service
Web Soil Survey URL: http://websoilsurvey.nrcs.usda.gov
Coordinate System: Web Mercator (EPSG:3857)

Maps from the Web Soil Survey are based on the Web Mercator projection, which preserves direction and shape but distorts distance and area. A projection that preserves area, such as the Albers equal-area conic projection, should be used if more accurate calculations of distance or area are required.

This product is generated from the USDA-NRCS certified data as of the version date(s) listed below.

Soil Survey Area: San Diego County Area, California
Survey Area Data: Version 9, Sep 17, 2015

Soil map units are labeled (as space allows) for map scales 1:50,000 or larger.

Date(s) aerial images were photographed: Dec 7, 2014—Jan 4, 2015

The orthophoto or other base map on which the soil lines were compiled and digitized probably differs from the background imagery displayed on these maps. As a result, some minor shifting of map unit boundaries may be evident.

Hydrologic Soil Group

Hydrologic Soil Group— Summary by Map Unit — San Diego County Area, California (CA638)				
Map unit symbol	Map unit name	Rating	Acres in AOI	Percent of AOI
VsE	Vista coarse sandy loam, 15 to 30 percent slopes	B	3.7	100.0%
Totals for Area of Interest			**3.7**	**100.0%**

Description

Hydrologic soil groups are based on estimates of runoff potential. Soils are assigned to one of four groups according to the rate of water infiltration when the soils are not protected by vegetation, are thoroughly wet, and receive precipitation from long-duration storms.

The soils in the United States are assigned to four groups (A, B, C, and D) and three dual classes (A/D, B/D, and C/D). The groups are defined as follows:

Group A. Soils having a high infiltration rate (low runoff potential) when thoroughly wet. These consist mainly of deep, well drained to excessively drained sands or gravelly sands. These soils have a high rate of water transmission.

Group B. Soils having a moderate infiltration rate when thoroughly wet. These consist chiefly of moderately deep or deep, moderately well drained or well drained soils that have moderately fine texture to moderately coarse texture. These soils have a moderate rate of water transmission.

Group C. Soils having a slow infiltration rate when thoroughly wet. These consist chiefly of soils having a layer that impedes the downward movement of water or soils of moderately fine texture or fine texture. These soils have a slow rate of water transmission.

Group D. Soils having a very slow infiltration rate (high runoff potential) when thoroughly wet. These consist chiefly of clays that have a high shrink-swell potential, soils that have a high water table, soils that have a claypan or clay layer at or near the surface, and soils that are shallow over nearly impervious material. These soils have a very slow rate of water transmission.

If a soil is assigned to a dual hydrologic group (A/D, B/D, or C/D), the first letter is for drained areas and the second is for undrained areas. Only the soils that in their natural condition are in group D are assigned to dual classes.

Rating Options

Aggregation Method: Dominant Condition

Component Percent Cutoff: None Specified

Tie-break Rule: Higher

TECHNICAL MEMORANDUM

TO: Edwin Sinsay, Project Manager, County of San Diego
Greg Brown, Jr., Sky Terrace, L.P.
Brendan Thiessen, Sky Terrace, L.P.

FROM: Luis Parra, PhD, PE, CPSWQ, ToR, D.WRE.

DATE: November 16, 2016

RE: Analysis of 12 inch CMP pipe at Terrace Hills.

INTRODUCTION

This memorandum summarizes the results found in the analysis of the 12 inch Corrugated Metal Pipe (CMP) at the Terrace Hill Project Site, which we will call Pipe A in this memo. The upstream invert of Pipe A is located at the Location of Point of Discharge (POD) 2 of Terrace Hill. The downstream invert of Pipe A is located at the northwest corner of the intersection of Villa Crest Drive and Meadow row, see Figure 1 below.

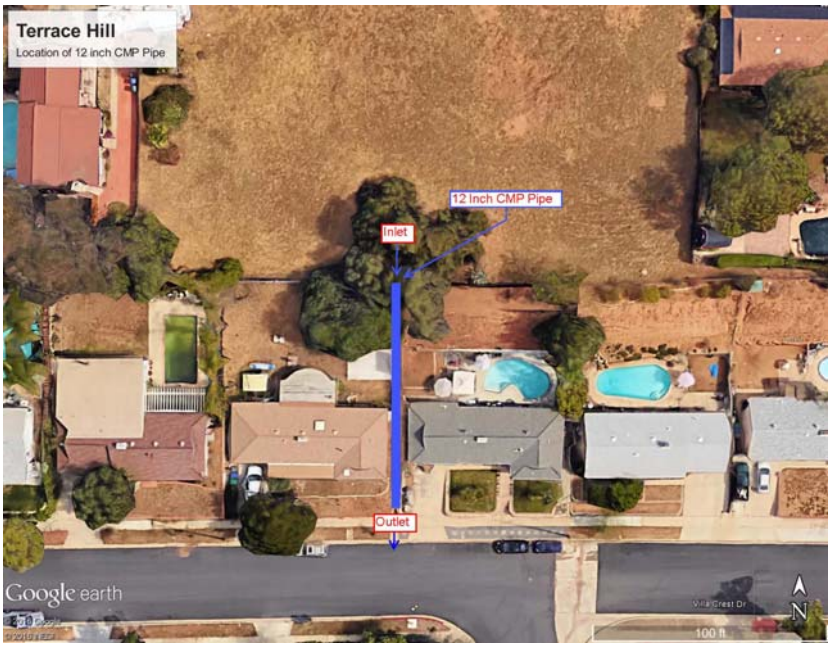


Figure 1. Location of 12 inch CMP Pipe.

Pipe A is made of corrugated metal pipe. It has a length of 107.11 feet. The upstream invert elevation is 713.14 feet and the downstream invert elevation is 703.14 feet. The Pipe is responsible for conveying flow from the area tributary to POD-2 in existing and will be responsible also in the proposed conditions.

Table 1 shows the flows at POD-2 per the *"Drainage Study for Terrace Hill Drive"* prepared by REC Consultants that are to be conveyed by Pipe A. Flows for the proposed unmitigated conditions are

shown as a worst case scenario. However, the flows will be mitigated by means of a BMP such that the proposed mitigated conditions are below the existing conditions.

Table 1 – Summary of 100 Year Peak Flows

Project Conditions	Flow (cfs)
Existing	2.47
Proposed Unmitigated	4.05
Proposed Mitigated	2.44

PIPE ANALYSIS

Pipe A was analyzed with the Hydraflow Express Extension for Autodesk AutoCAD Civil 3D. The main inputs for this program are the following: invert elevation down and up, length, slope, pipe diameter, pipe material and list of flows to be analyzed amongst others. Table 2 shows some of the most important parameters that were used in Hydraflow to analyze the pipe.

Table 2 – Summary of Input Parameter for Hydraflow

Parameter	Value
Invert Elevation Up	713.14 feet
Invert Elevation Down	703.14 feet
Length	107.11 feet
Slope	9.34 %
Pipe Diameter	12 inches
Manning's Coefficient	0.024 (CMP material)
Range of Flows	Q = 2.5 cfs to Q = 6.5 cfs

RESULTS & CONCLUSION

As can be seen in Figure 2 below and on the results found in Attachment 1, Pipe A has enough capacity to convey flows up to 5.50 cfs before it becomes pressurized, which is almost 1.50 cfs more than the unmitigated flow conditions. Attachment 1 also shows the results for various flows up to 6.50 cfs when the system becomes pressurized.

Q			Veloc		Depth		HGL			
Total (cfs)	Pipe (cfs)	Over (cfs)	Dn (ft/s)	Up (ft/s)	Dn (in)	Up (in)	Dn (ft)	Up (ft)	Hw (ft)	Hw/D
2.50	2.50	0.00	7.20	4.42	5.46	8.12	703.59	713.82	714.27	1.13
3.50	3.50	0.00	7.83	5.20	6.65	9.58	703.69	713.94	714.73	1.59
4.50	4.50	0.00	8.26	6.11	7.85	10.63	703.79	714.03	715.45	2.31
5.50	5.50	0.00	8.53	7.18	9.18	11.27	703.91	714.08	716.35	3.21
6.50	6.18	0.32	7.97	7.86	11.52	12.00	704.10	714.40	717.05	3.91

Figure 2. Hydraflow Summary Results.

In conclusion, Pipe A has the capacity to convey up to twice the flow that drains out to POD 2, whether it is the 2.44 cfs in proposed mitigated conditions or the 2.47 cfs in existing conditions.

ATTACHMENT 1

Project Exhibits and Hydraflow Results.

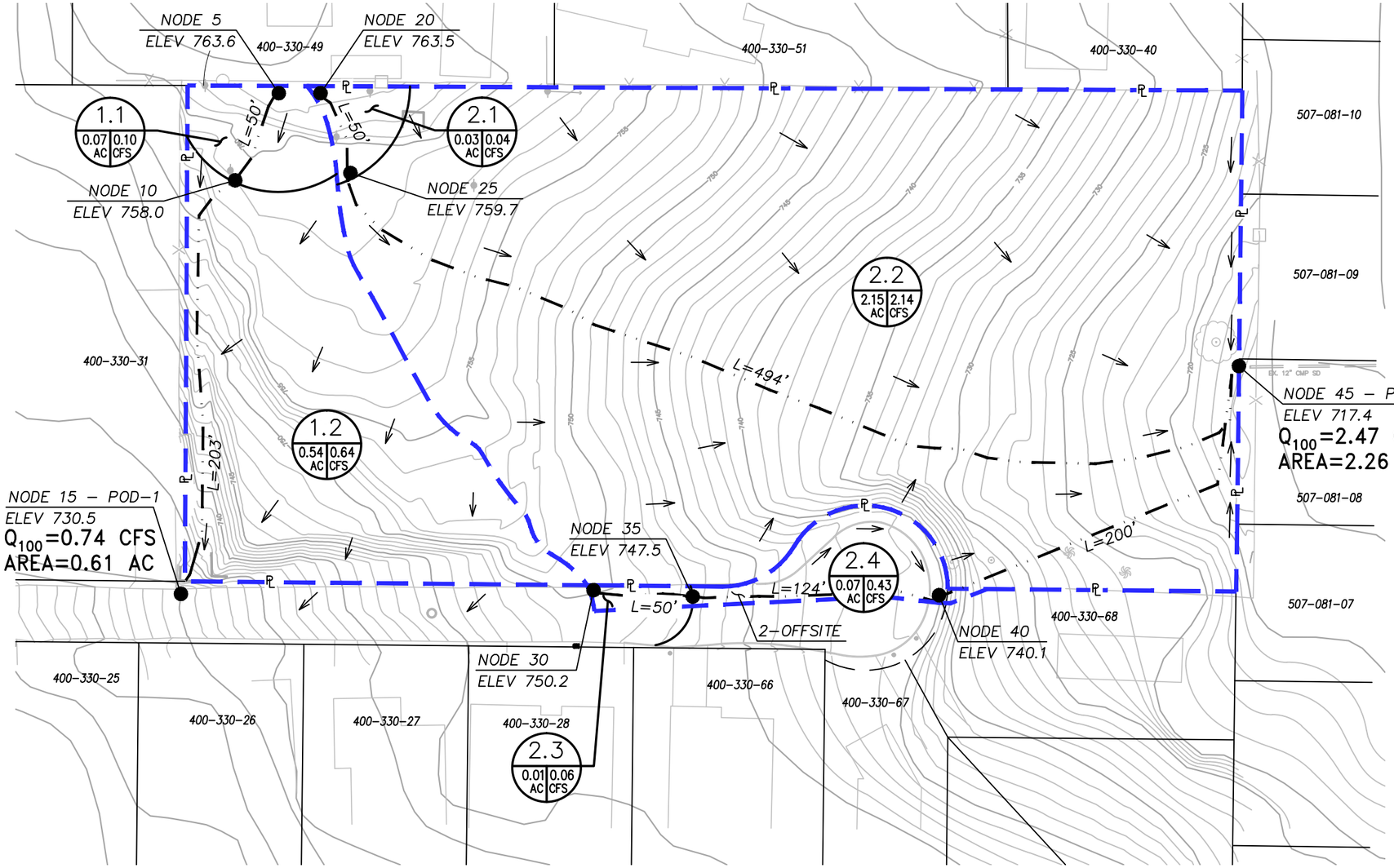
LEGEND

BASIN LIMITS

SUB BASIN LIMITS

FLOW–LINE

BASIN DESIGNATOR
AREA (AC)
Q (CFS)



60 30 0 60 120 180

SCALE: 1" = 60'

Civil Engineering • Environmental
Land Surveying
2442 Second Avenue
San Diego, CA 92101
(619)232–9200 (619)232–9210 Fax
R.E.C. Consultants, Inc.

DATE: 06–20–16
SCALE: 1" = 60'
DRAWN:
CHECKED:

SHEET TITLE: EXISTING CONDITIONS HYDROLOGY

PROJECT: TERRACE HILL DRIVE
EL CAJON, CA 92020

SHEET 1 OF 1 SHEETS

Q			Veloc		Depth		HGL			
Total	Pipe	Over	Dn	Up	Dn	Up	Dn	Up	Hw	Hw/D
(cfs)	(cfs)	(cfs)	(ft/s)	(ft/s)	(in)	(in)	(ft)	(ft)	(ft)	
2.50	2.50	0.00	7.20	4.42	5.46	8.12	703.59	713.82	714.27	1.13
3.50	3.50	0.00	7.83	5.20	6.65	9.58	703.69	713.94	714.73	1.59
4.50	4.50	0.00	8.26	6.11	7.85	10.63	703.79	714.03	715.45	2.31
5.50	5.50	0.00	8.53	7.18	9.18	11.27	703.91	714.08	716.35	3.21
6.50	6.18	0.32	7.97	7.86	11.52	12.00	704.10	714.40	717.05	3.91

Culvert Report

Circular Culvert

Invert Elev Dn (ft)	=	703.14
Pipe Length (ft)	=	107.11
Slope (%)	=	9.34
Invert Elev Up (ft)	=	713.14
Rise (in)	=	12.0
Shape	=	Circular
Span (in)	=	12.0
No. Barrels	=	1
n-Value	=	0.024
Culvert Type	=	Circular Corrugate Metal Pipe
Culvert Entrance	=	Projecting
Coeff. K,M,c,Y,k	=	0.034, 1.5, 0.0553, 0.54, 0.9

Embankment

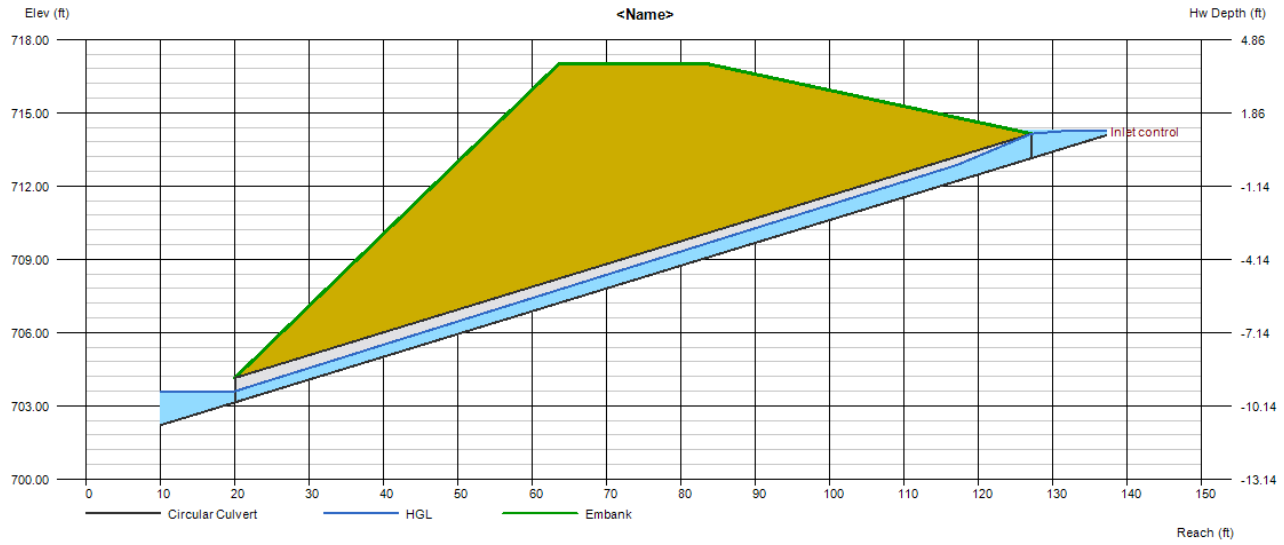
Top Elevation (ft)	=	717.00
Top Width (ft)	=	20.00
Crest Width (ft)	=	10.00

Calculations

Qmin (cfs)	=	2.50
Qmax (cfs)	=	6.50
Tailwater Elev (ft)	=	0.00

Highlighted

Qtotal (cfs)	=	2.50
Qpipe (cfs)	=	2.50
Qovertop (cfs)	=	0.00
Veloc Dn (ft/s)	=	7.20
Veloc Up (ft/s)	=	4.42
HGL Dn (ft)	=	703.59
HGL Up (ft)	=	713.82
Hw Elev (ft)	=	714.27
Hw/D (ft)	=	1.13
Flow Regime	=	Inlet Control



Culvert Report

Hydraflow Express Extension for Autodesk® AutoCAD® Civil 3D® by Autodesk, Inc. Wednesday, Nov 16 2016

Circular Culvert

Invert Elev Dn (ft)	=	703.14
Pipe Length (ft)	=	107.11
Slope (%)	=	9.34
Invert Elev Up (ft)	=	713.14
Rise (in)	=	12.0
Shape	=	Circular
Span (in)	=	12.0
No. Barrels	=	1
n-Value	=	0.024
Culvert Type	=	Circular Corrugate Metal Pipe
Culvert Entrance	=	Projecting
Coeff. K,M,c,Y,k	=	0.034, 1.5, 0.0553, 0.54, 0.9

Embankment

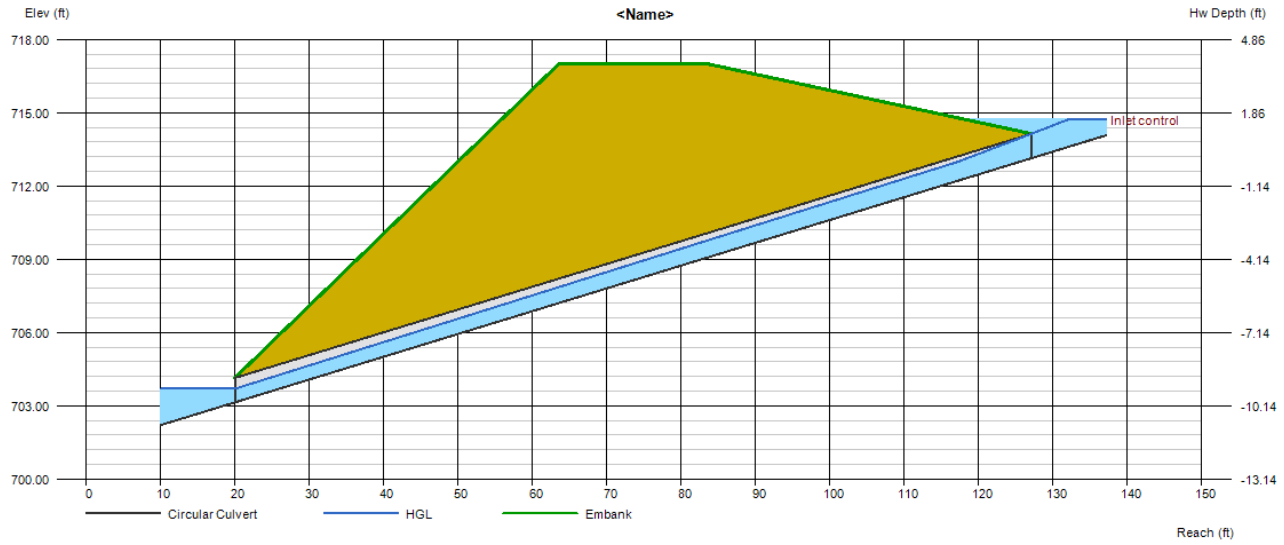
Top Elevation (ft)	=	717.00
Top Width (ft)	=	20.00
Crest Width (ft)	=	10.00

Calculations

Qmin (cfs)	=	2.50
Qmax (cfs)	=	6.50
Tailwater Elev (ft)	=	0.00

Highlighted

Qtotal (cfs)	=	3.50
Qpipe (cfs)	=	3.50
Qovertop (cfs)	=	0.00
Veloc Dn (ft/s)	=	7.83
Veloc Up (ft/s)	=	5.20
HGL Dn (ft)	=	703.69
HGL Up (ft)	=	713.94
Hw Elev (ft)	=	714.73
Hw/D (ft)	=	1.59
Flow Regime	=	Inlet Control



Culvert Report

Hydraflow Express Extension for Autodesk® AutoCAD® Civil 3D® by Autodesk, Inc. Wednesday, Nov 16 2016

Circular Culvert

Invert Elev Dn (ft)	=	703.14
Pipe Length (ft)	=	107.11
Slope (%)	=	9.34
Invert Elev Up (ft)	=	713.14
Rise (in)	=	12.0
Shape	=	Circular
Span (in)	=	12.0
No. Barrels	=	1
n-Value	=	0.024
Culvert Type	=	Circular Corrugate Metal Pipe
Culvert Entrance	=	Projecting
Coeff. K,M,c,Y,k	=	0.034, 1.5, 0.0553, 0.54, 0.9

Embankment

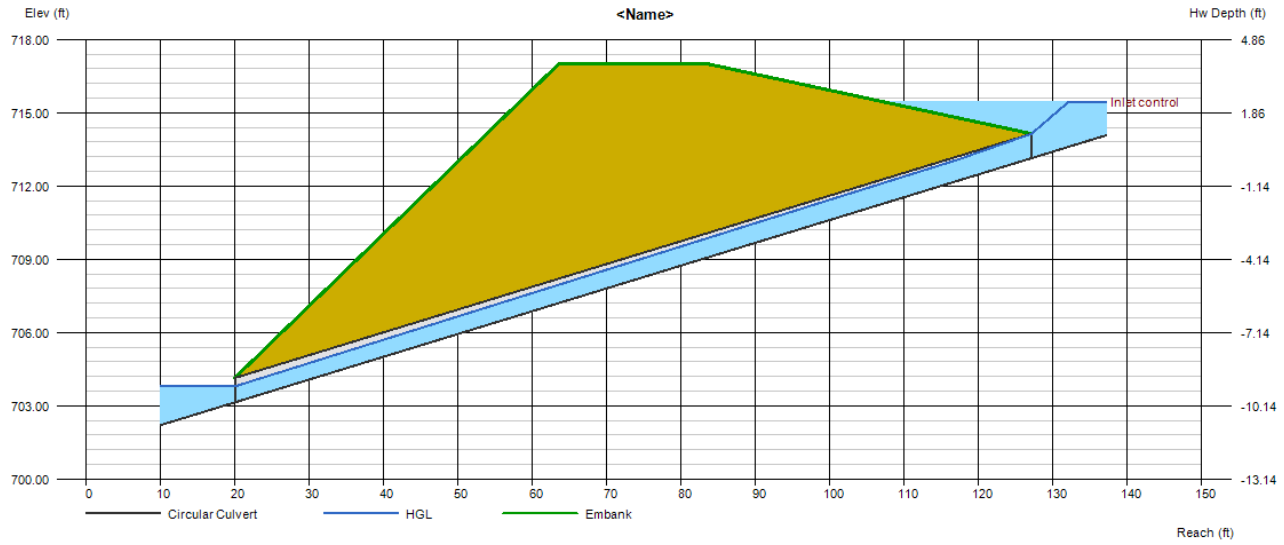
Top Elevation (ft)	=	717.00
Top Width (ft)	=	20.00
Crest Width (ft)	=	10.00

Calculations

Qmin (cfs)	=	2.50
Qmax (cfs)	=	6.50
Tailwater Elev (ft)	=	0.00

Highlighted

Qtotal (cfs)	=	4.50
Qpipe (cfs)	=	4.50
Qovertop (cfs)	=	0.00
Veloc Dn (ft/s)	=	8.26
Veloc Up (ft/s)	=	6.11
HGL Dn (ft)	=	703.79
HGL Up (ft)	=	714.03
Hw Elev (ft)	=	715.45
Hw/D (ft)	=	2.31
Flow Regime	=	Inlet Control



Culvert Report

Hydraflow Express Extension for Autodesk® AutoCAD® Civil 3D® by Autodesk, Inc. Wednesday, Nov 16 2016

Circular Culvert

Invert Elev Dn (ft)	=	703.14
Pipe Length (ft)	=	107.11
Slope (%)	=	9.34
Invert Elev Up (ft)	=	713.14
Rise (in)	=	12.0
Shape	=	Circular
Span (in)	=	12.0
No. Barrels	=	1
n-Value	=	0.024
Culvert Type	=	Circular Corrugate Metal Pipe
Culvert Entrance	=	Projecting
Coeff. K,M,c,Y,k	=	0.034, 1.5, 0.0553, 0.54, 0.9

Embankment

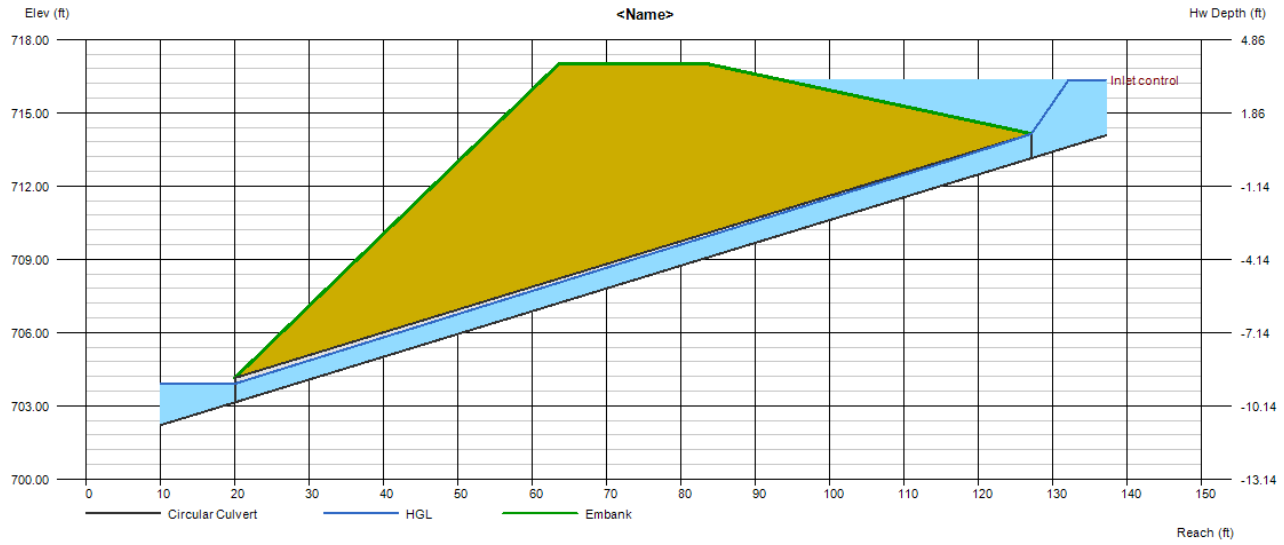
Top Elevation (ft)	=	717.00
Top Width (ft)	=	20.00
Crest Width (ft)	=	10.00

Calculations

Qmin (cfs)	=	2.50
Qmax (cfs)	=	6.50
Tailwater Elev (ft)	=	0.00

Highlighted

Qtotal (cfs)	=	5.50
Qpipe (cfs)	=	5.50
Qovertop (cfs)	=	0.00
Veloc Dn (ft/s)	=	8.53
Veloc Up (ft/s)	=	7.18
HGL Dn (ft)	=	703.91
HGL Up (ft)	=	714.08
Hw Elev (ft)	=	716.35
Hw/D (ft)	=	3.21
Flow Regime	=	Inlet Control



Culvert Report

Hydraflow Express Extension for Autodesk® AutoCAD® Civil 3D® by Autodesk, Inc. Wednesday, Nov 16 2016

Circular Culvert

Invert Elev Dn (ft)	=	703.14
Pipe Length (ft)	=	107.11
Slope (%)	=	9.34
Invert Elev Up (ft)	=	713.14
Rise (in)	=	12.0
Shape	=	Circular
Span (in)	=	12.0
No. Barrels	=	1
n-Value	=	0.024
Culvert Type	=	Circular Corrugate Metal Pipe
Culvert Entrance	=	Projecting
Coeff. K,M,c,Y,k	=	0.034, 1.5, 0.0553, 0.54, 0.9

Embankment

Top Elevation (ft)	=	717.00
Top Width (ft)	=	20.00
Crest Width (ft)	=	10.00

Calculations

Qmin (cfs)	=	2.50
Qmax (cfs)	=	6.50
Tailwater Elev (ft)	=	0.00

Highlighted

Qtotal (cfs)	=	6.50
Qpipe (cfs)	=	6.18
Qovertop (cfs)	=	0.32
Veloc Dn (ft/s)	=	7.97
Veloc Up (ft/s)	=	7.86
HGL Dn (ft)	=	704.10
HGL Up (ft)	=	714.40
Hw Elev (ft)	=	717.05
Hw/D (ft)	=	3.91
Flow Regime	=	Inlet Control