

PRIORITY PROJECT HYDROLOGY STUDY

FOR:

CORNERSTONE COMMUNITIES WOODWARD

APN No. 220-210-49

Woodward St, San Marcos, California

PREPARED FOR:

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Project No: 22-027

DATE PREPARED:

2/13/2023

DATE REVISED:

06/14/2023



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1.0 Project Description

1.1 Project Purpose

The objective of this study is to determine the amount of 100-year runoff that the existing site is generating right now and compare it to the 100 year runoff that the proposed project will be generating. We will also calculate adequacy of the proposed storm drain facilities and mitigation measures.

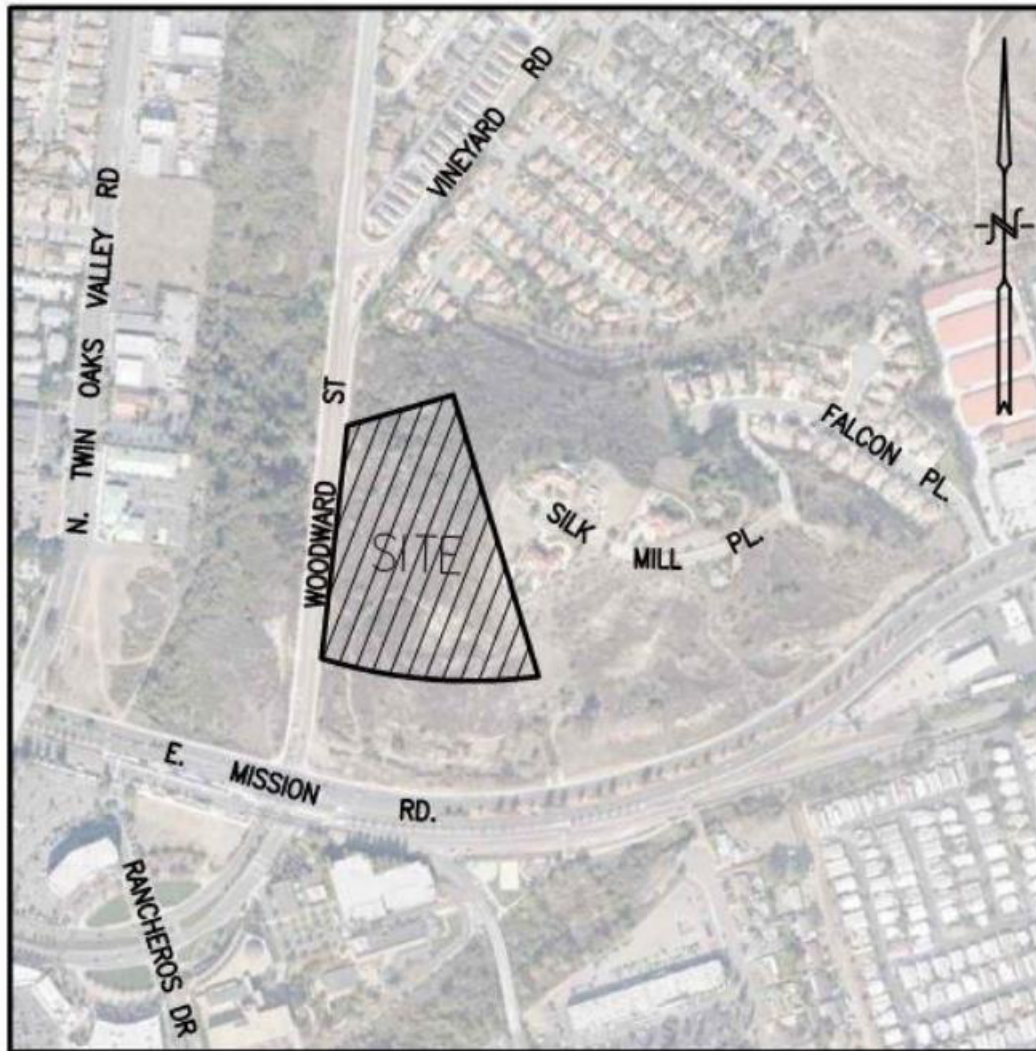
1.2 Project Proposed Facilities

The 8.57-acre project site is located Woodward Street in San Marcos, California. The site is currently undeveloped. The project site is face to Woodward Street to the east and bordered by East Mission Road to the north. The fill slopes have a gradient of about 2:1 (horizontal:vertical).

The project is proposing to build multifamily residential. As part of this project, associated improvements will include two biofiltration basins (BMP-A and BMP-B) located at the north and west edge of the project site, respectively. All necessary utilities (storm, sewer, water, etc.) will be installed as part of the project.

2.0 Vicinity Map

The project is located on the east side of Woodward Street and bounded by the East Mission Road to the north in San Marcos, California.



VICINITY MAP
NOT TO SCALE

Fig. 1 Vicinity Map

3.0 Site Map

Please see Attachment 1 – Site Map

4.0 Description of Watershed

4.1 Existing Conditions Topography and Drainage Patterns

The existing project onsite is currently undeveloped. The project fronts onto Woodward Street and East Mission Road. The property drains primarily by overland flow to an existing storm drain system located at the southwest corner of the project site. According to the Web Soil Survey, the soil type in this project is Type C and Type D. The same runoff factors will be used for the overall project calculations.

The upper east side of the project site drains westerly to the existing 18 inches and 24 inches storm drain pipe then drains to poc-1, which is located at the southwest corner of the project site. The lower east side of the project site drains southerly to the existing 12 and 18 inches storm drain pipe then to poc-2, which is located at the southeast corner of the project site. At the north edge of the project site, surface runoff drains northerly to poc-3, which is located at the north west edge of the project site.

The **pre-development onsite** area is approximately 8.57 acre. The impervious square footage of the site was estimated based on aerial photography and detailed aerial topographic mapping to be approximately 0% of the site. From table 3-1 “RUNOFF COEFFICIENTS FOR URBAN AREAS”, runoff coefficients for 0% impervious will be used in the pre-development runoff calculations.

A pre-developed drainage map can be found as Attachment 4 in this report.

4.2 Post Conditions Topography and Drainage Patterns

This project proposed to install residential houses. The project is proposed to build two biofiltration basins (BMP-A and BMP-B) for storm water quality, which located at the northeast corner and northwest edge of the project site, respectively, to incorporate the collection of storm water from the building and street and direct the storm water through storm water drainage pipes to POCs.

At the east side of the property, the project proposed to build brow ditch to direct surface flow northerly to the proposed 36 inches storage pipe 2 then follow the existing site slope drains to poc-3, which is located at the north edge along the Woodward Street of the project site. The middle part of the project site is proposed to build multifamily, park, and street improvement. The proposed impervious area routes surface runoff northerly through proposed storm drain storage pipe 1 then to BMP-A, which is located at northeast side of the project site. After runoff get treated in BMP-A, it outlets to a brow ditch down the slope to Woodward Street POC-1. The west part of the project site includes proposed graded slope, existing slope, and the proposed driveway. This part of the project drains surface flow southwesterly to poc-1. The rest of the project, the east part, routes stormwater southeasterly to existing 12 and 18 inches storm drain pipe then to poc-2, which is located at the southeast corner of the project site.

The average impervious square footage of the post-development condition was estimated based on aerial photography and detailed aerial topographic mapping. to be approximately

100%, 65%, and 0% of the site. From table 3-1 “RUNOFF COEFFICIENTS FOR URBAN AREAS”, runoff coefficient for 100%, 65%, and 0% impervious will be used in the post-development runoff calculations.

As calculated below and summarized further in section 6, the pre-development discharges a peak 100-year flow of 16.14 CFS to POC-1, 7.87 CFS to POC-2, and 2.17 CFS to POC-3. The project proposed post-development discharge a peak 100-year flow of 21.37 CFS to POC-1, 4.70 CFS to POC-2, and 3.61 CFS to POC-3, which need storage detention at POC-1 and POC-3 in post development. After mitigation, the peak 100-year flow of the post-development is 11.76 CFS at POC-1 and 2.05 CFS at POC-3. The northeast biofiltration basin (BMP-A) and storage pipe 1 perform peak flow detention purposes for POC-1, and the storage pipe 2 at the east side perform peak flow detention purposes for POC-3.

The mitigation for POC-1 has two parts. Part 1 is for flow being detained in storage pipe 1, part 2 is for flow after storage pipe 1 and being detained in BMP-A due to confluence. The final mitigated result for POC-1 is shown in part 2.

A post-developed drainage map can be found as Attachment 5 in this report.

4.3 Hydrologic Unit Contribution

The project site is located in Richland Hydrologic Sub Area of the San Marcos Hydrologic Area of the Carlsbad Hydrologic Unit (904.52).

5.0 Methodology

This report is prepared in accordance with the 2003 San Diego County Hydrology Manual. Based on the overall tributary study area, calculations are based on the Rational Method.

5.1 Hydrology Software

We are using **the CivilCadd/CivilDesign®** software to analyze the runoff. The module we are using is the one for the *San Diego County Flood Control Division 2003 Hydrology Manual*. Please see the detailed hydrology calculations in Attachment 6.

5.2 Routing Software

Hydrologic Modeling System (HEC-HMS), Version 4.9 is used for hydrologic routing of the entire project site. The hydrograph developed from the rational method is then manually entered into this software and routed into each detention pipe. The HEC-HMS simulation results can be found in Attachment 7 in this report.

5.3 Soil Type Determination

The soil type for the proposed project was determined by mapping the project limits on the EPA Web Soil Survey website. The Web soil Survey indicate that the site is composed of

soil type C and type D. The soil report and soil index map can be found in Attachment 3 of this report.

5.4 Isopluvial Value Determination

The isopluvial values for the 100-year 6 hour and 24 hour storm events were determined by plotting the projects location on the respective exhibits from Appendix B of the Hydrology Manual. The rainfall isopluvial maps can be found in Attachment 3 of this report.

6.0 Calculations

The intent of the post-development calculation done as part of this report is to verify the 100-year flowrates expected from the post-developed conditions are lower than the pre-developed conditions. These numbers will be used to size the proposed storm drainage pipes and to doublecheck if the existing storm drain outlet facilities are adequate.

6.1 Calculate Runoff Coefficient

The runoff coefficients for each of the drainage areas are taken from Table 3-1 of the Hydrology Manual. Based on the EPA Web Soil Survey, this project site is in type D and type C soil. The runoff coefficients C are based on the %IMPER. for this project. Table 3-1 is included in the CIVILD software, and the values chosen based on the program input parameters. The output file was checked to ensure that the correct C values are used.

In order to not have a negative impact on the post development downstream facilities, detention structure is needed in this project. The method we are using here on how to use the resulting values of the outflow hydrograph is to recalculate the runoff coefficient C value based on the fix values of the outflow hydrograph to achieve a C_{out} . The detailed description and calculation of the C_{out} value can be found in Attachment 7 in this report.

6.2 Manning Roughness Coefficient

Manning Roughness Coefficients are taken from San Diego County Drainage Design Manual. Values are taken from Table A-1, Average Manning Roughness Coefficients for Pavement and Gutters, Table A-2, Average Manning Roughness Coefficients for Closed Conduits, and Table A-5, Average Manning roughness Coefficient for Natural Channels. Values of 0.015 for Concrete Gutter, 0.016 for Concrete Pavement, 0.013 for PVC Pipe, and 0.03 for Fairly Regular Section Some Grass and Weeds, Little or No Brush are used in the hydrology calculations. Table of Manning's n value can be found in Attachment 2 in this report.

6.3 Rational Method Calculation Summary

The peak runoff values for the 100-year storm are calculated according to the Hydrology Manual Rational Method. The calculations are performed using the CIVILD software. A summary of the initial calculations is summarized in the table below:

Summary of Q100 Runoff

	PRE			POST			POST MITIGATION	
	POC-1	POC-2	POC-3	POC-1	POC-2	POC-3	POC-1	POC-3
Q (CFS)	16.14	7.87	2.17	21.37	4.70	3.61	11.76	2.05
A (Acres)	7.10	2.88	0.89	6.59	2.34	1.46	6.59	1.46
TC (MIN)	8.54	6.29	6.98	11.17	7.34	7.57	17.27	11.73

Table 1. Q100 Analysis Results

Structures that are used for detention are the biofiltration basin (BMP-A) and storage pipe 1 located at the northeast side of the project site, and storage pipe 2 located at the east side of the project site.

The total volume of BMP-A is 13387.08 cu ft. The total volume for storage pipe 1 and storage pipe 2 is 57937.32 cu ft and 15020.29 cu ft, respectively. The figures of stage versus volume of the detention structures are shown below:

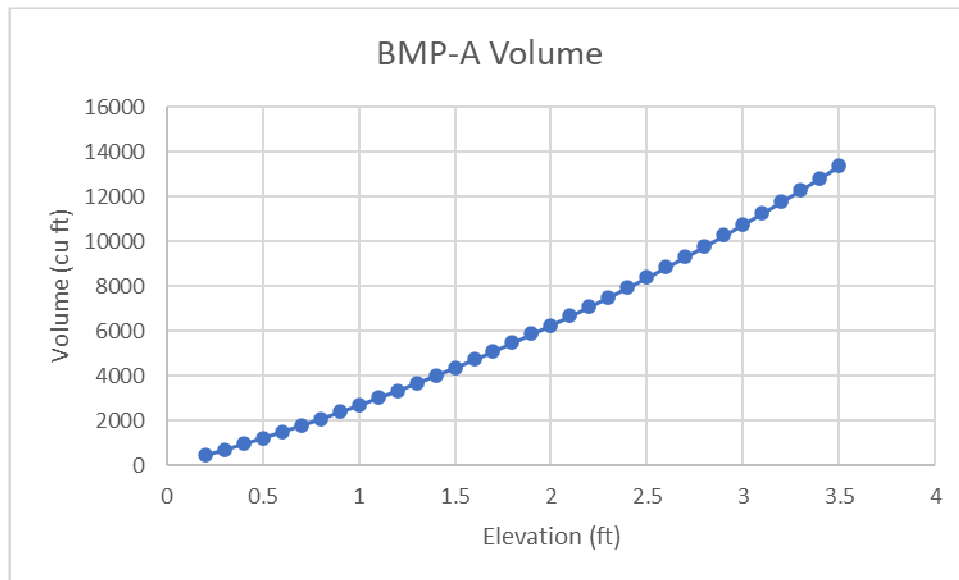


Fig. 2 BMP-A Volume

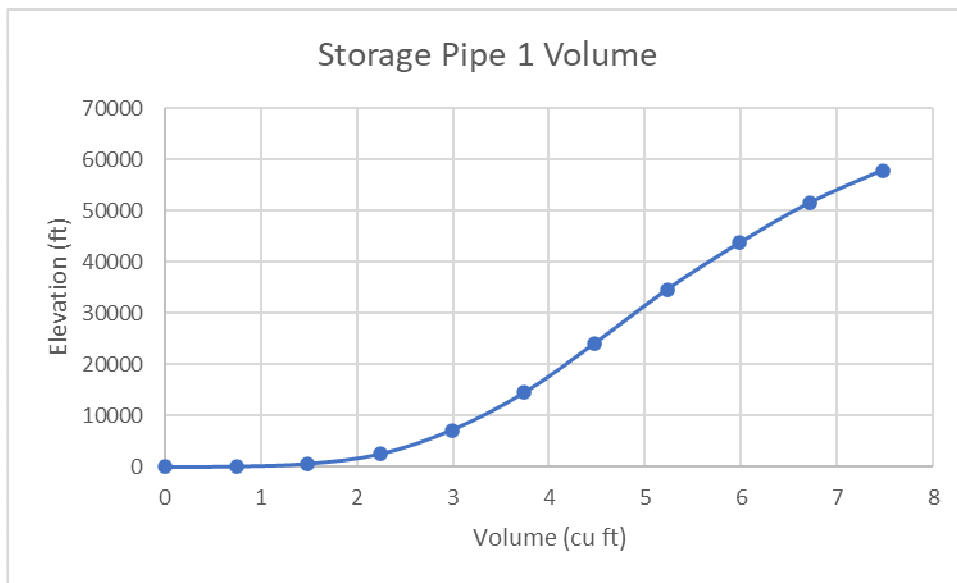


Fig. 3 Storage Pipe 1 Volume

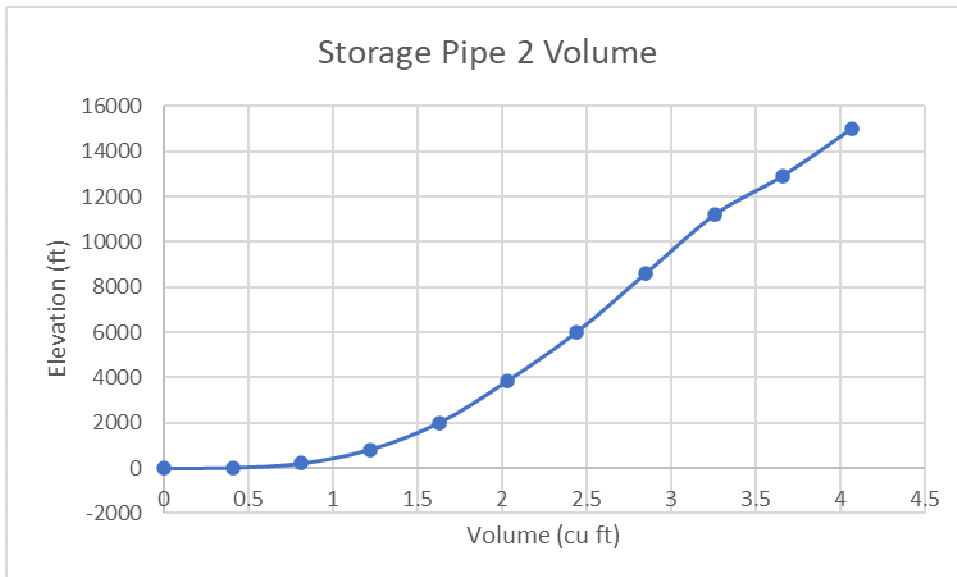


Fig. 4 Storage Pipe 2 Volume

CIVILD data and output files can be found in Attachment 6 of this report.

By observation of the results in the summary table, the mitigated developed condition of the site will have an overall decrease in the 100 year peak flow discharge from the site.

7.0 Summary

This project will not negatively impact the existing downstream storm drain facilities. Based on the results of this report, the project does not increase the 100-year peak flow rate of the Mitigated Post Development stormwater discharge from the site as flows are lower than those of the Pre Development condition.

8.0 References

County of San Diego, Department of Public Works, Flood Control Section, June 2003 San Diego County Hydrology Manual.

County of San Diego, Department of Public Works, Flood Control Section, September 2014 San Diego County Hydraulic Design Manual.

9.0 DECLARATION OF RESPONSIBLE CHARGE

I hereby declare that I am the engineer of work for this project. That I have exercised responsible charge over the design of the project as defined in section 6703 of the business and professions codes, and that the design is consistent with current design.

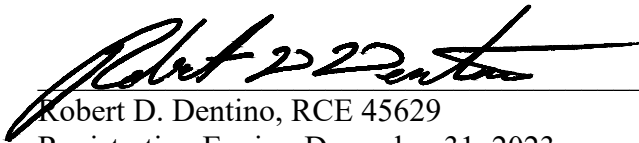
I understand that the check of the project drawings and specifications by the City of San Marcos is confined to a review only and does not relieve me, as engineer of work, of my responsibilities for project design.

ENGINEER OF WORK

Excel Engineering
440 State Place
Escondido, CA 92029
Tel – (760)745-8118
Fax – (760)745-1890

Project Number: 22-027




Robert D. Dentino, RCE 45629
Registration Expire: December 31, 2023

06/23/23
Date

ATTACHMENTS

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Attachment 2 – Figures & Tables from the San Diego County Hydrology Manual 2003

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Watershed Map

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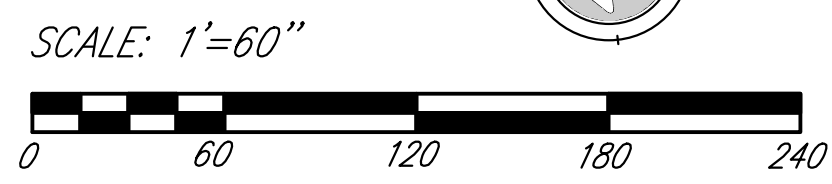
6c. CivilD Mitigated Post-Development Calculations

Attachment 7 – Hydrograph

7a. HEC-HMS Simulation Results

7b. Runoff Coefficient C After Detention Structure

ATTACHMENT 1
SITE MAP



CORNERSTONE COMMUNITIES
WOODWARD SITE MAP

ATTACHMENT 2
FIGURES & TABLES FROM THE SAN DIEGO COUNTY HYDROLOGY
MANUAL 2003

**Table 3-1
RUNOFF COEFFICIENTS FOR URBAN AREAS**

Land Use		Runoff Coefficient "C"				
NRCS Elements	County Elements	% IMPER.	Soil Type			
			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, C_p , 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

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.

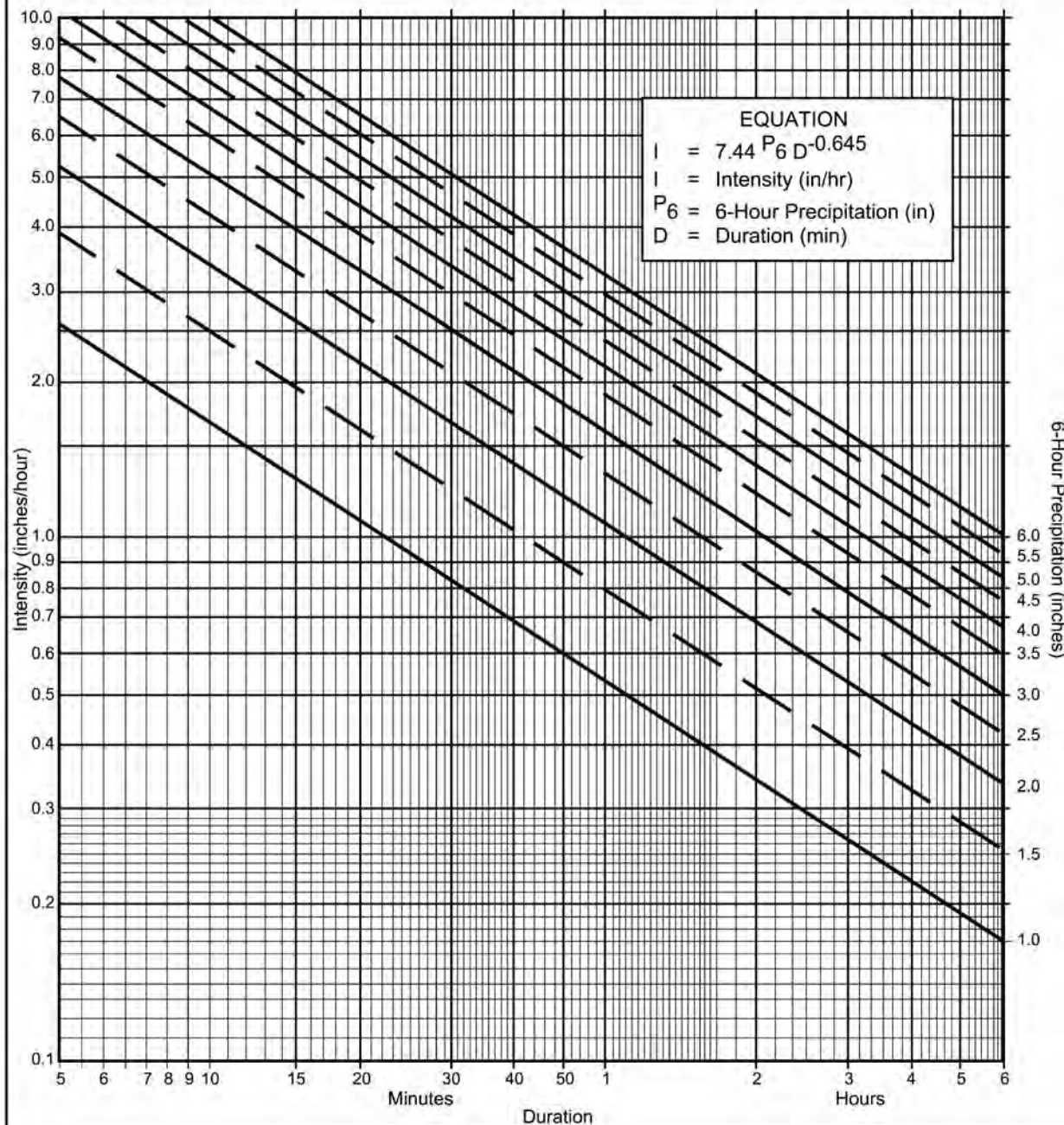
Table 3-2 provides limits of the length (Maximum Length (L_M)) of sheet flow to be used in hydrology studies. Initial T_i values based on average C values for the Land Use Element are also included. These values can be used in planning and design applications as described below. Exceptions may be approved 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/ Acre	.5%		1%		2%		3%		5%		10%	
		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



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 applicable 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 _____ year
- (b) $P_6 =$ _____ in., $P_{24} =$ _____, $\frac{P_6}{P_{24}} =$ _____ %⁽²⁾
- (c) Adjusted $P_6^{(2)} =$ _____ in.
- (d) $t_x =$ _____ min.
- (e) $I =$ _____ in./hr.

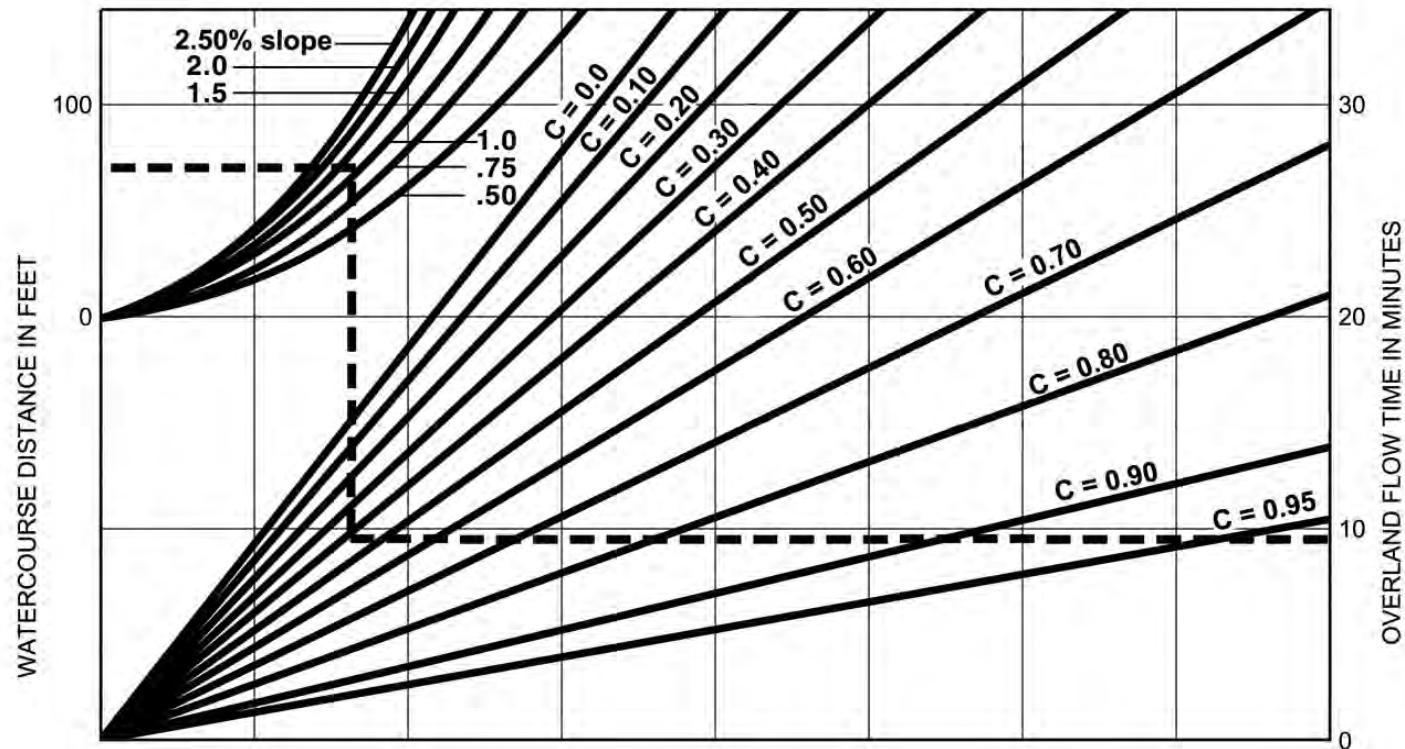
Note: This chart replaces the Intensity-Duration-Frequency curves used since 1965.

P6	1	1.5	2	2.5	3	3.5	4	4.5	5	5.5	6
Duration											
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



EXAMPLE:

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

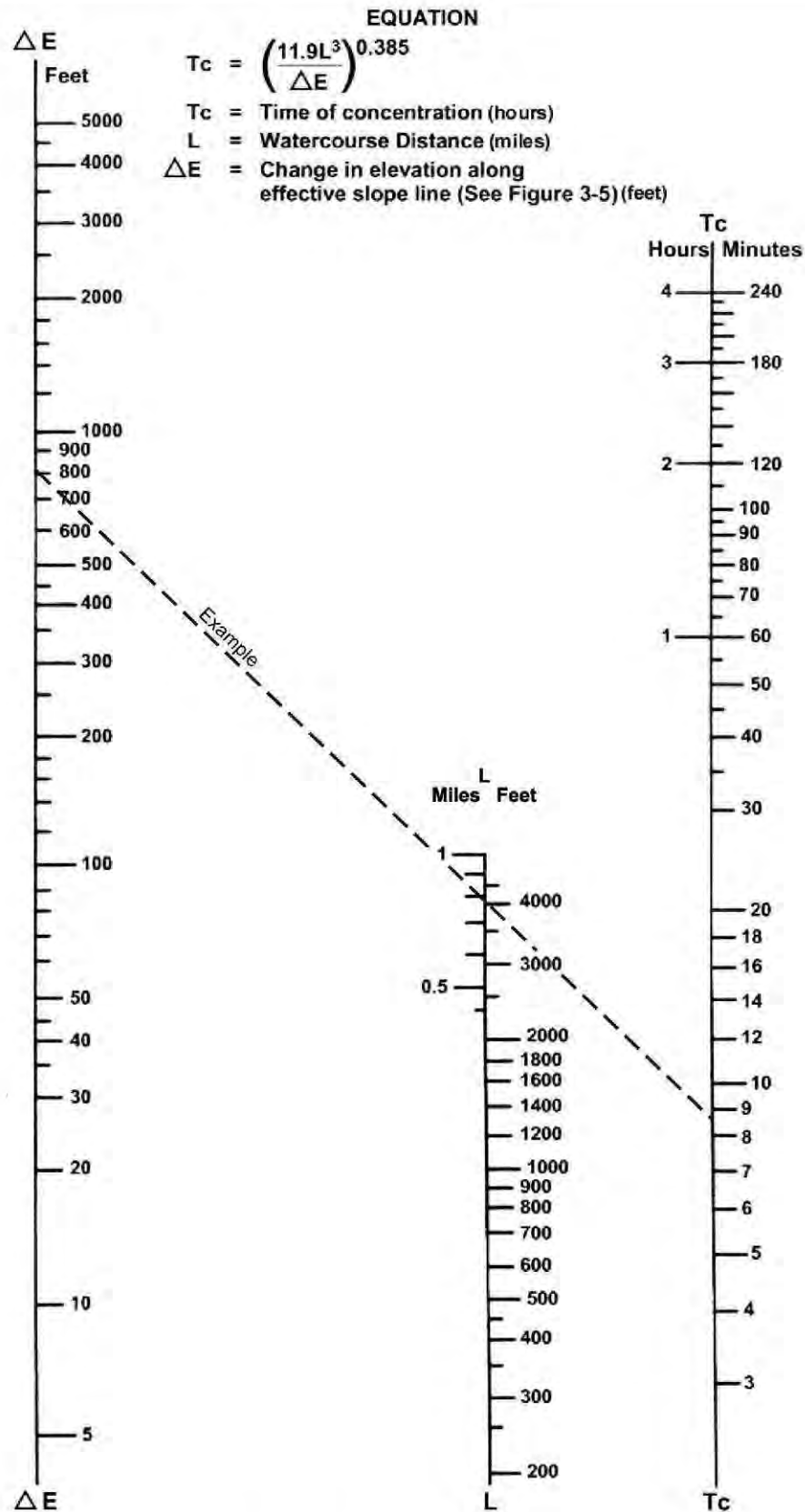
$$T = \frac{1.8 (1.1-C) \sqrt{D}}{\sqrt[3]{s}}$$

SOURCE: Airport Drainage, Federal Aviation Administration, 1965

F I G U R E

3-3

Rational Formula - Overland Time of Flow Nomograph

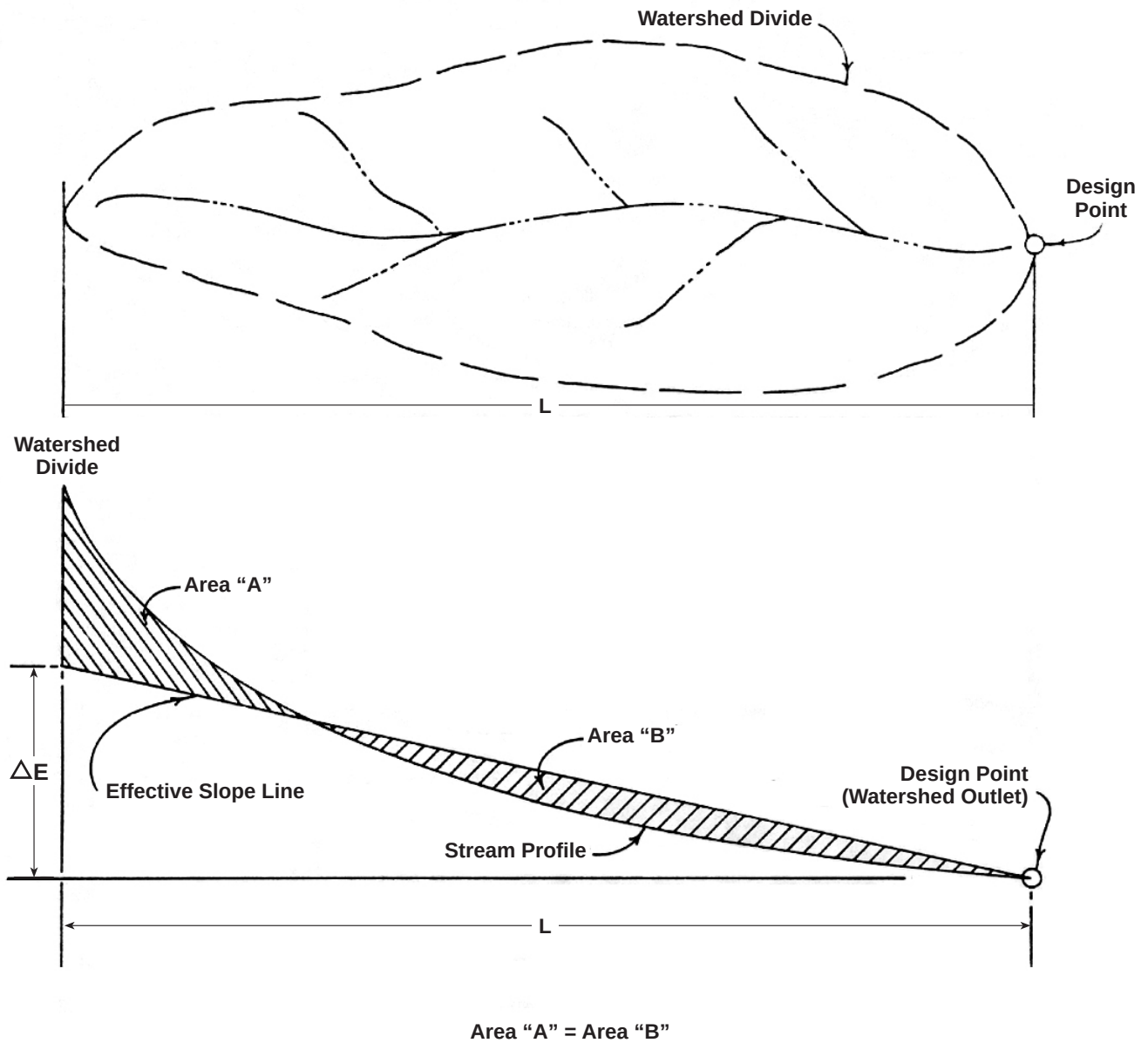


SOURCE: California Division of Highways (1941) and Kirpich (1940)

Nomograph for Determination of
Time of Concentration (T_c) or Travel Time (T_t) for Natural Watersheds

F I G U R E

3-4

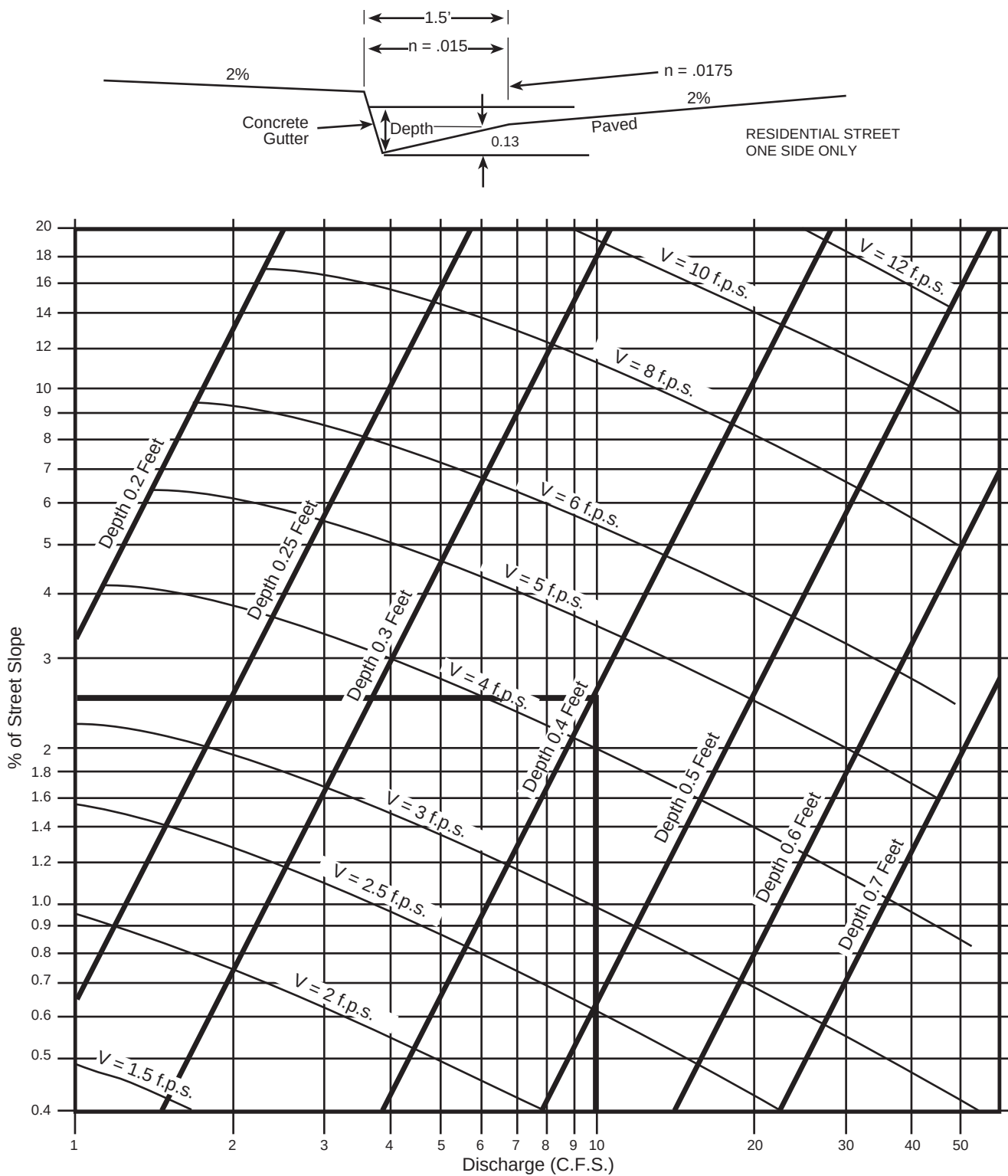


SOURCE: California Division of Highways (1941) and Kirpich (1940)

FIGURE

Computation of Effective Slope for Natural Watersheds

3-5



EXAMPLE:
 Given: $Q = 10$ $S = 2.5\%$
 Chart gives: Depth = 0.4, Velocity = 4.4 f.p.s.

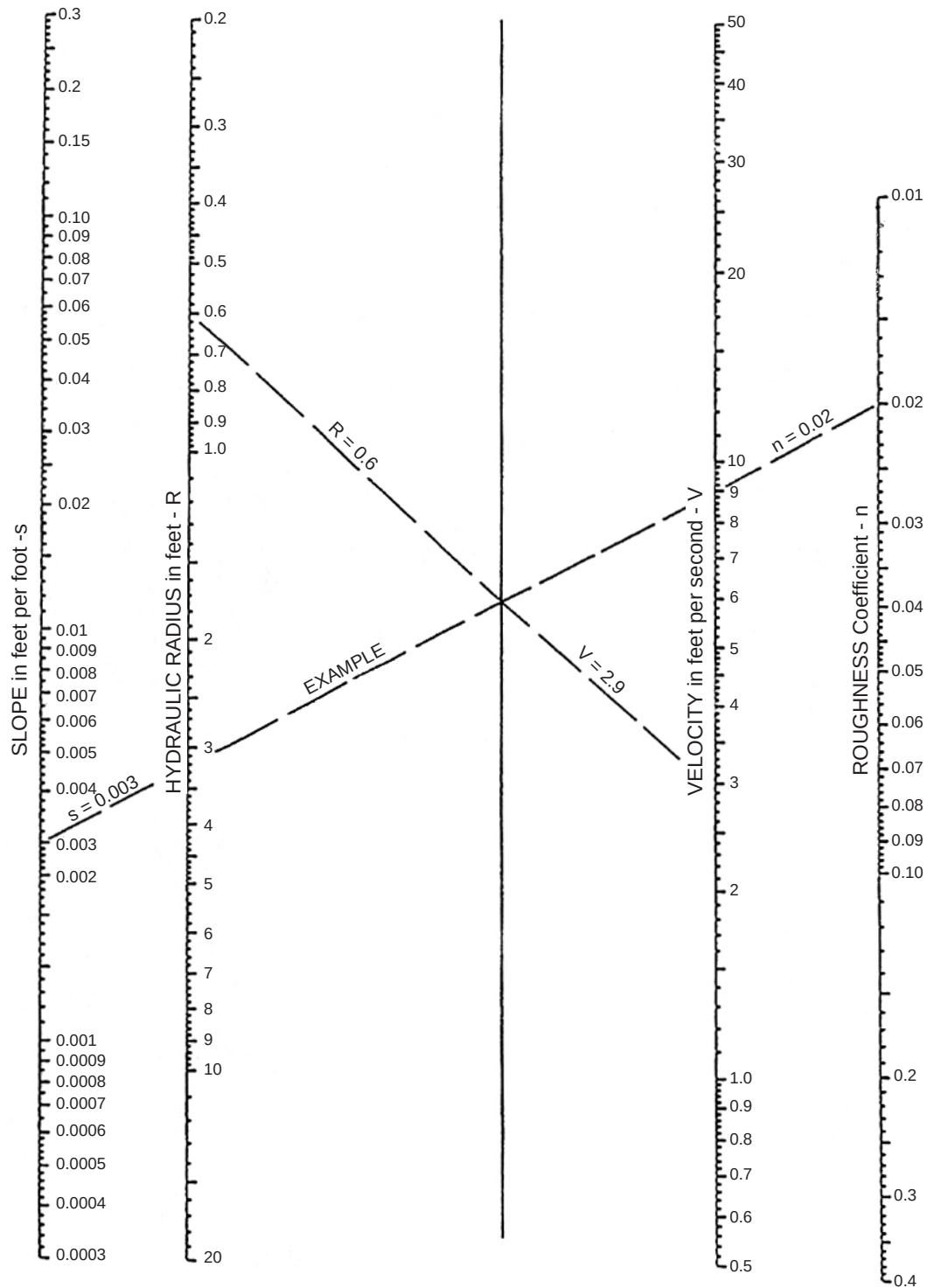
SOURCE: San Diego County Department of Special District Services Design Manual

Gutter and Roadway Discharge - Velocity Chart

FIGURE

3-6

$$\text{EQUATION: } V = \frac{1.49}{n} R^{2/3} S^{1/2}$$



GENERAL SOLUTION

SOURCE: USDOT, FHWA, HDS-3 (1961)

Manning's Equation Nomograph

FIGURE

3-7

Table A-1 Average Manning Roughness Coefficients for Pavement and Gutters¹

Concrete Gutter ²	0.015
Concrete Pavement	
Float Finish	0.014
Broom Finish.....	0.016
Concrete Gutter with Asphalt Pavement	
Smooth Finish.....	0.013
Rough Texture	0.015
Asphalt Pavement	
Smooth Finish.....	0.013
Rough Texture	0.016

Based on FHWA HEC-22.

¹ Based on materials and workmanship required by standard specifications.

² Increase roughness coefficient in gutters with mild slopes where sediment might accumulate by 0.020.

Table A-2 Average Manning Roughness Coefficients for Closed Conduits³

Reinforced Concrete Pipe (RCP)	0.013
Corrugated Metal Pipe and Pipe Arch	
2-3/8 x 1/2 inch Corrugations	
Unlined	0.024
Half Lined	
Full Flow	0.018
$d/D \geq 0.60$	0.016
$d/D < 0.60$	0.013
Fully Lined	0.013
3 x 1 inch Corrugations	0.027
6 x 2 inch Corrugations	0.032
Spiral Rib Pipe	0.013
Helically Wound Pipe	
18-inch	0.015
24-inch	0.017
30-inch	0.019
36-inch	0.021
42-inch	0.022
48-inch	0.023
Plastic Pipe (HPDE and PVC)	
Smooth	0.013
Corrugated	0.024
Vitrified Clay Pipe	0.014
Cast-Iron Pipe (Uncoated)	0.013
Steel Pipe	0.011
Brick	0.017
Cast-In-Place Concrete Pipe	
Rough Wood Forms	0.017
Smooth Wood or Steel Forms	0.014

³ Based on materials and workmanship required by standard specifications.

Table A-5 Average Manning Roughness Coefficients for Natural Channels

Minor Streams (Surface Width at Flood Stage < 100 ft)

Fairly Regular Section

(A) Some Grass and Weeds, Little or No Brush	0.030
(B) Dense Growth of Weeds, Depth of Flow Materially Greater Than Weed Height	0.040
(C) Some Weeds, Light Brush on Banks.....	0.040
(D) Some Weeds, Heavy Brush on Banks	0.060
(E) For Trees within Channel with Branches Submerged at High Stage, Increase All Above Values By	0.015

Irregular Section, with Pools, Slight Channel Meander

Channels (A) to (E) Above, Increase All Values By	0.015
---	-------

Mountain Streams; No Vegetation in Channel, Banks Usually Steep, Trees and Brush along Banks Submerged at High Stage

(A) Bottom, Gravel, Cobbles and Few Boulders	0.050
(B) Bottom, Cobbles with Large Boulders	0.060

Flood Plains (Adjacent To Natural Streams)

Pasture, No Brush

(A) Short Grass	0.030
(B) High Grass	0.040

Cultivated Areas

(A) No Crop	0.040
(B) Mature Row Crops	0.040
(C) Mature Field Crops.....	0.050

Heavy Weeds, Scattered Brush

Light Brush and Trees

Medium To Dense Brush.....

Dense Willows

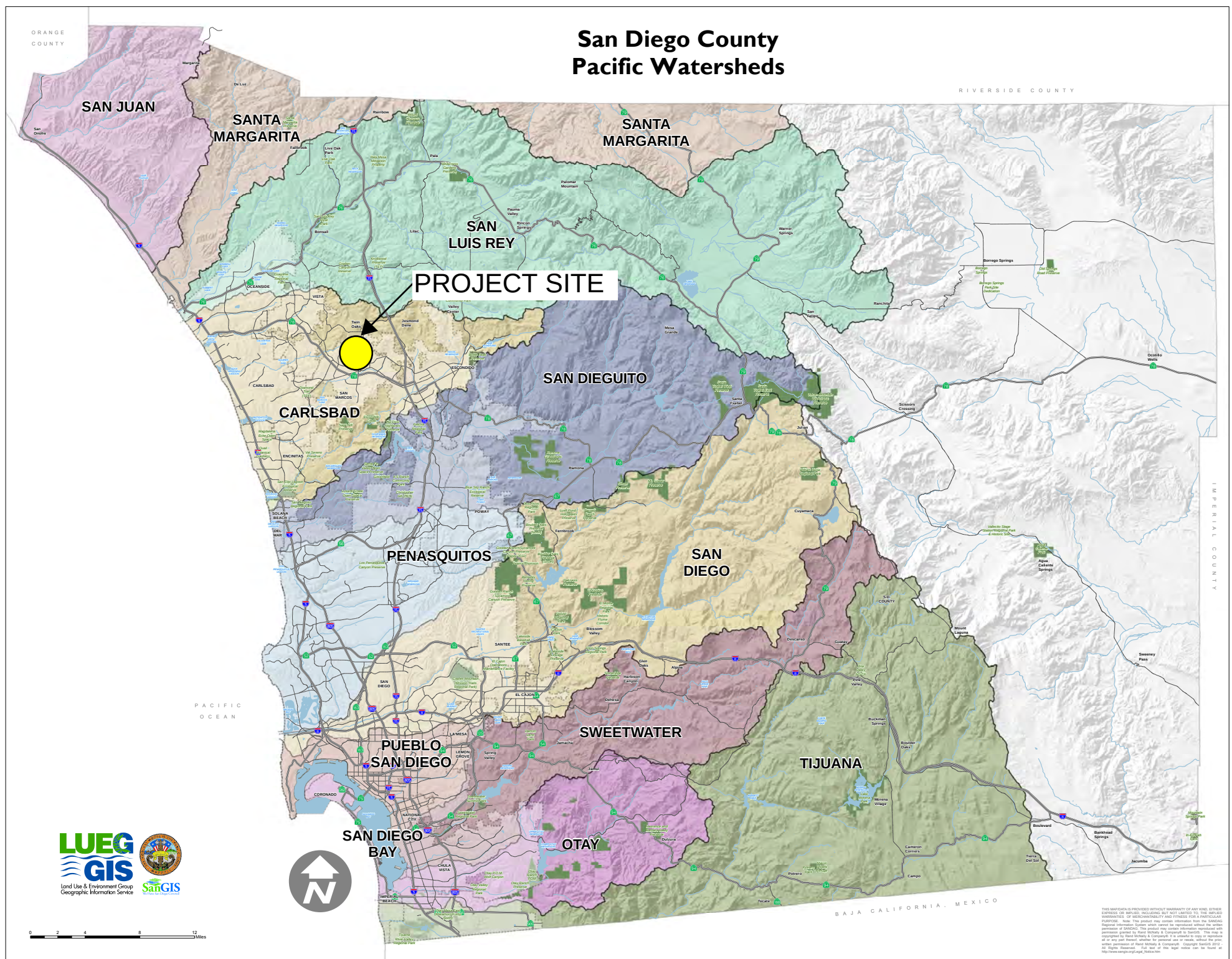
Cleared Land with Tree Stumps, 100-150 Per Acre.....

Heavy Stand of Timber, Little Undergrowth

(A) Flood Depth below Branches	0.110
(B) Flood Depth Reaches Branches	0.140

ATTACHMENT 3
WATERSHED INFORMATION
WATERSHED MAP

San Diego County Pacific Watersheds



SOIL INDEX MAP

County of San Diego Hydrology Manual



Soil Hydrologic Groups

Legend

Soil Groups

Group A

Group B

Group C

Group D

Undetermined

Data Unavailable

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SOIL REPORT

Hydrologic Soil Group—San Diego County Area, California



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:
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 16, Sep 13, 2021

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

Date(s) aerial images were photographed: Mar 14, 2022—Mar 17, 2022

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

Map unit symbol	Map unit name	Rating	Acres in AOI	Percent of AOI
CmE2	Cieneba rocky coarse sandy loam, 9 to 30 percent slopes, eroded	D	11.6	90.8%
HrC	Huerhuero loam, 2 to 9 percent slopes	D	0.2	1.4%
PeC	Placentia sandy loam, 2 to 9 percent slopes, warm MAAT, MLRA 19	C	1.0	7.8%
Totals for Area of Interest			12.8	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

RAINFALL ISOPLUVIAL MAPS

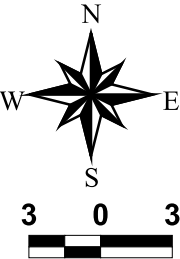
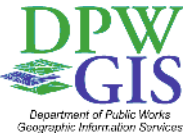
County of San Diego Hydrology Manual



Rainfall Isopluvials

100 Year Rainfall Event - 6 Hours

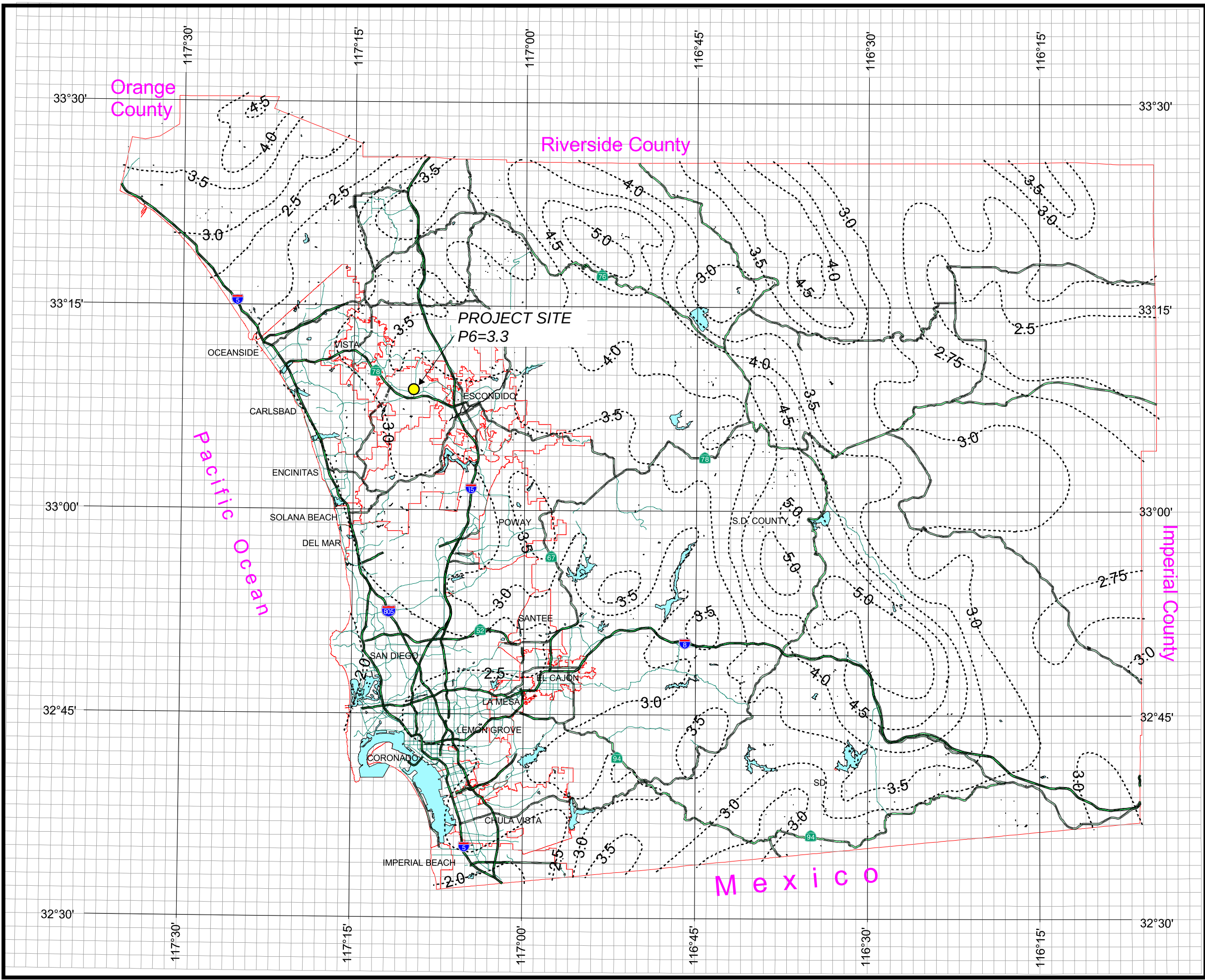
----- Isopluvial (inches)



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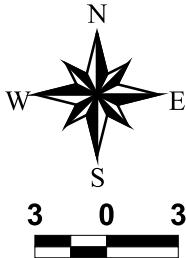
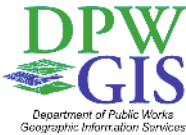
County of San Diego Hydrology Manual



Rainfall Isopluvials

100 Year Rainfall Event - 24 Hours

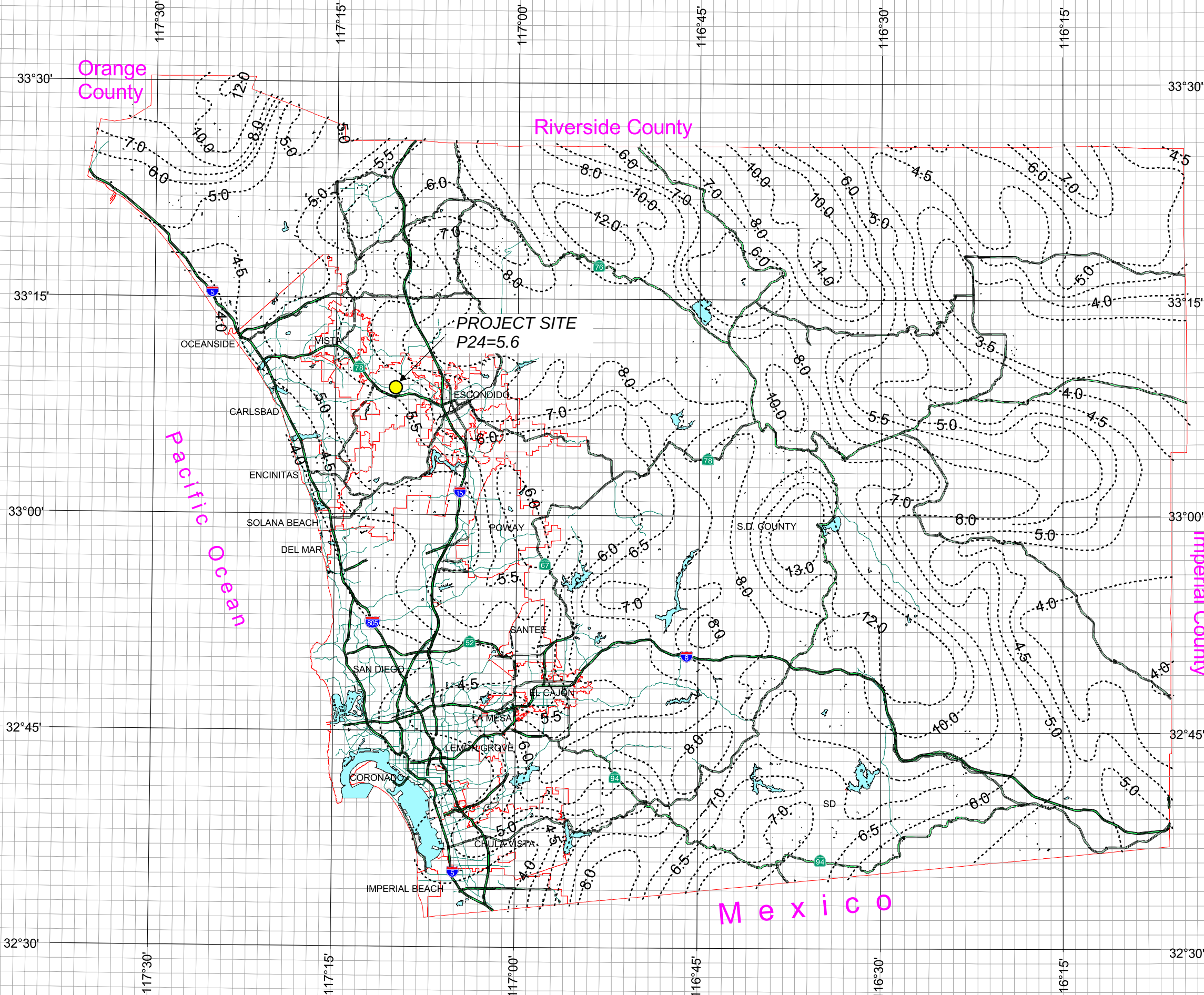
----- Isopluvial (inches)



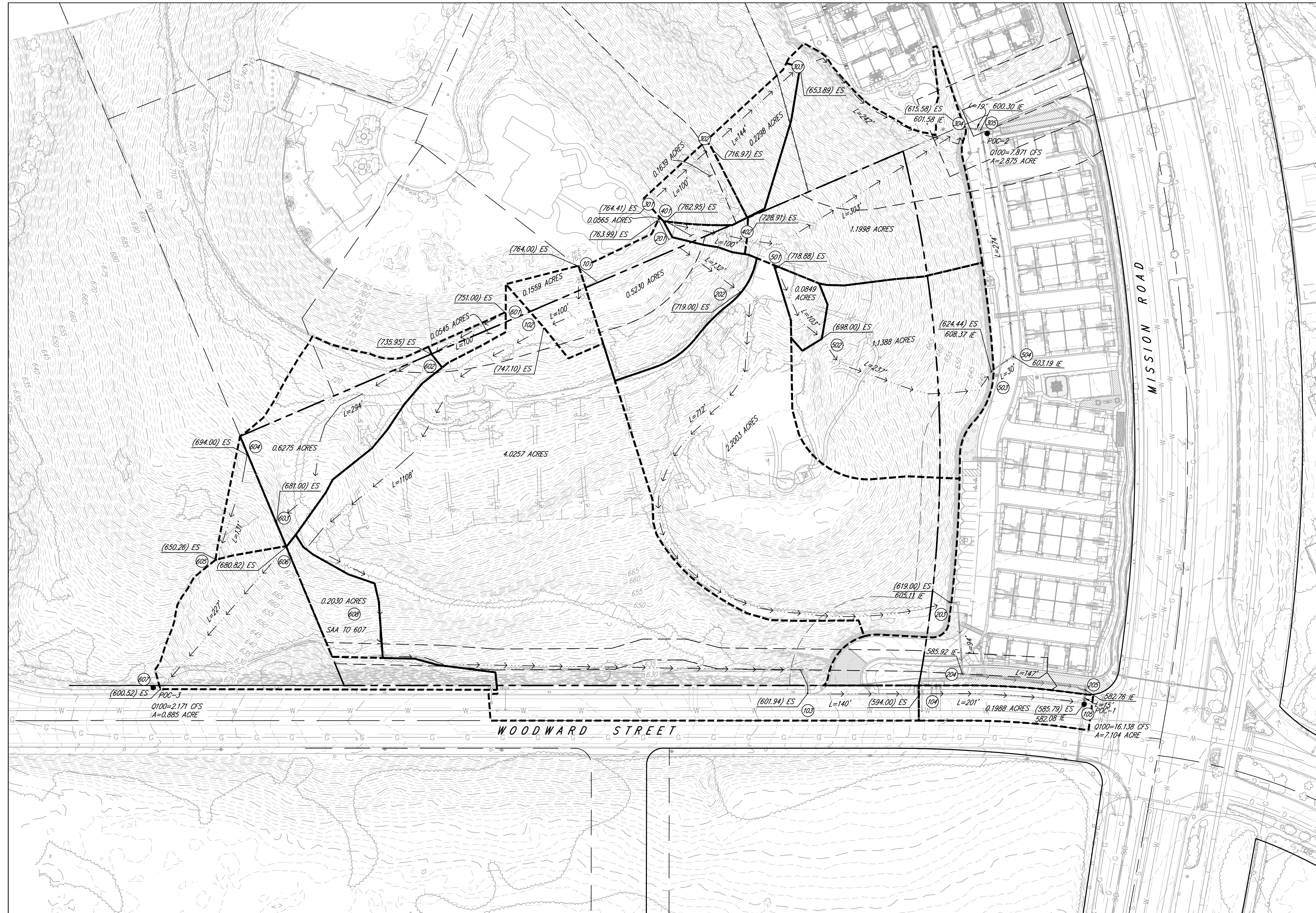
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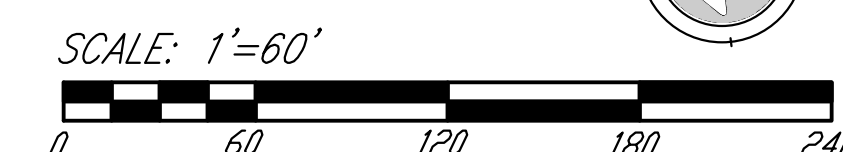
ATTACHMENT 4
PRE-DEVELOPMENT CONDITION EXHIBIT



- LEGEND**
- (100) NODE NUMBER
 - SURFACE FLOW
 - PIPE FLOW
 - HYDROLOGY BASIN BOUNDARY
 - ELEVATION

HYDROLOGIC SOIL GROUP
 THE HYDROLOGIC SOIL GROUP FOR THIS SITE IS TYPE C
 AND TYPE D

NOTE:
 APPROXIMATE DEPTH TO GROUNDWATER IS GREATER THAN 20'



ATTACHMENT 5
POST-DEVELOPMENT CONDITION EXHIBIT

5a. Hydrology Map of Post-Development Condition Exhibit

K:\22\2022\Engineering\TM Storm\Working Files\Hyd\22022 POST-HID.dwg 6/14/2022 2:51 PM ORIGINAL PLOT SIZE: PDF 24x36

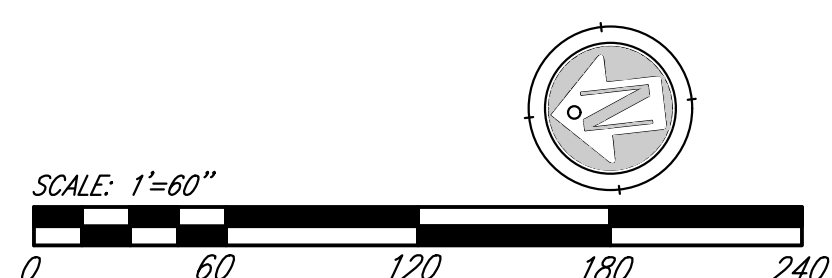


LEGEND

- 100 NODE NUMBER
- > SURFACE FLOW
- > PIPE FLOW
- HYDROLOGY BASIN BOUNDARY
- ELEVATION

HYDROLOGIC SOIL GROUP
THE HYDROLOGIC SOIL GROUP FOR THIS SITE IS TYPE C
AND TYPE D

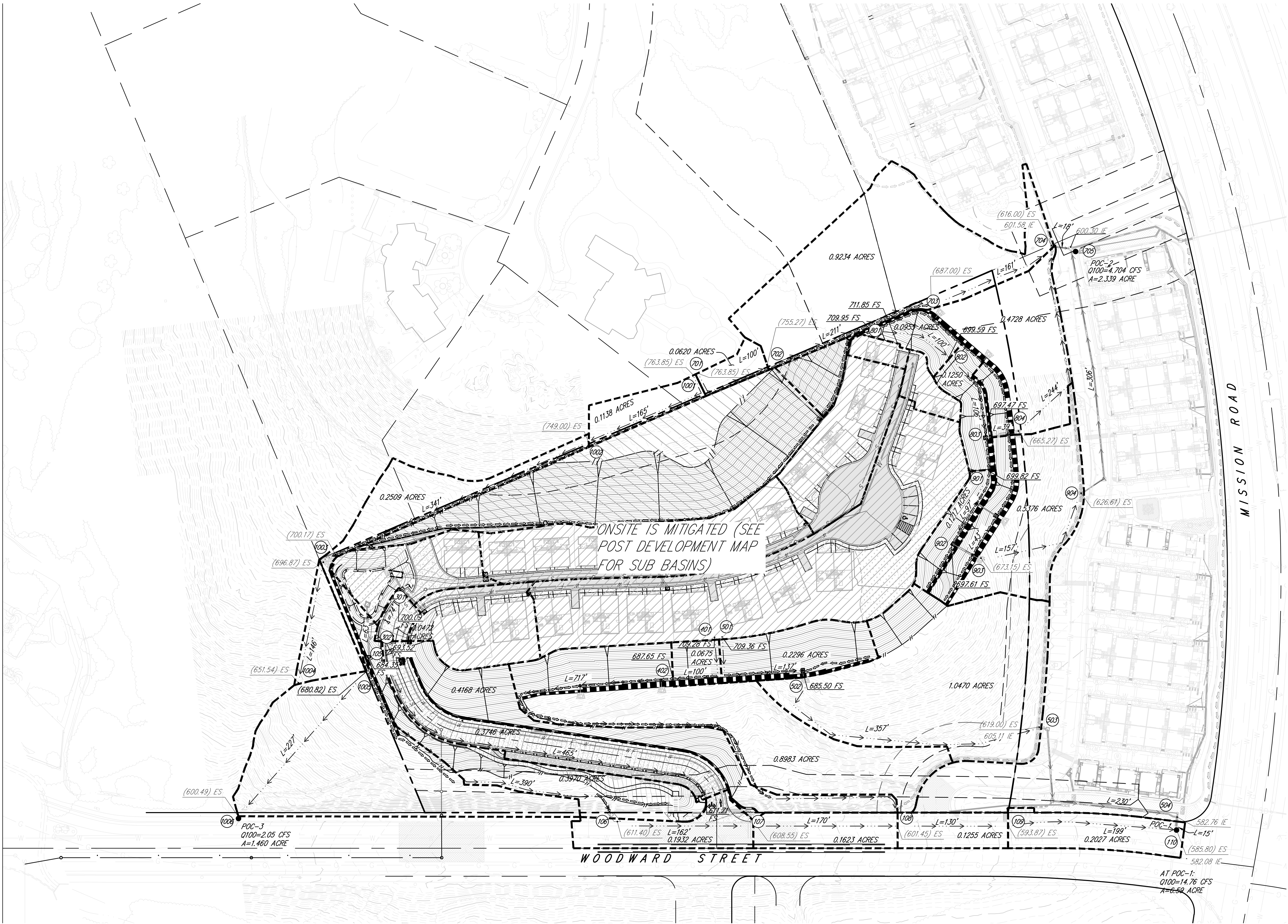
NOTE:
APPROXIMATE DEPTH TO GROUNDWATER IS GREATER THAN 20'



CORNERSTONE COMMUNITIES WOODWARD
POST DEVELOPMENT HYDROLOGY EXHIBIT

5b. Hydrology Map of Post-Development Mitigation Condition Exhibit

K:\22\20227\Engineering\TM\Storm\Working Files\Hyd\220227 POST-HYD - MIT.dwg 6/14/2023 3:18 PM ORIGINAL PLOT SIZE: PDF 24x36



LEGEND

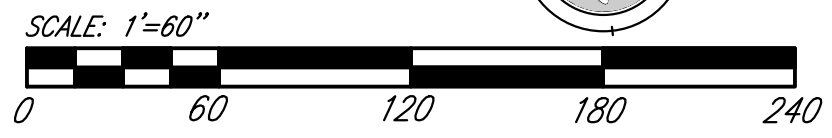
- 100 NODE NUMBER
- > SURFACE FLOW
- > PIPE FLOW
- HYDROLOGY BASIN BOUNDARY
- ELEVATION

HYDROLOGIC SOIL GROUP

THE HYDROLOGIC SOIL GROUP FOR THIS SITE IS TYPE C AND TYPE D

NOTE:

APPROXIMATE DEPTH TO GROUNDWATER IS GREATER THAN 20'



CORNERSTONE COMMUNITIES
WOODWARD POST DEVELOPMENT
MITIGATION HYDROLOGY EXHIBIT

ATTACHMENT 6

MODIFIED RATIONAL METHOD RUNOFF CALCULATIONS

Steps Taken To Analyze This Condition

The Rational Method Runoff Calculations are followed here. The software that we are using is the “Rational Hydrology Method, San Diego County (2003 Manual)” module of the CIVILCADD/CIVILDESIGN Engineering Software, Version 9.1.

Please see the subsequent pages for the calculations. These calculations are for the **Q₁₀₀**. The results are outlined/summarized in Section 6.

6a. CivilD Pre-Development Calculations


```

1
2 San Diego County Rational Hydrology Program
3
4 CIVILCADD/CIVILDESIGN Engineering Software,(c)1991-2019 Version 9.1
5
6 Rational method hydrology program based on
7 San Diego County Flood Control Division 2003 hydrology manual
8 Rational Hydrology Study Date: 09/08/22
9 -----
10 22027 PRE POC1
11
12
13
14 -----
15 ***** Hydrology Study Control Information *****
16 -----
17
18
19
20 Program License Serial Number 6332
21
22 -----
23 Rational hydrology study storm event year is 100.0
24 English (in-lb) input data Units used
25
26 Map data precipitation entered:
27 6 hour, precipitation(inches) = 3.300
28 24 hour precipitation(inches) = 5.600
29 P6/P24 = 58.9%
30 San Diego hydrology manual 'C' values used
31
32
33 +-----+
34 Process from Point/Station 101.000 to Point/Station 102.000
35 **** INITIAL AREA EVALUATION ****
36
37 -----
38 Decimal fraction soil group A = 0.000
39 Decimal fraction soil group B = 0.000
40 Decimal fraction soil group C = 0.000
41 Decimal fraction soil group D = 1.000
42 [UNDISTURBED NATURAL TERRAIN ]
43 (Permanent Open Space )
44 Impervious value, Ai = 0.000
45 Sub-Area C Value = 0.350
46 Initial subarea total flow distance = 100.000(Ft.)
47 Highest elevation = 764.000(Ft.)
48 Lowest elevation = 747.100(Ft.)
49 Elevation difference = 16.900(Ft.) Slope = 16.900 %
50 INITIAL AREA TIME OF CONCENTRATION CALCULATIONS:
51 The maximum overland flow distance is 100.00 (Ft)
52 for the top area slope value of 16.90 %, in a development type of
53 Permanent Open Space
54 In Accordance With Figure 3-3
55 Initial Area Time of Concentration = 5.26 minutes
56  $TC = [1.8 * (1.1 - C) * distance(Ft.)^{.5}] / (% slope^{(1/3)})$ 
57  $TC = [1.8 * (1.1 - 0.3500) * (100.000^{.5})] / (16.900^{(1/3)}) = 5.26$ 
58 Rainfall intensity (I) = 8.414(In/Hr) for a 100.0 year storm
59 Effective runoff coefficient used for area (Q=KCIA) is C = 0.350
60 Subarea runoff = 0.459(CFS)
61 Total initial stream area = 0.156(Ac.)
62
63 +-----+
64 Process from Point/Station 102.000 to Point/Station 103.000
65 **** IRREGULAR CHANNEL FLOW TRAVEL TIME ****
66
67 -----
68 Estimated mean flow rate at midpoint of channel = 5.065(CFS)
69 Depth of flow = 0.807(Ft.), Average velocity = 7.772(Ft/s)
70 ***** Irregular Channel Data *****

```

```

70 -----
71 Information entered for subchannel number 1 :
72 Point number      'X' coordinate      'Y' coordinate
73     1              0.00              2.00
74     2              2.00              0.00
75     3              4.00              2.00
76 Manning's 'N' friction factor = 0.030
77 -----
78 Sub-Channel flow = 5.065(CFS)
79   '   '   flow top width = 1.615(Ft.)
80   '   '   velocity= 7.772(Ft/s)
81   '   '   area = 0.652(Sq.Ft)
82   '   '   Froude number = 2.156
83
84 Upstream point elevation = 747.100(Ft.)
85 Downstream point elevation = 601.940(Ft.)
86 Flow length = 1108.000(Ft.)
87 Travel time = 2.38 min.
88 Time of concentration = 7.64 min.
89 Depth of flow = 0.807(Ft.)
90 Average velocity = 7.772(Ft/s)
91 Total irregular channel flow = 5.065(CFS)
92 Irregular channel normal depth above invert elev. = 0.807(Ft.)
93 Average velocity of channel(s) = 7.772(Ft/s)
94 Adding area flow to channel
95 Rainfall intensity (I) = 6.616(In/Hr) for a 100.0 year storm
96 Decimal fraction soil group A = 0.000
97 Decimal fraction soil group B = 0.000
98 Decimal fraction soil group C = 0.050
99 Decimal fraction soil group D = 0.950
100 [UNDISTURBED NATURAL TERRAIN ]
101 (Permanent Open Space )
102 Impervious value, Ai = 0.000
103 Sub-Area C Value = 0.347
104 Rainfall intensity = 6.616(In/Hr) for a 100.0 year storm
105 Effective runoff coefficient used for total area
106 (Q=KCIA) is C = 0.348 CA = 1.454
107 Subarea runoff = 9.158(CFS) for 4.026(Ac.)
108 Total runoff = 9.618(CFS) Total area = 4.182(Ac.)
109 Depth of flow = 1.027(Ft.), Average velocity = 9.123(Ft/s)
110
111
112 +-----+
113 Process from Point/Station 103.000 to Point/Station 104.000
114 **** IRREGULAR CHANNEL FLOW TRAVEL TIME ****
115
116 -----
117 Depth of flow = 0.718(Ft.), Average velocity = 4.208(Ft/s)
118 ***** Irregular Channel Data *****
119 -----
120 Information entered for subchannel number 1 :
121 Point number      'X' coordinate      'Y' coordinate
122     1              0.00              0.72
123     2              30.00             0.60
124     3              31.50             0.00
125     4              31.50             0.50
126 Manning's 'N' friction factor = 0.015
127 -----
128 Sub-Channel flow = 9.618(CFS)
129   '   '   flow top width = 29.719(Ft.)
130   '   '   velocity= 4.208(Ft/s)
131   '   '   area = 2.285(Sq.Ft)
132   '   '   Froude number = 2.674
133
134 Upstream point elevation = 601.940(Ft.)
135 Downstream point elevation = 594.000(Ft.)
136 Flow length = 140.000(Ft.)
137 Travel time = 0.55 min.
138 Time of concentration = 8.19 min.
139 Depth of flow = 0.718(Ft.)

```

```

139 Average velocity = 4.208(Ft/s)
140 Total irregular channel flow = 9.618(CFS)
141 Irregular channel normal depth above invert elev. = 0.718(Ft.)
142 Average velocity of channel(s) = 4.208(Ft/s)
143
144
145 ++++++
146 Process from Point/Station 104.000 to Point/Station 105.000
147 **** IRREGULAR CHANNEL FLOW TRAVEL TIME ****
148
149 Estimated mean flow rate at midpoint of channel = 9.846(CFS)
150 Depth of flow = 1.472(Ft.), Average velocity = 9.690(Ft/s)
151 ***** Irregular Channel Data *****
152 -----
153 Information entered for subchannel number 1 :
154 Point number 'X' coordinate 'Y' coordinate
155 1 0.00 2.00
156 2 33.00 1.60
157 3 34.50 0.00
158 4 34.50 1.00
159 Manning's 'N' friction factor = 0.015
160 -----
161 Sub-Channel flow = 9.846(CFS)
162 ' ' flow top width = 1.380(Ft.)
163 ' ' velocity = 9.690(Ft/s)
164 ' ' area = 1.016(Sq.Ft)
165 ' ' Froude number = 1.990
166
167 Upstream point elevation = 594.000(Ft.)
168 Downstream point elevation = 585.790(Ft.)
169 Flow length = 201.000(Ft.)
170 Travel time = 0.35 min.
171 Time of concentration = 8.54 min.
172 Depth of flow = 1.472(Ft.)
173 Average velocity = 9.690(Ft/s)
174 Total irregular channel flow = 9.846(CFS)
175 Irregular channel normal depth above invert elev. = 1.472(Ft.)
176 Average velocity of channel(s) = 9.690(Ft/s)
177 Adding area flow to channel
178 Rainfall intensity (I) = 6.157(In/Hr) for a 100.0 year storm
179 Decimal fraction soil group A = 0.000
180 Decimal fraction soil group B = 0.000
181 Decimal fraction soil group C = 1.000
182 Decimal fraction soil group D = 0.000
183 [INDUSTRIAL area type ]
184 (General Industrial )
185 Impervious value, Ai = 0.950
186 Sub-Area C Value = 0.870
187 Rainfall intensity = 6.157(In/Hr) for a 100.0 year storm
188 Effective runoff coefficient used for total area
189 (Q=KCIA) is C = 0.371 CA = 1.627
190 Subarea runoff = 0.399(CFS) for 0.199(Ac.)
191 Total runoff = 10.017(CFS) Total area = 4.381(Ac.)
192 Depth of flow = 1.481(Ft.), Average velocity = 9.741(Ft/s)
193
194
195 ++++++
196 Process from Point/Station 105.000 to Point/Station 105.000
197 **** CONFLUENCE OF MINOR STREAMS ****
198
199 Along Main Stream number: 1 in normal stream number 1
200 Stream flow area = 4.381(Ac.)
201 Runoff from this stream = 10.017(CFS)
202 Time of concentration = 8.54 min.
203 Rainfall intensity = 6.157(In/Hr)
204
205
206 ++++++
207 Process from Point/Station 201.000 to Point/Station 202.000

```

```

208 **** INITIAL AREA EVALUATION ****
209
210 Decimal fraction soil group A = 0.000
211 Decimal fraction soil group B = 0.000
212 Decimal fraction soil group C = 0.000
213 Decimal fraction soil group D = 1.000
214 [UNDISTURBED NATURAL TERRAIN
215 (Permanent Open Space )
216 Impervious value, Ai = 0.000
217 Sub-Area C Value = 0.350
218 Initial subarea total flow distance = 132.000(Ft.)
219 Highest elevation = 763.990(Ft.)
220 Lowest elevation = 719.000(Ft.)
221 Elevation difference = 44.990(Ft.) Slope = 34.083 %
222 INITIAL AREA TIME OF CONCENTRATION CALCULATIONS:
223 The maximum overland flow distance is 100.00 (Ft)
224 for the top area slope value of 34.08 %, in a development type of
225 Permanent Open Space
226 In Accordance With Figure 3-3
227 Initial Area Time of Concentration = 4.16 minutes
228  $TC = [1.8 * (1.1 - C) * distance(Ft.)^{.5}] / (\% slope^{(1/3)})$ 
229  $TC = [1.8 * (1.1 - 0.3500) * (100.000^{.5})] / (34.083^{(1/3)}) = 4.16$ 
230 Calculated TC of 4.164 minutes is less than 5 minutes,
231 resetting TC to 5.0 minutes for rainfall intensity calculations
232 Rainfall intensity (I) = 8.695(In/Hr) for a 100.0 year storm
233 Effective runoff coefficient used for area (Q=KCIA) is C = 0.350
234 Subarea runoff = 1.592(CFS)
235 Total initial stream area = 0.523(Ac.)
236
237
238 ++++++
239 Process from Point/Station 202.000 to Point/Station 203.000
240 **** IRREGULAR CHANNEL FLOW TRAVEL TIME ****
241
242 Estimated mean flow rate at midpoint of channel = 4.655(CFS)
243 Depth of flow = 0.772(Ft.), Average velocity = 7.811(Ft/s)
244 ***** Irregular Channel Data *****
245 -----
246 Information entered for subchannel number 1 :
247 Point number 'X' coordinate 'Y' coordinate
248 1 0.00 1.00
249 2 1.00 0.00
250 3 2.00 1.00
251 Manning's 'N' friction factor = 0.030
252 -----
253 Sub-Channel flow = 4.655(CFS)
254 ' ' flow top width = 1.544(Ft.)
255 ' ' velocity = 7.811(Ft/s)
256 ' ' area = 0.596(Sq.Ft)
257 ' ' Froude number = 2.216
258
259 Upstream point elevation = 719.000(Ft.)
260 Downstream point elevation = 619.000(Ft.)
261 Flow length = 712.000(Ft.)
262 Travel time = 1.52 min.
263 Time of concentration = 5.68 min.
264 Depth of flow = 0.772(Ft.)
265 Average velocity = 7.811(Ft/s)
266 Total irregular channel flow = 4.655(CFS)
267 Irregular channel normal depth above invert elev. = 0.772(Ft.)
268 Average velocity of channel(s) = 7.811(Ft/s)
269 Adding area flow to channel
270 Rainfall intensity (I) = 8.005(In/Hr) for a 100.0 year storm
271 Decimal fraction soil group A = 0.000
272 Decimal fraction soil group B = 0.000
273 Decimal fraction soil group C = 0.000
274 Decimal fraction soil group D = 1.000
275 [UNDISTURBED NATURAL TERRAIN
276 (Permanent Open Space )

```



```

277 Impervious value, Ai = 0.000
278 Sub-Area C Value = 0.350
279 Rainfall intensity = 8.005(In/Hr) for a 100.0 year storm
280 Effective runoff coefficient used for total area
281 (Q=KCIA) is C = 0.350 CA = 0.953
282 Subarea runoff = 6.038(CFS) for 2.200(Ac.)
283 Total runoff = 7.630(CFS) Total area = 2.723(Ac.)
284 Depth of flow = 0.929(Ft.), Average velocity = 8.838(Ft/s)
285
286
287 *****
288 Process from Point/Station 203.000 to Point/Station 204.000
289 **** PIPEFLOW TRAVEL TIME (User specified size) ****
290
291 Upstream point/station elevation = 605.110(Ft.)
292 Downstream point/station elevation = 585.920(Ft.)
293 Pipe length = 94.00(Ft.) Slope = 0.2041 Manning's N = 0.013
294 No. of pipes = 1 Required pipe flow = 7.630(CFS)
295 Given pipe size = 18.00(In.)
296 Calculated individual pipe flow = 7.630(CFS)
297 Normal flow depth in pipe = 4.88(In.)
298 Flow top width inside pipe = 16.00(In.)
299 Critical Depth = 12.84(In.)
300 Pipe flow velocity = 19.71(Ft/s)
301 Travel time through pipe = 0.08 min.
302 Time of concentration (TC) = 5.76 min.
303
304
305 *****
306 Process from Point/Station 204.000 to Point/Station 205.000
307 **** PIPEFLOW TRAVEL TIME (User specified size) ****
308
309 Upstream point/station elevation = 585.920(Ft.)
310 Downstream point/station elevation = 582.760(Ft.)
311 Pipe length = 147.00(Ft.) Slope = 0.0215 Manning's N = 0.013
312 No. of pipes = 1 Required pipe flow = 7.630(CFS)
313 Given pipe size = 18.00(In.)
314 Calculated individual pipe flow = 7.630(CFS)
315 Normal flow depth in pipe = 8.95(In.)
316 Flow top width inside pipe = 18.00(In.)
317 Critical Depth = 12.84(In.)
318 Pipe flow velocity = 8.70(Ft/s)
319 Travel time through pipe = 0.28 min.
320 Time of concentration (TC) = 6.04 min.
321
322
323 *****
324 Process from Point/Station 205.000 to Point/Station 105.000
325 **** PIPEFLOW TRAVEL TIME (User specified size) ****
326
327 Upstream point/station elevation = 582.760(Ft.)
328 Downstream point/station elevation = 582.080(Ft.)
329 Pipe length = 15.00(Ft.) Slope = 0.0453 Manning's N = 0.013
330 No. of pipes = 1 Required pipe flow = 7.630(CFS)
331 Given pipe size = 24.00(In.)
332 Calculated individual pipe flow = 7.630(CFS)
333 Normal flow depth in pipe = 6.46(In.)
334 Flow top width inside pipe = 21.29(In.)
335 Critical Depth = 11.79(In.)
336 Pipe flow velocity = 11.20(Ft/s)
337 Travel time through pipe = 0.02 min.
338 Time of concentration (TC) = 6.07 min.
339
340
341 *****
342 Process from Point/Station 105.000 to Point/Station 105.000
343 **** CONFLUENCE OF MINOR STREAMS ****
344
345 Along Main Stream number: 1 in normal stream number 2

```

```

346 Stream flow area = 2.723(Ac.)
347 Runoff from this stream = 7.630(CFS)
348 Time of concentration = 6.07 min.
349 Rainfall intensity = 7.675(In/Hr)
350 Summary of stream data:
351
352 Stream No. Flow rate (CFS) TC (min) Rainfall Intensity (In/Hr)
353
354
355
356 1 10.017 8.54 6.157
357 2 7.630 6.07 7.675
358 Qmax(1) =
359 1.000 * 1.000 * 10.017) +
360 0.802 * 1.000 * 7.630) + = 16.138
361 Qmax(2) =
362 1.000 * 0.711 * 10.017) +
363 1.000 * 1.000 * 7.630) + = 14.748
364
365 Total of 2 streams to confluence:
366 Flow rates before confluence point:
367 10.017 7.630
368 Maximum flow rates at confluence using above data:
369 16.138 14.748
370 Area of streams before confluence:
371 4.381 2.723
372 Results of confluence:
373 Total flow rate = 16.138(CFS)
374 Time of concentration = 8.537 min.
375 Effective stream area after confluence = 7.104(Ac.)
376 End of computations, total study area = 7.104 (Ac.)
377
378
379

```

```

1
2 San Diego County Rational Hydrology Program
3
4 CIVILCADD/CIVILDESIGN Engineering Software,(c)1991-2019 Version 9.1
5
6 Rational method hydrology program based on
7 San Diego County Flood Control Division 2003 hydrology manual
8 Rational Hydrology Study Date: 02/07/23
9 -----
10
11 22027 PRE POC2
12 UPDATED
13 -----
14 ***** Hydrology Study Control Information *****
15 -----
16
17
18
19
20 Program License Serial Number 6332
21 -----
22
23 Rational hydrology study storm event year is 100.0
24 English (in-lb) input data Units used
25
26 Map data precipitation entered:
27 6 hour, precipitation(inches) = 3.300
28 24 hour precipitation(inches) = 5.600
29 P6/P24 = 58.9%
30 San Diego hydrology manual 'C' values used
31
32
33 +-----+
34 Process from Point/Station 301.000 to Point/Station 302.000
35 **** INITIAL AREA EVALUATION ****
36
37 -----
38 Decimal fraction soil group A = 0.000
39 Decimal fraction soil group B = 0.000
40 Decimal fraction soil group C = 0.000
41 Decimal fraction soil group D = 1.000
42 [UNDISTURBED NATURAL TERRAIN ]
43 (Permanent Open Space )
44 Impervious value, Ai = 0.000
45 Sub-Area C Value = 0.350
46 Initial subarea total flow distance = 100.000(Ft.)
47 Highest elevation = 764.410(Ft.)
48 Lowest elevation = 716.970(Ft.)
49 Elevation difference = 47.440(Ft.) Slope = 47.440 %
50 INITIAL AREA TIME OF CONCENTRATION CALCULATIONS:
51 The maximum overland flow distance is 100.00 (Ft)
52 for the top area slope value of 47.44 %, in a development type of
53 Permanent Open Space
54 In Accordance With Figure 3-3
55 Initial Area Time of Concentration = 3.73 minutes
56 TC = [1.8*(1.1-C)*distance(Ft.)^0.5]/(% slope^(1/3))
57 TC = [1.8*(1.1-0.3500)*( 100.000^0.5)/( 47.440^(1/3))]= 3.73
58 Calculated TC of 3.729 minutes is less than 5 minutes,
59 resetting TC to 5.0 minutes for rainfall intensity calculations
60 Rainfall intensity (I) = 8.695(In/Hr) for a 100.0 year storm
61 Effective runoff coefficient used for area (Q=KCIA) is C = 0.350
62 Subarea runoff = 0.499(CFS)
63 Total initial stream area = 0.164(Ac.)
64
65 +-----+
66 Process from Point/Station 302.000 to Point/Station 303.000
67 **** IRREGULAR CHANNEL FLOW TRAVEL TIME ****
68
69 -----
70 Estimated mean flow rate at midpoint of channel = 0.849(CFS)

```

```

70 Depth of flow = 0.330(Ft.), Average velocity = 7.820(Ft/s)
71 ***** Irregular Channel Data *****
72 -----
73 Information entered for subchannel number 1 :
74 Point number 'X' coordinate 'Y' coordinate
75 1 0.00 1.00
76 2 1.00 0.00
77 3 2.00 1.00
78 Manning's 'N' friction factor = 0.030
79 -----
80 Sub-Channel flow = 0.849(CFS)
81 ' ' flow top width = 0.659(Ft.)
82 ' ' velocity= 7.820(Ft/s)
83 ' ' area = 0.109(Sq.Ft)
84 ' ' Froude number = 3.395
85
86 Upstream point elevation = 716.970(Ft.)
87 Downstream point elevation = 653.890(Ft.)
88 Flow length = 144.000(Ft.)
89 Travel time = 0.31 min.
90 Time of concentration = 4.04 min.
91 Depth of flow = 0.330(Ft.)
92 Average velocity = 7.820(Ft/s)
93 Total irregular channel flow = 0.849(CFS)
94 Irregular channel normal depth above invert elev. = 0.330(Ft.)
95 Average velocity of channel(s) = 7.820(Ft/s)
96 Adding area flow to channel
97 Calculated TC of 4.036 minutes is less than 5 minutes,
98 resetting TC to 5.0 minutes for rainfall intensity calculations
99 Rainfall intensity (I) = 8.695(In/Hr) for a 100.0 year storm
100 Decimal fraction soil group A = 0.000
101 Decimal fraction soil group B = 0.000
102 Decimal fraction soil group C = 0.000
103 Decimal fraction soil group D = 1.000
104 [UNDISTURBED NATURAL TERRAIN ]
105 (Permanent Open Space )
106 Impervious value, Ai = 0.000
107 Sub-Area C Value = 0.350
108 Rainfall intensity = 8.695(In/Hr) for a 100.0 year storm
109 Effective runoff coefficient used for total area
110 (Q=KCIA) is C = 0.350 CA = 0.138
111 Subarea runoff = 0.700(CFS) for 0.230(Ac.)
112 Total runoff = 1.199(CFS) Total area = 0.394(Ac.)
113 Depth of flow = 0.375(Ft.), Average velocity = 8.525(Ft/s)
114
115
116 ++++++
117 Process from Point/Station 303.000 to Point/Station 304.000
118 **** IRREGULAR CHANNEL FLOW TRAVEL TIME ****
119
120 -----
121 Depth of flow = 0.454(Ft.), Average velocity = 5.820(Ft/s)
122 ***** Irregular Channel Data *****
123 -----
124 Information entered for subchannel number 1 :
125 Point number 'X' coordinate 'Y' coordinate
126 1 0.00 1.00
127 2 1.00 0.00
128 3 2.00 1.00
129 Manning's 'N' friction factor = 0.030
130 -----
131 Sub-Channel flow = 1.199(CFS)
132 ' ' flow top width = 0.908(Ft.)
133 ' ' velocity= 5.820(Ft/s)
134 ' ' area = 0.206(Sq.Ft)
135 ' ' Froude number = 2.153
136
137 Upstream point elevation = 653.890(Ft.)
138 Downstream point elevation = 615.580(Ft.)
139 Flow length = 242.000(Ft.)

```

```

139 Travel time = 0.69 min.
140 Time of concentration = 4.73 min.
141 Depth of flow = 0.454(Ft.)
142 Average velocity = 5.820(Ft/s)
143 Total irregular channel flow = 1.199(CFS)
144 Irregular channel normal depth above invert elev. = 0.454(Ft.)
145 Average velocity of channel(s) = 5.820(Ft/s)
146
147
148 ++++++
149 Process from Point/Station 304.000 to Point/Station 304.000
150 **** CONFLUENCE OF MINOR STREAMS ****
151
152 -----
153 Along Main Stream number: 1 in normal stream number 1
154 Stream flow area = 0.394(Ac.)
155 Runoff from this stream = 1.199(CFS)
156 Time of concentration = 4.73 min.
157 Rainfall intensity = 8.695(In/Hr)
158
159 ++++++
160 Process from Point/Station 401.000 to Point/Station 402.000
161 **** INITIAL AREA EVALUATION ****
162
163 -----
164 Decimal fraction soil group A = 0.000
165 Decimal fraction soil group B = 0.000
166 Decimal fraction soil group C = 0.000
167 Decimal fraction soil group D = 1.000
168 [UNDISTURBED NATURAL TERRAIN ]
169 (Permanent Open Space )
170 Impervious value, Ai = 0.000
171 Sub-Area C Value = 0.350
172 Initial subarea total flow distance = 100.000(Ft.)
173 Highest elevation = 762.950(Ft.)
174 Lowest elevation = 728.910(Ft.)
175 Elevation difference = 34.040(Ft.) Slope = 34.040 %
176 INITIAL AREA TIME OF CONCENTRATION CALCULATIONS:
177 The maximum overland flow distance is 100.00 (Ft)
178 for the top area slope value of 34.04 %, in a development type of
179 Permanent Open Space
180 In Accordance With Figure 3-3
181 Initial Area Time of Concentration = 4.17 minutes
182 TC = [1.8*(1.1-C)*distance(Ft.)^0.5]/(% slope^(1/3))
183 TC = [1.8*(1.1-0.3500)*( 100.000^0.5)]/( 34.040^(1/3))= 4.17
184 Calculated TC of 4.166 minutes is less than 5 minutes,
185 resetting TC to 5.0 minutes for rainfall intensity calculations
186 Rainfall intensity (I) = 8.695(In/Hr) for a 100.0 year storm
187 Effective runoff coefficient used for area (Q=KCIA) is C = 0.350
188 Subarea runoff = 0.173(CFS)
189 Total initial stream area = 0.057(Ac.)
190
191 ++++++
192 Process from Point/Station 402.000 to Point/Station 304.000
193 **** IRREGULAR CHANNEL FLOW TRAVEL TIME ****
194
195 -----
196 Estimated mean flow rate at midpoint of channel = 1.999(CFS)
197 Depth of flow = 0.468(Ft.), Average velocity = 9.130(Ft/s)
198 ***** Irregular Channel Data *****
199
200 -----
201 Information entered for subchannel number 1 :
202 Point number 'X' coordinate 'Y' coordinate
203 1 0.00 1.00
204 2 1.00 0.00
205 3 2.00 1.00
206 Manning's 'N' friction factor = 0.030
207 -----
208 Sub-Channel flow = 1.999(CFS)
209 ' ' flow top width = 0.936(Ft.)

```



```

208      '      '      velocity=      9.130(Ft/s)
209      '      '      area =      0.219(Sq.Ft)
210      '      '      Froude number =      3.326
211
212 Upstream point elevation =      728.910(Ft.)
213 Downstream point elevation =      615.580(Ft.)
214 Flow length =      303.000(Ft.)
215 Travel time =      0.55 min.
216 Time of concentration =      4.72 min.
217 Depth of flow =      0.468(Ft.)
218 Average velocity =      9.130(Ft/s)
219 Total irregular channel flow =      1.999(CFS)
220 Irregular channel normal depth above invert elev. =      0.468(Ft.)
221 Average velocity of channel(s) =      9.130(Ft/s)
222 Adding area flow to channel
223 Calculated TC of      4.719 minutes is less than 5 minutes,
224 resetting TC to 5.0 minutes for rainfall intensity calculations
225 Rainfall intensity (I) =      8.695(In/Hr) for a 100.0 year storm
226 Decimal fraction soil group A = 0.000
227 Decimal fraction soil group B = 0.000
228 Decimal fraction soil group C = 0.000
229 Decimal fraction soil group D = 1.000
230 [UNDISTURBED NATURAL TERRAIN ]
231 (Permanent Open Space )
232 Impervious value, Ai = 0.000
233 Sub-Area C Value = 0.350
234 Rainfall intensity =      8.695(In/Hr) for a 100.0 year storm
235 Effective runoff coefficient used for total area
236 (Q=KCIA) is C = 0.350 CA =      0.440
237 Subarea runoff =      3.652(CFS) for 1.200(Ac.)
238 Total runoff =      3.825(CFS) Total area =      1.257(Ac.)
239 Depth of flow =      0.597(Ft.), Average velocity = 10.737(Ft/s)
240
241
242 ++++++
243 Process from Point/Station 304.000 to Point/Station 304.000
244 **** CONFLUENCE OF MINOR STREAMS ****
245
246 Along Main Stream number: 1 in normal stream number 2
247 Stream flow area =      1.257(Ac.)
248 Runoff from this stream =      3.825(CFS)
249 Time of concentration =      4.72 min.
250 Rainfall intensity =      8.695(In/Hr)
251 Summary of stream data:
252
253 Stream Flow rate TC Rainfall Intensity
254 No. (CFS) (min) (In/Hr)
255
256
257 1 1.199 4.73 8.695
258 2 3.825 4.72 8.695
259 Qmax(1) =
260 1.000 * 1.000 * 1.199) +
261 1.000 * 1.000 * 3.825) + = 5.024
262 Qmax(2) =
263 1.000 * 0.998 * 1.199) +
264 1.000 * 1.000 * 3.825) + = 5.022
265
266 Total of 2 streams to confluence:
267 Flow rates before confluence point:
268 1.199 3.825
269 Maximum flow rates at confluence using above data:
270 5.024 5.022
271 Area of streams before confluence:
272 0.394 1.257
273 Results of confluence:
274 Total flow rate = 5.024(CFS)
275 Time of concentration = 4.729 min.
276 Effective stream area after confluence = 1.651(Ac.)

```

```

277
278
279 *****
280 Process from Point/Station      304.000 to Point/Station      305.000
281 **** PIPEFLOW TRAVEL TIME (User specified size) ****
282
283 Upstream point/station elevation =  601.580(Ft.)
284 Downstream point/station elevation =  600.300(Ft.)
285 Pipe length =  19.00(Ft.) Slope =  0.0674 Manning's N = 0.013
286 No. of pipes = 1 Required pipe flow =  5.024(CFS)
287 Given pipe size =  18.00(In.)
288 Calculated individual pipe flow =  5.024(CFS)
289 Normal flow depth in pipe =  5.23(In.)
290 Flow top width inside pipe =  16.35(In.)
291 Critical Depth =  10.35(In.)
292 Pipe flow velocity =  11.77(Ft/s)
293 Travel time through pipe =  0.03 min.
294 Time of concentration (TC) =  4.76 min.
295
296
297 *****
298 Process from Point/Station      305.000 to Point/Station      305.000
299 **** CONFLUENCE OF MINOR STREAMS ****
300
301 Along Main Stream number: 1 in normal stream number 1
302 Stream flow area =  1.651(Ac.)
303 Runoff from this stream =  5.024(CFS)
304 Time of concentration =  4.76 min.
305 Rainfall intensity =  8.695(In/Hr)
306
307
308 *****
309 Process from Point/Station      501.000 to Point/Station      502.000
310 **** INITIAL AREA EVALUATION ****
311
312 Decimal fraction soil group A = 0.000
313 Decimal fraction soil group B = 0.000
314 Decimal fraction soil group C = 0.000
315 Decimal fraction soil group D = 1.000
316 [UNDISTURBED NATURAL TERRAIN          ]
317 (Permanent Open Space    )
318 Impervious value, Ai = 0.000
319 Sub-Area C Value = 0.350
320 Initial subarea total flow distance = 103.000(Ft.)
321 Highest elevation = 718.880(Ft.)
322 Lowest elevation = 698.000(Ft.)
323 Elevation difference = 20.880(Ft.) Slope = 20.272 %
324 INITIAL AREA TIME OF CONCENTRATION CALCULATIONS:
325 The maximum overland flow distance is 100.00 (Ft)
326 for the top area slope value of 20.27 %, in a development type of
327 Permanent Open Space
328 In Accordance With Figure 3-3
329 Initial Area Time of Concentration = 4.95 minutes
330  $TC = [1.8 * (1.1 - C) * distance(Ft.)^{.5} / (% slope^{(1/3)})]$ 
331  $TC = [1.8 * (1.1 - 0.3500) * (100.000^{.5}) / (20.272^{(1/3)})] = 4.95$ 
332 Calculated TC of 4.951 minutes is less than 5 minutes,
333 resetting TC to 5.0 minutes for rainfall intensity calculations
334 Rainfall intensity (I) = 8.695(In/Hr) for a 100.0 year storm
335 Effective runoff coefficient used for area (Q=KCIA) is C = 0.350
336 Subarea runoff = 0.259(CFS)
337 Total initial stream area = 0.085(Ac.)
338
339
340 *****
341 Process from Point/Station      502.000 to Point/Station      503.000
342 **** IRREGULAR CHANNEL FLOW TRAVEL TIME ****
343
344 Estimated mean flow rate at midpoint of channel = 1.945(CFS)
345 Depth of flow = 0.480(Ft.), Average velocity = 8.454(Ft/s)

```

```

346          ***** Irregular Channel Data *****
347          -----
348          Information entered for subchannel number 1 :
349          Point number      'X' coordinate      'Y' coordinate
350              1              0.00              1.00
351              2              1.00              0.00
352              3              2.00              1.00
353          Manning's 'N' friction factor =    0.030
354          -----
355          Sub-Channel flow =    1.945(CFS)
356          '      '      flow top width =    0.959(Ft.)
357          '      '      velocity=    8.455(Ft/s)
358          '      '      area =    0.230(Sq.Ft)
359          '      '      Froude number =    3.042
360
361          Upstream point elevation =    698.000(Ft.)
362          Downstream point elevation =    624.440(Ft.)
363          Flow length =    237.000(Ft.)
364          Travel time =    0.47 min.
365          Time of concentration =    5.42 min.
366          Depth of flow =    0.480(Ft.)
367          Average velocity =    8.454(Ft/s)
368          Total irregular channel flow =    1.945(CFS)
369          Irregular channel normal depth above invert elev. =    0.480(Ft.)
370          Average velocity of channel(s) =    8.454(Ft/s)
371          Adding area flow to channel
372          Rainfall intensity (I) =    8.256(In/Hr) for a    100.0 year storm
373          Decimal fraction soil group A =    0.000
374          Decimal fraction soil group B =    0.000
375          Decimal fraction soil group C =    0.000
376          Decimal fraction soil group D =    1.000
377          [UNDISTURBED NATURAL TERRAIN
378          (Permanent Open Space )
379          Impervious value, Ai =    0.000
380          Sub-Area C Value =    0.350
381          Rainfall intensity =    8.256(In/Hr) for a    100.0 year storm
382          Effective runoff coefficient used for total area
383          (Q=KCIA) is C =    0.350 CA =    0.428
384          Subarea runoff =    3.278(CFS) for    1.139(Ac.)
385          Total runoff =    3.537(CFS) Total area =    1.224(Ac.)
386          Depth of flow =    0.600(Ft.), Average velocity =    9.818(Ft/s)
387
388
389          +-----+
390          Process from Point/Station    503.000 to Point/Station    504.000
391          **** PIPEFLOW TRAVEL TIME (User specified size) ****
392
393          -----
394          Upstream point/station elevation =    608.370(Ft.)
395          Downstream point/station elevation =    603.190(Ft.)
396          Pipe length =    30.00(Ft.) Slope =    0.1727 Manning's N =    0.013
397          No. of pipes =    1 Required pipe flow =    3.537(CFS)
398          Given pipe size =    12.00(In.)
399          Calculated individual pipe flow =    3.537(CFS)
400          Normal flow depth in pipe =    3.99(In.)
401          Flow top width inside pipe =    11.31(In.)
402          Critical Depth =    9.64(In.)
403          Pipe flow velocity =    15.47(Ft/s)
404          Travel time through pipe =    0.03 min.
405          Time of concentration (TC) =    5.45 min.
406
407
408          +-----+
409          Process from Point/Station    504.000 to Point/Station    305.000
410          **** PIPEFLOW TRAVEL TIME (User specified size) ****
411
412          -----
413          Upstream point/station elevation =    603.190(Ft.)
414          Downstream point/station elevation =    600.300(Ft.)
415          Pipe length =    274.00(Ft.) Slope =    0.0105 Manning's N =    0.013
416          No. of pipes =    1 Required pipe flow =    3.537(CFS)

```

Given pipe size = 18.00(In.)
Calculated individual pipe flow = 3.537(CFS)
Normal flow depth in pipe = 7.09(In.)
Flow top width inside pipe = 17.59(In.)
Critical Depth = 8.61(In.)
Pipe flow velocity = 5.47(Ft/s)
Travel time through pipe = 0.84 min.
Time of concentration (TC) = 6.29 min.

Process from Point/Station 305.000 to Point/Station 305.000
**** CONFLUENCE OF MINOR STREAMS ****

Along Main Stream number: 1 in normal stream number 2
Stream flow area = 1.224(Ac.)
Runoff from this stream = 3.537(CFS)
Time of concentration = 6.29 min.
Rainfall intensity = 7.501(In/Hr)
Summary of stream data:

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

1	5.024	4.76	8.695
2	3.537	6.29	7.501

Qmax(1) =
1.000 * 1.000 * 5.024) +
1.000 * 0.757 * 3.537) + = 7.700
Qmax(2) =
0.863 * 1.000 * 5.024) +
1.000 * 1.000 * 3.537) + = 7.871

Total of 2 streams to confluence:
Flow rates before confluence point:
5.024 3.537

Maximum flow rates at confluence using above data:
7.700 7.871

Area of streams before confluence:
1.651 1.224

Results of confluence:
Total flow rate = 7.871(CFS)
Time of concentration = 6.286 min.
Effective stream area after confluence = 2.875(Ac.)
End of computations, total study area = 2.875 (Ac.)

```

San Diego County Rational Hydrology Program
CIVILCADD/CIVILDESIGN Engineering Software,(c)1991-2019 Version 9.1
Rational method hydrology program based on
San Diego County Flood Control Division 2003 hydrology manual
Rational Hydrology Study Date: 09/08/22
-----
22027 PRE POC3

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

Program License Serial Number 6332

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

Map data precipitation entered:
6 hour, precipitation(inches) = 3.300
24 hour precipitation(inches) = 5.600
P6/P24 = 58.9%
San Diego hydrology manual 'C' values used

+++++
Process from Point/Station 601.000 to Point/Station 602.000
**** INITIAL AREA EVALUATION ****
-----
Decimal fraction soil group A = 0.000
Decimal fraction soil group B = 0.000
Decimal fraction soil group C = 0.000
Decimal fraction soil group D = 1.000
[UNDISTURBED NATURAL TERRAIN ]
(Permanent Open Space )
Impervious value, Ai = 0.000
Sub-Area C Value = 0.350
Initial subarea total flow distance = 100.000(Ft.)
Highest elevation = 751.000(Ft.)
Lowest elevation = 735.950(Ft.)
Elevation difference = 15.050(Ft.) Slope = 15.050 %
INITIAL AREA TIME OF CONCENTRATION CALCULATIONS:
The maximum overland flow distance is 100.00 (Ft)
for the top area slope value of 15.05 %, in a development type of
Permanent Open Space
In Accordance With Figure 3-3
Initial Area Time of Concentration = 5.47 minutes
TC = [1.8*(1.1-C)*distance(Ft.)^.5]/(% slope^(1/3)]
TC = [1.8*(1.1-0.3500)*( 100.000^.5)]/( 15.050^(1/3)]= 5.47
Rainfall intensity (I) = 8.207(In/Hr) for a 100.0 year storm
Effective runoff coefficient used for area (Q=KCIA) is C = 0.350
Subarea runoff = 0.158(CFS)
Total initial stream area = 0.055(Ac.)

+++++
Process from Point/Station 602.000 to Point/Station 603.000
**** IRREGULAR CHANNEL FLOW TRAVEL TIME ****
-----
Estimated mean flow rate at midpoint of channel = 1.016(CFS)
Depth of flow = 0.414(Ft.), Average velocity = 5.943(Ft/s)
***** Irregular Channel Data *****

```



```

70 -----
71 Information entered for subchannel number 1 :
72 Point number      'X' coordinate      'Y' coordinate
73     1              0.00              1.00
74     2              1.00              0.00
75     3              2.00              1.00
76 Manning's 'N' friction factor = 0.030
77 -----
78 Sub-Channel flow = 1.016(CFS)
79     '      flow top width = 0.827(Ft.)
80     '      velocity= 5.943(Ft/s)
81     '      area = 0.171(Sq.Ft)
82     '      Froude number = 2.303
83
84 Upstream point elevation = 735.950(Ft.)
85 Downstream point elevation = 681.000(Ft.)
86 Flow length = 294.000(Ft.)
87 Travel time = 0.82 min.
88 Time of concentration = 6.29 min.
89 Depth of flow = 0.414(Ft.)
90 Average velocity = 5.943(Ft/s)
91 Total irregular channel flow = 1.016(CFS)
92 Irregular channel normal depth above invert elev. = 0.414(Ft.)
93 Average velocity of channel(s) = 5.943(Ft/s)
94 Adding area flow to channel
95 Rainfall intensity (I) = 7.496(In/Hr) for a 100.0 year storm
96 Decimal fraction soil group A = 0.000
97 Decimal fraction soil group B = 0.000
98 Decimal fraction soil group C = 0.000
99 Decimal fraction soil group D = 1.000
100 [UNDISTURBED NATURAL TERRAIN ]
101 (Permanent Open Space )
102 Impervious value, Ai = 0.000
103 Sub-Area C Value = 0.350
104 Rainfall intensity = 7.496(In/Hr) for a 100.0 year storm
105 Effective runoff coefficient used for total area
106 (Q=KCIA) is C = 0.350 CA = 0.239
107 Subarea runoff = 1.631(CFS) for 0.627(Ac.)
108 Total runoff = 1.789(CFS) Total area = 0.682(Ac.)
109 Depth of flow = 0.511(Ft.), Average velocity = 6.846(Ft/s)
110
111
112 +-----+
113 Process from Point/Station 604.000 to Point/Station 605.000
114 **** IRREGULAR CHANNEL FLOW TRAVEL TIME ****
115
116 -----
117 Depth of flow = 0.459(Ft.), Average velocity = 8.510(Ft/s)
118 ***** Irregular Channel Data *****
119 -----
120 Information entered for subchannel number 1 :
121 Point number      'X' coordinate      'Y' coordinate
122     1              0.00              1.00
123     2              1.00              0.00
124     3              2.00              1.00
125 Manning's 'N' friction factor = 0.030
126 -----
127 Sub-Channel flow = 1.789(CFS)
128     '      flow top width = 0.917(Ft.)
129     '      velocity= 8.510(Ft/s)
130     '      area = 0.210(Sq.Ft)
131     '      Froude number = 3.132
132
133 Upstream point elevation = 694.000(Ft.)
134 Downstream point elevation = 650.260(Ft.)
135 Flow length = 131.000(Ft.)
136 Travel time = 0.26 min.
137 Time of concentration = 6.55 min.
138 Depth of flow = 0.459(Ft.)
139 Average velocity = 8.510(Ft/s)

```

```

139 Total irregular channel flow = 1.789(CFS)
140 Irregular channel normal depth above invert elev. = 0.459(Ft.)
141 Average velocity of channel(s) = 8.510(Ft/s)
142
143
144 ++++++
145 Process from Point/Station 606.000 to Point/Station 607.000
146 **** IRREGULAR CHANNEL FLOW TRAVEL TIME ****
147
148 Depth of flow = 0.454(Ft.), Average velocity = 8.696(Ft/s)
149 ***** Irregular Channel Data *****
150 -----
151 Information entered for subchannel number 1 :
152 Point number 'X' coordinate 'Y' coordinate
153 1 0.00 1.00
154 2 1.00 0.00
155 3 2.00 1.00
156 Manning's 'N' friction factor = 0.030
157 -----
158 Sub-Channel flow = 1.789(CFS)
159 ' ' flow top width = 0.907(Ft.)
160 ' ' velocity= 8.696(Ft/s)
161 ' ' area = 0.206(Sq.Ft)
162 ' ' Froude number = 3.218
163
164 Upstream point elevation = 680.820(Ft.)
165 Downstream point elevation = 600.520(Ft.)
166 Flow length = 227.000(Ft.)
167 Travel time = 0.44 min.
168 Time of concentration = 6.98 min.
169 Depth of flow = 0.454(Ft.)
170 Average velocity = 8.696(Ft/s)
171 Total irregular channel flow = 1.789(CFS)
172 Irregular channel normal depth above invert elev. = 0.454(Ft.)
173 Average velocity of channel(s) = 8.696(Ft/s)
174
175
176 ++++++
177 Process from Point/Station 608.000 to Point/Station 607.000
178 **** SUBAREA FLOW ADDITION ****
179
180 Rainfall intensity (I) = 7.009(In/Hr) for a 100.0 year storm
181 Decimal fraction soil group A = 0.000
182 Decimal fraction soil group B = 0.000
183 Decimal fraction soil group C = 0.000
184 Decimal fraction soil group D = 1.000
185 [UNDISTURBED NATURAL TERRAIN ]
186 (Permanent Open Space )
187 Impervious value, Ai = 0.000
188 Sub-Area C Value = 0.350
189 Time of concentration = 6.98 min.
190 Rainfall intensity = 7.009(In/Hr) for a 100.0 year storm
191 Effective runoff coefficient used for total area
192 (Q=KCIA) is C = 0.350 CA = 0.310
193 Subarea runoff = 0.382(CFS) for 0.203(Ac.)
194 Total runoff = 2.171(CFS) Total area = 0.885(Ac.)
195 End of computations, total study area = 0.885 (Ac.)
196
197
198

```

6b. CivilD Post-Development Calculations

San Diego County Rational Hydrology Program
CIVILCADD/CIVILDESIGN Engineering Software, (c)1991-2019 Version 9.1
Rational method hydrology program based on
San Diego County Flood Control Division 2003 hydrology manual
Rational Hydrology Study Date: 06/14/23

22027 POST POC1
UPDATED

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

Program License Serial Number 6332

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

Map data precipitation entered:
6 hour, precipitation(inches) = 3.300
24 hour precipitation(inches) = 5.600
P6/P24 = 58.9%
San Diego hydrology manual 'C' values used

Process from Point/Station 101.000 to Point/Station 102.000
**** INITIAL AREA EVALUATION ****

Decimal fraction soil group A = 0.000
Decimal fraction soil group B = 0.000
Decimal fraction soil group C = 0.000
Decimal fraction soil group D = 1.000
[INDUSTRIAL area type]
(General Industrial)
Impervious value, Ai = 0.950
Sub-Area C Value = 0.870
Initial subarea total flow distance = 27.000 (Ft.)
Highest elevation = 711.850 (Ft.)
Lowest elevation = 711.150 (Ft.)
Elevation difference = 0.700 (Ft.) Slope = 2.593 %
Top of Initial Area Slope adjusted by User to 0.750 %
INITIAL AREA TIME OF CONCENTRATION CALCULATIONS:
The maximum overland flow distance is 60.00 (Ft)
for the top area slope value of 0.75 %, in a development type of
General Industrial
In Accordance With Figure 3-3
Initial Area Time of Concentration = 3.53 minutes
 $TC = [1.8 * (1.1 - C) * distance(Ft.)^{.5} / (% slope^{(1/3)})]$
 $TC = [1.8 * (1.1 - 0.8700) * (60.000^{.5}) / (0.750^{(1/3)})] = 3.53$
Calculated TC of 3.530 minutes is less than 5 minutes,
resetting TC to 5.0 minutes for rainfall intensity calculations
Rainfall intensity (I) = 8.695 (In/Hr) for a 100.0 year storm
Effective runoff coefficient used for area (Q=KCIA) is C = 0.870
Subarea runoff = 0.325 (CFS)
Total initial stream area = 0.043 (Ac.)

Process from Point/Station 102.000 to Point/Station 102.100
**** IRREGULAR CHANNEL FLOW TRAVEL TIME ****

```

70 Estimated mean flow rate at midpoint of channel = 1.589 (CFS)
71 Depth of flow = 0.877 (Ft.), Average velocity = 1.598 (Ft/s)
72 ***** Irregular Channel Data *****
73 -----
74 Information entered for subchannel number 1 :
75 Point number 'X' coordinate 'Y' coordinate
76 1 0.00 1.00
77 2 14.00 0.70
78 3 14.50 0.00
79 4 14.50 1.00
80 Manning's 'N' friction factor = 0.015
81 -----
82 Sub-Channel flow = 1.589 (CFS)
83 ' ' flow top width = 8.758 (Ft.)
84 ' ' velocity= 1.598 (Ft/s)
85 ' ' area = 0.994 (Sq.Ft)
86 ' ' Froude number = 0.836
87
88 Upstream point elevation = 711.150 (Ft.)
89 Downstream point elevation = 709.890 (Ft.)
90 Flow length = 223.000 (Ft.)
91 Travel time = 2.33 min.
92 Time of concentration = 5.85 min.
93 Depth of flow = 0.877 (Ft.)
94 Average velocity = 1.598 (Ft/s)
95 Total irregular channel flow = 1.589 (CFS)
96 Irregular channel normal depth above invert elev. = 0.877 (Ft.)
97 Average velocity of channel(s) = 1.598 (Ft/s)
98 Adding area flow to channel
99 Rainfall intensity (I) = 7.853 (In/Hr) for a 100.0 year storm
100 Decimal fraction soil group A = 0.000
101 Decimal fraction soil group B = 0.000
102 Decimal fraction soil group C = 0.000
103 Decimal fraction soil group D = 1.000
104 [INDUSTRIAL area type ]
105 (General Industrial )
106 Impervious value, Ai = 0.950
107 Sub-Area C Value = 0.870
108 Rainfall intensity = 7.853 (In/Hr) for a 100.0 year storm
109 Effective runoff coefficient used for total area
110 (Q=KCIA) is C = 0.870 CA = 0.353
111 Subarea runoff = 2.449 (CFS) for 0.363 (Ac.)
112 Total runoff = 2.774 (CFS) Total area = 0.406 (Ac.)
113 Depth of flow = 0.929 (Ft.), Average velocity = 1.826 (Ft/s)
114
115
116 +-----+
117 Process from Point/Station 102.100 to Point/Station 103.000
118 **** IRREGULAR CHANNEL FLOW TRAVEL TIME ****
119
120 -----
121 Estimated mean flow rate at midpoint of channel = 4.012 (CFS)
122 Depth of flow = 0.944 (Ft.), Average velocity = 2.373 (Ft/s)
123 ***** Irregular Channel Data *****
124 -----
125 Information entered for subchannel number 1 :
126 Point number 'X' coordinate 'Y' coordinate
127 1 0.00 1.00
128 2 14.00 0.70
129 3 14.50 0.00
130 4 14.50 1.00
131 Manning's 'N' friction factor = 0.015
132 -----
133 Sub-Channel flow = 4.012 (CFS)
134 ' ' flow top width = 11.903 (Ft.)
135 ' ' velocity= 2.373 (Ft/s)
136 ' ' area = 1.690 (Sq.Ft)
137 ' ' Froude number = 1.110
138
139 Upstream point elevation = 709.890 (Ft.)

```



```

139 Downstream point elevation = 706.410 (Ft.)
140 Flow length = 391.000 (Ft.)
141 Travel time = 2.75 min.
142 Time of concentration = 8.60 min.
143 Depth of flow = 0.944 (Ft.)
144 Average velocity = 2.373 (Ft/s)
145 Total irregular channel flow = 4.012 (CFS)
146 Irregular channel normal depth above invert elev. = 0.944 (Ft.)
147 Average velocity of channel(s) = 2.373 (Ft/s)
148 Adding area flow to channel
149 Rainfall intensity (I) = 6.128 (In/Hr) for a 100.0 year storm
150 Decimal fraction soil group A = 0.000
151 Decimal fraction soil group B = 0.000
152 Decimal fraction soil group C = 0.000
153 Decimal fraction soil group D = 1.000
154 [INDUSTRIAL area type ]
155 (General Industrial )
156 Impervious value, Ai = 0.950
157 Sub-Area C Value = 0.870
158 Rainfall intensity = 6.128 (In/Hr) for a 100.0 year storm
159 Effective runoff coefficient used for total area
160 (Q=KCIA) is C = 0.870 CA = 0.848
161 Subarea runoff = 2.424 (CFS) for 0.569 (Ac.)
162 Total runoff = 5.198 (CFS) Total area = 0.975 (Ac.)
163 Depth of flow = 0.973 (Ft.), Average velocity = 2.530 (Ft/s)
164
165
166 ++++++
167 Process from Point/Station 103.000 to Point/Station 103.000
168 **** CONFLUENCE OF MINOR STREAMS ****
169
170 Along Main Stream number: 1 in normal stream number 1
171 Stream flow area = 0.975 (Ac.)
172 Runoff from this stream = 5.198 (CFS)
173 Time of concentration = 8.60 min.
174 Rainfall intensity = 6.128 (In/Hr)
175
176
177 ++++++
178 Process from Point/Station 201.000 to Point/Station 202.000
179 **** INITIAL AREA EVALUATION ****
180
181 Decimal fraction soil group A = 0.000
182 Decimal fraction soil group B = 0.000
183 Decimal fraction soil group C = 0.000
184 Decimal fraction soil group D = 1.000
185 [INDUSTRIAL area type ]
186 (General Industrial )
187 Impervious value, Ai = 0.950
188 Sub-Area C Value = 0.870
189 Initial subarea total flow distance = 60.000 (Ft.)
190 Highest elevation = 711.570 (Ft.)
191 Lowest elevation = 711.050 (Ft.)
192 Elevation difference = 0.520 (Ft.) Slope = 0.867 %
193 Top of Initial Area Slope adjusted by User to 1.430 %
194 INITIAL AREA TIME OF CONCENTRATION CALCULATIONS:
195 The maximum overland flow distance is 60.00 (Ft)
196 for the top area slope value of 1.43 %, in a development type of
197 General Industrial
198 In Accordance With Figure 3-3
199 Initial Area Time of Concentration = 2.85 minutes
200 TC = [1.8*(1.1-C)*distance(Ft.)^.5]/(% slope^(1/3)]
201 TC = [1.8*(1.1-0.8700)*( 60.000^.5)/ ( 1.430^(1/3)]= 2.85
202 Calculated TC of 2.846 minutes is less than 5 minutes,
203 resetting TC to 5.0 minutes for rainfall intensity calculations
204 Rainfall intensity (I) = 8.695 (In/Hr) for a 100.0 year storm
205 Effective runoff coefficient used for area (Q=KCIA) is C = 0.870
206 Subarea runoff = 0.530 (CFS)
207 Total initial stream area = 0.070 (Ac.)

```

```

208
209
210 *****
211 Process from Point/Station      202.000 to Point/Station      202.100
212 **** IRREGULAR CHANNEL FLOW TRAVEL TIME ****
213
214 -----
215 Estimated mean flow rate at midpoint of channel =      4.122 (CFS)
216 Depth of flow =      1.317 (Ft.), Average velocity =      2.267 (Ft/s)
217 ***** Irregular Channel Data *****
218 -----
219 Information entered for subchannel number 1 :
220 Point number      'X' coordinate      'Y' coordinate
221      1              0.00              1.50
222      2              14.00              1.00
223      3              14.50              0.00
224      4              14.50              1.50
225 Manning's 'N' friction factor =      0.015
226 -----
227 Sub-Channel flow =      4.122 (CFS)
228 '      ' flow top width =      9.384 (Ft.)
229 '      ' velocity =      2.267 (Ft/s)
230 '      ' area =      1.818 (Sq.Ft)
231 '      ' Froude number =      0.908
232
233 Upstream point elevation =      711.050 (Ft.)
234 Downstream point elevation =      707.400 (Ft.)
235 Flow length =      608.000 (Ft.)
236 Travel time =      4.47 min.
237 Time of concentration =      7.32 min.
238 Depth of flow =      1.317 (Ft.)
239 Average velocity =      2.267 (Ft/s)
240 Total irregular channel flow =      4.122 (CFS)
241 Irregular channel normal depth above invert elev. =      1.317 (Ft.)
242 Average velocity of channel(s) =      2.267 (Ft/s)
243 Adding area flow to channel
244 Rainfall intensity (I) =      6.802 (In/Hr) for a      100.0 year storm
245 Decimal fraction soil group A = 0.000
246 Decimal fraction soil group B = 0.000
247 Decimal fraction soil group C = 0.000
248 Decimal fraction soil group D = 1.000
249 [COMMERCIAL area type      ]
250 (Office Professional      )
251 Impervious value, Ai = 0.900
252 Sub-Area C Value = 0.850
253 Rainfall intensity =      6.802 (In/Hr) for a      100.0 year storm
254 Effective runoff coefficient used for total area
255 (Q=KCIA) is C = 0.851 CA =      1.126
256 Subarea runoff =      7.129 (CFS) for      1.253 (Ac.)
257 Total runoff =      7.659 (CFS) Total area =      1.323 (Ac.)
258 Depth of flow =      1.416 (Ft.), Average velocity =      2.653 (Ft/s)
259
260 *****
261 Process from Point/Station      202.100 to Point/Station      103.000
262 **** PIPEFLOW TRAVEL TIME (User specified size) ****
263
264 -----
265 Upstream point/station elevation =      704.400 (Ft.)
266 Downstream point/station elevation =      695.330 (Ft.)
267 Pipe length =      17.00 (Ft.) Slope =      0.5335 Manning's N = 0.013
268 No. of pipes = 1 Required pipe flow =      7.659 (CFS)
269 Given pipe size =      18.00 (In.)
270 Calculated individual pipe flow =      7.659 (CFS)
271 Normal flow depth in pipe =      3.84 (In.)
272 Flow top width inside pipe =      14.75 (In.)
273 Critical Depth =      12.87 (In.)
274 Pipe flow velocity =      27.75 (Ft/s)
275 Travel time through pipe =      0.01 min.
276 Time of concentration (TC) =      7.33 min.

```

```

277
278 ++++++
279 Process from Point/Station      103.000 to Point/Station      103.000
280 **** CONFLUENCE OF MINOR STREAMS ****

```

```

281
282 Along Main Stream number: 1 in normal stream number 2
283 Stream flow area =      1.323 (Ac.)
284 Runoff from this stream =      7.659 (CFS)
285 Time of concentration =      7.33 min.
286 Rainfall intensity =      6.796 (In/Hr)
287 Summary of stream data:
288

```

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

1	5.198	8.60	6.128
2	7.659	7.33	6.796

```

295 Qmax (1) =
296      1.000 *      1.000 *      5.198) +
297      0.902 *      1.000 *      7.659) + =      12.104
298 Qmax (2) =
299      1.000 *      0.852 *      5.198) +
300      1.000 *      1.000 *      7.659) + =      12.086

```

```

301
302 Total of 2 streams to confluence:
303 Flow rates before confluence point:
304      5.198      7.659
305 Maximum flow rates at confluence using above data:
306      12.104      12.086
307 Area of streams before confluence:
308      0.975      1.323
309 Results of confluence:
310 Total flow rate =      12.104 (CFS)
311 Time of concentration =      8.601 min.
312 Effective stream area after confluence =      2.298 (Ac.)

```

```

313
314
315 ++++++
316 Process from Point/Station      103.000 to Point/Station      103.000
317 **** 6 HOUR HYDROGRAPH ****

```

```

318
319 ++++++
320 Hydrograph Data - Section 6, San Diego County Hydrology manual, June 2003

```

```

321
322
323 Time of Concentration =      8.60
324 Basin Area =      2.30 Acres
325 6 Hour Rainfall =      3.300 Inches
326 Runoff Coefficient =      0.859
327 Peak Discharge =      12.10 CFS
328      Time (Min)      Discharge (CFS)
329      0      0.000
330      8      0.389
331      16      0.395
332      24      0.407
333      32      0.413
334      40      0.427
335      48      0.434
336      56      0.450
337      64      0.458
338      72      0.477
339      80      0.486
340      88      0.507
341      96      0.519
342      104      0.544
343      112      0.557
344      120      0.587
345      128      0.604

```

346	136	0.641
347	144	0.663
348	152	0.710
349	160	0.738
350	168	0.802
351	176	0.840
352	184	0.932
353	192	0.988
354	200	1.132
355	208	1.228
356	216	1.501
357	224	1.709
358	232	2.510
359	240	3.536
360	248	12.104
361	256	2.013
362	264	1.347
363	272	1.054
364	280	0.883
365	288	0.768
366	296	0.685
367	304	0.622
368	312	0.572
369	320	0.531
370	328	0.496
371	336	0.467
372	344	0.442
373	352	0.420
374	360	0.401
375	368	0.384

+++++

6 - H O U R S T O R M

R u n o f f H y d r o g r a p h

Hydrograph in 1 Minute intervals ((CFS))

Time (h+m)	Volume	Ac.Ft	Q (CFS)	0	3.0	6.1	9.1	12.1
0+ 0	0.0000		0.00	Q				
0+ 1	0.0001		0.05	Q				
0+ 2	0.0002		0.10	Q				
0+ 3	0.0004		0.15	Q				
0+ 4	0.0007		0.19	Q				
0+ 5	0.0010		0.24	Q				
0+ 6	0.0014		0.29	Q				
0+ 7	0.0019		0.34	VQ				
0+ 8	0.0024		0.39	VQ				
0+ 9	0.0029		0.39	VQ				
0+10	0.0035		0.39	VQ				
0+11	0.0040		0.39	VQ				
0+12	0.0046		0.39	VQ				
0+13	0.0051		0.39	VQ				
0+14	0.0056		0.39	VQ				
0+15	0.0062		0.39	VQ				
0+16	0.0067		0.39	VQ				
0+17	0.0073		0.40	VQ				
0+18	0.0078		0.40	VQ				
0+19	0.0084		0.40	VQ				
0+20	0.0089		0.40	VQ				
0+21	0.0095		0.40	VQ				
0+22	0.0100		0.40	VQ				
0+23	0.0106		0.41	VQ				
0+24	0.0112		0.41	VQ				
0+25	0.0117		0.41	VQ				
0+26	0.0123		0.41	VQ				
0+27	0.0128		0.41	VQ				
0+28	0.0134		0.41	IQ				
0+29	0.0140		0.41	IQ				

415	0+30	0.0145	0.41	I Q				
416	0+31	0.0151	0.41	I Q				
417	0+32	0.0157	0.41	I Q				
418	0+33	0.0163	0.42	I Q				
419	0+34	0.0168	0.42	I Q				
420	0+35	0.0174	0.42	I Q				
421	0+36	0.0180	0.42	I Q				
422	0+37	0.0186	0.42	I Q				
423	0+38	0.0192	0.42	I Q				
424	0+39	0.0197	0.43	I Q				
425	0+40	0.0203	0.43	I Q				
426	0+41	0.0209	0.43	I Q				
427	0+42	0.0215	0.43	I Q				
428	0+43	0.0221	0.43	I Q				
429	0+44	0.0227	0.43	I Q				
430	0+45	0.0233	0.43	I Q				
431	0+46	0.0239	0.43	I Q				
432	0+47	0.0245	0.43	I Q				
433	0+48	0.0251	0.43	I Q				
434	0+49	0.0257	0.44	I Q				
435	0+50	0.0263	0.44	I Q				
436	0+51	0.0269	0.44	I Q V				
437	0+52	0.0275	0.44	I Q V				
438	0+53	0.0281	0.44	I Q V				
439	0+54	0.0287	0.45	I Q V				
440	0+55	0.0293	0.45	I Q V				
441	0+56	0.0300	0.45	I Q V				
442	0+57	0.0306	0.45	I Q V				
443	0+58	0.0312	0.45	I Q V				
444	0+59	0.0318	0.45	I Q V				
445	1+ 0	0.0325	0.45	I Q V				
446	1+ 1	0.0331	0.46	I Q V				
447	1+ 2	0.0337	0.46	I Q V				
448	1+ 3	0.0343	0.46	I Q V				
449	1+ 4	0.0350	0.46	I Q V				
450	1+ 5	0.0356	0.46	I Q V				
451	1+ 6	0.0362	0.46	I Q V				
452	1+ 7	0.0369	0.47	I Q V				
453	1+ 8	0.0375	0.47	I Q V				
454	1+ 9	0.0382	0.47	I Q V				
455	1+10	0.0388	0.47	I Q V				
456	1+11	0.0395	0.47	I Q V				
457	1+12	0.0401	0.48	I Q V				
458	1+13	0.0408	0.48	I Q V				
459	1+14	0.0415	0.48	I Q V				
460	1+15	0.0421	0.48	I Q V				
461	1+16	0.0428	0.48	I Q V				
462	1+17	0.0434	0.48	I Q V				
463	1+18	0.0441	0.48	I Q V				
464	1+19	0.0448	0.48	I Q V				
465	1+20	0.0455	0.49	I Q V				
466	1+21	0.0461	0.49	I Q V				
467	1+22	0.0468	0.49	I Q V				
468	1+23	0.0475	0.49	I Q V				
469	1+24	0.0482	0.50	I Q V				
470	1+25	0.0489	0.50	I Q V				
471	1+26	0.0495	0.50	I Q V				
472	1+27	0.0502	0.50	I Q V				
473	1+28	0.0509	0.51	I Q V				
474	1+29	0.0516	0.51	I Q V				
475	1+30	0.0523	0.51	I Q V				
476	1+31	0.0530	0.51	I Q V				
477	1+32	0.0538	0.51	I Q V				
478	1+33	0.0545	0.51	I Q V				
479	1+34	0.0552	0.52	I Q V				
480	1+35	0.0559	0.52	I Q V				
481	1+36	0.0566	0.52	I Q V				
482	1+37	0.0573	0.52	I Q V				
483	1+38	0.0580	0.52	I Q V				

484	1+39	0.0588	0.53	Q	V					
485	1+40	0.0595	0.53	Q	V					
486	1+41	0.0602	0.53	Q	V					
487	1+42	0.0610	0.54	Q	V					
488	1+43	0.0617	0.54	Q	V					
489	1+44	0.0625	0.54	Q	V					
490	1+45	0.0632	0.55	Q	V					
491	1+46	0.0640	0.55	Q	V					
492	1+47	0.0647	0.55	Q	V					
493	1+48	0.0655	0.55	Q	V					
494	1+49	0.0662	0.55	Q	V					
495	1+50	0.0670	0.55	Q	V					
496	1+51	0.0678	0.56	Q	V					
497	1+52	0.0685	0.56	Q	V					
498	1+53	0.0693	0.56	Q	V					
499	1+54	0.0701	0.56	Q	V					
500	1+55	0.0709	0.57	Q	V					
501	1+56	0.0717	0.57	Q	V					
502	1+57	0.0725	0.58	Q	V					
503	1+58	0.0733	0.58	Q	V					
504	1+59	0.0741	0.58	Q	V					
505	2+ 0	0.0749	0.59	Q	V					
506	2+ 1	0.0757	0.59	Q	V					
507	2+ 2	0.0765	0.59	Q	V					
508	2+ 3	0.0773	0.59	Q	V					
509	2+ 4	0.0781	0.60	Q	V					
510	2+ 5	0.0790	0.60	Q	V					
511	2+ 6	0.0798	0.60	Q	V					
512	2+ 7	0.0806	0.60	Q	V					
513	2+ 8	0.0814	0.60	Q	V					
514	2+ 9	0.0823	0.61	Q	V					
515	2+10	0.0831	0.61	Q	V					
516	2+11	0.0840	0.62	Q	V					
517	2+12	0.0848	0.62	Q	V					
518	2+13	0.0857	0.63	Q	V					
519	2+14	0.0866	0.63	Q	V					
520	2+15	0.0874	0.64	Q	V					
521	2+16	0.0883	0.64	Q	V					
522	2+17	0.0892	0.64	Q	V					
523	2+18	0.0901	0.65	Q	V					
524	2+19	0.0910	0.65	Q	V					
525	2+20	0.0919	0.65	Q	V					
526	2+21	0.0928	0.65	Q	V					
527	2+22	0.0937	0.66	Q	V					
528	2+23	0.0946	0.66	Q	V					
529	2+24	0.0955	0.66	Q	V					
530	2+25	0.0965	0.67	Q	V					
531	2+26	0.0974	0.67	Q	V					
532	2+27	0.0983	0.68	Q	V					
533	2+28	0.0993	0.69	Q	V					
534	2+29	0.1002	0.69	Q	V					
535	2+30	0.1012	0.70	Q	V					
536	2+31	0.1022	0.70	Q	V					
537	2+32	0.1031	0.71	Q	V					
538	2+33	0.1041	0.71	Q	V					
539	2+34	0.1051	0.72	Q	V					
540	2+35	0.1061	0.72	Q	V					
541	2+36	0.1071	0.72	Q	V					
542	2+37	0.1081	0.73	Q	V					
543	2+38	0.1091	0.73	Q	V					
544	2+39	0.1101	0.73	Q	V					
545	2+40	0.1111	0.74	Q	V					
546	2+41	0.1122	0.75	Q	V					
547	2+42	0.1132	0.75	Q	V					
548	2+43	0.1142	0.76	Q	V					
549	2+44	0.1153	0.77	Q	V					
550	2+45	0.1164	0.78	Q	V					
551	2+46	0.1175	0.79	Q	V					
552	2+47	0.1186	0.79	Q	V					

553	2+48	0.1197	0.80		Q	V							
554	2+49	0.1208	0.81		Q	V							
555	2+50	0.1219	0.81		Q	V							
556	2+51	0.1230	0.82		Q	V							
557	2+52	0.1241	0.82		Q	V							
558	2+53	0.1253	0.83		Q	V							
559	2+54	0.1264	0.83		Q	V							
560	2+55	0.1276	0.84		Q	V							
561	2+56	0.1287	0.84		Q	V							
562	2+57	0.1299	0.85		Q	V							
563	2+58	0.1311	0.86		Q	V							
564	2+59	0.1323	0.87		Q	V							
565	3+ 0	0.1335	0.89		Q	V							
566	3+ 1	0.1348	0.90		Q	V							
567	3+ 2	0.1360	0.91		Q	V							
568	3+ 3	0.1373	0.92		Q	V							
569	3+ 4	0.1386	0.93		Q	V							
570	3+ 5	0.1398	0.94		Q	V							
571	3+ 6	0.1411	0.95		Q	V							
572	3+ 7	0.1425	0.95		Q	V							
573	3+ 8	0.1438	0.96		Q	V							
574	3+ 9	0.1451	0.97		Q	V							
575	3+10	0.1465	0.97		Q	V							
576	3+11	0.1478	0.98		Q	V							
577	3+12	0.1492	0.99		Q	V							
578	3+13	0.1506	1.01		Q	V							
579	3+14	0.1520	1.02		Q	V							
580	3+15	0.1534	1.04		Q	V							
581	3+16	0.1549	1.06		Q	V							
582	3+17	0.1563	1.08		Q	V							
583	3+18	0.1579	1.10		Q	V							
584	3+19	0.1594	1.11		Q	V							
585	3+20	0.1609	1.13		Q	V							
586	3+21	0.1625	1.14		Q	V							
587	3+22	0.1641	1.16		Q	V							
588	3+23	0.1657	1.17		Q	V							
589	3+24	0.1674	1.18		Q	V							
590	3+25	0.1690	1.19		Q	V							
591	3+26	0.1707	1.20		Q	V							
592	3+27	0.1723	1.22		Q	V							
593	3+28	0.1740	1.23		Q	V							
594	3+29	0.1758	1.26		Q	V							
595	3+30	0.1775	1.30		Q	V							
596	3+31	0.1794	1.33		Q	V							
597	3+32	0.1813	1.36		Q	V							
598	3+33	0.1832	1.40		Q	V							
599	3+34	0.1852	1.43		Q	V							
600	3+35	0.1872	1.47		Q	V							
601	3+36	0.1892	1.50		Q	V							
602	3+37	0.1913	1.53		Q	V							
603	3+38	0.1935	1.55		Q	V							
604	3+39	0.1957	1.58		Q	V							
605	3+40	0.1979	1.61		Q	V							
606	3+41	0.2001	1.63		Q	V							
607	3+42	0.2024	1.66		Q	V							
608	3+43	0.2047	1.68		Q	V							
609	3+44	0.2071	1.71		Q	V							
610	3+45	0.2096	1.81		Q	V							
611	3+46	0.2122	1.91		Q	V							
612	3+47	0.2150	2.01		Q	V							
613	3+48	0.2179	2.11		Q	V							
614	3+49	0.2209	2.21		Q	V							
615	3+50	0.2241	2.31		Q	V							
616	3+51	0.2274	2.41		Q	V							
617	3+52	0.2309	2.51		Q	V							
618	3+53	0.2345	2.64		Q	V							
619	3+54	0.2383	2.77		Q	V							
620	3+55	0.2423	2.89		Q	V							
621	3+56	0.2465	3.02		Q	V							

622	3+57	0.2508	3.15			Q	V				
623	3+58	0.2553	3.28			Q	V				
624	3+59	0.2600	3.41			Q	V				
625	4+ 0	0.2649	3.54			Q	V				
626	4+ 1	0.2712	4.61				V				
627	4+ 2	0.2791	5.68				Q V				
628	4+ 3	0.2884	6.75				VQ				
629	4+ 4	0.2991	7.82				V Q				
630	4+ 5	0.3114	8.89				V		Q		
631	4+ 6	0.3251	9.96				V		Q		
632	4+ 7	0.3403	11.03				V			Q	
633	4+ 8	0.3570	12.10				V				Q
634	4+ 9	0.3719	10.84				V		Q		
635	4+10	0.3851	9.58				V	Q			
636	4+11	0.3966	8.32				Q V				
637	4+12	0.4063	7.06				Q	V			
638	4+13	0.4143	5.80				Q	V			
639	4+14	0.4205	4.54			Q		V			
640	4+15	0.4250	3.27			Q		V			
641	4+16	0.4278	2.01		Q			V			
642	4+17	0.4305	1.93		Q			V			
643	4+18	0.4330	1.85		Q			V			
644	4+19	0.4354	1.76		Q			V			
645	4+20	0.4377	1.68		Q			V			
646	4+21	0.4399	1.60		Q			V			
647	4+22	0.4420	1.51		Q			V			
648	4+23	0.4440	1.43		Q			V			
649	4+24	0.4458	1.35		Q			V			
650	4+25	0.4477	1.31		Q			V			
651	4+26	0.4494	1.27		Q			V			
652	4+27	0.4511	1.24		Q			V			
653	4+28	0.4528	1.20		Q			V			
654	4+29	0.4544	1.16		Q			V			
655	4+30	0.4559	1.13		Q			V			
656	4+31	0.4574	1.09		Q			V			
657	4+32	0.4589	1.05		Q			V			
658	4+33	0.4603	1.03		Q			V			
659	4+34	0.4617	1.01		Q			V			
660	4+35	0.4631	0.99		Q			V			
661	4+36	0.4644	0.97		Q			V			
662	4+37	0.4657	0.95		Q			V			
663	4+38	0.4670	0.93		Q			V			
664	4+39	0.4682	0.90		Q			V			
665	4+40	0.4694	0.88		Q			V			
666	4+41	0.4706	0.87		Q			V			
667	4+42	0.4718	0.85		Q			V			
668	4+43	0.4730	0.84		Q			V			
669	4+44	0.4741	0.83		Q			V			
670	4+45	0.4752	0.81		Q			V			
671	4+46	0.4763	0.80		Q			V			
672	4+47	0.4774	0.78		Q			V			
673	4+48	0.4784	0.77		Q			V			
674	4+49	0.4795	0.76		Q			V			
675	4+50	0.4805	0.75		Q			V			
676	4+51	0.4815	0.74		Q			V			
677	4+52	0.4825	0.73		Q			V			
678	4+53	0.4835	0.72		Q			V			
679	4+54	0.4845	0.71		Q			V			
680	4+55	0.4855	0.70		Q			V			
681	4+56	0.4864	0.69		Q			V			
682	4+57	0.4873	0.68		Q			V			
683	4+58	0.4883	0.67		Q			V			
684	4+59	0.4892	0.66		Q			V			
685	5+ 0	0.4901	0.65		Q			V			
686	5+ 1	0.4910	0.65		Q			V			
687	5+ 2	0.4918	0.64		Q			V			
688	5+ 3	0.4927	0.63		Q			V			
689	5+ 4	0.4936	0.62		Q			V			
690	5+ 5	0.4944	0.62		Q			V			


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760
761 ++++++
762 Process from Point/Station      103.000 to Point/Station      104.000
763 **** PIPEFLOW TRAVEL TIME (User specified size) ****
764
765 Upstream point/station elevation =  695.330 (Ft.)
766 Downstream point/station elevation =  693.410 (Ft.)
767 Pipe length =  105.00 (Ft.) Slope =  0.0183 Manning's N = 0.013
768 No. of pipes = 1 Required pipe flow =  12.104 (CFS)
769 Given pipe size =  48.00 (In.)
770 Calculated individual pipe flow =  12.104 (CFS)
771 Normal flow depth in pipe =  8.12 (In.)
772 Flow top width inside pipe =  35.99 (In.)
773 Critical Depth =  12.19 (In.)
774 Pipe flow velocity =  8.60 (Ft/s)
775 Travel time through pipe =  0.20 min.
776 Time of concentration (TC) =  8.80 min.
777
778
779 ++++++
780 Process from Point/Station      104.000 to Point/Station      104.000
781 **** SUBAREA FLOW ADDITION ****
782
783 Rainfall intensity (I) =  6.036 (In/Hr) for a  100.0 year storm
784 Decimal fraction soil group A = 0.000
785 Decimal fraction soil group B = 0.000
786 Decimal fraction soil group C = 0.000
787 Decimal fraction soil group D = 1.000
788 [UNDISTURBED NATURAL TERRAIN
789 (Permanent Open Space
790 Impervious value, Ai = 0.000
791 Sub-Area C Value = 0.350
792 Time of concentration =  8.80 min.
793 Rainfall intensity =  6.036 (In/Hr) for a  100.0 year storm
794 Effective runoff coefficient used for total area
795 (Q=KCIA) is C = 0.807 CA =  2.065
796 Subarea runoff =  0.362 (CFS) for  0.260 (Ac.)
797 Total runoff =  12.466 (CFS) Total area =  2.558 (Ac.)
798
799
800 ++++++
801 Process from Point/Station      104.000 to Point/Station      104.000
802 **** SUBAREA FLOW ADDITION ****
803
804 Rainfall intensity (I) =  6.036 (In/Hr) for a  100.0 year storm
805 Decimal fraction soil group A = 0.000
806 Decimal fraction soil group B = 0.000
807 Decimal fraction soil group C = 0.000
808 Decimal fraction soil group D = 1.000
809 [HIGH DENSITY RESIDENTIAL
810 (43.0 DU/A or Less
811 Impervious value, Ai = 0.800
812 Sub-Area C Value = 0.790
813 Time of concentration =  8.80 min.
814 Rainfall intensity =  6.036 (In/Hr) for a  100.0 year storm
815 Effective runoff coefficient used for total area
816 (Q=KCIA) is C = 0.806 CA =  2.290
817 Subarea runoff =  1.354 (CFS) for  0.284 (Ac.)
818 Total runoff =  13.820 (CFS) Total area =  2.842 (Ac.)
819
820
821 ++++++
822 Process from Point/Station      104.000 to Point/Station      104.000
823 **** 6 HOUR HYDROGRAPH ****
824
825 ++++++
826 Hydrograph Data - Section 6, San Diego County Hydrology manual, June 2003
827
828

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829 Time of Concentration = 8.80
830 Basin Area = 2.84 Acres
831 6 Hour Rainfall = 3.300 Inches
832 Runoff Coefficient = 0.806
833 Peak Discharge = 13.82 CFS
834 Time (Min) Discharge (CFS)
835 0 0.000
836 8 0.451
837 16 0.458
838 24 0.472
839 32 0.479
840 40 0.495
841 48 0.504
842 56 0.522
843 64 0.532
844 72 0.553
845 80 0.564
846 88 0.588
847 96 0.601
848 104 0.630
849 112 0.646
850 120 0.681
851 128 0.701
852 136 0.744
853 144 0.768
854 152 0.824
855 160 0.856
856 168 0.930
857 176 0.974
858 184 1.080
859 192 1.146
860 200 1.313
861 208 1.424
862 216 1.741
863 224 1.982
864 232 2.911
865 240 4.101
866 248 13.820
867 256 2.335
868 264 1.562
869 272 1.222
870 280 1.024
871 288 0.891
872 296 0.795
873 304 0.721
874 312 0.663
875 320 0.616
876 328 0.576
877 336 0.542
878 344 0.513
879 352 0.487
880 360 0.465
881 368 0.445

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882 ++++++

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6 - H O U R S T O R M

R u n o f f H y d r o g r a p h

Hydrograph in 1 Minute intervals ((CFS))

Time (h+m)	Volume Ac.Ft	Q (CFS)	0	3.5	6.9	10.4	13.8
0+ 0	0.0000	0.00	Q				
0+ 1	0.0001	0.06	Q				
0+ 2	0.0002	0.11	Q				
0+ 3	0.0005	0.17	Q				
0+ 4	0.0008	0.23	Q				
0+ 5	0.0012	0.28	Q				
0+ 6	0.0016	0.34	Q				

898	0+ 7	0.0022	0.39	VQ				
899	0+ 8	0.0028	0.45	VQ				
900	0+ 9	0.0034	0.45	VQ				
901	0+10	0.0040	0.45	VQ				
902	0+11	0.0047	0.45	VQ				
903	0+12	0.0053	0.45	VQ				
904	0+13	0.0059	0.46	VQ				
905	0+14	0.0066	0.46	VQ				
906	0+15	0.0072	0.46	VQ				
907	0+16	0.0078	0.46	VQ				
908	0+17	0.0084	0.46	VQ				
909	0+18	0.0091	0.46	VQ				
910	0+19	0.0097	0.46	VQ				
911	0+20	0.0104	0.46	VQ				
912	0+21	0.0110	0.47	VQ				
913	0+22	0.0116	0.47	VQ				
914	0+23	0.0123	0.47	VQ				
915	0+24	0.0129	0.47	VQ				
916	0+25	0.0136	0.47	VQ				
917	0+26	0.0142	0.47	VQ				
918	0+27	0.0149	0.47	VQ				
919	0+28	0.0156	0.48	IQ				
920	0+29	0.0162	0.48	IQ				
921	0+30	0.0169	0.48	IQ				
922	0+31	0.0175	0.48	IQ				
923	0+32	0.0182	0.48	IQ				
924	0+33	0.0189	0.48	IQ				
925	0+34	0.0195	0.48	IQ				
926	0+35	0.0202	0.49	IQ				
927	0+36	0.0209	0.49	IQ				
928	0+37	0.0215	0.49	IQ				
929	0+38	0.0222	0.49	IQ				
930	0+39	0.0229	0.49	IQ				
931	0+40	0.0236	0.50	IQ				
932	0+41	0.0243	0.50	IQ				
933	0+42	0.0249	0.50	IQ				
934	0+43	0.0256	0.50	IQ				
935	0+44	0.0263	0.50	IQ				
936	0+45	0.0270	0.50	IQ				
937	0+46	0.0277	0.50	IQ				
938	0+47	0.0284	0.50	IQ				
939	0+48	0.0291	0.50	IQ				
940	0+49	0.0298	0.51	IQ				
941	0+50	0.0305	0.51	IQ				
942	0+51	0.0312	0.51	IQV				
943	0+52	0.0319	0.51	IQV				
944	0+53	0.0326	0.52	IQV				
945	0+54	0.0333	0.52	IQV				
946	0+55	0.0340	0.52	IQV				
947	0+56	0.0347	0.52	IQV				
948	0+57	0.0355	0.52	IQV				
949	0+58	0.0362	0.52	IQV				
950	0+59	0.0369	0.53	IQV				
951	1+ 0	0.0376	0.53	IQV				
952	1+ 1	0.0384	0.53	IQV				
953	1+ 2	0.0391	0.53	IQV				
954	1+ 3	0.0398	0.53	IQV				
955	1+ 4	0.0406	0.53	IQV				
956	1+ 5	0.0413	0.53	IQV				
957	1+ 6	0.0420	0.54	IQV				
958	1+ 7	0.0428	0.54	IQV				
959	1+ 8	0.0435	0.54	IQV				
960	1+ 9	0.0443	0.54	IQV				
961	1+10	0.0450	0.55	IQV				
962	1+11	0.0458	0.55	IQV				
963	1+12	0.0466	0.55	IQ V				
964	1+13	0.0473	0.55	IQ V				
965	1+14	0.0481	0.56	IQ V				
966	1+15	0.0488	0.56	IQ V				

967	1+16	0.0496	0.56	I Q V				
968	1+17	0.0504	0.56	I Q V				
969	1+18	0.0512	0.56	I Q V				
970	1+19	0.0519	0.56	I Q V				
971	1+20	0.0527	0.56	I Q V				
972	1+21	0.0535	0.57	I Q V				
973	1+22	0.0543	0.57	I Q V				
974	1+23	0.0551	0.57	I Q V				
975	1+24	0.0559	0.58	I Q V				
976	1+25	0.0567	0.58	I Q V				
977	1+26	0.0575	0.58	I Q V				
978	1+27	0.0583	0.59	I Q V				
979	1+28	0.0591	0.59	I Q V				
980	1+29	0.0599	0.59	I Q V				
981	1+30	0.0607	0.59	I Q V				
982	1+31	0.0615	0.59	I Q V				
983	1+32	0.0623	0.59	I Q V				
984	1+33	0.0632	0.60	I Q V				
985	1+34	0.0640	0.60	I Q V				
986	1+35	0.0648	0.60	I Q V				
987	1+36	0.0656	0.60	I Q V				
988	1+37	0.0665	0.61	I Q V				
989	1+38	0.0673	0.61	I Q V				
990	1+39	0.0682	0.61	I Q V				
991	1+40	0.0690	0.62	I Q V				
992	1+41	0.0699	0.62	I Q V				
993	1+42	0.0707	0.62	I Q V				
994	1+43	0.0716	0.63	I Q V				
995	1+44	0.0724	0.63	I Q V				
996	1+45	0.0733	0.63	I Q V				
997	1+46	0.0742	0.63	I Q V				
998	1+47	0.0751	0.64	I Q V				
999	1+48	0.0759	0.64	I Q V				
1000	1+49	0.0768	0.64	I Q V				
1001	1+50	0.0777	0.64	I Q V				
1002	1+51	0.0786	0.64	I Q V				
1003	1+52	0.0795	0.65	I Q V				
1004	1+53	0.0804	0.65	I Q V				
1005	1+54	0.0813	0.65	I Q V				
1006	1+55	0.0822	0.66	I Q V				
1007	1+56	0.0831	0.66	I Q V				
1008	1+57	0.0840	0.67	I Q V				
1009	1+58	0.0850	0.67	I Q V				
1010	1+59	0.0859	0.68	I Q V				
1011	2+ 0	0.0868	0.68	I Q V				
1012	2+ 1	0.0878	0.68	I Q V				
1013	2+ 2	0.0887	0.69	I Q V				
1014	2+ 3	0.0897	0.69	I Q V				
1015	2+ 4	0.0906	0.69	I Q V				
1016	2+ 5	0.0916	0.69	I Q V				
1017	2+ 6	0.0925	0.70	I Q V				
1018	2+ 7	0.0935	0.70	I Q V				
1019	2+ 8	0.0945	0.70	I Q V				
1020	2+ 9	0.0954	0.71	I Q V				
1021	2+10	0.0964	0.71	I Q V				
1022	2+11	0.0974	0.72	I Q V				
1023	2+12	0.0984	0.72	I Q V				
1024	2+13	0.0994	0.73	I Q V				
1025	2+14	0.1004	0.73	I Q V				
1026	2+15	0.1014	0.74	I Q V				
1027	2+16	0.1024	0.74	I Q V				
1028	2+17	0.1035	0.75	I Q V				
1029	2+18	0.1045	0.75	I Q V				
1030	2+19	0.1055	0.75	I Q V				
1031	2+20	0.1066	0.76	I Q V				
1032	2+21	0.1076	0.76	I Q V				
1033	2+22	0.1087	0.76	I Q V				
1034	2+23	0.1097	0.77	I Q V				
1035	2+24	0.1108	0.77	I Q V				

1036	2+25	0.1119	0.78		Q	V							
1037	2+26	0.1129	0.78		Q	V							
1038	2+27	0.1140	0.79		Q	V							
1039	2+28	0.1151	0.80		Q	V							
1040	2+29	0.1162	0.80		Q	V							
1041	2+30	0.1173	0.81		Q	V							
1042	2+31	0.1185	0.82		Q	V							
1043	2+32	0.1196	0.82		Q	V							
1044	2+33	0.1207	0.83		Q	V							
1045	2+34	0.1219	0.83		Q	V							
1046	2+35	0.1230	0.84		Q	V							
1047	2+36	0.1242	0.84		Q	V							
1048	2+37	0.1254	0.84		Q	V							
1049	2+38	0.1265	0.85		Q	V							
1050	2+39	0.1277	0.85		Q	V							
1051	2+40	0.1289	0.86		Q	V							
1052	2+41	0.1301	0.87		Q	V							
1053	2+42	0.1313	0.87		Q	V							
1054	2+43	0.1325	0.88		Q	V							
1055	2+44	0.1337	0.89		Q	V							
1056	2+45	0.1350	0.90		Q	V							
1057	2+46	0.1362	0.91		Q	V							
1058	2+47	0.1375	0.92		Q	V							
1059	2+48	0.1388	0.93		Q	V							
1060	2+49	0.1401	0.94		Q	V							
1061	2+50	0.1414	0.94		Q	V							
1062	2+51	0.1427	0.95		Q	V							
1063	2+52	0.1440	0.95		Q	V							
1064	2+53	0.1453	0.96		Q	V							
1065	2+54	0.1466	0.96		Q	V							
1066	2+55	0.1480	0.97		Q	V							
1067	2+56	0.1493	0.97		Q	V							
1068	2+57	0.1507	0.99		Q	V							
1069	2+58	0.1520	1.00		Q	V							
1070	2+59	0.1534	1.01		Q	V							
1071	3+ 0	0.1548	1.03		Q	V							
1072	3+ 1	0.1563	1.04		Q	V							
1073	3+ 2	0.1577	1.05		Q	V							
1074	3+ 3	0.1592	1.07		Q	V							
1075	3+ 4	0.1607	1.08		Q	V							
1076	3+ 5	0.1622	1.09		Q	V							
1077	3+ 6	0.1637	1.10		Q	V							
1078	3+ 7	0.1652	1.10		Q	V							
1079	3+ 8	0.1668	1.11		Q	V							
1080	3+ 9	0.1683	1.12		Q	V							
1081	3+10	0.1699	1.13		Q	V							
1082	3+11	0.1714	1.14		Q	V							
1083	3+12	0.1730	1.15		Q	V							
1084	3+13	0.1746	1.17		Q	V							
1085	3+14	0.1762	1.19		Q	V							
1086	3+15	0.1779	1.21		Q	V							
1087	3+16	0.1796	1.23		Q	V							
1088	3+17	0.1813	1.25		Q	V							
1089	3+18	0.1831	1.27		Q	V							
1090	3+19	0.1849	1.29		Q	V							
1091	3+20	0.1867	1.31		Q	V							
1092	3+21	0.1885	1.33		Q	V							
1093	3+22	0.1903	1.34		Q	V							
1094	3+23	0.1922	1.35		Q	V							
1095	3+24	0.1941	1.37		Q	V							
1096	3+25	0.1960	1.38		Q	V							
1097	3+26	0.1979	1.40		Q	V							
1098	3+27	0.1999	1.41		Q	V							
1099	3+28	0.2018	1.42		Q	V							
1100	3+29	0.2038	1.46		Q	V							
1101	3+30	0.2059	1.50		Q	V							
1102	3+31	0.2080	1.54		Q	V							
1103	3+32	0.2102	1.58		Q	V							
1104	3+33	0.2124	1.62		Q	V							

1105	3+34	0.2147	1.66	Q	V				
1106	3+35	0.2171	1.70	Q	V				
1107	3+36	0.2195	1.74	Q	V				
1108	3+37	0.2219	1.77	Q	V				
1109	3+38	0.2244	1.80	Q	V				
1110	3+39	0.2269	1.83	Q	V				
1111	3+40	0.2295	1.86	Q	V				
1112	3+41	0.2321	1.89	Q	V				
1113	3+42	0.2347	1.92	Q	V				
1114	3+43	0.2374	1.95	Q	V				
1115	3+44	0.2401	1.98	Q	V				
1116	3+45	0.2430	2.10	Q	V				
1117	3+46	0.2461	2.21	Q	V				
1118	3+47	0.2493	2.33	Q	V				
1119	3+48	0.2527	2.45	Q	V				
1120	3+49	0.2562	2.56	Q	V				
1121	3+50	0.2599	2.68	Q	V				
1122	3+51	0.2637	2.79	Q	V				
1123	3+52	0.2677	2.91	Q	V				
1124	3+53	0.2720	3.06	Q	V				
1125	3+54	0.2764	3.21	Q	V				
1126	3+55	0.2810	3.36	Q	V				
1127	3+56	0.2858	3.51	Q	V				
1128	3+57	0.2909	3.65	Q	V				
1129	3+58	0.2961	3.80	Q	V				
1130	3+59	0.3016	3.95	Q	V				
1131	4+ 0	0.3072	4.10	Q	V				
1132	4+ 1	0.3145	5.32		Q	V			
1133	4+ 2	0.3235	6.53		Q	V			
1134	4+ 3	0.3342	7.75			VQ			
1135	4+ 4	0.3465	8.96			V	Q		
1136	4+ 5	0.3606	10.18			V		Q	
1137	4+ 6	0.3762	11.39			V			Q
1138	4+ 7	0.3936	12.61			V			
1139	4+ 8	0.4126	13.82			V			Q
1140	4+ 9	0.4297	12.38			V		Q	
1141	4+10	0.4448	10.95			V	Q		
1142	4+11	0.4579	9.51			Q	V		
1143	4+12	0.4690	8.08			Q	V		
1144	4+13	0.4782	6.64			Q	V		
1145	4+14	0.4853	5.21		Q		V		
1146	4+15	0.4905	3.77		Q		V		
1147	4+16	0.4937	2.33	Q			V		
1148	4+17	0.4968	2.24	Q			V		
1149	4+18	0.4998	2.14	Q			V		
1150	4+19	0.5026	2.04	Q			V		
1151	4+20	0.5053	1.95	Q			V		
1152	4+21	0.5078	1.85	Q			V		
1153	4+22	0.5102	1.76	Q			V		
1154	4+23	0.5125	1.66	Q			V		
1155	4+24	0.5147	1.56	Q			V		
1156	4+25	0.5168	1.52	Q			V		
1157	4+26	0.5188	1.48	Q			V		
1158	4+27	0.5208	1.43	Q			V		
1159	4+28	0.5227	1.39	Q			V		
1160	4+29	0.5246	1.35	Q			V		
1161	4+30	0.5264	1.31	Q			V		
1162	4+31	0.5281	1.26	Q			V		
1163	4+32	0.5298	1.22	Q			V		
1164	4+33	0.5314	1.20	Q			V		
1165	4+34	0.5330	1.17	Q			V		
1166	4+35	0.5346	1.15	Q			V		
1167	4+36	0.5362	1.12	Q			V		
1168	4+37	0.5377	1.10	Q			V		
1169	4+38	0.5392	1.07	Q			V		
1170	4+39	0.5406	1.05	Q			V		
1171	4+40	0.5420	1.02	Q			V		
1172	4+41	0.5434	1.01	Q			V		
1173	4+42	0.5448	0.99	Q			V		

1174	4+43	0.5461	0.97	Q				V	
1175	4+44	0.5474	0.96	Q				V	
1176	4+45	0.5487	0.94	Q				V	
1177	4+46	0.5500	0.92	Q				V	
1178	4+47	0.5512	0.91	Q				V	
1179	4+48	0.5525	0.89	Q				V	
1180	4+49	0.5537	0.88	Q				V	
1181	4+50	0.5549	0.87	Q				V	
1182	4+51	0.5561	0.85	Q				V	
1183	4+52	0.5572	0.84	Q				V	
1184	4+53	0.5584	0.83	Q				V	
1185	4+54	0.5595	0.82	Q				V	
1186	4+55	0.5606	0.81	Q				V	
1187	4+56	0.5617	0.79	Q				V	
1188	4+57	0.5628	0.79	Q				V	
1189	4+58	0.5639	0.78	Q				V	
1190	4+59	0.5649	0.77	Q				V	
1191	5+ 0	0.5660	0.76	Q				V	
1192	5+ 1	0.5670	0.75	Q				V	
1193	5+ 2	0.5680	0.74	Q				V	
1194	5+ 3	0.5690	0.73	Q				V	
1195	5+ 4	0.5700	0.72	Q				V	
1196	5+ 5	0.5710	0.71	Q				V	
1197	5+ 6	0.5720	0.71	Q				V	
1198	5+ 7	0.5729	0.70	Q				V	
1199	5+ 8	0.5739	0.69	Q				V	
1200	5+ 9	0.5748	0.68	Q				V	
1201	5+10	0.5758	0.68	Q				V	
1202	5+11	0.5767	0.67	Q				V	
1203	5+12	0.5776	0.66	Q				V	
1204	5+13	0.5785	0.66	Q				V	
1205	5+14	0.5794	0.65	Q				V	
1206	5+15	0.5803	0.65	Q				V	
1207	5+16	0.5812	0.64	Q				V	
1208	5+17	0.5820	0.63	Q				V	
1209	5+18	0.5829	0.63	Q				V	
1210	5+19	0.5838	0.62	Q				V	
1211	5+20	0.5846	0.62	Q				V	
1212	5+21	0.5854	0.61	Q				V	
1213	5+22	0.5863	0.61	Q				V	
1214	5+23	0.5871	0.60	Q				V	
1215	5+24	0.5879	0.60	Q				V	
1216	5+25	0.5887	0.59	Q				V	
1217	5+26	0.5895	0.59	Q				V	
1218	5+27	0.5903	0.58	Q				V	
1219	5+28	0.5911	0.58	Q				V	
1220	5+29	0.5919	0.57	Q				V	
1221	5+30	0.5927	0.57	Q				V	
1222	5+31	0.5935	0.56	Q				V	
1223	5+32	0.5943	0.56	Q				V	
1224	5+33	0.5950	0.55	Q				V	
1225	5+34	0.5958	0.55	Q				V	
1226	5+35	0.5965	0.55	Q				V	
1227	5+36	0.5973	0.54	Q				V	
1228	5+37	0.5980	0.54	Q				V	
1229	5+38	0.5988	0.53	Q				V	
1230	5+39	0.5995	0.53	Q				V	
1231	5+40	0.6002	0.53	Q				V	
1232	5+41	0.6009	0.52	Q				V	
1233	5+42	0.6016	0.52	Q				V	
1234	5+43	0.6024	0.52	Q				V	
1235	5+44	0.6031	0.51	Q				V	
1236	5+45	0.6038	0.51	Q				V	
1237	5+46	0.6045	0.51	Q				V	
1238	5+47	0.6052	0.50	Q				V	
1239	5+48	0.6058	0.50	Q				V	
1240	5+49	0.6065	0.50	Q				V	
1241	5+50	0.6072	0.49	Q				V	
1242	5+51	0.6079	0.49	Q				V	

1243	5+52	0.6086	0.49	Q				V
1244	5+53	0.6092	0.48	Q				V
1245	5+54	0.6099	0.48	Q				V
1246	5+55	0.6105	0.48	Q				V
1247	5+56	0.6112	0.48	Q				V
1248	5+57	0.6119	0.47	Q				V
1249	5+58	0.6125	0.47	Q				V
1250	5+59	0.6131	0.47	Q				V
1251	6+ 0	0.6138	0.46	Q				V
1252	6+ 1	0.6144	0.46	Q				V
1253	6+ 2	0.6151	0.46	Q				V
1254	6+ 3	0.6157	0.46	Q				V
1255	6+ 4	0.6163	0.45	Q				V
1256	6+ 5	0.6169	0.45	Q				V
1257	6+ 6	0.6176	0.45	Q				V
1258	6+ 7	0.6182	0.45	Q				V
1259	6+ 8	0.6188	0.44	Q				V

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1267 ++++++

1268 Process from Point/Station 104.000 to Point/Station 105.000

1269 **** PIPEFLOW TRAVEL TIME (User specified size) ****

1270

1271 Upstream point/station elevation = 690.910 (Ft.)

1272 Downstream point/station elevation = 684.350 (Ft.)

1273 Pipe length = 63.00 (Ft.) Slope = 0.1041 Manning's N = 0.013

1274 No. of pipes = 1 Required pipe flow = 13.820 (CFS)

1275 Given pipe size = 18.00 (In.)

1276 Calculated individual pipe flow = 13.820 (CFS)

1277 Normal flow depth in pipe = 8.00 (In.)

1278 Flow top width inside pipe = 17.89 (In.)

1279 Critical Depth = 16.52 (In.)

1280 Pipe flow velocity = 18.21 (Ft/s)

1281 Travel time through pipe = 0.06 min.

1282 Time of concentration (TC) = 8.86 min.

1283
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1285 ++++++

1286 Process from Point/Station 105.000 to Point/Station 106.000

1287 **** IRREGULAR CHANNEL FLOW TRAVEL TIME ****

1288

1289 Estimated mean flow rate at midpoint of channel = 14.072 (CFS)

1290 Depth of flow = 0.874 (Ft.), Average velocity = 18.419 (Ft/s)

1291 ***** Irregular Channel Data *****

1292

1293 Information entered for subchannel number 1 :

Point number	'X' coordinate	'Y' coordinate
1	0.00	1.00
2	1.00	0.00
3	2.00	1.00

1298 Manning's 'N' friction factor = 0.016

1299

1300 Sub-Channel flow = 14.072 (CFS)

1301 ' ' flow top width = 1.748 (Ft.)

1302 ' ' velocity = 18.419 (Ft/s)

1303 ' ' area = 0.764 (Sq.Ft)

1304 ' ' Froude number = 4.910

1305

1306 Upstream point elevation = 684.820 (Ft.)

1307 Downstream point elevation = 611.400 (Ft.)

1308 Flow length = 390.000 (Ft.)

1309 Travel time = 0.35 min.

1310 Time of concentration = 9.21 min.

1311 Depth of flow = 0.874 (Ft.)

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1312 Average velocity = 18.419 (Ft/s)
1313 Total irregular channel flow = 14.072 (CFS)
1314 Irregular channel normal depth above invert elev. = 0.874 (Ft.)
1315 Average velocity of channel(s) = 18.419 (Ft/s)
1316 Adding area flow to channel
1317 Rainfall intensity (I) = 5.861 (In/Hr) for a 100.0 year storm
1318 Decimal fraction soil group A = 0.000
1319 Decimal fraction soil group B = 0.000
1320 Decimal fraction soil group C = 0.050
1321 Decimal fraction soil group D = 0.950
1322 [UNDISTURBED NATURAL TERRAIN ]
1323 (Permanent Open Space )
1324 Impervious value, Ai = 0.000
1325 Sub-Area C Value = 0.347
1326 Rainfall intensity = 5.861 (In/Hr) for a 100.0 year storm
1327 Effective runoff coefficient used for total area
1328 (Q=KCIA) is C = 0.749 CA = 2.428
1329 Subarea runoff = 0.408 (CFS) for 0.397 (Ac.)
1330 Total runoff = 14.228 (CFS) Total area = 3.239 (Ac.)
1331 Depth of flow = 0.878 (Ft.), Average velocity = 18.470 (Ft/s)
1332
1333
1334 ++++++
1335 Process from Point/Station 106.000 to Point/Station 107.000
1336 **** IRREGULAR CHANNEL FLOW TRAVEL TIME ****
1337
1338 -----
1339 Estimated mean flow rate at midpoint of channel = 14.430 (CFS)
1340 Depth of flow = 0.461 (Ft.), Average velocity = 4.222 (Ft/s)
1341 ***** Irregular Channel Data *****
1342 -----
1343 Information entered for subchannel number 1 :
1344 Point number 'X' coordinate 'Y' coordinate
1345 1 0.00 0.63
1346 2 25.00 0.13
1347 3 26.50 0.00
1348 4 26.50 0.50
1349 5 31.50 0.60
1350 Manning's 'N' friction factor = 0.015
1351 -----
1352 Sub-Channel flow = 14.430 (CFS)
1353 ' ' flow top width = 18.293 (Ft.)
1354 ' ' velocity = 4.222 (Ft/s)
1355 ' ' area = 3.418 (Sq.Ft)
1356 ' ' Froude number = 1.721
1357
1358 Upstream point elevation = 611.400 (Ft.)
1359 Downstream point elevation = 608.550 (Ft.)
1360 Flow length = 162.000 (Ft.)
1361 Travel time = 0.64 min.
1362 Time of concentration = 9.85 min.
1363 Depth of flow = 0.461 (Ft.)
1364 Average velocity = 4.222 (Ft/s)
1365 Total irregular channel flow = 14.430 (CFS)
1366 Irregular channel normal depth above invert elev. = 0.461 (Ft.)
1367 Average velocity of channel(s) = 4.222 (Ft/s)
1368 Adding area flow to channel
1369 Rainfall intensity (I) = 5.613 (In/Hr) for a 100.0 year storm
1370 Decimal fraction soil group A = 0.000
1371 Decimal fraction soil group B = 0.000
1372 Decimal fraction soil group C = 0.050
1373 Decimal fraction soil group D = 0.950
1374 [INDUSTRIAL area type ]
1375 (General Industrial )
1376 Impervious value, Ai = 0.950
1377 Sub-Area C Value = 0.870
1378 Rainfall intensity = 5.613 (In/Hr) for a 100.0 year storm
1379 Effective runoff coefficient used for total area
1380 (Q=KCIA) is C = 0.756 CA = 2.595
1381 Subarea runoff = 0.340 (CFS) for 0.193 (Ac.)

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1381 Total runoff =      14.568 (CFS)  Total area =      3.432 (Ac.)
1382 Depth of flow =      0.462 (Ft.), Average velocity =      4.232 (Ft/s)
1383
1384
1385 ++++++
1386 Process from Point/Station      107.000 to Point/Station      107.000
1387 **** CONFLUENCE OF MINOR STREAMS ****
1388
1389 -----
1389 Along Main Stream number: 1 in normal stream number 1
1390 Stream flow area =      3.432 (Ac.)
1391 Runoff from this stream =      14.568 (CFS)
1392 Time of concentration =      9.85 min.
1393 Rainfall intensity =      5.613 (In/Hr)
1394
1395
1396 ++++++
1397 Process from Point/Station      301.000 to Point/Station      302.000
1398 **** INITIAL AREA EVALUATION ****
1399
1400 -----
1400 Decimal fraction soil group A = 0.000
1401 Decimal fraction soil group B = 0.000
1402 Decimal fraction soil group C = 0.000
1403 Decimal fraction soil group D = 1.000
1404 [HIGH DENSITY RESIDENTIAL
1405 (43.0 DU/A or Less
1406 Impervious value, Ai = 0.800
1407 Sub-Area C Value = 0.790
1408 Initial subarea total flow distance =      74.000 (Ft.)
1409 Highest elevation =      700.090 (Ft.)
1410 Lowest elevation =      693.340 (Ft.)
1411 Elevation difference =      6.750 (Ft.) Slope =      9.122 %
1412 Top of Initial Area Slope adjusted by User to      9.838 %
1413 INITIAL AREA TIME OF CONCENTRATION CALCULATIONS:
1414 The maximum overland flow distance is 100.00 (Ft)
1415 for the top area slope value of      9.84 %, in a development type of
1416 43.0 DU/A or Less
1417 In Accordance With Figure 3-3
1418 Initial Area Time of Concentration =      2.60 minutes
1419 TC = [1.8*(1.1-C)*distance(Ft.)^.5]/(% slope^(1/3)]
1420 TC = [1.8*(1.1-0.7900)*( 100.000^.5)/( 9.838^(1/3)]=      2.60
1421 Calculated TC of      2.604 minutes is less than 5 minutes,
1422 resetting TC to 5.0 minutes for rainfall intensity calculations
1423 Rainfall intensity (I) =      8.695 (In/Hr) for a      100.0 year storm
1424 Effective runoff coefficient used for area (Q=KCIA) is C = 0.790
1425 Subarea runoff =      0.323 (CFS)
1426 Total initial stream area =      0.047 (Ac.)
1427
1428
1429 ++++++
1430 Process from Point/Station      302.000 to Point/Station      107.000
1431 **** IRREGULAR CHANNEL FLOW TRAVEL TIME ****
1432
1433 -----
1433 Estimated mean flow rate at midpoint of channel =      1.486 (CFS)
1434 Depth of flow =      0.020 (Ft.), Average velocity =      2.907 (Ft/s)
1435 ***** Irregular Channel Data *****
1436
1437 -----
1437 Information entered for subchannel number 1 :
1438 Point number      'X' coordinate      'Y' coordinate
1439      1              0.00              0.50
1440      2              0.00              0.00
1441      3             25.00              0.00
1442      4             25.00              0.50
1443 Manning's 'N' friction factor =      0.016
1444
1445 -----
1445 Sub-Channel flow =      1.486 (CFS)
1446      '      '      flow top width =      25.000 (Ft.)
1447      '      '      velocity=      2.907 (Ft/s)
1448      '      '      area =      0.511 (Sq.Ft)
1449      '      '      Froude number =      3.583

```

```

1450
1451 Upstream point elevation = 693.340 (Ft.)
1452 Downstream point elevation = 611.680 (Ft.)
1453 Flow length = 465.000 (Ft.)
1454 Travel time = 2.67 min.
1455 Time of concentration = 5.27 min.
1456 Depth of flow = 0.020 (Ft.)
1457 Average velocity = 2.907 (Ft/s)
1458 Total irregular channel flow = 1.486 (CFS)
1459 Irregular channel normal depth above invert elev. = 0.020 (Ft.)
1460 Average velocity of channel(s) = 2.907 (Ft/s)
1461 Adding area flow to channel
1462 Rainfall intensity (I) = 8.404 (In/Hr) for a 100.0 year storm
1463 Decimal fraction soil group A = 0.000
1464 Decimal fraction soil group B = 0.000
1465 Decimal fraction soil group C = 0.000
1466 Decimal fraction soil group D = 1.000
1467 [HIGH DENSITY RESIDENTIAL ]
1468 (24.0 DU/A or Less )
1469 Impervious value, Ai = 0.650
1470 Sub-Area C Value = 0.710
1471 Rainfall intensity = 8.404 (In/Hr) for a 100.0 year storm
1472 Effective runoff coefficient used for total area
1473 (Q=KCIA) is C = 0.719 CA = 0.303
1474 Subarea runoff = 2.227 (CFS) for 0.375 (Ac.)
1475 Total runoff = 2.550 (CFS) Total area = 0.422 (Ac.)
1476 Depth of flow = 0.028 (Ft.), Average velocity = 3.607 (Ft/s)
1477
1478
1479 ++++++
1480 Process from Point/Station 107.000 to Point/Station 107.000
1481 **** CONFLUENCE OF MINOR STREAMS ****
1482
1483 Along Main Stream number: 1 in normal stream number 2
1484 Stream flow area = 0.422 (Ac.)
1485 Runoff from this stream = 2.550 (CFS)
1486 Time of concentration = 5.27 min.
1487 Rainfall intensity = 8.404 (In/Hr)
1488 Summary of stream data:
1489
1490 Stream Flow rate TC Rainfall Intensity
1491 No. (CFS) (min) (In/Hr)
1492
1493
1494 1 14.568 9.85 5.613
1495 2 2.550 5.27 8.404
1496 Qmax(1) =
1497 1.000 * 1.000 * 14.568) +
1498 0.668 * 1.000 * 2.550) + = 16.271
1499 Qmax(2) =
1500 1.000 * 0.535 * 14.568) +
1501 1.000 * 1.000 * 2.550) + = 10.341
1502
1503 Total of 2 streams to confluence:
1504 Flow rates before confluence point:
1505 14.568 2.550
1506 Maximum flow rates at confluence using above data:
1507 16.271 10.341
1508 Area of streams before confluence:
1509 3.432 0.422
1510 Results of confluence:
1511 Total flow rate = 16.271 (CFS)
1512 Time of concentration = 9.854 min.
1513 Effective stream area after confluence = 3.854 (Ac.)
1514
1515
1516 ++++++
1517 Process from Point/Station 107.000 to Point/Station 108.000
1518 **** IRREGULAR CHANNEL FLOW TRAVEL TIME ****

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1519
1520 Estimated mean flow rate at midpoint of channel = 16.465 (CFS)
1521 Depth of flow = 0.426 (Ft.), Average velocity = 6.042 (Ft/s)
1522 ***** Irregular Channel Data *****
1523 -----
1524 Information entered for subchannel number 1 :
1525 Point number 'X' coordinate 'Y' coordinate
1526 1 0.00 0.63
1527 2 25.00 0.13
1528 3 26.50 0.00
1529 4 26.50 0.50
1530 5 31.50 0.60
1531 Manning's 'N' friction factor = 0.015
1532 -----
1533 Sub-Channel flow = 16.465 (CFS)
1534 ' ' flow top width = 16.279 (Ft.)
1535 ' ' velocity = 6.042 (Ft/s)
1536 ' ' area = 2.725 (Sq.Ft)
1537 ' ' Froude number = 2.603
1538
1539 Upstream point elevation = 608.550 (Ft.)
1540 Downstream point elevation = 601.450 (Ft.)
1541 Flow length = 170.000 (Ft.)
1542 Travel time = 0.47 min.
1543 Time of concentration = 10.32 min.
1544 Depth of flow = 0.426 (Ft.)
1545 Average velocity = 6.042 (Ft/s)
1546 Total irregular channel flow = 16.465 (CFS)
1547 Irregular channel normal depth above invert elev. = 0.426 (Ft.)
1548 Average velocity of channel (s) = 6.042 (Ft/s)
1549 Adding area flow to channel
1550 Rainfall intensity (I) = 5.447 (In/Hr) for a 100.0 year storm
1551 Decimal fraction soil group A = 0.000
1552 Decimal fraction soil group B = 0.000
1553 Decimal fraction soil group C = 0.050
1554 Decimal fraction soil group D = 0.950
1555 [INDUSTRIAL area type ]
1556 (General Industrial )
1557 Impervious value, Ai = 0.950
1558 Sub-Area C Value = 0.870
1559 Rainfall intensity = 5.447 (In/Hr) for a 100.0 year storm
1560 Effective runoff coefficient used for total area
1561 (Q=KCIA) is C = 0.757 CA = 3.040
1562 Subarea runoff = 0.287 (CFS) for 0.162 (Ac.)
1563 Total runoff = 16.558 (CFS) Total area = 4.016 (Ac.)
1564 Depth of flow = 0.426 (Ft.), Average velocity = 6.051 (Ft/s)
1565
1566
1567 ++++++
1568 Process from Point/Station 108.000 to Point/Station 108.000
1569 **** CONFLUENCE OF MINOR STREAMS ****
1570 -----
1571 Along Main Stream number: 1 in normal stream number 1
1572 Stream flow area = 4.016 (Ac.)
1573 Runoff from this stream = 16.558 (CFS)
1574 Time of concentration = 10.32 min.
1575 Rainfall intensity = 5.447 (In/Hr)
1576
1577 ++++++
1578 Process from Point/Station 401.000 to Point/Station 402.000
1579 **** INITIAL AREA EVALUATION ****
1580 -----
1581
1582 Decimal fraction soil group A = 0.000
1583 Decimal fraction soil group B = 0.000
1584 Decimal fraction soil group C = 0.000
1585 Decimal fraction soil group D = 1.000
1586 [UNDISTURBED NATURAL TERRAIN ]
1587 (Permanent Open Space )

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1588 Impervious value, Ai = 0.000
1589 Sub-Area C Value = 0.350
1590 Initial subarea total flow distance = 100.000 (Ft.)
1591 Highest elevation = 709.280 (Ft.)
1592 Lowest elevation = 687.650 (Ft.)
1593 Elevation difference = 21.630 (Ft.) Slope = 21.630 %
1594 Top of Initial Area Slope adjusted by User to 23.240 %
1595 INITIAL AREA TIME OF CONCENTRATION CALCULATIONS:
1596 The maximum overland flow distance is 100.00 (Ft)
1597 for the top area slope value of 23.24 %, in a development type of
1598 Permanent Open Space
1599 In Accordance With Figure 3-3
1600 Initial Area Time of Concentration = 4.73 minutes
1601  $TC = [1.8 * (1.1 - C) * distance(Ft.)^{.5} / (% slope^{(1/3)})]$ 
1602  $TC = [1.8 * (1.1 - 0.3500) * (100.000^{.5}) / (23.240^{(1/3)})] = 4.73$ 
1603 Calculated TC of 4.731 minutes is less than 5 minutes,
1604 resetting TC to 5.0 minutes for rainfall intensity calculations
1605 Rainfall intensity (I) = 8.695 (In/Hr) for a 100.0 year storm
1606 Effective runoff coefficient used for area (Q=KCIA) is C = 0.350
1607 Subarea runoff = 0.207 (CFS)
1608 Total initial stream area = 0.068 (Ac.)
1609
1610
1611 ++++++
1612 Process from Point/Station 402.000 to Point/Station 108.000
1613 **** IRREGULAR CHANNEL FLOW TRAVEL TIME ****
1614
1615 -----
1616 Estimated mean flow rate at midpoint of channel = 1.331 (CFS)
1617 Depth of flow = 0.497 (Ft.), Average velocity = 5.388 (Ft/s)
1618 ***** Irregular Channel Data *****
1619
1620 -----
1621 Information entered for subchannel number 1 :
1622 Point number 'X' coordinate 'Y' coordinate
1623 1 0.00 1.00
1624 2 1.00 0.00
1625 3 2.00 1.00
1626 Manning's 'N' friction factor = 0.030
1627
1628 -----
1629 Sub-Channel flow = 1.331 (CFS)
1630 ' ' flow top width = 0.994 (Ft.)
1631 ' ' velocity = 5.388 (Ft/s)
1632 ' ' area = 0.247 (Sq.Ft)
1633 ' ' Froude number = 1.905
1634
1635 Upstream point elevation = 687.650 (Ft.)
1636 Downstream point elevation = 601.450 (Ft.)
1637 Flow length = 717.000 (Ft.)
1638 Travel time = 2.22 min.
1639 Time of concentration = 6.95 min.
1640 Depth of flow = 0.497 (Ft.)
1641 Average velocity = 5.388 (Ft/s)
1642 Total irregular channel flow = 1.331 (CFS)
1643 Irregular channel normal depth above invert elev. = 0.497 (Ft.)
1644 Average velocity of channel(s) = 5.388 (Ft/s)
1645 Adding area flow to channel
1646 Rainfall intensity (I) = 7.032 (In/Hr) for a 100.0 year storm
1647 Decimal fraction soil group A = 0.000
1648 Decimal fraction soil group B = 0.000
1649 Decimal fraction soil group C = 0.000
1650 Decimal fraction soil group D = 1.000
1651 [UNDISTURBED NATURAL TERRAIN ]
1652 (Permanent Open Space )
1653 Impervious value, Ai = 0.000
1654 Sub-Area C Value = 0.350
1655 Rainfall intensity = 7.032 (In/Hr) for a 100.0 year storm
1656 Effective runoff coefficient used for total area
1657 (Q=KCIA) is C = 0.350 CA = 0.338
1658 Subarea runoff = 2.170 (CFS) for 0.898 (Ac.)
1659 Total runoff = 2.377 (CFS) Total area = 0.966 (Ac.)

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1657 Depth of flow = 0.618 (Ft.), Average velocity = 6.229 (Ft/s)
1658
1659
1660 ++++++
1661 Process from Point/Station 108.000 to Point/Station 108.000
1662 **** CONFLUENCE OF MINOR STREAMS ****
1663
1664 Along Main Stream number: 1 in normal stream number 2
1665 Stream flow area = 0.966 (Ac.)
1666 Runoff from this stream = 2.377 (CFS)
1667 Time of concentration = 6.95 min.
1668 Rainfall intensity = 7.032 (In/Hr)
1669 Summary of stream data:
1670
1671 Stream Flow rate TC Rainfall Intensity
1672 No. (CFS) (min) (In/Hr)
1673
1674
1675 1 16.558 10.32 5.447
1676 2 2.377 6.95 7.032
1677 Qmax (1) =
1678 1.000 * 1.000 * 16.558) +
1679 0.775 * 1.000 * 2.377) + = 18.400
1680 Qmax (2) =
1681 1.000 * 0.673 * 16.558) +
1682 1.000 * 1.000 * 2.377) + = 13.523
1683
1684 Total of 2 streams to confluence:
1685 Flow rates before confluence point:
1686 16.558 2.377
1687 Maximum flow rates at confluence using above data:
1688 18.400 13.523
1689 Area of streams before confluence:
1690 4.016 0.966
1691 Results of confluence:
1692 Total flow rate = 18.400 (CFS)
1693 Time of concentration = 10.323 min.
1694 Effective stream area after confluence = 4.982 (Ac.)
1695
1696
1697 ++++++
1698 Process from Point/Station 108.000 to Point/Station 109.000
1699 **** IRREGULAR CHANNEL FLOW TRAVEL TIME ****
1700
1701 Estimated mean flow rate at midpoint of channel = 18.549 (CFS)
1702 Depth of flow = 0.420 (Ft.), Average velocity = 7.056 (Ft/s)
1703 ***** Irregular Channel Data *****
1704
1705 -----
1706 Information entered for subchannel number 1 :
1707 Point number 'X' coordinate 'Y' coordinate
1708 1 0.00 0.63
1709 2 25.00 0.13
1710 3 26.50 0.00
1711 4 26.50 0.50
1712 5 31.50 0.60
1713 Manning's 'N' friction factor = 0.015
1714
1715 -----
1716 Sub-Channel flow = 18.549 (CFS)
1717 ' ' flow top width = 15.980 (Ft.)
1718 ' ' velocity = 7.056 (Ft/s)
1719 ' ' area = 2.629 (Sq.Ft)
1720 ' ' Froude number = 3.066
1721
1722 Upstream point elevation = 601.450 (Ft.)
1723 Downstream point elevation = 593.870 (Ft.)
1724 Flow length = 130.000 (Ft.)
1725 Travel time = 0.31 min.
1726 Time of concentration = 10.63 min.
1727 Depth of flow = 0.420 (Ft.)

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1726 Average velocity = 7.056 (Ft/s)
1727 Total irregular channel flow = 18.549 (CFS)
1728 Irregular channel normal depth above invert elev. = 0.420 (Ft.)
1729 Average velocity of channel(s) = 7.056 (Ft/s)
1730 Adding area flow to channel
1731 Rainfall intensity (I) = 5.345 (In/Hr) for a 100.0 year storm
1732 Decimal fraction soil group A = 0.000
1733 Decimal fraction soil group B = 0.000
1734 Decimal fraction soil group C = 0.000
1735 Decimal fraction soil group D = 1.000
1736 [INDUSTRIAL area type ]
1737 (General Industrial )
1738 Impervious value, Ai = 0.950
1739 Sub-Area C Value = 0.870
1740 Rainfall intensity = 5.345 (In/Hr) for a 100.0 year storm
1741 Effective runoff coefficient used for total area
1742 (Q=KCIA) is C = 0.683 CA = 3.487
1743 Subarea runoff = 0.241 (CFS) for 0.126 (Ac.)
1744 Total runoff = 18.641 (CFS) Total area = 5.108 (Ac.)
1745 Depth of flow = 0.420 (Ft.), Average velocity = 7.065 (Ft/s)
1746
1747
1748 ++++++
1749 Process from Point/Station 109.000 to Point/Station 110.000
1750 **** IRREGULAR CHANNEL FLOW TRAVEL TIME ****
1751
1752 -----
1753 Estimated mean flow rate at midpoint of channel = 18.833 (CFS)
1754 Depth of flow = 0.445 (Ft.), Average velocity = 6.177 (Ft/s)
1755 ***** Irregular Channel Data *****
1756 -----
1757 Information entered for subchannel number 1 :
1758 Point number 'X' coordinate 'Y' coordinate
1759 1 0.00 0.63
1760 2 25.00 0.13
1761 3 26.50 0.00
1762 4 26.50 0.50
1763 5 31.50 0.60
1764 Manning's 'N' friction factor = 0.015
1765 -----
1766 Sub-Channel flow = 18.833 (CFS)
1767 ' ' flow top width = 17.246 (Ft.)
1768 ' ' velocity = 6.177 (Ft/s)
1769 ' ' area = 3.049 (Sq.Ft)
1770 ' ' Froude number = 2.589
1771
1772 Upstream point elevation = 593.870 (Ft.)
1773 Downstream point elevation = 585.800 (Ft.)
1774 Flow length = 199.000 (Ft.)
1775 Travel time = 0.54 min.
1776 Time of concentration = 11.17 min.
1777 Depth of flow = 0.445 (Ft.)
1778 Average velocity = 6.177 (Ft/s)
1779 Total irregular channel flow = 18.833 (CFS)
1780 Irregular channel normal depth above invert elev. = 0.445 (Ft.)
1781 Average velocity of channel(s) = 6.177 (Ft/s)
1782 Adding area flow to channel
1783 Rainfall intensity (I) = 5.178 (In/Hr) for a 100.0 year storm
1784 Decimal fraction soil group A = 0.000
1785 Decimal fraction soil group B = 0.000
1786 Decimal fraction soil group C = 0.000
1787 Decimal fraction soil group D = 1.000
1788 [INDUSTRIAL area type ]
1789 (General Industrial )
1790 Impervious value, Ai = 0.950
1791 Sub-Area C Value = 0.870
1792 Rainfall intensity = 5.178 (In/Hr) for a 100.0 year storm
1793 Effective runoff coefficient used for total area
1794 (Q=KCIA) is C = 0.690 CA = 3.664
1795 Subarea runoff = 0.331 (CFS) for 0.203 (Ac.)

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1795 Total runoff =      18.973 (CFS)  Total area =      5.311 (Ac.)
1796 Depth of flow =      0.446 (Ft.), Average velocity =      6.188 (Ft/s)
1797
1798
1799 ++++++
1800 Process from Point/Station      110.000 to Point/Station      110.000
1801 **** CONFLUENCE OF MINOR STREAMS ****
1802
1803 -----
1803 Along Main Stream number: 1 in normal stream number 1
1804 Stream flow area =      5.311 (Ac.)
1805 Runoff from this stream =      18.973 (CFS)
1806 Time of concentration =      11.17 min.
1807 Rainfall intensity =      5.178 (In/Hr)
1808
1809
1810 ++++++
1811 Process from Point/Station      501.000 to Point/Station      502.000
1812 **** INITIAL AREA EVALUATION ****
1813
1814 -----
1814 Decimal fraction soil group A = 0.000
1815 Decimal fraction soil group B = 0.000
1816 Decimal fraction soil group C = 0.000
1817 Decimal fraction soil group D = 1.000
1818 [UNDISTURBED NATURAL TERRAIN
1819 (Permanent Open Space )
1820 Impervious value, Ai = 0.000
1821 Sub-Area C Value = 0.350
1822 Initial subarea total flow distance = 137.000 (Ft.)
1823 Highest elevation = 709.360 (Ft.)
1824 Lowest elevation = 685.490 (Ft.)
1825 Elevation difference = 23.870 (Ft.) Slope = 17.423 %
1826 Top of Initial Area Slope adjusted by User to 19.708 %
1827 INITIAL AREA TIME OF CONCENTRATION CALCULATIONS:
1828 The maximum overland flow distance is 100.00 (Ft)
1829 for the top area slope value of 19.71 %, in a development type of
1830 Permanent Open Space
1831 In Accordance With Figure 3-3
1832 Initial Area Time of Concentration = 5.00 minutes
1833 TC = [1.8*(1.1-C)*distance (Ft.)^.5]/(% slope^(1/3)]
1834 TC = [1.8*(1.1-0.3500)*( 100.000^.5)/( 19.708^(1/3)]= 5.00
1835 Calculated TC of 4.998 minutes is less than 5 minutes,
1836 resetting TC to 5.0 minutes for rainfall intensity calculations
1837 Rainfall intensity (I) = 8.695 (In/Hr) for a 100.0 year storm
1838 Effective runoff coefficient used for area (Q=KCIA) is C = 0.350
1839 Subarea runoff = 0.700 (CFS)
1840 Total initial stream area = 0.230 (Ac.)
1841
1842
1843 ++++++
1844 Process from Point/Station      502.000 to Point/Station      503.000
1845 **** IRREGULAR CHANNEL FLOW TRAVEL TIME ****
1846
1847 -----
1847 Estimated mean flow rate at midpoint of channel = 2.157 (CFS)
1848 Depth of flow = 0.549 (Ft.), Average velocity = 7.164 (Ft/s)
1849 ***** Irregular Channel Data *****
1850
1851 -----
1851 Information entered for subchannel number 1 :
1852 Point number 'X' coordinate 'Y' coordinate
1853 1 0.00 1.00
1854 2 1.00 0.00
1855 3 2.00 1.00
1856 Manning's 'N' friction factor = 0.030
1857
1858 -----
1858 Sub-Channel flow = 2.157 (CFS)
1859 ' ' flow top width = 1.097 (Ft.)
1860 ' ' velocity= 7.164 (Ft/s)
1861 ' ' area = 0.301 (Sq.Ft)
1862 ' ' Froude number = 2.410
1863

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1864 Upstream point elevation = 685.490(Ft.)
1865 Downstream point elevation = 619.000(Ft.)
1866 Flow length = 357.000(Ft.)
1867 Travel time = 0.83 min.
1868 Time of concentration = 5.83 min.
1869 Depth of flow = 0.549(Ft.)
1870 Average velocity = 7.164(Ft/s)
1871 Total irregular channel flow = 2.157(CFS)
1872 Irregular channel normal depth above invert elev. = 0.549(Ft.)
1873 Average velocity of channel(s) = 7.164(Ft/s)
1874 Adding area flow to channel
1875 Rainfall intensity (I) = 7.876(In/Hr) for a 100.0 year storm
1876 Decimal fraction soil group A = 0.000
1877 Decimal fraction soil group B = 0.000
1878 Decimal fraction soil group C = 0.000
1879 Decimal fraction soil group D = 1.000
1880 [UNDISTURBED NATURAL TERRAIN ]
1881 (Permanent Open Space )
1882 Impervious value, Ai = 0.000
1883 Sub-Area C Value = 0.350
1884 Rainfall intensity = 7.876(In/Hr) for a 100.0 year storm
1885 Effective runoff coefficient used for total area
1886 (Q=KCIA) is C = 0.350 CA = 0.447
1887 Subarea runoff = 2.820(CFS) for 1.047(Ac.)
1888 Total runoff = 3.520(CFS) Total area = 1.277(Ac.)
1889 Depth of flow = 0.659(Ft.), Average velocity = 8.097(Ft/s)
1890
1891
1892 ++++++
1893 Process from Point/Station 503.000 to Point/Station 504.000
1894 **** PIPEFLOW TRAVEL TIME (User specified size) ****
1895
1896 Upstream point/station elevation = 605.110(Ft.)
1897 Downstream point/station elevation = 582.760(Ft.)
1898 Pipe length = 230.00(Ft.) Slope = 0.0972 Manning's N = 0.013
1899 No. of pipes = 1 Required pipe flow = 3.520(CFS)
1900 Given pipe size = 18.00(In.)
1901 Calculated individual pipe flow = 3.520(CFS)
1902 Normal flow depth in pipe = 3.98(In.)
1903 Flow top width inside pipe = 14.95(In.)
1904 Critical Depth = 8.59(In.)
1905 Pipe flow velocity = 12.10(Ft/s)
1906 Travel time through pipe = 0.32 min.
1907 Time of concentration (TC) = 6.15 min.
1908
1909
1910 ++++++
1911 Process from Point/Station 504.000 to Point/Station 110.000
1912 **** PIPEFLOW TRAVEL TIME (User specified size) ****
1913
1914 Upstream point/station elevation = 582.760(Ft.)
1915 Downstream point/station elevation = 582.080(Ft.)
1916 Pipe length = 15.00(Ft.) Slope = 0.0453 Manning's N = 0.013
1917 No. of pipes = 1 Required pipe flow = 3.520(CFS)
1918 Given pipe size = 24.00(In.)
1919 Calculated individual pipe flow = 3.520(CFS)
1920 Normal flow depth in pipe = 4.39(In.)
1921 Flow top width inside pipe = 18.56(In.)
1922 Critical Depth = 7.88(In.)
1923 Pipe flow velocity = 8.94(Ft/s)
1924 Travel time through pipe = 0.03 min.
1925 Time of concentration (TC) = 6.17 min.
1926
1927
1928 ++++++
1929 Process from Point/Station 110.000 to Point/Station 110.000
1930 **** CONFLUENCE OF MINOR STREAMS ****
1931
1932 Along Main Stream number: 1 in normal stream number 2

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1933 Stream flow area = 1.277 (Ac.)
1934 Runoff from this stream = 3.520 (CFS)
1935 Time of concentration = 6.17 min.
1936 Rainfall intensity = 7.589 (In/Hr)
1937 Summary of stream data:
1938
1939 Stream Flow rate TC Rainfall Intensity
1940 No. (CFS) (min) (In/Hr)
1941
1942
1943 1 18.973 11.17 5.178
1944 2 3.520 6.17 7.589
1945 Qmax (1) =
1946 1.000 * 1.000 * 18.973) +
1947 0.682 * 1.000 * 3.520) + = 21.374
1948 Qmax (2) =
1949 1.000 * 0.553 * 18.973) +
1950 1.000 * 1.000 * 3.520) + = 14.008
1951
1952 Total of 2 streams to confluence:
1953 Flow rates before confluence point:
1954 18.973 3.520
1955 Maximum flow rates at confluence using above data:
1956 21.374 14.008
1957 Area of streams before confluence:
1958 5.311 1.277
1959 Results of confluence:
1960 Total flow rate = 21.374 (CFS)
1961 Time of concentration = 11.167 min.
1962 Effective stream area after confluence = 6.588 (Ac.)
1963 End of computations, total study area = 6.588 (Ac.)
1964
1965
1966

```

```

1
2 San Diego County Rational Hydrology Program
3
4 CIVILCADD/CIVILDESIGN Engineering Software,(c)1991-2019 Version 9.1
5
6 Rational method hydrology program based on
7 San Diego County Flood Control Division 2003 hydrology manual
8 Rational Hydrology Study Date: 02/06/23
9 -----
10 22027 POST POC2
11 UPDATED
12
13
14 -----
15 ***** Hydrology Study Control Information *****
16 -----
17
18
19
20 Program License Serial Number 6332
21
22 -----
23 Rational hydrology study storm event year is 100.0
24 English (in-lb) input data Units used
25
26 Map data precipitation entered:
27 6 hour, precipitation(inches) = 3.300
28 24 hour precipitation(inches) = 5.600
29 P6/P24 = 58.9%
30 San Diego hydrology manual 'C' values used
31
32
33 +-----+
34 Process from Point/Station 701.000 to Point/Station 702.000
35 **** INITIAL AREA EVALUATION ****
36
37 -----
38 Decimal fraction soil group A = 0.000
39 Decimal fraction soil group B = 0.000
40 Decimal fraction soil group C = 0.000
41 Decimal fraction soil group D = 1.000
42 [UNDISTURBED NATURAL TERRAIN ]
43 (Permanent Open Space )
44 Impervious value, Ai = 0.000
45 Sub-Area C Value = 0.350
46 Initial subarea total flow distance = 100.000(Ft.)
47 Highest elevation = 763.850(Ft.)
48 Lowest elevation = 755.270(Ft.)
49 Elevation difference = 8.580(Ft.) Slope = 8.580 %
50 INITIAL AREA TIME OF CONCENTRATION CALCULATIONS:
51 The maximum overland flow distance is 100.00 (Ft)
52 for the top area slope value of 8.58 %, in a development type of
53 Permanent Open Space
54 In Accordance With Figure 3-3
55 Initial Area Time of Concentration = 6.59 minutes
56 TC = [1.8*(1.1-C)*distance(Ft.)^0.5]/(% slope^(1/3))
57 TC = [1.8*(1.1-0.3500)*( 100.000^0.5)/( 8.580^(1/3))]= 6.59
58 Rainfall intensity (I) = 7.273(In/Hr) for a 100.0 year storm
59 Effective runoff coefficient used for area (Q=KCIA) is C = 0.350
60 Subarea runoff = 0.158(CFS)
61 Total initial stream area = 0.062(Ac.)
62
63 +-----+
64 Process from Point/Station 702.000 to Point/Station 703.000
65 **** IRREGULAR CHANNEL FLOW TRAVEL TIME ****
66
67 -----
68 Estimated mean flow rate at midpoint of channel = 1.306(CFS)
69 Depth of flow = 0.410(Ft.), Average velocity = 7.774(Ft/s)
70 ***** Irregular Channel Data *****

```



```

70 -----
71 Information entered for subchannel number 1 :
72 Point number      'X' coordinate      'Y' coordinate
73     1              0.00              1.00
74     2              1.00              0.00
75     3              2.00              1.00
76 Manning's 'N' friction factor = 0.030
77 -----
78 Sub-Channel flow = 1.306(CFS)
79   '   '   flow top width = 0.820(Ft.)
80   '   '   velocity= 7.774(Ft/s)
81   '   '   area = 0.168(Sq.Ft)
82   '   '   Froude number = 3.026
83
84 Upstream point elevation = 755.270(Ft.)
85 Downstream point elevation = 687.000(Ft.)
86 Flow length = 211.000(Ft.)
87 Travel time = 0.45 min.
88 Time of concentration = 7.05 min.
89 Depth of flow = 0.410(Ft.)
90 Average velocity = 7.774(Ft/s)
91 Total irregular channel flow = 1.306(CFS)
92 Irregular channel normal depth above invert elev. = 0.410(Ft.)
93 Average velocity of channel(s) = 7.774(Ft/s)
94 Adding area flow to channel
95 Rainfall intensity (I) = 6.968(In/Hr) for a 100.0 year storm
96 Decimal fraction soil group A = 0.000
97 Decimal fraction soil group B = 0.000
98 Decimal fraction soil group C = 0.000
99 Decimal fraction soil group D = 1.000
100 [UNDISTURBED NATURAL TERRAIN ]
101 (Permanent Open Space )
102 Impervious value, Ai = 0.000
103 Sub-Area C Value = 0.350
104 Rainfall intensity = 6.968(In/Hr) for a 100.0 year storm
105 Effective runoff coefficient used for total area
106 (Q=KCIA) is C = 0.350 CA = 0.345
107 Subarea runoff = 2.245(CFS) for 0.923(Ac.)
108 Total runoff = 2.402(CFS) Total area = 0.985(Ac.)
109 Depth of flow = 0.515(Ft.), Average velocity = 9.053(Ft/s)
110
111
112 +-----+
113 Process from Point/Station 703.000 to Point/Station 704.000
114 **** IRREGULAR CHANNEL FLOW TRAVEL TIME ****
115
116 -----
117 Depth of flow = 0.486(Ft.), Average velocity = 10.168(Ft/s)
118 ***** Irregular Channel Data *****
119 -----
120 Information entered for subchannel number 1 :
121 Point number      'X' coordinate      'Y' coordinate
122     1              0.00              1.00
123     2              1.00              0.00
124     3              2.00              1.00
125 Manning's 'N' friction factor = 0.030
126 -----
127 Sub-Channel flow = 2.402(CFS)
128   '   '   flow top width = 0.972(Ft.)
129   '   '   velocity= 10.168(Ft/s)
130   '   '   area = 0.236(Sq.Ft)
131   '   '   Froude number = 3.635
132
133 Upstream point elevation = 687.000(Ft.)
134 Downstream point elevation = 616.000(Ft.)
135 Flow length = 161.000(Ft.)
136 Travel time = 0.26 min.
137 Time of concentration = 7.31 min.
138 Depth of flow = 0.486(Ft.)
139 Average velocity = 10.168(Ft/s)

```

```

139 Total irregular channel flow = 2.402(CFS)
140 Irregular channel normal depth above invert elev. = 0.486(Ft.)
141 Average velocity of channel(s) = 10.168(Ft/s)
142
143
144 ++++++
145 Process from Point/Station 704.000 to Point/Station 704.000
146 **** CONFLUENCE OF MINOR STREAMS ****
147
148 Along Main Stream number: 1 in normal stream number 1
149 Stream flow area = 0.985(Ac.)
150 Runoff from this stream = 2.402(CFS)
151 Time of concentration = 7.31 min.
152 Rainfall intensity = 6.805(In/Hr)
153
154
155 ++++++
156 Process from Point/Station 801.000 to Point/Station 802.000
157 **** INITIAL AREA EVALUATION ****
158
159 Decimal fraction soil group A = 0.000
160 Decimal fraction soil group B = 0.000
161 Decimal fraction soil group C = 0.000
162 Decimal fraction soil group D = 1.000
163 [UNDISTURBED NATURAL TERRAIN ]
164 (Permanent Open Space )
165 Impervious value, Ai = 0.000
166 Sub-Area C Value = 0.350
167 Initial subarea total flow distance = 100.000(Ft.)
168 Highest elevation = 709.950(Ft.)
169 Lowest elevation = 699.560(Ft.)
170 Elevation difference = 10.390(Ft.) Slope = 10.390 %
171 Top of Initial Area Slope adjusted by User to 7.500 %
172 INITIAL AREA TIME OF CONCENTRATION CALCULATIONS:
173 The maximum overland flow distance is 100.00 (Ft)
174 for the top area slope value of 7.50 %, in a development type of
175 Permanent Open Space
176 In Accordance With Figure 3-3
177 Initial Area Time of Concentration = 6.90 minutes
178 TC = [1.8*(1.1-C)*distance(Ft.)^0.5]/(% slope^(1/3))
179 TC = [1.8*(1.1-0.3500)*( 100.000^0.5)/( 7.500^(1/3))]= 6.90
180 Rainfall intensity (I) = 7.066(In/Hr) for a 100.0 year storm
181 Effective runoff coefficient used for area (Q=KCIA) is C = 0.350
182 Subarea runoff = 0.237(CFS)
183 Total initial stream area = 0.096(Ac.)
184
185
186 ++++++
187 Process from Point/Station 802.000 to Point/Station 803.000
188 **** IRREGULAR CHANNEL FLOW TRAVEL TIME ****
189
190 Estimated mean flow rate at midpoint of channel = 0.392(CFS)
191 Depth of flow = 0.441(Ft.), Average velocity = 2.015(Ft/s)
192 ***** Irregular Channel Data *****
193 -----
194 Information entered for subchannel number 1 :
195 Point number 'X' coordinate 'Y' coordinate
196 1 0.00 1.00
197 2 1.00 0.00
198 3 2.00 1.00
199 Manning's 'N' friction factor = 0.030
200 -----
201 Sub-Channel flow = 0.392(CFS)
202 ' ' flow top width = 0.882(Ft.)
203 ' ' velocity= 2.015(Ft/s)
204 ' ' area = 0.195(Sq.Ft)
205 ' ' Froude number = 0.756
206
207 Upstream point elevation = 699.560(Ft.)

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```

208 Downstream point elevation = 697.470(Ft.)
209 Flow length = 106.000(Ft.)
210 Travel time = 0.88 min.
211 Time of concentration = 7.77 min.
212 Depth of flow = 0.441(Ft.)
213 Average velocity = 2.015(Ft/s)
214 Total irregular channel flow = 0.392(CFS)
215 Irregular channel normal depth above invert elev. = 0.441(Ft.)
216 Average velocity of channel(s) = 2.015(Ft/s)
217 Adding area flow to channel
218 Rainfall intensity (I) = 6.541(In/Hr) for a 100.0 year storm
219 Decimal fraction soil group A = 0.000
220 Decimal fraction soil group B = 0.000
221 Decimal fraction soil group C = 0.000
222 Decimal fraction soil group D = 1.000
223 [UNDISTURBED NATURAL TERRAIN ]
224 (Permanent Open Space )
225 Impervious value, Ai = 0.000
226 Sub-Area C Value = 0.350
227 Rainfall intensity = 6.541(In/Hr) for a 100.0 year storm
228 Effective runoff coefficient used for total area
229 (Q=KCIA) is C = 0.350 CA = 0.077
230 Subarea runoff = 0.269(CFS) for 0.125(Ac.)
231 Total runoff = 0.506(CFS) Total area = 0.221(Ac.)
232 Depth of flow = 0.485(Ft.), Average velocity = 2.148(Ft/s)
233
234
235 *****
236 Process from Point/Station 803.000 to Point/Station 804.000
237 **** PIPEFLOW TRAVEL TIME (User specified size) ****
238
239 Upstream point/station elevation = 697.470(Ft.)
240 Downstream point/station elevation = 665.270(Ft.)
241 Pipe length = 39.00(Ft.) Slope = 0.8256 Manning's N = 0.013
242 No. of pipes = 1 Required pipe flow = 0.506(CFS)
243 Given pipe size = 24.00(In.)
244 Calculated individual pipe flow = 0.506(CFS)
245 Normal flow depth in pipe = 0.88(In.)
246 Flow top width inside pipe = 9.01(In.)
247 Critical Depth = 2.91(In.)
248 Pipe flow velocity = 13.70(Ft/s)
249 Travel time through pipe = 0.05 min.
250 Time of concentration (TC) = 7.82 min.
251
252
253 *****
254 Process from Point/Station 804.000 to Point/Station 704.000
255 **** IRREGULAR CHANNEL FLOW TRAVEL TIME ****
256
257 Estimated mean flow rate at midpoint of channel = 1.047(CFS)
258 Depth of flow = 0.412(Ft.), Average velocity = 6.164(Ft/s)
259 ***** Irregular Channel Data *****
260 -----
261 Information entered for subchannel number 1 :
262 Point number 'X' coordinate 'Y' coordinate
263 1 0.00 1.00
264 2 1.00 0.00
265 3 2.00 1.00
266 Manning's 'N' friction factor = 0.030
267 -----
268 Sub-Channel flow = 1.047(CFS)
269 ' ' flow top width = 0.824(Ft.)
270 ' ' velocity = 6.164(Ft/s)
271 ' ' area = 0.170(Sq.Ft)
272 ' ' Froude number = 2.393
273
274 Upstream point elevation = 665.270(Ft.)
275 Downstream point elevation = 616.000(Ft.)
276 Flow length = 244.000(Ft.)

```

```

277 Travel time = 0.66 min.
278 Time of concentration = 8.48 min.
279 Depth of flow = 0.412(Ft.)
280 Average velocity = 6.164(Ft/s)
281 Total irregular channel flow = 1.047(CFS)
282 Irregular channel normal depth above invert elev. = 0.412(Ft.)
283 Average velocity of channel(s) = 6.164(Ft/s)
284 Adding area flow to channel
285 Rainfall intensity (I) = 6.184(In/Hr) for a 100.0 year storm
286 Decimal fraction soil group A = 0.000
287 Decimal fraction soil group B = 0.000
288 Decimal fraction soil group C = 0.000
289 Decimal fraction soil group D = 1.000
290 [UNDISTURBED NATURAL TERRAIN ]
291 (Permanent Open Space )
292 Impervious value, Ai = 0.000
293 Sub-Area C Value = 0.350
294 Rainfall intensity = 6.184(In/Hr) for a 100.0 year storm
295 Effective runoff coefficient used for total area
296 (Q=KCIA) is C = 0.350 CA = 0.243
297 Subarea runoff = 0.996(CFS) for 0.473(Ac.)
298 Total runoff = 1.502(CFS) Total area = 0.694(Ac.)
299 Depth of flow = 0.472(Ft.), Average velocity = 6.746(Ft/s)
300
301
302 ++++++
303 Process from Point/Station 704.000 to Point/Station 704.000
304 **** CONFLUENCE OF MINOR STREAMS ****
305
306 Along Main Stream number: 1 in normal stream number 2
307 Stream flow area = 0.694(Ac.)
308 Runoff from this stream = 1.502(CFS)
309 Time of concentration = 8.48 min.
310 Rainfall intensity = 6.184(In/Hr)
311 Summary of stream data:
312
313 Stream Flow rate TC Rainfall Intensity
314 No. (CFS) (min) (In/Hr)
315
316
317 1 2.402 7.31 6.805
318 2 1.502 8.48 6.184
319 Qmax(1) =
320 1.000 * 1.000 * 2.402) +
321 1.000 * 0.862 * 1.502) + = 3.697
322 Qmax(2) =
323 0.909 * 1.000 * 2.402) +
324 1.000 * 1.000 * 1.502) + = 3.685
325
326 Total of 2 streams to confluence:
327 Flow rates before confluence point:
328 2.402 1.502
329 Maximum flow rates at confluence using above data:
330 3.697 3.685
331 Area of streams before confluence:
332 0.985 0.694
333 Results of confluence:
334 Total flow rate = 3.697(CFS)
335 Time of concentration = 7.311 min.
336 Effective stream area after confluence = 1.679(Ac.)
337
338
339 ++++++
340 Process from Point/Station 704.000 to Point/Station 705.000
341 **** PIPEFLOW TRAVEL TIME (User specified size) ****
342
343 Upstream point/station elevation = 601.580(Ft.)
344 Downstream point/station elevation = 600.300(Ft.)
345 Pipe length = 18.00(Ft.) Slope = 0.0711 Manning's N = 0.013

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```

346 No. of pipes = 1 Required pipe flow = 3.697(CFS)
347 Given pipe size = 18.00(In.)
348 Calculated individual pipe flow = 3.697(CFS)
349 Normal flow depth in pipe = 4.42(In.)
350 Flow top width inside pipe = 15.49(In.)
351 Critical Depth = 8.82(In.)
352 Pipe flow velocity = 10.99(Ft/s)
353 Travel time through pipe = 0.03 min.
354 Time of concentration (TC) = 7.34 min.
355
356
357 ++++++
358 Process from Point/Station 705.000 to Point/Station 705.000
359 **** CONFLUENCE OF MINOR STREAMS ****
360
361 Along Main Stream number: 1 in normal stream number 1
362 Stream flow area = 1.679(Ac.)
363 Runoff from this stream = 3.697(CFS)
364 Time of concentration = 7.34 min.
365 Rainfall intensity = 6.789(In/Hr)
366
367
368 ++++++
369 Process from Point/Station 901.000 to Point/Station 902.000
370 **** INITIAL AREA EVALUATION ****
371
372 Decimal fraction soil group A = 0.000
373 Decimal fraction soil group B = 0.000
374 Decimal fraction soil group C = 0.000
375 Decimal fraction soil group D = 1.000
376 [UNDISTURBED NATURAL TERRAIN ]
377 (Permanent Open Space )
378 Impervious value, Ai = 0.000
379 Sub-Area C Value = 0.350
380 Initial subarea total flow distance = 97.000(Ft.)
381 Highest elevation = 699.820(Ft.)
382 Lowest elevation = 697.610(Ft.)
383 Elevation difference = 2.210(Ft.) Slope = 2.278 %
384 Top of Initial Area Slope adjusted by User to 3.619 %
385 INITIAL AREA TIME OF CONCENTRATION CALCULATIONS:
386 The maximum overland flow distance is 100.00 (Ft)
387 for the top area slope value of 3.62 %, in a development type of
388 Permanent Open Space
389 In Accordance With Figure 3-3
390 Initial Area Time of Concentration = 8.79 minutes
391 TC = [1.8*(1.1-C)*distance(Ft.)^0.5]/(% slope^(1/3))
392 TC = [1.8*(1.1-0.3500)*( 100.000^0.5)/( 3.619^(1/3))]= 8.79
393 Rainfall intensity (I) = 6.041(In/Hr) for a 100.0 year storm
394 Effective runoff coefficient used for area (Q=KCIA) is C = 0.350
395 Subarea runoff = 0.258(CFS)
396 Total initial stream area = 0.122(Ac.)
397
398
399 ++++++
400 Process from Point/Station 902.000 to Point/Station 903.000
401 **** PIPEFLOW TRAVEL TIME (User specified size) ****
402
403 Upstream point/station elevation = 697.610(Ft.)
404 Downstream point/station elevation = 673.150(Ft.)
405 Pipe length = 43.00(Ft.) Slope = 0.5688 Manning's N = 0.013
406 No. of pipes = 1 Required pipe flow = 0.258(CFS)
407 Given pipe size = 24.00(In.)
408 Calculated individual pipe flow = 0.258(CFS)
409 Normal flow depth in pipe = 0.70(In.)
410 Flow top width inside pipe = 8.07(In.)
411 Critical Depth = 2.06(In.)
412 Pipe flow velocity = 9.80(Ft/s)
413 Travel time through pipe = 0.07 min.
414 Time of concentration (TC) = 8.87 min.

```

Process from Point/Station 903.000 to Point/Station 904.000
**** IRREGULAR CHANNEL FLOW TRAVEL TIME ****

Estimated mean flow rate at midpoint of channel = 0.827(CFS)
Depth of flow = 0.351(Ft.), Average velocity = 6.710(Ft/s)
***** Irregular Channel Data *****

Information entered for subchannel number 1 :
Point number 'X' coordinate 'Y' coordinate
1 0.00 1.00
2 1.00 0.00
3 2.00 1.00
Manning's 'N' friction factor = 0.030

Sub-Channel flow = 0.827(CFS)
' ' flow top width = 0.702(Ft.)
' ' velocity = 6.710(Ft/s)
' ' area = 0.123(Sq.Ft)
' ' Froude number = 2.823

Upstream point elevation = 673.150(Ft.)
Downstream point elevation = 626.610(Ft.)
Flow length = 157.000(Ft.)
Travel time = 0.39 min.
Time of concentration = 9.26 min.
Depth of flow = 0.351(Ft.)
Average velocity = 6.710(Ft/s)
Total irregular channel flow = 0.827(CFS)
Irregular channel normal depth above invert elev. = 0.351(Ft.)
Average velocity of channel(s) = 6.710(Ft/s)
Adding area flow to channel
Rainfall intensity (I) = 5.844(In/Hr) for a 100.0 year storm
Decimal fraction soil group A = 0.000
Decimal fraction soil group B = 0.000
Decimal fraction soil group C = 0.000
Decimal fraction soil group D = 1.000
[UNDISTURBED NATURAL TERRAIN]
(Permanent Open Space)
Impervious value, Ai = 0.000
Sub-Area C Value = 0.350
Rainfall intensity = 5.844(In/Hr) for a 100.0 year storm
Effective runoff coefficient used for total area
(Q=KCIA) is C = 0.350 CA = 0.231
Subarea runoff = 1.092(CFS) for 0.538(Ac.)
Total runoff = 1.350(CFS) Total area = 0.660(Ac.)
Depth of flow = 0.422(Ft.), Average velocity = 7.585(Ft/s)

Process from Point/Station 904.000 to Point/Station 705.000
**** PIPEFLOW TRAVEL TIME (User specified size) ****

Upstream point/station elevation = 626.610(Ft.)
Downstream point/station elevation = 600.300(Ft.)
Pipe length = 306.00(Ft.) Slope = 0.0860 Manning's N = 0.013
No. of pipes = 1 Required pipe flow = 1.350(CFS)
Given pipe size = 18.00(In.)
Calculated individual pipe flow = 1.350(CFS)
Normal flow depth in pipe = 2.57(In.)
Flow top width inside pipe = 12.59(In.)
Critical Depth = 5.22(In.)
Pipe flow velocity = 8.73(Ft/s)
Travel time through pipe = 0.58 min.
Time of concentration (TC) = 9.84 min.

```

*****
Process from Point/Station      705.000 to Point/Station      705.000
**** CONFLUENCE OF MINOR STREAMS ****

```

Along Main Stream number: 1 in normal stream number 2
 Stream flow area = 0.660(Ac.)
 Runoff from this stream = 1.350(CFS)
 Time of concentration = 9.84 min.
 Rainfall intensity = 5.618(In/Hr)
 Summary of stream data:

Stream No.	Flow rate (CFS)	TC (min)	Rainfall Intensity (In/Hr)
1	3.697	7.34	6.789
2	1.350	9.84	5.618

Qmax(1) =
 1.000 * 1.000 * 3.697) +
 1.000 * 0.746 * 1.350) + = 4.704
 Qmax(2) =
 0.828 * 1.000 * 3.697) +
 1.000 * 1.000 * 1.350) + = 4.410

Total of 2 streams to confluence:
 Flow rates before confluence point:
 3.697 1.350
 Maximum flow rates at confluence using above data:
 4.704 4.410
 Area of streams before confluence:
 1.679 0.660
 Results of confluence:
 Total flow rate = 4.704(CFS)
 Time of concentration = 7.338 min.
 Effective stream area after confluence = 2.339(Ac.)
 End of computations, total study area = 2.339 (Ac.)

```

1
2 San Diego County Rational Hydrology Program
3
4 CIVILCADD/CIVILDESIGN Engineering Software,(c)1991-2019 Version 9.1
5
6 Rational method hydrology program based on
7 San Diego County Flood Control Division 2003 hydrology manual
8 Rational Hydrology Study Date: 02/06/23
9 -----
10
11 22027 POST POC3
12 UPDATED
13
14 -----
15 ***** Hydrology Study Control Information *****
16 -----
17
18
19
20 Program License Serial Number 6332
21
22 -----
23 Rational hydrology study storm event year is 100.0
24 English (in-lb) input data Units used
25
26 Map data precipitation entered:
27 6 hour, precipitation(inches) = 3.300
28 24 hour precipitation(inches) = 5.600
29 P6/P24 = 58.9%
30 San Diego hydrology manual 'C' values used
31
32
33 +-----+
34 Process from Point/Station 1001.000 to Point/Station 1002.000
35 **** INITIAL AREA EVALUATION ****
36
37 -----
38 Decimal fraction soil group A = 0.000
39 Decimal fraction soil group B = 0.000
40 Decimal fraction soil group C = 0.000
41 Decimal fraction soil group D = 1.000
42 [UNDISTURBED NATURAL TERRAIN ]
43 (Permanent Open Space )
44 Impervious value, Ai = 0.000
45 Sub-Area C Value = 0.350
46 Initial subarea total flow distance = 165.000(Ft.)
47 Highest elevation = 763.850(Ft.)
48 Lowest elevation = 749.000(Ft.)
49 Elevation difference = 14.850(Ft.) Slope = 9.000 %
50 INITIAL AREA TIME OF CONCENTRATION CALCULATIONS:
51 The maximum overland flow distance is 100.00 (Ft)
52 for the top area slope value of 9.00 %, in a development type of
53 Permanent Open Space
54 In Accordance With Figure 3-3
55 Initial Area Time of Concentration = 6.49 minutes
56 TC = [1.8*(1.1-C)*distance(Ft.)^.5]/(% slope^(1/3)]
57 TC = [1.8*(1.1-0.3500)*( 100.000^.5)/( 9.000^(1/3)]= 6.49
58 Rainfall intensity (I) = 7.348(In/Hr) for a 100.0 year storm
59 Effective runoff coefficient used for area (Q=KCIA) is C = 0.350
60 Subarea runoff = 0.293(CFS)
61 Total initial stream area = 0.114(Ac.)
62
63 +-----+
64 Process from Point/Station 1002.000 to Point/Station 1003.000
65 **** IRREGULAR CHANNEL FLOW TRAVEL TIME ****
66
67 -----
68 Estimated mean flow rate at midpoint of channel = 0.616(CFS)
69 Depth of flow = 0.326(Ft.), Average velocity = 5.792(Ft/s)
70 ***** Irregular Channel Data *****

```

```

70 -----
71 Information entered for subchannel number 1 :
72 Point number      'X' coordinate      'Y' coordinate
73     1              0.00              1.00
74     2              1.00              0.00
75     3              2.00              1.00
76 Manning's 'N' friction factor = 0.023
77 -----
78 Sub-Channel flow = 0.616(CFS)
79     '      flow top width = 0.652(Ft.)
80     '      velocity= 5.792(Ft/s)
81     '      area = 0.106(Sq.Ft)
82     '      Froude number = 2.528
83
84 Upstream point elevation = 749.000(Ft.)
85 Downstream point elevation = 700.170(Ft.)
86 Flow length = 341.000(Ft.)
87 Travel time = 0.98 min.
88 Time of concentration = 7.47 min.
89 Depth of flow = 0.326(Ft.)
90 Average velocity = 5.792(Ft/s)
91 Total irregular channel flow = 0.616(CFS)
92 Irregular channel normal depth above invert elev. = 0.326(Ft.)
93 Average velocity of channel(s) = 5.792(Ft/s)
94 Adding area flow to channel
95 Rainfall intensity (I) = 6.710(In/Hr) for a 100.0 year storm
96 Decimal fraction soil group A = 0.000
97 Decimal fraction soil group B = 0.000
98 Decimal fraction soil group C = 0.000
99 Decimal fraction soil group D = 1.000
100 [UNDISTURBED NATURAL TERRAIN
101 (Permanent Open Space )
102 Impervious value, Ai = 0.000
103 Sub-Area C Value = 0.350
104 Rainfall intensity = 6.710(In/Hr) for a 100.0 year storm
105 Effective runoff coefficient used for total area
106 (Q=KCIA) is C = 0.350 CA = 0.128
107 Subarea runoff = 0.564(CFS) for 0.251(Ac.)
108 Total runoff = 0.857(CFS) Total area = 0.365(Ac.)
109 Depth of flow = 0.369(Ft.), Average velocity = 6.291(Ft/s)
110
111
112 +-----+
113 Process from Point/Station 1003.000 to Point/Station 1003.000
114 **** CONFLUENCE OF MINOR STREAMS ****
115
116 -----
117 Along Main Stream number: 1 in normal stream number 1
118 Stream flow area = 0.365(Ac.)
119 Runoff from this stream = 0.857(CFS)
120 Time of concentration = 7.47 min.
121 Rainfall intensity = 6.710(In/Hr)
122
123 +-----+
124 Process from Point/Station 1101.000 to Point/Station 1102.000
125 **** INITIAL AREA EVALUATION ****
126
127 -----
128 Decimal fraction soil group A = 0.000
129 Decimal fraction soil group B = 0.000
130 Decimal fraction soil group C = 0.000
131 Decimal fraction soil group D = 1.000
132 [UNDISTURBED NATURAL TERRAIN
133 (Permanent Open Space )
134 Impervious value, Ai = 0.000
135 Sub-Area C Value = 0.350
136 Initial subarea total flow distance = 100.000(Ft.)
137 Highest elevation = 738.850(Ft.)
138 Lowest elevation = 714.230(Ft.)
139 Elevation difference = 24.620(Ft.) Slope = 24.620 %

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139 Top of Initial Area Slope adjusted by User to 24.160 %
140 INITIAL AREA TIME OF CONCENTRATION CALCULATIONS:
141 The maximum overland flow distance is 100.00 (Ft)
142 for the top area slope value of 24.16 %, in a development type of
143 Permanent Open Space
144 In Accordance With Figure 3-3
145 Initial Area Time of Concentration = 4.67 minutes
146  $TC = [1.8 * (1.1 - C) * distance(Ft.)^{.5} / (% slope^{(1/3)})]$ 
147  $TC = [1.8 * (1.1 - 0.3500) * (100.000^{.5}) / (24.160^{(1/3)})] = 4.67$ 
148 Calculated TC of 4.670 minutes is less than 5 minutes,
149 resetting TC to 5.0 minutes for rainfall intensity calculations
150 Rainfall intensity (I) = 8.695(In/Hr) for a 100.0 year storm
151 Effective runoff coefficient used for area (Q=KCIA) is C = 0.350
152 Subarea runoff = 0.289(CFS)
153 Total initial stream area = 0.095(Ac.)
154
155
156 ++++++
157 Process from Point/Station 1102.000 to Point/Station 1103.000
158 **** IRREGULAR CHANNEL FLOW TRAVEL TIME ****
159
160 -----
161 Estimated mean flow rate at midpoint of channel = 1.585(CFS)
162 Depth of flow = 0.647(Ft.), Average velocity = 3.784(Ft/s)
163 ***** Irregular Channel Data *****
164 -----
165 Information entered for subchannel number 1 :
166 Point number 'X' coordinate 'Y' coordinate
167 1 0.00 1.00
168 2 1.00 0.00
169 3 2.00 1.00
170 Manning's 'N' friction factor = 0.019
171 -----
172 Sub-Channel flow = 1.585(CFS)
173 ' ' flow top width = 1.295(Ft.)
174 ' ' velocity = 3.784(Ft/s)
175 ' ' area = 0.419(Sq.Ft)
176 ' ' Froude number = 1.172
177
178 Upstream point elevation = 714.230(Ft.)
179 Downstream point elevation = 707.250(Ft.)
180 Flow length = 417.291(Ft.)
181 Travel time = 1.84 min.
182 Time of concentration = 6.51 min.
183 Depth of flow = 0.647(Ft.)
184 Average velocity = 3.784(Ft/s)
185 Total irregular channel flow = 1.585(CFS)
186 Irregular channel normal depth above invert elev. = 0.647(Ft.)
187 Average velocity of channel(s) = 3.784(Ft/s)
188 Adding area flow to channel
189 Rainfall intensity (I) = 7.336(In/Hr) for a 100.0 year storm
190 Decimal fraction soil group A = 0.000
191 Decimal fraction soil group B = 0.000
192 Decimal fraction soil group C = 0.000
193 Decimal fraction soil group D = 1.000
194 [UNDISTURBED NATURAL TERRAIN ]
195 (Permanent Open Space )
196 Impervious value, Ai = 0.000
197 Sub-Area C Value = 0.350
198 Rainfall intensity = 7.336(In/Hr) for a 100.0 year storm
199 Effective runoff coefficient used for total area
200 (Q=KCIA) is C = 0.350 CA = 0.383
201 Subarea runoff = 2.522(CFS) for 1.000(Ac.)
202 Total runoff = 2.811(CFS) Total area = 1.095(Ac.)
203 Depth of flow = 0.802(Ft.), Average velocity = 4.367(Ft/s)
204
205 ++++++
206 Process from Point/Station 1103.000 to Point/Station 1103.000
207 **** 6 HOUR HYDROGRAPH ****

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Hydrograph Data - Section 6, San Diego County Hydrology manual, June 2003

Time of Concentration = 6.51
Basin Area = 1.46 Acres
6 Hour Rainfall = 3.300 Inches
Runoff Coefficient = 0.263
Peak Discharge = 2.81 CFS

Time (Min)	Discharge (CFS)
0	0.000
6	0.075
12	0.076
18	0.078
24	0.079
30	0.081
36	0.082
42	0.084
48	0.085
54	0.087
60	0.088
66	0.091
72	0.092
78	0.095
84	0.097
90	0.100
96	0.102
102	0.105
108	0.107
114	0.111
120	0.114
126	0.119
132	0.121
138	0.127
144	0.130
150	0.137
156	0.141
162	0.150
168	0.155
174	0.166
180	0.172
186	0.187
192	0.196
198	0.218
204	0.231
210	0.265
216	0.287
222	0.351
228	0.400
234	0.587
240	0.827
246	2.811
252	0.470
258	0.315
264	0.246
270	0.206
276	0.180
282	0.160
288	0.145
294	0.134
300	0.124
306	0.116
312	0.109
318	0.103
324	0.098
330	0.094
336	0.090
342	0.086

277 348 0.083
278 354 0.080
279 360 0.077
280 366 0.075

281 ++++++

282 6 - H O U R S T O R M

283 R u n o f f H y d r o g r a p h

284 -----

285 Hydrograph in 1 Minute intervals ((CFS))

286 -----

287 -----
288 Time(h+m) Volume Ac.Ft Q(CFS) 0 0.7 1.4 2.1 2.8

289 -----

290	0+ 0	0.0000	0.00	Q				
291	0+ 1	0.0000	0.01	Q				
292	0+ 2	0.0001	0.03	Q				
293	0+ 3	0.0001	0.04	Q				
294	0+ 4	0.0002	0.05	Q				
295	0+ 5	0.0003	0.06	Q				
296	0+ 6	0.0004	0.08	VQ				
297	0+ 7	0.0005	0.08	VQ				
298	0+ 8	0.0006	0.08	VQ				
299	0+ 9	0.0007	0.08	VQ				
300	0+10	0.0008	0.08	VQ				
301	0+11	0.0009	0.08	VQ				
302	0+12	0.0010	0.08	VQ				
303	0+13	0.0011	0.08	VQ				
304	0+14	0.0012	0.08	VQ				
305	0+15	0.0013	0.08	VQ				
306	0+16	0.0014	0.08	VQ				
307	0+17	0.0015	0.08	VQ				
308	0+18	0.0016	0.08	VQ				
309	0+19	0.0017	0.08	VQ				
310	0+20	0.0018	0.08	VQ				
311	0+21	0.0020	0.08	VQ				
312	0+22	0.0021	0.08	VQ				
313	0+23	0.0022	0.08	VQ				
314	0+24	0.0023	0.08	VQ				
315	0+25	0.0024	0.08	VQ				
316	0+26	0.0025	0.08	VQ				
317	0+27	0.0026	0.08	IQ				
318	0+28	0.0027	0.08	IQ				
319	0+29	0.0028	0.08	IQ				
320	0+30	0.0029	0.08	IQ				
321	0+31	0.0030	0.08	IQ				
322	0+32	0.0032	0.08	IQ				
323	0+33	0.0033	0.08	IQ				
324	0+34	0.0034	0.08	IQ				
325	0+35	0.0035	0.08	IQ				
326	0+36	0.0036	0.08	IQ				
327	0+37	0.0037	0.08	IQ				
328	0+38	0.0038	0.08	IQ				
329	0+39	0.0040	0.08	IQ				
330	0+40	0.0041	0.08	IQ				
331	0+41	0.0042	0.08	IQ				
332	0+42	0.0043	0.08	IQ				
333	0+43	0.0044	0.08	IQ				
334	0+44	0.0045	0.08	IQ				
335	0+45	0.0046	0.08	IQ				
336	0+46	0.0048	0.08	IQ				
337	0+47	0.0049	0.08	IQ				
338	0+48	0.0050	0.08	IQ				
339	0+49	0.0051	0.09	IQ				
340	0+50	0.0052	0.09	QV				
341	0+51	0.0053	0.09	QV				
342	0+52	0.0055	0.09	QV				
343	0+53	0.0056	0.09	QV				
344	0+54	0.0057	0.09	QV				
345	0+55	0.0058	0.09	QV				

346	0+56	0.0059	0.09	QV				
347	0+57	0.0061	0.09	QV				
348	0+58	0.0062	0.09	QV				
349	0+59	0.0063	0.09	QV				
350	1+ 0	0.0064	0.09	QV				
351	1+ 1	0.0066	0.09	QV				
352	1+ 2	0.0067	0.09	QV				
353	1+ 3	0.0068	0.09	QV				
354	1+ 4	0.0069	0.09	QV				
355	1+ 5	0.0071	0.09	QV				
356	1+ 6	0.0072	0.09	QV				
357	1+ 7	0.0073	0.09	QV				
358	1+ 8	0.0074	0.09	QV				
359	1+ 9	0.0076	0.09	QV				
360	1+10	0.0077	0.09	QV				
361	1+11	0.0078	0.09	Q V				
362	1+12	0.0079	0.09	Q V				
363	1+13	0.0081	0.09	Q V				
364	1+14	0.0082	0.09	Q V				
365	1+15	0.0083	0.09	Q V				
366	1+16	0.0084	0.09	Q V				
367	1+17	0.0086	0.09	Q V				
368	1+18	0.0087	0.10	Q V				
369	1+19	0.0088	0.10	Q V				
370	1+20	0.0090	0.10	Q V				
371	1+21	0.0091	0.10	Q V				
372	1+22	0.0092	0.10	Q V				
373	1+23	0.0094	0.10	Q V				
374	1+24	0.0095	0.10	Q V				
375	1+25	0.0096	0.10	Q V				
376	1+26	0.0098	0.10	Q V				
377	1+27	0.0099	0.10	Q V				
378	1+28	0.0100	0.10	Q V				
379	1+29	0.0102	0.10	Q V				
380	1+30	0.0103	0.10	Q V				
381	1+31	0.0105	0.10	Q V				
382	1+32	0.0106	0.10	Q V				
383	1+33	0.0107	0.10	Q V				
384	1+34	0.0109	0.10	Q V				
385	1+35	0.0110	0.10	Q V				
386	1+36	0.0112	0.10	Q V				
387	1+37	0.0113	0.10	Q V				
388	1+38	0.0114	0.10	Q V				
389	1+39	0.0116	0.10	Q V				
390	1+40	0.0117	0.10	Q V				
391	1+41	0.0119	0.10	Q V				
392	1+42	0.0120	0.11	Q V				
393	1+43	0.0122	0.11	Q V				
394	1+44	0.0123	0.11	Q V				
395	1+45	0.0124	0.11	Q V				
396	1+46	0.0126	0.11	Q V				
397	1+47	0.0127	0.11	Q V				
398	1+48	0.0129	0.11	Q V				
399	1+49	0.0130	0.11	Q V				
400	1+50	0.0132	0.11	Q V				
401	1+51	0.0133	0.11	Q V				
402	1+52	0.0135	0.11	Q V				
403	1+53	0.0136	0.11	Q V				
404	1+54	0.0138	0.11	Q V				
405	1+55	0.0139	0.11	Q V				
406	1+56	0.0141	0.11	Q V				
407	1+57	0.0143	0.11	Q V				
408	1+58	0.0144	0.11	Q V				
409	1+59	0.0146	0.11	Q V				
410	2+ 0	0.0147	0.11	Q V				
411	2+ 1	0.0149	0.11	Q V				
412	2+ 2	0.0150	0.12	Q V				
413	2+ 3	0.0152	0.12	Q V				
414	2+ 4	0.0154	0.12	Q V				

415	2+ 5	0.0155	0.12	Q	V				
416	2+ 6	0.0157	0.12	Q	V				
417	2+ 7	0.0158	0.12	Q	V				
418	2+ 8	0.0160	0.12	Q	V				
419	2+ 9	0.0162	0.12	Q	V				
420	2+10	0.0163	0.12	Q	V				
421	2+11	0.0165	0.12	Q	V				
422	2+12	0.0167	0.12	Q	V				
423	2+13	0.0168	0.12	Q	V				
424	2+14	0.0170	0.12	Q	V				
425	2+15	0.0172	0.12	Q	V				
426	2+16	0.0174	0.13	Q	V				
427	2+17	0.0175	0.13	Q	V				
428	2+18	0.0177	0.13	Q	V				
429	2+19	0.0179	0.13	Q	V				
430	2+20	0.0181	0.13	Q	V				
431	2+21	0.0182	0.13	Q	V				
432	2+22	0.0184	0.13	Q	V				
433	2+23	0.0186	0.13	Q	V				
434	2+24	0.0188	0.13	Q	V				
435	2+25	0.0190	0.13	Q	V				
436	2+26	0.0191	0.13	Q	V				
437	2+27	0.0193	0.13	Q	V				
438	2+28	0.0195	0.13	Q	V				
439	2+29	0.0197	0.14	Q	V				
440	2+30	0.0199	0.14	Q	V				
441	2+31	0.0201	0.14	Q	V				
442	2+32	0.0203	0.14	Q	V				
443	2+33	0.0205	0.14	Q	V				
444	2+34	0.0206	0.14	Q	V				
445	2+35	0.0208	0.14	Q	V				
446	2+36	0.0210	0.14	Q	V				
447	2+37	0.0212	0.14	Q	V				
448	2+38	0.0214	0.14	Q	V				
449	2+39	0.0216	0.15	Q	V				
450	2+40	0.0218	0.15	Q	V				
451	2+41	0.0220	0.15	Q	V				
452	2+42	0.0222	0.15	Q	V				
453	2+43	0.0225	0.15	Q	V				
454	2+44	0.0227	0.15	Q	V				
455	2+45	0.0229	0.15	Q	V				
456	2+46	0.0231	0.15	Q	V				
457	2+47	0.0233	0.15	Q	V				
458	2+48	0.0235	0.15	Q	V				
459	2+49	0.0237	0.16	Q	V				
460	2+50	0.0239	0.16	Q	V				
461	2+51	0.0242	0.16	Q	V				
462	2+52	0.0244	0.16	Q	V				
463	2+53	0.0246	0.16	Q	V				
464	2+54	0.0248	0.17	Q	V				
465	2+55	0.0251	0.17	Q	V				
466	2+56	0.0253	0.17	Q	V				
467	2+57	0.0255	0.17	Q	V				
468	2+58	0.0258	0.17	Q	V				
469	2+59	0.0260	0.17	Q	V				
470	3+ 0	0.0262	0.17	Q	V				
471	3+ 1	0.0265	0.17	Q	V				
472	3+ 2	0.0267	0.18	Q	V				
473	3+ 3	0.0270	0.18	Q	V				
474	3+ 4	0.0272	0.18	Q	V				
475	3+ 5	0.0275	0.18	Q	V				
476	3+ 6	0.0277	0.19	Q	V				
477	3+ 7	0.0280	0.19	Q	V				
478	3+ 8	0.0283	0.19	Q	V				
479	3+ 9	0.0285	0.19	Q	V				
480	3+10	0.0288	0.19	Q	V				
481	3+11	0.0291	0.19	Q	V				
482	3+12	0.0293	0.20	Q	V				
483	3+13	0.0296	0.20	Q	V				

484	3+14	0.0299	0.20	Q	V			
485	3+15	0.0302	0.21	Q	V			
486	3+16	0.0305	0.21	Q	V			
487	3+17	0.0308	0.21	Q	V			
488	3+18	0.0311	0.22	Q	V			
489	3+19	0.0314	0.22	Q	V			
490	3+20	0.0317	0.22	Q	V			
491	3+21	0.0320	0.22	Q	V			
492	3+22	0.0323	0.23	Q	V			
493	3+23	0.0326	0.23	Q	V			
494	3+24	0.0329	0.23	Q	V			
495	3+25	0.0332	0.24	Q	V			
496	3+26	0.0336	0.24	Q	V			
497	3+27	0.0339	0.25	Q	V			
498	3+28	0.0343	0.25	Q	V			
499	3+29	0.0346	0.26	Q	V			
500	3+30	0.0350	0.26	Q	V			
501	3+31	0.0354	0.27	Q	V			
502	3+32	0.0357	0.27	Q	V			
503	3+33	0.0361	0.28	Q	V			
504	3+34	0.0365	0.28	Q	V			
505	3+35	0.0369	0.28	Q	V			
506	3+36	0.0373	0.29	Q	V			
507	3+37	0.0377	0.30	Q	V			
508	3+38	0.0381	0.31	Q	V			
509	3+39	0.0386	0.32	Q	V			
510	3+40	0.0390	0.33	Q	V			
511	3+41	0.0395	0.34	Q	V			
512	3+42	0.0400	0.35	Q	V			
513	3+43	0.0405	0.36	Q	V			
514	3+44	0.0410	0.37	Q	V			
515	3+45	0.0415	0.38	Q	V			
516	3+46	0.0420	0.38	Q	V			
517	3+47	0.0426	0.39	Q	V			
518	3+48	0.0431	0.40	Q	V			
519	3+49	0.0437	0.43	Q	V			
520	3+50	0.0443	0.46	Q	V			
521	3+51	0.0450	0.49	Q	V			
522	3+52	0.0457	0.52	Q	V			
523	3+53	0.0465	0.56	Q	V			
524	3+54	0.0473	0.59	Q	V			
525	3+55	0.0482	0.63	Q	V			
526	3+56	0.0491	0.67	Q	V			
527	3+57	0.0501	0.71	Q	V			
528	3+58	0.0511	0.75	Q	V			
529	3+59	0.0522	0.79	Q	V			
530	4+ 0	0.0533	0.83	Q	V			
531	4+ 1	0.0549	1.16	Q	V	Q		
532	4+ 2	0.0570	1.49		Q	V	Q	
533	4+ 3	0.0595	1.82			V	Q	
534	4+ 4	0.0624	2.15			V	V	Q
535	4+ 5	0.0658	2.48			V	V	
536	4+ 6	0.0697	2.81			V	V	
537	4+ 7	0.0730	2.42				V	Q
538	4+ 8	0.0758	2.03			Q	QV	
539	4+ 9	0.0781	1.64				V	
540	4+10	0.0798	1.25		Q		V	
541	4+11	0.0810	0.86				V	
542	4+12	0.0817	0.47	Q			V	
543	4+13	0.0823	0.44	Q			V	
544	4+14	0.0828	0.42	Q			V	
545	4+15	0.0834	0.39	Q			V	
546	4+16	0.0839	0.37	Q			V	
547	4+17	0.0844	0.34	Q			V	
548	4+18	0.0848	0.31	Q			V	
549	4+19	0.0852	0.30	Q			V	
550	4+20	0.0856	0.29	Q			V	
551	4+21	0.0860	0.28	Q			V	
552	4+22	0.0864	0.27	Q			V	

553	4+23	0.0867	0.26	Q				V	
554	4+24	0.0871	0.25	Q				V	
555	4+25	0.0874	0.24	Q				V	
556	4+26	0.0877	0.23	Q				V	
557	4+27	0.0880	0.23	Q				V	
558	4+28	0.0883	0.22	Q				V	
559	4+29	0.0886	0.21	Q				V	
560	4+30	0.0889	0.21	Q				V	
561	4+31	0.0892	0.20	Q				V	
562	4+32	0.0895	0.20	Q				V	
563	4+33	0.0897	0.19	Q				V	
564	4+34	0.0900	0.19	Q				V	
565	4+35	0.0902	0.18	Q				V	
566	4+36	0.0905	0.18	Q				V	
567	4+37	0.0907	0.18	Q				V	
568	4+38	0.0910	0.17	Q				V	
569	4+39	0.0912	0.17	Q				V	
570	4+40	0.0914	0.17	Q				V	
571	4+41	0.0917	0.16	Q				V	
572	4+42	0.0919	0.16	Q				V	
573	4+43	0.0921	0.16	Q				V	
574	4+44	0.0923	0.16	Q				V	
575	4+45	0.0925	0.15	Q				V	
576	4+46	0.0927	0.15	Q				V	
577	4+47	0.0929	0.15	Q				V	
578	4+48	0.0931	0.15	Q				V	
579	4+49	0.0933	0.14	Q				V	
580	4+50	0.0935	0.14	Q				V	
581	4+51	0.0937	0.14	Q				V	
582	4+52	0.0939	0.14	Q				V	
583	4+53	0.0941	0.14	Q				V	
584	4+54	0.0943	0.13	Q				V	
585	4+55	0.0945	0.13	Q				V	
586	4+56	0.0946	0.13	Q				V	
587	4+57	0.0948	0.13	Q				V	
588	4+58	0.0950	0.13	Q				V	
589	4+59	0.0952	0.13	Q				V	
590	5+ 0	0.0953	0.12	Q				V	
591	5+ 1	0.0955	0.12	Q				V	
592	5+ 2	0.0957	0.12	Q				V	
593	5+ 3	0.0958	0.12	Q				V	
594	5+ 4	0.0960	0.12	Q				V	
595	5+ 5	0.0962	0.12	Q				V	
596	5+ 6	0.0963	0.12	Q				V	
597	5+ 7	0.0965	0.11	Q				V	
598	5+ 8	0.0966	0.11	Q				V	
599	5+ 9	0.0968	0.11	Q				V	
600	5+10	0.0969	0.11	Q				V	
601	5+11	0.0971	0.11	Q				V	
602	5+12	0.0972	0.11	Q				V	
603	5+13	0.0974	0.11	Q				V	
604	5+14	0.0975	0.11	Q				V	
605	5+15	0.0977	0.11	Q				V	
606	5+16	0.0978	0.11	Q				V	
607	5+17	0.0980	0.10	Q				V	
608	5+18	0.0981	0.10	Q				V	
609	5+19	0.0983	0.10	Q				V	
610	5+20	0.0984	0.10	Q				V	
611	5+21	0.0985	0.10	Q				V	
612	5+22	0.0987	0.10	Q				V	
613	5+23	0.0988	0.10	Q				V	
614	5+24	0.0989	0.10	Q				V	
615	5+25	0.0991	0.10	Q				V	
616	5+26	0.0992	0.10	Q				V	
617	5+27	0.0993	0.10	Q				V	
618	5+28	0.0995	0.10	Q				V	
619	5+29	0.0996	0.09	Q				V	
620	5+30	0.0997	0.09	Q				V	
621	5+31	0.0999	0.09	Q				V	

622	5+32	0.1000	0.09	Q					V
623	5+33	0.1001	0.09	Q					V
624	5+34	0.1002	0.09	Q					V
625	5+35	0.1004	0.09	Q					V
626	5+36	0.1005	0.09	Q					V
627	5+37	0.1006	0.09	Q					V
628	5+38	0.1007	0.09	Q					V
629	5+39	0.1009	0.09	Q					V
630	5+40	0.1010	0.09	Q					V
631	5+41	0.1011	0.09	Q					V
632	5+42	0.1012	0.09	Q					V
633	5+43	0.1013	0.09	Q					V
634	5+44	0.1015	0.08	Q					V
635	5+45	0.1016	0.08	Q					V
636	5+46	0.1017	0.08	Q					V
637	5+47	0.1018	0.08	Q					V
638	5+48	0.1019	0.08	Q					V
639	5+49	0.1020	0.08	Q					V
640	5+50	0.1021	0.08	Q					V
641	5+51	0.1022	0.08	Q					V
642	5+52	0.1024	0.08	Q					V
643	5+53	0.1025	0.08	Q					V
644	5+54	0.1026	0.08	Q					V
645	5+55	0.1027	0.08	Q					V
646	5+56	0.1028	0.08	Q					V
647	5+57	0.1029	0.08	Q					V
648	5+58	0.1030	0.08	Q					V
649	5+59	0.1031	0.08	Q					V
650	6+ 0	0.1032	0.08	Q					V
651	6+ 1	0.1033	0.08	Q					V
652	6+ 2	0.1034	0.08	Q					V
653	6+ 3	0.1035	0.08	Q					V
654	6+ 4	0.1036	0.08	Q					V
655	6+ 5	0.1037	0.08	Q					V
656	6+ 6	0.1039	0.07	Q					V

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Process from Point/Station

1103.000

to Point/Station

1003.000

**** PIPEFLOW TRAVEL TIME (User specified size) ****

Upstream point/station elevation =

707.250(Ft.)

Downstream point/station elevation =

700.170(Ft.)

Pipe length =

212.00(Ft.)

Slope =

0.0334

Manning's N =

0.013

No. of pipes =

1

Required pipe flow =

2.811(CFS)

Given pipe size =

18.00(In.)

Calculated individual pipe flow =

2.811(CFS)

Normal flow depth in pipe =

4.65(In.)

Flow top width inside pipe =

15.76(In.)

Critical Depth =

7.64(In.)

Pipe flow velocity =

7.76(Ft/s)

Travel time through pipe =

0.46 min.

Time of concentration (TC) =

6.96 min.

680

681

682

Process from Point/Station

1003.000

to Point/Station

1003.000

**** CONFLUENCE OF MINOR STREAMS ****

Along Main Stream number:

1

in normal stream number

2

Stream flow area =

1.095(Ac.)

Runoff from this stream =

2.811(CFS)

Time of concentration =

6.96 min.

Rainfall intensity =

7.022(In/Hr)

Summary of stream data:

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

1	0.857	7.47	6.710
2	2.811	6.96	7.022

Qmax(1) =
1.000 * 1.000 * 0.857) +
0.956 * 1.000 * 2.811) + = 3.544

Qmax(2) =
1.000 * 0.932 * 0.857) +
1.000 * 1.000 * 2.811) + = 3.610

Total of 2 streams to confluence:

Flow rates before confluence point:

0.857 2.811

Maximum flow rates at confluence using above data:

3.544 3.610

Area of streams before confluence:

0.365 1.095

Results of confluence:

Total flow rate = 3.610(CFS)

Time of concentration = 6.963 min.

Effective stream area after confluence = 1.460(Ac.)

Process from Point/Station 1003.000 to Point/Station 1004.000
**** IRREGULAR CHANNEL FLOW TRAVEL TIME ****

Depth of flow = 0.605(Ft.), Average velocity = 9.870(Ft/s)
***** Irregular Channel Data *****

Information entered for subchannel number 1 :

Point number 'X' coordinate 'Y' coordinate

1 0.00 1.00

2 1.00 0.00

3 2.00 1.00

Manning's 'N' friction factor = 0.030

Sub-Channel flow = 3.610(CFS)
' ' flow top width = 1.210(Ft.)
' ' velocity= 9.870(Ft/s)
' ' area = 0.366(Sq.Ft)
' ' Froude number = 3.163

Upstream point elevation = 696.870(Ft.)

Downstream point elevation = 651.540(Ft.)

Flow length = 146.000(Ft.)

Travel time = 0.25 min.

Time of concentration = 7.21 min.

Depth of flow = 0.605(Ft.)

Average velocity = 9.870(Ft/s)

Total irregular channel flow = 3.610(CFS)

Irregular channel normal depth above invert elev. = 0.605(Ft.)

Average velocity of channel(s) = 9.870(Ft/s)

Process from Point/Station 1005.000 to Point/Station 1006.000
**** IRREGULAR CHANNEL FLOW TRAVEL TIME ****

Depth of flow = 0.590(Ft.), Average velocity = 10.366(Ft/s)
***** Irregular Channel Data *****

Information entered for subchannel number 1 :

Point number 'X' coordinate 'Y' coordinate


```
760         1           0.00           1.00
761         2           1.00           0.00
762         3           2.00           1.00
763 Manning's 'N' friction factor = 0.030
764 -----
765 Sub-Channel flow = 3.610(CFS)
766 ' ' flow top width = 1.180(Ft.)
767 ' ' velocity= 10.366(Ft/s)
768 ' ' area = 0.348(Sq.Ft)
769 ' ' Froude number = 3.363
770
771 Upstream point elevation = 680.820(Ft.)
772 Downstream point elevation = 600.490(Ft.)
773 Flow length = 227.000(Ft.)
774 Travel time = 0.36 min.
775 Time of concentration = 7.57 min.
776 Depth of flow = 0.590(Ft.)
777 Average velocity = 10.366(Ft/s)
778 Total irregular channel flow = 3.610(CFS)
779 Irregular channel normal depth above invert elev. = 0.590(Ft.)
780 Average velocity of channel(s) = 10.366(Ft/s)
781 End of computations, total study area = 1.460 (Ac.)
782
783
784
```

6c. CivilD Mitigated Post-Development Calculations

```

San Diego County Rational Hydrology Program

CIVILCADD/CIVILDESIGN Engineering Software,(c)1991-2019 Version 9.1

Rational method hydrology program based on
San Diego County Flood Control Division 2003 hydrology manual
Rational Hydrology Study Date: 02/07/23
-----
22027 POST POC1
MITIGATION PART 1

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

Program License Serial Number 6332

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

Map data precipitation entered:
6 hour, precipitation(inches) = 3.300
24 hour precipitation(inches) = 5.600
P6/P24 = 58.9%
San Diego hydrology manual 'C' values used

+++++
Process from Point/Station 101.000 to Point/Station 103.000
**** USER DEFINED FLOW INFORMATION AT A POINT ****

-----
User specified 'C' value of 0.789 given for subarea
Rainfall intensity (I) = 5.708(In/Hr) for a 100.0 year storm
User specified values are as follows:
TC = 9.60 min. Rain intensity = 5.71(In/Hr)
Total area = 2.300(Ac.) Total runoff = 10.357(CFS)

+++++
Process from Point/Station 104.000 to Point/Station 104.000
**** SUBAREA FLOW ADDITION ****

-----
Rainfall intensity (I) = 5.708(In/Hr) for a 100.0 year storm
Decimal fraction soil group A = 0.000
Decimal fraction soil group B = 0.000
Decimal fraction soil group C = 0.000
Decimal fraction soil group D = 1.000
[UNDISTURBED NATURAL TERRAIN ]
(Permanent Open Space )
Impervious value, Ai = 0.000
Sub-Area C Value = 0.350
Time of concentration = 9.60 min.
Rainfall intensity = 5.708(In/Hr) for a 100.0 year storm
Effective runoff coefficient used for total area
(Q=KCIA) is C = 0.744 CA = 1.906
Subarea runoff = 0.522(CFS) for 0.260(Ac.)
Total runoff = 10.879(CFS) Total area = 2.560(Ac.)

+++++
Process from Point/Station 104.000 to Point/Station 104.000
**** SUBAREA FLOW ADDITION ****

-----
Rainfall intensity (I) = 5.708(In/Hr) for a 100.0 year storm

```

Decimal fraction soil group A = 0.000
 Decimal fraction soil group B = 0.000
 Decimal fraction soil group C = 0.000
 Decimal fraction soil group D = 1.000
 [HIGH DENSITY RESIDENTIAL
 (43.0 DU/A or Less)
 Impervious value, Ai = 0.800
 Sub-Area C Value = 0.790
 Time of concentration = 9.60 min.
 Rainfall intensity = 5.708(In/Hr) for a 100.0 year storm
 Effective runoff coefficient used for total area
 (Q=KCIA) is C = 0.749 CA = 2.130
 Subarea runoff = 1.281(CFS) for 0.284(Ac.)
 Total runoff = 12.159(CFS) Total area = 2.844(Ac.)

 Process from Point/Station 104.000 to Point/Station 104.000
 **** 6 HOUR HYDROGRAPH ****

 Hydrograph Data - Section 6, San Diego County Hydrology manual, June 2003

Time of Concentration = 9.60
 Basin Area = 2.84 Acres
 6 Hour Rainfall = 3.300 Inches
 Runoff Coefficient = 0.749
 Peak Discharge = 12.16 CFS
 Time (Min) Discharge (CFS)

0	0.000
9	0.413
18	0.427
27	0.434
36	0.450
45	0.459
54	0.477
63	0.486
72	0.507
81	0.519
90	0.544
99	0.557
108	0.587
117	0.604
126	0.641
135	0.663
144	0.710
153	0.738
162	0.802
171	0.840
180	0.932
189	0.988
198	1.132
207	1.228
216	1.501
225	1.709
234	2.510
243	3.537
252	12.159
261	2.013
270	1.347
279	1.054
288	0.883
297	0.768
306	0.685
315	0.622
324	0.572
333	0.531
342	0.496

139 351 0.467
140 360 0.442
141 369 0.420

142 ++++++

143 6 - H O U R S T O R M
144 R u n o f f H y d r o g r a p h

145 -----

146 Hydrograph in 1 Minute intervals ((CFS))

147 -----

148 -----
149 Time(h+m) Volume Ac.Ft Q(CFS) 0 3.0 6.1 9.1 12.2
150 -----

151	0+ 0	0.0000	0.00	Q				
152	0+ 1	0.0001	0.05	Q				
153	0+ 2	0.0002	0.09	Q				
154	0+ 3	0.0004	0.14	Q				
155	0+ 4	0.0006	0.18	Q				
156	0+ 5	0.0009	0.23	Q				
157	0+ 6	0.0013	0.28	Q				
158	0+ 7	0.0018	0.32	VQ				
159	0+ 8	0.0023	0.37	VQ				
160	0+ 9	0.0028	0.41	VQ				
161	0+10	0.0034	0.41	VQ				
162	0+11	0.0040	0.42	VQ				
163	0+12	0.0046	0.42	VQ				
164	0+13	0.0051	0.42	VQ				
165	0+14	0.0057	0.42	VQ				
166	0+15	0.0063	0.42	VQ				
167	0+16	0.0069	0.42	VQ				
168	0+17	0.0075	0.43	VQ				
169	0+18	0.0081	0.43	VQ				
170	0+19	0.0087	0.43	VQ				
171	0+20	0.0092	0.43	VQ				
172	0+21	0.0098	0.43	VQ				
173	0+22	0.0104	0.43	VQ				
174	0+23	0.0110	0.43	VQ				
175	0+24	0.0116	0.43	VQ				
176	0+25	0.0122	0.43	VQ				
177	0+26	0.0128	0.43	VQ				
178	0+27	0.0134	0.43	VQ				
179	0+28	0.0140	0.44	VQ				
180	0+29	0.0146	0.44	IQ				
181	0+30	0.0152	0.44	IQ				
182	0+31	0.0158	0.44	IQ				
183	0+32	0.0164	0.44	IQ				
184	0+33	0.0171	0.44	IQ				
185	0+34	0.0177	0.45	IQ				
186	0+35	0.0183	0.45	IQ				
187	0+36	0.0189	0.45	IQ				
188	0+37	0.0195	0.45	IQ				
189	0+38	0.0202	0.45	IQ				
190	0+39	0.0208	0.45	IQ				
191	0+40	0.0214	0.45	IQ				
192	0+41	0.0220	0.45	IQ				
193	0+42	0.0227	0.46	IQ				
194	0+43	0.0233	0.46	IQ				
195	0+44	0.0239	0.46	IQ				
196	0+45	0.0245	0.46	IQ				
197	0+46	0.0252	0.46	IQ				
198	0+47	0.0258	0.46	IQ				
199	0+48	0.0265	0.46	IQ				
200	0+49	0.0271	0.47	IQ				
201	0+50	0.0277	0.47	IQ				
202	0+51	0.0284	0.47	IQ				
203	0+52	0.0290	0.47	QV				
204	0+53	0.0297	0.47	QV				
205	0+54	0.0304	0.48	QV				
206	0+55	0.0310	0.48	QV				
207	0+56	0.0317	0.48	QV				

208	0+57	0.0323	0.48	QV				
209	0+58	0.0330	0.48	QV				
210	0+59	0.0337	0.48	QV				
211	1+ 0	0.0343	0.48	QV				
212	1+ 1	0.0350	0.48	QV				
213	1+ 2	0.0357	0.49	QV				
214	1+ 3	0.0363	0.49	QV				
215	1+ 4	0.0370	0.49	QV				
216	1+ 5	0.0377	0.49	QV				
217	1+ 6	0.0384	0.49	QV				
218	1+ 7	0.0390	0.50	QV				
219	1+ 8	0.0397	0.50	QV				
220	1+ 9	0.0404	0.50	QV				
221	1+10	0.0411	0.50	QV				
222	1+11	0.0418	0.50	QV				
223	1+12	0.0425	0.51	QV				
224	1+13	0.0432	0.51	QV				
225	1+14	0.0439	0.51	Q V				
226	1+15	0.0446	0.51	Q V				
227	1+16	0.0453	0.51	Q V				
228	1+17	0.0460	0.51	Q V				
229	1+18	0.0467	0.51	Q V				
230	1+19	0.0474	0.52	Q V				
231	1+20	0.0482	0.52	Q V				
232	1+21	0.0489	0.52	Q V				
233	1+22	0.0496	0.52	Q V				
234	1+23	0.0503	0.52	Q V				
235	1+24	0.0510	0.53	Q V				
236	1+25	0.0518	0.53	Q V				
237	1+26	0.0525	0.53	Q V				
238	1+27	0.0532	0.54	Q V				
239	1+28	0.0540	0.54	Q V				
240	1+29	0.0547	0.54	Q V				
241	1+30	0.0555	0.54	Q V				
242	1+31	0.0562	0.55	Q V				
243	1+32	0.0570	0.55	Q V				
244	1+33	0.0577	0.55	Q V				
245	1+34	0.0585	0.55	Q V				
246	1+35	0.0592	0.55	Q V				
247	1+36	0.0600	0.55	Q V				
248	1+37	0.0608	0.55	Q V				
249	1+38	0.0615	0.56	Q V				
250	1+39	0.0623	0.56	Q V				
251	1+40	0.0631	0.56	Q V				
252	1+41	0.0638	0.56	Q V				
253	1+42	0.0646	0.57	Q V				
254	1+43	0.0654	0.57	Q V				
255	1+44	0.0662	0.57	Q V				
256	1+45	0.0670	0.58	Q V				
257	1+46	0.0678	0.58	Q V				
258	1+47	0.0686	0.58	Q V				
259	1+48	0.0694	0.59	Q V				
260	1+49	0.0702	0.59	Q V				
261	1+50	0.0710	0.59	Q V				
262	1+51	0.0719	0.59	Q V				
263	1+52	0.0727	0.59	Q V				
264	1+53	0.0735	0.60	Q V				
265	1+54	0.0743	0.60	Q V				
266	1+55	0.0752	0.60	Q V				
267	1+56	0.0760	0.60	Q V				
268	1+57	0.0768	0.60	Q V				
269	1+58	0.0776	0.61	Q V				
270	1+59	0.0785	0.61	Q V				
271	2+ 0	0.0793	0.62	Q V				
272	2+ 1	0.0802	0.62	Q V				
273	2+ 2	0.0811	0.62	Q V				
274	2+ 3	0.0819	0.63	Q V				
275	2+ 4	0.0828	0.63	Q V				
276	2+ 5	0.0837	0.64	Q V				

277	2+ 6	0.0846	0.64	Q	V				
278	2+ 7	0.0854	0.64	Q	V				
279	2+ 8	0.0863	0.65	Q	V				
280	2+ 9	0.0872	0.65	Q	V				
281	2+10	0.0881	0.65	Q	V				
282	2+11	0.0890	0.65	Q	V				
283	2+12	0.0899	0.66	Q	V				
284	2+13	0.0908	0.66	Q	V				
285	2+14	0.0917	0.66	Q	V				
286	2+15	0.0927	0.66	Q	V				
287	2+16	0.0936	0.67	Q	V				
288	2+17	0.0945	0.67	Q	V				
289	2+18	0.0954	0.68	Q	V				
290	2+19	0.0964	0.68	Q	V				
291	2+20	0.0973	0.69	Q	V				
292	2+21	0.0983	0.69	Q	V				
293	2+22	0.0992	0.70	Q	V				
294	2+23	0.1002	0.71	Q	V				
295	2+24	0.1012	0.71	Q	V				
296	2+25	0.1022	0.71	Q	V				
297	2+26	0.1032	0.72	Q	V				
298	2+27	0.1042	0.72	Q	V				
299	2+28	0.1052	0.72	Q	V				
300	2+29	0.1062	0.73	Q	V				
301	2+30	0.1072	0.73	Q	V				
302	2+31	0.1082	0.73	Q	V				
303	2+32	0.1092	0.73	Q	V				
304	2+33	0.1102	0.74	Q	V				
305	2+34	0.1112	0.75	Q	V				
306	2+35	0.1123	0.75	Q	V				
307	2+36	0.1133	0.76	Q	V				
308	2+37	0.1144	0.77	Q	V				
309	2+38	0.1154	0.77	Q	V				
310	2+39	0.1165	0.78	Q	V				
311	2+40	0.1176	0.79	Q	V				
312	2+41	0.1187	0.79	Q	V				
313	2+42	0.1198	0.80	Q	V				
314	2+43	0.1209	0.81	Q	V				
315	2+44	0.1220	0.81	Q	V				
316	2+45	0.1231	0.81	Q	V				
317	2+46	0.1243	0.82	Q	V				
318	2+47	0.1254	0.82	Q	V				
319	2+48	0.1265	0.83	Q	V				
320	2+49	0.1277	0.83	Q	V				
321	2+50	0.1288	0.84	Q	V				
322	2+51	0.1300	0.84	Q	V				
323	2+52	0.1312	0.85	Q	V				
324	2+53	0.1323	0.86	Q	V				
325	2+54	0.1335	0.87	Q	V				
326	2+55	0.1348	0.88	Q	V				
327	2+56	0.1360	0.89	Q	V				
328	2+57	0.1372	0.90	Q	V				
329	2+58	0.1385	0.91	Q	V				
330	2+59	0.1397	0.92	Q	V				
331	3+ 0	0.1410	0.93	Q	V				
332	3+ 1	0.1423	0.94	Q	V				
333	3+ 2	0.1436	0.94	Q	V				
334	3+ 3	0.1449	0.95	Q	V				
335	3+ 4	0.1463	0.96	Q	V				
336	3+ 5	0.1476	0.96	Q	V				
337	3+ 6	0.1489	0.97	Q	V				
338	3+ 7	0.1503	0.98	Q	V				
339	3+ 8	0.1516	0.98	Q	V				
340	3+ 9	0.1530	0.99	Q	V				
341	3+10	0.1544	1.00	Q	V				
342	3+11	0.1558	1.02	Q	V				
343	3+12	0.1572	1.04	Q	V				
344	3+13	0.1586	1.05	Q	V				
345	3+14	0.1601	1.07	Q	V				

346	3+15	0.1616	1.08	Q	V				
347	3+16	0.1631	1.10	Q	V				
348	3+17	0.1647	1.12	Q	V				
349	3+18	0.1662	1.13	Q	V				
350	3+19	0.1678	1.14	Q	V				
351	3+20	0.1694	1.15	Q	V				
352	3+21	0.1710	1.16	Q	V				
353	3+22	0.1726	1.17	Q	V				
354	3+23	0.1742	1.19	Q	V				
355	3+24	0.1759	1.20	Q	V				
356	3+25	0.1775	1.21	Q	V				
357	3+26	0.1792	1.22	Q	V				
358	3+27	0.1809	1.23	Q	V				
359	3+28	0.1826	1.26	Q	V				
360	3+29	0.1844	1.29	Q	V				
361	3+30	0.1862	1.32	Q	V				
362	3+31	0.1881	1.35	Q	V				
363	3+32	0.1900	1.38	Q	V				
364	3+33	0.1919	1.41	Q	V				
365	3+34	0.1939	1.44	Q	V				
366	3+35	0.1959	1.47	Q	V				
367	3+36	0.1980	1.50	Q	V				
368	3+37	0.2001	1.52	Q	V				
369	3+38	0.2022	1.55	Q	V				
370	3+39	0.2044	1.57	Q	V				
371	3+40	0.2066	1.59	Q	V				
372	3+41	0.2088	1.62	Q	V				
373	3+42	0.2111	1.64	Q	V				
374	3+43	0.2134	1.66	Q	V				
375	3+44	0.2157	1.69	Q	V				
376	3+45	0.2180	1.71	Q	V				
377	3+46	0.2205	1.80	Q	V				
378	3+47	0.2231	1.89	Q	V				
379	3+48	0.2258	1.98	Q	V				
380	3+49	0.2287	2.07	Q	V				
381	3+50	0.2317	2.15	Q	V				
382	3+51	0.2348	2.24	Q	V				
383	3+52	0.2380	2.33	Q	V				
384	3+53	0.2413	2.42	Q	V				
385	3+54	0.2448	2.51	Q	V				
386	3+55	0.2484	2.62	Q	V				
387	3+56	0.2521	2.74	Q	V				
388	3+57	0.2561	2.85	Q	V				
389	3+58	0.2602	2.97	Q	V				
390	3+59	0.2644	3.08	Q	V				
391	4+ 0	0.2688	3.19	Q	V				
392	4+ 1	0.2734	3.31	Q	V				
393	4+ 2	0.2781	3.42	Q	V				
394	4+ 3	0.2829	3.54	Q	V				
395	4+ 4	0.2891	4.49		V				
396	4+ 5	0.2966	5.45		V				
397	4+ 6	0.3055	6.41		V				
398	4+ 7	0.3156	7.37		V				
399	4+ 8	0.3271	8.33		V				
400	4+ 9	0.3399	9.29		V				
401	4+10	0.3540	10.24		V				
402	4+11	0.3694	11.20		V				
403	4+12	0.3862	12.16		V				
404	4+13	0.4014	11.03		V				
405	4+14	0.4150	9.90		V				
406	4+15	0.4271	8.78		V				
407	4+16	0.4376	7.65		V				
408	4+17	0.4466	6.52		V				
409	4+18	0.4540	5.40		V				
410	4+19	0.4599	4.27		V				
411	4+20	0.4643	3.14		V				
412	4+21	0.4670	2.01		V				
413	4+22	0.4697	1.94		V				
414	4+23	0.4723	1.87		V				

415	4+24	0.4747	1.79		Q			V	
416	4+25	0.4771	1.72		Q			V	
417	4+26	0.4794	1.64		Q			V	
418	4+27	0.4815	1.57		Q			V	
419	4+28	0.4836	1.49		Q			V	
420	4+29	0.4855	1.42		Q			V	
421	4+30	0.4874	1.35		Q			V	
422	4+31	0.4892	1.31		Q			V	
423	4+32	0.4910	1.28		Q			V	
424	4+33	0.4927	1.25		Q			V	
425	4+34	0.4944	1.22		Q			V	
426	4+35	0.4960	1.18		Q			V	
427	4+36	0.4976	1.15		Q			V	
428	4+37	0.4991	1.12		Q			V	
429	4+38	0.5006	1.09		Q			V	
430	4+39	0.5021	1.05		Q			V	
431	4+40	0.5035	1.03		Q			V	
432	4+41	0.5049	1.02		Q			V	
433	4+42	0.5063	1.00		Q			V	
434	4+43	0.5076	0.98		Q			V	
435	4+44	0.5089	0.96		Q			V	
436	4+45	0.5102	0.94		Q			V	
437	4+46	0.5115	0.92		Q			V	
438	4+47	0.5127	0.90		Q			V	
439	4+48	0.5140	0.88		Q			V	
440	4+49	0.5152	0.87		Q			V	
441	4+50	0.5163	0.86		Q			V	
442	4+51	0.5175	0.84		Q			V	
443	4+52	0.5186	0.83		Q			V	
444	4+53	0.5198	0.82		Q			V	
445	4+54	0.5209	0.81		Q			V	
446	4+55	0.5220	0.79		Q			V	
447	4+56	0.5231	0.78		Q			V	
448	4+57	0.5241	0.77		Q			V	
449	4+58	0.5252	0.76		Q			V	
450	4+59	0.5262	0.75		Q			V	
451	5+ 0	0.5272	0.74		Q			V	
452	5+ 1	0.5282	0.73		Q			V	
453	5+ 2	0.5292	0.72		Q			V	
454	5+ 3	0.5302	0.71		Q			V	
455	5+ 4	0.5312	0.70		Q			V	
456	5+ 5	0.5321	0.69		Q			V	
457	5+ 6	0.5331	0.69		Q			V	
458	5+ 7	0.5340	0.68		Q			V	
459	5+ 8	0.5349	0.67		Q			V	
460	5+ 9	0.5358	0.66		Q			V	
461	5+10	0.5367	0.66		Q			V	
462	5+11	0.5376	0.65		Q			V	
463	5+12	0.5385	0.64		Q			V	
464	5+13	0.5394	0.64		Q			V	
465	5+14	0.5403	0.63		Q			V	
466	5+15	0.5411	0.62		Q			V	
467	5+16	0.5420	0.62		Q			V	
468	5+17	0.5428	0.61		Q			V	
469	5+18	0.5437	0.61		Q			V	
470	5+19	0.5445	0.60		Q			V	
471	5+20	0.5453	0.59		Q			V	
472	5+21	0.5461	0.59		Q			V	
473	5+22	0.5469	0.58		Q			V	
474	5+23	0.5477	0.58		Q			V	
475	5+24	0.5485	0.57		Q			V	
476	5+25	0.5493	0.57		Q			V	
477	5+26	0.5501	0.56		Q			V	
478	5+27	0.5508	0.56		Q			V	
479	5+28	0.5516	0.55		Q			V	
480	5+29	0.5523	0.55		Q			V	
481	5+30	0.5531	0.54		Q			V	
482	5+31	0.5538	0.54		Q			V	
483	5+32	0.5546	0.54		Q			V	

484	5+33	0.5553	0.53	Q					V
485	5+34	0.5560	0.53	Q					V
486	5+35	0.5567	0.52	Q					V
487	5+36	0.5575	0.52	Q					V
488	5+37	0.5582	0.52	Q					V
489	5+38	0.5589	0.51	Q					V
490	5+39	0.5596	0.51	Q					V
491	5+40	0.5603	0.50	Q					V
492	5+41	0.5610	0.50	Q					V
493	5+42	0.5616	0.50	Q					V
494	5+43	0.5623	0.49	Q					V
495	5+44	0.5630	0.49	Q					V
496	5+45	0.5637	0.49	Q					V
497	5+46	0.5643	0.48	Q					V
498	5+47	0.5650	0.48	Q					V
499	5+48	0.5657	0.48	Q					V
500	5+49	0.5663	0.47	Q					V
501	5+50	0.5670	0.47	Q					V
502	5+51	0.5676	0.47	Q					V
503	5+52	0.5682	0.46	Q					V
504	5+53	0.5689	0.46	Q					V
505	5+54	0.5695	0.46	Q					V
506	5+55	0.5701	0.46	Q					V
507	5+56	0.5708	0.45	Q					V
508	5+57	0.5714	0.45	Q					V
509	5+58	0.5720	0.45	Q					V
510	5+59	0.5726	0.44	Q					V
511	6+ 0	0.5732	0.44	Q					V
512	6+ 1	0.5738	0.44	Q					V
513	6+ 2	0.5744	0.44	Q					V
514	6+ 3	0.5750	0.43	Q					V
515	6+ 4	0.5756	0.43	Q					V
516	6+ 5	0.5762	0.43	Q					V
517	6+ 6	0.5768	0.43	Q					V
518	6+ 7	0.5774	0.43	Q					V
519	6+ 8	0.5780	0.42	Q					V
520	6+ 9	0.5785	0.42	Q					V

521	-----
522	
523	
524	
525	
526	
527	
528	*****
529	Process from Point/Station 104.000 to Point/Station 105.000
530	**** PIPEFLOW TRAVEL TIME (User specified size) ****
531	
532	Upstream point/station elevation = 690.910(Ft.)
533	Downstream point/station elevation = 685.810(Ft.)
534	Pipe length = 63.00(Ft.) Slope = 0.0810 Manning's N = 0.013
535	No. of pipes = 1 Required pipe flow = 12.159(CFS)
536	Given pipe size = 18.00(In.)
537	Calculated individual pipe flow = 12.159(CFS)
538	Normal flow depth in pipe = 7.99(In.)
539	Flow top width inside pipe = 17.89(In.)
540	Critical Depth = 15.85(In.)
541	Pipe flow velocity = 16.04(Ft/s)
542	Travel time through pipe = 0.07 min.
543	Time of concentration (TC) = 9.67 min.
544	
545	
546	*****
547	Process from Point/Station 105.000 to Point/Station 106.000
548	**** IRREGULAR CHANNEL FLOW TRAVEL TIME ****
549	
550	Estimated mean flow rate at midpoint of channel = 12.414(CFS)
551	Depth of flow = 0.832(Ft.), Average velocity = 17.941(Ft/s)
552	***** Irregular Channel Data *****

```

553 -----
554 Information entered for subchannel number 1 :
555 Point number      'X' coordinate      'Y' coordinate
556     1              0.00              1.00
557     2              1.00              0.00
558     3              2.00              1.00
559 Manning's 'N' friction factor = 0.016
560 -----
561 Sub-Channel flow = 12.414(CFS)
562 '      ' flow top width = 1.664(Ft.)
563 '      ' velocity= 17.941(Ft/s)
564 '      ' area = 0.692(Sq.Ft)
565 '      ' Froude number = 4.902
566
567 Upstream point elevation = 685.810(Ft.)
568 Downstream point elevation = 611.400(Ft.)
569 Flow length = 390.000(Ft.)
570 Travel time = 0.36 min.
571 Time of concentration = 10.03 min.
572 Depth of flow = 0.832(Ft.)
573 Average velocity = 17.941(Ft/s)
574 Total irregular channel flow = 12.414(CFS)
575 Irregular channel normal depth above invert elev. = 0.832(Ft.)
576 Average velocity of channel(s) = 17.941(Ft/s)
577 Adding area flow to channel
578 Rainfall intensity (I) = 5.550(In/Hr) for a 100.0 year storm
579 Decimal fraction soil group A = 0.000
580 Decimal fraction soil group B = 0.000
581 Decimal fraction soil group C = 0.050
582 Decimal fraction soil group D = 0.950
583 [UNDISTURBED NATURAL TERRAIN ]
584 (Permanent Open Space )
585 Impervious value, Ai = 0.000
586 Sub-Area C Value = 0.347
587 Rainfall intensity = 5.550(In/Hr) for a 100.0 year storm
588 Effective runoff coefficient used for total area
589 (Q=KCIA) is C = 0.700 CA = 2.268
590 Subarea runoff = 0.429(CFS) for 0.397(Ac.)
591 Total runoff = 12.588(CFS) Total area = 3.241(Ac.)
592 Depth of flow = 0.836(Ft.), Average velocity = 18.003(Ft/s)
593
594
595 +-----+
596 Process from Point/Station 106.000 to Point/Station 107.000
597 **** IRREGULAR CHANNEL FLOW TRAVEL TIME ****
598
599 -----
599 Estimated mean flow rate at midpoint of channel = 12.828(CFS)
600 Depth of flow = 0.445(Ft.), Average velocity = 4.101(Ft/s)
601 ***** Irregular Channel Data *****
602 -----
603 Information entered for subchannel number 1 :
604 Point number      'X' coordinate      'Y' coordinate
605     1              0.00              0.63
606     2              25.00              0.13
607     3              26.50              0.00
608     4              26.50              0.50
609     5              31.50              0.60
610 Manning's 'N' friction factor = 0.015
611 -----
612 Sub-Channel flow = 12.828(CFS)
613 '      ' flow top width = 17.483(Ft.)
614 '      ' velocity= 4.101(Ft/s)
615 '      ' area = 3.128(Sq.Ft)
616 '      ' Froude number = 1.709
617
618 Upstream point elevation = 611.400(Ft.)
619 Downstream point elevation = 608.550(Ft.)
620 Flow length = 162.000(Ft.)
621 Travel time = 0.66 min.

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622 Time of concentration = 10.69 min.
623 Depth of flow = 0.445(Ft.)
624 Average velocity = 4.101(Ft/s)
625 Total irregular channel flow = 12.828(CFS)
626 Irregular channel normal depth above invert elev. = 0.445(Ft.)
627 Average velocity of channel(s) = 4.101(Ft/s)
628 Adding area flow to channel
629 Rainfall intensity (I) = 5.327(In/Hr) for a 100.0 year storm
630 Decimal fraction soil group A = 0.000
631 Decimal fraction soil group B = 0.000
632 Decimal fraction soil group C = 0.050
633 Decimal fraction soil group D = 0.950
634 [INDUSTRIAL area type ]
635 (General Industrial )
636 Impervious value, Ai = 0.950
637 Sub-Area C Value = 0.870
638 Rainfall intensity = 5.327(In/Hr) for a 100.0 year storm
639 Effective runoff coefficient used for total area
640 (Q=KCIA) is C = 0.709 CA = 2.436
641 Subarea runoff = 0.389(CFS) for 0.193(Ac.)
642 Total runoff = 12.977(CFS) Total area = 3.434(Ac.)
643 Depth of flow = 0.446(Ft.), Average velocity = 4.113(Ft/s)
644
645
646 ++++++
647 Process from Point/Station 107.000 to Point/Station 107.000
648 **** CONFLUENCE OF MINOR STREAMS ****
649
650 Along Main Stream number: 1 in normal stream number 1
651 Stream flow area = 3.434(Ac.)
652 Runoff from this stream = 12.977(CFS)
653 Time of concentration = 10.69 min.
654 Rainfall intensity = 5.327(In/Hr)
655
656
657 ++++++
658 Process from Point/Station 301.000 to Point/Station 302.000
659 **** INITIAL AREA EVALUATION ****
660
661 Decimal fraction soil group A = 0.000
662 Decimal fraction soil group B = 0.000
663 Decimal fraction soil group C = 0.000
664 Decimal fraction soil group D = 1.000
665 [HIGH DENSITY RESIDENTIAL ]
666 (43.0 DU/A or Less )
667 Impervious value, Ai = 0.800
668 Sub-Area C Value = 0.790
669 Initial subarea total flow distance = 74.000(Ft.)
670 Highest elevation = 699.890(Ft.)
671 Lowest elevation = 693.340(Ft.)
672 Elevation difference = 6.550(Ft.) Slope = 8.851 %
673 Top of Initial Area Slope adjusted by User to 9.838 %
674 INITIAL AREA TIME OF CONCENTRATION CALCULATIONS:
675 The maximum overland flow distance is 100.00 (Ft)
676 for the top area slope value of 9.84 %, in a development type of
677 43.0 DU/A or Less
678 In Accordance With Figure 3-3
679 Initial Area Time of Concentration = 2.60 minutes
680 TC = [1.8*(1.1-C)*distance(Ft.)^0.5]/(% slope^(1/3))
681 TC = [1.8*(1.1-0.7900)*( 100.000^0.5)/( 9.838^(1/3))]= 2.60
682 Calculated TC of 2.604 minutes is less than 5 minutes,
683 resetting TC to 5.0 minutes for rainfall intensity calculations
684 Rainfall intensity (I) = 8.695(In/Hr) for a 100.0 year storm
685 Effective runoff coefficient used for area (Q=KCIA) is C = 0.790
686 Subarea runoff = 0.323(CFS)
687 Total initial stream area = 0.047(Ac.)
688
689
690 ++++++

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691 Process from Point/Station 302.000 to Point/Station 107.000
692 **** IRREGULAR CHANNEL FLOW TRAVEL TIME ****
693

694 Estimated mean flow rate at midpoint of channel = 1.486(CFS)
695 Depth of flow = 0.020(Ft.), Average velocity = 2.907(Ft/s)
696 ***** Irregular Channel Data *****

697 -----
698 Information entered for subchannel number 1 :
699 Point number 'X' coordinate 'Y' coordinate
700 1 0.00 0.50
701 2 0.00 0.00
702 3 25.00 0.00
703 4 25.00 0.50

704 Manning's 'N' friction factor = 0.016
705 -----

706 Sub-Channel flow = 1.486(CFS)
707 ' ' flow top width = 25.000(Ft.)
708 ' ' velocity = 2.907(Ft/s)
709 ' ' area = 0.511(Sq.Ft)
710 ' ' Froude number = 3.583

711
712 Upstream point elevation = 693.340(Ft.)
713 Downstream point elevation = 611.680(Ft.)
714 Flow length = 465.000(Ft.)
715 Travel time = 2.67 min.
716 Time of concentration = 5.27 min.
717 Depth of flow = 0.020(Ft.)
718 Average velocity = 2.907(Ft/s)
719 Total irregular channel flow = 1.486(CFS)
720 Irregular channel normal depth above invert elev. = 0.020(Ft.)
721 Average velocity of channel(s) = 2.907(Ft/s)
722 Adding area flow to channel
723 Rainfall intensity (I) = 8.404(In/Hr) for a 100.0 year storm
724 Decimal fraction soil group A = 0.000
725 Decimal fraction soil group B = 0.000
726 Decimal fraction soil group C = 0.000
727 Decimal fraction soil group D = 1.000
728 [HIGH DENSITY RESIDENTIAL]
729 (24.0 DU/A or Less)
730 Impervious value, Ai = 0.650
731 Sub-Area C Value = 0.710
732 Rainfall intensity = 8.404(In/Hr) for a 100.0 year storm
733 Effective runoff coefficient used for total area
734 (Q=KCIA) is C = 0.719 CA = 0.303
735 Subarea runoff = 2.227(CFS) for 0.375(Ac.)
736 Total runoff = 2.550(CFS) Total area = 0.422(Ac.)
737 Depth of flow = 0.028(Ft.), Average velocity = 3.607(Ft/s)
738
739

740 ++++++
741 Process from Point/Station 107.000 to Point/Station 107.000
742 **** CONFLUENCE OF MINOR STREAMS ****
743

744 Along Main Stream number: 1 in normal stream number 2
745 Stream flow area = 0.422(Ac.)
746 Runoff from this stream = 2.550(CFS)
747 Time of concentration = 5.27 min.
748 Rainfall intensity = 8.404(In/Hr)
749 Summary of stream data:
750

Stream No.	Flow rate (CFS)	TC (min)	Rainfall Intensity (In/Hr)
1	12.977	10.69	5.327
2	2.550	5.27	8.404

755 Qmax(1) =
756 1.000 * 1.000 * 12.977) +
757 0.634 * 1.000 * 2.550) + = 14.593


```

760 Qmax(2) =
761     1.000 *      0.493 *      12.977) +
762     1.000 *      1.000 *      2.550) + =      8.950
763
764 Total of 2 streams to confluence:
765 Flow rates before confluence point:
766     12.977      2.550
767 Maximum flow rates at confluence using above data:
768     14.593      8.950
769 Area of streams before confluence:
770     3.434      0.422
771 Results of confluence:
772 Total flow rate =      14.593(CFS)
773 Time of concentration =      10.686 min.
774 Effective stream area after confluence =      3.856(Ac.)
775
776
777 ++++++
778 Process from Point/Station      107.000 to Point/Station      108.000
779 **** IRREGULAR CHANNEL FLOW TRAVEL TIME ****
780
781 -----
782 Estimated mean flow rate at midpoint of channel =      14.790(CFS)
783 Depth of flow =      0.412(Ft.), Average velocity =      5.885(Ft/s)
784 ***** Irregular Channel Data *****
785
786 -----
787 Information entered for subchannel number 1 :
788 Point number      'X' coordinate      'Y' coordinate
789     1              0.00              0.63
790     2              25.00             0.13
791     3              26.50             0.00
792     4              26.50             0.50
793     5              31.50             0.60
794 Manning's 'N' friction factor =      0.015
795
796 -----
797 Sub-Channel flow =      14.790(CFS)
798 '      '      flow top width =      15.615(Ft.)
799 '      '      velocity=      5.885(Ft/s)
800 '      '      area =      2.513(Sq.Ft)
801 '      '      Froude number =      2.585
802
803 Upstream point elevation =      608.550(Ft.)
804 Downstream point elevation =      601.450(Ft.)
805 Flow length =      170.000(Ft.)
806 Travel time =      0.48 min.
807 Time of concentration =      11.17 min.
808 Depth of flow =      0.412(Ft.)
809 Average velocity =      5.885(Ft/s)
810 Total irregular channel flow =      14.790(CFS)
811 Irregular channel normal depth above invert elev. =      0.412(Ft.)
812 Average velocity of channel(s) =      5.885(Ft/s)
813 Adding area flow to channel
814 Rainfall intensity (I) =      5.178(In/Hr) for a      100.0 year storm
815 Decimal fraction soil group A = 0.000
816 Decimal fraction soil group B = 0.000
817 Decimal fraction soil group C = 0.050
818 Decimal fraction soil group D = 0.950
819 [INDUSTRIAL area type      ]
820 (General Industrial      )
821 Impervious value, Ai = 0.950
822 Sub-Area C Value = 0.870
823 Rainfall intensity =      5.178(In/Hr) for a      100.0 year storm
824 Effective runoff coefficient used for total area
825 (Q=KCIA) is C = 0.717 CA =      2.880
826 Subarea runoff =      0.321(CFS) for      0.162(Ac.)
827 Total runoff =      14.914(CFS) Total area =      4.018(Ac.)
828 Depth of flow =      0.413(Ft.), Average velocity =      5.897(Ft/s)
829
830 ++++++

```

```

829 Process from Point/Station 108.000 to Point/Station 108.000
830 **** CONFLUENCE OF MINOR STREAMS ****
831
832 Along Main Stream number: 1 in normal stream number 1
833 Stream flow area = 4.018(Ac.)
834 Runoff from this stream = 14.914(CFS)
835 Time of concentration = 11.17 min.
836 Rainfall intensity = 5.178(In/Hr)
837
838
839 ++++++
840 Process from Point/Station 401.000 to Point/Station 402.000
841 **** INITIAL AREA EVALUATION ****
842
843 Decimal fraction soil group A = 0.000
844 Decimal fraction soil group B = 0.000
845 Decimal fraction soil group C = 0.000
846 Decimal fraction soil group D = 1.000
847 [UNDISTURBED NATURAL TERRAIN ]
848 (Permanent Open Space )
849 Impervious value, Ai = 0.000
850 Sub-Area C Value = 0.350
851 Initial subarea total flow distance = 100.000(Ft.)
852 Highest elevation = 709.280(Ft.)
853 Lowest elevation = 687.650(Ft.)
854 Elevation difference = 21.630(Ft.) Slope = 21.630 %
855 Top of Initial Area Slope adjusted by User to 23.240 %
856 INITIAL AREA TIME OF CONCENTRATION CALCULATIONS:
857 The maximum overland flow distance is 100.00 (Ft)
858 for the top area slope value of 23.24 %, in a development type of
859 Permanent Open Space
860 In Accordance With Figure 3-3
861 Initial Area Time of Concentration = 4.73 minutes
862 TC = [1.8*(1.1-C)*distance(Ft.)^0.5]/(% slope^(1/3))
863 TC = [1.8*(1.1-0.3500)*( 100.000^0.5)/( 23.240^(1/3))]= 4.73
864 Calculated TC of 4.731 minutes is less than 5 minutes,
865 resetting TC to 5.0 minutes for rainfall intensity calculations
866 Rainfall intensity (I) = 8.695(In/Hr) for a 100.0 year storm
867 Effective runoff coefficient used for area (Q=KCIA) is C = 0.350
868 Subarea runoff = 0.207(CFS)
869 Total initial stream area = 0.068(Ac.)
870
871
872 ++++++
873 Process from Point/Station 402.000 to Point/Station 108.000
874 **** IRREGULAR CHANNEL FLOW TRAVEL TIME ****
875
876 Estimated mean flow rate at midpoint of channel = 1.331(CFS)
877 Depth of flow = 0.497(Ft.), Average velocity = 5.388(Ft/s)
878 ***** Irregular Channel Data *****
879 -----
880 Information entered for subchannel number 1 :
881 Point number 'X' coordinate 'Y' coordinate
882 1 0.00 1.00
883 2 1.00 0.00
884 3 2.00 1.00
885 Manning's 'N' friction factor = 0.030
886 -----
887 Sub-Channel flow = 1.331(CFS)
888 ' ' flow top width = 0.994(Ft.)
889 ' ' velocity= 5.388(Ft/s)
890 ' ' area = 0.247(Sq.Ft)
891 ' ' Froude number = 1.905
892
893 Upstream point elevation = 687.650(Ft.)
894 Downstream point elevation = 601.450(Ft.)
895 Flow length = 717.000(Ft.)
896 Travel time = 2.22 min.
897 Time of concentration = 6.95 min.

```

```

898 Depth of flow = 0.497(Ft.)
899 Average velocity = 5.388(Ft/s)
900 Total irregular channel flow = 1.331(CFS)
901 Irregular channel normal depth above invert elev. = 0.497(Ft.)
902 Average velocity of channel(s) = 5.388(Ft/s)
903 Adding area flow to channel
904 Rainfall intensity (I) = 7.032(In/Hr) for a 100.0 year storm
905 Decimal fraction soil group A = 0.000
906 Decimal fraction soil group B = 0.000
907 Decimal fraction soil group C = 0.000
908 Decimal fraction soil group D = 1.000
909 [UNDISTURBED NATURAL TERRAIN ]
910 (Permanent Open Space )
911 Impervious value, Ai = 0.000
912 Sub-Area C Value = 0.350
913 Rainfall intensity = 7.032(In/Hr) for a 100.0 year storm
914 Effective runoff coefficient used for total area
915 (Q=KCIA) is C = 0.350 CA = 0.338
916 Subarea runoff = 2.170(CFS) for 0.898(Ac.)
917 Total runoff = 2.377(CFS) Total area = 0.966(Ac.)
918 Depth of flow = 0.618(Ft.), Average velocity = 6.229(Ft/s)
919
920
921 ++++++
922 Process from Point/Station 108.000 to Point/Station 108.000
923 **** CONFLUENCE OF MINOR STREAMS ****
924
925 Along Main Stream number: 1 in normal stream number 2
926 Stream flow area = 0.966(Ac.)
927 Runoff from this stream = 2.377(CFS)
928 Time of concentration = 6.95 min.
929 Rainfall intensity = 7.032(In/Hr)
930 Summary of stream data:
931
932 Stream Flow rate TC Rainfall Intensity
933 No. (CFS) (min) (In/Hr)
934
935
936 1 14.914 11.17 5.178
937 2 2.377 6.95 7.032
938 Qmax(1) =
939 1.000 * 1.000 * 14.914) +
940 0.736 * 1.000 * 2.377) + = 16.664
941 Qmax(2) =
942 1.000 * 0.622 * 14.914) +
943 1.000 * 1.000 * 2.377) + = 11.657
944
945 Total of 2 streams to confluence:
946 Flow rates before confluence point:
947 14.914 2.377
948 Maximum flow rates at confluence using above data:
949 16.664 11.657
950 Area of streams before confluence:
951 4.018 0.966
952 Results of confluence:
953 Total flow rate = 16.664(CFS)
954 Time of concentration = 11.168 min.
955 Effective stream area after confluence = 4.984(Ac.)
956
957
958 ++++++
959 Process from Point/Station 108.000 to Point/Station 109.000
960 **** IRREGULAR CHANNEL FLOW TRAVEL TIME ****
961
962 Estimated mean flow rate at midpoint of channel = 16.835(CFS)
963 Depth of flow = 0.408(Ft.), Average velocity = 6.890(Ft/s)
964 ***** Irregular Channel Data *****
965 -----
966 Information entered for subchannel number 1 :

```

```

967 Point number      'X' coordinate      'Y' coordinate
968     1              0.00              0.63
969     2             25.00              0.13
970     3             26.50              0.00
971     4             26.50              0.50
972     5             31.50              0.60
973 Manning's 'N' friction factor = 0.015
974 -----
975 Sub-Channel flow = 16.835(CFS)
976     '      flow top width = 15.389(Ft.)
977     '      velocity= 6.890(Ft/s)
978     '      area = 2.443(Sq.Ft)
979     '      Froude number = 3.047
980
981 Upstream point elevation = 601.450(Ft.)
982 Downstream point elevation = 593.870(Ft.)
983 Flow length = 130.000(Ft.)
984 Travel time = 0.31 min.
985 Time of concentration = 11.48 min.
986 Depth of flow = 0.408(Ft.)
987 Average velocity = 6.890(Ft/s)
988 Total irregular channel flow = 16.835(CFS)
989 Irregular channel normal depth above invert elev. = 0.408(Ft.)
990 Average velocity of channel(s) = 6.890(Ft/s)
991 Adding area flow to channel
992 Rainfall intensity (I) = 5.086(In/Hr) for a 100.0 year storm
993 Decimal fraction soil group A = 0.000
994 Decimal fraction soil group B = 0.000
995 Decimal fraction soil group C = 0.000
996 Decimal fraction soil group D = 1.000
997 [INDUSTRIAL area type ]
998 (General Industrial )
999 Impervious value, Ai = 0.950
1000 Sub-Area C Value = 0.870
1001 Rainfall intensity = 5.086(In/Hr) for a 100.0 year storm
1002 Effective runoff coefficient used for total area
1003 (Q=KCIA) is C = 0.651 CA = 3.328
1004 Subarea runoff = 0.262(CFS) for 0.126(Ac.)
1005 Total runoff = 16.926(CFS) Total area = 5.110(Ac.)
1006 Depth of flow = 0.408(Ft.), Average velocity = 6.899(Ft/s)
1007
1008
1009 +-----+
1010 Process from Point/Station 109.000 to Point/Station 110.000
1011 **** IRREGULAR CHANNEL FLOW TRAVEL TIME ****
1012
1013 -----
1014 Estimated mean flow rate at midpoint of channel = 17.149(CFS)
1015 Depth of flow = 0.433(Ft.), Average velocity = 6.036(Ft/s)
1016 ***** Irregular Channel Data *****
1017 -----
1018 Information entered for subchannel number 1 :
1019 Point number      'X' coordinate      'Y' coordinate
1020     1              0.00              0.63
1021     2             25.00              0.13
1022     3             26.50              0.00
1023     4             26.50              0.50
1024     5             31.50              0.60
1025 Manning's 'N' friction factor = 0.015
1026 -----
1027 Sub-Channel flow = 17.149(CFS)
1028     '      flow top width = 16.632(Ft.)
1029     '      velocity= 6.036(Ft/s)
1030     '      area = 2.841(Sq.Ft)
1031     '      Froude number = 2.573
1032
1033 Upstream point elevation = 593.870(Ft.)
1034 Downstream point elevation = 585.800(Ft.)
1035 Flow length = 199.000(Ft.)
1036 Travel time = 0.55 min.

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1036 Time of concentration = 12.03 min.
1037 Depth of flow = 0.433(Ft.)
1038 Average velocity = 6.036(Ft/s)
1039 Total irregular channel flow = 17.149(CFS)
1040 Irregular channel normal depth above invert elev. = 0.433(Ft.)
1041 Average velocity of channel(s) = 6.036(Ft/s)
1042 Adding area flow to channel
1043 Rainfall intensity (I) = 4.935(In/Hr) for a 100.0 year storm
1044 Decimal fraction soil group A = 0.000
1045 Decimal fraction soil group B = 0.000
1046 Decimal fraction soil group C = 0.000
1047 Decimal fraction soil group D = 1.000
1048 [INDUSTRIAL area type ]
1049 (General Industrial )
1050 Impervious value, Ai = 0.950
1051 Sub-Area C Value = 0.870
1052 Rainfall intensity = 4.935(In/Hr) for a 100.0 year storm
1053 Effective runoff coefficient used for total area
1054 (Q=KCIA) is C = 0.660 CA = 3.505
1055 Subarea runoff = 0.369(CFS) for 0.203(Ac.)
1056 Total runoff = 17.295(CFS) Total area = 5.313(Ac.)
1057 Depth of flow = 0.434(Ft.), Average velocity = 6.048(Ft/s)
1058
1059
1060 *****
1061 Process from Point/Station 110.000 to Point/Station 110.000
1062 **** CONFLUENCE OF MINOR STREAMS ****
1063
1064 -----
1065 Along Main Stream number: 1 in normal stream number 1
1066 Stream flow area = 5.313(Ac.)
1067 Runoff from this stream = 17.295(CFS)
1068 Time of concentration = 12.03 min.
1069 Rainfall intensity = 4.935(In/Hr)
1070
1071 *****
1072 Process from Point/Station 501.000 to Point/Station 502.000
1073 **** INITIAL AREA EVALUATION ****
1074
1075 -----
1076 Decimal fraction soil group A = 0.000
1077 Decimal fraction soil group B = 0.000
1078 Decimal fraction soil group C = 0.000
1079 Decimal fraction soil group D = 1.000
1080 [UNDISTURBED NATURAL TERRAIN ]
1081 (Permanent Open Space )
1082 Impervious value, Ai = 0.000
1083 Sub-Area C Value = 0.350
1084 Initial subarea total flow distance = 137.000(Ft.)
1085 Highest elevation = 709.360(Ft.)
1086 Lowest elevation = 685.490(Ft.)
1087 Elevation difference = 23.870(Ft.) Slope = 17.423 %
1088 Top of Initial Area Slope adjusted by User to 19.708 %
1089 INITIAL AREA TIME OF CONCENTRATION CALCULATIONS:
1090 The maximum overland flow distance is 100.00 (Ft)
1091 for the top area slope value of 19.71 %, in a development type of
1092 Permanent Open Space
1093 In Accordance With Figure 3-3
1094 Initial Area Time of Concentration = 5.00 minutes
1095 TC = [1.8*(1.1-C)*distance(Ft.)^0.5]/(% slope^(1/3))
1096 TC = [1.8*(1.1-0.3500)*( 100.000^0.5)/( 19.708^(1/3))]= 5.00
1097 Calculated TC of 4.998 minutes is less than 5 minutes,
1098 resetting TC to 5.0 minutes for rainfall intensity calculations
1099 Rainfall intensity (I) = 8.695(In/Hr) for a 100.0 year storm
1100 Effective runoff coefficient used for area (Q=KCIA) is C = 0.350
1101 Subarea runoff = 0.700(CFS)
1102 Total initial stream area = 0.230(Ac.)
1103
1104 *****

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```

1105 Process from Point/Station      502.000 to Point/Station      503.000
1106 **** IRREGULAR CHANNEL FLOW TRAVEL TIME ****
1107
1108 Estimated mean flow rate at midpoint of channel =      2.157(CFS)
1109 Depth of flow =  0.549(Ft.), Average velocity =  7.164(Ft/s)
1110 ***** Irregular Channel Data *****
1111 -----
1112 Information entered for subchannel number 1 :
1113 Point number      'X' coordinate      'Y' coordinate
1114      1              0.00              1.00
1115      2              1.00              0.00
1116      3              2.00              1.00
1117 Manning's 'N' friction factor =  0.030
1118 -----
1119 Sub-Channel flow =  2.157(CFS)
1120      '      '      flow top width =  1.097(Ft.)
1121      '      '      velocity=  7.164(Ft/s)
1122      '      '      area =  0.301(Sq.Ft)
1123      '      '      Froude number =  2.410
1124
1125 Upstream point elevation =  685.490(Ft.)
1126 Downstream point elevation =  619.000(Ft.)
1127 Flow length =  357.000(Ft.)
1128 Travel time =  0.83 min.
1129 Time of concentration =  5.83 min.
1130 Depth of flow =  0.549(Ft.)
1131 Average velocity =  7.164(Ft/s)
1132 Total irregular channel flow =  2.157(CFS)
1133 Irregular channel normal depth above invert elev. =  0.549(Ft.)
1134 Average velocity of channel(s) =  7.164(Ft/s)
1135 Adding area flow to channel
1136 Rainfall intensity (I) =  7.876(In/Hr) for a  100.0 year storm
1137 Decimal fraction soil group A = 0.000
1138 Decimal fraction soil group B = 0.000
1139 Decimal fraction soil group C = 0.000
1140 Decimal fraction soil group D = 1.000
1141 [UNDISTURBED NATURAL TERRAIN      ]
1142 (Permanent Open Space      )
1143 Impervious value, Ai = 0.000
1144 Sub-Area C Value = 0.350
1145 Rainfall intensity =  7.876(In/Hr) for a  100.0 year storm
1146 Effective runoff coefficient used for total area
1147 (Q=KCIA) is C = 0.350 CA =  0.447
1148 Subarea runoff =  2.820(CFS) for  1.047(Ac.)
1149 Total runoff =  3.520(CFS) Total area =  1.277(Ac.)
1150 Depth of flow =  0.659(Ft.), Average velocity =  8.097(Ft/s)
1151
1152
1153 ++++++
1154 Process from Point/Station      503.000 to Point/Station      504.000
1155 **** PIPEFLOW TRAVEL TIME (User specified size) ****
1156
1157 Upstream point/station elevation =  605.110(Ft.)
1158 Downstream point/station elevation =  582.760(Ft.)
1159 Pipe length =  230.00(Ft.) Slope =  0.0972 Manning's N = 0.013
1160 No. of pipes = 1 Required pipe flow =  3.520(CFS)
1161 Given pipe size =  18.00(In.)
1162 Calculated individual pipe flow =  3.520(CFS)
1163 Normal flow depth in pipe =  3.98(In.)
1164 Flow top width inside pipe =  14.95(In.)
1165 Critical Depth =  8.59(In.)
1166 Pipe flow velocity =  12.10(Ft/s)
1167 Travel time through pipe =  0.32 min.
1168 Time of concentration (TC) =  6.15 min.
1169
1170
1171 ++++++
1172 Process from Point/Station      504.000 to Point/Station      110.000
1173 **** PIPEFLOW TRAVEL TIME (User specified size) ****

```

```

Upstream point/station elevation = 582.760(Ft.)
Downstream point/station elevation = 582.080(Ft.)
Pipe length = 15.00(Ft.) Slope = 0.0453 Manning's N = 0.013
No. of pipes = 1 Required pipe flow = 3.520(CFS)
Given pipe size = 24.00(In.)
Calculated individual pipe flow = 3.520(CFS)
Normal flow depth in pipe = 4.39(In.)
Flow top width inside pipe = 18.56(In.)
Critical Depth = 7.88(In.)
Pipe flow velocity = 8.94(Ft/s)
Travel time through pipe = 0.03 min.
Time of concentration (TC) = 6.17 min.

+++++
Process from Point/Station 110.000 to Point/Station 110.000
**** CONFLUENCE OF MINOR STREAMS ****

```

```

Along Main Stream number: 1 in normal stream number 2
Stream flow area = 1.277(Ac.)
Runoff from this stream = 3.520(CFS)
Time of concentration = 6.17 min.
Rainfall intensity = 7.589(In/Hr)
Summary of stream data:

```

Stream No.	Flow rate (CFS)	TC (min)	Rainfall Intensity (In/Hr)
1	17.295	12.03	4.935
2	3.520	6.17	7.589

```

Qmax(1) =
1.000 * 1.000 * 17.295) +
0.650 * 1.000 * 3.520) + = 19.584
Qmax(2) =
1.000 * 0.513 * 17.295) +
1.000 * 1.000 * 3.520) + = 12.394

Total of 2 streams to confluence:
Flow rates before confluence point:
17.295 3.520
Maximum flow rates at confluence using above data:
19.584 12.394
Area of streams before confluence:
5.313 1.277
Results of confluence:
Total flow rate = 19.584(CFS)
Time of concentration = 12.031 min.
Effective stream area after confluence = 6.590(Ac.)
End of computations, total study area = 6.590 (Ac.)

```


San Diego County Rational Hydrology Program
CIVILCADD/CIVILDESIGN Engineering Software, (c)1991-2019 Version 9.1
Rational method hydrology program based on
San Diego County Flood Control Division 2003 hydrology manual
Rational Hydrology Study Date: 06/14/23

22027 POST POC1

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

Program License Serial Number 6332

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

Map data precipitation entered:
6 hour, precipitation(inches) = 3.300
24 hour precipitation(inches) = 5.600
P6/P24 = 58.9%
San Diego hydrology manual 'C' values used

Process from Point/Station 103.000 to Point/Station 104.000
**** USER DEFINED FLOW INFORMATION AT A POINT ****

User specified 'C' value of 0.502 given for subarea
Rainfall intensity (I) = 4.356(In/Hr) for a 100.0 year storm
User specified values are as follows:
TC = 14.60 min. Rain intensity = 4.36(In/Hr)
Total area = 2.840(Ac.) Total runoff = 6.206(CFS)

Process from Point/Station 104.000 to Point/Station 105.000
**** PIPEFLOW TRAVEL TIME (User specified size) ****

Upstream point/station elevation = 691.990(Ft.)
Downstream point/station elevation = 684.820(Ft.)
Pipe length = 63.00(Ft.) Slope = 0.1138 Manning's N = 0.013
No. of pipes = 1 Required pipe flow = 6.206(CFS)
Given pipe size = 18.00(In.)
Calculated individual pipe flow = 6.206(CFS)
Normal flow depth in pipe = 5.10(In.)
Flow top width inside pipe = 16.22(In.)
Critical Depth = 11.55(In.)
Pipe flow velocity = 15.08(Ft/s)
Travel time through pipe = 0.07 min.
Time of concentration (TC) = 14.67 min.

Process from Point/Station 105.000 to Point/Station 106.000
**** IRREGULAR CHANNEL FLOW TRAVEL TIME ****

Estimated mean flow rate at midpoint of channel = 6.461(CFS)
Depth of flow = 0.653(Ft.), Average velocity = 15.162(Ft/s)
***** Irregular Channel Data *****

```

70 Information entered for subchannel number 1 :
71 Point number      'X' coordinate      'Y' coordinate
72     1              0.00              1.00
73     2              1.00              0.00
74     3              2.00              1.00
75 Manning's 'N' friction factor = 0.016
76 -----
77 Sub-Channel flow = 6.461 (CFS)
78 '      ' flow top width = 1.306 (Ft.)
79 '      ' velocity= 15.162 (Ft/s)
80 '      ' area = 0.426 (Sq.Ft)
81 '      ' Froude number = 4.677
82
83 Upstream point elevation = 684.820 (Ft.)
84 Downstream point elevation = 611.400 (Ft.)
85 Flow length = 390.000 (Ft.)
86 Travel time = 0.43 min.
87 Time of concentration = 15.10 min.
88 Depth of flow = 0.653 (Ft.)
89 Average velocity = 15.162 (Ft/s)
90 Total irregular channel flow = 6.461 (CFS)
91 Irregular channel normal depth above invert elev. = 0.653 (Ft.)
92 Average velocity of channel(s) = 15.162 (Ft/s)
93 Adding area flow to channel
94 Rainfall intensity (I) = 4.263 (In/Hr) for a 100.0 year storm
95 Decimal fraction soil group A = 0.000
96 Decimal fraction soil group B = 0.000
97 Decimal fraction soil group C = 0.050
98 Decimal fraction soil group D = 0.950
99 [UNDISTURBED NATURAL TERRAIN ]
100 (Permanent Open Space )
101 Impervious value, Ai = 0.000
102 Sub-Area C Value = 0.347
103 Rainfall intensity = 4.263 (In/Hr) for a 100.0 year storm
104 Effective runoff coefficient used for total area
105 (Q=KCIA) is C = 0.483 CA = 1.564
106 Subarea runoff = 0.459 (CFS) for 0.397 (Ac.)
107 Total runoff = 6.665 (CFS) Total area = 3.237 (Ac.)
108 Depth of flow = 0.660 (Ft.), Average velocity = 15.280 (Ft/s)
109
110
111 ++++++
112 Process from Point/Station 106.000 to Point/Station 107.000
113 **** IRREGULAR CHANNEL FLOW TRAVEL TIME ****
114
115 -----
116 Estimated mean flow rate at midpoint of channel = 6.864 (CFS)
117 Depth of flow = 0.369 (Ft.), Average velocity = 3.518 (Ft/s)
118 ***** Irregular Channel Data *****
119 -----
120 Information entered for subchannel number 1 :
121 Point number      'X' coordinate      'Y' coordinate
122     1              0.00              0.63
123     2              25.00             0.13
124     3              26.50              0.00
125     4              26.50              0.50
126     5              31.50              0.60
127 Manning's 'N' friction factor = 0.015
128 -----
129 Sub-Channel flow = 6.864 (CFS)
130 '      ' flow top width = 13.712 (Ft.)
131 '      ' velocity= 3.518 (Ft/s)
132 '      ' area = 1.951 (Sq.Ft)
133 '      ' Froude number = 1.643
134
135 Upstream point elevation = 611.400 (Ft.)
136 Downstream point elevation = 608.550 (Ft.)
137 Flow length = 162.000 (Ft.)
138 Travel time = 0.77 min.
139 Time of concentration = 15.87 min.

```

```

139 Depth of flow = 0.369(Ft.)
140 Average velocity = 3.518(Ft/s)
141 Total irregular channel flow = 6.864(CFS)
142 Irregular channel normal depth above invert elev. = 0.369(Ft.)
143 Average velocity of channel(s) = 3.518(Ft/s)
144 Adding area flow to channel
145 Rainfall intensity (I) = 4.128(In/Hr) for a 100.0 year storm
146 Decimal fraction soil group A = 0.000
147 Decimal fraction soil group B = 0.000
148 Decimal fraction soil group C = 0.050
149 Decimal fraction soil group D = 0.950
150 [INDUSTRIAL area type ]
151 (General Industrial )
152 Impervious value, Ai = 0.950
153 Sub-Area C Value = 0.870
154 Rainfall intensity = 4.128(In/Hr) for a 100.0 year storm
155 Effective runoff coefficient used for total area
156 (Q=KCIA) is C = 0.505 CA = 1.732
157 Subarea runoff = 0.483(CFS) for 0.193(Ac.)
158 Total runoff = 7.149(CFS) Total area = 3.430(Ac.)
159 Depth of flow = 0.374(Ft.), Average velocity = 3.553(Ft/s)
160
161
162 ++++++
163 Process from Point/Station 107.000 to Point/Station 107.000
164 **** CONFLUENCE OF MINOR STREAMS ****
165
166 -----
167 Along Main Stream number: 1 in normal stream number 1
168 Stream flow area = 3.430(Ac.)
169 Runoff from this stream = 7.149(CFS)
170 Time of concentration = 15.87 min.
171 Rainfall intensity = 4.128(In/Hr)
172
173 ++++++
174 Process from Point/Station 301.000 to Point/Station 302.000
175 **** INITIAL AREA EVALUATION ****
176
177 -----
178 Decimal fraction soil group A = 0.000
179 Decimal fraction soil group B = 0.000
180 Decimal fraction soil group C = 0.000
181 Decimal fraction soil group D = 1.000
182 [HIGH DENSITY RESIDENTIAL ]
183 (43.0 DU/A or Less )
184 Impervious value, Ai = 0.800
185 Sub-Area C Value = 0.790
186 Initial subarea total flow distance = 74.000(Ft.)
187 Highest elevation = 700.090(Ft.)
188 Lowest elevation = 693.340(Ft.)
189 Elevation difference = 6.750(Ft.) Slope = 9.122 %
190 Top of Initial Area Slope adjusted by User to 9.838 %
191 INITIAL AREA TIME OF CONCENTRATION CALCULATIONS:
192 The maximum overland flow distance is 100.00 (Ft)
193 for the top area slope value of 9.84 %, in a development type of
194 43.0 DU/A or Less
195 In Accordance With Figure 3-3
196 Initial Area Time of Concentration = 2.60 minutes
197 TC = [1.8*(1.1-C)*distance(Ft.)^.5]/(% slope^(1/3)]
198 TC = [1.8*(1.1-0.7900)*( 100.000^.5)/( 9.838^(1/3)]= 2.60
199 Calculated TC of 2.604 minutes is less than 5 minutes,
200 resetting TC to 5.0 minutes for rainfall intensity calculations
201 Rainfall intensity (I) = 8.695(In/Hr) for a 100.0 year storm
202 Effective runoff coefficient used for area (Q=KCIA) is C = 0.790
203 Subarea runoff = 0.323(CFS)
204 Total initial stream area = 0.047(Ac.)
205
206 ++++++
207 Process from Point/Station 302.000 to Point/Station 107.000

```

**** IRREGULAR CHANNEL FLOW TRAVEL TIME ****

Estimated **mean** flow rate at midpoint of channel = 1.488 (CFS)

Depth of flow = 0.020 (Ft.), **Average** velocity = 2.923 (Ft/s)

***** Irregular Channel Data *****

Information entered for subchannel number 1 :

Point number	'X' coordinate	'Y' coordinate
1	0.00	0.50
2	0.00	0.00
3	25.00	0.00
4	25.00	0.50

Manning's 'N' friction factor = 0.016

Sub-Channel flow = 1.488 (CFS)

' ' flow top width = 25.000 (Ft.)

' ' velocity = 2.923 (Ft/s)

' ' area = 0.509 (Sq.Ft)

' ' Froude number = 3.611

Upstream point elevation = 693.340 (Ft.)

Downstream point elevation = 610.470 (Ft.)

Flow **length** = 464.000 (Ft.)

Travel time = 2.65 min.

Time of concentration = 5.25 min.

Depth of flow = 0.020 (Ft.)

Average velocity = 2.923 (Ft/s)

Total irregular channel flow = 1.488 (CFS)

Irregular channel normal depth above invert elev. = 0.020 (Ft.)

Average velocity of channel (s) = 2.923 (Ft/s)

Adding area flow to channel

Rainfall intensity (I) = 8.426 (In/Hr) for a 100.0 year storm

Decimal fraction soil group A = 0.000

Decimal fraction soil group B = 0.000

Decimal fraction soil group C = 0.000

Decimal fraction soil group D = 1.000

[HIGH DENSITY RESIDENTIAL]

(24.0 DU/A or Less)

Impervious value, Ai = 0.650

Sub-Area C Value = 0.710

Rainfall intensity = 8.426 (In/Hr) for a 100.0 year storm

Effective runoff coefficient used for total area

(Q=KCIA) is C = 0.719 CA = 0.303

Subarea runoff = 2.233 (CFS) for 0.375 (Ac.)

Total runoff = 2.556 (CFS) Total area = 0.422 (Ac.)

Depth of flow = 0.028 (Ft.), **Average** velocity = 3.629 (Ft/s)

Process from Point/Station 107.000 to Point/Station 107.000

**** CONFLUENCE OF MINOR STREAMS ****

Along Main Stream number: 1 in normal stream number 2

Stream flow area = 0.422 (Ac.)

Runoff from this stream = 2.556 (CFS)

Time of concentration = 5.25 min.

Rainfall intensity = 8.426 (In/Hr)

Summary of stream data:

Stream No.	Flow rate (CFS)	TC (min)	Rainfall Intensity (In/Hr)
1	7.149	15.87	4.128
2	2.556	5.25	8.426

Qmax (1) =

1.000 * 1.000 * 7.149) +

0.490 * 1.000 * 2.556) + = 8.401

Qmax (2) =

```

277         1.000 *      0.331 *      7.149) +
278         1.000 *      1.000 *      2.556) + =          4.921
279
280 Total of 2 streams to confluence:
281 Flow rates before confluence point:
282         7.149      2.556
283 Maximum flow rates at confluence using above data:
284         8.401      4.921
285 Area of streams before confluence:
286         3.430      0.422
287 Results of confluence:
288 Total flow rate =      8.401 (CFS)
289 Time of concentration =      15.866 min.
290 Effective stream area after confluence =      3.852 (Ac.)
291
292
293 ++++++
294 Process from Point/Station      107.000 to Point/Station      108.000
295 **** IRREGULAR CHANNEL FLOW TRAVEL TIME ****
296
297 -----
298 Estimated mean flow rate at midpoint of channel =      8.479 (CFS)
299 Depth of flow =      0.312 (Ft.), Average velocity =      6.764 (Ft/s)
300 ***** Irregular Channel Data *****
301 -----
302 Information entered for subchannel number 1 :
303 Point number      'X' coordinate      'Y' coordinate
304      1              0.00              0.63
305      2             25.00              0.13
306      3             26.50              0.00
307      4             26.50              0.50
308      5             31.50              0.60
309 Manning's 'N' friction factor =      0.015
310 -----
311 Sub-Channel flow =      8.479 (CFS)
312 '      '      flow top width =      10.873 (Ft.)
313 '      '      velocity =      6.764 (Ft/s)
314 '      '      area =      1.254 (Sq.Ft)
315 '      '      Froude number =      3.511
316
317 Upstream point elevation =      608.550 (Ft.)
318 Downstream point elevation =      593.870 (Ft.)
319 Flow length =      170.000 (Ft.)
320 Travel time =      0.42 min.
321 Time of concentration =      16.28 min.
322 Depth of flow =      0.312 (Ft.)
323 Average velocity =      6.764 (Ft/s)
324 Total irregular channel flow =      8.479 (CFS)
325 Irregular channel normal depth above invert elev. =      0.312 (Ft.)
326 Average velocity of channel(s) =      6.764 (Ft/s)
327 Adding area flow to channel
328 Rainfall intensity (I) =      4.060 (In/Hr) for a      100.0 year storm
329 Decimal fraction soil group A = 0.000
330 Decimal fraction soil group B = 0.000
331 Decimal fraction soil group C = 0.050
332 Decimal fraction soil group D = 0.950
333 [UNDISTURBED NATURAL TERRAIN      ]
334 (Permanent Open Space      )
335 Impervious value, Ai = 0.000
336 Sub-Area C Value = 0.347
337 Rainfall intensity =      4.060 (In/Hr) for a      100.0 year storm
338 Effective runoff coefficient used for total area
339 (Q=KCIA) is C = 0.521      CA =      2.091
340 Subarea runoff =      0.089 (CFS) for      0.162 (Ac.)
341 Total runoff =      8.490 (CFS)      Total area =      4.014 (Ac.)
342 Depth of flow =      0.313 (Ft.), Average velocity =      6.766 (Ft/s)
343
344 ++++++
345 Process from Point/Station      108.000 to Point/Station      108.000

```

```

346 **** CONFLUENCE OF MINOR STREAMS ****
347
348 Along Main Stream number: 1 in normal stream number 1
349 Stream flow area = 4.014 (Ac.)
350 Runoff from this stream = 8.490 (CFS)
351 Time of concentration = 16.28 min.
352 Rainfall intensity = 4.060 (In/Hr)
353
354
355 ++++++
356 Process from Point/Station 401.000 to Point/Station 402.000
357 **** INITIAL AREA EVALUATION ****
358
359 Decimal fraction soil group A = 0.000
360 Decimal fraction soil group B = 0.000
361 Decimal fraction soil group C = 0.000
362 Decimal fraction soil group D = 1.000
363 [UNDISTURBED NATURAL TERRAIN ]
364 (Permanent Open Space )
365 Impervious value, Ai = 0.000
366 Sub-Area C Value = 0.350
367 Initial subarea total flow distance = 100.000 (Ft.)
368 Highest elevation = 709.280 (Ft.)
369 Lowest elevation = 686.650 (Ft.)
370 Elevation difference = 22.630 (Ft.) Slope = 22.630 %
371 Top of Initial Area Slope adjusted by User to 23.240 %
372 INITIAL AREA TIME OF CONCENTRATION CALCULATIONS:
373 The maximum overland flow distance is 100.00 (Ft)
374 for the top area slope value of 23.24 %, in a development type of
375 Permanent Open Space
376 In Accordance With Figure 3-3
377 Initial Area Time of Concentration = 4.73 minutes
378 TC = [1.8*(1.1-C)*distance (Ft.)^.5]/(% slope^(1/3)]
379 TC = [1.8*(1.1-0.3500)*( 100.000^.5)/( 23.240^(1/3)]= 4.73
380 Calculated TC of 4.731 minutes is less than 5 minutes,
381 resetting TC to 5.0 minutes for rainfall intensity calculations
382 Rainfall intensity (I) = 8.695 (In/Hr) for a 100.0 year storm
383 Effective runoff coefficient used for area (Q=KCIA) is C = 0.350
384 Subarea runoff = 0.207 (CFS)
385 Total initial stream area = 0.068 (Ac.)
386
387
388 ++++++
389 Process from Point/Station 402.000 to Point/Station 108.000
390 **** IRREGULAR CHANNEL FLOW TRAVEL TIME ****
391
392 Estimated mean flow rate at midpoint of channel = 1.444 (CFS)
393 Depth of flow = 0.405 (Ft.), Average velocity = 8.815 (Ft/s)
394 ***** Irregular Channel Data *****
395
396 -----
397 Information entered for subchannel number 1 :
398 Point number 'X' coordinate 'Y' coordinate
399 1 0.00 1.00
400 2 1.00 0.00
401 3 2.00 1.00
402 Manning's 'N' friction factor = 0.016
403
404 -----
405 Sub-Channel flow = 1.444 (CFS)
406 ' ' flow top width = 0.809 (Ft.)
407 ' ' velocity= 8.815 (Ft/s)
408 ' ' area = 0.164 (Sq.Ft)
409 ' ' Froude number = 3.454
410
411 Upstream point elevation = 687.650 (Ft.)
412 Downstream point elevation = 601.330 (Ft.)
413 Flow length = 717.000 (Ft.)
414 Travel time = 1.36 min.
415 Time of concentration = 6.09 min.
416 Depth of flow = 0.405 (Ft.)

```

```

415 Average velocity = 8.815 (Ft/s)
416 Total irregular channel flow = 1.444 (CFS)
417 Irregular channel normal depth above invert elev. = 0.405 (Ft.)
418 Average velocity of channel(s) = 8.815 (Ft/s)
419 Adding area flow to channel
420 Rainfall intensity (I) = 7.659 (In/Hr) for a 100.0 year storm
421 Decimal fraction soil group A = 0.000
422 Decimal fraction soil group B = 0.000
423 Decimal fraction soil group C = 0.000
424 Decimal fraction soil group D = 1.000
425 [UNDISTURBED NATURAL TERRAIN ]
426 (Permanent Open Space )
427 Impervious value, Ai = 0.000
428 Sub-Area C Value = 0.350
429 Rainfall intensity = 7.659 (In/Hr) for a 100.0 year storm
430 Effective runoff coefficient used for total area
431 (Q=KCIA) is C = 0.350 CA = 0.338
432 Subarea runoff = 2.383 (CFS) for 0.898 (Ac.)
433 Total runoff = 2.590 (CFS) Total area = 0.966 (Ac.)
434 Depth of flow = 0.504 (Ft.), Average velocity = 10.202 (Ft/s)
435
436
437 ++++++
438 Process from Point/Station 108.000 to Point/Station 108.000
439 **** CONFLUENCE OF MINOR STREAMS ****
440
441 -----
442 Along Main Stream number: 1 in normal stream number 2
443 Stream flow area = 0.966 (Ac.)
444 Runoff from this stream = 2.590 (CFS)
445 Time of concentration = 6.09 min.
446 Rainfall intensity = 7.659 (In/Hr)
447 Summary of stream data:
448
449 Stream Flow rate TC Rainfall Intensity
450 No. (CFS) (min) (In/Hr)
451
452 1 8.490 16.28 4.060
453 2 2.590 6.09 7.659
454 Qmax (1) =
455 1.000 * 1.000 * 8.490) +
456 0.530 * 1.000 * 2.590) + = 9.862
457 Qmax (2) =
458 1.000 * 0.374 * 8.490) +
459 1.000 * 1.000 * 2.590) + = 5.762
460
461 Total of 2 streams to confluence:
462 Flow rates before confluence point:
463 8.490 2.590
464 Maximum flow rates at confluence using above data:
465 9.862 5.762
466 Area of streams before confluence:
467 4.014 0.966
468 Results of confluence:
469 Total flow rate = 9.862 (CFS)
470 Time of concentration = 16.285 min.
471 Effective stream area after confluence = 4.980 (Ac.)
472
473
474 ++++++
475 Process from Point/Station 108.000 to Point/Station 109.000
476 **** IRREGULAR CHANNEL FLOW TRAVEL TIME ****
477
478 -----
479 Estimated mean flow rate at midpoint of channel = 9.908 (CFS)
480 Depth of flow = 0.346 (Ft.), Average velocity = 6.015 (Ft/s)
481 ***** Irregular Channel Data *****
482
483 -----
484 Information entered for subchannel number 1 :
485 Point number 'X' coordinate 'Y' coordinate

```



```

484         1           0.00           0.63
485         2          25.00           0.13
486         3          26.50           0.00
487         4          26.50           0.50
488         5          31.50           0.60
489 Manning's 'N' friction factor = 0.015
490 -----
491 Sub-Channel flow = 9.908 (CFS)
492 ' ' flow top width = 12.553 (Ft.)
493 ' ' velocity= 6.015 (Ft/s)
494 ' ' area = 1.647 (Sq.Ft)
495 ' ' Froude number = 2.927
496
497 Upstream point elevation = 601.330 (Ft.)
498 Downstream point elevation = 593.870 (Ft.)
499 Flow length = 130.000 (Ft.)
500 Travel time = 0.36 min.
501 Time of concentration = 16.65 min.
502 Depth of flow = 0.346 (Ft.)
503 Average velocity = 6.015 (Ft/s)
504 Total irregular channel flow = 9.908 (CFS)
505 Irregular channel normal depth above invert elev. = 0.346 (Ft.)
506 Average velocity of channel(s) = 6.015 (Ft/s)
507 Adding area flow to channel
508 Rainfall intensity (I) = 4.003 (In/Hr) for a 100.0 year storm
509 Decimal fraction soil group A = 0.000
510 Decimal fraction soil group B = 0.000
511 Decimal fraction soil group C = 0.000
512 Decimal fraction soil group D = 1.000
513 [UNDISTURBED NATURAL TERRAIN ]
514 (Permanent Open Space )
515 Impervious value, Ai = 0.000
516 Sub-Area C Value = 0.350
517 Rainfall intensity = 4.003 (In/Hr) for a 100.0 year storm
518 Effective runoff coefficient used for total area
519 (Q=KCIA) is C = 0.484 CA = 2.473
520 Subarea runoff = 0.038 (CFS) for 0.126 (Ac.)
521 Total runoff = 9.900 (CFS) Total area = 5.106 (Ac.)
522 Depth of flow = 0.346 (Ft.), Average velocity = 6.014 (Ft/s)
523
524
525 ++++++
526 Process from Point/Station 109.000 to Point/Station 110.000
527 **** IRREGULAR CHANNEL FLOW TRAVEL TIME ****
528
529 -----
530 Estimated mean flow rate at midpoint of channel = 9.966 (CFS)
531 Depth of flow = 0.364 (Ft.), Average velocity = 5.283 (Ft/s)
532 ***** Irregular Channel Data *****
533 -----
534 Information entered for subchannel number 1 :
535 Point number 'X' coordinate 'Y' coordinate
536 1 0.00 0.63
537 2 25.00 0.13
538 3 26.50 0.00
539 4 26.50 0.50
540 5 31.50 0.60
541 Manning's 'N' friction factor = 0.015
542 -----
543 Sub-Channel flow = 9.966 (CFS)
544 ' ' flow top width = 13.474 (Ft.)
545 ' ' velocity= 5.283 (Ft/s)
546 ' ' area = 1.887 (Sq.Ft)
547 ' ' Froude number = 2.488
548
549 Upstream point elevation = 593.870 (Ft.)
550 Downstream point elevation = 585.800 (Ft.)
551 Flow length = 199.000 (Ft.)
552 Travel time = 0.63 min.
553 Time of concentration = 17.27 min.

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553 Depth of flow = 0.364(Ft.)
554 Average velocity = 5.283(Ft/s)
555 Total irregular channel flow = 9.966(CFS)
556 Irregular channel normal depth above invert elev. = 0.364(Ft.)
557 Average velocity of channel(s) = 5.283(Ft/s)
558 Adding area flow to channel
559 Rainfall intensity (I) = 3.908(In/Hr) for a 100.0 year storm
560 Decimal fraction soil group A = 0.000
561 Decimal fraction soil group B = 0.000
562 Decimal fraction soil group C = 0.000
563 Decimal fraction soil group D = 1.000
564 [UNDISTURBED NATURAL TERRAIN ]
565 (Permanent Open Space )
566 Impervious value, Ai = 0.000
567 Sub-Area C Value = 0.350
568 Rainfall intensity = 3.908(In/Hr) for a 100.0 year storm
569 Effective runoff coefficient used for total area
570 (Q=KCIA) is C = 0.479 CA = 2.544
571 Subarea runoff = 0.044(CFS) for 0.203(Ac.)
572 Total runoff = 9.945(CFS) Total area = 5.309(Ac.)
573 Depth of flow = 0.364(Ft.), Average velocity = 5.280(Ft/s)
574
575
576 ++++++
577 Process from Point/Station 110.000 to Point/Station 110.000
578 **** CONFLUENCE OF MINOR STREAMS ****
579
580 Along Main Stream number: 1 in normal stream number 1
581 Stream flow area = 5.309(Ac.)
582 Runoff from this stream = 9.945(CFS)
583 Time of concentration = 17.27 min.
584 Rainfall intensity = 3.908(In/Hr)
585
586
587 ++++++
588 Process from Point/Station 501.000 to Point/Station 502.000
589 **** INITIAL AREA EVALUATION ****
590
591 Decimal fraction soil group A = 0.000
592 Decimal fraction soil group B = 0.000
593 Decimal fraction soil group C = 0.000
594 Decimal fraction soil group D = 1.000
595 [UNDISTURBED NATURAL TERRAIN ]
596 (Permanent Open Space )
597 Impervious value, Ai = 0.000
598 Sub-Area C Value = 0.350
599 Initial subarea total flow distance = 137.000(Ft.)
600 Highest elevation = 709.360(Ft.)
601 Lowest elevation = 685.500(Ft.)
602 Elevation difference = 23.860(Ft.) Slope = 17.416 %
603 INITIAL AREA TIME OF CONCENTRATION CALCULATIONS:
604 The maximum overland flow distance is 100.00 (Ft)
605 for the top area slope value of 17.42 %, in a development type of
606 Permanent Open Space
607 In Accordance With Figure 3-3
608 Initial Area Time of Concentration = 5.21 minutes
609 TC = [1.8*(1.1-C)*distance(Ft.)^.5]/(% slope^(1/3)]
610 TC = [1.8*(1.1-0.3500)*( 100.000^.5)/( 17.420^(1/3)]= 5.21
611 Rainfall intensity (I) = 8.469(In/Hr) for a 100.0 year storm
612 Effective runoff coefficient used for area (Q=KCIA) is C = 0.350
613 Subarea runoff = 0.682(CFS)
614 Total initial stream area = 0.230(Ac.)
615
616
617 ++++++
618 Process from Point/Station 502.000 to Point/Station 503.000
619 **** IRREGULAR CHANNEL FLOW TRAVEL TIME ****
620
621 Estimated mean flow rate at midpoint of channel = 2.105(CFS)

```

```

622 Depth of flow = 0.544(Ft.), Average velocity = 7.120(Ft/s)
623 ***** Irregular Channel Data *****
624 -----
625 Information entered for subchannel number 1 :
626 Point number 'X' coordinate 'Y' coordinate
627 1 0.00 1.00
628 2 1.00 0.00
629 3 2.00 1.00
630 Manning's 'N' friction factor = 0.030
631 -----
632 Sub-Channel flow = 2.105(CFS)
633 ' ' flow top width = 1.087(Ft.)
634 ' ' velocity= 7.120(Ft/s)
635 ' ' area = 0.296(Sq.Ft)
636 ' ' Froude number = 2.407
637
638 Upstream point elevation = 685.500(Ft.)
639 Downstream point elevation = 619.000(Ft.)
640 Flow length = 357.000(Ft.)
641 Travel time = 0.84 min.
642 Time of concentration = 6.04 min.
643 Depth of flow = 0.544(Ft.)
644 Average velocity = 7.120(Ft/s)
645 Total irregular channel flow = 2.105(CFS)
646 Irregular channel normal depth above invert elev. = 0.544(Ft.)
647 Average velocity of channel(s) = 7.120(Ft/s)
648 Adding area flow to channel
649 Rainfall intensity (I) = 7.694(In/Hr) for a 100.0 year storm
650 Decimal fraction soil group A = 0.000
651 Decimal fraction soil group B = 0.000
652 Decimal fraction soil group C = 0.000
653 Decimal fraction soil group D = 1.000
654 [UNDISTURBED NATURAL TERRAIN ]
655 (Permanent Open Space )
656 Impervious value, Ai = 0.000
657 Sub-Area C Value = 0.350
658 Rainfall intensity = 7.694(In/Hr) for a 100.0 year storm
659 Effective runoff coefficient used for total area
660 (Q=KCIA) is C = 0.350 CA = 0.447
661 Subarea runoff = 2.757(CFS) for 1.047(Ac.)
662 Total runoff = 3.439(CFS) Total area = 1.277(Ac.)
663 Depth of flow = 0.654(Ft.), Average velocity = 8.050(Ft/s)
664
665
666 +-----+
667 Process from Point/Station 503.000 to Point/Station 504.000
668 **** PIPEFLOW TRAVEL TIME (User specified size) ****
669 -----
670 Upstream point/station elevation = 605.110(Ft.)
671 Downstream point/station elevation = 582.760(Ft.)
672 Pipe length = 230.00(Ft.) Slope = 0.0972 Manning's N = 0.013
673 No. of pipes = 1 Required pipe flow = 3.439(CFS)
674 Given pipe size = 18.00(In.)
675 Calculated individual pipe flow = 3.439(CFS)
676 Normal flow depth in pipe = 3.94(In.)
677 Flow top width inside pipe = 14.88(In.)
678 Critical Depth = 8.48(In.)
679 Pipe flow velocity = 12.02(Ft/s)
680 Travel time through pipe = 0.32 min.
681 Time of concentration (TC) = 6.36 min.
682
683
684 +-----+
685 Process from Point/Station 504.000 to Point/Station 110.000
686 **** PIPEFLOW TRAVEL TIME (User specified size) ****
687 -----
688 Upstream point/station elevation = 582.760(Ft.)
689 Downstream point/station elevation = 582.080(Ft.)
690 Pipe length = 15.00(Ft.) Slope = 0.0453 Manning's N = 0.013

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691 No. of pipes = 1 Required pipe flow = 3.439 (CFS)
692 Given pipe size = 24.00 (In.)
693 Calculated individual pipe flow = 3.439 (CFS)
694 Normal flow depth in pipe = 4.34 (In.)
695 Flow top width inside pipe = 18.48 (In.)
696 Critical Depth = 7.78 (In.)
697 Pipe flow velocity = 8.88 (Ft/s)
698 Travel time through pipe = 0.03 min.
699 Time of concentration (TC) = 6.39 min.
700
701
702 ++++++
703 Process from Point/Station 110.000 to Point/Station 110.000
704 **** CONFLUENCE OF MINOR STREAMS ****
705
706 Along Main Stream number: 1 in normal stream number 2
707 Stream flow area = 1.277 (Ac.)
708 Runoff from this stream = 3.439 (CFS)
709 Time of concentration = 6.39 min.
710 Rainfall intensity = 7.422 (In/Hr)
711 Summary of stream data:
712
713 Stream Flow rate TC Rainfall Intensity
714 No. (CFS) (min) (In/Hr)
715
716
717 1 9.945 17.27 3.908
718 2 3.439 6.39 7.422
719 Qmax (1) =
720 1.000 * 1.000 * 9.945) +
721 0.527 * 1.000 * 3.439) + = 11.755
722 Qmax (2) =
723 1.000 * 0.370 * 9.945) +
724 1.000 * 1.000 * 3.439) + = 7.118
725
726 Total of 2 streams to confluence:
727 Flow rates before confluence point:
728 9.945 3.439
729 Maximum flow rates at confluence using above data:
730 11.755 7.118
731 Area of streams before confluence:
732 5.309 1.277
733 Results of confluence:
734 Total flow rate = 11.755 (CFS)
735 Time of concentration = 17.273 min.
736 Effective stream area after confluence = 6.586 (Ac.)
737 End of computations, total study area = 6.586 (Ac.)
738
739
740

```

```

1
2 San Diego County Rational Hydrology Program
3
4 CIVILCADD/CIVILDESIGN Engineering Software,(c)1991-2019 Version 9.1
5
6 Rational method hydrology program based on
7 San Diego County Flood Control Division 2003 hydrology manual
8 Rational Hydrology Study Date: 02/10/23
9 -----
10 22027 post poc 3 mit
11
12
13
14 -----
15 ***** Hydrology Study Control Information *****
16 -----
17
18
19
20 Program License Serial Number 6332
21
22 -----
23 Rational hydrology study storm event year is 100.0
24 English (in-lb) input data Units used
25
26 Map data precipitation entered:
27 6 hour, precipitation(inches) = 3.300
28 24 hour precipitation(inches) = 5.600
29 P6/P24 = 58.9%
30 San Diego hydrology manual 'C' values used
31
32
33 +-----+
34 Process from Point/Station 1001.000 to Point/Station 1002.000
35 **** INITIAL AREA EVALUATION ****
36
37 -----
38 Decimal fraction soil group A = 0.000
39 Decimal fraction soil group B = 0.000
40 Decimal fraction soil group C = 0.000
41 Decimal fraction soil group D = 1.000
42 [UNDISTURBED NATURAL TERRAIN ]
43 (Permanent Open Space )
44 Impervious value, Ai = 0.000
45 Sub-Area C Value = 0.350
46 Initial subarea total flow distance = 165.000(Ft.)
47 Highest elevation = 763.850(Ft.)
48 Lowest elevation = 749.000(Ft.)
49 Elevation difference = 14.850(Ft.) Slope = 9.000 %
50 INITIAL AREA TIME OF CONCENTRATION CALCULATIONS:
51 The maximum overland flow distance is 100.00 (Ft)
52 for the top area slope value of 9.00 %, in a development type of
53 Permanent Open Space
54 In Accordance With Figure 3-3
55 Initial Area Time of Concentration = 6.49 minutes
56 TC = [1.8*(1.1-C)*distance(Ft.)^.5]/(% slope^(1/3)]
57 TC = [1.8*(1.1-0.3500)*( 100.000^.5)/( 9.000^(1/3)]= 6.49
58 Rainfall intensity (I) = 7.348(In/Hr) for a 100.0 year storm
59 Effective runoff coefficient used for area (Q=KCIA) is C = 0.350
60 Subarea runoff = 0.293(CFS)
61 Total initial stream area = 0.114(Ac.)
62
63 +-----+
64 Process from Point/Station 1002.000 to Point/Station 1003.000
65 **** IRREGULAR CHANNEL FLOW TRAVEL TIME ****
66
67 -----
68 Estimated mean flow rate at midpoint of channel = 0.616(CFS)
69 Depth of flow = 0.285(Ft.), Average velocity = 7.604(Ft/s)
70 ***** Irregular Channel Data *****

```

```

70 -----
71 Information entered for subchannel number 1 :
72 Point number      'X' coordinate      'Y' coordinate
73     1              0.00              1.00
74     2              1.00              0.00
75     3              2.00              1.00
76 Manning's 'N' friction factor = 0.016
77 -----
78 Sub-Channel flow = 0.616(CFS)
79   '   '   flow top width = 0.569(Ft.)
80   '   '   velocity= 7.604(Ft/s)
81   '   '   area = 0.081(Sq.Ft)
82   '   '   Froude number = 3.552
83
84 Upstream point elevation = 749.000(Ft.)
85 Downstream point elevation = 700.170(Ft.)
86 Flow length = 341.000(Ft.)
87 Travel time = 0.75 min.
88 Time of concentration = 7.24 min.
89 Depth of flow = 0.285(Ft.)
90 Average velocity = 7.604(Ft/s)
91 Total irregular channel flow = 0.616(CFS)
92 Irregular channel normal depth above invert elev. = 0.285(Ft.)
93 Average velocity of channel(s) = 7.604(Ft/s)
94 Adding area flow to channel
95 Rainfall intensity (I) = 6.849(In/Hr) for a 100.0 year storm
96 Decimal fraction soil group A = 0.000
97 Decimal fraction soil group B = 0.000
98 Decimal fraction soil group C = 0.000
99 Decimal fraction soil group D = 1.000
100 [UNDISTURBED NATURAL TERRAIN ]
101 (Permanent Open Space )
102 Impervious value, Ai = 0.000
103 Sub-Area C Value = 0.350
104 Rainfall intensity = 6.849(In/Hr) for a 100.0 year storm
105 Effective runoff coefficient used for total area
106 (Q=KCIA) is C = 0.350 CA = 0.128
107 Subarea runoff = 0.582(CFS) for 0.251(Ac.)
108 Total runoff = 0.875(CFS) Total area = 0.365(Ac.)
109 Depth of flow = 0.325(Ft.), Average velocity = 8.301(Ft/s)
110
111
112 +-----+
113 Process from Point/Station 1003.000 to Point/Station 1003.000
114 **** CONFLUENCE OF MINOR STREAMS ****
115
116 -----
117 Along Main Stream number: 1 in normal stream number 1
118 Stream flow area = 0.365(Ac.)
119 Runoff from this stream = 0.875(CFS)
120 Time of concentration = 7.24 min.
121 Rainfall intensity = 6.849(In/Hr)
122
123 +-----+
124 Process from Point/Station 1101.000 to Point/Station 1103.000
125 **** USER DEFINED FLOW INFORMATION AT A POINT ****
126
127 -----
128 User specified 'C' value of 0.234 given for subarea
129 Rainfall intensity (I) = 5.385(In/Hr) for a 100.0 year storm
130 User specified values are as follows:
131 TC = 10.51 min. Rain intensity = 5.38(In/Hr)
132 Total area = 1.095(Ac.) Total runoff = 1.387(CFS)
133
134 +-----+
135 Process from Point/Station 1103.000 to Point/Station 1003.000
136 **** PIPEFLOW TRAVEL TIME (User specified size) ****
137
138 -----
139 Upstream point/station elevation = 709.270(Ft.)

```

```

139 Downstream point/station elevation = 700.170(Ft.)
140 Pipe length = 212.00(Ft.) Slope = 0.0429 Manning's N = 0.013
141 No. of pipes = 1 Required pipe flow = 1.387(CFS)
142 Given pipe size = 18.00(In.)
143 Calculated individual pipe flow = 1.387(CFS)
144 Normal flow depth in pipe = 3.08(In.)
145 Flow top width inside pipe = 13.56(In.)
146 Critical Depth = 5.29(In.)
147 Pipe flow velocity = 6.90(Ft/s)
148 Travel time through pipe = 0.51 min.
149 Time of concentration (TC) = 11.02 min.
150
151
152 *****
153 Process from Point/Station 1003.000 to Point/Station 1003.000
154 **** CONFLUENCE OF MINOR STREAMS ****
155
156 Along Main Stream number: 1 in normal stream number 2
157 Stream flow area = 1.095(Ac.)
158 Runoff from this stream = 1.387(CFS)
159 Time of concentration = 11.02 min.
160 Rainfall intensity = 5.222(In/Hr)
161 Summary of stream data:
162
163 Stream Flow rate TC Rainfall Intensity
164 No. (CFS) (min) (In/Hr)
165
166
167 1 0.875 7.24 6.849
168 2 1.387 11.02 5.222
169 Qmax(1) =
170 1.000 * 1.000 * 0.875) +
171 1.000 * 0.657 * 1.387) + = 1.786
172 Qmax(2) =
173 0.762 * 1.000 * 0.875) +
174 1.000 * 1.000 * 1.387) + = 2.054
175
176 Total of 2 streams to confluence:
177 Flow rates before confluence point:
178 0.875 1.387
179 Maximum flow rates at confluence using above data:
180 1.786 2.054
181 Area of streams before confluence:
182 0.365 1.095
183 Results of confluence:
184 Total flow rate = 2.054(CFS)
185 Time of concentration = 11.022 min.
186 Effective stream area after confluence = 1.460(Ac.)
187
188
189 *****
190 Process from Point/Station 1003.000 to Point/Station 1004.000
191 **** IRREGULAR CHANNEL FLOW TRAVEL TIME ****
192
193 Depth of flow = 0.490(Ft.), Average velocity = 8.572(Ft/s)
194 ***** Irregular Channel Data *****
195 -----
196 Information entered for subchannel number 1 :
197 Point number 'X' coordinate 'Y' coordinate
198 1 0.00 1.00
199 2 1.00 0.00
200 3 2.00 1.00
201 Manning's 'N' friction factor = 0.030
202 -----
203 Sub-Channel flow = 2.054(CFS)
204 ' ' flow top width = 0.979(Ft.)
205 ' ' velocity= 8.572(Ft/s)
206 ' ' area = 0.240(Sq.Ft)
207 ' ' Froude number = 3.053

```



```

208
209 Upstream point elevation = 696.870(Ft.)
210 Downstream point elevation = 651.540(Ft.)
211 Flow length = 146.000(Ft.)
212 Travel time = 0.28 min.
213 Time of concentration = 11.31 min.
214 Depth of flow = 0.490(Ft.)
215 Average velocity = 8.572(Ft/s)
216 Total irregular channel flow = 2.054(CFS)
217 Irregular channel normal depth above invert elev. = 0.490(Ft.)
218 Average velocity of channel(s) = 8.572(Ft/s)
219
220
221 ++++++
222 Process from Point/Station 1005.000 to Point/Station 1006.000
223 **** IRREGULAR CHANNEL FLOW TRAVEL TIME ****
224
225 Depth of flow = 0.478(Ft.), Average velocity = 9.003(Ft/s)
226 ***** Irregular Channel Data *****
227 -----
228 Information entered for subchannel number 1 :
229 Point number 'X' coordinate 'Y' coordinate
230 1 0.00 1.00
231 2 1.00 0.00
232 3 2.00 1.00
233 Manning's 'N' friction factor = 0.030
234 -----
235 Sub-Channel flow = 2.054(CFS)
236 ' ' flow top width = 0.955(Ft.)
237 ' ' velocity= 9.003(Ft/s)
238 ' ' area = 0.228(Sq.Ft)
239 ' ' Froude number = 3.246
240
241 Upstream point elevation = 680.820(Ft.)
242 Downstream point elevation = 600.490(Ft.)
243 Flow length = 227.000(Ft.)
244 Travel time = 0.42 min.
245 Time of concentration = 11.73 min.
246 Depth of flow = 0.478(Ft.)
247 Average velocity = 9.003(Ft/s)
248 Total irregular channel flow = 2.054(CFS)
249 Irregular channel normal depth above invert elev. = 0.478(Ft.)
250 Average velocity of channel(s) = 9.003(Ft/s)
251 End of computations, total study area = 1.460 (Ac.)
252
253
254

```

ATTACHMENT 7
HYDROGRAPH

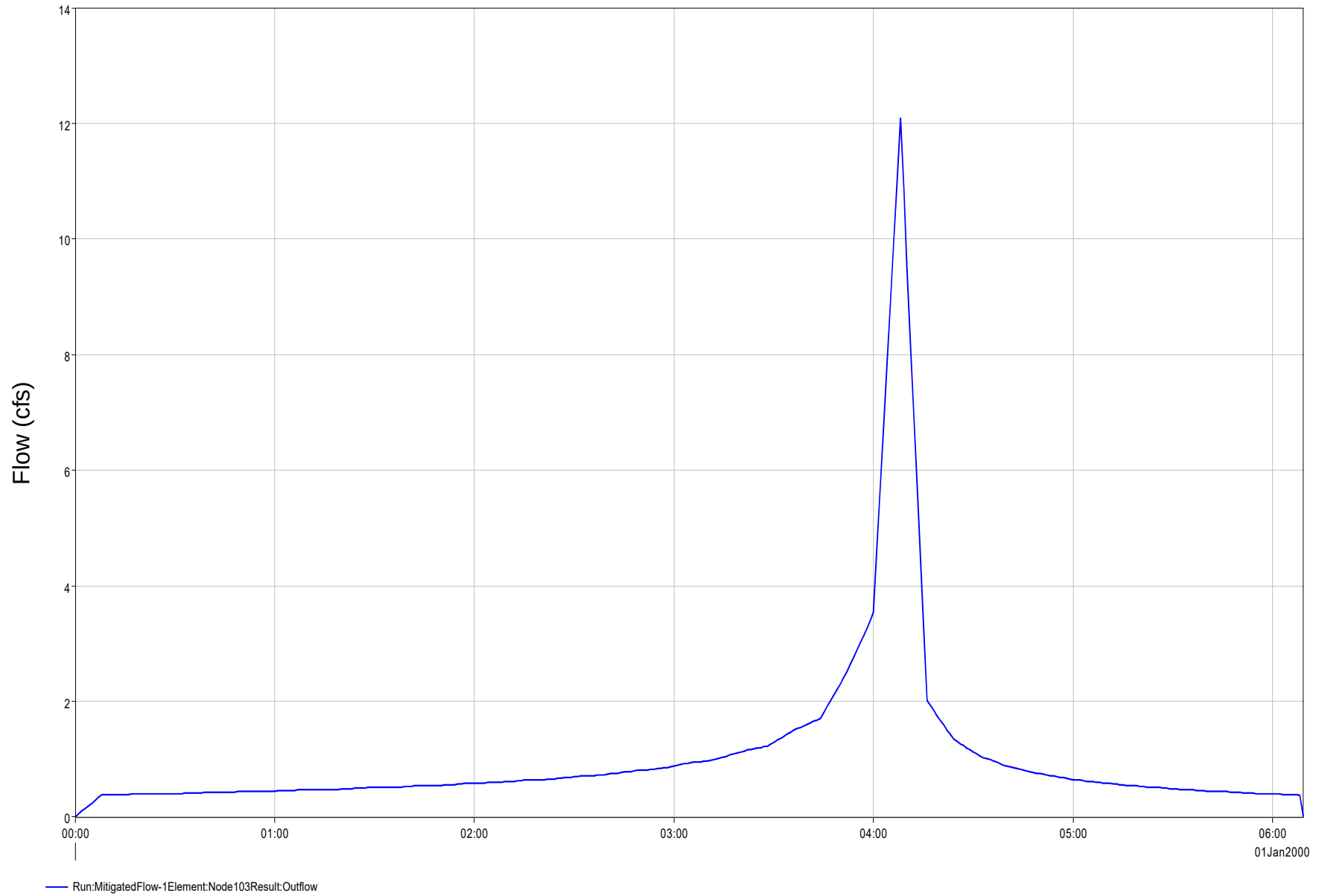
7a. HEC-HMS Simulations Results

POC-1 PART 1 MITIGATION INFLOW HYDROGRAPH

Summary Results for Source "Node 103"	
Project: 22027_PostDev-Detention Simulation Run: Mitigated Flow-1 Source: Node 103	
Start of Run: 01Jan2000, 00:00	Basin Model: woodward
End of Run: 01Jan2000, 06:09	Meteorologic Model: precipitation
Compute Time: 10Feb2023, 13:18:29	Control Specifications: time of analysis
Volume Units: ☒ IN ☐ ACRE-FT	
Computed Results	
Peak Discharge: 12.10 (CFS)	Date/Time of Peak Discharge: 01Jan2000, 04:08
Volume: n/a	

POC-1 PART 1 MITIGATION INFLOW HYDROGRAPH

Source "Node 103" Results for Run "Mitigated Flow-1"



POC-1 PART 1 MITIGATED OUTFLOW SUMMARY TABLE

Summary Results for Reservoir "Sto-Pipe-to BMP-A"

Project: 22027_PostDev-Detention

Simulation Run: Mitigated Flow-1

Reservoir: Sto-Pipe-to BMP-A

Start of Run: 01Jan2000, 00:00

Basin Model: woodward

End of Run: 01Jan2000, 06:09

Meteorologic Model: precipitation

Compute Time:DATA CHANGED, RECOMPUTE

Control Specifications:time of analysis

Volume Units: ☒ IN ☐ ACRE-FT

Computed Results

Peak Inflow: 12.10 (CFS)

Peak Discharge: 10.36 (CFS)

Inflow Volume: n/a

Discharge Volume:n/a

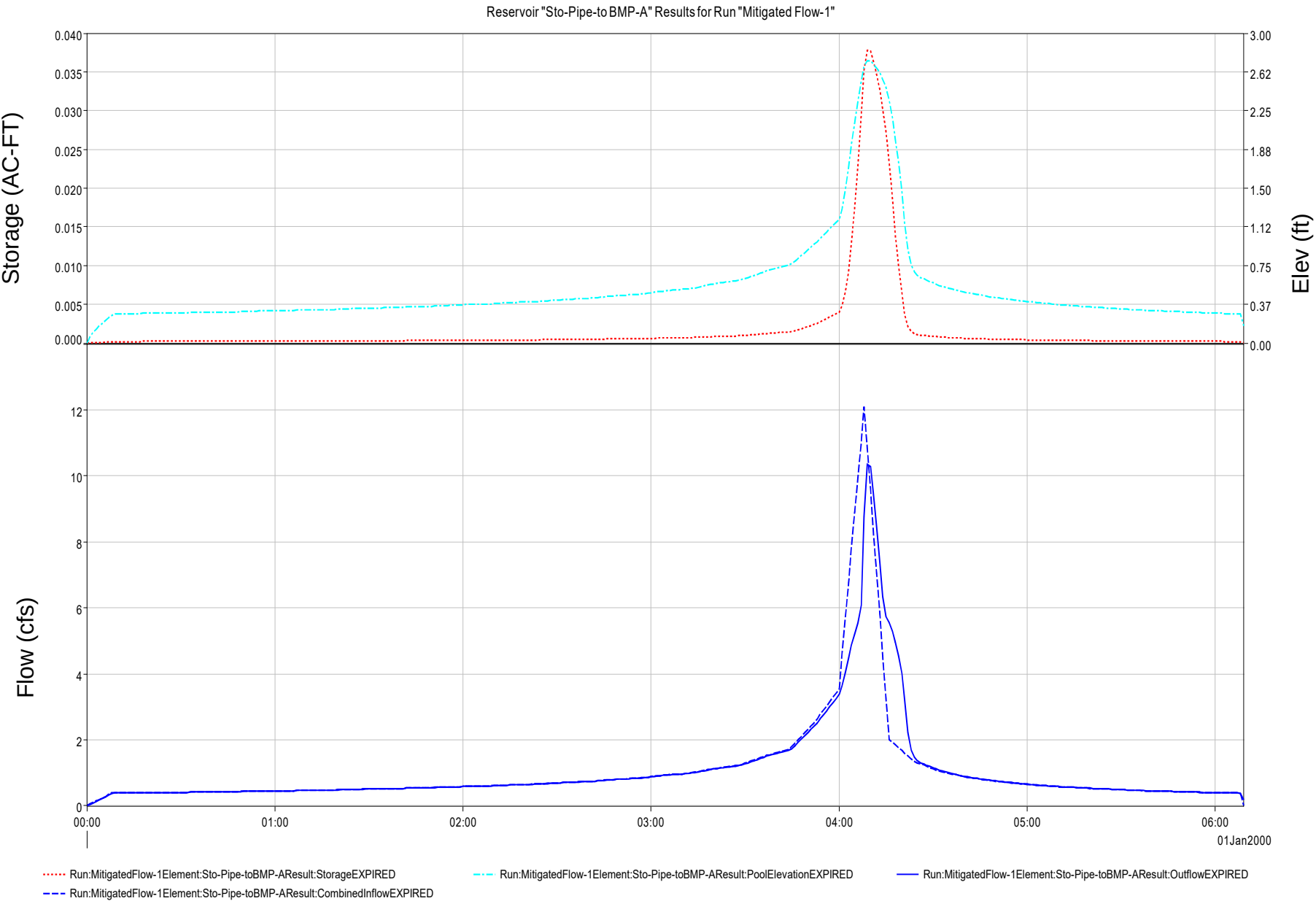
Date/Time of Peak Inflow: 01Jan2000, 04:08

Date/Time of Peak Discharge:01Jan2000, 04:09

Peak Storage: 0.0 (ACRE-FT)

Peak Elevation: 2.74 (FT)

POC-1 PART 1 MITIGATED OUTFLOW HYDROGRAPH

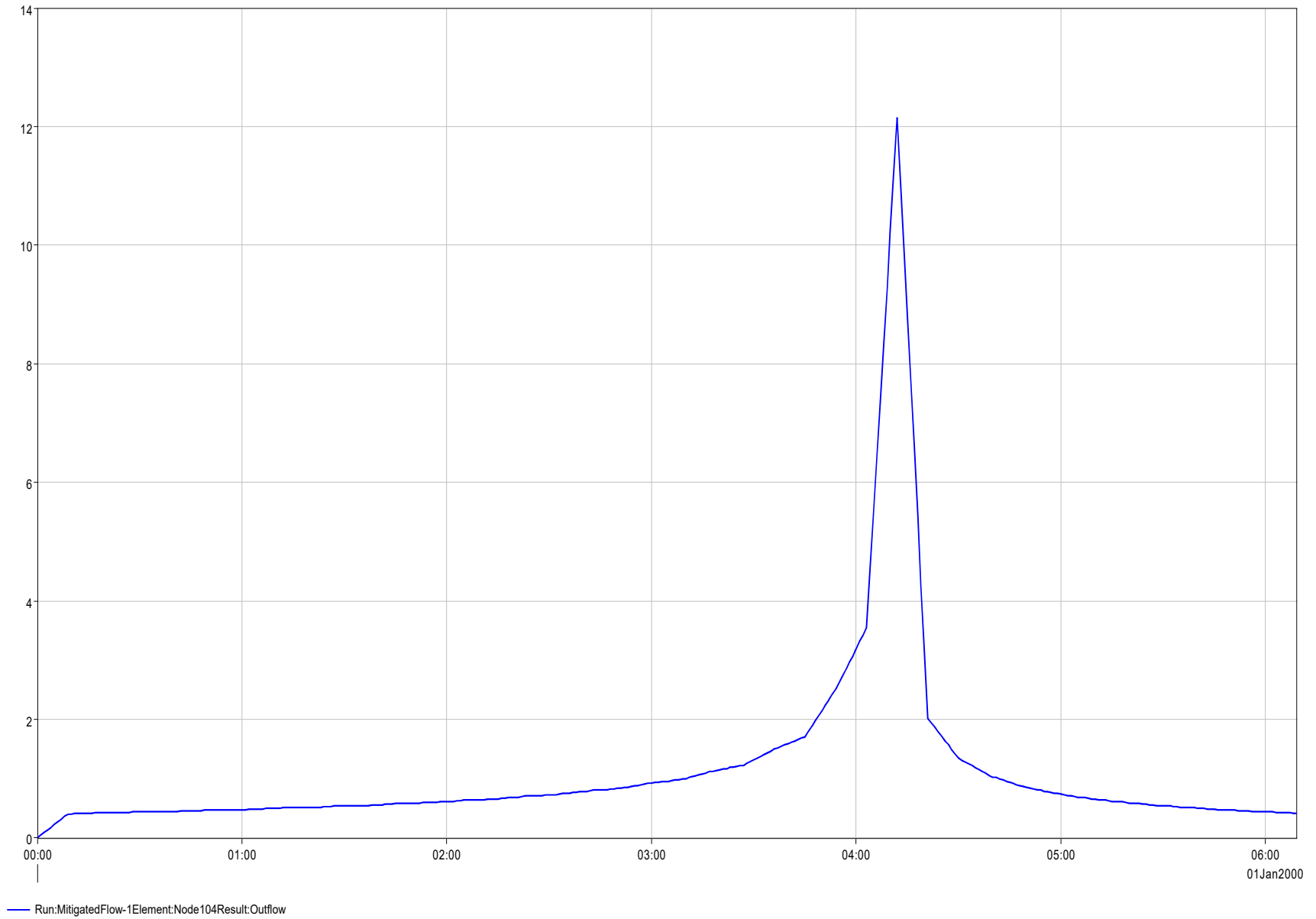


POC-1 PART 2 MITIGATION INFLOW HYDROGRAPH

Summary Results for Source "Node 104"	
Project: 22027_PostDev-Detention Simulation Run: Mitigated Flow-1 Source: Node 104	
Start of Run: 01Jan2000, 00:00	Basin Model: woodward
End of Run: 01Jan2000, 06:09	Meteorologic Model: precipitation
Compute Time: 10Feb2023, 13:18:29	Control Specifications: time of analysis
Volume Units: ☒ IN ☐ ACRE-FT	
Computed Results	
Peak Discharge: 12.16 (CFS)	Date/Time of Peak Discharge: 01Jan2000, 04:12
Volume: n/a	

POC-1 PART 2 MITIGATION INFLOW HYDROGRAPH

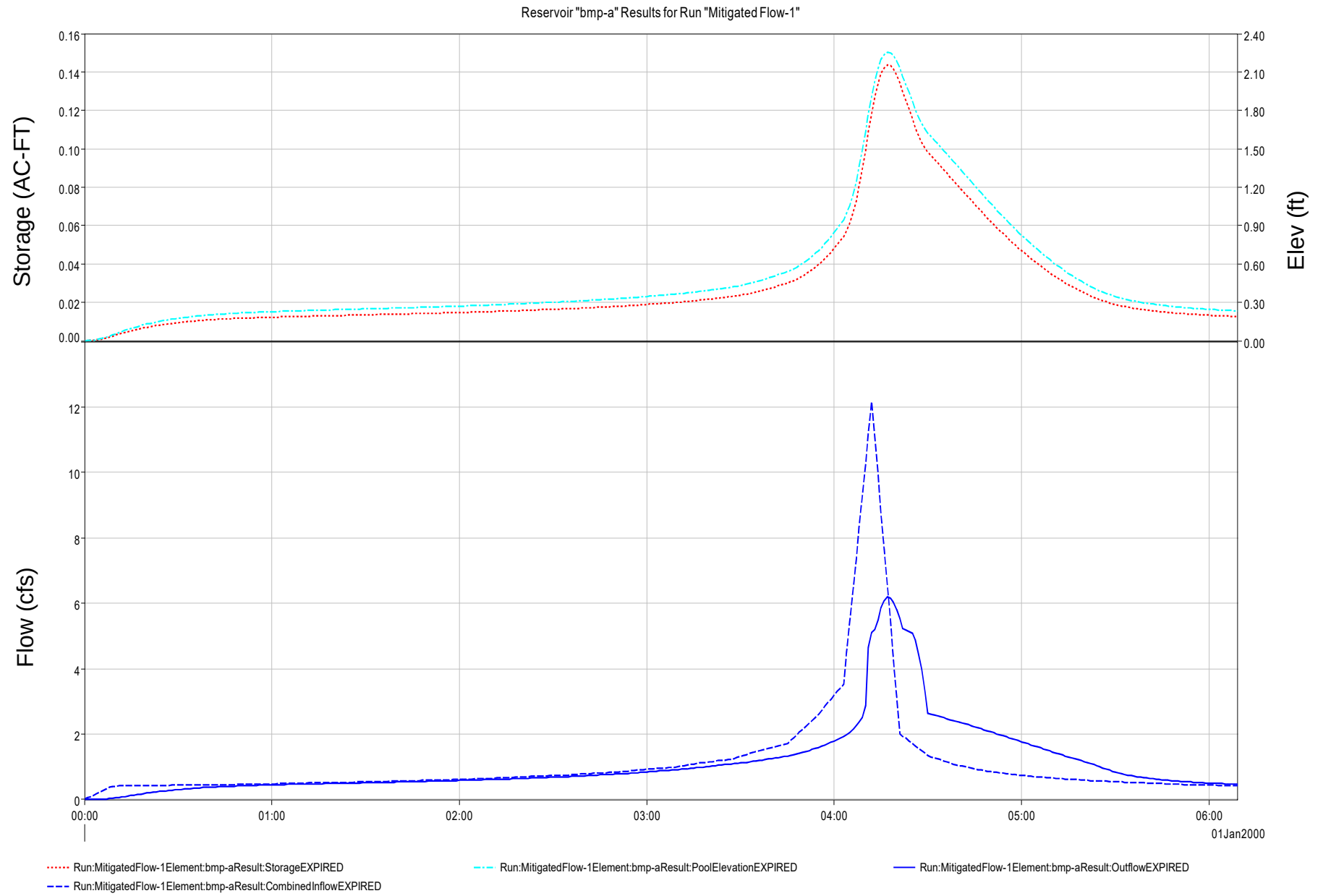
Source "Node 104" Results for Run "Mitigated Flow-1"



POC-1 PART 2 MITIGATED OUTFLOW SUMMARY TABLE

Summary Results for Reservoir "bmp-a"		—		□		✕	
Project: 22027_PostDev-Detention				Simulation Run: Mitigated Flow-1			
Reservoir: bmp-a							
Start of Run: 01Jan2000, 00:00		Basin Model: woodward					
End of Run: 01Jan2000, 06:09		Meteorologic Model: precipitation					
Compute Time: DATA CHANGED, RECOMPUTE		Control Specifications: time of analysis					
Volume Units: ☒ IN ☐ ACRE-FT							
Computed Results							
Peak Inflow: 12.16 (CFS)		Date/Time of Peak Inflow: 01Jan2000, 04:12					
Peak Discharge: 6.21 (CFS)		Date/Time of Peak Discharge: 01Jan2000, 04:17					
Inflow Volume: n/a		Peak Storage: 0.1 (ACRE-FT)					
Discharge Volume: n/a		Peak Elevation: 2.25 (FT)					

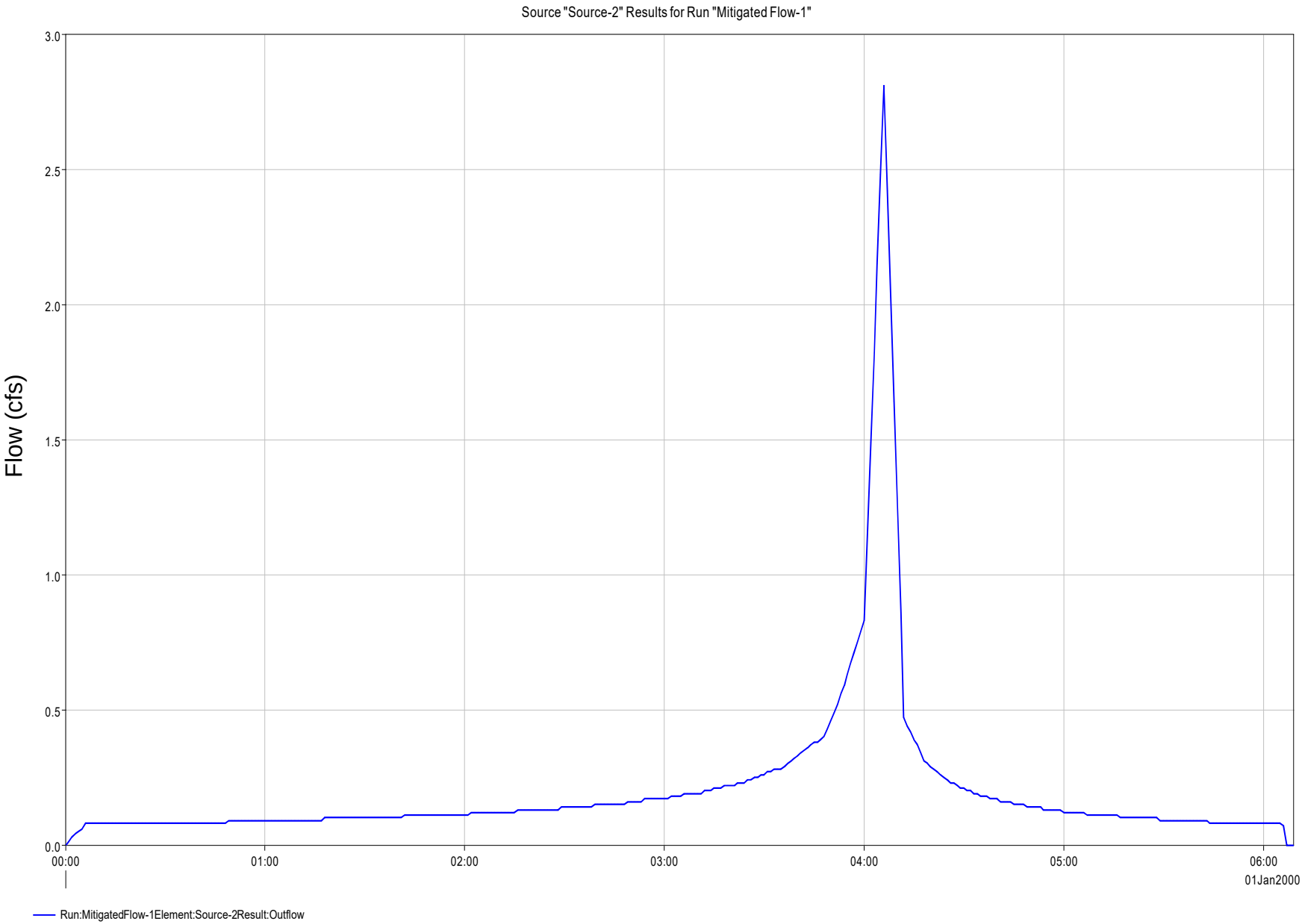
POC-1 PART 2 MITIGATED OUTFLOW HYDROGRAPH



POC-3 MITIGATION INFLOW SUMMARY TBALE

Summary Results for Source "Source-2"	
Project: 22027_PostDev-Detention Simulation Run: Mitigated Flow-1 Source: Source-2	
Start of Run: 01Jan2000, 00:00	Basin Model: woodward
End of Run: 01Jan2000, 06:09	Meteorologic Model: precipitation
Compute Time: 10Feb2023, 13:18:29	Control Specifications: time of analysis
Volume Units: ☒ IN ☐ ACRE-FT	
Computed Results	
Peak Discharge: 2.81 (CFS)	Date/Time of Peak Discharge: 01Jan2000, 04:06
Volume: n/a	

POC-3 MITIGATION INFLOW HYDROGRAPH

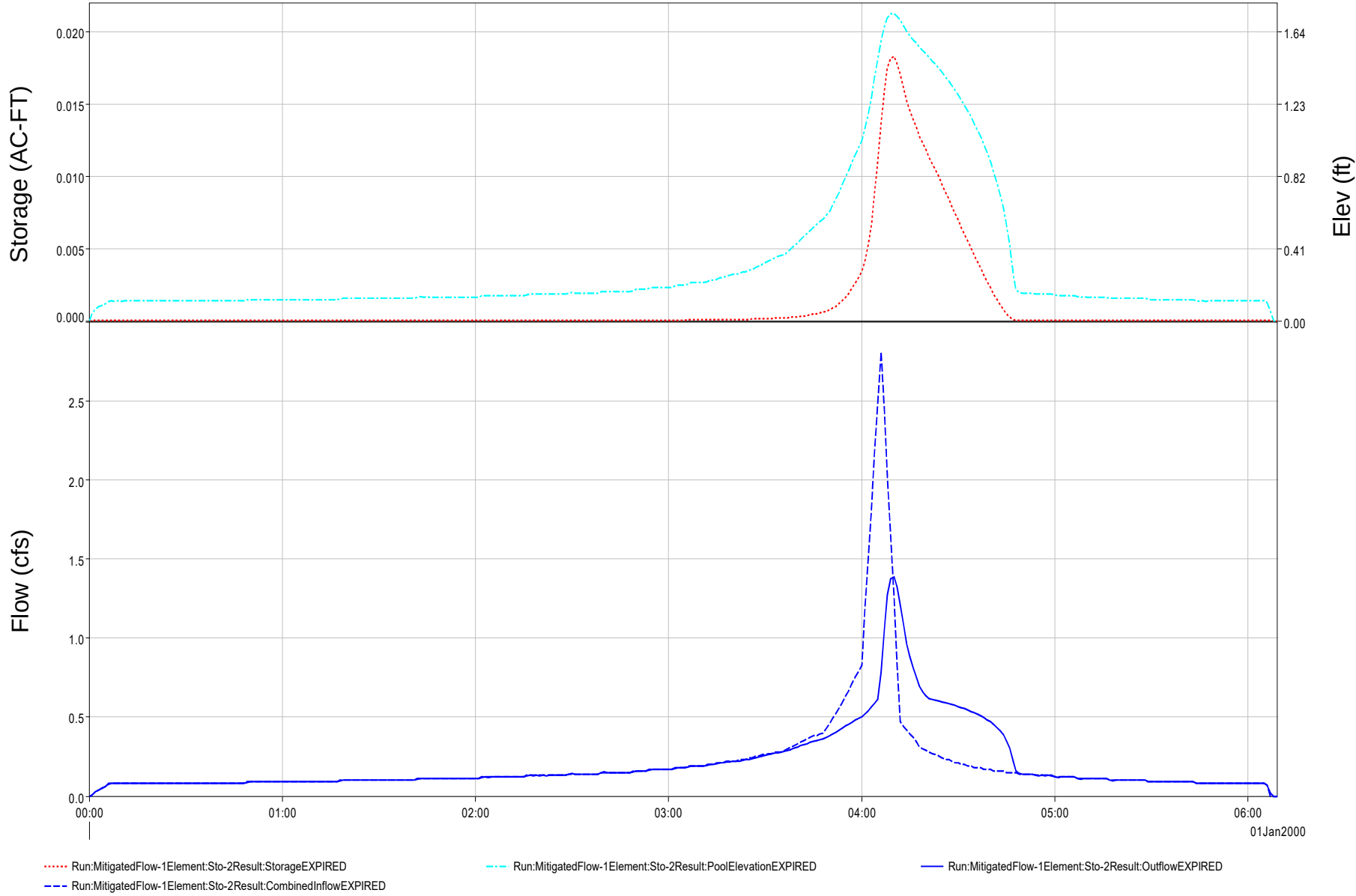


POC-3 MITIGATED OUTFLOW SUMMARY TABLE

Summary Results for Reservoir "Sto-2"			
Project: 22027_PostDev-Detention		Simulation Run: Mitigated Flow-1	
Reservoir: Sto-2			
Start of Run: 01Jan2000, 00:00	Basin Model: woodward		
End of Run: 01Jan2000, 06:09	Meteorologic Model: precipitation		
Compute Time: DATA CHANGED, RECOMPUTE	Control Specifications: time of analysis		
Volume Units: ☒ IN ☐ ACRE-FT			
Computed Results			
Peak Inflow: 2.81 (CFS)	Date/Time of Peak Inflow: 01Jan2000, 04:06		
Peak Discharge: 1.39 (CFS)	Date/Time of Peak Discharge: 01Jan2000, 04:10		
Inflow Volume: n/a	Peak Storage: 0.0 (ACRE-FT)		
Discharge Volume: n/a	Peak Elevation: 1.74 (FT)		

POC-3 MITIGATED OUTFLOW HYDROGRAPH

Reservoir "Sto-2" Results for Run "Mitigated Flow-1"



7b. Runoff Coefficient C After Detention Structure

CALCULATION AFTER THE DETENTION STRUCTURE

The purpose of the detention structure is to alter the peak flow and or time to peak of a given storm so it will not have a negative impact on the downstream facilities. There are different methods on how to use the resulting values of the outflow hydrograph.

For the purposes of this example there will be an association of the following values:

Q_{in} = Is equal to the inflow value that will enter the basin before storage

Q_{out} = Is equal to the outflow value that will exit the basin after storage

Tc_{in} = Is equal to the Time of Concentration flowing into the basin before detention

Tc_{out} = Is equal to the Time of Concentration exiting the basin after detention

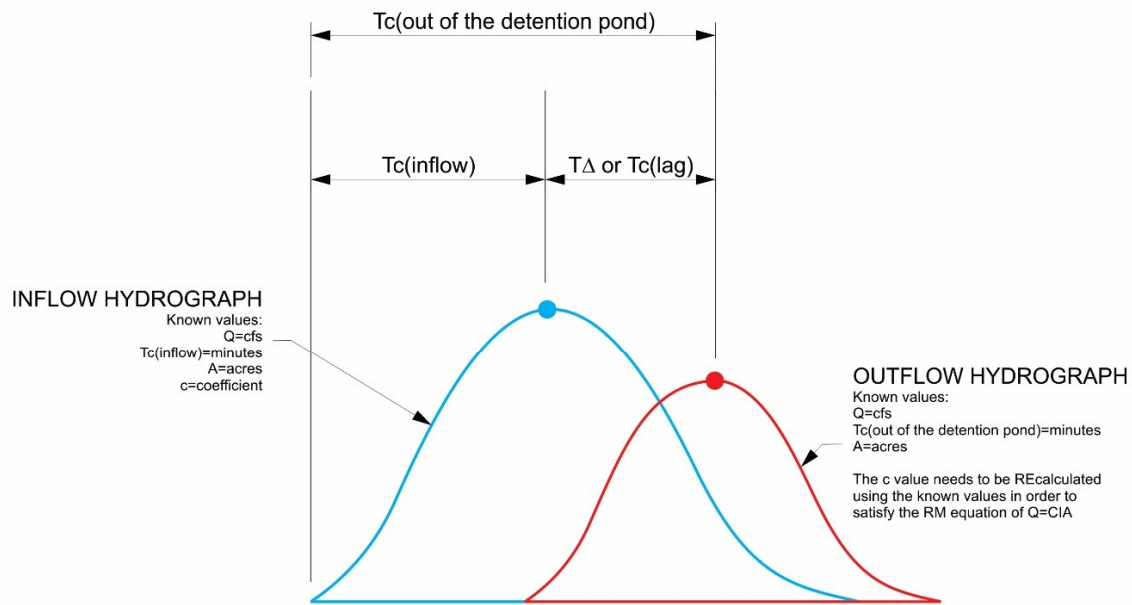
A = Area of the tributary area being examined; (This value does not change)

c_{inflow} = The runoff coefficient going into the basin for detention

c_{out} = The runoff coefficient recalculated taking into account water stored in pond for detention

One method is to keep the value of c_{inflow} and solve for the I =intensity & Tc_{out} (outflow). In this interpretation, we will get a Tc that will not match the value of the Tc_{out} (out of the detention structure) of the outflow hydrograph that was calculated using the detention pond. The Tc Using this method shows a disruption on the oneness & continuity of the outflow hydrograph & the formula $Q=cIA$.

The second method; that is the method we are using is to recalculate the c =coefficient based on the fix values of the outflow hydrograph to achieve a c_{out} . This value uses the c_{inflow} from the flow into the detention basin and then is recalculated by the output of the hydrograph software using $Q=cIA$; translated as $c=Q/IA$. This method preserves the formula $Q=cIA$ & does not alter the Tc_{out} (out of the detention structure). This method shows that in order to maintain mathematical integrity of the rational equation ($Q=CIA$), the detention structure alters the runoff coefficient which is the only unknown in the equation. It is noted that the designer feels it is important to hold the value of Tc and the Q values that are calculated from the hydrograph.



**GRAPHICAL DIAGRAM OF THE HYDROGRAPH
COMING OUT OF THE DETENTION POND**

The routing of the runoff through the detention structure gives us the $Q_{(\text{out of the detention structure})}$ and $T\Delta$ time lag between $Q_{(\text{inflow})}$ & $Q_{(\text{out of the detention structure})}$.

The known fix values coming out of the detention structure are:

- o $Q = \text{cfs}$
- o $T_c(\text{out of the detention structure}) = \text{minutes}$
- o $A = \text{acres}$
- o *Please note that $c = \text{coefficient}$ is not given directly from the resulting hydrograph coming out of the detention pond.*

In order to satisfy the rational equation of $Q = CIA$ (see Section 3 of the 2003 San Diego County Hydrology Manual) coming out of the detention structure, we will calculate the only unknown value of the equation which is the outlet runoff coefficient, $C_{(\text{outlet})}$. By using the $T_c(\text{out of the detention structure})$ we can solve for the intensity, I. With the intensity (I) value calculated, we can solve for the outlet runoff coefficient, $C_{(\text{outlet})}$.

The following equations are used in

this stage: $Q = CIA$ $I =$
 $7.44P_6D^{-0.645}$

Where:

$Q_{(\text{out of the detention structure})} = \text{runoff (cfs), known value}$

$T_{c(\text{inflow})} = \text{detention structure inflow time of concentration (D)}$
 (minutes)

$T\Delta = \text{time lag between } Q_{(\text{inflow})} \text{ \& } Q_{(\text{out of the detention structure})}$

(minutes) $T_{c(\text{out of the detention structure})} = T_{c(\text{inflow})} + T\Delta$ (minutes)

P_6 = 6 hour precipitation (inches), known value.

I = intensity (inches/hour), calculated based on the value of $T_{c(\text{out of the detention structure})}$

A = tributary area of the detention structure (acres),

known value $C_{(\text{outflow})}$ = runoff coefficient (unitless),

value to be solved

CALCULATIONS For STO-1			
LINE	ITEM	AT THE OUTFLOW OF STO-1	REMARKS
1	P6 inch	3.3	KNOWN VALUE
2	TC (inflow) mins	8.6	KNOWN VALUE
3	TC (lag) mins	1	FROM THE OUTFLOW HYDROGRAPH
4	TC (ouflow) mins	9.6	LINE 2+3
5	I inches/hour	5.708	FROM THE INTENSITY FORMULA
6	Q(outflow)	10.35706	KNOWN VALUE
7	A (inflow=outflow)	2.3	KNOWN VALUE
8	c(inflow)	0.859	KNOWN VALUE FROM THE CONTRIBUTING BASIN(S)
9	c(outflow)	0.789	CALCULATED FROM $C=Q/IA$

CALCULATIONS For BMP-A			
LINE	ITEM	AT THE OUTFLOW OF STO-1	REMARKS
1	P6 inch	3.3	KNOWN VALUE
2	TC (inflow) mins	9.6	KNOWN VALUE
3	TC (lag) mins	5	FROM THE OUTFLOW HYDROGRAPH
4	TC (ouflow) mins	14.6	LINE 2+3
5	I inches/hour	4.356	FROM THE INTENSITY FORMULA
6	Q(outflow)	6.20628	KNOWN VALUE
7	A (inflow=outflow)	2.84	KNOWN VALUE
8	c(inflow)	0.749	KNOWN VALUE FROM THE CONTRIBUTING BASIN(S)
9	c(outflow)	0.502	CALCULATED FROM $C=Q/IA$

CALCULATIONS For STO-2			
LINE	ITEM	AT THE OUTFLOW OF STO-2	REMARKS
1	P6 inch	3.3	KNOWN VALUE
2	TC (inflow) mins	6.51	KNOWN VALUE
3	TC (lag) mins	4	FROM THE OUTFLOW HYDROGRAPH
4	TC (ouflow) mins	10.51	LINE 2+3
5	I inches/hour	5.385	FROM THE INTENSITY FORMULA
6	Q(outflow)	1.38743	KNOWN VALUE
7	A (inflow=outflow)	1.1	KNOWN VALUE
8	c(inflow)	0.35	KNOWN VALUE FROM THE CONTRIBUTING BASIN(S)
9	c(outflow)	0.234	CALCULATED FROM $C=Q/IA$

The preceding highlighted data are then used to continue the calculations downstream of the detention structure.

In summary these are the steps of the calculations presented here:

1. Hydrologic methods of calculation as laid out in the 2003 San Diego Hydrology Manual was used upstream of the detention structure. These includes the methods of determining c, Tc and confluence of a junction. The c values used in the proposed conditions range from “undisturbed natural terrain” to “low & high density residential” whichever is appropriate for the contributing basin.
2. At the outflow of the detention structure, the c value was recalculated using the resulting values of the outflow hydrograph. This method preserves the values of $T_{c(\text{out of the detention structure})}$, A & $Q_{(\text{outflow})}$. Methods and software satisfy the formula $Q=cIA$ & the 2003 San Diego Hydrology Manual. This step shows that in order to maintain mathematical integrity of the rational equation ($Q=CIA$), the detention structure alters the runoff coefficient which is the only unknown in the equation.
3. The values determined in step 2 were used in the continuation of the calculations using the Hydrologic methods of calculation as laid out in the 2003 San Diego Hydrology Manual downstream of the detention structure. These includes the methods of determining c, Tc and confluence of a junction. The c values used in the proposed conditions range from “undisturbed natural terrain” to “low & high density residential” whichever is appropriate for the contributing basin.