Project Specific
Hydrology / Hydraulics Report

FOR:
PRELIMINARY GRADING FOR
CENTERPOINTE 78
990 North Broadway
Escondido, CA 92026

PREPARED FOR:
PACIFIC CHASSE PARTNERS, LLC
501 Santa Monica Blvd, Suite 312
Santa Monica, CA 90401

PREPARED BY:
EXCEL ENGINEERING
440 State Place
Escondido, CA 92029
Tel: (760) 745-8118
Engineer of Work
Project No: 12-005

DATE PREPARED:
April 3, 2013

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1.0 PROJECT DESCRIPTION AND PURPOSE

The purposes of this project are to develop a multi retail center improve the water quality and on-site drainage system, and to analyze the proposed facilities associated with this project to ensure that downstream or offsite properties will not be adversely affected by our project's proposed development. The improvements are: parking lots, buildings, and drainage facilities. Drainage facilities, such as the bio-retention basins, are utilized for water quality purposes. Please see Water Quality Report prepared by Excel Engineering, dated ___.

2.0 VICINITY MAP

The project site is located on North Broadway, in between Lincoln Avenue and Highway 78 in Escondido, San Diego County, CA. Please see Attachment A- Vicinity map.

3.0 SITE MAP

Please see Attachment B – Site map

4.0 DESCRIPTION OF WATERSHED

4.1 Existing Conditions Topography

The project site is an existing car lot, which consists of office buildings, car garages, retaining walls, asphalt parking lots, concrete gutters, and minimal vegetation. It's approximately 3.69 acres, bounded on the west by residential housing, north by Lincoln Avenue, North Broadway on the east, and an earthen swale and Highway 78 to the south. The site consists of parcels in a rectangular shape, located north of Highway 78, in the City of Escondido.

The existing conditions are divided into 6 separate tributary basins, which are labeled as Basin A, B, C, D, E, and F. Much of the storm water flows over the asphalt parking lots, collected in concrete gutters, and then routed to Lincoln Avenue. The southeast area of the existing site flows over land and into an existing curb inlet at the corner of North Broadway and Highway 78. The southwest and southern portions flow over land and into an existing brow ditch, located in between Highway 78 and the project site.

Land use in the surrounding areas is predominantly zoned for commercial development. The soil type in this area is predominantly type "D."
For more features of the site, please see Attachment D – Watershed Information Topographic Maps: Pre-Development Map.

4.2 Existing Conditions + Project Conditions Topography

For the purpose of hydrologic analysis, the project is divided into five large tributary basins designated as Basin A, B, C, D, and E. And 3 smaller tributary

basins designated as Basin B1, C1, and E1. The flow generated on basins A, B, and C will be directed to bio-retention facilities parallel to Lincoln Avenue. Flow from Basin D enters a bio-retention facility on the southern side of the project site. The discharge from these bio-retention facilities are routed to the northeast corner of the site, where it will connect to a proposed storm drain cleanout structure, which eventually ties into the existing storm drain system at the northwest corner of North Broadway and Lincoln Ave. The storm water from the loading dock and receiving area on the southwest corner of the project is Basin E and is directed to a flume shaped structure. Two, 60-inch Bio Clean Flume Filters will be installed within the flume shaped structure. Please see Attachment F for the Bio Clean Fume Filter details. Basin C1 storm water is routed to a bio-retention facility on the southeast corner of the site, where it eventually discharges onto North Broadway and to an existing catch basin on the corner of North Broadway and Highway 78. Both Basins B1 and E1 storm water flows overland and onto Lincoln Ave. Please see Attachment D – Watershed Information Topographic Maps: Post-Development Map.

4.3 Hydrologic Unit Contribution

The project is within the Carlsbad Hydrologic Unit (904), Escondido Creek HA (904.6), and Escondido HSA (904.62)
Impaired Receiving Water Bodies – Escondido Creek
303(d) Listed Pollutant / Stressor – DDT, Manganese, Phosphate, Selenium, Sulfates, and Total Dissolved Solid.

5.0 METHODOLOGY

This study complies with the 2003 San Diego Hydrology Manual and City of Escondido Design and Standard Drawing. The Rational Method, as presented in section 3, workbook examples, and Escondido C factor and T_C were utilized.

5.1 Hydrology Software

The "Rational Hydrology Method, San Diego County (2003 Manual)" module of the *CIVILCADD/CIVIL DESIGN* Engineering software version 7.4 is used in this study. This software was also used to develop hydrographs from the Rational Method results. This procedure also complies with the 2003 San Diego Hydrology Manual as presented in Section 6.

6.0 CALCULATIONS

6.1 Determine the Watersheds that affect the project

Please see the "Watershed Topographic Maps" for both the "Pre & Post Development" conditions in Attachment D.

6.2 Analyze 2 Year & 50 Year - 6 Hour Storm using Rational Method

Please see "Pre & Post Development Hydrologic 2 Year & 50 Year 6 Hour Storm Analysis" in Attachment E for the details & printouts of the calculation involved in determining the runoffs for both the 2 year & 50 year, 6 hour storm.

6.3 Analyze Q_2 and Q_{50} Year Storm using Hydrograph

In order for this project to comply with the City of Escondido Water Quality requirements as outlined in Drainage Design Standard, Section 1 through 5, the 2 & 50 years 6 hour storm is analyzed.

6.4 Analyses and Recapitulation

For the existing condition, much of the storm water flows north towards Lincoln Avenue. The remaining storm water flows south towards Highway 78 and the landscaping in between the project site and Highway 78. This assumption is considered per existing gutters, buildings, and topography. In the post development, there will be similar outfalls.

In the Post development condition mentioned above, there are five, large tributary areas labeled as Basin A, B, C, D and E. And three smaller tributary areas labeled as Basin B1, C1, and E1. Basin A (1.091 Acres) and Basin B (0.727 Acres) are directed to bio-retention facilities. Basin C (0.486 Acres) flows to a bio-retention facility on the southeast corner of the project site. Basin D (0.735 Acres) enters a bio-retention facility on the southern side of the project site and is routed north, where it connects with the drainage system that collects the discharge from the bio-retention facilities serving Basins A, B, and C. Eventually, the discharge from Basins A, B, C, and D enter the existing storm drain system on the northwest corner of North Broadway and Lincoln Ave. Basin E (0.36 Acres) flows to a concrete flume structure on the southwest corner of the project and discharges to an existing gutter, which is located in the landscaping between the project site and Highway 78. (Please see attachment E for Hydrology calculation using CivilD program.)

Existing Condition

As we can see from Table 1, the ultimate Q_2 and Q_{50} peak flows are 11.87cfs and 21.83 cfs, respectively. Existing condition is calculated as a whole area with 3.69 Acres in size.

Table 1. 2 Year and 50 Year Storm Event Peak flows

	Q (cfs)		Area (Acres)
	2 Year	50 Year	
Outfall A	2.07	3.82	1.686
Outfall B	2.08	3.83	0.634
Outfall C	4.56	8.52	0.656
Outfall D	1.49	2.69	0.319
Outfall E	1.62	2.88	0.342
Outfall F	0.05	0.09	0.05
Total	11.87	21.83	3.69

Post Development Condition

See Table 2 and 3 below for more detail calculations:

Table 2. 2 Year Storm and 50 Year Event Peak flows

	Q (cfs)		Area (Acres)
	2 Year	50 Year	
Outfall A	8.08	14.764	3.039
Outfall B	0.39	0.752	0.165
Outfall C	1.06	1.966	0.36
Outfall D	0.36	0.639	0.079
Outfall E	0.20	0.36	0.047
Total	10.09	18.48	3.69

Table 3. Runoff Recapitulation

	2 Year Storm		50 Year Storm	
	Pre	Post	Pre	Post
Q Peak runoff (cfs)	11.87	10.09	21.83	18.48

Table 3 shows that the peak flows of the 2 and 50 year storm of the Post-development are less than that of the Pre-Development.

7.0 SUMMARY

This Hydrology/Hydraulic report is prepared to evaluate the conditions of concern for the Centerpointe 78 Project. The site area is approximately 3.69 acres with the majority of the storm water flow going to Lincoln Avenue. On the south of the site there is an existing gutter surrounded by vegetation, which is where the remaining storm water flows to.

From the calculation, the peak flows of the 2 and 50 year storm of the Post-development are less than the Pre-Development peak flows.

As presented in this study, we have shown that this project will not increase storm runoff and thus not adversely affect the existing downstream storm drain facilities.

8.0 REFERENCES

Domingue Edward N., Design Standards and Standard Drawings; City of Escondido May 6, 2009

City of Escondido; Storm Water Management Requirements and Local Standard Urban Storm Water Mitigation Plan, November 13, 2002.

California Stormwater Quality Association; Stormwater Best Management Practice Handbook- New Development and Redevelopment, January 2003.

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

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 Murrieta 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: 12-005

_____ _____

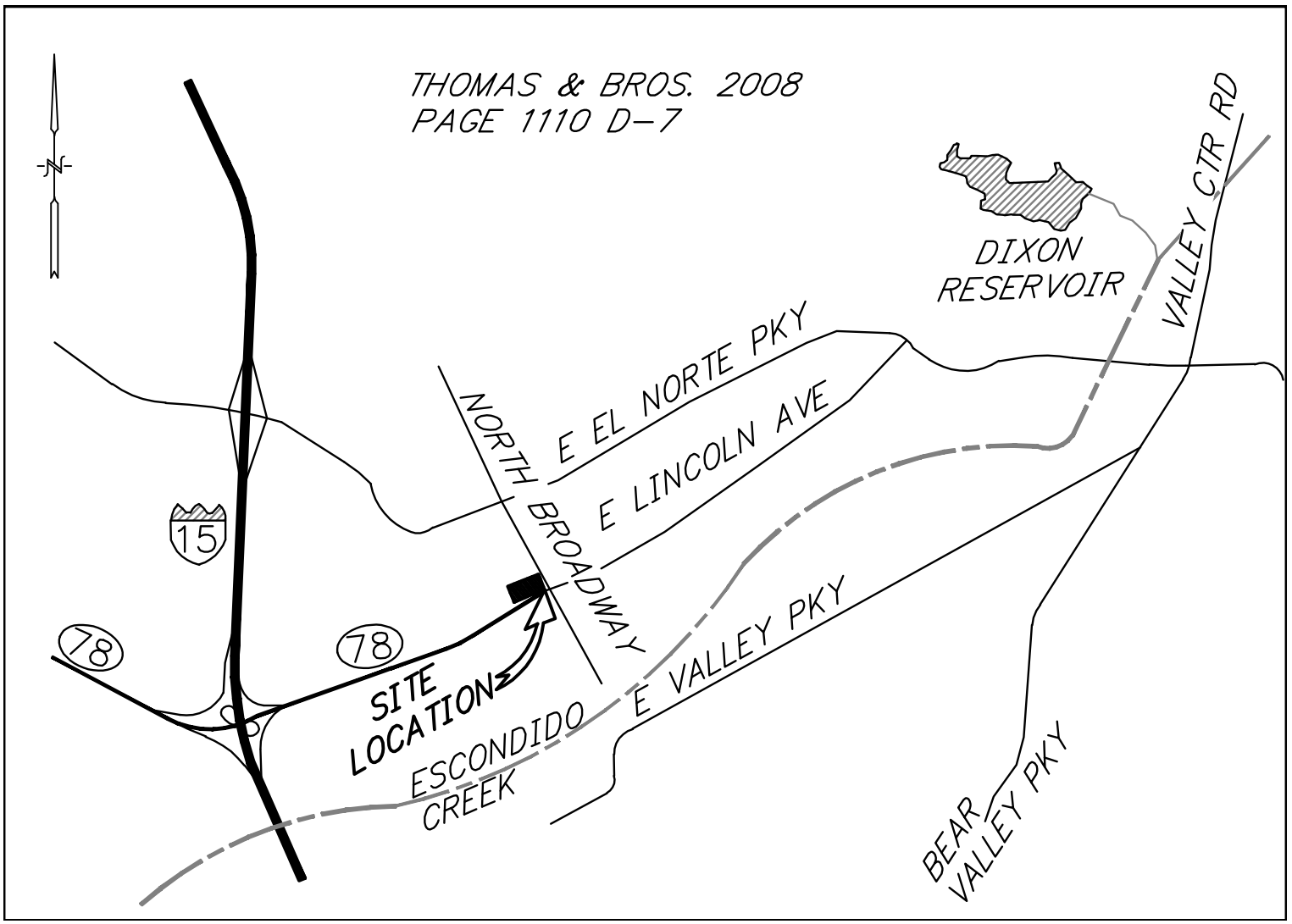
Robert D. Dentino, RCE 45629 Date
Registration Expire: December 31, 2014

ATTACHMENTS

VICINITY MAP

ATTACHMENT A

VICINITY MAP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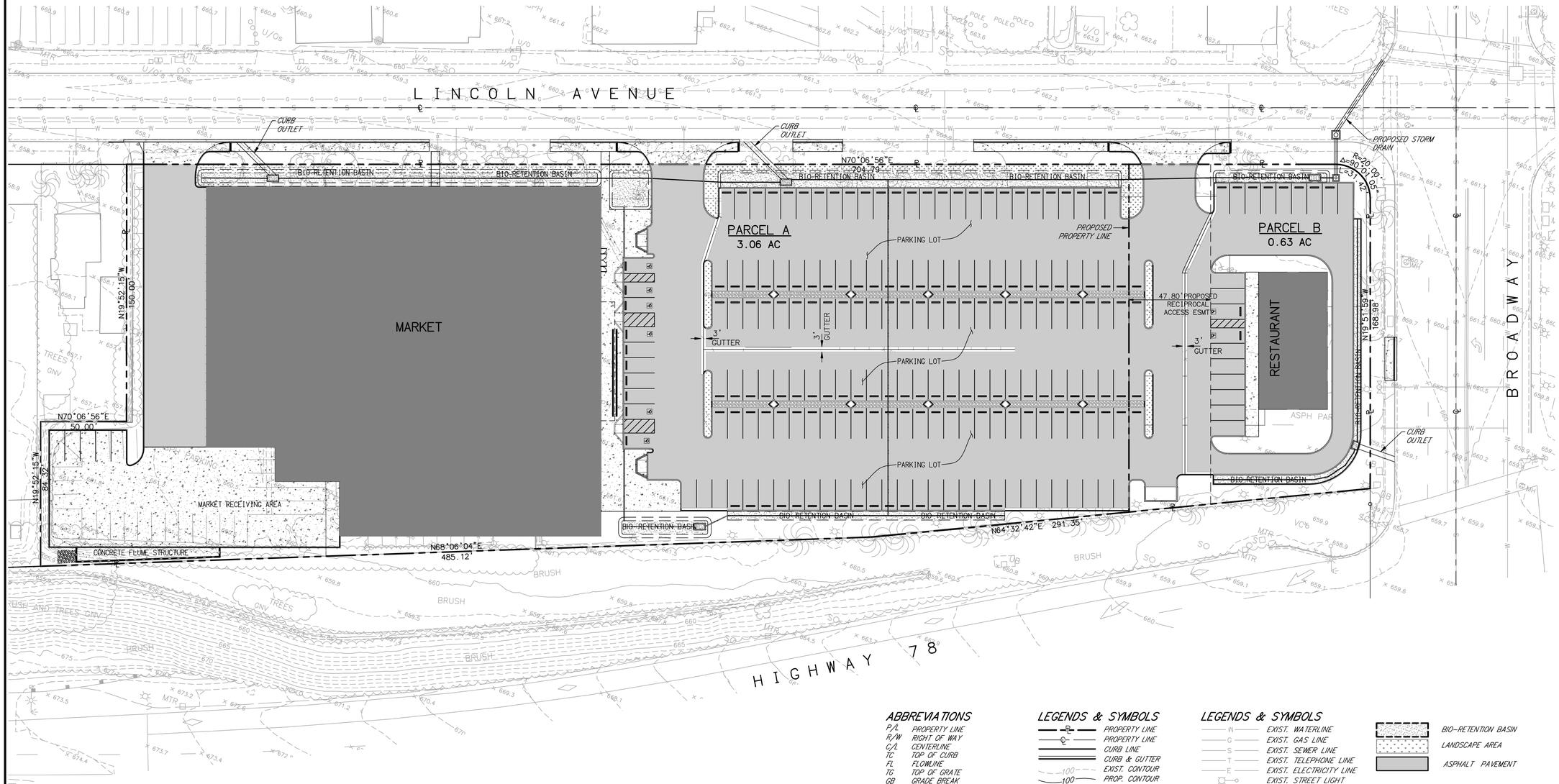
N
DIXON
RESERVOIR
VALLEY CTR RD
E EL NORTE PKY
E LINCOLN AVE
NORTH BROADWAY
15
78
78
SITE
LOCATION
ESCONDIDO
CREEK
E VALLEY PKY
BEAR
VALLEY PKY

ATTACHMENT B

SITE MAP

See 36”x24” map at the attached pocket

SITE MAP
990 NORTH BROADWAY
ESCONDIDO, CA



ABBREVIATIONS

P/L	PROPERTY LINE
R/W	RIGHT OF WAY
C/L	CENTERLINE
TC	TOP OF CURB
FL	FLOWLINE
TG	TOP OF GRATE
GB	GRADE BREAK
FG	FINISH GRADE
FS	FINISH SURFACE
HP	HIGH POINT
IE	INVERT OF DRAIN
PAD	PAD ELEVATION
FF	FINISH FLOOR
BVC	BEGIN VERTICLE CURVE
EVC	END VERTICLE CURVE
PI	POINT OF INTERSECTION
EP	EDGE OF PAVEMENT
TW	TOP OF WALL
TF	TOP OF FOOTING

LEGENDS & SYMBOLS

- PROPERTY LINE
- PROPERTY LINE
- CURB LINE
- CURB & GUTTER
- EXIST. CONTOUR
- PROP. CONTOUR
- TOP & TOE OF SLOPE
- DAYLIGHT LINE
- DIRECTION OF FLOW
- GRADE
- VEHICLE WHEEL STOP
- PARKING SPACE NUMBER
- STORMDRAIN PIPE

LEGENDS & SYMBOLS

- EXIST. WATERLINE
- EXIST. GAS LINE
- EXIST. SEWER LINE
- EXIST. TELEPHONE LINE
- EXIST. ELECTRICITY LINE
- EXIST. STREET LIGHT
- EXIST. FIRE HYDRANT
- WATER LINE
- GAS LINE
- SEWER LINE
- TELEPHONE LINE
- ELECTRICITY LINE
- PROP. FIRE HYDRANT
- WATER SERVICE
- SEWER SERVICE
- PROP. STREET LIGHT

- BIO-RETENTION BASIN
- LANDSCAPE AREA
- ASPHALT PAVEMENT

SCALE: 1"=30'

0 30 60 90 120

CENTERPOINTE 78
SITE MAP

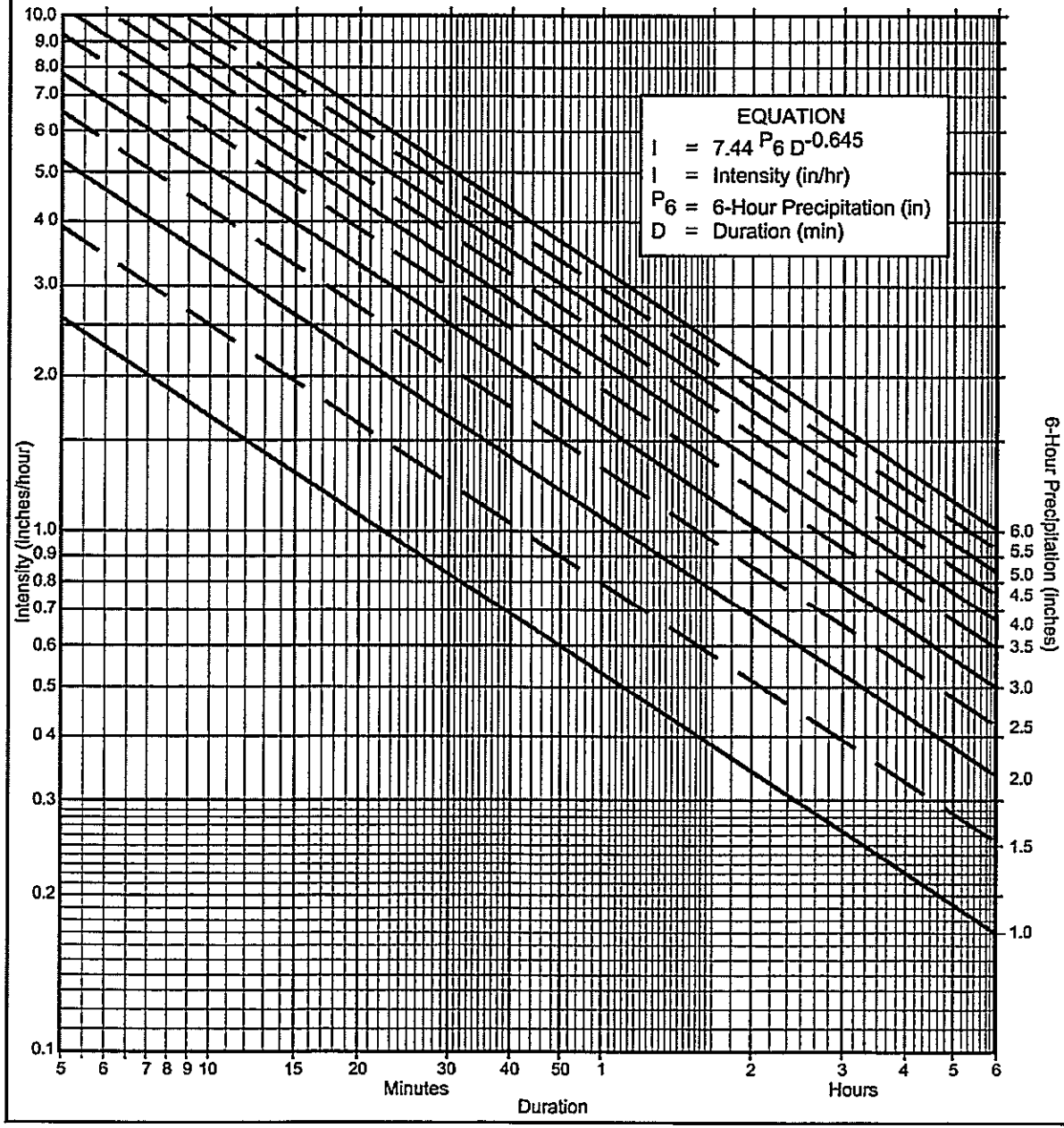
APN 229-121-08, 09, 10, 11, 12, 13, 14, 15

SITE ADDRESS: 990 NORTH BROADWAY
ESCONDIDO, CA 92026

ESCONDIDO
City of Choice

ATTACHMENT C

FIGURES & TABLES FROM SAN DIEGO COUNTY HYDROLOGY MANUAL



Directions for Application:

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

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

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

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

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

Application Form:

(a) Selected frequency _____ year

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

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

(d) t_x = _____ min.

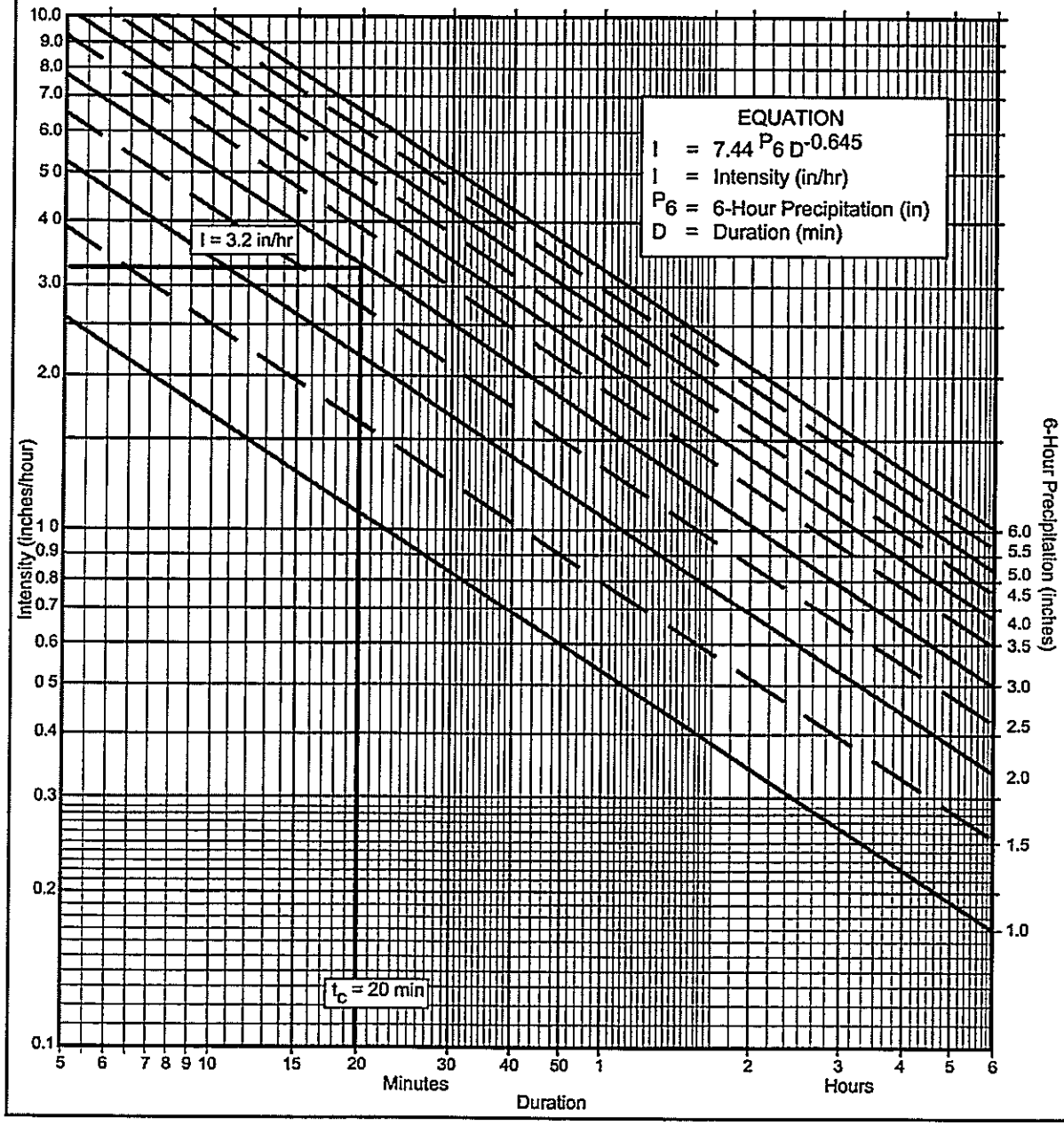
(e) I = _____ in./hr.

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	I	I	I	I	I	I	I	I	I	I	I
5	2.63	3.95	5.27	6.59	7.90	9.22	10 54	11.86	13.17	14.49	15.81
7	2.12	3.18	4.24	5.30	6.36	7.42	8.48	9.54	10.60	11.66	12.72
10	1.68	2.53	3.37	4.21	5.05	5 90	6 74	7.58	8 42	9.27	10.11
15	1.30	1.95	2 59	3.24	3 89	4.54	5.19	5.84	6.49	7.13	7.78
20	1 08	1.62	2.15	2.69	3.23	3.77	4.31	4.85	5 39	5.93	6.46
25	0.93	1.40	1 87	2 33	2.80	3.27	3.73	4.20	4.67	5.13	5.60
30	0 83	1.24	1.66	2 07	2.49	2.90	3.32	3.73	4.15	4.56	4.98
40	0 69	1.03	1.38	1.72	2.07	2.41	2.76	3 10	3.45	3.79	4.13
50	0 60	0.90	1.19	1 49	1.79	2.09	2.39	2.69	2.98	3.28	3 58
60	0.53	0.80	1.06	1 33	1.59	1.86	2.12	2.39	2.65	2.92	3.18
90	0.41	0.61	0 82	1.02	1.23	1.43	1.63	1.84	2.04	2.25	2.45
120	0 34	0.51	0.68	0 85	1.02	1.19	1.36	1.53	1.70	1.87	2.04
150	0.29	0.44	0.59	0.73	0.88	1.03	1.18	1.32	1.47	1.62	1.76
180	0.26	0.39	0.52	0.65	0.78	0.91	1.04	1.18	1.31	1.44	1.57
240	0.22	0.33	0.43	0.54	0.65	0.76	0 87	0 98	1.08	1.19	1.30
300	0.19	0.28	0.38	0 47	0.56	0.66	0.75	0.85	0 94	1.03	1.13
360	0.17	0.25	0 33	0.42	0.50	0.58	0.67	0.75	0.84	0.92	1.00

Intensity-Duration Design Chart - Template

FIGURE 3-1



Directions for Application:

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

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

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

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

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

Application Form:

(a) Selected frequency 50 year

(b) P_6 = 3 in., P_{24} = 5.5, $\frac{P_6}{P_{24}}$ = 54.5 %(2)

(c) Adjusted P_6(2) = 3 in.

(d) t_x = 20 min.

(e) I = 3.2 in./hr.

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

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

Intensity-Duration Design Chart - Example

FIGURE 3-2

Table 3-1
RUNOFF COEFFICIENTS FOR URBAN AREAS

Land Use		Runoff Coefficient "C"				
			Soil Type			
NRCS Elements	County Elements	% IMPER.	A	B	C	D
Undisturbed Natural Terrain (Natural)	Permanent Open Space	0*	0.20	0.25	0.30	0.35
Low Density Residential (LDR)	Residential, 1.0 DU/A or less	10	0.27	0.32	0.36	0.41
Low Density Residential (LDR)	Residential, 2.0 DU/A or less	20	0.34	0.38	0.42	0.46
Low Density Residential (LDR)	Residential, 2.9 DU/A or less	25	0.38	0.41	0.45	0.49
Medium Density Residential (MDR)	Residential, 4.3 DU/A or less	30	0.41	0.45	0.48	0.52
Medium Density Residential (MDR)	Residential, 7.3 DU/A or less	40	0.48	0.51	0.54	0.57
Medium Density Residential (MDR)	Residential, 10.9 DU/A or less	45	0.52	0.54	0.57	0.60
Medium Density Residential (MDR)	Residential, 14.5 DU/A or less	50	0 55	0.58	0.60	0.63
High Density Residential (HDR)	Residential, 24.0 DU/A or less	65	0.66	0.67	0.69	0.71
High Density Residential (HDR)	Residential, 43.0 DU/A or less	80	0.76	0.77	0.78	0.79
Commercial/Industrial (N. Com)	Neighborhood Commercial	80	0.76	0.77	0.78	0.79
Commercial/Industrial (G. Com)	General Commercial	85	0.80	0.80	0.81	0.82
Commercial/Industrial (O.P. Com)	Office Professional/Commercial	90	0.83	0.84	0.84	0.85
Commercial/Industrial (Limited I.)	Limited Industrial	90	0.83	0.84	0.84	0.85
Commercial/Industrial (General I.)	General Industrial	95	0.87	0.87	0.87	0.87

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

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.

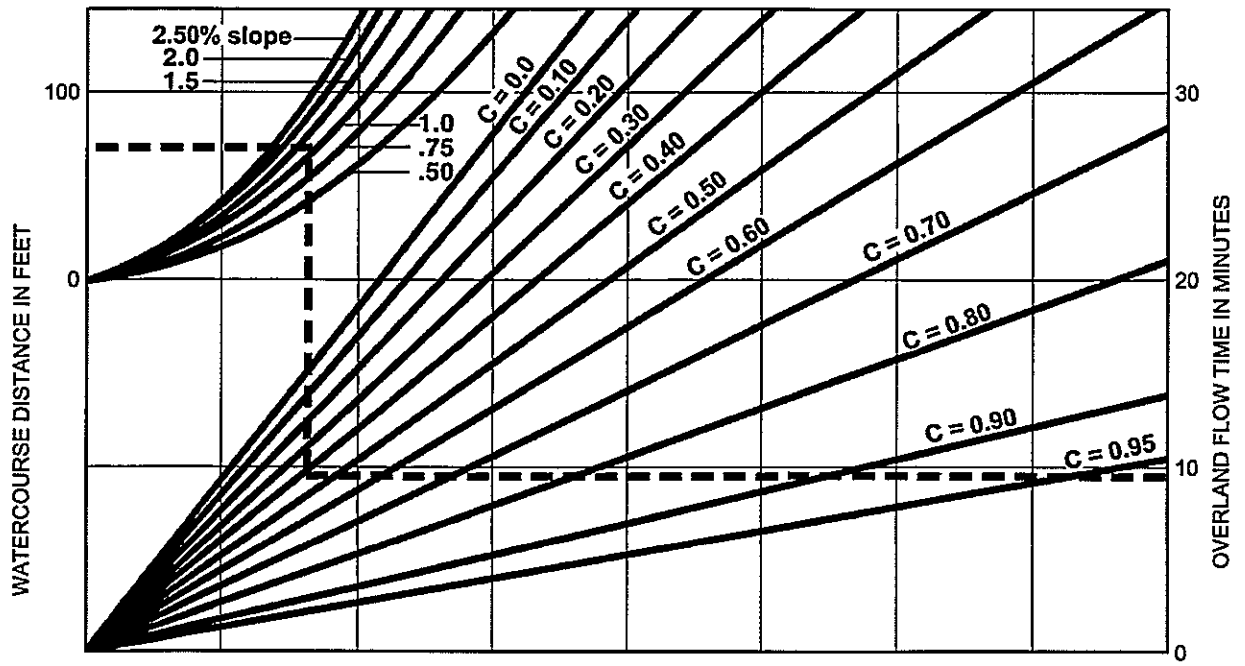
Table 3-2 provides limits of the length (Maximum Length (L_M)) of sheet flow to be used in hydrology studies. Initial T_i values based on average C values for the Land Use Element are also included. These values can be used in planning and design applications as described below. Exceptions may be approved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



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

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

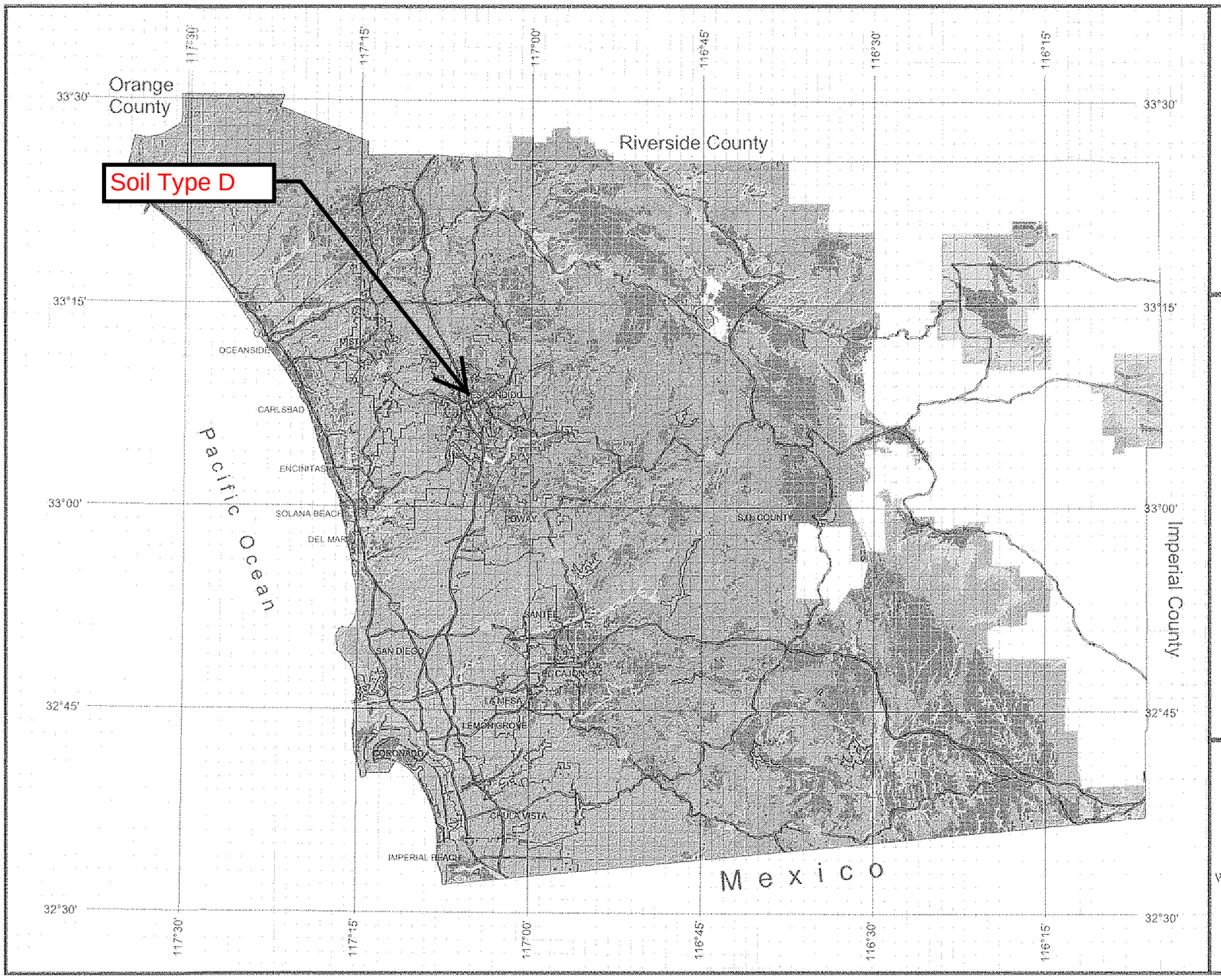
SOURCE: Airport Drainage, Federal Aviation Administration, 1965

FIGURE 3-3

Rational Formula - Overland Time of Flow Nomograph

County of San Diego Hydrology Manual

Soil Hydrologic Groups



Legend

Soil Groups

- Group A
- Group B
- Group C
- Group D
- Undetermined
- Data Unavailable

DPW GIS

SanGIS

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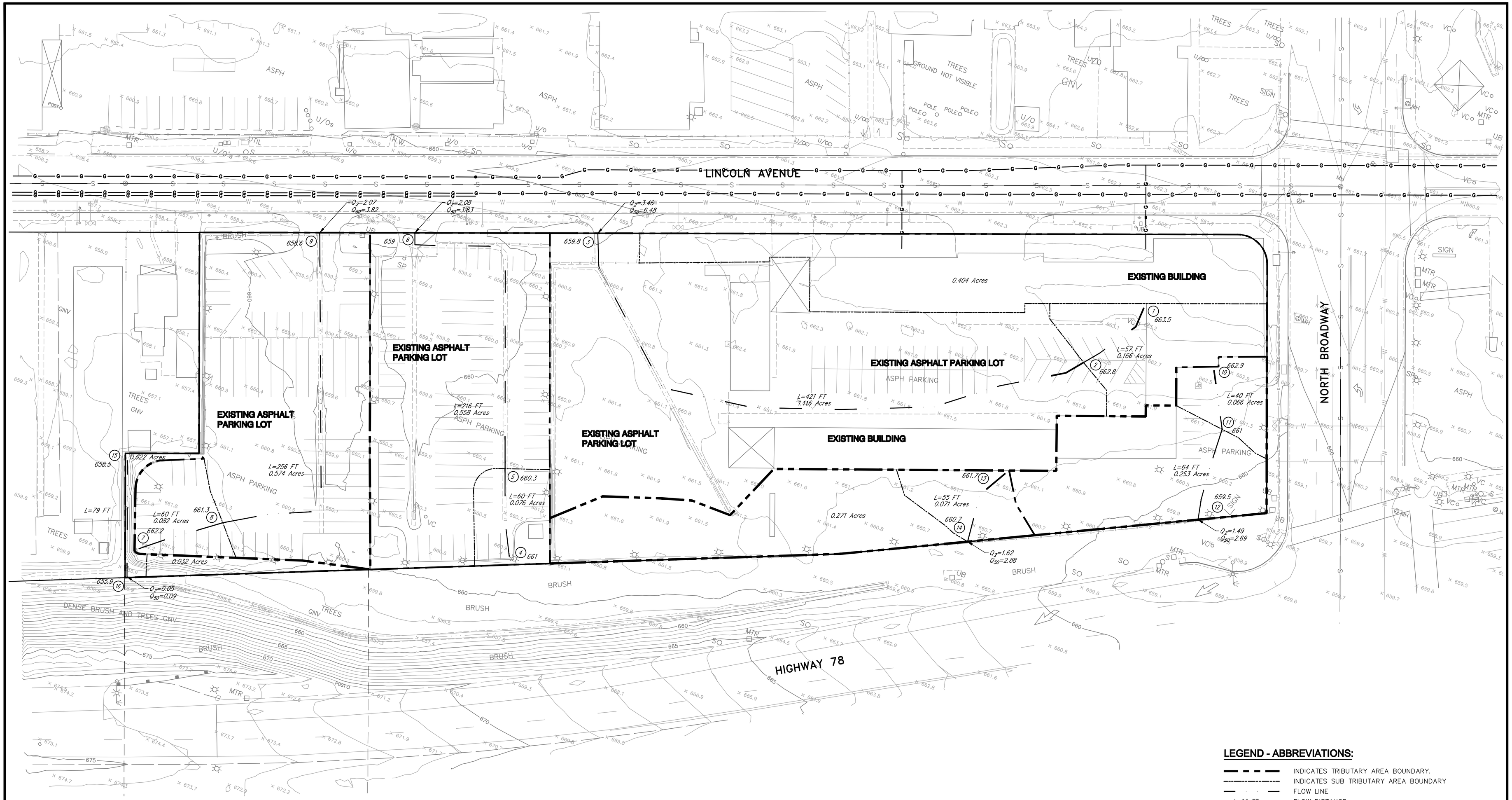
N W E S

3 0 3 Miles

ATTACHMENT D
WATERSHED INFORMATION

Topographic Maps



LEGEND - ABBREVIATIONS:

— — —	INDICATES TRIBUTARY AREA BOUNDARY.
-----------	INDICATES SUB TRIBUTARY AREA BOUNDARY
— · · —	FLOW LINE
L=66 FT	FLOW DISTANCE

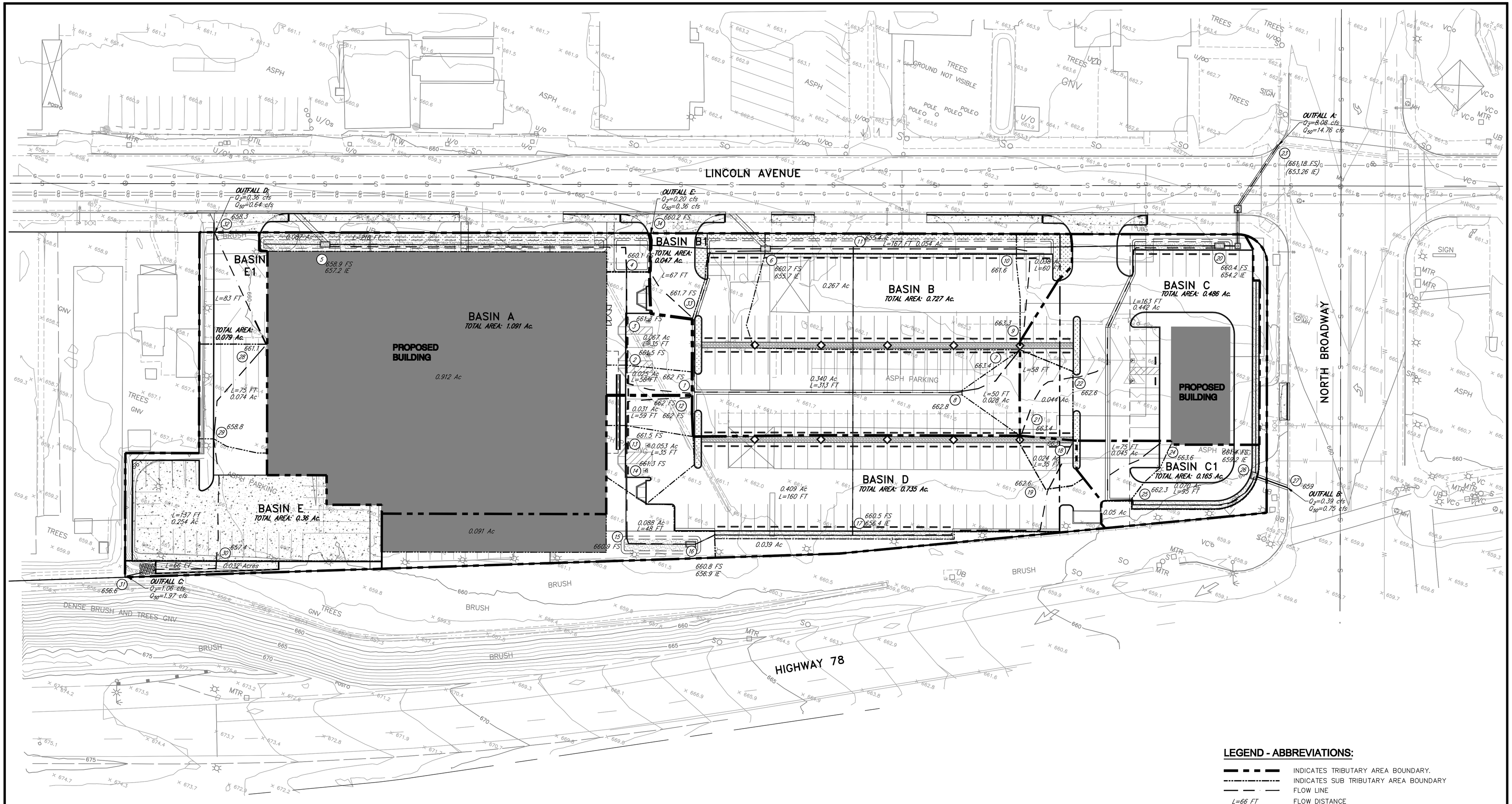
SCALE: 1"=30'

0 30 60 90 120

GATEWAY CENTER
HYDROLOGY PRE-DEVELOPMENT MAP

APN 229-121-08, 09, 10, 11, 12, 13, 14, 15

SITE ADDRESS: 990 NORTH BROADWAY
ESCONDIDO, CA 92026



LEGEND - ABBREVIATIONS:

— — —	INDICATES TRIBUTARY AREA BOUNDARY.
·-·-·-·-·	INDICATES SUB TRIBUTARY AREA BOUNDARY
— — · — —	FLOW LINE
L=66 FT	FLOW DISTANCE
1.234 Ac	SUB BASIN AREA (ACRES)
660.7 (14)	NODE AND ELEVATION

CENTERPOINTE 78
HYDROLOGY POST-DEVELOPMENT MAP

APN 229-121-08, 09, 10, 11, 12, 13, 14, 15

SITE ADDRESS: 990 NORTH BROADWAY
ESCONDIDO, CA 92026

ESCONDIDO
City of Choice

ATTACHMENT E

PRE/POST DEVELOPMENT HYDROLOGIC
2 YEAR & 50 YEAR 6 HR STORM ANALYSES

PRE-DEVELOPMENT

San Diego County Rational Hydrology Program

CIVILCADD/CIVILDESIGN Engineering Software,(c)1991-2004 Version 7.4

Rational method hydrology program based on
San Diego County Flood Control Division 2003 hydrology manual
Rational Hydrology Study Date: 02/25/13

********* Hydrology Study Control Information **********
BASIN A - OUTFALL A

Program License Serial Number 4012

Rational hydrology study storm event year is 2.0
English (in-lb) input data Units used

Map data precipitation entered:
6 hour, precipitation(inches) = 1.550
24 hour precipitation(inches) = 2.400
P6/P24 = 64.6%
San Diego hydrology manual 'C' values used

++
Process from Point/Station 1.000 to Point/Station 2.000
**** 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
[COMMERCIAL area type]
(Office Professional)
Impervious value, Ai = 0.900
Sub-Area C Value = 0.850
Initial subarea total flow distance = 57.000(Ft.)
Highest elevation = 663.500(Ft.)
Lowest elevation = 662.800(Ft.)
Elevation difference = 0.700(Ft.) Slope = 1.228 %
INITIAL AREA TIME OF CONCENTRATION CALCULATIONS:
The maximum overland flow distance is 60.00 (Ft)
for the top area slope value of 1.23 %, in a development type of
Office Professional
In Accordance With Figure 3-3
Initial Area Time of Concentration = 3.26 minutes
TC = [1.8*(1.1-C)*distance(Ft.)^.5)/(% slope^(1/3)]
TC = [1.8*(1.1-0.8500)*(60.000^.5)/(1.228^(1/3)]= 3.26
Rainfall intensity (I) = 5.386(In/Hr) for a 2.0 year storm
Effective runoff coefficient used for area (Q=KCIA) is C = 0.850
Subarea runoff = 0.760(CFS)
Total initial stream area = 0.166(Ac.)

++
Process from Point/Station 2.000 to Point/Station 3.000
**** IRREGULAR CHANNEL FLOW TRAVEL TIME ****

Estimated mean flow rate at midpoint of channel = 2.161(CFS)
Depth of flow = 0.141(Ft.), Average velocity = 1.704(Ft/s)
******* Irregular Channel Data ***********

Information entered for subchannel number 1 :

Point number	'X' coordinate	'Y' coordinate
1	0.00	0.60
2	40.00	0.00
3	70.00	0.50

San Diego County Rational Hydrology Program

CIVILCADD/CIVILDESIGN Engineering Software,(c)1991-2004 Version 7.4

Rational method hydrology program based on
San Diego County Flood Control Division 2003 hydrology manual
Rational Hydrology Study Date: 02/25/13

********* Hydrology Study Control Information **********
BASIN A - OUTFALL A

Program License Serial Number 4012

Rational hydrology study storm event year is 50.0
English (in-lb) input data Units used

Map data precipitation entered:
6 hour, precipitation(inches) = 2.750
24 hour precipitation(inches) = 5.750
P6/P24 = 47.8%
San Diego hydrology manual 'C' values used

++
Process from Point/Station 1.000 to Point/Station 2.000
**** 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
[COMMERCIAL area type]
(Office Professional)
Impervious value, Ai = 0.900
Sub-Area C Value = 0.850
Initial subarea total flow distance = 57.000(Ft.)
Highest elevation = 663.500(Ft.)
Lowest elevation = 662.800(Ft.)
Elevation difference = 0.700(Ft.) Slope = 1.228 %
INITIAL AREA TIME OF CONCENTRATION CALCULATIONS:
The maximum overland flow distance is 60.00 (Ft)
for the top area slope value of 1.23 %, in a development type of
Office Professional
In Accordance With Figure 3-3
Initial Area Time of Concentration = 3.26 minutes
TC = [1.8*(1.1-C)*distance(Ft.)^.5)/(% slope^(1/3)]
TC = [1.8*(1.1-0.8500)*(60.000^.5)/(1.228^(1/3)]= 3.26
Rainfall intensity (I) = 9.557(In/Hr) for a 50.0 year storm
Effective runoff coefficient used for area (Q=KCIA) is C = 0.850
Subarea runoff = 1.348(CFS)
Total initial stream area = 0.166(Ac.)

++
Process from Point/Station 2.000 to Point/Station 3.000
**** IRREGULAR CHANNEL FLOW TRAVEL TIME ****

Estimated mean flow rate at midpoint of channel = 3.955(CFS)
Depth of flow = 0.177(Ft.), Average velocity = 1.983(Ft/s)
******* Irregular Channel Data ***********

Information entered for subchannel number 1 :

Point number	'X' coordinate	'Y' coordinate
1	0.00	0.60
2	40.00	0.00
3	70.00	0.50

```
Manning's 'N' friction factor =   0.013
-----------------------------------------------------------------
Sub-Channel flow  =      3.955(CFS)
  '     '       flow top width =     22.481(Ft.)
  '     '    velocity=    1.983(Ft/s)
  '     '       area =      1.995(Sq.Ft)
  '     '       Froude number =     1.173

Upstream point elevation =   662.800(Ft.)
Downstream point elevation =   659.600(Ft.)
Flow length =   421.000(Ft.)
Travel time  =    3.54 min.
Time of concentration =    6.79 min.
Depth of flow =   0.177(Ft.)
Average velocity =   1.983(Ft/s)
Total irregular channel flow =     3.955(CFS)
Irregular channel normal depth above invert elev. =   0.177(Ft.)
Average velocity of channel(s) =   1.983(Ft/s)
 Adding area flow to channel
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
[COMMERCIAL area type                        ]
(Office Professional    )
Impervious value, Ai = 0.900
Sub-Area C Value = 0.850
Rainfall intensity =      5.945(In/Hr) for a    50.0 year storm
Effective runoff coefficient used for total area
(Q=KCIA) is C = 0.850  CA =      1.090
Subarea runoff =      5.130(CFS) for      1.116(Ac.)
Total runoff =      6.479(CFS)       Total area =       1.282(Ac.)
Depth of flow =   0.214(Ft.), Average velocity =   2.243(Ft/s)


++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++
Process from Point/Station        3.000 to Point/Station        3.000
**** SUBAREA FLOW ADDITION ****
_________________________________________________________________________
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
[COMMERCIAL area type                        ]
(Office Professional    )
Impervious value, Ai = 0.900
Sub-Area C Value = 0.850
Time of concentration =     6.79 min.
Rainfall intensity =      5.945(In/Hr) for a    50.0 year storm
Effective runoff coefficient used for total area
(Q=KCIA) is C = 0.850  CA =      1.433
Subarea runoff =      2.042(CFS) for      0.404(Ac.)
Total runoff =      8.520(CFS)       Total area =       1.686(Ac.)
End of computations, total study area =           1.686 (Ac.)
```

```
Manning's 'N' friction factor =   0.013
-----------------------------------------------------------------
Sub-Channel flow  =      2.161(CFS)
  '     '       flow top width =     17.920(Ft.)
  '     '    velocity=    1.704(Ft/s)
  '     '       area =      1.268(Sq.Ft)
  '     '       Froude number =     1.129

Upstream point elevation =   662.800(Ft.)
Downstream point elevation =   659.600(Ft.)
Flow length =   421.000(Ft.)
Travel time  =    4.12 min.
Time of concentration =    7.37 min.
Depth of flow =   0.141(Ft.)
Average velocity =   1.704(Ft/s)
Total irregular channel flow =     2.161(CFS)
Irregular channel normal depth above invert elev. =   0.141(Ft.)
Average velocity of channel(s) =   1.704(Ft/s)
 Adding area flow to channel
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
[COMMERCIAL area type                        ]
(Office Professional    )
Impervious value, Ai = 0.900
Sub-Area C Value = 0.850
Rainfall intensity =      3.179(In/Hr) for a     2.0 year storm
Effective runoff coefficient used for total area
(Q=KCIA) is C = 0.850  CA =      1.090
Subarea runoff =      2.704(CFS) for      1.116(Ac.)
Total runoff =      3.464(CFS)       Total area =       1.282(Ac.)
Depth of flow =   0.169(Ft.), Average velocity =   1.918(Ft/s)


++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++
Process from Point/Station        3.000 to Point/Station        3.000
**** SUBAREA FLOW ADDITION ****
_________________________________________________________________________
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
[COMMERCIAL area type                        ]
(Office Professional    )
Impervious value, Ai = 0.900
Sub-Area C Value = 0.850
Time of concentration =     7.37 min.
Rainfall intensity =      3.179(In/Hr) for a     2.0 year storm
Effective runoff coefficient used for total area
(Q=KCIA) is C = 0.850  CA =      1.433
Subarea runoff =      1.092(CFS) for      0.404(Ac.)
Total runoff =      4.556(CFS)       Total area =       1.686(Ac.)
End of computations, total study area =           1.686 (Ac.)
```

San Diego County Rational Hydrology Program

CIVILCADD/CIVILDESIGN Engineering Software,(c)1991-2004 Version 7.4

Rational method hydrology program based on
San Diego County Flood Control Division 2003 hydrology manual
Rational Hydrology Study Date: 02/20/13

********* Hydrology Study Control Information **********
BASIN B - OUTFALL B

Program License Serial Number 4012

Rational hydrology study storm event year is 2.0
English (in-lb) input data Units used

Map data precipitation entered:
6 hour, precipitation(inches) = 1.550
24 hour precipitation(inches) = 2.400
P6/P24 = 64.6%
San Diego hydrology manual 'C' values used

++
Process from Point/Station 4.000 to Point/Station 5.000
**** 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
[COMMERCIAL area type]
(Office Professional)
Impervious value, Ai = 0.900
Sub-Area C Value = 0.850
Initial subarea total flow distance = 60.000(Ft.)
Highest elevation = 661.000(Ft.)
Lowest elevation = 660.300(Ft.)
Elevation difference = 0.700(Ft.) Slope = 1.167 %
INITIAL AREA TIME OF CONCENTRATION CALCULATIONS:
The maximum overland flow distance is 60.00 (Ft)
for the top area slope value of 1.17 %, in a development type of
Office Professional
In Accordance With Figure 3-3
Initial Area Time of Concentration = 3.31 minutes
TC = [1.8*(1.1-C)*distance(Ft.)^.5)/(% slope^(1/3)]
TC = [1.8*(1.1-0.8500)*(60.000^.5)/(1.167^(1/3)]= 3.31
Rainfall intensity (I) = 5.328(In/Hr) for a 2.0 year storm
Effective runoff coefficient used for area (Q=KCIA) is C = 0.850
Subarea runoff = 0.344(CFS)
Total initial stream area = 0.076(Ac.)

++
Process from Point/Station 5.000 to Point/Station 6.000
**** IRREGULAR CHANNEL FLOW TRAVEL TIME ****

Estimated mean flow rate at midpoint of channel = 1.241(CFS)
Depth of flow = 0.165(Ft.), Average velocity = 1.682(Ft/s)
******* Irregular Channel Data ***********

Information entered for subchannel number 1 :

Point number	'X' coordinate	'Y' coordinate
1	0.00	0.40
2	12.00	0.00
3	24.00	0.50

```
Manning's 'N' friction factor =   0.013
-----------------------------------------------------------------
Sub-Channel flow  =      1.241(CFS)
  '     '       flow top width =      8.928(Ft.)
  '     '    velocity=    1.682(Ft/s)
  '     '       area =      0.738(Sq.Ft)
  '     '       Froude number =     1.031

Upstream point elevation =   660.300(Ft.)
Downstream point elevation =   659.000(Ft.)
Flow length =   216.000(Ft.)
Travel time  =    2.14 min.
Time of concentration =    5.45 min.
Depth of flow =   0.165(Ft.)
Average velocity =   1.682(Ft/s)
Total irregular channel flow =     1.241(CFS)
Irregular channel normal depth above invert elev. =   0.165(Ft.)
Average velocity of channel(s) =   1.682(Ft/s)
 Adding area flow to channel
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
[COMMERCIAL area type                        ]
(Office Professional    )
Impervious value, Ai = 0.900
Sub-Area C Value = 0.850
Rainfall intensity =      3.863(In/Hr) for a     2.0 year storm
Effective runoff coefficient used for total area
(Q=KCIA) is C = 0.850  CA =      0.539
Subarea runoff =      1.737(CFS) for      0.558(Ac.)
Total runoff =      2.082(CFS)       Total area =       0.634(Ac.)
Depth of flow =   0.201(Ft.), Average velocity =   1.914(Ft/s)
End of computations, total study area =           0.634 (Ac.)
```

San Diego County Rational Hydrology Program

CIVILCADD/CIVILDESIGN Engineering Software,(c)1991-2004 Version 7.4

Rational method hydrology program based on
San Diego County Flood Control Division 2003 hydrology manual
Rational Hydrology Study Date: 02/20/13

********* Hydrology Study Control Information **********
BASIN B - OUTFALL B

Program License Serial Number 4012

Rational hydrology study storm event year is 50.0
English (in-lb) input data Units used

Map data precipitation entered:
6 hour, precipitation(inches) = 2.750
24 hour precipitation(inches) = 5.750
P6/P24 = 47.8%
San Diego hydrology manual 'C' values used

++
Process from Point/Station 4.000 to Point/Station 5.000
**** 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
[COMMERCIAL area type]
(Office Professional)
Impervious value, Ai = 0.900
Sub-Area C Value = 0.850
Initial subarea total flow distance = 60.000(Ft.)
Highest elevation = 661.000(Ft.)
Lowest elevation = 660.300(Ft.)
Elevation difference = 0.700(Ft.) Slope = 1.167 %
INITIAL AREA TIME OF CONCENTRATION CALCULATIONS:
The maximum overland flow distance is 60.00 (Ft)
for the top area slope value of 1.17 %, in a development type of
Office Professional
In Accordance With Figure 3-3
Initial Area Time of Concentration = 3.31 minutes
TC = [1.8*(1.1-C)*distance(Ft.)^.5)/(% slope^(1/3)]
TC = [1.8*(1.1-0.8500)*(60.000^.5)/(1.167^(1/3)]= 3.31
Rainfall intensity (I) = 9.453(In/Hr) for a 50.0 year storm
Effective runoff coefficient used for area (Q=KCIA) is C = 0.850
Subarea runoff = 0.611(CFS)
Total initial stream area = 0.076(Ac.)

++
Process from Point/Station 5.000 to Point/Station 6.000
**** IRREGULAR CHANNEL FLOW TRAVEL TIME ****

Estimated mean flow rate at midpoint of channel = 2.265(CFS)
Depth of flow = 0.207(Ft.), Average velocity = 1.955(Ft/s)
******* Irregular Channel Data ***********

Information entered for subchannel number 1 :

Point number	'X' coordinate	'Y' coordinate
1	0.00	0.40
2	12.00	0.00
3	24.00	0.50

```
Manning's 'N' friction factor =   0.013
-----------------------------------------------------------------
Sub-Channel flow  =      2.265(CFS)
  '     '       flow top width =     11.187(Ft.)
  '     '    velocity=    1.955(Ft/s)
  '     '       area =      1.159(Sq.Ft)
  '     '       Froude number =     1.070

Upstream point elevation =   660.300(Ft.)
Downstream point elevation =   659.000(Ft.)
Flow length =   216.000(Ft.)
Travel time  =    1.84 min.
Time of concentration =    5.15 min.
Depth of flow =   0.207(Ft.)
Average velocity =   1.955(Ft/s)
Total irregular channel flow =     2.265(CFS)
Irregular channel normal depth above invert elev. =   0.207(Ft.)
Average velocity of channel(s) =   1.955(Ft/s)
 Adding area flow to channel
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
[COMMERCIAL area type                        ]
(Office Professional    )
Impervious value, Ai = 0.900
Sub-Area C Value = 0.850
Rainfall intensity =      7.107(In/Hr) for a    50.0 year storm
Effective runoff coefficient used for total area
(Q=KCIA) is C = 0.850  CA =      0.539
Subarea runoff =      3.219(CFS) for      0.558(Ac.)
Total runoff =      3.830(CFS)       Total area =       0.634(Ac.)
Depth of flow =   0.252(Ft.), Average velocity =   2.229(Ft/s)
End of computations, total study area =           0.634 (Ac.)
```

San Diego County Rational Hydrology Program

CIVILCADD/CIVILDESIGN Engineering Software,(c)1991-2004 Version 7.4

Rational method hydrology program based on
San Diego County Flood Control Division 2003 hydrology manual
Rational Hydrology Study Date: 02/20/13

********* Hydrology Study Control Information **********
BASIN C - OUTFALL C

Program License Serial Number 4012

Rational hydrology study storm event year is 2.0
English (in-lb) input data Units used

Map data precipitation entered:
6 hour, precipitation(inches) = 1.550
24 hour precipitation(inches) = 2.400
P6/P24 = 64.6%
San Diego hydrology manual 'C' values used

++
Process from Point/Station 7.000 to Point/Station 8.000
**** 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
[COMMERCIAL area type]
(Office Professional)
Impervious value, Ai = 0.900
Sub-Area C Value = 0.850
Initial subarea total flow distance = 60.000(Ft.)
Highest elevation = 662.200(Ft.)
Lowest elevation = 661.300(Ft.)
Elevation difference = 0.900(Ft.) Slope = 1.500 %
INITIAL AREA TIME OF CONCENTRATION CALCULATIONS:
The maximum overland flow distance is 70.00 (Ft)
for the top area slope value of 1.50 %, in a development type of
Office Professional
In Accordance With Figure 3-3
Initial Area Time of Concentration = 3.29 minutes
TC = [1.8*(1.1-C)*distance(Ft.)^.5)/(% slope^(1/3)]
TC = [1.8*(1.1-0.8500)*(70.000^.5)/(1.500^(1/3)]= 3.29
Rainfall intensity (I) = 5.351(In/Hr) for a 2.0 year storm
Effective runoff coefficient used for area (Q=KCIA) is C = 0.850
Subarea runoff = 0.373(CFS)
Total initial stream area = 0.082(Ac.)

++
Process from Point/Station 8.000 to Point/Station 9.000
**** IRREGULAR CHANNEL FLOW TRAVEL TIME ****

Estimated mean flow rate at midpoint of channel = 1.255(CFS)
Depth of flow = 0.111(Ft.), Average velocity = 1.705(Ft/s)
******* Irregular Channel Data ***********

Information entered for subchannel number 1 :

Point number	'X' coordinate	'Y' coordinate
1	0.00	0.50
2	30.00	0.00
3	60.00	0.50

```
Manning's 'N' friction factor =   0.013
-----------------------------------------------------------------
Sub-Channel flow  =      1.255(CFS)
  '     '       flow top width =     13.292(Ft.)
  '     '    velocity=    1.705(Ft/s)
  '     '       area =      0.736(Sq.Ft)
  '     '       Froude number =     1.277

Upstream point elevation =   661.300(Ft.)
Downstream point elevation =   658.600(Ft.)
Flow length =   256.000(Ft.)
Travel time  =    2.50 min.
Time of concentration =    5.79 min.
Depth of flow =   0.111(Ft.)
Average velocity =   1.705(Ft/s)
Total irregular channel flow =     1.255(CFS)
Irregular channel normal depth above invert elev. =   0.111(Ft.)
Average velocity of channel(s) =   1.705(Ft/s)
 Adding area flow to channel
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
[COMMERCIAL area type                        ]
(Office Professional    )
Impervious value, Ai = 0.900
Sub-Area C Value = 0.850
Rainfall intensity =      3.715(In/Hr) for a     2.0 year storm
Effective runoff coefficient used for total area
(Q=KCIA) is C = 0.850  CA =      0.558
Subarea runoff =      1.698(CFS) for      0.574(Ac.)
Total runoff =      2.071(CFS)       Total area =       0.656(Ac.)
Depth of flow =   0.134(Ft.), Average velocity =   1.933(Ft/s)
End of computations, total study area =           0.656 (Ac.)
```

San Diego County Rational Hydrology Program

CIVILCADD/CIVILDESIGN Engineering Software,(c)1991-2004 Version 7.4

Rational method hydrology program based on
San Diego County Flood Control Division 2003 hydrology manual
Rational Hydrology Study Date: 02/20/13

********* Hydrology Study Control Information **********
BASIN C - OUTFALL C

Program License Serial Number 4012

Rational hydrology study storm event year is 50.0
English (in-lb) input data Units used

Map data precipitation entered:
6 hour, precipitation(inches) = 2.750
24 hour precipitation(inches) = 5.750
P6/P24 = 47.8%
San Diego hydrology manual 'C' values used

++
Process from Point/Station 7.000 to Point/Station 8.000
**** 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
[COMMERCIAL area type]
(Office Professional)
Impervious value, Ai = 0.900
Sub-Area C Value = 0.850
Initial subarea total flow distance = 60.000(Ft.)
Highest elevation = 662.200(Ft.)
Lowest elevation = 661.300(Ft.)
Elevation difference = 0.900(Ft.) Slope = 1.500 %
INITIAL AREA TIME OF CONCENTRATION CALCULATIONS:
The maximum overland flow distance is 70.00 (Ft)
for the top area slope value of 1.50 %, in a development type of
Office Professional
In Accordance With Figure 3-3
Initial Area Time of Concentration = 3.29 minutes
TC = [1.8*(1.1-C)*distance(Ft.)^.5)/(% slope^(1/3)]
TC = [1.8*(1.1-0.8500)*(70.000^.5)/(1.500^(1/3)]= 3.29
Rainfall intensity (I) = 9.493(In/Hr) for a 50.0 year storm
Effective runoff coefficient used for area (Q=KCIA) is C = 0.850
Subarea runoff = 0.662(CFS)
Total initial stream area = 0.082(Ac.)

++
Process from Point/Station 8.000 to Point/Station 9.000
**** IRREGULAR CHANNEL FLOW TRAVEL TIME ****

Estimated mean flow rate at midpoint of channel = 2.270(CFS)
Depth of flow = 0.138(Ft.), Average velocity = 1.978(Ft/s)
******* Irregular Channel Data ***********

Information entered for subchannel number 1 :

Point number	'X' coordinate	'Y' coordinate
1	0.00	0.50
2	30.00	0.00
3	60.00	0.50

```
Manning's 'N' friction factor =   0.013
-----------------------------------------------------------------
Sub-Channel flow  =      2.270(CFS)
  '     '       flow top width =     16.599(Ft.)
  '     '    velocity=    1.978(Ft/s)
  '     '       area =      1.148(Sq.Ft)
  '     '       Froude number =     1.325

Upstream point elevation =   661.300(Ft.)
Downstream point elevation =   658.600(Ft.)
Flow length =   256.000(Ft.)
Travel time  =    2.16 min.
Time of concentration =    5.45 min.
Depth of flow =   0.138(Ft.)
Average velocity =   1.978(Ft/s)
Total irregular channel flow =     2.270(CFS)
Irregular channel normal depth above invert elev. =   0.138(Ft.)
Average velocity of channel(s) =   1.978(Ft/s)
 Adding area flow to channel
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
[COMMERCIAL area type                        ]
(Office Professional    )
Impervious value, Ai = 0.900
Sub-Area C Value = 0.850
Rainfall intensity =      6.857(In/Hr) for a    50.0 year storm
Effective runoff coefficient used for total area
(Q=KCIA) is C = 0.850  CA =      0.558
Subarea runoff =      3.162(CFS) for      0.574(Ac.)
Total runoff =      3.823(CFS)       Total area =       0.656(Ac.)
Depth of flow =   0.168(Ft.), Average velocity =   2.253(Ft/s)
End of computations, total study area =           0.656 (Ac.)
```

San Diego County Rational Hydrology Program

CIVILCADD/CIVILDESIGN Engineering Software,(c)1991-2004 Version 7.4

Rational method hydrology program based on
San Diego County Flood Control Division 2003 hydrology manual
Rational Hydrology Study Date: 02/20/13

********* Hydrology Study Control Information **********
BASIN D - OUTFALL D

Program License Serial Number 4012

Rational hydrology study storm event year is 2.0
English (in-lb) input data Units used

Map data precipitation entered:
6 hour, precipitation(inches) = 1.550
24 hour precipitation(inches) = 2.400
P6/P24 = 64.6%
San Diego hydrology manual 'C' values used

++
Process from Point/Station 10.000 to Point/Station 11.000
**** 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
[COMMERCIAL area type]
(Office Professional)
Impervious value, Ai = 0.900
Sub-Area C Value = 0.850
Initial subarea total flow distance = 40.000(Ft.)
Highest elevation = 662.900(Ft.)
Lowest elevation = 661.000(Ft.)
Elevation difference = 1.900(Ft.) Slope = 4.750 %
INITIAL AREA TIME OF CONCENTRATION CALCULATIONS:
The maximum overland flow distance is 90.00 (Ft)
for the top area slope value of 4.75 %, in a development type of
Office Professional
In Accordance With Figure 3-3
Initial Area Time of Concentration = 2.54 minutes
TC = [1.8*(1.1-C)*distance(Ft.)^.5)/(% slope^(1/3)]
TC = [1.8*(1.1-0.8500)*(90.000^.5)/(4.750^(1/3)]= 2.54
Rainfall intensity (I) = 6.322(In/Hr) for a 2.0 year storm
Effective runoff coefficient used for area (Q=KCIA) is C = 0.850
Subarea runoff = 0.355(CFS)
Total initial stream area = 0.066(Ac.)

++
Process from Point/Station 11.000 to Point/Station 12.000
**** IRREGULAR CHANNEL FLOW TRAVEL TIME ****

Estimated mean flow rate at midpoint of channel = 0.950(CFS)
Depth of flow = 0.061(Ft.), Average velocity = 1.707(Ft/s)
******* Irregular Channel Data ***********

Information entered for subchannel number 1 :

Point number	'X' coordinate	'Y' coordinate
1	0.00	0.20
2	30.00	0.00
3	60.00	0.20

```
Manning's 'N' friction factor =   0.013
-----------------------------------------------------------------
Sub-Channel flow  =      0.950(CFS)
  '     '       flow top width =     18.277(Ft.)
  '     '    velocity=    1.707(Ft/s)
  '     '       area =      0.557(Sq.Ft)
  '     '       Froude number =     1.723

Upstream point elevation =   661.000(Ft.)
Downstream point elevation =   659.500(Ft.)
Flow length =    64.000(Ft.)
Travel time  =    0.62 min.
Time of concentration =    3.16 min.
Depth of flow =   0.061(Ft.)
Average velocity =   1.707(Ft/s)
Total irregular channel flow =     0.950(CFS)
Irregular channel normal depth above invert elev. =   0.061(Ft.)
Average velocity of channel(s) =   1.707(Ft/s)
 Adding area flow to channel
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
[COMMERCIAL area type                        ]
(Office Professional    )
Impervious value, Ai = 0.900
Sub-Area C Value = 0.850
Rainfall intensity =      5.485(In/Hr) for a     2.0 year storm
Effective runoff coefficient used for total area
(Q=KCIA) is C = 0.850  CA =      0.271
Subarea runoff =      1.133(CFS) for      0.253(Ac.)
Total runoff =      1.487(CFS)       Total area =       0.319(Ac.)
Depth of flow =   0.072(Ft.), Average velocity =   1.909(Ft/s)
End of computations, total study area =           0.319 (Ac.)
```

San Diego County Rational Hydrology Program

CIVILCADD/CIVILDESIGN Engineering Software,(c)1991-2004 Version 7.4

Rational method hydrology program based on
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Rational Hydrology Study Date: 02/20/13

********* Hydrology Study Control Information **********
BASIN D - OUTFALL D

Program License Serial Number 4012

Rational hydrology study storm event year is 50.0
English (in-lb) input data Units used

Map data precipitation entered:
6 hour, precipitation(inches) = 2.750
24 hour precipitation(inches) = 5.750
P6/P24 = 47.8%
San Diego hydrology manual 'C' values used

++
Process from Point/Station 10.000 to Point/Station 11.000
**** 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
[COMMERCIAL area type]
(Office Professional)
Impervious value, Ai = 0.900
Sub-Area C Value = 0.850
Initial subarea total flow distance = 40.000(Ft.)
Highest elevation = 662.900(Ft.)
Lowest elevation = 661.000(Ft.)
Elevation difference = 1.900(Ft.) Slope = 4.750 %
INITIAL AREA TIME OF CONCENTRATION CALCULATIONS:
The maximum overland flow distance is 90.00 (Ft)
for the top area slope value of 4.75 %, in a development type of
Office Professional
In Accordance With Figure 3-3
Initial Area Time of Concentration = 2.54 minutes
TC = [1.8*(1.1-C)*distance(Ft.)^.5)/(% slope^(1/3)]
TC = [1.8*(1.1-0.8500)*(90.000^.5)/(4.750^(1/3)]= 2.54
Rainfall intensity (I) = 11.216(In/Hr) for a 50.0 year storm
Effective runoff coefficient used for area (Q=KCIA) is C = 0.850
Subarea runoff = 0.629(CFS)
Total initial stream area = 0.066(Ac.)

++
Process from Point/Station 11.000 to Point/Station 12.000
**** IRREGULAR CHANNEL FLOW TRAVEL TIME ****

Estimated mean flow rate at midpoint of channel = 1.703(CFS)
Depth of flow = 0.076(Ft.), Average velocity = 1.975(Ft/s)
******* Irregular Channel Data ***********

Information entered for subchannel number 1 :

Point number	'X' coordinate	'Y' coordinate
1	0.00	0.20
2	30.00	0.00
3	60.00	0.20

```
Manning's 'N' friction factor =   0.013
-----------------------------------------------------------------
Sub-Channel flow  =      1.703(CFS)
  '     '       flow top width =     22.747(Ft.)
  '     '    velocity=    1.975(Ft/s)
  '     '       area =      0.862(Sq.Ft)
  '     '       Froude number =     1.787

Upstream point elevation =   661.000(Ft.)
Downstream point elevation =   659.500(Ft.)
Flow length =    64.000(Ft.)
Travel time  =    0.54 min.
Time of concentration =    3.08 min.
Depth of flow =   0.076(Ft.)
Average velocity =   1.975(Ft/s)
Total irregular channel flow =     1.703(CFS)
Irregular channel normal depth above invert elev. =   0.076(Ft.)
Average velocity of channel(s) =   1.975(Ft/s)
 Adding area flow to channel
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
[COMMERCIAL area type                        ]
(Office Professional    )
Impervious value, Ai = 0.900
Sub-Area C Value = 0.850
Rainfall intensity =      9.904(In/Hr) for a    50.0 year storm
Effective runoff coefficient used for total area
(Q=KCIA) is C = 0.850  CA =      0.271
Subarea runoff =      2.056(CFS) for      0.253(Ac.)
Total runoff =      2.685(CFS)       Total area =       0.319(Ac.)
Depth of flow =   0.090(Ft.), Average velocity =   2.213(Ft/s)
End of computations, total study area =           0.319 (Ac.)
```

San Diego County Rational Hydrology Program

CIVILCADD/CIVILDESIGN Engineering Software,(c)1991-2004 Version 7.4

Rational method hydrology program based on
San Diego County Flood Control Division 2003 hydrology manual
       Rational Hydrology Study   Date: 02/20/13

 *********   Hydrology Study Control Information **********
BASIN E - OUTFALL E

Program License Serial Number 4012

Rational hydrology study storm event year is   2.0
English (in-lb) input data Units used

Map data precipitation entered:
6 hour, precipitation(inches) = 1.550
24 hour precipitation(inches) = 2.400
P6/P24 =   64.6%
San Diego hydrology manual 'C' values used

++
Process from Point/Station   13.000 to Point/Station   14.000
**** 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
[COMMERCIAL area type   ]
(Office Professional   )
Impervious value, Ai = 0.900
Sub-Area C Value = 0.850
Initial subarea total flow distance =   55.000(Ft.)
Highest elevation = 661.700(Ft.)
Lowest elevation = 660.700(Ft.)
Elevation difference =   1.000(Ft.) Slope = 1.818 %
INITIAL AREA TIME OF CONCENTRATION CALCULATIONS:
The maximum overland flow distance is 70.00 (Ft)
for the top area slope value of   1.82 %, in a development type of
 Office Professional
In Accordance With Figure 3-3
Initial Area Time of Concentration =   3.08 minutes
TC = [1.8*(1.1-C)*distance(Ft.)^.5)/(% slope^(1/3)]
TC = [1.8*(1.1-0.8500)*(70.000^.5)/(1.818^(1/3)]=   3.08
Rainfall intensity (I) =   5.576(In/Hr) for a   2.0 year storm
Effective runoff coefficient used for area (Q=KCIA) is C = 0.850
Subarea runoff =   0.337(CFS)
Total initial stream area =   0.071(Ac.)

++
Process from Point/Station   14.000 to Point/Station   14.000
**** SUBAREA FLOW ADDITION ****
_____
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
[COMMERCIAL area type   ]
(Office Professional   )
Impervious value, Ai = 0.900
Sub-Area C Value = 0.850
Time of concentration =   3.08 min.

Rainfall intensity = 5.576(In/Hr) for a 2.0 year storm
Effective runoff coefficient used for total area
(Q=KCIA) is C = 0.850 CA = 0.291
Subarea runoff = 1.285(CFS) for 0.271(Ac.)
Total runoff = 1.621(CFS) Total area = 0.342(Ac.)
End of computations, total study area = 0.342 (Ac.)

San Diego County Rational Hydrology Program

CIVILCADD/CIVILDESIGN Engineering Software,(c)1991-2004 Version 7.4

Rational method hydrology program based on
San Diego County Flood Control Division 2003 hydrology manual
       Rational Hydrology Study   Date: 02/20/13

 *********   Hydrology Study Control Information **********
BASIN E - OUTFALL E

Program License Serial Number 4012

Rational hydrology study storm event year is   50.0
English (in-lb) input data Units used

Map data precipitation entered:
6 hour, precipitation(inches) = 2.750
24 hour precipitation(inches) = 5.750
P6/P24 =   47.8%
San Diego hydrology manual 'C' values used

++
Process from Point/Station   13.000 to Point/Station   14.000
**** 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
[COMMERCIAL area type   ]
(Office Professional   )
Impervious value, Ai = 0.900
Sub-Area C Value = 0.850
Initial subarea total flow distance =   55.000(Ft.)
Highest elevation = 661.700(Ft.)
Lowest elevation = 660.700(Ft.)
Elevation difference =   1.000(Ft.) Slope = 1.818 %
INITIAL AREA TIME OF CONCENTRATION CALCULATIONS:
The maximum overland flow distance is 70.00 (Ft)
for the top area slope value of   1.82 %, in a development type of
 Office Professional
In Accordance With Figure 3-3
Initial Area Time of Concentration =   3.08 minutes
TC = [1.8*(1.1-C)*distance(Ft.)^.5)/(% slope^(1/3)]
TC = [1.8*(1.1-0.8500)*(70.000^.5)/(1.818^(1/3)]=   3.08
Rainfall intensity (I) =   9.894(In/Hr) for a   50.0 year storm
Effective runoff coefficient used for area (Q=KCIA) is C = 0.850
Subarea runoff =   0.597(CFS)
Total initial stream area =   0.071(Ac.)

++
Process from Point/Station   14.000 to Point/Station   14.000
**** SUBAREA FLOW ADDITION ****

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
[COMMERCIAL area type   ]
(Office Professional   )
Impervious value, Ai = 0.900
Sub-Area C Value = 0.850
Time of concentration =   3.08 min.

Rainfall intensity = 9.894(In/Hr) for a 50.0 year storm
Effective runoff coefficient used for total area
(Q=KCIA) is C = 0.850 CA = 0.291
Subarea runoff = 2.279(CFS) for 0.271(Ac.)
Total runoff = 2.876(CFS) Total area = 0.342(Ac.)
End of computations, total study area = 0.342 (Ac.)

San Diego County Rational Hydrology Program

CIVILCADD/CIVILDESIGN Engineering Software,(c)1991-2004 Version 7.4

Rational method hydrology program based on
San Diego County Flood Control Division 2003 hydrology manual
       Rational Hydrology Study   Date: 02/20/13

 *********   Hydrology Study Control Information **********
BASIN F - OUTFALL F

Program License Serial Number 4012

Rational hydrology study storm event year is   2.0
English (in-lb) input data Units used

Map data precipitation entered:
6 hour, precipitation(inches) = 1.550
24 hour precipitation(inches) = 2.400
P6/P24 =   64.6%
San Diego hydrology manual 'C' values used

++
Process from Point/Station   15.000 to Point/Station   16.000
**** 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 =   79.000(Ft.)
Highest elevation = 658.500(Ft.)
Lowest elevation = 655.900(Ft.)
Elevation difference =   2.600(Ft.) Slope = 3.291 %
INITIAL AREA TIME OF CONCENTRATION CALCULATIONS:
The maximum overland flow distance is 100.00 (Ft)
for the top area slope value of   3.29 %, in a development type of
 Permanent Open Space
In Accordance With Figure 3-3
Initial Area Time of Concentration =   9.08 minutes
TC = [1.8*(1.1-C)*distance(Ft.)^.5)/(% slope^(1/3)]
TC = [1.8*(1.1-0.3500)*(100.000^.5)/(3.291^(1/3)]=   9.08
Rainfall intensity (I) =   2.780(In/Hr) for a   2.0 year storm
Effective runoff coefficient used for area (Q=KCIA) is C = 0.350
Subarea runoff =   0.021(CFS)
Total initial stream area =   0.022(Ac.)

++
Process from Point/Station   16.000 to Point/Station   16.000
**** SUBAREA FLOW ADDITION ****
_____
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 =   9.08 min.

Rainfall intensity = 2.780(In/Hr) for a 2.0 year storm
Effective runoff coefficient used for total area
(Q=KCIA) is C = 0.350 CA = 0.019
Subarea runoff = 0.031(CFS) for 0.032(Ac.)
Total runoff = 0.053(CFS) Total area = 0.054(Ac.)
End of computations, total study area = 0.054 (Ac.)

San Diego County Rational Hydrology Program

CIVILCADD/CIVILDESIGN Engineering Software,(c)1991-2004 Version 7.4

Rational method hydrology program based on
San Diego County Flood Control Division 2003 hydrology manual
Rational Hydrology Study Date: 02/20/13

********* Hydrology Study Control Information **********
BASIN F - OUTFALL F

Program License Serial Number 4012

Rational hydrology study storm event year is 50.0
English (in-lb) input data Units used

Map data precipitation entered:
6 hour, precipitation(inches) = 2.750
24 hour precipitation(inches) = 5.750
P6/P24 = 47.8%
San Diego hydrology manual 'C' values used

++
Process from Point/Station 15.000 to Point/Station 16.000
**** 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 = 79.000(Ft.)
Highest elevation = 658.500(Ft.)
Lowest elevation = 655.900(Ft.)
Elevation difference = 2.600(Ft.) Slope = 3.291 %
INITIAL AREA TIME OF CONCENTRATION CALCULATIONS:
The maximum overland flow distance is 100.00 (Ft)
for the top area slope value of 3.29 %, in a development type of
Permanent Open Space
In Accordance With Figure 3-3
Initial Area Time of Concentration = 9.08 minutes
TC = [1.8*(1.1-C)*distance(Ft.)^.5)/(% slope^(1/3)]
TC = [1.8*(1.1-0.3500)*(100.000^.5)/(3.291^(1/3)]= 9.08
Rainfall intensity (I) = 4.932(In/Hr) for a 50.0 year storm
Effective runoff coefficient used for area (Q=KCIA) is C = 0.350
Subarea runoff = 0.038(CFS)
Total initial stream area = 0.022(Ac.)

++
Process from Point/Station 16.000 to Point/Station 16.000
**** SUBAREA FLOW ADDITION ****

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 = 9.08 min.

Rainfall intensity = 4.932(In/Hr) for a 50.0 year storm
Effective runoff coefficient used for total area
(Q=KCIA) is C = 0.350 CA = 0.019
Subarea runoff = 0.055(CFS) for 0.032(Ac.)
Total runoff = 0.093(CFS) Total area = 0.054(Ac.)
End of computations, total study area = 0.054 (Ac.)

POST-DEVELOPMENT

San Diego County Rational Hydrology Program

CIVILCADD/CIVILDESIGN Engineering Software,(c)1991-2004 Version 7.4

Rational method hydrology program based on
San Diego County Flood Control Division 2003 hydrology manual
       Rational Hydrology Study   Date: 04/02/13

Outfall A
Basin A, B, C, and D
2 Year Rainfall Event

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

Program License Serial Number 4012

Rational hydrology study storm event year is   2.0
English (in-lb) input data Units used

Map data precipitation entered:
6 hour, precipitation(inches) = 1.550
24 hour precipitation(inches) = 2.400
P6/P24 =   64.6%
San Diego hydrology manual 'C' values used

++
Process from Point/Station   1.000 to Point/Station   2.000
**** 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
[COMMERCIAL area type   ]
(General Commercial   )
Impervious value, Ai = 0.850
Sub-Area C Value = 0.820
Initial subarea total flow distance =   56.000(Ft.)
Highest elevation = 662.000(Ft.)
Lowest elevation = 661.500(Ft.)
Elevation difference =   0.500(Ft.) Slope = 0.893 %
INITIAL AREA TIME OF CONCENTRATION CALCULATIONS:
The maximum overland flow distance is 60.00 (Ft)
for the top area slope value of   0.89 %, in a development type of
 General Commercial
In Accordance With Figure 3-3
Initial Area Time of Concentration =   4.05 minutes
TC = [1.8*(1.1-C)*distance(Ft.)^.5)/(% slope^(1/3)]
TC = [1.8*(1.1-0.8200)*(60.000^.5)/(0.893^(1/3)]=   4.05
Rainfall intensity (I) =   4.675(In/Hr) for a   2.0 year storm
Effective runoff coefficient used for area (Q=KCIA) is C = 0.820
Subarea runoff =   0.096(CFS)
Total initial stream area =   0.025(Ac.)

++
Process from Point/Station   2.000 to Point/Station   3.000
**** IRREGULAR CHANNEL FLOW TRAVEL TIME ****
_____
Estimated mean flow rate at midpoint of channel =   0.224(CFS)
Depth of flow =   0.070(Ft.), Average velocity =   0.918(Ft/s)
       ******* Irregular Channel Data ***********

Information entered for subchannel number 1 :

```
Point number      'X' coordinate     'Y' coordinate
       1              0.00              0.45
       2             45.00              0.00
       3             45.50              0.50
Manning's 'N' friction factor =   0.013
-----------------------------------------------------------------
Sub-Channel flow  =      0.224(CFS)
  '     '       flow top width =      7.025(Ft.)
  '     '    velocity=    0.918(Ft/s)
  '     '       area =      0.244(Sq.Ft)
  '     '       Froude number =     0.868

Upstream point elevation =   661.500(Ft.)
Downstream point elevation =   661.300(Ft.)
Flow length =    35.000(Ft.)
Travel time  =    0.64 min.
Time of concentration =    4.69 min.
Depth of flow =   0.070(Ft.)
Average velocity =   0.918(Ft/s)
Total irregular channel flow =     0.224(CFS)
Irregular channel normal depth above invert elev. =   0.070(Ft.)
Average velocity of channel(s) =   0.918(Ft/s)
 Adding area flow to channel
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
[COMMERCIAL area type                         ]
(General Commercial    )
Impervious value, Ai = 0.850
Sub-Area C Value = 0.820
Rainfall intensity =      4.256(In/Hr) for a     2.0 year storm
Effective runoff coefficient used for total area
(Q=KCIA) is C = 0.820  CA =      0.075
Subarea runoff =      0.225(CFS) for      0.067(Ac.)
Total runoff =      0.321(CFS)       Total area =       0.092(Ac.)
Depth of flow =   0.080(Ft.), Average velocity =   1.004(Ft/s)


++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++
Process from Point/Station        3.000 to Point/Station        4.000
**** PIPEFLOW TRAVEL TIME (Program estimated size) ****
________________________________________________________________________
Upstream point/station elevation =   661.300(Ft.)
Downstream point/station elevation =   660.100(Ft.)
Pipe length  =    30.00(Ft.)   Manning's N = 0.013
No. of pipes = 1  Required pipe flow  =     0.321(CFS)
Nearest computed pipe diameter  =      6.00(In.)
Calculated individual pipe flow  =     0.321(CFS)
Normal flow depth in pipe =    2.20(In.)
Flow top width inside pipe =    5.78(In.)
Critical Depth =    3.45(In.)
Pipe flow velocity =      4.93(Ft/s)
Travel time through pipe =    0.10 min.
Time of concentration (TC) =     4.79 min.


++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++
Process from Point/Station        4.000 to Point/Station        4.000
**** SUBAREA FLOW ADDITION ****
________________________________________________________________________
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
[COMMERCIAL area type                         ]
(General Commercial    )
Impervious value, Ai = 0.850
Sub-Area C Value = 0.820
Time of concentration =     4.79 min.
Rainfall intensity =      4.198(In/Hr) for a     2.0 year storm
```

```
Effective runoff coefficient used for total area
(Q=KCIA) is C = 0.820  CA =      0.823
Subarea runoff =      3.135(CFS) for      0.912(Ac.)
Total runoff =      3.456(CFS)       Total area =       1.004(Ac.)


++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++
Process from Point/Station        4.000 to Point/Station        5.000
**** IRREGULAR CHANNEL FLOW TRAVEL TIME ****
________________________________________________________________________
Estimated mean flow rate at midpoint of channel =      3.494(CFS)
Depth of flow =   0.324(Ft.), Average velocity =   1.544(Ft/s)
       ******* Irregular Channel Data ***********
------------------------------------------------------------------
Information entered for subchannel number 1 :
Point number      'X' coordinate     'Y' coordinate
       1              0.00              0.53
       2              2.10              0.00
       3              7.80              0.00
       4              9.90              0.53
Manning's 'N' friction factor =   0.030
------------------------------------------------------------------
Sub-Channel flow  =      3.494(CFS)
  '     '       flow top width =      8.288(Ft.)
  '     '    velocity=    1.544(Ft/s)
  '     '       area =      2.263(Sq.Ft)
  '     '       Froude number =     0.521

Upstream point elevation =   660.100(Ft.)
Downstream point elevation =   658.900(Ft.)
Flow length =   216.000(Ft.)
Travel time  =    2.33 min.
Time of concentration =    7.12 min.
Depth of flow =   0.324(Ft.)
Average velocity =   1.544(Ft/s)
Total irregular channel flow =     3.494(CFS)
Irregular channel normal depth above invert elev. =   0.324(Ft.)
Average velocity of channel(s) =   1.544(Ft/s)
 Adding area flow to channel
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
[COMMERCIAL area type                        ]
(General Commercial    )
Impervious value, Ai = 0.850
Sub-Area C Value = 0.820
The area added to the existing stream causes a
a lower flow rate of Q =      2.908(CFS)
therefore the upstream flow rate of Q =      3.456(CFS) is being used
Rainfall intensity =      3.251(In/Hr) for a     2.0 year storm
Effective runoff coefficient used for total area
(Q=KCIA) is C = 0.820  CA =      0.895
Subarea runoff =      0.000(CFS) for      0.087(Ac.)
Total runoff =      3.456(CFS)       Total area =       1.091(Ac.)
Depth of flow =   0.322(Ft.), Average velocity =   1.538(Ft/s)


++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++
Process from Point/Station        5.000 to Point/Station        6.000
**** PIPEFLOW TRAVEL TIME (Program estimated size) ****
________________________________________________________________________
Upstream point/station elevation =   657.200(Ft.)
Downstream point/station elevation =   655.700(Ft.)
Pipe length  =   293.00(Ft.)   Manning's N = 0.013
No. of pipes = 1  Required pipe flow  =     3.456(CFS)
Nearest computed pipe diameter  =     15.00(In.)
Calculated individual pipe flow  =     3.456(CFS)
Normal flow depth in pipe =    9.67(In.)
Flow top width inside pipe =   14.36(In.)
Critical Depth =    9.00(In.)
```

```
Pipe flow velocity =      4.13(Ft/s)
Travel time through pipe =    1.18 min.
Time of concentration (TC) =     8.30 min.


++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++
Process from Point/Station        6.000 to Point/Station        6.000
**** CONFLUENCE OF MINOR STREAMS ****
________________________________________________________________________
Along Main Stream number: 1 in normal stream number 1
Stream flow area =      1.091(Ac.)
Runoff from this stream =      3.456(CFS)
Time of concentration =    8.30 min.
Rainfall intensity =     2.944(In/Hr)


++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++
Process from Point/Station        7.000 to Point/Station        8.000
**** 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
[COMMERCIAL area type                        ]
(General Commercial    )
Impervious value, Ai = 0.850
Sub-Area C Value = 0.820
Initial subarea total flow distance  =   50.000(Ft.)
Highest elevation =  663.400(Ft.)
Lowest elevation =  662.800(Ft.)
Elevation difference =    0.600(Ft.) Slope =  1.200 %
INITIAL AREA TIME OF CONCENTRATION CALCULATIONS:
The maximum overland flow distance is 60.00 (Ft)
for the top area slope value of   1.20 %, in a development type of
 General Commercial
In Accordance With Figure 3-3
Initial Area Time of Concentration =   3.67 minutes
TC = [1.8*(1.1-C)*distance(Ft.)^.5)/(% slope^(1/3)]
TC = [1.8*(1.1-0.8200)*(  60.000^.5)/(   1.200^(1/3)]=   3.67
Rainfall intensity (I) =      4.982(In/Hr) for a     2.0 year storm
Effective runoff coefficient used for area (Q=KCIA) is C = 0.820
Subarea runoff =      0.114(CFS)
Total initial stream area =        0.028(Ac.)


++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++
Process from Point/Station        8.000 to Point/Station        6.000
**** IRREGULAR CHANNEL FLOW TRAVEL TIME ****
________________________________________________________________________
Estimated mean flow rate at midpoint of channel =      0.538(CFS)
Depth of flow =   0.077(Ft.), Average velocity =   1.065(Ft/s)
       ******* Irregular Channel Data ***********
------------------------------------------------------------------
Information entered for subchannel number 1 :
Point number      'X' coordinate     'Y' coordinate
       1              0.00              0.35
       2             30.00              0.00
       3             60.00              0.35
Manning's 'N' friction factor =   0.013
------------------------------------------------------------------
Sub-Channel flow  =      0.538(CFS)
  '     '       flow top width =     13.155(Ft.)
  '     '    velocity=    1.065(Ft/s)
  '     '       area =      0.505(Sq.Ft)
  '     '       Froude number =     0.958

Upstream point elevation =   662.800(Ft.)
Downstream point elevation =   660.700(Ft.)
Flow length =   313.000(Ft.)
Travel time  =    4.90 min.
```

```
Time of concentration =    8.57 min.
Depth of flow =   0.077(Ft.)
Average velocity =   1.065(Ft/s)
Total irregular channel flow =     0.538(CFS)
Irregular channel normal depth above invert elev. =   0.077(Ft.)
Average velocity of channel(s) =   1.065(Ft/s)
 Adding area flow to channel
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
[COMMERCIAL area type                        ]
(General Commercial    )
Impervious value, Ai = 0.850
Sub-Area C Value = 0.820
Rainfall intensity =      2.885(In/Hr) for a     2.0 year storm
Effective runoff coefficient used for total area
(Q=KCIA) is C = 0.820  CA =      0.302
Subarea runoff =      0.756(CFS) for      0.340(Ac.)
Total runoff =      0.870(CFS)       Total area =       0.368(Ac.)
Depth of flow =   0.092(Ft.), Average velocity =   1.201(Ft/s)


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Process from Point/Station        6.000 to Point/Station        6.000
**** CONFLUENCE OF MINOR STREAMS ****
______________________________________________________________________________
Along Main Stream number: 1 in normal stream number 2
Stream flow area =      0.368(Ac.)
Runoff from this stream =      0.870(CFS)
Time of concentration =    8.57 min.
Rainfall intensity =     2.885(In/Hr)


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Process from Point/Station        9.000 to Point/Station       10.000
**** 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
[COMMERCIAL area type                        ]
(General Commercial    )
Impervious value, Ai = 0.850
Sub-Area C Value = 0.820
Initial subarea total flow distance  =   60.000(Ft.)
Highest elevation =  663.300(Ft.)
Lowest elevation =  661.600(Ft.)
Elevation difference =    1.700(Ft.) Slope =  2.833 %
INITIAL AREA TIME OF CONCENTRATION CALCULATIONS:
The maximum overland flow distance is 85.00 (Ft)
for the top area slope value of   2.83 %, in a development type of
 General Commercial
In Accordance With Figure 3-3
Initial Area Time of Concentration =   3.28 minutes
TC = [1.8*(1.1-C)*distance(Ft.)^.5)/(% slope^(1/3)]
TC = [1.8*(1.1-0.8200)*(  85.000^.5)/(   2.833^(1/3)]=   3.28
Rainfall intensity (I) =      5.356(In/Hr) for a     2.0 year storm
Effective runoff coefficient used for area (Q=KCIA) is C = 0.820
Subarea runoff =      0.167(CFS)
Total initial stream area =        0.038(Ac.)


++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++
Process from Point/Station       10.000 to Point/Station       10.000
**** SUBAREA FLOW ADDITION ****
______________________________________________________________________________
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
[COMMERCIAL area type                        ]
(General Commercial    )
Impervious value, Ai = 0.850
Sub-Area C Value = 0.820
Time of concentration =     3.28 min.
Rainfall intensity =      5.356(In/Hr) for a     2.0 year storm
Effective runoff coefficient used for total area
(Q=KCIA) is C = 0.820  CA =      0.250
Subarea runoff =      1.173(CFS) for      0.267(Ac.)
Total runoff =      1.340(CFS)       Total area =       0.305(Ac.)


++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++
Process from Point/Station       10.000 to Point/Station        6.000
**** IRREGULAR CHANNEL FLOW TRAVEL TIME ****
______________________________________________________________________________
Estimated mean flow rate at midpoint of channel =      1.369(CFS)
Depth of flow =   0.155(Ft.), Average velocity =   1.020(Ft/s)
       ******* Irregular Channel Data ***********
------------------------------------------------------------------
Information entered for subchannel number 1 :
Point number      'X' coordinate     'Y' coordinate
       1              0.00              0.50
       2              0.50              0.00
       3              8.83              0.00
       4             10.33              0.50
Manning's 'N' friction factor =   0.030
------------------------------------------------------------------
Sub-Channel flow  =      1.369(CFS)
  '     '       flow top width =      8.952(Ft.)
  '     '    velocity=    1.020(Ft/s)
  '     '       area =      1.343(Sq.Ft)
  '     '       Froude number =     0.464

Upstream point elevation =   661.600(Ft.)
Downstream point elevation =   660.700(Ft.)
Flow length =   167.000(Ft.)
Travel time  =    2.73 min.
Time of concentration =    6.01 min.
Depth of flow =   0.155(Ft.)
Average velocity =   1.020(Ft/s)
Total irregular channel flow =     1.369(CFS)
Irregular channel normal depth above invert elev. =   0.155(Ft.)
Average velocity of channel(s) =   1.020(Ft/s)
 Adding area flow to channel
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
[COMMERCIAL area type                        ]
(General Commercial    )
Impervious value, Ai = 0.850
Sub-Area C Value = 0.820
The area added to the existing stream causes a
a lower flow rate of Q =      1.067(CFS)
therefore the upstream flow rate of Q =      1.340(CFS) is being used
Rainfall intensity =      3.626(In/Hr) for a     2.0 year storm
Effective runoff coefficient used for total area
(Q=KCIA) is C = 0.820  CA =      0.294
Subarea runoff =      0.000(CFS) for      0.054(Ac.)
Total runoff =      1.340(CFS)       Total area =       0.359(Ac.)
Depth of flow =   0.153(Ft.), Average velocity =   1.011(Ft/s)


++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++
Process from Point/Station        6.000 to Point/Station        6.000
**** CONFLUENCE OF MINOR STREAMS ****
______________________________________________________________________________
Along Main Stream number: 1 in normal stream number 3
Stream flow area =      0.359(Ac.)
```

```
Runoff from this stream =      1.340(CFS)
Time of concentration =    6.01 min.
Rainfall intensity =     3.626(In/Hr)
Summary of stream data:

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


1        3.456      8.30               2.944
2        0.870      8.57               2.885
3        1.340      6.01               3.626
Qmax(1) =
          1.000 *    1.000 *     3.456) +
          1.000 *    0.969 *     0.870) +
          0.812 *    1.000 *     1.340) + =       5.387
Qmax(2) =
          0.980 *    1.000 *     3.456) +
          1.000 *    1.000 *     0.870) +
          0.796 *    1.000 *     1.340) + =       5.322
Qmax(3) =
          1.000 *    0.724 *     3.456) +
          1.000 *    0.702 *     0.870) +
          1.000 *    1.000 *     1.340) + =       4.453

Total of 3 streams to confluence:
Flow rates before confluence point:
       3.456       0.870       1.340
Maximum flow rates at confluence using above data:
        5.387        5.322        4.453
Area of streams before confluence:
        1.091        0.368        0.359
Results of confluence:
Total flow rate =      5.387(CFS)
Time of concentration =     8.305 min.
Effective stream area after confluence =      1.818(Ac.)


++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++
Process from Point/Station        6.000 to Point/Station       11.000
**** PIPEFLOW TRAVEL TIME (Program estimated size) ****
________________________________________________________________________
Upstream point/station elevation =   655.700(Ft.)
Downstream point/station elevation =   655.400(Ft.)
Pipe length  =    57.00(Ft.)   Manning's N = 0.013
No. of pipes = 1  Required pipe flow  =     5.387(CFS)
Nearest computed pipe diameter  =     18.00(In.)
Calculated individual pipe flow  =     5.387(CFS)
Normal flow depth in pipe =   11.17(In.)
Flow top width inside pipe =   17.47(In.)
Critical Depth =   10.73(In.)
Pipe flow velocity =      4.68(Ft/s)
Travel time through pipe =    0.20 min.
Time of concentration (TC) =     8.51 min.


++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++
Process from Point/Station       11.000 to Point/Station       11.000
**** CONFLUENCE OF MAIN STREAMS ****
________________________________________________________________________
The following data inside Main Stream is listed:
In Main Stream number: 1
Stream flow area =      1.818(Ac.)
Runoff from this stream =      5.387(CFS)
Time of concentration =    8.51 min.
Rainfall intensity =     2.898(In/Hr)
Program is now starting with Main Stream No. 2


++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++
Process from Point/Station       12.000 to Point/Station       13.000
```

```
**** 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
[COMMERCIAL area type                        ]
(General Commercial    )
Impervious value, Ai = 0.850
Sub-Area C Value = 0.820
Initial subarea total flow distance  =   59.000(Ft.)
Highest elevation =  662.000(Ft.)
Lowest elevation =  661.500(Ft.)
Elevation difference =    0.500(Ft.) Slope =  0.847 %
INITIAL AREA TIME OF CONCENTRATION CALCULATIONS:
The maximum overland flow distance is 60.00 (Ft)
for the top area slope value of   0.85 %, in a development type of
 General Commercial
In Accordance With Figure 3-3
Initial Area Time of Concentration =   4.13 minutes
TC = [1.8*(1.1-C)*distance(Ft.)^.5)/(% slope^(1/3)]
TC = [1.8*(1.1-0.8200)*(  60.000^.5)/(   0.847^(1/3)]=   4.13
Rainfall intensity (I) =      4.623(In/Hr) for a     2.0 year storm
Effective runoff coefficient used for area (Q=KCIA) is C = 0.820
Subarea runoff =      0.118(CFS)
Total initial stream area =        0.031(Ac.)


++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++
Process from Point/Station       13.000 to Point/Station       14.000
**** IRREGULAR CHANNEL FLOW TRAVEL TIME ****
_____________________________________________________________________
Estimated mean flow rate at midpoint of channel =      0.218(CFS)
Depth of flow =   0.077(Ft.), Average velocity =   0.986(Ft/s)
       ******* Irregular Channel Data ***********
---------------------------------------------------------------
Information entered for subchannel number 1 :
Point number      'X' coordinate     'Y' coordinate
       1              0.00              0.64
       2             46.50              0.00
       3             47.00              0.50
Manning's 'N' friction factor =   0.013
---------------------------------------------------------------
Sub-Channel flow  =      0.218(CFS)
  '     '       flow top width =      5.708(Ft.)
  '     '    velocity=    0.986(Ft/s)
  '     '       area =      0.221(Sq.Ft)
  '     '       Froude number =     0.882

Upstream point elevation =   661.500(Ft.)
Downstream point elevation =   661.300(Ft.)
Flow length =    35.000(Ft.)
Travel time  =    0.59 min.
Time of concentration =    4.72 min.
Depth of flow =   0.077(Ft.)
Average velocity =   0.986(Ft/s)
Total irregular channel flow =     0.218(CFS)
Irregular channel normal depth above invert elev. =   0.077(Ft.)
Average velocity of channel(s) =   0.986(Ft/s)
 Adding area flow to channel
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
[COMMERCIAL area type                        ]
(General Commercial    )
Impervious value, Ai = 0.850
Sub-Area C Value = 0.820
Rainfall intensity =      4.240(In/Hr) for a     2.0 year storm
Effective runoff coefficient used for total area
(Q=KCIA) is C = 0.820  CA =      0.069
```

```
Subarea runoff =      0.175(CFS) for      0.053(Ac.)
Total runoff =      0.292(CFS)       Total area =       0.084(Ac.)
Depth of flow =   0.086(Ft.), Average velocity =   1.060(Ft/s)


++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++
Process from Point/Station       14.000 to Point/Station       15.000
**** PIPEFLOW TRAVEL TIME (Program estimated size) ****
________________________________________________________________________
Upstream point/station elevation =   661.300(Ft.)
Downstream point/station elevation =   660.900(Ft.)
Pipe length  =    42.00(Ft.)   Manning's N = 0.013
No. of pipes = 1  Required pipe flow  =     0.292(CFS)
Nearest computed pipe diameter  =      6.00(In.)
Calculated individual pipe flow  =     0.292(CFS)
Normal flow depth in pipe =    3.12(In.)
Flow top width inside pipe =    6.00(In.)
Critical Depth =    3.28(In.)
Pipe flow velocity =      2.83(Ft/s)
Travel time through pipe =    0.25 min.
Time of concentration (TC) =     4.97 min.


++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++
Process from Point/Station       15.000 to Point/Station       15.000
**** SUBAREA FLOW ADDITION ****
________________________________________________________________________
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
[COMMERCIAL area type                        ]
(General Commercial    )
Impervious value, Ai = 0.850
Sub-Area C Value = 0.820
Time of concentration =     4.97 min.
Rainfall intensity =      4.102(In/Hr) for a     2.0 year storm
Effective runoff coefficient used for total area
(Q=KCIA) is C = 0.820  CA =      0.143
Subarea runoff =      0.297(CFS) for      0.091(Ac.)
Total runoff =      0.589(CFS)       Total area =       0.175(Ac.)


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Process from Point/Station       15.000 to Point/Station       16.000
**** IRREGULAR CHANNEL FLOW TRAVEL TIME ****
________________________________________________________________________
Estimated mean flow rate at midpoint of channel =      0.705(CFS)
Depth of flow =   0.141(Ft.), Average velocity =   0.585(Ft/s)
       ******* Irregular Channel Data ***********
------------------------------------------------------------------
Information entered for subchannel number 1 :
Point number      'X' coordinate     'Y' coordinate
       1              0.00              0.50
       2              2.00              0.00
       3             10.00              0.00
       4             12.00              0.50
Manning's 'N' friction factor =   0.030
------------------------------------------------------------------
Sub-Channel flow  =      0.705(CFS)
  '     '       flow top width =      9.126(Ft.)
  '     '    velocity=    0.585(Ft/s)
  '     '       area =      1.205(Sq.Ft)
  '     '       Froude number =     0.284

Upstream point elevation =   660.900(Ft.)
Downstream point elevation =   660.800(Ft.)
Flow length =    48.000(Ft.)
Travel time  =    1.37 min.
Time of concentration =    6.33 min.
Depth of flow =   0.141(Ft.)
```

```
Average velocity =   0.585(Ft/s)
Total irregular channel flow =     0.705(CFS)
Irregular channel normal depth above invert elev. =   0.141(Ft.)
Average velocity of channel(s) =   0.585(Ft/s)
 Adding area flow to channel
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
[COMMERCIAL area type                        ]
(General Commercial    )
Impervious value, Ai = 0.850
Sub-Area C Value = 0.820
Rainfall intensity =      3.506(In/Hr) for a     2.0 year storm
Effective runoff coefficient used for total area
(Q=KCIA) is C = 0.820  CA =      0.216
Subarea runoff =      0.168(CFS) for      0.088(Ac.)
Total runoff =      0.756(CFS)       Total area =       0.263(Ac.)
Depth of flow =   0.147(Ft.), Average velocity =   0.600(Ft/s)


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Process from Point/Station       16.000 to Point/Station       17.000
**** PIPEFLOW TRAVEL TIME (Program estimated size) ****
______________________________________________________________________________
Upstream point/station elevation =   656.900(Ft.)
Downstream point/station elevation =   656.400(Ft.)
Pipe length  =   108.00(Ft.)   Manning's N = 0.013
No. of pipes = 1  Required pipe flow  =     0.756(CFS)
Nearest computed pipe diameter  =      9.00(In.)
Calculated individual pipe flow  =     0.756(CFS)
Normal flow depth in pipe =    5.40(In.)
Flow top width inside pipe =    8.82(In.)
Critical Depth =    4.76(In.)
Pipe flow velocity =      2.73(Ft/s)
Travel time through pipe =    0.66 min.
Time of concentration (TC) =     6.99 min.


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Process from Point/Station       17.000 to Point/Station       17.000
**** SUBAREA FLOW ADDITION ****
______________________________________________________________________________
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
[COMMERCIAL area type                        ]
(General Commercial    )
Impervious value, Ai = 0.850
Sub-Area C Value = 0.820
Time of concentration =     6.99 min.
Rainfall intensity =      3.290(In/Hr) for a     2.0 year storm
Effective runoff coefficient used for total area
(Q=KCIA) is C = 0.820  CA =      0.248
Subarea runoff =      0.058(CFS) for      0.039(Ac.)
Total runoff =      0.815(CFS)       Total area =       0.302(Ac.)


++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++
Process from Point/Station       17.000 to Point/Station       17.000
**** CONFLUENCE OF MINOR STREAMS ****
______________________________________________________________________________
Along Main Stream number: 2 in normal stream number 1
Stream flow area =      0.302(Ac.)
Runoff from this stream =      0.815(CFS)
Time of concentration =    6.99 min.
Rainfall intensity =     3.290(In/Hr)


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

```
Process from Point/Station       18.000 to Point/Station       19.000
**** 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
[COMMERCIAL area type                         ]
(General Commercial    )
Impervious value, Ai = 0.850
Sub-Area C Value = 0.820
Initial subarea total flow distance  =   35.000(Ft.)
Highest elevation =  663.000(Ft.)
Lowest elevation =  662.600(Ft.)
Elevation difference =    0.400(Ft.) Slope =  1.143 %
INITIAL AREA TIME OF CONCENTRATION CALCULATIONS:
The maximum overland flow distance is 60.00 (Ft)
for the top area slope value of   1.14 %, in a development type of
 General Commercial
In Accordance With Figure 3-3
Initial Area Time of Concentration =   3.73 minutes
TC = [1.8*(1.1-C)*distance(Ft.)^.5)/(% slope^(1/3)]
TC = [1.8*(1.1-0.8200)*(  60.000^.5)/(   1.143^(1/3)]=   3.73
Rainfall intensity (I) =      4.930(In/Hr) for a     2.0 year storm
Effective runoff coefficient used for area (Q=KCIA) is C = 0.820
Subarea runoff =      0.097(CFS)
Total initial stream area =        0.024(Ac.)


++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++
Process from Point/Station       19.000 to Point/Station       17.000
**** IRREGULAR CHANNEL FLOW TRAVEL TIME ****
_____________________________________________________________________
Estimated mean flow rate at midpoint of channel =      0.814(CFS)
Depth of flow =   0.134(Ft.), Average velocity =   2.148(Ft/s)
       ******* Irregular Channel Data ***********
---------------------------------------------------------------
Information entered for subchannel number 1 :
Point number      'X' coordinate     'Y' coordinate
       1              0.00              1.46
       2             60.00              0.00
       3             60.50              0.50
Manning's 'N' friction factor =   0.013
---------------------------------------------------------------
Sub-Channel flow  =      0.814(CFS)
  '     '       flow top width =      5.650(Ft.)
  '     '    velocity=    2.148(Ft/s)
  '     '       area =      0.379(Sq.Ft)
  '     '       Froude number =     1.461

Upstream point elevation =   662.600(Ft.)
Downstream point elevation =   660.500(Ft.)
Flow length =   160.000(Ft.)
Travel time  =    1.24 min.
Time of concentration =    4.98 min.
Depth of flow =   0.134(Ft.)
Average velocity =   2.148(Ft/s)
Total irregular channel flow =     0.814(CFS)
Irregular channel normal depth above invert elev. =   0.134(Ft.)
Average velocity of channel(s) =   2.148(Ft/s)
 Adding area flow to channel
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
[COMMERCIAL area type                         ]
(General Commercial    )
Impervious value, Ai = 0.850
Sub-Area C Value = 0.820
Rainfall intensity =      4.097(In/Hr) for a     2.0 year storm
Effective runoff coefficient used for total area
```

```
(Q=KCIA) is C = 0.820  CA =      0.355
Subarea runoff =      1.358(CFS) for      0.409(Ac.)
Total runoff =      1.455(CFS)       Total area =       0.433(Ac.)
Depth of flow =   0.167(Ft.), Average velocity =   2.483(Ft/s)


++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++
Process from Point/Station       17.000 to Point/Station       17.000
**** CONFLUENCE OF MINOR STREAMS ****
________________________________________________________________________
Along Main Stream number: 2 in normal stream number 2
Stream flow area =      0.433(Ac.)
Runoff from this stream =      1.455(CFS)
Time of concentration =    4.98 min.
Rainfall intensity =     4.097(In/Hr)
Summary of stream data:

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


1        0.815      6.99               3.290
2        1.455      4.98               4.097
Qmax(1) =
          1.000 *    1.000 *     0.815) +
          0.803 *    1.000 *     1.455) + =       1.983
Qmax(2) =
          1.000 *    0.712 *     0.815) +
          1.000 *    1.000 *     1.455) + =       2.034

Total of 2 streams to confluence:
Flow rates before confluence point:
       0.815       1.455
Maximum flow rates at confluence using above data:
        1.983        2.034
Area of streams before confluence:
        0.302        0.433
Results of confluence:
Total flow rate =      2.034(CFS)
Time of concentration =     4.975 min.
Effective stream area after confluence =      0.735(Ac.)


++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++
Process from Point/Station       17.000 to Point/Station       11.000
**** PIPEFLOW TRAVEL TIME (Program estimated size) ****
________________________________________________________________________
Upstream point/station elevation =   656.400(Ft.)
Downstream point/station elevation =   655.400(Ft.)
Pipe length  =   196.00(Ft.)   Manning's N = 0.013
No. of pipes = 1  Required pipe flow  =     2.034(CFS)
Nearest computed pipe diameter  =     12.00(In.)
Calculated individual pipe flow  =     2.034(CFS)
Normal flow depth in pipe =    8.11(In.)
Flow top width inside pipe =   11.23(In.)
Critical Depth =    7.30(In.)
Pipe flow velocity =      3.60(Ft/s)
Travel time through pipe =    0.91 min.
Time of concentration (TC) =     5.88 min.


++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++
Process from Point/Station       11.000 to Point/Station       11.000
**** CONFLUENCE OF MAIN STREAMS ****
________________________________________________________________________
The following data inside Main Stream is listed:
In Main Stream number: 2
Stream flow area =      0.735(Ac.)
Runoff from this stream =      2.034(CFS)
Time of concentration =    5.88 min.
Rainfall intensity =     3.677(In/Hr)
```

```
Summary of stream data:

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


1        5.387      8.51               2.898
2        2.034      5.88               3.677
Qmax(1) =
          1.000 *    1.000 *     5.387) +
          0.788 *    1.000 *     2.034) + =       6.991
Qmax(2) =
          1.000 *    0.691 *     5.387) +
          1.000 *    1.000 *     2.034) + =       5.759

Total of 2 main streams to confluence:
Flow rates before confluence point:
       5.387       2.034
Maximum flow rates at confluence using above data:
        6.991        5.759
Area of streams before confluence:
        1.818        0.735


Results of confluence:
Total flow rate =      6.991(CFS)
Time of concentration =     8.508 min.
Effective stream area after confluence  =      2.553(Ac.)


++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++
Process from Point/Station       11.000 to Point/Station       20.000
**** PIPEFLOW TRAVEL TIME (Program estimated size) ****
________________________________________________________________________
Upstream point/station elevation =   655.400(Ft.)
Downstream point/station elevation =   654.200(Ft.)
Pipe length  =   246.00(Ft.)   Manning's N = 0.013
No. of pipes = 1  Required pipe flow  =     6.991(CFS)
Nearest computed pipe diameter  =     18.00(In.)
Calculated individual pipe flow  =     6.991(CFS)
Normal flow depth in pipe =   14.04(In.)
Flow top width inside pipe =   14.91(In.)
Critical Depth =   12.28(In.)
Pipe flow velocity =      4.73(Ft/s)
Travel time through pipe =    0.87 min.
Time of concentration (TC) =     9.38 min.


++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++
Process from Point/Station       20.000 to Point/Station       20.000
**** CONFLUENCE OF MINOR STREAMS ****
________________________________________________________________________
Along Main Stream number: 1 in normal stream number 1
Stream flow area =      2.553(Ac.)
Runoff from this stream =      6.991(CFS)
Time of concentration =    9.38 min.
Rainfall intensity =     2.722(In/Hr)


++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++
Process from Point/Station       21.000 to Point/Station       22.000
**** 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
[COMMERCIAL area type                        ]
(General Commercial    )
Impervious value, Ai = 0.850
Sub-Area C Value = 0.820
```

```
Initial subarea total flow distance  =   58.000(Ft.)
Highest elevation =  663.400(Ft.)
Lowest elevation =  662.600(Ft.)
Elevation difference =    0.800(Ft.) Slope =  1.379 %
INITIAL AREA TIME OF CONCENTRATION CALCULATIONS:
The maximum overland flow distance is 60.00 (Ft)
for the top area slope value of   1.38 %, in a development type of
 General Commercial
In Accordance With Figure 3-3
Initial Area Time of Concentration =   3.51 minutes
TC = [1.8*(1.1-C)*distance(Ft.)^.5)/(% slope^(1/3)]
TC = [1.8*(1.1-0.8200)*(  60.000^.5)/(   1.379^(1/3)]=   3.51
Rainfall intensity (I) =      5.133(In/Hr) for a     2.0 year storm
Effective runoff coefficient used for area (Q=KCIA) is C = 0.820
Subarea runoff =      0.185(CFS)
Total initial stream area =        0.044(Ac.)


++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++
Process from Point/Station       22.000 to Point/Station       20.000
**** IRREGULAR CHANNEL FLOW TRAVEL TIME ****
________________________________________________________________________
Estimated mean flow rate at midpoint of channel =      1.085(CFS)
Depth of flow =   0.085(Ft.), Average velocity =   2.721(Ft/s)
       ******* Irregular Channel Data ***********
------------------------------------------------------------------
Information entered for subchannel number 1 :
Point number      'X' coordinate     'Y' coordinate
       1              0.00              0.27
       2             18.60              0.00
       3             53.60              0.87
Manning's 'N' friction factor =   0.013
------------------------------------------------------------------
Sub-Channel flow  =      1.085(CFS)
  '     '       flow top width =      9.328(Ft.)
  '     '    velocity=    2.721(Ft/s)
  '     '       area =      0.399(Sq.Ft)
  '     '       Froude number =     2.320

Upstream point elevation =   662.600(Ft.)
Downstream point elevation =   660.400(Ft.)
Flow length =    58.000(Ft.)
Travel time  =    0.36 min.
Time of concentration =    3.86 min.
Depth of flow =   0.085(Ft.)
Average velocity =   2.721(Ft/s)
Total irregular channel flow =     1.085(CFS)
Irregular channel normal depth above invert elev. =   0.085(Ft.)
Average velocity of channel(s) =   2.721(Ft/s)
 Adding area flow to channel
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
[COMMERCIAL area type                        ]
(General Commercial    )
Impervious value, Ai = 0.850
Sub-Area C Value = 0.820
Rainfall intensity =      4.824(In/Hr) for a     2.0 year storm
Effective runoff coefficient used for total area
(Q=KCIA) is C = 0.820  CA =      0.399
Subarea runoff =      1.737(CFS) for      0.442(Ac.)
Total runoff =      1.922(CFS)       Total area =       0.486(Ac.)
Depth of flow =   0.106(Ft.), Average velocity =   3.139(Ft/s)


++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++
Process from Point/Station       20.000 to Point/Station       20.000
**** CONFLUENCE OF MINOR STREAMS ****
________________________________________________________________________
Along Main Stream number: 1 in normal stream number 2
```

```
Stream flow area =      0.486(Ac.)
Runoff from this stream =      1.922(CFS)
Time of concentration =    3.86 min.
Rainfall intensity =     4.824(In/Hr)
Summary of stream data:

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


1        6.991      9.38               2.722
2        1.922      3.86               4.824
Qmax(1) =
          1.000 *    1.000 *     6.991) +
          0.564 *    1.000 *     1.922) + =       8.076
Qmax(2) =
          1.000 *    0.412 *     6.991) +
          1.000 *    1.000 *     1.922) + =       4.802

Total of 2 streams to confluence:
Flow rates before confluence point:
       6.991       1.922
Maximum flow rates at confluence using above data:
        8.076        4.802
Area of streams before confluence:
        2.553        0.486
Results of confluence:
Total flow rate =      8.076(CFS)
Time of concentration =     9.376 min.
Effective stream area after confluence =      3.039(Ac.)


++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++
Process from Point/Station       20.000 to Point/Station       23.000
**** PIPEFLOW TRAVEL TIME (Program estimated size) ****
________________________________________________________________________
Upstream point/station elevation =   654.200(Ft.)
Downstream point/station elevation =   653.260(Ft.)
Pipe length  =    86.00(Ft.)   Manning's N = 0.013
No. of pipes = 3  Required pipe flow  =     8.076(CFS)
Nearest computed pipe diameter  =     12.00(In.)
Calculated individual pipe flow  =     2.692(CFS)
Normal flow depth in pipe =    7.56(In.)
Flow top width inside pipe =   11.59(In.)
Critical Depth =    8.44(In.)
Pipe flow velocity =      5.17(Ft/s)
Travel time through pipe =    0.28 min.
Time of concentration (TC) =     9.65 min.
End of computations, total study area =           3.039 (Ac.)
```

San Diego County Rational Hydrology Program

CIVILCADD/CIVILDESIGN Engineering Software,(c)1991-2004 Version 7.4

Rational method hydrology program based on
San Diego County Flood Control Division 2003 hydrology manual
       Rational Hydrology Study   Date: 04/02/13

Outfall A
Basin A, B, C, and D
50 Year Rainfall Event

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

Program License Serial Number 4012

Rational hydrology study storm event year is   50.0
English (in-lb) input data Units used

Map data precipitation entered:
6 hour, precipitation(inches) = 2.750
24 hour precipitation(inches) = 5.750
P6/P24 =   47.8%
San Diego hydrology manual 'C' values used

++
Process from Point/Station   1.000 to Point/Station   2.000
**** 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
[COMMERCIAL area type   ]
(General Commercial   )
Impervious value, Ai = 0.850
Sub-Area C Value = 0.820
Initial subarea total flow distance =   56.000(Ft.)
Highest elevation = 662.000(Ft.)
Lowest elevation = 661.500(Ft.)
Elevation difference =   0.500(Ft.) Slope = 0.893 %
INITIAL AREA TIME OF CONCENTRATION CALCULATIONS:
The maximum overland flow distance is 60.00 (Ft)
for the top area slope value of   0.89 %, in a development type of
 General Commercial
In Accordance With Figure 3-3
Initial Area Time of Concentration =   4.05 minutes
TC = [1.8*(1.1-C)*distance(Ft.)^.5)/(% slope^(1/3)]
TC = [1.8*(1.1-0.8200)*(60.000^.5)/(0.893^(1/3)]=   4.05
Rainfall intensity (I) =   8.295(In/Hr) for a   50.0 year storm
Effective runoff coefficient used for area (Q=KCIA) is C = 0.820
Subarea runoff =   0.170(CFS)
Total initial stream area =   0.025(Ac.)

++
Process from Point/Station   2.000 to Point/Station   3.000
**** IRREGULAR CHANNEL FLOW TRAVEL TIME ****
_____
Estimated mean flow rate at midpoint of channel =   0.398(CFS)
Depth of flow =   0.086(Ft.), Average velocity =   1.060(Ft/s)
       ******* Irregular Channel Data ***********

Information entered for subchannel number 1 :

```
Point number      'X' coordinate     'Y' coordinate
       1              0.00              0.45
       2             45.00              0.00
       3             45.50              0.50
Manning's 'N' friction factor =   0.013
-----------------------------------------------------------------
Sub-Channel flow  =      0.398(CFS)
  '     '       flow top width =      8.710(Ft.)
  '     '    velocity=    1.060(Ft/s)
  '     '       area =      0.376(Sq.Ft)
  '     '       Froude number =     0.899

Upstream point elevation =   661.500(Ft.)
Downstream point elevation =   661.300(Ft.)
Flow length =    35.000(Ft.)
Travel time  =    0.55 min.
Time of concentration =    4.60 min.
Depth of flow =   0.086(Ft.)
Average velocity =   1.060(Ft/s)
Total irregular channel flow =     0.398(CFS)
Irregular channel normal depth above invert elev. =   0.086(Ft.)
Average velocity of channel(s) =   1.060(Ft/s)
 Adding area flow to channel
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
[COMMERCIAL area type                         ]
(General Commercial    )
Impervious value, Ai = 0.850
Sub-Area C Value = 0.820
Rainfall intensity =      7.641(In/Hr) for a    50.0 year storm
Effective runoff coefficient used for total area
(Q=KCIA) is C = 0.820  CA =      0.075
Subarea runoff =      0.406(CFS) for      0.067(Ac.)
Total runoff =      0.576(CFS)       Total area =       0.092(Ac.)
Depth of flow =   0.099(Ft.), Average velocity =   1.162(Ft/s)


++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++
Process from Point/Station        3.000 to Point/Station        4.000
**** PIPEFLOW TRAVEL TIME (Program estimated size) ****
________________________________________________________________________
Upstream point/station elevation =   661.300(Ft.)
Downstream point/station elevation =   660.100(Ft.)
Pipe length  =    30.00(Ft.)   Manning's N = 0.013
No. of pipes = 1  Required pipe flow  =     0.576(CFS)
Nearest computed pipe diameter  =      6.00(In.)
Calculated individual pipe flow  =     0.576(CFS)
Normal flow depth in pipe =    3.05(In.)
Flow top width inside pipe =    6.00(In.)
Critical Depth =    4.64(In.)
Pipe flow velocity =      5.75(Ft/s)
Travel time through pipe =    0.09 min.
Time of concentration (TC) =     4.69 min.


++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++
Process from Point/Station        4.000 to Point/Station        4.000
**** SUBAREA FLOW ADDITION ****
________________________________________________________________________
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
[COMMERCIAL area type                         ]
(General Commercial    )
Impervious value, Ai = 0.850
Sub-Area C Value = 0.820
Time of concentration =     4.69 min.
Rainfall intensity =      7.549(In/Hr) for a    50.0 year storm
```

```
Effective runoff coefficient used for total area
(Q=KCIA) is C = 0.820  CA =      0.823
Subarea runoff =      5.639(CFS) for      0.912(Ac.)
Total runoff =      6.215(CFS)       Total area =       1.004(Ac.)


++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++
Process from Point/Station        4.000 to Point/Station        5.000
**** IRREGULAR CHANNEL FLOW TRAVEL TIME ****
________________________________________________________________________
Estimated mean flow rate at midpoint of channel =      6.249(CFS)
Depth of flow =   0.448(Ft.), Average velocity =   1.860(Ft/s)
       ******* Irregular Channel Data ***********
------------------------------------------------------------------
Information entered for subchannel number 1 :
Point number      'X' coordinate     'Y' coordinate
       1              0.00              0.53
       2              2.10              0.00
       3              7.80              0.00
       4              9.90              0.53
Manning's 'N' friction factor =   0.030
------------------------------------------------------------------
Sub-Channel flow  =      6.249(CFS)
  '     '       flow top width =      9.287(Ft.)
  '     '    velocity=    1.860(Ft/s)
  '     '       area =      3.360(Sq.Ft)
  '     '       Froude number =     0.545

Upstream point elevation =   660.100(Ft.)
Downstream point elevation =   658.900(Ft.)
Flow length =   216.000(Ft.)
Travel time  =    1.94 min.
Time of concentration =    6.63 min.
Depth of flow =   0.448(Ft.)
Average velocity =   1.860(Ft/s)
Total irregular channel flow =     6.249(CFS)
Irregular channel normal depth above invert elev. =   0.448(Ft.)
Average velocity of channel(s) =   1.860(Ft/s)
 Adding area flow to channel
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
[COMMERCIAL area type                        ]
(General Commercial    )
Impervious value, Ai = 0.850
Sub-Area C Value = 0.820
The area added to the existing stream causes a
a lower flow rate of Q =      5.405(CFS)
therefore the upstream flow rate of Q =      6.215(CFS) is being used
Rainfall intensity =      6.042(In/Hr) for a    50.0 year storm
Effective runoff coefficient used for total area
(Q=KCIA) is C = 0.820  CA =      0.895
Subarea runoff =      0.000(CFS) for      0.087(Ac.)
Total runoff =      6.215(CFS)       Total area =       1.091(Ac.)
Depth of flow =   0.447(Ft.), Average velocity =   1.857(Ft/s)


++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++
Process from Point/Station        5.000 to Point/Station        6.000
**** PIPEFLOW TRAVEL TIME (Program estimated size) ****
________________________________________________________________________
Upstream point/station elevation =   657.200(Ft.)
Downstream point/station elevation =   655.700(Ft.)
Pipe length  =   293.00(Ft.)   Manning's N = 0.013
No. of pipes = 1  Required pipe flow  =     6.215(CFS)
Nearest computed pipe diameter  =     18.00(In.)
Calculated individual pipe flow  =     6.215(CFS)
Normal flow depth in pipe =   12.48(In.)
Flow top width inside pipe =   16.60(In.)
Critical Depth =   11.56(In.)
```

```
Pipe flow velocity =      4.75(Ft/s)
Travel time through pipe =    1.03 min.
Time of concentration (TC) =     7.65 min.


++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++
Process from Point/Station        6.000 to Point/Station        6.000
**** CONFLUENCE OF MINOR STREAMS ****
________________________________________________________________________
Along Main Stream number: 1 in normal stream number 1
Stream flow area =      1.091(Ac.)
Runoff from this stream =      6.215(CFS)
Time of concentration =    7.65 min.
Rainfall intensity =     5.505(In/Hr)


++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++
Process from Point/Station        7.000 to Point/Station        8.000
**** 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
[COMMERCIAL area type                        ]
(General Commercial    )
Impervious value, Ai = 0.850
Sub-Area C Value = 0.820
Initial subarea total flow distance  =   50.000(Ft.)
Highest elevation =  663.400(Ft.)
Lowest elevation =  662.800(Ft.)
Elevation difference =    0.600(Ft.) Slope =  1.200 %
INITIAL AREA TIME OF CONCENTRATION CALCULATIONS:
The maximum overland flow distance is 60.00 (Ft)
for the top area slope value of   1.20 %, in a development type of
 General Commercial
In Accordance With Figure 3-3
Initial Area Time of Concentration =   3.67 minutes
TC = [1.8*(1.1-C)*distance(Ft.)^.5)/(% slope^(1/3)]
TC = [1.8*(1.1-0.8200)*(  60.000^.5)/(   1.200^(1/3)]=   3.67
Rainfall intensity (I) =      8.839(In/Hr) for a    50.0 year storm
Effective runoff coefficient used for area (Q=KCIA) is C = 0.820
Subarea runoff =      0.203(CFS)
Total initial stream area =        0.028(Ac.)


++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++
Process from Point/Station        8.000 to Point/Station        6.000
**** IRREGULAR CHANNEL FLOW TRAVEL TIME ****
________________________________________________________________________
Estimated mean flow rate at midpoint of channel =      0.954(CFS)
Depth of flow =   0.095(Ft.), Average velocity =   1.229(Ft/s)
       ******* Irregular Channel Data ***********
------------------------------------------------------------------
Information entered for subchannel number 1 :
Point number      'X' coordinate     'Y' coordinate
       1              0.00              0.35
       2             30.00              0.00
       3             60.00              0.35
Manning's 'N' friction factor =   0.013
------------------------------------------------------------------
Sub-Channel flow  =      0.954(CFS)
  '     '       flow top width =     16.310(Ft.)
  '     '    velocity=    1.229(Ft/s)
  '     '       area =      0.776(Sq.Ft)
  '     '       Froude number =     0.993

Upstream point elevation =   662.800(Ft.)
Downstream point elevation =   660.700(Ft.)
Flow length =   313.000(Ft.)
Travel time  =    4.24 min.
```

```
Time of concentration =    7.92 min.
Depth of flow =   0.095(Ft.)
Average velocity =   1.229(Ft/s)
Total irregular channel flow =     0.954(CFS)
Irregular channel normal depth above invert elev. =   0.095(Ft.)
Average velocity of channel(s) =   1.229(Ft/s)
 Adding area flow to channel
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
[COMMERCIAL area type                         ]
(General Commercial    )
Impervious value, Ai = 0.850
Sub-Area C Value = 0.820
Rainfall intensity =      5.386(In/Hr) for a    50.0 year storm
Effective runoff coefficient used for total area
(Q=KCIA) is C = 0.820  CA =      0.302
Subarea runoff =      1.422(CFS) for      0.340(Ac.)
Total runoff =      1.625(CFS)       Total area =       0.368(Ac.)
Depth of flow =   0.116(Ft.), Average velocity =   1.404(Ft/s)


++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++
Process from Point/Station        6.000 to Point/Station        6.000
**** CONFLUENCE OF MINOR STREAMS ****
______________________________________________________________________________
Along Main Stream number: 1 in normal stream number 2
Stream flow area =      0.368(Ac.)
Runoff from this stream =      1.625(CFS)
Time of concentration =    7.92 min.
Rainfall intensity =     5.386(In/Hr)


++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++
Process from Point/Station        9.000 to Point/Station       10.000
**** 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
[COMMERCIAL area type                         ]
(General Commercial    )
Impervious value, Ai = 0.850
Sub-Area C Value = 0.820
Initial subarea total flow distance  =   60.000(Ft.)
Highest elevation =  663.300(Ft.)
Lowest elevation =  661.600(Ft.)
Elevation difference =    1.700(Ft.) Slope =  2.833 %
INITIAL AREA TIME OF CONCENTRATION CALCULATIONS:
The maximum overland flow distance is 85.00 (Ft)
for the top area slope value of   2.83 %, in a development type of
 General Commercial
In Accordance With Figure 3-3
Initial Area Time of Concentration =   3.28 minutes
TC = [1.8*(1.1-C)*distance(Ft.)^.5)/(% slope^(1/3)]
TC = [1.8*(1.1-0.8200)*(  85.000^.5)/(   2.833^(1/3)]=   3.28
Rainfall intensity (I) =      9.502(In/Hr) for a    50.0 year storm
Effective runoff coefficient used for area (Q=KCIA) is C = 0.820
Subarea runoff =      0.296(CFS)
Total initial stream area =        0.038(Ac.)


++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++
Process from Point/Station       10.000 to Point/Station       10.000
**** SUBAREA FLOW ADDITION ****
______________________________________________________________________________
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
[COMMERCIAL area type                        ]
(General Commercial    )
Impervious value, Ai = 0.850
Sub-Area C Value = 0.820
Time of concentration =     3.28 min.
Rainfall intensity =      9.502(In/Hr) for a    50.0 year storm
Effective runoff coefficient used for total area
(Q=KCIA) is C = 0.820  CA =      0.250
Subarea runoff =      2.080(CFS) for      0.267(Ac.)
Total runoff =      2.377(CFS)       Total area =       0.305(Ac.)


++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++
Process from Point/Station       10.000 to Point/Station        6.000
**** IRREGULAR CHANNEL FLOW TRAVEL TIME ****
______________________________________________________________________________
Estimated mean flow rate at midpoint of channel =      2.403(CFS)
Depth of flow =   0.217(Ft.), Average velocity =   1.261(Ft/s)
       ******* Irregular Channel Data ***********
------------------------------------------------------------------
Information entered for subchannel number 1 :
Point number      'X' coordinate     'Y' coordinate
       1              0.00              0.50
       2              0.50              0.00
       3              8.83              0.00
       4             10.33              0.50
Manning's 'N' friction factor =   0.030
------------------------------------------------------------------
Sub-Channel flow  =      2.403(CFS)
  '     '       flow top width =      9.199(Ft.)
  '     '    velocity=    1.261(Ft/s)
  '     '       area =      1.905(Sq.Ft)
  '     '       Froude number =     0.488

Upstream point elevation =   661.600(Ft.)
Downstream point elevation =   660.700(Ft.)
Flow length =   167.000(Ft.)
Travel time  =    2.21 min.
Time of concentration =    5.49 min.
Depth of flow =   0.217(Ft.)
Average velocity =   1.261(Ft/s)
Total irregular channel flow =     2.403(CFS)
Irregular channel normal depth above invert elev. =   0.217(Ft.)
Average velocity of channel(s) =   1.261(Ft/s)
 Adding area flow to channel
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
[COMMERCIAL area type                        ]
(General Commercial    )
Impervious value, Ai = 0.850
Sub-Area C Value = 0.820
The area added to the existing stream causes a
a lower flow rate of Q =      2.008(CFS)
therefore the upstream flow rate of Q =      2.377(CFS) is being used
Rainfall intensity =      6.821(In/Hr) for a    50.0 year storm
Effective runoff coefficient used for total area
(Q=KCIA) is C = 0.820  CA =      0.294
Subarea runoff =      0.000(CFS) for      0.054(Ac.)
Total runoff =      2.377(CFS)       Total area =       0.359(Ac.)
Depth of flow =   0.216(Ft.), Average velocity =   1.256(Ft/s)


++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++
Process from Point/Station        6.000 to Point/Station        6.000
**** CONFLUENCE OF MINOR STREAMS ****
______________________________________________________________________________
Along Main Stream number: 1 in normal stream number 3
Stream flow area =      0.359(Ac.)
```

```
Runoff from this stream =      2.377(CFS)
Time of concentration =    5.49 min.
Rainfall intensity =     6.821(In/Hr)
Summary of stream data:

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


1        6.215      7.65               5.505
2        1.625      7.92               5.386
3        2.377      5.49               6.821
Qmax(1) =
          1.000 *    1.000 *     6.215) +
          1.000 *    0.967 *     1.625) +
          0.807 *    1.000 *     2.377) + =       9.705
Qmax(2) =
          0.978 *    1.000 *     6.215) +
          1.000 *    1.000 *     1.625) +
          0.790 *    1.000 *     2.377) + =       9.583
Qmax(3) =
          1.000 *    0.717 *     6.215) +
          1.000 *    0.693 *     1.625) +
          1.000 *    1.000 *     2.377) + =       7.962

Total of 3 streams to confluence:
Flow rates before confluence point:
       6.215       1.625       2.377
Maximum flow rates at confluence using above data:
        9.705        9.583        7.962
Area of streams before confluence:
        1.091        0.368        0.359
Results of confluence:
Total flow rate =      9.705(CFS)
Time of concentration =     7.655 min.
Effective stream area after confluence =      1.818(Ac.)


++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++
Process from Point/Station        6.000 to Point/Station       11.000
**** PIPEFLOW TRAVEL TIME (Program estimated size) ****
____________________________________________________________________________
Upstream point/station elevation =   655.700(Ft.)
Downstream point/station elevation =   655.400(Ft.)
Pipe length  =    57.00(Ft.)   Manning's N = 0.013
No. of pipes = 1  Required pipe flow  =     9.705(CFS)
Nearest computed pipe diameter  =     21.00(In.)
Calculated individual pipe flow  =     9.705(CFS)
Normal flow depth in pipe =   14.79(In.)
Flow top width inside pipe =   19.17(In.)
Critical Depth =   13.91(In.)
Pipe flow velocity =      5.36(Ft/s)
Travel time through pipe =    0.18 min.
Time of concentration (TC) =     7.83 min.


++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++
Process from Point/Station       11.000 to Point/Station       11.000
**** CONFLUENCE OF MAIN STREAMS ****
____________________________________________________________________________
The following data inside Main Stream is listed:
In Main Stream number: 1
Stream flow area =      1.818(Ac.)
Runoff from this stream =      9.705(CFS)
Time of concentration =    7.83 min.
Rainfall intensity =     5.424(In/Hr)
Program is now starting with Main Stream No. 2


++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++
Process from Point/Station       12.000 to Point/Station       13.000
```

```
**** 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
[COMMERCIAL area type                        ]
(General Commercial    )
Impervious value, Ai = 0.850
Sub-Area C Value = 0.820
Initial subarea total flow distance  =   59.000(Ft.)
Highest elevation =  662.000(Ft.)
Lowest elevation =  661.500(Ft.)
Elevation difference =    0.500(Ft.) Slope =  0.847 %
INITIAL AREA TIME OF CONCENTRATION CALCULATIONS:
The maximum overland flow distance is 60.00 (Ft)
for the top area slope value of   0.85 %, in a development type of
 General Commercial
In Accordance With Figure 3-3
Initial Area Time of Concentration =   4.13 minutes
TC = [1.8*(1.1-C)*distance(Ft.)^.5)/(% slope^(1/3)]
TC = [1.8*(1.1-0.8200)*(  60.000^.5)/(   0.847^(1/3)]=   4.13
Rainfall intensity (I) =      8.201(In/Hr) for a    50.0 year storm
Effective runoff coefficient used for area (Q=KCIA) is C = 0.820
Subarea runoff =      0.208(CFS)
Total initial stream area =        0.031(Ac.)


++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++
Process from Point/Station       13.000 to Point/Station       14.000
**** IRREGULAR CHANNEL FLOW TRAVEL TIME ****
_____________________________________________________________________
Estimated mean flow rate at midpoint of channel =      0.387(CFS)
Depth of flow =   0.096(Ft.), Average velocity =   1.138(Ft/s)
       ******* Irregular Channel Data ***********
---------------------------------------------------------------
Information entered for subchannel number 1 :
Point number      'X' coordinate     'Y' coordinate
       1              0.00              0.64
       2             46.50              0.00
       3             47.00              0.50
Manning's 'N' friction factor =   0.013
---------------------------------------------------------------
Sub-Channel flow  =      0.387(CFS)
  '     '       flow top width =      7.077(Ft.)
  '     '    velocity=    1.138(Ft/s)
  '     '       area =      0.340(Sq.Ft)
  '     '       Froude number =     0.915

Upstream point elevation =   661.500(Ft.)
Downstream point elevation =   661.300(Ft.)
Flow length =    35.000(Ft.)
Travel time  =    0.51 min.
Time of concentration =    4.64 min.
Depth of flow =   0.096(Ft.)
Average velocity =   1.138(Ft/s)
Total irregular channel flow =     0.387(CFS)
Irregular channel normal depth above invert elev. =   0.096(Ft.)
Average velocity of channel(s) =   1.138(Ft/s)
 Adding area flow to channel
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
[COMMERCIAL area type                        ]
(General Commercial    )
Impervious value, Ai = 0.850
Sub-Area C Value = 0.820
Rainfall intensity =      7.604(In/Hr) for a    50.0 year storm
Effective runoff coefficient used for total area
(Q=KCIA) is C = 0.820  CA =      0.069
```

```
Subarea runoff =      0.315(CFS) for      0.053(Ac.)
Total runoff =      0.524(CFS)       Total area =       0.084(Ac.)
Depth of flow =   0.108(Ft.), Average velocity =   1.227(Ft/s)


++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++
Process from Point/Station       14.000 to Point/Station       15.000
**** PIPEFLOW TRAVEL TIME (Program estimated size) ****
----------------------------------------------------------------------
Upstream point/station elevation =   661.300(Ft.)
Downstream point/station elevation =   660.900(Ft.)
Pipe length  =    42.00(Ft.)   Manning's N = 0.013
No. of pipes = 1  Required pipe flow  =     0.524(CFS)
Nearest computed pipe diameter  =      6.00(In.)
Calculated individual pipe flow  =     0.524(CFS)
Normal flow depth in pipe =    4.70(In.)
Flow top width inside pipe =    4.94(In.)
Critical Depth =    4.43(In.)
Pipe flow velocity =      3.18(Ft/s)
Travel time through pipe =    0.22 min.
Time of concentration (TC) =     4.86 min.


++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++
Process from Point/Station       15.000 to Point/Station       15.000
**** SUBAREA FLOW ADDITION ****
----------------------------------------------------------------------
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
[COMMERCIAL area type                        ]
(General Commercial    )
Impervious value, Ai = 0.850
Sub-Area C Value = 0.820
Time of concentration =     4.86 min.
Rainfall intensity =      7.380(In/Hr) for a    50.0 year storm
Effective runoff coefficient used for total area
(Q=KCIA) is C = 0.820  CA =      0.143
Subarea runoff =      0.535(CFS) for      0.091(Ac.)
Total runoff =      1.059(CFS)       Total area =       0.175(Ac.)


++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++
Process from Point/Station       15.000 to Point/Station       16.000
**** IRREGULAR CHANNEL FLOW TRAVEL TIME ****
----------------------------------------------------------------------
Estimated mean flow rate at midpoint of channel =      1.277(CFS)
Depth of flow =   0.200(Ft.), Average velocity =   0.727(Ft/s)
       ******* Irregular Channel Data ***********
----------------------------------------------------------------
Information entered for subchannel number 1 :
Point number      'X' coordinate     'Y' coordinate
       1              0.00              0.50
       2              2.00              0.00
       3             10.00              0.00
       4             12.00              0.50
Manning's 'N' friction factor =   0.030
----------------------------------------------------------------
Sub-Channel flow  =      1.277(CFS)
  '     '       flow top width =      9.598(Ft.)
  '     '    velocity=    0.727(Ft/s)
  '     '       area =      1.757(Sq.Ft)
  '     '       Froude number =     0.299

Upstream point elevation =   660.900(Ft.)
Downstream point elevation =   660.800(Ft.)
Flow length =    48.000(Ft.)
Travel time  =    1.10 min.
Time of concentration =    5.96 min.
Depth of flow =   0.200(Ft.)
```

```
Average velocity =   0.727(Ft/s)
Total irregular channel flow =     1.277(CFS)
Irregular channel normal depth above invert elev. =   0.200(Ft.)
Average velocity of channel(s) =   0.727(Ft/s)
 Adding area flow to channel
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
[COMMERCIAL area type                        ]
(General Commercial    )
Impervious value, Ai = 0.850
Sub-Area C Value = 0.820
Rainfall intensity =      6.469(In/Hr) for a    50.0 year storm
Effective runoff coefficient used for total area
(Q=KCIA) is C = 0.820  CA =      0.216
Subarea runoff =      0.336(CFS) for      0.088(Ac.)
Total runoff =      1.395(CFS)       Total area =       0.263(Ac.)
Depth of flow =   0.210(Ft.), Average velocity =   0.750(Ft/s)


++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++
Process from Point/Station       16.000 to Point/Station       17.000
**** PIPEFLOW TRAVEL TIME (Program estimated size) ****
______________________________________________________________________________
Upstream point/station elevation =   656.900(Ft.)
Downstream point/station elevation =   656.400(Ft.)
Pipe length  =   108.00(Ft.)   Manning's N = 0.013
No. of pipes = 1  Required pipe flow  =     1.395(CFS)
Nearest computed pipe diameter  =     12.00(In.)
Calculated individual pipe flow  =     1.395(CFS)
Normal flow depth in pipe =    6.53(In.)
Flow top width inside pipe =   11.95(In.)
Critical Depth =    5.99(In.)
Pipe flow velocity =      3.19(Ft/s)
Travel time through pipe =    0.56 min.
Time of concentration (TC) =     6.52 min.


++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++
Process from Point/Station       17.000 to Point/Station       17.000
**** SUBAREA FLOW ADDITION ****
______________________________________________________________________________
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
[COMMERCIAL area type                        ]
(General Commercial    )
Impervious value, Ai = 0.850
Sub-Area C Value = 0.820
Time of concentration =     6.52 min.
Rainfall intensity =      6.103(In/Hr) for a    50.0 year storm
Effective runoff coefficient used for total area
(Q=KCIA) is C = 0.820  CA =      0.248
Subarea runoff =      0.116(CFS) for      0.039(Ac.)
Total runoff =      1.511(CFS)       Total area =       0.302(Ac.)


++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++
Process from Point/Station       17.000 to Point/Station       17.000
**** CONFLUENCE OF MINOR STREAMS ****
______________________________________________________________________________
Along Main Stream number: 2 in normal stream number 1
Stream flow area =      0.302(Ac.)
Runoff from this stream =      1.511(CFS)
Time of concentration =    6.52 min.
Rainfall intensity =     6.103(In/Hr)


++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++
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Process from Point/Station       18.000 to Point/Station       19.000
**** 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
[COMMERCIAL area type                        ]
(General Commercial    )
Impervious value, Ai = 0.850
Sub-Area C Value = 0.820
Initial subarea total flow distance  =   35.000(Ft.)
Highest elevation =  663.000(Ft.)
Lowest elevation =  662.600(Ft.)
Elevation difference =    0.400(Ft.) Slope =  1.143 %
INITIAL AREA TIME OF CONCENTRATION CALCULATIONS:
The maximum overland flow distance is 60.00 (Ft)
for the top area slope value of   1.14 %, in a development type of
 General Commercial
In Accordance With Figure 3-3
Initial Area Time of Concentration =   3.73 minutes
TC = [1.8*(1.1-C)*distance(Ft.)^.5)/(% slope^(1/3)]
TC = [1.8*(1.1-0.8200)*(  60.000^.5)/(   1.143^(1/3)]=   3.73
Rainfall intensity (I) =      8.747(In/Hr) for a    50.0 year storm
Effective runoff coefficient used for area (Q=KCIA) is C = 0.820
Subarea runoff =      0.172(CFS)
Total initial stream area =        0.024(Ac.)


++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++
Process from Point/Station       19.000 to Point/Station       17.000
**** IRREGULAR CHANNEL FLOW TRAVEL TIME ****
------------------------------------------------------------------------
Estimated mean flow rate at midpoint of channel =      1.436(CFS)
Depth of flow =   0.166(Ft.), Average velocity =   2.475(Ft/s)
       ******* Irregular Channel Data ***********
-------------------------------------------------------------------
Information entered for subchannel number 1 :
Point number      'X' coordinate     'Y' coordinate
       1              0.00              1.46
       2             60.00              0.00
       3             60.50              0.50
Manning's 'N' friction factor =   0.013
-------------------------------------------------------------------
Sub-Channel flow  =      1.436(CFS)
  '     '       flow top width =      6.989(Ft.)
  '     '    velocity=    2.475(Ft/s)
  '     '       area =      0.580(Sq.Ft)
  '     '       Froude number =     1.514

Upstream point elevation =   662.600(Ft.)
Downstream point elevation =   660.500(Ft.)
Flow length =   160.000(Ft.)
Travel time  =    1.08 min.
Time of concentration =    4.81 min.
Depth of flow =   0.166(Ft.)
Average velocity =   2.475(Ft/s)
Total irregular channel flow =     1.436(CFS)
Irregular channel normal depth above invert elev. =   0.166(Ft.)
Average velocity of channel(s) =   2.475(Ft/s)
 Adding area flow to channel
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
[COMMERCIAL area type                        ]
(General Commercial    )
Impervious value, Ai = 0.850
Sub-Area C Value = 0.820
Rainfall intensity =      7.428(In/Hr) for a    50.0 year storm
Effective runoff coefficient used for total area
```

```
(Q=KCIA) is C = 0.820  CA =      0.355
Subarea runoff =      2.465(CFS) for      0.409(Ac.)
Total runoff =      2.637(CFS)       Total area =       0.433(Ac.)
Depth of flow =   0.209(Ft.), Average velocity =   2.882(Ft/s)


++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++
Process from Point/Station       17.000 to Point/Station       17.000
**** CONFLUENCE OF MINOR STREAMS ****
________________________________________________________________________
Along Main Stream number: 2 in normal stream number 2
Stream flow area =      0.433(Ac.)
Runoff from this stream =      2.637(CFS)
Time of concentration =    4.81 min.
Rainfall intensity =     7.428(In/Hr)
Summary of stream data:

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


1        1.511      6.52               6.103
2        2.637      4.81               7.428
Qmax(1) =
          1.000 *    1.000 *     1.511) +
          0.822 *    1.000 *     2.637) + =       3.678
Qmax(2) =
          1.000 *    0.737 *     1.511) +
          1.000 *    1.000 *     2.637) + =       3.752

Total of 2 streams to confluence:
Flow rates before confluence point:
       1.511       2.637
Maximum flow rates at confluence using above data:
        3.678        3.752
Area of streams before confluence:
        0.302        0.433
Results of confluence:
Total flow rate =      3.752(CFS)
Time of concentration =     4.811 min.
Effective stream area after confluence =      0.735(Ac.)


++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++
Process from Point/Station       17.000 to Point/Station       11.000
**** PIPEFLOW TRAVEL TIME (Program estimated size) ****
________________________________________________________________________
Upstream point/station elevation =   656.400(Ft.)
Downstream point/station elevation =   655.400(Ft.)
Pipe length  =   196.00(Ft.)   Manning's N = 0.013
No. of pipes = 1  Required pipe flow  =     3.752(CFS)
Nearest computed pipe diameter  =     15.00(In.)
Calculated individual pipe flow  =     3.752(CFS)
Normal flow depth in pipe =   10.27(In.)
Flow top width inside pipe =   13.94(In.)
Critical Depth =    9.39(In.)
Pipe flow velocity =      4.19(Ft/s)
Travel time through pipe =    0.78 min.
Time of concentration (TC) =     5.59 min.


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Process from Point/Station       11.000 to Point/Station       11.000
**** CONFLUENCE OF MAIN STREAMS ****
________________________________________________________________________
The following data inside Main Stream is listed:
In Main Stream number: 2
Stream flow area =      0.735(Ac.)
Runoff from this stream =      3.752(CFS)
Time of concentration =    5.59 min.
Rainfall intensity =     6.742(In/Hr)
```

```
Summary of stream data:

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


1        9.705      7.83               5.424
2        3.752      5.59               6.742
Qmax(1) =
          1.000 *    1.000 *     9.705) +
          0.805 *    1.000 *     3.752) + =      12.723
Qmax(2) =
          1.000 *    0.714 *     9.705) +
          1.000 *    1.000 *     3.752) + =      10.680

Total of 2 main streams to confluence:
Flow rates before confluence point:
       9.705       3.752
Maximum flow rates at confluence using above data:
       12.723       10.680
Area of streams before confluence:
        1.818        0.735


Results of confluence:
Total flow rate =     12.723(CFS)
Time of concentration =     7.832 min.
Effective stream area after confluence  =      2.553(Ac.)


++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++
Process from Point/Station       11.000 to Point/Station       20.000
**** PIPEFLOW TRAVEL TIME (Program estimated size) ****
______________________________________________________________________________
Upstream point/station elevation =   655.400(Ft.)
Downstream point/station elevation =   654.200(Ft.)
Pipe length  =   246.00(Ft.)   Manning's N = 0.013
No. of pipes = 1  Required pipe flow  =    12.723(CFS)
Nearest computed pipe diameter  =     24.00(In.)
Calculated individual pipe flow  =    12.723(CFS)
Normal flow depth in pipe =   16.31(In.)
Flow top width inside pipe =   22.40(In.)
Critical Depth =   15.39(In.)
Pipe flow velocity =      5.59(Ft/s)
Travel time through pipe =    0.73 min.
Time of concentration (TC) =     8.56 min.


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Process from Point/Station       20.000 to Point/Station       20.000
**** CONFLUENCE OF MINOR STREAMS ****
______________________________________________________________________________
Along Main Stream number: 1 in normal stream number 1
Stream flow area =      2.553(Ac.)
Runoff from this stream =     12.723(CFS)
Time of concentration =    8.56 min.
Rainfall intensity =     5.120(In/Hr)


++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++
Process from Point/Station       21.000 to Point/Station       22.000
**** 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
[COMMERCIAL area type                        ]
(General Commercial    )
Impervious value, Ai = 0.850
Sub-Area C Value = 0.820
```

```
Initial subarea total flow distance  =   58.000(Ft.)
Highest elevation =  663.400(Ft.)
Lowest elevation =  662.600(Ft.)
Elevation difference =    0.800(Ft.) Slope =  1.379 %
INITIAL AREA TIME OF CONCENTRATION CALCULATIONS:
The maximum overland flow distance is 60.00 (Ft)
for the top area slope value of   1.38 %, in a development type of
 General Commercial
In Accordance With Figure 3-3
Initial Area Time of Concentration =   3.51 minutes
TC = [1.8*(1.1-C)*distance(Ft.)^.5)/(% slope^(1/3)]
TC = [1.8*(1.1-0.8200)*(  60.000^.5)/(   1.379^(1/3)]=   3.51
Rainfall intensity (I) =      9.107(In/Hr) for a    50.0 year storm
Effective runoff coefficient used for area (Q=KCIA) is C = 0.820
Subarea runoff =      0.329(CFS)
Total initial stream area =        0.044(Ac.)


++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++
Process from Point/Station       22.000 to Point/Station       20.000
**** IRREGULAR CHANNEL FLOW TRAVEL TIME ****
________________________________________________________________________
Estimated mean flow rate at midpoint of channel =      1.931(CFS)
Depth of flow =   0.106(Ft.), Average velocity =   3.143(Ft/s)
       ******* Irregular Channel Data ***********
------------------------------------------------------------------
Information entered for subchannel number 1 :
Point number      'X' coordinate     'Y' coordinate
       1              0.00              0.27
       2             18.60              0.00
       3             53.60              0.87
Manning's 'N' friction factor =   0.013
------------------------------------------------------------------
Sub-Channel flow  =      1.931(CFS)
  '     '       flow top width =     11.580(Ft.)
  '     '    velocity=    3.143(Ft/s)
  '     '       area =      0.614(Sq.Ft)
  '     '       Froude number =     2.405

Upstream point elevation =   662.600(Ft.)
Downstream point elevation =   660.400(Ft.)
Flow length =    58.000(Ft.)
Travel time  =    0.31 min.
Time of concentration =    3.81 min.
Depth of flow =   0.106(Ft.)
Average velocity =   3.143(Ft/s)
Total irregular channel flow =     1.931(CFS)
Irregular channel normal depth above invert elev. =   0.106(Ft.)
Average velocity of channel(s) =   3.143(Ft/s)
 Adding area flow to channel
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
[COMMERCIAL area type                        ]
(General Commercial    )
Impervious value, Ai = 0.850
Sub-Area C Value = 0.820
Rainfall intensity =      8.627(In/Hr) for a    50.0 year storm
Effective runoff coefficient used for total area
(Q=KCIA) is C = 0.820  CA =      0.399
Subarea runoff =      3.109(CFS) for      0.442(Ac.)
Total runoff =      3.438(CFS)       Total area =       0.486(Ac.)
Depth of flow =   0.132(Ft.), Average velocity =   3.631(Ft/s)


++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++
Process from Point/Station       20.000 to Point/Station       20.000
**** CONFLUENCE OF MINOR STREAMS ****
________________________________________________________________________
Along Main Stream number: 1 in normal stream number 2
```

```
Stream flow area =      0.486(Ac.)
Runoff from this stream =      3.438(CFS)
Time of concentration =    3.81 min.
Rainfall intensity =     8.627(In/Hr)
Summary of stream data:

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


1       12.723      8.56               5.120
2        3.438      3.81               8.627
Qmax(1) =
          1.000 *    1.000 *    12.723) +
          0.594 *    1.000 *     3.438) + =      14.764
Qmax(2) =
          1.000 *    0.445 *    12.723) +
          1.000 *    1.000 *     3.438) + =       9.105

Total of 2 streams to confluence:
Flow rates before confluence point:
      12.723       3.438
Maximum flow rates at confluence using above data:
       14.764        9.105
Area of streams before confluence:
        2.553        0.486
Results of confluence:
Total flow rate =     14.764(CFS)
Time of concentration =     8.565 min.
Effective stream area after confluence =      3.039(Ac.)


++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++
Process from Point/Station       20.000 to Point/Station       23.000
**** PIPEFLOW TRAVEL TIME (Program estimated size) ****
________________________________________________________________________
Upstream point/station elevation =   654.200(Ft.)
Downstream point/station elevation =   653.260(Ft.)
Pipe length  =    86.00(Ft.)   Manning's N = 0.013
No. of pipes = 1  Required pipe flow  =    14.764(CFS)
Nearest computed pipe diameter  =     21.00(In.)
Calculated individual pipe flow  =    14.764(CFS)
Normal flow depth in pipe =   15.45(In.)
Flow top width inside pipe =   18.52(In.)
Critical Depth =   17.10(In.)
Pipe flow velocity =      7.78(Ft/s)
Travel time through pipe =    0.18 min.
Time of concentration (TC) =     8.75 min.
End of computations, total study area =           3.039 (Ac.)
```

San Diego County Rational Hydrology Program

CIVILCADD/CIVILDESIGN Engineering Software,(c)1991-2004 Version 7.4

Rational method hydrology program based on
San Diego County Flood Control Division 2003 hydrology manual
       Rational Hydrology Study   Date: 04/02/13

Outfall B
Basin C1
2 Year Rainfall Event

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

Program License Serial Number 4012

Rational hydrology study storm event year is   2.0
English (in-lb) input data Units used

Map data precipitation entered:
6 hour, precipitation(inches) = 1.550
24 hour precipitation(inches) = 2.400
P6/P24 =   64.6%
San Diego hydrology manual 'C' values used

++
Process from Point/Station   24.000 to Point/Station   25.000
**** 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
[COMMERCIAL area type   ]
(General Commercial   )
Impervious value, Ai = 0.850
Sub-Area C Value = 0.820
Initial subarea total flow distance =   75.000(Ft.)
Highest elevation = 663.600(Ft.)
Lowest elevation = 662.300(Ft.)
Elevation difference =   1.300(Ft.) Slope = 1.733 %
Top of Initial Area Slope adjusted by User to 2.034 %
INITIAL AREA TIME OF CONCENTRATION CALCULATIONS:
The maximum overland flow distance is 75.00 (Ft)
for the top area slope value of   2.03 %, in a development type of
 General Commercial
In Accordance With Figure 3-3
Initial Area Time of Concentration =   3.44 minutes
TC = [1.8*(1.1-C)*distance(Ft.)^.5)/(% slope^(1/3)]
TC = [1.8*(1.1-0.8200)*(75.000^.5)/(2.034^(1/3)]=   3.44
Rainfall intensity (I) =   5.193(In/Hr) for a   2.0 year storm
Effective runoff coefficient used for area (Q=KCIA) is C = 0.820
Subarea runoff =   0.192(CFS)
Total initial stream area =   0.045(Ac.)

++
Process from Point/Station   25.000 to Point/Station   26.000
**** IRREGULAR CHANNEL FLOW TRAVEL TIME ****
_____
Estimated mean flow rate at midpoint of channel =   0.262(CFS)
Depth of flow =   0.160(Ft.), Average velocity =   0.317(Ft/s)
       ******* Irregular Channel Data **********

```
Information entered for subchannel number 1 :
Point number      'X' coordinate     'Y' coordinate
       1              0.00              0.74
       2             12.00              0.50
       3             12.50              0.00
       4             17.50              0.00
       5             18.00              0.50
Manning's 'N' friction factor =   0.130
-----------------------------------------------------------------
Sub-Channel flow  =      0.262(CFS)
  '     '       flow top width =      5.321(Ft.)
  '     '    velocity=    0.317(Ft/s)
  '     '       area =      0.828(Sq.Ft)
  '     '       Froude number =     0.141

Upstream point elevation =   662.300(Ft.)
Downstream point elevation =   661.400(Ft.)
Flow length =    95.000(Ft.)
Travel time  =    5.00 min.
Time of concentration =    8.44 min.
Depth of flow =   0.160(Ft.)
Average velocity =   0.317(Ft/s)
Total irregular channel flow =     0.262(CFS)
Irregular channel normal depth above invert elev. =   0.160(Ft.)
Average velocity of channel(s) =   0.317(Ft/s)
 Adding area flow to channel
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
[COMMERCIAL area type                         ]
(General Commercial    )
Impervious value, Ai = 0.850
Sub-Area C Value = 0.820
Rainfall intensity =      2.912(In/Hr) for a     2.0 year storm
Effective runoff coefficient used for total area
(Q=KCIA) is C = 0.820  CA =      0.094
Subarea runoff =      0.083(CFS) for      0.070(Ac.)
Total runoff =      0.275(CFS)       Total area =       0.115(Ac.)
Depth of flow =   0.165(Ft.), Average velocity =   0.322(Ft/s)


++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++
Process from Point/Station       26.000 to Point/Station       27.000
**** PIPEFLOW TRAVEL TIME (Program estimated size) ****
________________________________________________________________________
Upstream point/station elevation =   659.200(Ft.)
Downstream point/station elevation =   659.000(Ft.)
Pipe length  =    22.00(Ft.)   Manning's N = 0.013
No. of pipes = 1  Required pipe flow  =     0.275(CFS)
Nearest computed pipe diameter  =      6.00(In.)
Calculated individual pipe flow  =     0.275(CFS)
Normal flow depth in pipe =    3.05(In.)
Flow top width inside pipe =    6.00(In.)
Critical Depth =    3.17(In.)
Pipe flow velocity =      2.74(Ft/s)
Travel time through pipe =    0.13 min.
Time of concentration (TC) =     8.58 min.


++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++
Process from Point/Station       27.000 to Point/Station       27.000
**** SUBAREA FLOW ADDITION ****
________________________________________________________________________
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
[COMMERCIAL area type                         ]
(General Commercial    )
Impervious value, Ai = 0.850
```

Sub-Area C Value = 0.820
Time of concentration = 8.58 min.
Rainfall intensity = 2.883(In/Hr) for a 2.0 year storm
Effective runoff coefficient used for total area
(Q=KCIA) is C = 0.820 CA = 0.135
Subarea runoff = 0.115(CFS) for 0.050(Ac.)
Total runoff = 0.390(CFS) Total area = 0.165(Ac.)
End of computations, total study area = 0.165 (Ac.)

San Diego County Rational Hydrology Program

CIVILCADD/CIVILDESIGN Engineering Software,(c)1991-2004 Version 7.4

Rational method hydrology program based on
San Diego County Flood Control Division 2003 hydrology manual
       Rational Hydrology Study   Date: 04/02/13

Outfall B
Basin C1
50 Year Rainfall Event

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

Program License Serial Number 4012

Rational hydrology study storm event year is   50.0
English (in-lb) input data Units used

Map data precipitation entered:
6 hour, precipitation(inches) = 2.750
24 hour precipitation(inches) = 5.750
P6/P24 =   47.8%
San Diego hydrology manual 'C' values used

++
Process from Point/Station   24.000 to Point/Station   25.000
**** 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
[COMMERCIAL area type   ]
(General Commercial   )
Impervious value, Ai = 0.850
Sub-Area C Value = 0.820
Initial subarea total flow distance =   75.000(Ft.)
Highest elevation = 663.600(Ft.)
Lowest elevation = 662.300(Ft.)
Elevation difference =   1.300(Ft.) Slope = 1.733 %
Top of Initial Area Slope adjusted by User to 2.034 %
INITIAL AREA TIME OF CONCENTRATION CALCULATIONS:
The maximum overland flow distance is 75.00 (Ft)
for the top area slope value of   2.03 %, in a development type of
 General Commercial
In Accordance With Figure 3-3
Initial Area Time of Concentration =   3.44 minutes
TC = [1.8*(1.1-C)*distance(Ft.)^.5)/(% slope^(1/3)]
TC = [1.8*(1.1-0.8200)*(75.000^.5)/(2.034^(1/3)]=   3.44
Rainfall intensity (I) =   9.214(In/Hr) for a   50.0 year storm
Effective runoff coefficient used for area (Q=KCIA) is C = 0.820
Subarea runoff =   0.340(CFS)
Total initial stream area =   0.045(Ac.)

++
Process from Point/Station   25.000 to Point/Station   26.000
**** IRREGULAR CHANNEL FLOW TRAVEL TIME ****
_____
Estimated mean flow rate at midpoint of channel =   0.481(CFS)
Depth of flow =   0.231(Ft.), Average velocity =   0.398(Ft/s)
       ******* Irregular Channel Data ***********

```
Information entered for subchannel number 1 :
Point number      'X' coordinate     'Y' coordinate
       1              0.00              0.74
       2             12.00              0.50
       3             12.50              0.00
       4             17.50              0.00
       5             18.00              0.50
Manning's 'N' friction factor =   0.130
-----------------------------------------------------------------
Sub-Channel flow  =      0.481(CFS)
  '     '       flow top width =      5.462(Ft.)
  '     '    velocity=    0.398(Ft/s)
  '     '       area =      1.208(Sq.Ft)
  '     '       Froude number =     0.149

Upstream point elevation =   662.300(Ft.)
Downstream point elevation =   661.400(Ft.)
Flow length =    95.000(Ft.)
Travel time  =    3.98 min.
Time of concentration =    7.43 min.
Depth of flow =   0.231(Ft.)
Average velocity =   0.398(Ft/s)
Total irregular channel flow =     0.481(CFS)
Irregular channel normal depth above invert elev. =   0.231(Ft.)
Average velocity of channel(s) =   0.398(Ft/s)
 Adding area flow to channel
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
[COMMERCIAL area type                         ]
(General Commercial    )
Impervious value, Ai = 0.850
Sub-Area C Value = 0.820
Rainfall intensity =      5.614(In/Hr) for a    50.0 year storm
Effective runoff coefficient used for total area
(Q=KCIA) is C = 0.820  CA =      0.094
Subarea runoff =      0.189(CFS) for      0.070(Ac.)
Total runoff =      0.529(CFS)       Total area =       0.115(Ac.)
Depth of flow =   0.245(Ft.), Average velocity =   0.412(Ft/s)


++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++
Process from Point/Station       26.000 to Point/Station       27.000
**** PIPEFLOW TRAVEL TIME (Program estimated size) ****
________________________________________________________________________
Upstream point/station elevation =   659.200(Ft.)
Downstream point/station elevation =   659.000(Ft.)
Pipe length  =    22.00(Ft.)   Manning's N = 0.013
No. of pipes = 1  Required pipe flow  =     0.529(CFS)
Nearest computed pipe diameter  =      6.00(In.)
Calculated individual pipe flow  =     0.529(CFS)
Normal flow depth in pipe =    4.86(In.)
Flow top width inside pipe =    4.70(In.)
Critical Depth =    4.45(In.)
Pipe flow velocity =      3.11(Ft/s)
Travel time through pipe =    0.12 min.
Time of concentration (TC) =     7.54 min.


++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++
Process from Point/Station       27.000 to Point/Station       27.000
**** SUBAREA FLOW ADDITION ****
________________________________________________________________________
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
[COMMERCIAL area type                         ]
(General Commercial    )
Impervious value, Ai = 0.850
```

Sub-Area C Value = 0.820
Time of concentration = 7.54 min.
Rainfall intensity = 5.557(In/Hr) for a 50.0 year storm
Effective runoff coefficient used for total area
(Q=KCIA) is C = 0.820 CA = 0.135
Subarea runoff = 0.222(CFS) for 0.050(Ac.)
Total runoff = 0.752(CFS) Total area = 0.165(Ac.)
End of computations, total study area = 0.165 (Ac.)

San Diego County Rational Hydrology Program

CIVILCADD/CIVILDESIGN Engineering Software,(c)1991-2004 Version 7.4

Rational method hydrology program based on
San Diego County Flood Control Division 2003 hydrology manual
       Rational Hydrology Study   Date: 04/02/13

Outfall C
Basin E
2 Year Rainfall Event

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

Program License Serial Number 4012

Rational hydrology study storm event year is   2.0
English (in-lb) input data Units used

Map data precipitation entered:
6 hour, precipitation(inches) = 1.550
24 hour precipitation(inches) = 2.400
P6/P24 =   64.6%
San Diego hydrology manual 'C' values used

++
Process from Point/Station   28.000 to Point/Station   29.000
**** 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
[COMMERCIAL area type   ]
(General Commercial   )
Impervious value, Ai = 0.850
Sub-Area C Value = 0.820
Initial subarea total flow distance =   75.000(Ft.)
Highest elevation = 661.100(Ft.)
Lowest elevation = 658.800(Ft.)
Elevation difference =   2.300(Ft.) Slope = 3.067 %
Top of Initial Area Slope adjusted by User to 2.154 %
INITIAL AREA TIME OF CONCENTRATION CALCULATIONS:
The maximum overland flow distance is 75.00 (Ft)
for the top area slope value of   2.15 %, in a development type of
 General Commercial
In Accordance With Figure 3-3
Initial Area Time of Concentration =   3.38 minutes
TC = [1.8*(1.1-C)*distance(Ft.)^.5)/(% slope^(1/3)]
TC = [1.8*(1.1-0.8200)*(75.000^.5)/(2.154^(1/3)]=   3.38
Rainfall intensity (I) =   5.257(In/Hr) for a   2.0 year storm
Effective runoff coefficient used for area (Q=KCIA) is C = 0.820
Subarea runoff =   0.319(CFS)
Total initial stream area =   0.074(Ac.)

++
Process from Point/Station   29.000 to Point/Station   30.000
**** IRREGULAR CHANNEL FLOW TRAVEL TIME ****
_____
Estimated mean flow rate at midpoint of channel =   0.696(CFS)
Depth of flow =   0.052(Ft.), Average velocity =   1.018(Ft/s)
       ******* Irregular Channel Data ***********

```
Information entered for subchannel number 1 :
Point number      'X' coordinate     'Y' coordinate
       1              0.00              0.20
       2             50.00              0.00
       3            100.00              0.20
Manning's 'N' friction factor =   0.013
-----------------------------------------------------------------
Sub-Channel flow  =      0.696(CFS)
  '     '       flow top width =     26.144(Ft.)
  '     '    velocity=    1.018(Ft/s)
  '     '       area =      0.684(Sq.Ft)
  '     '       Froude number =     1.109

Upstream point elevation =   658.800(Ft.)
Downstream point elevation =   657.400(Ft.)
Flow length =   137.000(Ft.)
Travel time  =    2.24 min.
Time of concentration =    5.62 min.
Depth of flow =   0.052(Ft.)
Average velocity =   1.018(Ft/s)
Total irregular channel flow =     0.696(CFS)
Irregular channel normal depth above invert elev. =   0.052(Ft.)
Average velocity of channel(s) =   1.018(Ft/s)
 Adding area flow to channel
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
[COMMERCIAL area type                        ]
(General Commercial    )
Impervious value, Ai = 0.850
Sub-Area C Value = 0.820
Rainfall intensity =      3.786(In/Hr) for a     2.0 year storm
Effective runoff coefficient used for total area
(Q=KCIA) is C = 0.820  CA =      0.269
Subarea runoff =      0.699(CFS) for      0.254(Ac.)
Total runoff =      1.018(CFS)       Total area =       0.328(Ac.)
Depth of flow =   0.060(Ft.), Average velocity =   1.120(Ft/s)


++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++
Process from Point/Station       30.000 to Point/Station       31.000
**** IRREGULAR CHANNEL FLOW TRAVEL TIME ****
________________________________________________________________________
Estimated mean flow rate at midpoint of channel =      1.068(CFS)
Depth of flow =   0.078(Ft.), Average velocity =   2.258(Ft/s)
       ******* Irregular Channel Data ***********
-----------------------------------------------------------------
Information entered for subchannel number 1 :
Point number      'X' coordinate     'Y' coordinate
       1              0.00              0.50
       2              0.50              0.00
       3              6.50              0.00
       4              7.00              0.50
Manning's 'N' friction factor =   0.013
-----------------------------------------------------------------
Sub-Channel flow  =      1.068(CFS)
  '     '       flow top width =      6.156(Ft.)
  '     '    velocity=    2.258(Ft/s)
  '     '       area =      0.473(Sq.Ft)
  '     '       Froude number =     1.436

Upstream point elevation =   657.400(Ft.)
Downstream point elevation =   656.600(Ft.)
Flow length =    66.000(Ft.)
Travel time  =    0.49 min.
Time of concentration =    6.11 min.
Depth of flow =   0.078(Ft.)
Average velocity =   2.258(Ft/s)
Total irregular channel flow =     1.068(CFS)
Irregular channel normal depth above invert elev. =   0.078(Ft.)
```

```
Average velocity of channel(s) =   2.258(Ft/s)
 Adding area flow to channel
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
[COMMERCIAL area type                        ]
(General Commercial    )
Impervious value, Ai = 0.850
Sub-Area C Value = 0.820
Rainfall intensity =      3.588(In/Hr) for a     2.0 year storm
Effective runoff coefficient used for total area
(Q=KCIA) is C = 0.820  CA =      0.295
Subarea runoff =      0.041(CFS) for      0.032(Ac.)
Total runoff =      1.059(CFS)       Total area =       0.360(Ac.)
Depth of flow =   0.077(Ft.), Average velocity =   2.251(Ft/s)
End of computations, total study area =           0.360 (Ac.)
```

San Diego County Rational Hydrology Program

CIVILCADD/CIVILDESIGN Engineering Software,(c)1991-2004 Version 7.4

Rational method hydrology program based on
San Diego County Flood Control Division 2003 hydrology manual
       Rational Hydrology Study   Date: 04/02/13

Outfall C
Basin E
50 Year Rainfall Event

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

Program License Serial Number 4012

Rational hydrology study storm event year is   50.0
English (in-lb) input data Units used

Map data precipitation entered:
6 hour, precipitation(inches) = 2.750
24 hour precipitation(inches) = 5.750
P6/P24 =   47.8%
San Diego hydrology manual 'C' values used

++
Process from Point/Station   28.000 to Point/Station   29.000
**** 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
[COMMERCIAL area type   ]
(General Commercial   )
Impervious value, Ai = 0.850
Sub-Area C Value = 0.820
Initial subarea total flow distance =   75.000(Ft.)
Highest elevation = 661.100(Ft.)
Lowest elevation = 658.800(Ft.)
Elevation difference =   2.300(Ft.) Slope = 3.067 %
Top of Initial Area Slope adjusted by User to 2.154 %
INITIAL AREA TIME OF CONCENTRATION CALCULATIONS:
The maximum overland flow distance is 75.00 (Ft)
for the top area slope value of   2.15 %, in a development type of
 General Commercial
In Accordance With Figure 3-3
Initial Area Time of Concentration =   3.38 minutes
TC = [1.8*(1.1-C)*distance(Ft.)^.5)/(% slope^(1/3)]
TC = [1.8*(1.1-0.8200)*(75.000^.5)/(2.154^(1/3)]=   3.38
Rainfall intensity (I) =   9.328(In/Hr) for a   50.0 year storm
Effective runoff coefficient used for area (Q=KCIA) is C = 0.820
Subarea runoff =   0.566(CFS)
Total initial stream area =   0.074(Ac.)

++
Process from Point/Station   29.000 to Point/Station   30.000
**** IRREGULAR CHANNEL FLOW TRAVEL TIME ****
_____
Estimated mean flow rate at midpoint of channel =   1.263(CFS)
Depth of flow =   0.065(Ft.), Average velocity =   1.182(Ft/s)
       ******* Irregular Channel Data ***********

```
Information entered for subchannel number 1 :
Point number      'X' coordinate     'Y' coordinate
       1              0.00              0.20
       2             50.00              0.00
       3            100.00              0.20
Manning's 'N' friction factor =   0.013
-----------------------------------------------------------------
Sub-Channel flow  =      1.263(CFS)
  '     '       flow top width =     32.697(Ft.)
  '     '    velocity=    1.182(Ft/s)
  '     '       area =      1.069(Sq.Ft)
  '     '       Froude number =     1.152

Upstream point elevation =   658.800(Ft.)
Downstream point elevation =   657.400(Ft.)
Flow length =   137.000(Ft.)
Travel time  =    1.93 min.
Time of concentration =    5.31 min.
Depth of flow =   0.065(Ft.)
Average velocity =   1.182(Ft/s)
Total irregular channel flow =     1.263(CFS)
Irregular channel normal depth above invert elev. =   0.065(Ft.)
Average velocity of channel(s) =   1.182(Ft/s)
 Adding area flow to channel
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
[COMMERCIAL area type                        ]
(General Commercial    )
Impervious value, Ai = 0.850
Sub-Area C Value = 0.820
Rainfall intensity =      6.968(In/Hr) for a    50.0 year storm
Effective runoff coefficient used for total area
(Q=KCIA) is C = 0.820  CA =      0.269
Subarea runoff =      1.308(CFS) for      0.254(Ac.)
Total runoff =      1.874(CFS)       Total area =       0.328(Ac.)
Depth of flow =   0.076(Ft.), Average velocity =   1.304(Ft/s)


++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++
Process from Point/Station       30.000 to Point/Station       31.000
**** IRREGULAR CHANNEL FLOW TRAVEL TIME ****
________________________________________________________________________
Estimated mean flow rate at midpoint of channel =      1.966(CFS)
Depth of flow =   0.112(Ft.), Average velocity =   2.865(Ft/s)
       ******* Irregular Channel Data ***********
-----------------------------------------------------------------
Information entered for subchannel number 1 :
Point number      'X' coordinate     'Y' coordinate
       1              0.00              0.50
       2              0.50              0.00
       3              6.50              0.00
       4              7.00              0.50
Manning's 'N' friction factor =   0.013
-----------------------------------------------------------------
Sub-Channel flow  =      1.966(CFS)
  '     '       flow top width =      6.225(Ft.)
  '     '    velocity=    2.865(Ft/s)
  '     '       area =      0.686(Sq.Ft)
  '     '       Froude number =     1.521

Upstream point elevation =   657.400(Ft.)
Downstream point elevation =   656.600(Ft.)
Flow length =    66.000(Ft.)
Travel time  =    0.38 min.
Time of concentration =    5.70 min.
Depth of flow =   0.112(Ft.)
Average velocity =   2.865(Ft/s)
Total irregular channel flow =     1.966(CFS)
Irregular channel normal depth above invert elev. =   0.112(Ft.)
```

```
Average velocity of channel(s) =   2.865(Ft/s)
 Adding area flow to channel
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
[COMMERCIAL area type                        ]
(General Commercial    )
Impervious value, Ai = 0.850
Sub-Area C Value = 0.820
Rainfall intensity =      6.661(In/Hr) for a    50.0 year storm
Effective runoff coefficient used for total area
(Q=KCIA) is C = 0.820  CA =      0.295
Subarea runoff =      0.092(CFS) for      0.032(Ac.)
Total runoff =      1.966(CFS)       Total area =       0.360(Ac.)
Depth of flow =   0.112(Ft.), Average velocity =   2.865(Ft/s)
End of computations, total study area =           0.360 (Ac.)
```

San Diego County Rational Hydrology Program

CIVILCADD/CIVILDESIGN Engineering Software,(c)1991-2004 Version 7.4

Rational method hydrology program based on
San Diego County Flood Control Division 2003 hydrology manual
        Rational Hydrology Study   Date: 04/02/13

Outfall D
Basin E1
2 Year Rainfall Event

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

Program License Serial Number 4012

Rational hydrology study storm event year is   2.0
English (in-lb) input data Units used

Map data precipitation entered:
6 hour, precipitation(inches) = 1.550
24 hour precipitation(inches) = 2.400
P6/P24 =   64.6%
San Diego hydrology manual 'C' values used

++
Process from Point/Station   28.000 to Point/Station   32.000
**** 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
[COMMERCIAL area type   ]
(General Commercial   )
Impervious value, Ai = 0.850
Sub-Area C Value = 0.820
Initial subarea total flow distance =   83.000(Ft.)
Highest elevation = 661.100(Ft.)
Lowest elevation = 658.300(Ft.)
Elevation difference =   2.800(Ft.) Slope = 3.373 %
INITIAL AREA TIME OF CONCENTRATION CALCULATIONS:
The maximum overland flow distance is 85.00 (Ft)
for the top area slope value of   3.37 %, in a development type of
 General Commercial
In Accordance With Figure 3-3
Initial Area Time of Concentration =   3.10 minutes
TC = [1.8*(1.1-C)*distance(Ft.)^.5)/(% slope^(1/3)]
TC = [1.8*(1.1-0.8200)*(85.000^.5)/(3.373^(1/3)]=   3.10
Rainfall intensity (I) =   5.561(In/Hr) for a   2.0 year storm
Effective runoff coefficient used for area (Q=KCIA) is C = 0.820
Subarea runoff =   0.360(CFS)
Total initial stream area =   0.079(Ac.)
End of computations, total study area =   0.079 (Ac.)

San Diego County Rational Hydrology Program

CIVILCADD/CIVILDESIGN Engineering Software,(c)1991-2004 Version 7.4

Rational method hydrology program based on
San Diego County Flood Control Division 2003 hydrology manual
        Rational Hydrology Study   Date: 04/02/13

Outfall D
Basin E1
50 Year Rainfall Event

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

Program License Serial Number 4012

Rational hydrology study storm event year is   50.0
English (in-lb) input data Units used

Map data precipitation entered:
6 hour, precipitation(inches) = 2.750
24 hour precipitation(inches) = 5.750
P6/P24 =   47.8%
San Diego hydrology manual 'C' values used

++
Process from Point/Station   28.000 to Point/Station   32.000
**** 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
[COMMERCIAL area type   ]
(General Commercial   )
Impervious value, Ai = 0.850
Sub-Area C Value = 0.820
Initial subarea total flow distance =   83.000(Ft.)
Highest elevation = 661.100(Ft.)
Lowest elevation = 658.300(Ft.)
Elevation difference =   2.800(Ft.) Slope = 3.373 %
INITIAL AREA TIME OF CONCENTRATION CALCULATIONS:
The maximum overland flow distance is 85.00 (Ft)
for the top area slope value of   3.37 %, in a development type of
 General Commercial
In Accordance With Figure 3-3
Initial Area Time of Concentration =   3.10 minutes
TC = [1.8*(1.1-C)*distance(Ft.)^.5)/(% slope^(1/3)]
TC = [1.8*(1.1-0.8200)*(85.000^.5)/(3.373^(1/3)]=   3.10
Rainfall intensity (I) =   9.866(In/Hr) for a   50.0 year storm
Effective runoff coefficient used for area (Q=KCIA) is C = 0.820
Subarea runoff =   0.639(CFS)
Total initial stream area =   0.079(Ac.)
End of computations, total study area =   0.079 (Ac.)

San Diego County Rational Hydrology Program

CIVILCADD/CIVILDESIGN Engineering Software,(c)1991-2004 Version 7.4

Rational method hydrology program based on
San Diego County Flood Control Division 2003 hydrology manual
Rational Hydrology Study Date: 04/02/13

Outfall E
Basin B1
2 Year Rainfall Event

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

Program License Serial Number 4012

Rational hydrology study storm event year is 2.0
English (in-lb) input data Units used

Map data precipitation entered:
6 hour, precipitation(inches) = 1.550
24 hour precipitation(inches) = 2.400
P6/P24 = 64.6%
San Diego hydrology manual 'C' values used

++

Process from Point/Station 33.000 to Point/Station 34.000
**** 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
[COMMERCIAL area type]
(General Commercial)
Impervious value, Ai = 0.850
Sub-Area C Value = 0.820
Initial subarea total flow distance = 67.000(Ft.)
Highest elevation = 661.700(Ft.)
Lowest elevation = 660.200(Ft.)
Elevation difference = 1.500(Ft.) Slope = 2.239 %
INITIAL AREA TIME OF CONCENTRATION CALCULATIONS:
The maximum overland flow distance is 75.00 (Ft)
for the top area slope value of 2.24 %, in a development type of
 General Commercial
In Accordance With Figure 3-3
Initial Area Time of Concentration = 3.34 minutes
TC = [1.8*(1.1-C)*distance(Ft.)^.5)/(% slope^(1/3)]
TC = [1.8*(1.1-0.8200)*(75.000^.5)/(2.239^(1/3)]= 3.34
Rainfall intensity (I) = 5.301(In/Hr) for a 2.0 year storm
Effective runoff coefficient used for area (Q=KCIA) is C = 0.820
Subarea runoff = 0.204(CFS)
Total initial stream area = 0.047(Ac.)
End of computations, total study area = 0.047 (Ac.)

San Diego County Rational Hydrology Program

CIVILCADD/CIVILDESIGN Engineering Software,(c)1991-2004 Version 7.4

Rational method hydrology program based on
San Diego County Flood Control Division 2003 hydrology manual
Rational Hydrology Study Date: 04/02/13

Outfall E
Basin B1
50 Year Rainfall Event

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

Program License Serial Number 4012

Rational hydrology study storm event year is 50.0
English (in-lb) input data Units used

Map data precipitation entered:
6 hour, precipitation(inches) = 2.750
24 hour precipitation(inches) = 5.750
P6/P24 = 47.8%
San Diego hydrology manual 'C' values used

++

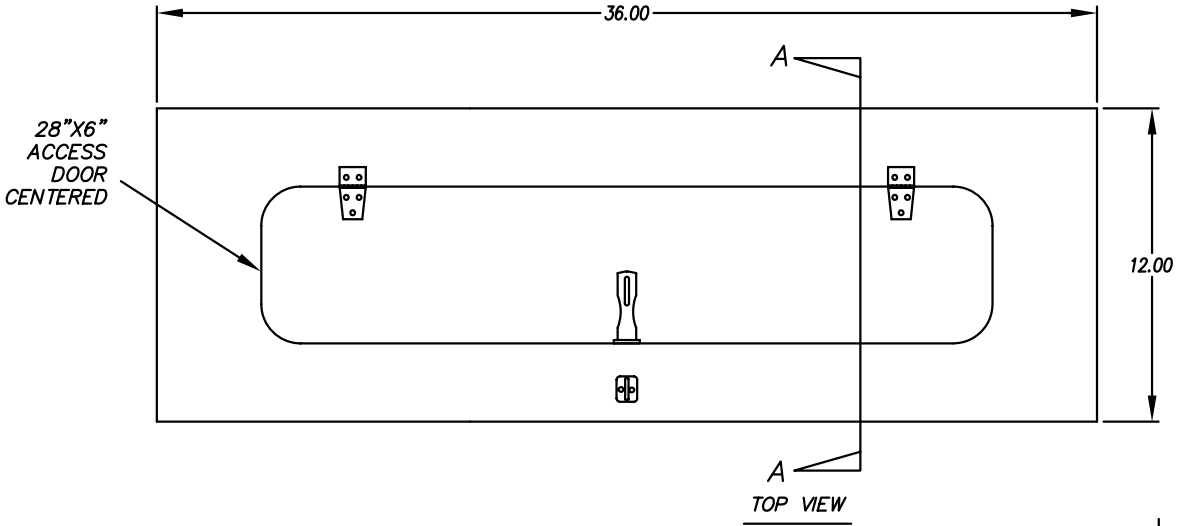
Process from Point/Station 33.000 to Point/Station 34.000
**** INITIAL AREA EVALUATION ****

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
[COMMERCIAL area type]
(General Commercial)
Impervious value, Ai = 0.850
Sub-Area C Value = 0.820
Initial subarea total flow distance = 67.000(Ft.)
Highest elevation = 661.700(Ft.)
Lowest elevation = 660.200(Ft.)
Elevation difference = 1.500(Ft.) Slope = 2.239 %
INITIAL AREA TIME OF CONCENTRATION CALCULATIONS:
The maximum overland flow distance is 75.00 (Ft)
for the top area slope value of 2.24 %, in a development type of
 General Commercial
In Accordance With Figure 3-3
Initial Area Time of Concentration = 3.34 minutes
TC = [1.8*(1.1-C)*distance(Ft.)^.5)/(% slope^(1/3)]
TC = [1.8*(1.1-0.8200)*(75.000^.5)/(2.239^(1/3)]= 3.34
Rainfall intensity (I) = 9.406(In/Hr) for a 50.0 year storm
Effective runoff coefficient used for area (Q=KCIA) is C = 0.820
Subarea runoff = 0.362(CFS)
Total initial stream area = 0.047(Ac.)
End of computations, total study area = 0.047 (Ac.)

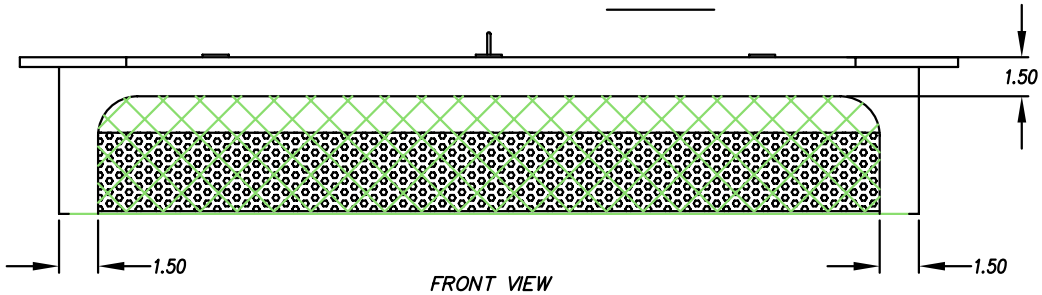
ATTACHMENT F

BIO CLEAN FLUME FILTER

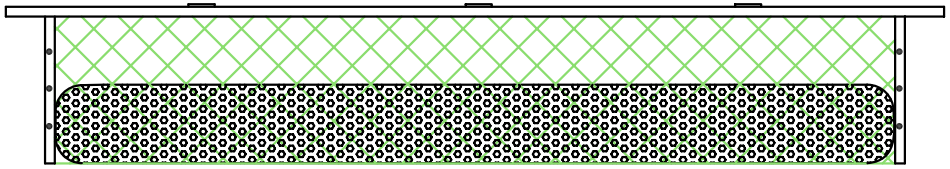
BIO CLEAN FLUME FILTER – 36 INCH – MEDIA TYPE



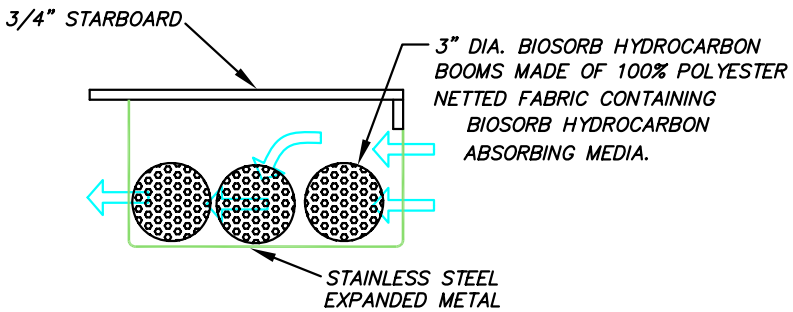
TOP VIEW



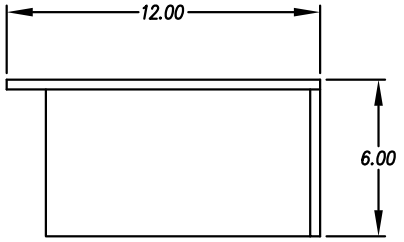
FRONT VIEW



REAR VIEW



SECTION A–A



SIDE VIEW

5 YEAR MANUFACTURERS WARRANTY

PATENTED

ALL FILTER SCREENS ARE STAINLESS STEEL

TREATMENT FLOW RATE = .78 CFS

TREATMENT FLOW RATE = .26 CFS PER LINEAR FOOT FLOW RATE ASSUMES 50% BLOCKAGE

P 760–433–7640 F 760–433–3176

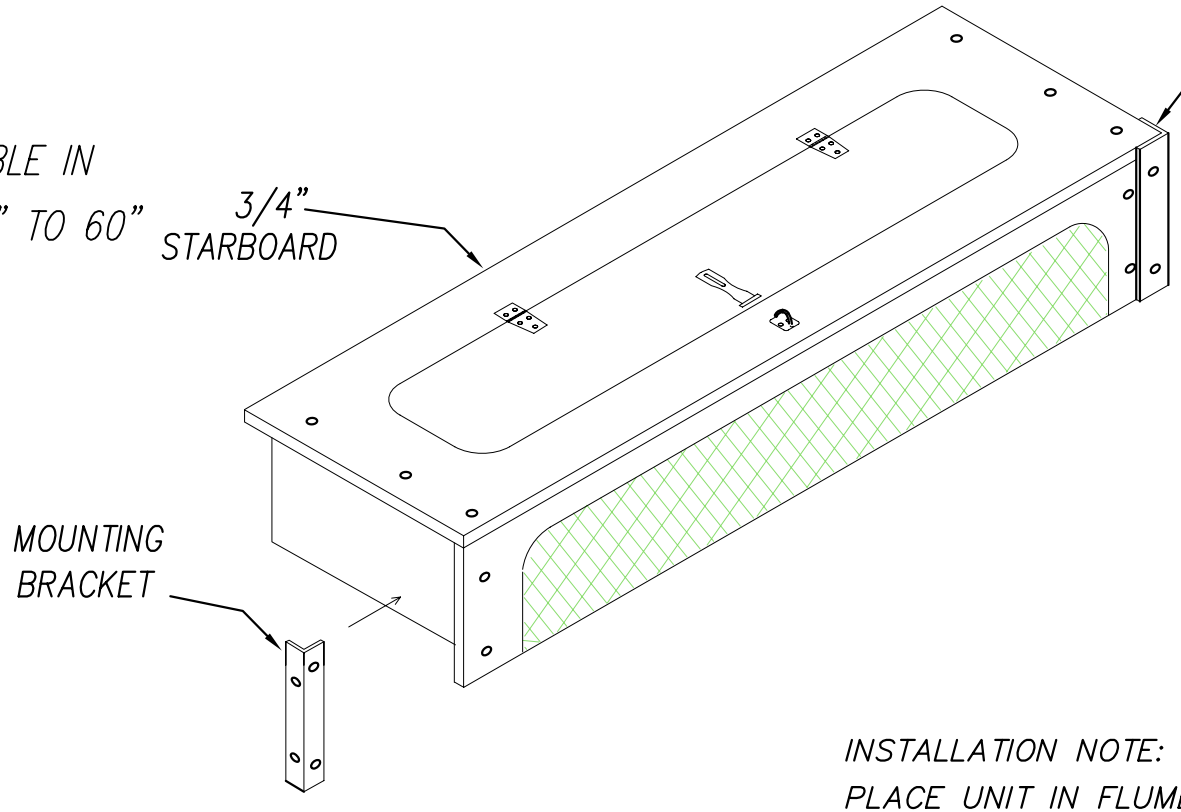
EMAIL: info@biocleanenvironmental.net

BIO CLEAN® ENVIRONMENTAL SERVICES, INC.

SIZE	FSCM NO.	DWG NO. BIO CLEAN FLUME FILTER 36" – MEDIA TYPE	REV
SCALE N.T.S.		SHEET 1 OF 2	

BIO CLEAN FLUME FILTER – 36 INCH – MEDIA TYPE

THIS FILTER IS AVAILABLE IN SIZES RANGING FROM 12" TO 60"



TREATMENT FLOW RATE = .78 CFS

TREATMENT FLOW RATE = .26 CFS PER LINEAR FOOT FLOW RATE ASSUMES 50% BLOCKAGE

INSTALLATION NOTE:

PLACE UNIT IN FLUME AND MARK CONCRETE FOR MOUNTING ANGLES. INSTALL ANGLES, THEN PLACE UNIT ON MOUNTING ANGLES AND INSTALL WITH 2" X #8 SCREWS.

THE BIOSORB MATERIAL IS MADE OF A PROPRIETARY POLYMER BASED BEADS. THE MATERIAL IS USUALLY CONTAINED WITHIN BOOMS OR POUCHES. THE BOOMS AND POUCHES ARE MADE OF 100% POLYESTER NETTED FABRIC WITH SIEVE OPENINGS 1mm, OPEN AREA RATIO IS APPROXIMATELY 67%.
THE BIOSORB AND NETTING ARE OF SUFFICIENT STRENGTH TO SUPPORT WATER, SEDIMENT, AND DEBRIS LOADS WHEN THE MEDIA IS AT MAXIMUM ABSORPTION CAPACITY, WITH NO SLIPPAGE, BREAKING, OR TEARING. THE BIOSORB HAS BEEN TESTED THROUGH RIGOROUS FLOW AND LOADING CONDITIONS.
THE BIOSORB IS DESIGNED TO CAPTURE HIGH LEVELS OF HYDROCARBONS INCLUDING BUT NOT LIMITED TO OILS AND GREASE, GASOLINE, DIESEL, AND PAHS. THE GRANULE NATURE OF THE MATERIAL, WITH APPROXIMATELY 2000MM SIZED GRANULES ALSO HAS THE PHYSICAL ABILITY TO BLOCK AND FILTER TRASH AND LITTER, GRASS AND FOLIAGE, AND SEDIMENTS.

P 760-433-7640 F 760-433-3176
EMAIL: info@biocleanenvironmental.net

BIO CLEAN ENVIRONMENTAL SERVICES, INC.

SIZE	FSCM NO.	DWG NO. BIO CLEAN FLUME FILTER 36" – MEDIA TYPE	REV
SCALE N.T.S.		SHEET 2 OF 2	