Preliminary Drainage Study

for

Shady Oak

Project No.:

PDS2016-TM-5614

PDS2016-REZ-16-005

PDS2016-STP-16-019

Prepared For:

Touchstone Communities

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Prepared By:

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16885 Via Del Campo Ct, Suite 304, SD, CA 92127
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TSAC Job No. 2142

Declaration of Responsible Charge

I hereby declare that I am the Civil 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 code, and that the design is consistent with current standards.

I understand that the check of the Drainage Report by the County of San Diego is confined to a review only and does not relieve me, as Engineer of Work, of my responsibilities for project design.

7-5-17

Stephen J. McPartland RCE 35109 Date

TABLE OF CONTENTS

Tables:

Appendices:

Map Pockets:

INTRODUCTION 1.0

The project site fronts Mirar De Valle Road and is located approximately 600 feet west of Valley Center Road and is bounded by open space and low density residential from the south and west. Refer to the Vicinity Map shown at the end of this section. The site is characterized by gentle and uniform topography with elevations ranging from 1316 to 1297 feet above mean sea level.

The site is relatively flat with gentle to moderate sloping towards the northeast. The project proposes to develop a vacant lot into a residential subdivision consisting of 47 residential lots, private internal streets,alleys and associated offsite improvements. Offsite improvements include the removal of existing AC berm and portion of AC pavement fronting the property on Mirar De Valle. Curb and gutter is proposed in the frontage along with a 5' decomposed granite pathway. Old Mirar De Valle is designed as a secondary fire access plan and is only to be constructed if Street A of Park Circle TM 5603 is not constructed prior to Shady Oak project.

Shady Oak is located within Valley Center Hydrologic Sub-Area (HSA 903.14), which is part of the Lower San Luis Hydrologic Area (HA 903.10) and San Luis Rey Hydrologic Unit (HU 903.00).

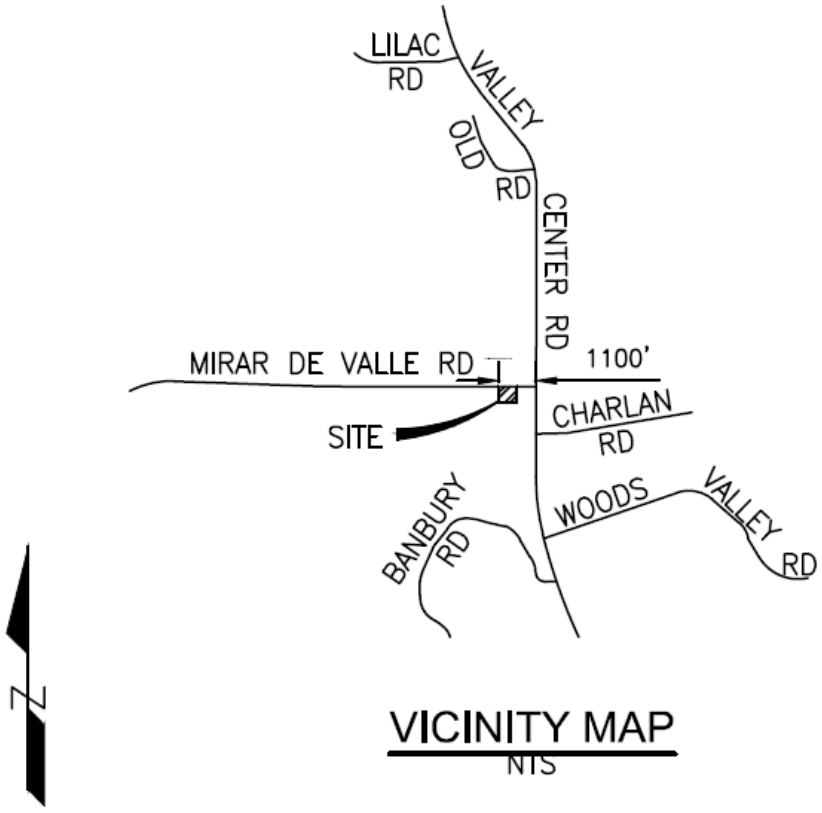
In Pre-project condition, a portion of the hillside south of the project sheet flows onto the site and confluences with site flows in a northeasterly direction, eventually converging with surrounding flows associated with Mirar De Valle and low density residential areas to the south. Flows discharge to the north of Mirar De Valle via a 3- 8' (W) x 2' (H) RCB constructed as part of Mirar de Valle Improvements (CG 4307). Runoff continues its course north eventually discharging into Moosa Canyon Creek. Flows continue west on Moosa Canyon Creek eventually joining with San Luis Rey River which ultimately outlets to the Pacific Ocean.

In the Post-project condition, drainage areas and patterns will not be altered or diverted. Offsite flows will be bypassed and not comingle with project runoff. Storm water runoff from the project will flow into Treatment Control BMPs along the sites frontage. The increase of impervious surfaces will generate additional runoff. However, through the use of Low Impact Development (LID) practices, Treatment Control BMPs and discharge limiting orifices, flows leaving the site will be detained to be equal or less than pre-project condition.

STORM WATER PLAN REQUIREMENTS 1.1

The site design BMPs, source control and treatment control BMPs utilized to address water quality and hydromodification requirements have been designed in accordance to the February 2016 County of San Diego BMP Design Manual. Refer to the Storm Water Quality Management Plan (SWQMP) titled, "Major Storm Water Quality Management Plan (Major SWQMP) for Shady Oak", prepared by TSAC Engineering.

VICINITY MAP 1.2



HYDROLOGIC METHODOLOGY AND CRITERIA 2.0

This study has been prepared consistent with current County of San Diego's ordinances and procedures. All components of the study are designed to convey storm water based on a 100-year flood event. The anticipated storm runoff has been calculated using the Rational Method based on the 2003 County of San Diego Hydrology Manual.

The Rational Method (RM) is a mathematical formula used to determine the maximum runoff rate from a given rainfall. It has particular application in urban storm drainage, where it is used to estimate peak runoff rates from small urban and rural watersheds for the design of storm drains and small drainage structures.

The RM formula estimates the peak rate of runoff at any location in a watershed as a function of the drainage area (A), runoff coefficient (C), and rainfall intensity (I) for a duration equal to the time of concentration (Tc), which is the time required for water to flow from the most remote point of the basin to the location being analyzed. The RM formula is expressed as follows:

Q = C I A

Q = peak discharge, cubic feet per second (cfs)

C = runoff coefficient, based on San Diego County Hydrology Manual (Refer to Appendix A)

I = Rainfall intensity (in/hr) (Refer to Appendix A)

A = Drainage Area, (Acres)

The RM formula is based on the assumption that for constant rainfall intensity, the peak discharge rate at a point will occur when the raindrop that falls at the most upstream point in the tributary drainage basin arrives at the point of interest.

Runoff coefficients (C) based on land use and soil types were obtained from the San Diego County Hydrology Manual, Table 3-1. Soil types were determined from the Hydrology Soils

Map provided in Appendix A as well as the US Department of Agriculture (USDA) Soil Survey program. This runoff coefficient was then multiplied by the percentage of total area (A) included in that class.

The rainfall intensity (I) can be determined from the County of San Diego Intensity-Duration Design Chart. The 6-hour storm rainfall amount (P6) and 24-hour storm rainfall amount (P24), were determined from the isopluvial maps provided in Appendix A. Intensity can also be calculated using the following equation:

$$\mathbf{I = 7.44 (P_6) (D^{-.645})}$$

I = Intensity (inches/hour)

P_6 = 6 Hour Precipitation (inches)

D = Duration in minutes (use Tc)

The Time of Concentration (Tc) is the time required for runoff to flow from the most remote part of the drainage area to the point of interest. The Tc is composed of two components: initial time of concentration (Ti) and travel time (Tt). The Ti is the time required for runoff to travel across the surface of the most remote subarea in the study, or "initial subarea." The Tt is the time required for the runoff to flow in a watercourse or series of watercourses from the initial subarea to the point of interest. For the RM, the Tc at any point within the drainage area is given by:

$$Tc = Ti + Tt$$

The Civilcadd/Civil Design Engineering Software, based on the 2003 County of San Diego Hydrology Manual, was used to determine on-site 100-year, 6-hour peak flow rates.

The Civil Design Hydrology Program is a computer-aided design program in which the user develops a node-link model of the watershed. The hydrologic model is developed by creating independent node-link models of each interior drainage basin and linking these sub-models together at confluence points. The program has the capability to perform calculations for 11

hydrologic processes. These processes are assigned code numbers that appear in the results. The code numbers and their significance are as follows:

Subarea Hydrologic Processes (Codes)

Code 1: Initial subarea input, top of stream

Code 2: Street flow thru subarea, includes subarea runoff

Code 3: Addition of runoff from subarea to stream

Code 4: Street Inlet + parallel street & pipe flow + area

Code 5: Pipeflow travel time (program estimated pipesize)

Code 6: Pipeflow travel time (user specified pipesize)

Code 7: Improved channel travel time (open or box)

Code 8: Irregular channel travel time

Code 9: User specified entry of data at a point

Code 10: Confluence at downstream point in current stream

Code 11: Confluence at main stream

HYDROLOGIC RESULTS 3.0

The 100-year 6-hour peak flow rates for the pre- and post-project conditions can be found in Table 3.1. Drainage Basin boundaries, and drainage areas can be found on the workmaps titled,"Pre-Project Hydrologic Workmap for Shady Oak" and "Post-Project Hydrologic Workmap for Shady Oak", located in Map Pocket 1 and 2.

Pre-project and post-project hydrologic analyses have been performed for the 100-year storm event. For the purpose of this drainage report one major drainage basin has been identified,

herein referred to as Drainage Basin 100. The proposed project will mimic the existing drainage patterns, which flow in a northeasterly direction. Onsite runoff will sheet flow northerly into Biofiltration Basins proposed along the northerly portion of the site. Once treated, the flows will be piped into a proposed curb inlet on Mirar de Valle used to capture offsite flows.The mainline will continue its course east until discharging into a channel proposed with the Park Circle Project, County of San Diego Tract No. 5603.

Table 3.1 summarizes the results of the 100-year pre-project and post-project hydrologic analyses for Shady Oak.

Table 3.1: Summary of Pre- and Post-Project 100-Year Peak Discharge Rates

	Node Number	Area (acres)	Q_{100} (cfs)	Q_{100} with mitigation (cfs)	T_c (min)	I (in/hr)
Pre-Project/ Post-Project (undetained)	105/105	31.8/31.8	63.9 /66.1	63.9	14.5/14.5	5.0/5.0

CONCLUSION 4.0

This preliminary drainage report presents the 100-year, 6-hour post-project hydrologic analyses for the Shady Oak Project. The post project condition peak discharge rates were determined using the Rational Method based on the hydrologic methodology and criteria described in the San Diego County Hydrology Manual, dated June 2003.

As designed, the development will not alter the natural drainage path or divert any water from the existing natural conditions or drainage boundaries. Runoff from the Shady Oak site will sheet flow into a biofiltration basins along the northerly portion of the site. Street A “Road 19” will be directed to the biofiltration basins via reverse curb outlet and ditch for treatment.

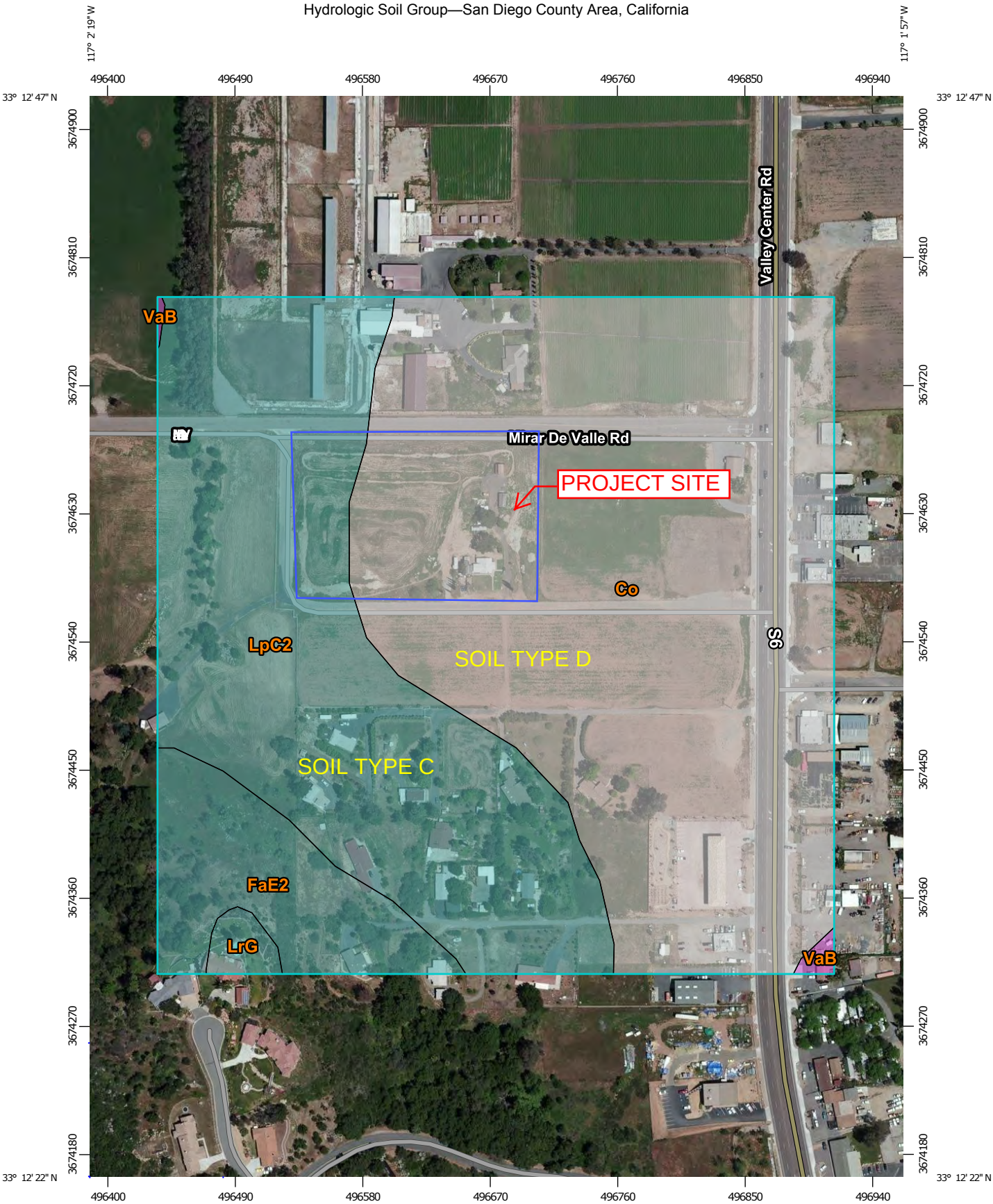
Old Mirar De Valle is designed as a secondary fire access plan and is only to be constructed if Street A of Park Circle TM 5603 is not constructed prior to Shady Oak project. A biofiltration basin has been designed for this alternative.

On and offsite runoff ultimately discharge to the Moosa Canyon Creek. Once treated, onsite flows will be piped into a proposed curb inlet on Mirar de Valle used to capture offsite flows.

The mainline will continue its course east until discharging into a channel associated with the Park Circle Project, County of San Diego Tract No. 5603.
The basins have been designed to meet the Water Quality and Hydromodification standards. By treating and detaining flows on-site, downstream impacts such as erosion and sedimentation will be nonexistent.

The pre and post project drainage area is 31.8 Acres. In the pre-project condition, 63.9 CFS discharge into the property north of Mirar de Valle via 3-2' (h) x 8' (w) box culverts. In the post project condition, 63.9 CFS (66.1 CFS undetained) will discharge into the box culverts, which have capacity for 128.5 CFS as shown on the As-Builts (CG 4307, TM 5039-2). The increase in runoff will be mitigated by detaining within the biofiltration basins. In order to detain 2.2 cfs, 0.06 acre-feet (2613 ft^3) of volume is required. This will be accomplished by allowing 6" of ponding above the Hydromodification volume within the biofiltration basins. Detailed outlet works will be designed in the Final Engineering stage.
The project site is located south of Moosa Canyon Creek and out of the 100-year flood hazard area as shown on the FIRM provided in Appendix A.

Appendix A: Hydrologic Reference Material


117° 2' 19" W
117° 1' 57" W
496400
496490
496580
496670
496760
496850
496940
33° 12' 47" N
33° 12' 22" N
3674900
3674810
3674720
3674630
3674540
3674450
3674360
3674270
3674180
Valley Center Rd
Mirar De Valle Rd
PROJECT SITE
VaB
Co
LpC2
SOIL TYPE D
SOIL TYPE C
FaE2
LrG
VaB
S6
Map Scale: 1:3,700 if printed on A portrait (8.5" x 11") sheet.
N
Meters
0 50 100 200 300
Feet
0 150 300 600 900
Map projection: Web Mercator Corner coordinates: WGS84 Edge tics: UTM Zone 11N WGS84

MAP LEGEND

Area of Interest (AOI)

- Area of Interest (AOI)

Soils

Soil Rating Polygons

- A
- A/D
- B
- B/D
- C
- C/D
- D
- Not rated or not available

Soil Rating Lines

- A
- A/D
- B
- B/D
- C
- C/D
- D
- Not rated or not available

Soil Rating Points

- A
- A/D
- B
- B/D
- C
- C/D
- D
- Not rated or not available

Water Features

- Streams and Canals

Transportation

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

Background

- Aerial Photography

MAP INFORMATION

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

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

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

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

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

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

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

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

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

Date(s) aerial images were photographed: Data not available.

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

Hydrologic Soil Group

Hydrologic Soil Group— Summary by Map Unit — San Diego County Area, California (CA638)				
Map unit symbol	**Map unit name**	**Rating**	**Acres in AOI**	**Percent of AOI**
Co	Clayey alluvial land		32.0	56.7%
FaE2	Fallbrook sandy loam, 15 to 30 percent slopes, eroded	C	4.5	7.9%
LpC2	Las Posas fine sandy loam, 5 to 9 percent slopes, erode d	C	19.3	34.2%
LrG	Las Posas stony fine sandy loam, 30 to 65 percent slope s	C	0.5	0.8%
VaB	Visalia sandy loam, 2 to 5 percent slopes	A	0.2	0.3%
Totals for Area of Interest			**56.4**	**100.0%**

Description

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

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

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

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

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

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

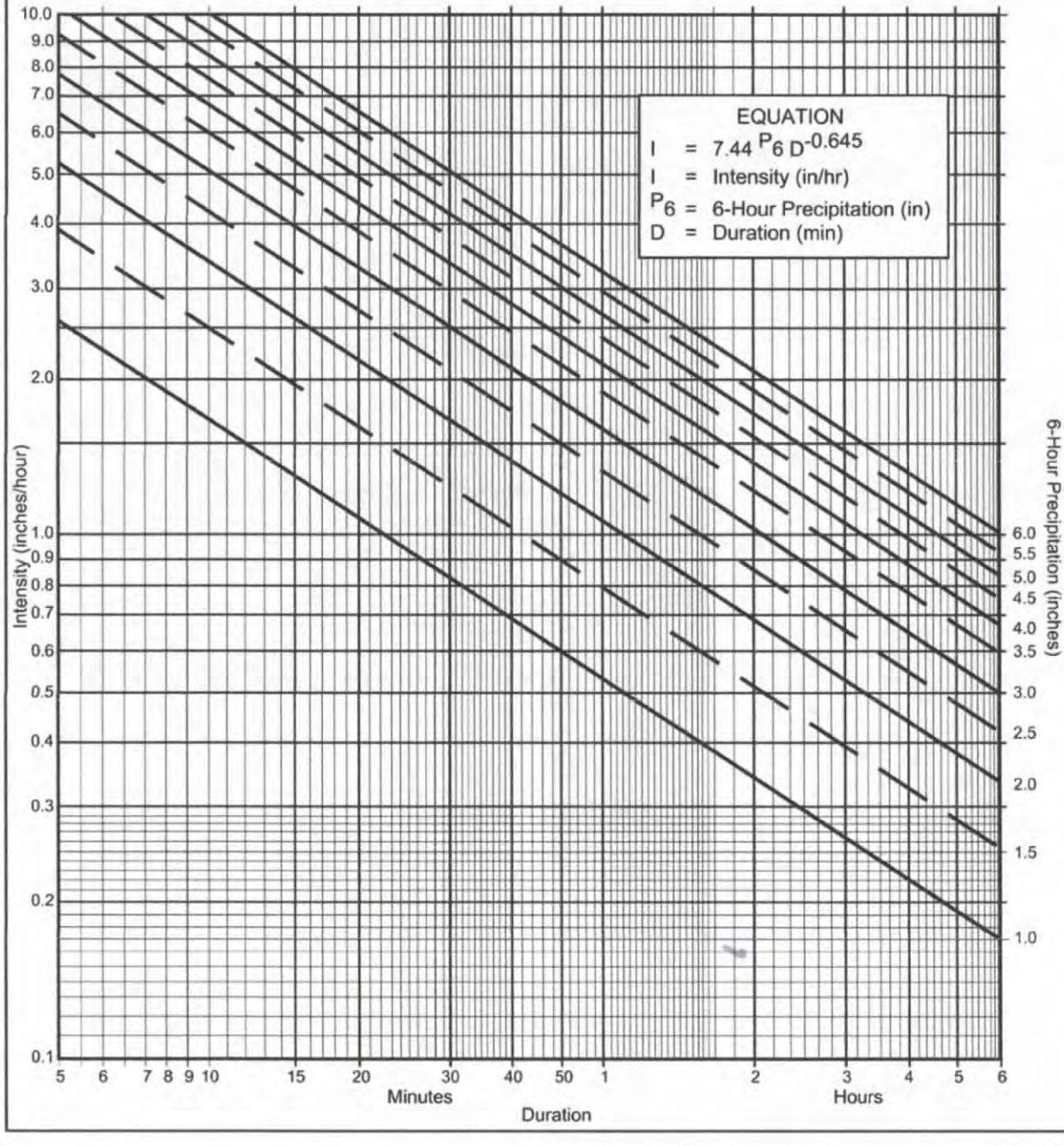
If a soil is assigned to a dual hydrologic group (A/D, B/D, or C/D), the first letter is for drained areas and the second is for undrained areas. Only the soils that in their natural condition are in group D are assigned to dual classes.

Rating Options

Aggregation Method: Dominant Condition

Component Percent Cutoff: *None Specified*

Tie-break Rule: Higher



Directions for Application:

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

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

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

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

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

Application Form:

(a) Selected frequency 100 year

(b) P_6 = 3.75 in., P_{24} = 8.2, $\frac{P_6}{P_{24}}$ = 45.7 %(2)

(c) Adjusted P_6(2) = 3.75 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

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

4.1.2.1 Hydrologic Soil Group

Soil properties influence the relationship between rainfall and runoff since soils have differing rates of infiltration. Based on infiltration rates, the NRCS has divided soils into four hydrologic soil groups.

Group A

Soils have high infiltration rate when thoroughly wetted; chiefly deep, well-drained to excessively drained sand, gravel, or both. Rate of water transmission is high; thus runoff potential is low.

Group B

Soils have moderate infiltration rate when thoroughly wetted; chiefly soils that are moderately deep to deep, moderately well drained to well drained, and moderately coarse textured. Rate of water transmission is moderate.

Group C

Soils have slow infiltration rate when thoroughly wetted; chiefly soils that have a layer impeding downward movement of water, or moderately fine to fine textured soils that have a slow infiltration rate. Rate of water transmission is slow.

Group D

Soils have very slow infiltration rate when thoroughly wetted; chiefly clays that have a high shrink-swell potential, soils that have a high permanent water table, soils that have a claypan or clay layer at or near the surface, or soils that are shallow over nearly impervious material. Rate of water transmission is very slow.

A list of soils throughout San Diego County and their hydrologic classification is located on the map in Appendix A. Soil Survey maps can be obtained from local NRCS offices for use in estimating soil type. The NRCS maps are also available at the County of San Diego DPWFCS. Consideration should be given to the effects of urbanization on the

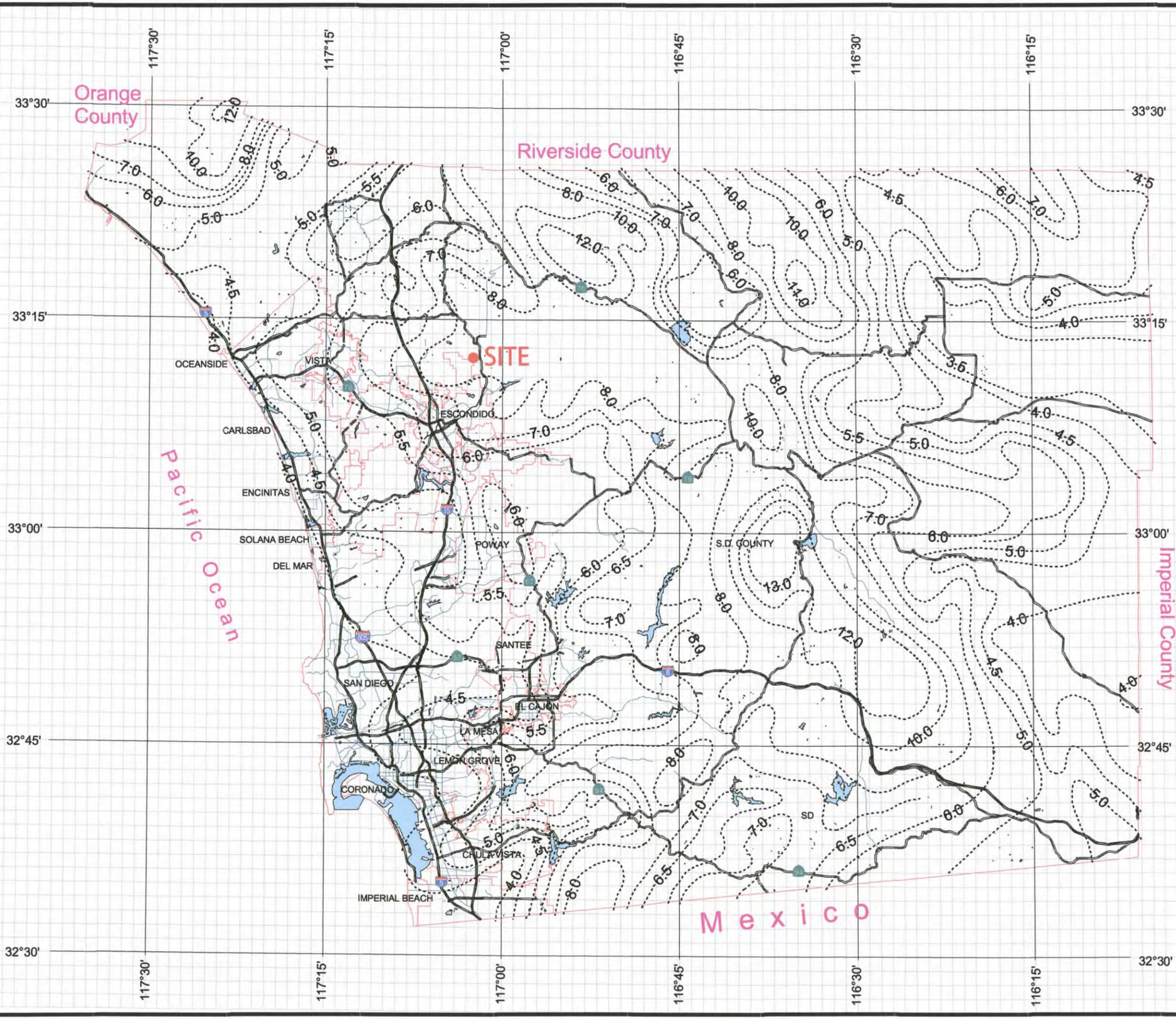
County of San Diego Hydrology Manual

Rainfall Isopluvials

100 Year Rainfall Event - 24 Hours

Isopluvial (inches)

P24 = 8.2"



DPW GIS — Department of Public Works Geographic Information Services

SanGIS — We Have San Diego Covered!

N
W E
S

3 0 3 Miles

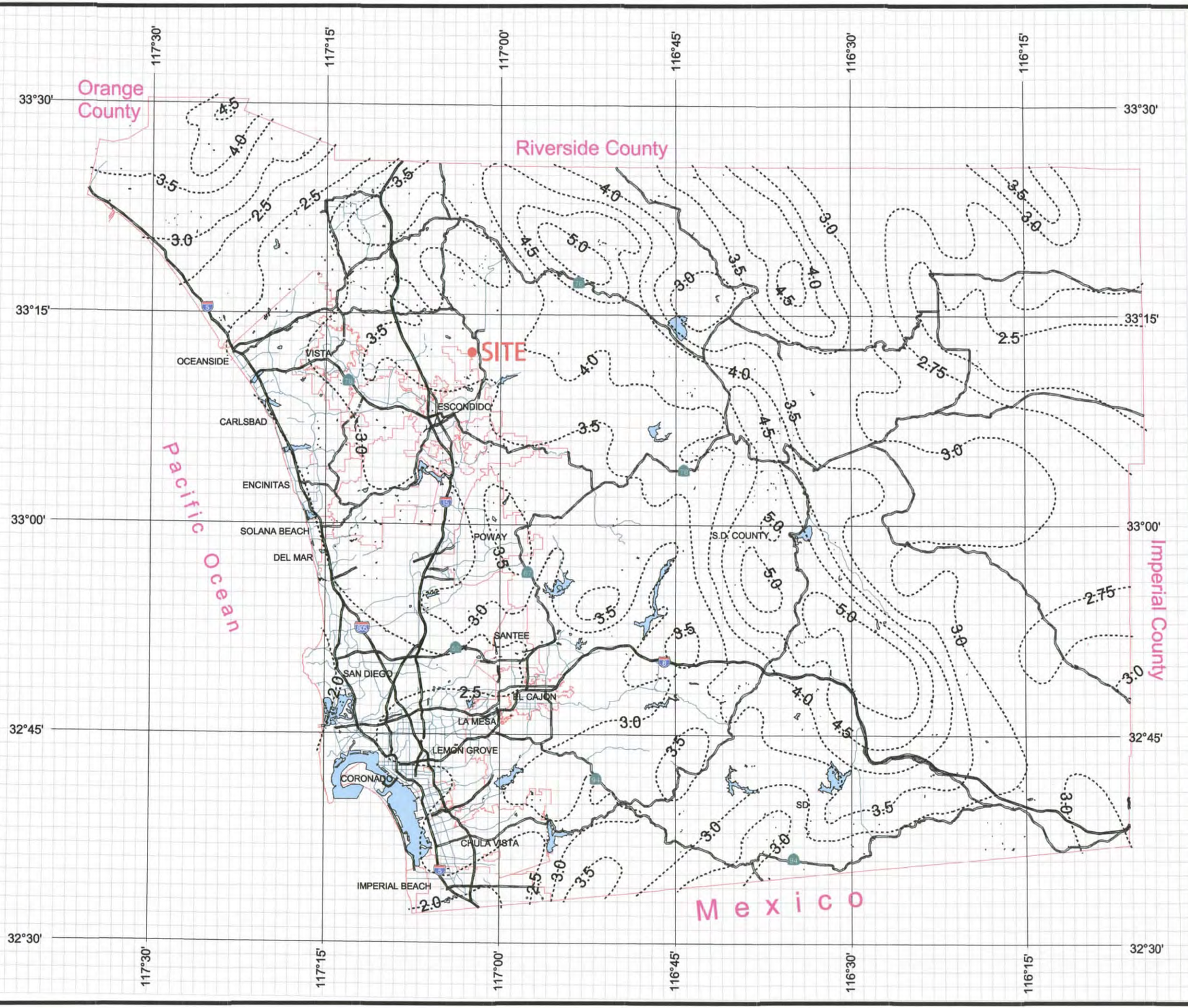
County of San Diego Hydrology Manual

Rainfall Isopluvials

100 Year Rainfall Event - 6 Hours

Isopluvial (inches)

P6 = 3.75"

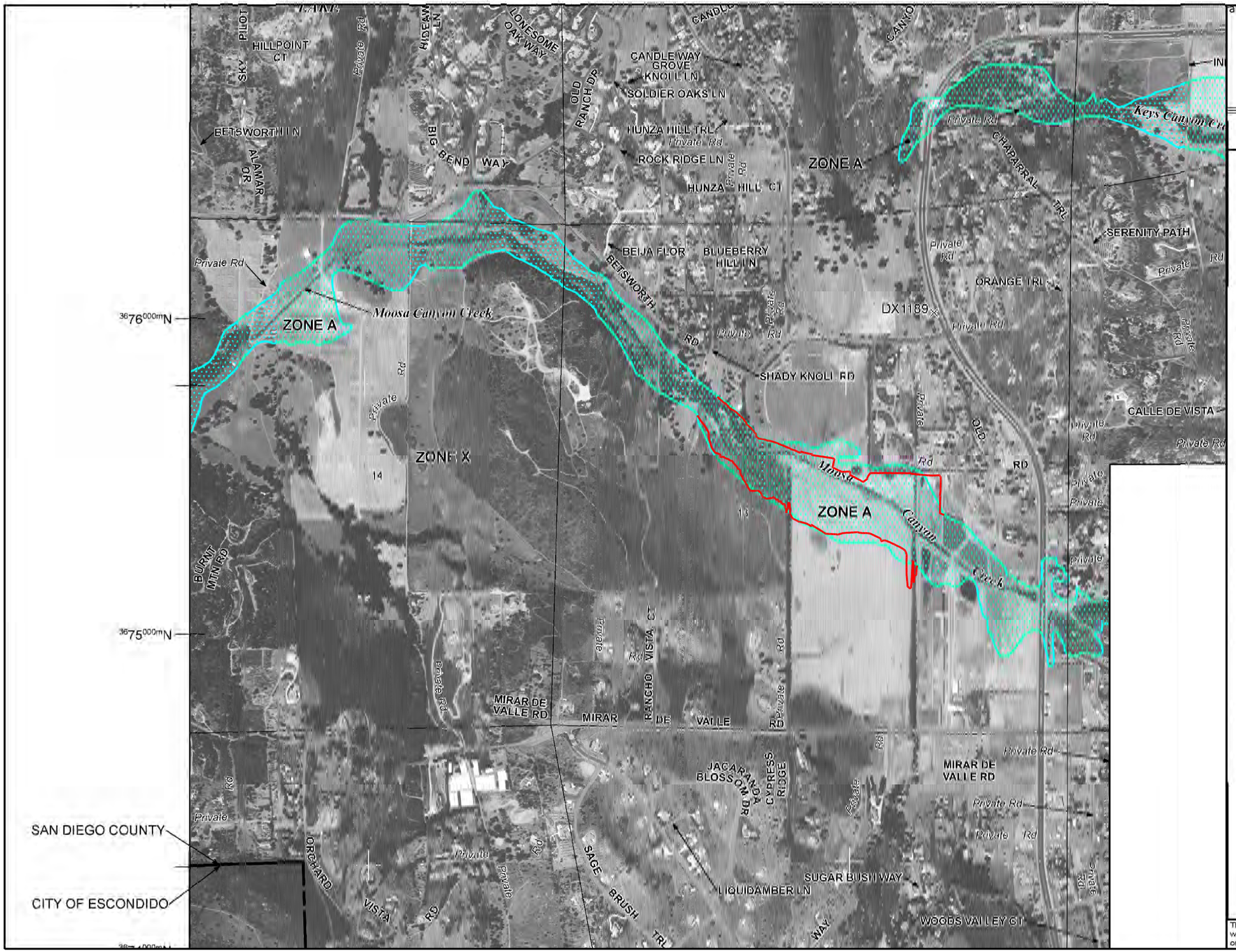


DPW GIS
Department of Public Works Geographic Information Services

SanGIS
We Have San Diego Covered!

N W E S

3 0 3 Miles



ance Program at 1-800-638-6620.

MAP SCALE 1" = 1000'

0 500 1,000 1,500 2,000 FEET

NFIP NATIONAL FLOOD INSURANCE PROGRAM

PANEL 0810G

FIRM

FLOOD INSURANCE RATE MAP

SAN DIEGO COUNTY, CALIFORNIA AND INCORPORATED AREAS

PANEL 810 OF 2375

(SEE MAP INDEX FOR FIRM PANEL LAYOUT)

CONTAINS:

COMMUNITY	NUMBER	PANEL	SUFFIX
ESCONDIDO, CITY OF	060290	0810	G
SAN DIEGO COUNTY	060284	0810	G

Notice to User: The **Map Number** shown below should be used when placing map orders; the **Community Number** shown above should be used on insurance applications for the subject community.

MAP NUMBER 06073C0810G

MAP REVISED MAY 16, 2012

Federal Emergency Management Agency

THE REVISED ZONE A FLOODPLAIN IS DELINEATED IN RED.

ANNOTATED FIRM

Appendix B: 100-Year Pre-Project Condition Hydrologic Output

San Diego County Rational Hydrology Program

CIVILCADD/CIVILDESIGN Engineering Software,(c)1991-2009 Version 7.8

Rational method hydrology program based on
San Diego County Flood Control Division 2003 hydrology manual
Rational Hydrology Study Date: 01/24/17

Shady Oak
Existing Conditions
Major Drainage Basin 100
100-Year Flow Rate

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

Program License Serial Number 6289

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

Map data precipitation entered:
6 hour, precipitation(inches) = 3.750
24 hour precipitation(inches) = 8.200
P6/P24 = 45.7%
San Diego hydrology manual 'C' values used

++
Process from Point/Station 100.000 to Point/Station 101.000
**** INITIAL AREA EVALUATION ****

Decimal fraction soil group A = 0.000
Decimal fraction soil group B = 0.000
Decimal fraction soil group C = 1.000
Decimal fraction soil group D = 0.000
[LOW DENSITY RESIDENTIAL]
(1.0 DU/A or Less)
Impervious value, Ai = 0.100
Sub-Area C Value = 0.360
Initial subarea total flow distance = 75.000(Ft.)
Highest elevation = 1508.000(Ft.)
Lowest elevation = 1502.000(Ft.)
Elevation difference = 6.000(Ft.) Slope = 8.000 %
INITIAL AREA TIME OF CONCENTRATION CALCULATIONS:
The maximum overland flow distance is 100.00 (Ft)
for the top area slope value of 8.00 %, in a development type of
1.0 DU/A or Less

```
In Accordance With Figure 3-3
Initial Area Time of Concentration =   6.66 minutes
TC = [1.8*(1.1-C)*distance(Ft.)^.5)/(% slope^(1/3)]
TC = [1.8*(1.1-0.3600)*( 100.000^.5)/(   8.000^(1/3)]=   6.66
Rainfall intensity (I) =      8.212(In/Hr) for a   100.0 year storm
Effective runoff coefficient used for area (Q=KCIA) is C = 0.360
Subarea runoff =      0.296(CFS)
Total initial stream area =        0.100(Ac.)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Process from Point/Station      101.000 to Point/Station      102.000
**** IMPROVED CHANNEL TRAVEL TIME ****
------------------------------------------------------------------------
Upstream point elevation =  1502.000(Ft.)
Downstream point elevation =  1330.000(Ft.)
Channel length thru subarea  =   845.000(Ft.)
Channel base width      =   25.000(Ft.)
Slope or 'Z' of left channel bank =   5.000
Slope or 'Z' of right channel bank =   5.000
Estimated mean flow rate at midpoint of channel =     13.964(CFS)
Manning's 'N'    = 0.035
Maximum depth of channel  =    4.000(Ft.)
Flow(q) thru subarea =     13.964(CFS)
Depth of flow =   0.119(Ft.), Average velocity =   4.570(Ft/s)
Channel flow top width =   26.194(Ft.)
Flow Velocity =    4.57(Ft/s)
Travel time  =    3.08 min.
Time of concentration =    9.74 min.
Critical depth =      0.211(Ft.)
 Adding area flow to channel
Rainfall intensity (I) =      6.426(In/Hr) for a   100.0 year storm
Decimal fraction soil group A = 0.000
Decimal fraction soil group B = 0.000
Decimal fraction soil group C = 0.997
Decimal fraction soil group D = 0.003
[LOW DENSITY RESIDENTIAL                     ]
(1.0 DU/A or Less       )
Impervious value, Ai = 0.100
Sub-Area C Value = 0.360
Rainfall intensity =      6.426(In/Hr) for a   100.0 year storm
Effective runoff coefficient used for total area
(Q=KCIA) is C = 0.360  CA =      4.286
Subarea runoff =     27.245(CFS) for     11.800(Ac.)
Total runoff =     27.540(CFS)      Total area =      11.900(Ac.)
Depth of flow =   0.179(Ft.), Average velocity =   5.942(Ft/s)
Critical depth =      0.328(Ft.)


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Process from Point/Station      102.000 to Point/Station      103.000
**** IMPROVED CHANNEL TRAVEL TIME ****
------------------------------------------------------------------------
Upstream point elevation =  1330.000(Ft.)
Downstream point elevation =  1295.000(Ft.)
Channel length thru subarea  =   800.000(Ft.)
```

```
Channel base width      =   37.000(Ft.)
Slope or 'Z' of left channel bank =  58.000
Slope or 'Z' of right channel bank =  58.000
Estimated mean flow rate at midpoint of channel =     34.236(CFS)
Manning's 'N'    = 0.035
Maximum depth of channel  =    1.000(Ft.)
Flow(q) thru subarea =     34.236(CFS)
Depth of flow =   0.235(Ft.), Average velocity =   2.883(Ft/s)
Channel flow top width =   64.222(Ft.)
Flow Velocity =    2.88(Ft/s)
Travel time  =    4.63 min.
Time of concentration =   14.37 min.
Critical depth =      0.258(Ft.)
 Adding area flow to channel
Rainfall intensity (I) =      5.001(In/Hr) for a   100.0 year storm
Decimal fraction soil group A = 0.000
Decimal fraction soil group B = 0.000
Decimal fraction soil group C = 0.115
Decimal fraction soil group D = 0.885
[LOW DENSITY RESIDENTIAL                    ]
(1.0 DU/A or Less       )
Impervious value, Ai = 0.100
Sub-Area C Value = 0.404
Rainfall intensity =      5.001(In/Hr) for a   100.0 year storm
Effective runoff coefficient used for total area
(Q=KCIA) is C = 0.380  CA =      8.167
Subarea runoff =     13.305(CFS) for      9.600(Ac.)
Total runoff =     40.845(CFS)      Total area =      21.500(Ac.)
Depth of flow =   0.258(Ft.), Average velocity =   3.042(Ft/s)
Critical depth =      0.287(Ft.)


++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++
Process from Point/Station      103.000 to Point/Station      103.000
**** CONFLUENCE OF MINOR STREAMS ****
------------------------------------------------------------------------
Along Main Stream number: 1 in normal stream number 1
Stream flow area =     21.500(Ac.)
Runoff from this stream =     40.845(CFS)
Time of concentration =   14.37 min.
Rainfall intensity =     5.001(In/Hr)


++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++
Process from Point/Station      110.000 to Point/Station      111.000
**** INITIAL AREA EVALUATION ****
------------------------------------------------------------------------
Decimal fraction soil group A = 0.000
Decimal fraction soil group B = 0.000
Decimal fraction soil group C = 1.000
Decimal fraction soil group D = 0.000
[UNDISTURBED NATURAL TERRAIN                ]
(Permanent Open Space   )
Impervious value, Ai = 0.000
Sub-Area C Value = 0.300
Initial subarea total flow distance  =  162.000(Ft.)
```

```
Highest elevation = 1486.000(Ft.)
Lowest elevation = 1445.000(Ft.)
Elevation difference =   41.000(Ft.) Slope = 25.309 %
Top of Initial Area Slope adjusted by User to 25.000 %
INITIAL AREA TIME OF CONCENTRATION CALCULATIONS:
The maximum overland flow distance is 100.00 (Ft)
for the top area slope value of  25.00 %, in a development type of
 Permanent Open Space
In Accordance With Figure 3-3
Initial Area Time of Concentration =   4.92 minutes
TC = [1.8*(1.1-C)*distance(Ft.)^.5)/(% slope^(1/3)]
TC = [1.8*(1.1-0.3000)*( 100.000^.5)/(  25.000^(1/3)]=   4.92
Calculated TC of    4.925 minutes is less than 5 minutes,
 resetting TC to 5.0 minutes for rainfall intensity calculations
Rainfall intensity (I) =      9.880(In/Hr) for a   100.0 year storm
Effective runoff coefficient used for area (Q=KCIA) is C = 0.300
Subarea runoff =      0.296(CFS)
Total initial stream area =        0.100(Ac.)


++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++
Process from Point/Station      111.000 to Point/Station      103.000
**** IMPROVED CHANNEL TRAVEL TIME ****
________________________________________________________________________
Upstream point elevation =  1445.000(Ft.)
Downstream point elevation =  1295.000(Ft.)
Channel length thru subarea  =  1405.000(Ft.)
Channel base width      =   19.000(Ft.)
Slope or 'Z' of left channel bank =  30.000
Slope or 'Z' of right channel bank =  30.000
Estimated mean flow rate at midpoint of channel =      8.108(CFS)
Manning's 'N'    = 0.035
Maximum depth of channel  =    0.200(Ft.)
Flow(q) thru subarea =      8.108(CFS)
Depth of flow =   0.118(Ft.), Average velocity =   3.035(Ft/s)
Channel flow top width =   26.108(Ft.)
Flow Velocity =    3.03(Ft/s)
Travel time  =    7.72 min.
Time of concentration =   12.64 min.
Critical depth =      0.162(Ft.)
 Adding area flow to channel
Rainfall intensity (I) =      5.432(In/Hr) for a   100.0 year storm
Decimal fraction soil group A = 0.000
Decimal fraction soil group B = 0.000
Decimal fraction soil group C = 0.300
Decimal fraction soil group D = 0.700
[LOW DENSITY RESIDENTIAL                    ]
(1.0 DU/A or Less       )
Impervious value, Ai = 0.100
Sub-Area C Value = 0.395
Rainfall intensity =      5.432(In/Hr) for a   100.0 year storm
Effective runoff coefficient used for total area
(Q=KCIA) is C = 0.394  CA =      2.913
Subarea runoff =     15.530(CFS) for      7.300(Ac.)
Total runoff =     15.826(CFS)      Total area =       7.400(Ac.)
Depth of flow =   0.173(Ft.), Average velocity =   3.783(Ft/s)
```

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Critical depth =      0.238(Ft.)


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Process from Point/Station      103.000 to Point/Station      103.000
**** CONFLUENCE OF MINOR STREAMS ****
------------------------------------------------------------------------
Along Main Stream number: 1 in normal stream number 2
Stream flow area =      7.400(Ac.)
Runoff from this stream =     15.826(CFS)
Time of concentration =   12.64 min.
Rainfall intensity =     5.432(In/Hr)
Summary of stream data:

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


1       40.845     14.37               5.001
2       15.826     12.64               5.432
Qmax(1) =
         1.000 *    1.000 *    40.845) +
         0.921 *    1.000 *    15.826) + =      55.417
Qmax(2) =
         1.000 *    0.880 *    40.845) +
         1.000 *    1.000 *    15.826) + =      51.763

Total of 2 streams to confluence:
Flow rates before confluence point:
      40.845      15.826
Maximum flow rates at confluence using above data:
       55.417       51.763
Area of streams before confluence:
       21.500        7.400
Results of confluence:
Total flow rate =     55.417(CFS)
Time of concentration =    14.367 min.
Effective stream area after confluence =     28.900(Ac.)


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Process from Point/Station      103.000 to Point/Station      104.000
**** PIPEFLOW TRAVEL TIME (Program estimated size) ****
------------------------------------------------------------------------
Upstream point/station elevation =  1295.000(Ft.)
Downstream point/station elevation =  1294.500(Ft.)
Pipe length  =    12.00(Ft.) Slope =   0.0417  Manning's N = 0.024
No. of pipes = 1  Required pipe flow  =    55.417(CFS)
Nearest computed pipe diameter  =     33.00(In.)
Calculated individual pipe flow  =    55.417(CFS)
Normal flow depth in pipe =   25.59(In.)
Flow top width inside pipe =   27.54(In.)
Critical Depth =   29.06(In.)
Pipe flow velocity =     11.20(Ft/s)
Travel time through pipe =    0.02 min.
Time of concentration (TC) =    14.39 min.
```

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Process from Point/Station      104.000 to Point/Station      104.000
**** CONFLUENCE OF MINOR STREAMS ****
------------------------------------------------------------------------
Along Main Stream number: 1 in normal stream number 1
Stream flow area =     28.900(Ac.)
Runoff from this stream =     55.417(CFS)
Time of concentration =   14.39 min.
Rainfall intensity =     4.997(In/Hr)


++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++
Process from Point/Station      120.000 to Point/Station      121.000
**** INITIAL AREA EVALUATION ****
------------------------------------------------------------------------
Decimal fraction soil group A = 0.000
Decimal fraction soil group B = 0.000
Decimal fraction soil group C = 1.000
Decimal fraction soil group D = 0.000
[UNDISTURBED NATURAL TERRAIN                ]
(Permanent Open Space   )
Impervious value, Ai = 0.000
Sub-Area C Value = 0.300
Initial subarea total flow distance  =  100.000(Ft.)
Highest elevation = 1340.000(Ft.)
Lowest elevation = 1325.000(Ft.)
Elevation difference =   15.000(Ft.) Slope = 15.000 %
INITIAL AREA TIME OF CONCENTRATION CALCULATIONS:
The maximum overland flow distance is 100.00 (Ft)
for the top area slope value of  15.00 %, in a development type of
 Permanent Open Space
In Accordance With Figure 3-3
Initial Area Time of Concentration =   5.84 minutes
TC = [1.8*(1.1-C)*distance(Ft.)^.5)/(% slope^(1/3)]
TC = [1.8*(1.1-0.3000)*( 100.000^.5)/(  15.000^(1/3)]=   5.84
Rainfall intensity (I) =      8.940(In/Hr) for a   100.0 year storm
Effective runoff coefficient used for area (Q=KCIA) is C = 0.300
Subarea runoff =      0.268(CFS)
Total initial stream area =        0.100(Ac.)


++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++
Process from Point/Station      121.000 to Point/Station      122.000
**** STREET FLOW TRAVEL TIME + SUBAREA FLOW ADDITION ****
------------------------------------------------------------------------
Top of street segment elevation =  1325.000(Ft.)
End of street segment elevation =  1298.000(Ft.)
Length of street segment  =  1117.000(Ft.)
Height of curb above gutter flowline  =    6.0(In.)
Width of half street (curb to crown)  =  32.000(Ft.)
Distance from crown to crossfall grade break  =  31.999(Ft.)
Slope from gutter to grade break (v/hz) =   0.020
Slope from grade break to crown (v/hz)  =   0.020
Street flow is on [2] side(s) of the street
```

```
Distance from curb to property line  =  10.000(Ft.)
Slope from curb to property line (v/hz) =   0.000
Gutter width =   0.000(Ft.)
Gutter hike from flowline =  6.000(In.)
 Manning's N in gutter =  0.0150
 Manning's N from gutter to grade break =  0.0150
 Manning's N from grade break to crown =  0.0130
Estimated mean flow rate at midpoint of street =      4.397(CFS)
Depth of flow =   0.575(Ft.), Average velocity =   2.456(Ft/s)
Warning: depth of flow exceeds top of curb
Streetflow hydraulics at midpoint of street travel:
Halfstreet flow width =   3.766(Ft.)
Flow velocity =   2.46(Ft/s)
Travel time =    7.58 min.     TC =   13.42  min.
 Adding area flow to street
Rainfall intensity (I) =      5.227(In/Hr) for a   100.0 year storm
Decimal fraction soil group A = 0.000
Decimal fraction soil group B = 0.000
Decimal fraction soil group C = 0.610
Decimal fraction soil group D = 0.390
[MEDIUM DENSITY RESIDENTIAL                 ]
(10.9 DU/A or Less      )
Impervious value, Ai = 0.450
Sub-Area C Value = 0.582
Rainfall intensity =      5.227(In/Hr) for a   100.0 year storm
Effective runoff coefficient used for total area
(Q=KCIA) is C = 0.572  CA =      1.659
Subarea runoff =      8.402(CFS) for      2.800(Ac.)
Total runoff =      8.670(CFS)      Total area =       2.900(Ac.)
Street flow at end of street =      8.670(CFS)
Half street flow at end of street =      4.335(CFS)
Depth of flow =   0.610(Ft.), Average velocity =   3.103(Ft/s)
Warning: depth of flow exceeds top of curb
Flow width (from curb towards crown)=   5.482(Ft.)


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Process from Point/Station      122.000 to Point/Station      104.000
**** PIPEFLOW TRAVEL TIME (User specified size) ****
------------------------------------------------------------------------
Upstream point/station elevation =  1295.200(Ft.)
Downstream point/station elevation =  1294.500(Ft.)
Pipe length  =   160.00(Ft.) Slope =   0.0044  Manning's N = 0.024
No. of pipes = 1  Required pipe flow  =     8.670(CFS)
Given pipe size =     18.00(In.)
NOTE: Normal flow is pressure flow in user selected pipe size.
The approximate hydraulic grade line above the pipe invert is
     3.574(Ft.)  at the headworks or inlet of the pipe(s)
 Pipe friction loss =      3.714(Ft.)
 Minor friction loss =      0.561(Ft.)    K-factor =   1.50
Pipe flow velocity =      4.91(Ft/s)
Travel time through pipe =    0.54 min.
Time of concentration (TC) =    13.96 min.


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Process from Point/Station      104.000 to Point/Station      104.000
**** CONFLUENCE OF MINOR STREAMS ****
----------------------------------------------------------------------
Along Main Stream number: 1 in normal stream number 2
Stream flow area =      2.900(Ac.)
Runoff from this stream =      8.670(CFS)
Time of concentration =   13.96 min.
Rainfall intensity =     5.095(In/Hr)
Summary of stream data:

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


1       55.417     14.39               4.997
2        8.670     13.96               5.095
Qmax(1) =
         1.000 *    1.000 *    55.417) +
         0.981 *    1.000 *     8.670) + =      63.922
Qmax(2) =
         1.000 *    0.971 *    55.417) +
         1.000 *    1.000 *     8.670) + =      62.459

Total of 2 streams to confluence:
Flow rates before confluence point:
      55.417       8.670
Maximum flow rates at confluence using above data:
       63.922       62.459
Area of streams before confluence:
       28.900        2.900
Results of confluence:
Total flow rate =     63.922(CFS)
Time of concentration =    14.385 min.
Effective stream area after confluence =     31.800(Ac.)


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Process from Point/Station      104.000 to Point/Station      105.000
**** PIPEFLOW TRAVEL TIME (Program estimated size) ****
----------------------------------------------------------------------
Upstream point/station elevation =  1294.500(Ft.)
Downstream point/station elevation =  1288.700(Ft.)
Pipe length  =    96.00(Ft.) Slope =   0.0604  Manning's N = 0.024
No. of pipes = 1  Required pipe flow  =    63.922(CFS)
Nearest computed pipe diameter  =     33.00(In.)
Calculated individual pipe flow  =    63.922(CFS)
Normal flow depth in pipe =   24.66(In.)
Flow top width inside pipe =   28.69(In.)
Critical Depth =   30.40(In.)
Pipe flow velocity =     13.43(Ft/s)
Travel time through pipe =    0.12 min.
Time of concentration (TC) =    14.50 min.
End of computations, total study area =          31.800 (Ac.)
```

Appendix C: 100-Year Post-Project Condition Hydrologic Output

San Diego County Rational Hydrology Program

CIVILCADD/CIVILDESIGN Engineering Software,(c)1991-2009 Version 7.8

Rational method hydrology program based on
San Diego County Flood Control Division 2003 hydrology manual
      Rational Hydrology Study   Date: 01/24/17

Shady Oak
Proposed Conditions
Major Drainage Basin 100
100-Year Flow Rate

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

Program License Serial Number 6289

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

Map data precipitation entered:
6 hour, precipitation(inches) = 3.750
24 hour precipitation(inches) = 8.200
P6/P24 =   45.7%
San Diego hydrology manual 'C' values used

++
Process from Point/Station   100.000 to Point/Station   101.000
**** INITIAL AREA EVALUATION ****

Decimal fraction soil group A = 0.000
Decimal fraction soil group B = 0.000
Decimal fraction soil group C = 1.000
Decimal fraction soil group D = 0.000
[LOW DENSITY RESIDENTIAL   ]
(1.0 DU/A or Less   )
Impervious value, Ai = 0.100
Sub-Area C Value = 0.360
Initial subarea total flow distance =   75.000(Ft.)
Highest elevation = 1508.000(Ft.)
Lowest elevation = 1502.000(Ft.)
Elevation difference =   6.000(Ft.) Slope = 8.000 %
INITIAL AREA TIME OF CONCENTRATION CALCULATIONS:
The maximum overland flow distance is 100.00 (Ft)
for the top area slope value of   8.00 %, in a development type of
 1.0 DU/A or Less

```
In Accordance With Figure 3-3
Initial Area Time of Concentration =   6.66 minutes
TC = [1.8*(1.1-C)*distance(Ft.)^.5)/(% slope^(1/3)]
TC = [1.8*(1.1-0.3600)*( 100.000^.5)/(   8.000^(1/3)]=   6.66
Rainfall intensity (I) =      8.212(In/Hr) for a   100.0 year storm
Effective runoff coefficient used for area (Q=KCIA) is C = 0.360
Subarea runoff =      0.296(CFS)
Total initial stream area =        0.100(Ac.)


++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++
Process from Point/Station      101.000 to Point/Station      102.000
**** IMPROVED CHANNEL TRAVEL TIME ****
------------------------------------------------------------------------
Upstream point elevation =  1502.000(Ft.)
Downstream point elevation =  1330.000(Ft.)
Channel length thru subarea  =   845.000(Ft.)
Channel base width      =   25.000(Ft.)
Slope or 'Z' of left channel bank =   5.000
Slope or 'Z' of right channel bank =   5.000
Estimated mean flow rate at midpoint of channel =     13.964(CFS)
Manning's 'N'    = 0.035
Maximum depth of channel  =    4.000(Ft.)
Flow(q) thru subarea =     13.964(CFS)
Depth of flow =   0.119(Ft.), Average velocity =   4.570(Ft/s)
Channel flow top width =   26.194(Ft.)
Flow Velocity =    4.57(Ft/s)
Travel time  =    3.08 min.
Time of concentration =    9.74 min.
Critical depth =      0.211(Ft.)
 Adding area flow to channel
Rainfall intensity (I) =      6.426(In/Hr) for a   100.0 year storm
Decimal fraction soil group A = 0.000
Decimal fraction soil group B = 0.000
Decimal fraction soil group C = 0.997
Decimal fraction soil group D = 0.003
[LOW DENSITY RESIDENTIAL                     ]
(1.0 DU/A or Less       )
Impervious value, Ai = 0.100
Sub-Area C Value = 0.360
Rainfall intensity =      6.426(In/Hr) for a   100.0 year storm
Effective runoff coefficient used for total area
(Q=KCIA) is C = 0.360  CA =      4.286
Subarea runoff =     27.245(CFS) for     11.800(Ac.)
Total runoff =     27.540(CFS)      Total area =      11.900(Ac.)
Depth of flow =   0.179(Ft.), Average velocity =   5.942(Ft/s)
Critical depth =      0.328(Ft.)


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Process from Point/Station      102.000 to Point/Station      103.000
**** IMPROVED CHANNEL TRAVEL TIME ****
------------------------------------------------------------------------
Upstream point elevation =  1330.000(Ft.)
Downstream point elevation =  1295.000(Ft.)
Channel length thru subarea  =   800.000(Ft.)
```

```
Channel base width      =   37.000(Ft.)
Slope or 'Z' of left channel bank =  58.000
Slope or 'Z' of right channel bank =  58.000
Estimated mean flow rate at midpoint of channel =     34.236(CFS)
Manning's 'N'    = 0.035
Maximum depth of channel  =    1.000(Ft.)
Flow(q) thru subarea =     34.236(CFS)
Depth of flow =   0.235(Ft.), Average velocity =   2.883(Ft/s)
Channel flow top width =   64.222(Ft.)
Flow Velocity =    2.88(Ft/s)
Travel time  =    4.63 min.
Time of concentration =   14.37 min.
Critical depth =      0.258(Ft.)
 Adding area flow to channel
Rainfall intensity (I) =      5.001(In/Hr) for a   100.0 year storm
Decimal fraction soil group A = 0.000
Decimal fraction soil group B = 0.000
Decimal fraction soil group C = 0.115
Decimal fraction soil group D = 0.885
[LOW DENSITY RESIDENTIAL                    ]
(1.0 DU/A or Less       )
Impervious value, Ai = 0.100
Sub-Area C Value = 0.404
Rainfall intensity =      5.001(In/Hr) for a   100.0 year storm
Effective runoff coefficient used for total area
(Q=KCIA) is C = 0.380  CA =      8.167
Subarea runoff =     13.305(CFS) for      9.600(Ac.)
Total runoff =     40.845(CFS)      Total area =      21.500(Ac.)
Depth of flow =   0.258(Ft.), Average velocity =   3.042(Ft/s)
Critical depth =      0.287(Ft.)


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Process from Point/Station      103.000 to Point/Station      103.000
**** CONFLUENCE OF MINOR STREAMS ****
------------------------------------------------------------------------
Along Main Stream number: 1 in normal stream number 1
Stream flow area =     21.500(Ac.)
Runoff from this stream =     40.845(CFS)
Time of concentration =   14.37 min.
Rainfall intensity =     5.001(In/Hr)


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Process from Point/Station      110.000 to Point/Station      111.000
**** INITIAL AREA EVALUATION ****
------------------------------------------------------------------------
Decimal fraction soil group A = 0.000
Decimal fraction soil group B = 0.000
Decimal fraction soil group C = 1.000
Decimal fraction soil group D = 0.000
[UNDISTURBED NATURAL TERRAIN                ]
(Permanent Open Space   )
Impervious value, Ai = 0.000
Sub-Area C Value = 0.300
Initial subarea total flow distance  =  162.000(Ft.)
```

```
Highest elevation = 1486.000(Ft.)
Lowest elevation = 1445.000(Ft.)
Elevation difference =   41.000(Ft.) Slope = 25.309 %
INITIAL AREA TIME OF CONCENTRATION CALCULATIONS:
The maximum overland flow distance is 100.00 (Ft)
for the top area slope value of  25.30 %, in a development type of
 Permanent Open Space
In Accordance With Figure 3-3
Initial Area Time of Concentration =   4.91 minutes
TC = [1.8*(1.1-C)*distance(Ft.)^.5)/(% slope^(1/3)]
TC = [1.8*(1.1-0.3000)*( 100.000^.5)/(  25.300^(1/3)]=   4.91
Calculated TC of    4.905 minutes is less than 5 minutes,
 resetting TC to 5.0 minutes for rainfall intensity calculations
Rainfall intensity (I) =      9.880(In/Hr) for a   100.0 year storm
Effective runoff coefficient used for area (Q=KCIA) is C = 0.300
Subarea runoff =      0.296(CFS)
Total initial stream area =        0.100(Ac.)


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Process from Point/Station      111.000 to Point/Station      103.000
**** IMPROVED CHANNEL TRAVEL TIME ****
------------------------------------------------------------------------
Upstream point elevation =  1445.000(Ft.)
Downstream point elevation =  1295.000(Ft.)
Channel length thru subarea  =  1537.000(Ft.)
Channel base width      =   19.000(Ft.)
Slope or 'Z' of left channel bank =  30.000
Slope or 'Z' of right channel bank =  30.000
Estimated mean flow rate at midpoint of channel =      2.456(CFS)
Manning's 'N'    = 0.035
Maximum depth of channel  =    0.200(Ft.)
Flow(q) thru subarea =      2.456(CFS)
Depth of flow =   0.061(Ft.), Average velocity =   1.939(Ft/s)
Channel flow top width =   22.649(Ft.)
Flow Velocity =    1.94(Ft/s)
Travel time  =   13.21 min.
Time of concentration =   18.11 min.
Critical depth =      0.077(Ft.)
 Adding area flow to channel
Rainfall intensity (I) =      4.307(In/Hr) for a   100.0 year storm
Decimal fraction soil group A = 0.000
Decimal fraction soil group B = 0.000
Decimal fraction soil group C = 0.593
Decimal fraction soil group D = 0.407
[LOW DENSITY RESIDENTIAL                    ]
(1.0 DU/A or Less       )
Impervious value, Ai = 0.100
Sub-Area C Value = 0.380
Rainfall intensity =      4.307(In/Hr) for a   100.0 year storm
Effective runoff coefficient used for total area
(Q=KCIA) is C = 0.377  CA =      1.057
Subarea runoff =      4.256(CFS) for      2.700(Ac.)
Total runoff =      4.552(CFS)      Total area =       2.800(Ac.)
Depth of flow =   0.087(Ft.), Average velocity =   2.416(Ft/s)
Critical depth =      0.113(Ft.)
```

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Process from Point/Station      103.000 to Point/Station      103.000
**** CONFLUENCE OF MINOR STREAMS ****
------------------------------------------------------------------------------
Along Main Stream number: 1 in normal stream number 2
Stream flow area =      2.800(Ac.)
Runoff from this stream =      4.552(CFS)
Time of concentration =   18.11 min.
Rainfall intensity =     4.307(In/Hr)
Summary of stream data:

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


1       40.845     14.37               5.001
2        4.552     18.11               4.307
Qmax(1) =
         1.000 *    1.000 *    40.845) +
         1.000 *    0.793 *     4.552) + =      44.456
Qmax(2) =
         0.861 *    1.000 *    40.845) +
         1.000 *    1.000 *     4.552) + =      39.727

Total of 2 streams to confluence:
Flow rates before confluence point:
      40.845       4.552
Maximum flow rates at confluence using above data:
       44.456       39.727
Area of streams before confluence:
       21.500        2.800
Results of confluence:
Total flow rate =     44.456(CFS)
Time of concentration =    14.367 min.
Effective stream area after confluence =     24.300(Ac.)


++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++
Process from Point/Station      103.000 to Point/Station      104.000
**** PIPEFLOW TRAVEL TIME (Program estimated size) ****
------------------------------------------------------------------------------
Upstream point/station elevation =  1295.000(Ft.)
Downstream point/station elevation =  1294.500(Ft.)
Pipe length  =    12.00(Ft.) Slope =   0.0417  Manning's N = 0.024
No. of pipes = 1  Required pipe flow  =    44.456(CFS)
Nearest computed pipe diameter  =     30.00(In.)
Calculated individual pipe flow  =    44.456(CFS)
Normal flow depth in pipe =   24.09(In.)
Flow top width inside pipe =   23.86(In.)
Critical Depth =   26.60(In.)
Pipe flow velocity =     10.53(Ft/s)
Travel time through pipe =    0.02 min.
Time of concentration (TC) =    14.39 min.
```

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Process from Point/Station      104.000 to Point/Station      104.000
**** CONFLUENCE OF MINOR STREAMS ****
------------------------------------------------------------------------
Along Main Stream number: 1 in normal stream number 1
Stream flow area =     24.300(Ac.)
Runoff from this stream =     44.456(CFS)
Time of concentration =   14.39 min.
Rainfall intensity =     4.997(In/Hr)


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Process from Point/Station      150.000 to Point/Station      151.000
**** 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
[MEDIUM DENSITY RESIDENTIAL                 ]
(10.9 DU/A or Less      )
Impervious value, Ai = 0.450
Sub-Area C Value = 0.600
Initial subarea total flow distance  =   72.000(Ft.)
Highest elevation = 1299.000(Ft.)
Lowest elevation = 1298.000(Ft.)
Elevation difference =    1.000(Ft.) Slope =  1.389 %
INITIAL AREA TIME OF CONCENTRATION CALCULATIONS:
The maximum overland flow distance is 65.00 (Ft)
for the top area slope value of   1.38 %, in a development type of
 10.9 DU/A or Less
In Accordance With Figure 3-3
Initial Area Time of Concentration =   6.52 minutes
TC = [1.8*(1.1-C)*distance(Ft.)^.5)/(% slope^(1/3)]
TC = [1.8*(1.1-0.6000)*(  65.000^.5)/(   1.380^(1/3)]=   6.52
Rainfall intensity (I) =      8.328(In/Hr) for a   100.0 year storm
Effective runoff coefficient used for area (Q=KCIA) is C = 0.600
Subarea runoff =      0.500(CFS)
Total initial stream area =        0.100(Ac.)


++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++
Process from Point/Station      151.000 to Point/Station      152.000
**** STREET FLOW TRAVEL TIME + SUBAREA FLOW ADDITION ****
------------------------------------------------------------------------
Top of street segment elevation =  1298.000(Ft.)
End of street segment elevation =  1297.700(Ft.)
Length of street segment  =    36.500(Ft.)
Height of curb above gutter flowline  =    6.0(In.)
Width of half street (curb to crown)  =  41.000(Ft.)
Distance from crown to crossfall grade break  =  40.990(Ft.)
Slope from gutter to grade break (v/hz) =   0.020
Slope from grade break to crown (v/hz)  =   0.020
Street flow is on [1] side(s) of the street
Distance from curb to property line  =  10.000(Ft.)
```

```
Slope from curb to property line (v/hz) =   0.020
Gutter width =   0.000(Ft.)
Gutter hike from flowline =  6.000(In.)
 Manning's N in gutter =  0.0150
 Manning's N from gutter to grade break =  0.0150
 Manning's N from grade break to crown =  0.0130
Estimated mean flow rate at midpoint of street =      2.215(CFS)
Depth of flow =   0.661(Ft.), Average velocity =   1.711(Ft/s)
Warning: depth of flow exceeds top of curb
Distance that curb overflow reaches into property =    8.05(Ft.)
Streetflow hydraulics at midpoint of street travel:
Halfstreet flow width =   8.045(Ft.)
Flow velocity =   1.71(Ft/s)
Travel time =    0.36 min.     TC =    6.87  min.
 Adding area flow to street
Rainfall intensity (I) =      8.047(In/Hr) for a   100.0 year storm
Decimal fraction soil group A = 0.000
Decimal fraction soil group B = 0.000
Decimal fraction soil group C = 0.000
Decimal fraction soil group D = 1.000
[MEDIUM DENSITY RESIDENTIAL                 ]
(10.9 DU/A or Less      )
Impervious value, Ai = 0.450
Sub-Area C Value = 0.600
Rainfall intensity =      8.047(In/Hr) for a   100.0 year storm
Effective runoff coefficient used for total area
(Q=KCIA) is C = 0.600  CA =      0.480
Subarea runoff =      3.363(CFS) for      0.700(Ac.)
Total runoff =      3.863(CFS)      Total area =       0.800(Ac.)
Street flow at end of street =      3.863(CFS)
Half street flow at end of street =      3.863(CFS)
Depth of flow =   0.698(Ft.), Average velocity =   1.978(Ft/s)
Warning: depth of flow exceeds top of curb
Distance that curb overflow reaches into property =    9.88(Ft.)
Flow width (from curb towards crown)=   9.881(Ft.)


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Process from Point/Station      152.000 to Point/Station      104.000
**** PIPEFLOW TRAVEL TIME (User specified size) ****
------------------------------------------------------------------------
Upstream point/station elevation =  1295.200(Ft.)
Downstream point/station elevation =  1294.500(Ft.)
Pipe length  =   160.00(Ft.) Slope =   0.0044  Manning's N = 0.024
No. of pipes = 1  Required pipe flow  =     3.863(CFS)
Given pipe size =     18.00(In.)
NOTE: Normal flow is pressure flow in user selected pipe size.
The approximate hydraulic grade line above the pipe invert is
     0.148(Ft.)  at the headworks or inlet of the pipe(s)
 Pipe friction loss =      0.737(Ft.)
 Minor friction loss =      0.111(Ft.)    K-factor =   1.50
Pipe flow velocity =      2.19(Ft/s)
Travel time through pipe =    1.22 min.
Time of concentration (TC) =     8.09 min.
```

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Process from Point/Station      104.000 to Point/Station      104.000
**** CONFLUENCE OF MINOR STREAMS ****
------------------------------------------------------------------------
Along Main Stream number: 1 in normal stream number 2
Stream flow area =      0.800(Ac.)
Runoff from this stream =      3.863(CFS)
Time of concentration =    8.09 min.
Rainfall intensity =     7.242(In/Hr)
Summary of stream data:

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


1       44.456     14.39               4.997
2        3.863      8.09               7.242
Qmax(1) =
         1.000 *    1.000 *    44.456) +
         0.690 *    1.000 *     3.863) + =      47.121
Qmax(2) =
         1.000 *    0.563 *    44.456) +
         1.000 *    1.000 *     3.863) + =      28.871

Total of 2 streams to confluence:
Flow rates before confluence point:
      44.456       3.863
Maximum flow rates at confluence using above data:
       47.121       28.871
Area of streams before confluence:
       24.300        0.800
Results of confluence:
Total flow rate =     47.121(CFS)
Time of concentration =    14.386 min.
Effective stream area after confluence =     25.100(Ac.)


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Process from Point/Station      104.000 to Point/Station      105.000
**** PIPEFLOW TRAVEL TIME (Program estimated size) ****
------------------------------------------------------------------------
Upstream point/station elevation =  1294.500(Ft.)
Downstream point/station elevation =  1288.700(Ft.)
Pipe length  =    96.00(Ft.) Slope =   0.0604  Manning's N = 0.024
No. of pipes = 1  Required pipe flow  =    47.121(CFS)
Nearest computed pipe diameter  =     30.00(In.)
Calculated individual pipe flow  =    47.121(CFS)
Normal flow depth in pipe =   21.49(In.)
Flow top width inside pipe =   27.04(In.)
Critical Depth =   27.12(In.)
Pipe flow velocity =     12.52(Ft/s)
Travel time through pipe =    0.13 min.
Time of concentration (TC) =    14.51 min.


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Process from Point/Station      105.000 to Point/Station      105.000
**** CONFLUENCE OF MAIN STREAMS ****
--------------------------------------------------------------------------------
The following data inside Main Stream is listed:
In Main Stream number: 1
Stream flow area =     25.100(Ac.)
Runoff from this stream =     47.121(CFS)
Time of concentration =   14.51 min.
Rainfall intensity =     4.969(In/Hr)
Program is now starting with Main Stream No. 2


++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++
Process from Point/Station      130.000 to Point/Station      131.000
**** INITIAL AREA EVALUATION ****
--------------------------------------------------------------------------------
Decimal fraction soil group A = 0.000
Decimal fraction soil group B = 0.000
Decimal fraction soil group C = 1.000
Decimal fraction soil group D = 0.000
[MEDIUM DENSITY RESIDENTIAL                 ]
(10.9 DU/A or Less      )
Impervious value, Ai = 0.450
Sub-Area C Value = 0.570
Initial subarea total flow distance  =   60.000(Ft.)
Highest elevation = 1317.800(Ft.)
Lowest elevation = 1314.000(Ft.)
Elevation difference =    3.800(Ft.) Slope =  6.333 %
INITIAL AREA TIME OF CONCENTRATION CALCULATIONS:
The maximum overland flow distance is 100.00 (Ft)
for the top area slope value of   6.33 %, in a development type of
 10.9 DU/A or Less
In Accordance With Figure 3-3
Initial Area Time of Concentration =   5.16 minutes
TC = [1.8*(1.1-C)*distance(Ft.)^.5)/(% slope^(1/3)]
TC = [1.8*(1.1-0.5700)*( 100.000^.5)/(   6.330^(1/3)]=   5.16
Rainfall intensity (I) =      9.685(In/Hr) for a   100.0 year storm
Effective runoff coefficient used for area (Q=KCIA) is C = 0.570
Subarea runoff =      0.552(CFS)
Total initial stream area =        0.100(Ac.)


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Process from Point/Station      131.000 to Point/Station      132.000
**** STREET FLOW TRAVEL TIME + SUBAREA FLOW ADDITION ****
--------------------------------------------------------------------------------
Top of street segment elevation =  1314.000(Ft.)
End of street segment elevation =  1297.000(Ft.)
Length of street segment  =   770.000(Ft.)
Height of curb above gutter flowline  =    6.0(In.)
Width of half street (curb to crown)  =  13.000(Ft.)
Distance from crown to crossfall grade break  =  11.500(Ft.)
Slope from gutter to grade break (v/hz) =   0.015
Slope from grade break to crown (v/hz)  =   0.015
Street flow is on [2] side(s) of the street
Distance from curb to property line  =  11.500(Ft.)
```

```
Slope from curb to property line (v/hz) =   0.015
Gutter width =   1.500(Ft.)
Gutter hike from flowline =  0.270(In.)
 Manning's N in gutter =  0.0150
 Manning's N from gutter to grade break =  0.0150
 Manning's N from grade break to crown =  0.0130
Estimated mean flow rate at midpoint of street =      9.295(CFS)
Depth of flow =   0.198(Ft.), Average velocity =   3.558(Ft/s)
Note:  depth of flow exceeds top of street crown.
Streetflow hydraulics at midpoint of street travel:
Halfstreet flow width =  13.000(Ft.)
Flow velocity =   3.56(Ft/s)
Travel time =    3.61 min.     TC =    8.76  min.
 Adding area flow to street
Rainfall intensity (I) =      6.880(In/Hr) for a   100.0 year storm
Decimal fraction soil group A = 0.000
Decimal fraction soil group B = 0.000
Decimal fraction soil group C = 0.756
Decimal fraction soil group D = 0.244
[MEDIUM DENSITY RESIDENTIAL                  ]
(10.9 DU/A or Less      )
Impervious value, Ai = 0.450
Sub-Area C Value = 0.577
Rainfall intensity =      6.880(In/Hr) for a   100.0 year storm
Effective runoff coefficient used for total area
(Q=KCIA) is C = 0.577  CA =      2.597
Subarea runoff =     17.316(CFS) for      4.400(Ac.)
Total runoff =     17.868(CFS)      Total area =       4.500(Ac.)
Street flow at end of street =     17.868(CFS)
Half street flow at end of street =      8.934(CFS)
Depth of flow =   0.246(Ft.), Average velocity =   4.613(Ft/s)
Note:  depth of flow exceeds top of street crown.
Flow width (from curb towards crown)=  13.000(Ft.)


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Process from Point/Station      132.000 to Point/Station      132.000
**** CONFLUENCE OF MINOR STREAMS ****
------------------------------------------------------------------------
Along Main Stream number: 2 in normal stream number 1
Stream flow area =      4.500(Ac.)
Runoff from this stream =     17.868(CFS)
Time of concentration =    8.76 min.
Rainfall intensity =     6.880(In/Hr)


++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++
Process from Point/Station      140.000 to Point/Station      141.000
**** 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
[MEDIUM DENSITY RESIDENTIAL                  ]
(10.9 DU/A or Less      )
```

```
Impervious value, Ai = 0.450
Sub-Area C Value = 0.600
Initial subarea total flow distance  =  127.000(Ft.)
Highest elevation = 1311.300(Ft.)
Lowest elevation = 1307.560(Ft.)
Elevation difference =    3.740(Ft.) Slope =  2.945 %
INITIAL AREA TIME OF CONCENTRATION CALCULATIONS:
The maximum overland flow distance is 90.00 (Ft)
for the top area slope value of   2.94 %, in a development type of
 10.9 DU/A or Less
In Accordance With Figure 3-3
Initial Area Time of Concentration =   5.96 minutes
TC = [1.8*(1.1-C)*distance(Ft.)^.5)/(% slope^(1/3)]
TC = [1.8*(1.1-0.6000)*(  90.000^.5)/(   2.940^(1/3)]=   5.96
Rainfall intensity (I) =      8.822(In/Hr) for a   100.0 year storm
Effective runoff coefficient used for area (Q=KCIA) is C = 0.600
Subarea runoff =      0.529(CFS)
Total initial stream area =        0.100(Ac.)


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Process from Point/Station      141.000 to Point/Station      132.000
**** STREET FLOW TRAVEL TIME + SUBAREA FLOW ADDITION ****
________________________________________________________________________
Top of street segment elevation =  1307.560(Ft.)
End of street segment elevation =  1297.000(Ft.)
Length of street segment  =   300.000(Ft.)
Height of curb above gutter flowline  =    6.0(In.)
Width of half street (curb to crown)  =  14.000(Ft.)
Distance from crown to crossfall grade break  =  12.500(Ft.)
Slope from gutter to grade break (v/hz) =   0.004
Slope from grade break to crown (v/hz)  =   0.020
Street flow is on [2] side(s) of the street
Distance from curb to property line  =  10.000(Ft.)
Slope from curb to property line (v/hz) =   0.015
Gutter width =   1.500(Ft.)
Gutter hike from flowline =  4.000(In.)
 Manning's N in gutter =  0.0150
 Manning's N from gutter to grade break =  0.0150
 Manning's N from grade break to crown =  0.0130
Estimated mean flow rate at midpoint of street =      1.059(CFS)
Depth of flow =   0.244(Ft.), Average velocity =   3.948(Ft/s)
Streetflow hydraulics at midpoint of street travel:
Halfstreet flow width =   1.500(Ft.)
Flow velocity =   3.95(Ft/s)
Travel time =    1.27 min.     TC =    7.23  min.
 Adding area flow to street
Rainfall intensity (I) =      7.791(In/Hr) for a   100.0 year storm
Decimal fraction soil group A = 0.000
Decimal fraction soil group B = 0.000
Decimal fraction soil group C = 0.000
Decimal fraction soil group D = 1.000
[MEDIUM DENSITY RESIDENTIAL                  ]
(10.9 DU/A or Less      )
Impervious value, Ai = 0.450
Sub-Area C Value = 0.600
```

```
Rainfall intensity =      7.791(In/Hr) for a   100.0 year storm
Effective runoff coefficient used for total area
(Q=KCIA) is C = 0.600  CA =      0.180
Subarea runoff =      0.873(CFS) for      0.200(Ac.)
Total runoff =      1.402(CFS)      Total area =       0.300(Ac.)
Street flow at end of street =      1.402(CFS)
Half street flow at end of street =      0.701(CFS)
Depth of flow =   0.271(Ft.), Average velocity =   4.236(Ft/s)
Flow width (from curb towards crown)=   1.500(Ft.)


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Process from Point/Station      132.000 to Point/Station      132.000
**** CONFLUENCE OF MINOR STREAMS ****
------------------------------------------------------------------------
Along Main Stream number: 2 in normal stream number 2
Stream flow area =      0.300(Ac.)
Runoff from this stream =      1.402(CFS)
Time of concentration =    7.23 min.
Rainfall intensity =     7.791(In/Hr)
Summary of stream data:

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


1       17.868      8.76               6.880
2        1.402      7.23               7.791
Qmax(1) =
         1.000 *    1.000 *    17.868) +
         0.883 *    1.000 *     1.402) + =      19.106
Qmax(2) =
         1.000 *    0.825 *    17.868) +
         1.000 *    1.000 *     1.402) + =      16.136

Total of 2 streams to confluence:
Flow rates before confluence point:
      17.868       1.402
Maximum flow rates at confluence using above data:
       19.106       16.136
Area of streams before confluence:
        4.500        0.300
Results of confluence:
Total flow rate =     19.106(CFS)
Time of concentration =     8.764 min.
Effective stream area after confluence =      4.800(Ac.)


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Process from Point/Station      132.000 to Point/Station      122.000
**** PIPEFLOW TRAVEL TIME (Program estimated size) ****
------------------------------------------------------------------------
Upstream point/station elevation =  1292.700(Ft.)
Downstream point/station elevation =  1259.600(Ft.)
Pipe length  =    12.66(Ft.) Slope =   2.6145  Manning's N = 0.015
No. of pipes = 1  Required pipe flow  =    19.106(CFS)
```

```
Nearest computed pipe diameter  =      9.00(In.)
Calculated individual pipe flow  =    19.106(CFS)
Normal flow depth in pipe =    6.22(In.)
Flow top width inside pipe =    8.31(In.)
Critical depth could not be calculated.
Pipe flow velocity =     58.60(Ft/s)
Travel time through pipe =    0.00 min.
Time of concentration (TC) =     8.77 min.


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Process from Point/Station      122.000 to Point/Station      122.000
**** CONFLUENCE OF MINOR STREAMS ****
------------------------------------------------------------------------
Along Main Stream number: 2 in normal stream number 1
Stream flow area =      4.800(Ac.)
Runoff from this stream =     19.106(CFS)
Time of concentration =    8.77 min.
Rainfall intensity =     6.878(In/Hr)


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Process from Point/Station      120.000 to Point/Station      121.000
**** INITIAL AREA EVALUATION ****
------------------------------------------------------------------------
Decimal fraction soil group A = 0.000
Decimal fraction soil group B = 0.000
Decimal fraction soil group C = 1.000
Decimal fraction soil group D = 0.000
[UNDISTURBED NATURAL TERRAIN                ]
(Permanent Open Space   )
Impervious value, Ai = 0.000
Sub-Area C Value = 0.300
Initial subarea total flow distance  =  100.000(Ft.)
Highest elevation = 1340.000(Ft.)
Lowest elevation = 1325.000(Ft.)
Elevation difference =   15.000(Ft.) Slope = 15.000 %
INITIAL AREA TIME OF CONCENTRATION CALCULATIONS:
The maximum overland flow distance is 100.00 (Ft)
for the top area slope value of  15.00 %, in a development type of
 Permanent Open Space
In Accordance With Figure 3-3
Initial Area Time of Concentration =   5.84 minutes
TC = [1.8*(1.1-C)*distance(Ft.)^.5)/(% slope^(1/3)]
TC = [1.8*(1.1-0.3000)*( 100.000^.5)/(  15.000^(1/3)]=   5.84
Rainfall intensity (I) =      8.940(In/Hr) for a   100.0 year storm
Effective runoff coefficient used for area (Q=KCIA) is C = 0.300
Subarea runoff =      0.268(CFS)
Total initial stream area =        0.100(Ac.)


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Process from Point/Station      121.000 to Point/Station      122.000
**** STREET FLOW TRAVEL TIME + SUBAREA FLOW ADDITION ****
------------------------------------------------------------------------
Top of street segment elevation =  1325.000(Ft.)
```

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End of street segment elevation =  1298.100(Ft.)
Length of street segment  =  1008.000(Ft.)
Height of curb above gutter flowline  =    6.0(In.)
Width of half street (curb to crown)  =  30.100(Ft.)
Distance from crown to crossfall grade break  =  28.600(Ft.)
Slope from gutter to grade break (v/hz) =   0.055
Slope from grade break to crown (v/hz)  =   0.020
Street flow is on [2] side(s) of the street
Distance from curb to property line  =  10.500(Ft.)
Slope from curb to property line (v/hz) =   0.500
Gutter width =   1.500(Ft.)
Gutter hike from flowline =  5.000(In.)
 Manning's N in gutter =  0.0150
 Manning's N from gutter to grade break =  0.0150
 Manning's N from grade break to crown =  0.0130
Estimated mean flow rate at midpoint of street =      3.350(CFS)
Depth of flow =   0.466(Ft.), Average velocity =   3.744(Ft/s)
Streetflow hydraulics at midpoint of street travel:
Halfstreet flow width =   3.967(Ft.)
Flow velocity =   3.74(Ft/s)
Travel time =    4.49 min.     TC =   10.33  min.
 Adding area flow to street
Rainfall intensity (I) =      6.189(In/Hr) for a   100.0 year storm
Decimal fraction soil group A = 0.000
Decimal fraction soil group B = 0.000
Decimal fraction soil group C = 0.930
Decimal fraction soil group D = 0.070
[MEDIUM DENSITY RESIDENTIAL                  ]
(10.9 DU/A or Less      )
Impervious value, Ai = 0.450
Sub-Area C Value = 0.572
Rainfall intensity =      6.189(In/Hr) for a   100.0 year storm
Effective runoff coefficient used for total area
(Q=KCIA) is C = 0.558  CA =      1.060
Subarea runoff =      6.290(CFS) for      1.800(Ac.)
Total runoff =      6.559(CFS)      Total area =       1.900(Ac.)
Street flow at end of street =      6.559(CFS)
Half street flow at end of street =      3.279(CFS)
Depth of flow =   0.533(Ft.), Average velocity =   3.959(Ft/s)
Warning: depth of flow exceeds top of curb
Distance that curb overflow reaches into property =    0.07(Ft.)
Flow width (from curb towards crown)=   7.330(Ft.)


++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++
Process from Point/Station      122.000 to Point/Station      122.000
**** CONFLUENCE OF MINOR STREAMS ****
------------------------------------------------------------------------
Along Main Stream number: 2 in normal stream number 2
Stream flow area =      1.900(Ac.)
Runoff from this stream =      6.559(CFS)
Time of concentration =   10.33 min.
Rainfall intensity =     6.189(In/Hr)
Summary of stream data:

Stream   Flow rate      TC            Rainfall Intensity
```

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


1       19.106      8.77               6.878
2        6.559     10.33               6.189
Qmax(1) =
         1.000 *    1.000 *    19.106) +
         1.000 *    0.849 *     6.559) + =      24.675
Qmax(2) =
         0.900 *    1.000 *    19.106) +
         1.000 *    1.000 *     6.559) + =      23.751

Total of 2 streams to confluence:
Flow rates before confluence point:
      19.106       6.559
Maximum flow rates at confluence using above data:
       24.675       23.751
Area of streams before confluence:
        4.800        1.900
Results of confluence:
Total flow rate =     24.675(CFS)
Time of concentration =     8.767 min.
Effective stream area after confluence =      6.700(Ac.)


++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++
Process from Point/Station      122.000 to Point/Station      105.000
**** PIPEFLOW TRAVEL TIME (Program estimated size) ****
________________________________________________________________________
Upstream point/station elevation =  1292.500(Ft.)
Downstream point/station elevation =  1291.000(Ft.)
Pipe length  =   317.66(Ft.) Slope =   0.0047  Manning's N = 0.015
No. of pipes = 1  Required pipe flow  =    24.675(CFS)
Nearest computed pipe diameter  =     33.00(In.)
Calculated individual pipe flow  =    24.675(CFS)
Normal flow depth in pipe =   21.98(In.)
Flow top width inside pipe =   31.12(In.)
Critical Depth =   19.72(In.)
Pipe flow velocity =      5.87(Ft/s)
Travel time through pipe =    0.90 min.
Time of concentration (TC) =     9.67 min.


++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++
Process from Point/Station      105.000 to Point/Station      105.000
**** CONFLUENCE OF MAIN STREAMS ****
________________________________________________________________________
The following data inside Main Stream is listed:
In Main Stream number: 2
Stream flow area =      6.700(Ac.)
Runoff from this stream =     24.675(CFS)
Time of concentration =    9.67 min.
Rainfall intensity =     6.457(In/Hr)
Summary of stream data:

Stream   Flow rate      TC            Rainfall Intensity
```

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


1       47.121     14.51               4.969
2       24.675      9.67               6.457
Qmax(1) =
         1.000 *    1.000 *    47.121) +
         0.770 *    1.000 *    24.675) + =      66.109
Qmax(2) =
         1.000 *    0.666 *    47.121) +
         1.000 *    1.000 *    24.675) + =      56.068

Total of 2 main streams to confluence:
Flow rates before confluence point:
      47.121      24.675
Maximum flow rates at confluence using above data:
       66.109       56.068
Area of streams before confluence:
       25.100        6.700


Results of confluence:
Total flow rate =     66.109(CFS)
Time of concentration =    14.514 min.
Effective stream area after confluence  =     31.800(Ac.)
End of computations, total study area =          31.800 (Ac.)
```

Appendix D: HEC-1 Detention Calculations

```
1*****************************************
*                                       *
*   FLOOD HYDROGRAPH PACKAGE  (HEC-1)   *
*             JUN   1998                *
*           VERSION 4.1                 *
*                                       *
*  RUN DATE   18APR17  TIME  17:17:04   *
*                                       *
*****************************************
```

```
*****************************************
*                                       *
*    U.S. ARMY CORPS OF ENGINEERS       *
*    HYDROLOGIC ENGINEERING CENTER      *
*          609 SECOND STREET            *
*        DAVIS, CALIFORNIA 95616        *
*            (916) 756-1104             *
*                                       *
*****************************************
```

```
X     X  XXXXXXX   XXXXX          X
X     X  X        X     X        XX
X     X  X        X              X
XXXXXXX  XXXX     X        XXXXX  X
X     X  X        X              X
X     X  X        X     X        X
X     X  XXXXXXX   XXXXX          XXX
```

THIS PROGRAM REPLACES ALL PREVIOUS VERSIONS OF HEC-1 KNOWN AS HEC1 (JAN 73), HEC1GS, HEC1DB, AND HEC1KW.

THE DEFINITIONS OF VARIABLES -RTIMP- AND -RTIOR- HAVE CHANGED FROM THOSE USED WITH THE 1973-STYLE INPUT STRUCTURE.
THE DEFINITION OF -AMSKK- ON RM-CARD WAS CHANGED WITH REVISIONS DATED 28 SEP 81. THIS IS THE FORTRAN77 VERSION
NEW OPTIONS: DAMBREAK OUTFLOW SUBMERGENCE , SINGLE EVENT DAMAGE CALCULATION, DSS:WRITE STAGE FREQUENCY,
DSS:READ TIME SERIES AT DESIRED CALCULATION INTERVAL LOSS RATE:GREEN AND AMPT INFILTRATION
KINEMATIC WAVE: NEW FINITE DIFFERENCE ALGORITHM

1 HEC-1 INPUT PAGE 1

```
          LINE          ID.....1.....2.....3.....4.....5.....6.....7.....8.....9.....10
                        *DIAGRAM
*** FREE ***
               1        ID   SHADY OAK
               2        ID   PRELIMINARY 100-YEAR DETENTION ANALYSIS
               3        IT       2 01JAN90    1200     200

               4        KK   BASIN
               5        KM   RATIONAL METHOD HYDROGRAPH PROGRAM
               6        KM   100-YEAR, 6-HOUR RAINFALL IS 3.75 INCHES
               7        KM   RATIONAL METHOD RUNOFF COEFFICIENT IS 0.418
               8        KM   RATIONAL METHOD TIME OF CONCENTRATION IS 14.514 MINUTES
               9        KM   DRAINAGE AREA IS 31.8 ACRES
              10        BA  0.0497
              11        IN      15 01JAN90    1153
              12        QI       0       3      3.1      3.3      3.4      3.6      3.8      4.1      4.3      4.8
              13        QI       5     5.8      6.3      7.7      8.7     12.8     16.6     66.1     10.3      6.9
              14        QI     5.4     4.5      3.9      3.5      3.2        0        0        0        0        0
              15        QI       0       0        0        0        0        0

              16        KK  DETAIN
              17        RS       1    STOR       -1
              18        SV       0    0.06
              19        SQ       0    63.9
              20        SE     100     101
              21        ZZ
```

1 SCHEMATIC DIAGRAM OF STREAM NETWORK

```
 INPUT
  LINE      (V) ROUTING          (--->) DIVERSION OR PUMP FLOW

   NO.      (.) CONNECTOR        (<---) RETURN OF DIVERTED OR PUMPED FLOW

     4       BASIN
              V
              V
    16      DETAIN

 (***) RUNOFF ALSO COMPUTED AT THIS LOCATION
```


```
1*****************************************
*                                       *
*   FLOOD HYDROGRAPH PACKAGE  (HEC-1)   *
*             JUN   1998                *
*           VERSION 4.1                 *
*                                       *
*  RUN DATE   18APR17  TIME  17:17:04   *
*                                       *
*****************************************
```

```
*****************************************
*                                       *
*    U.S. ARMY CORPS OF ENGINEERS       *
*    HYDROLOGIC ENGINEERING CENTER      *
*          609 SECOND STREET            *
*        DAVIS, CALIFORNIA 95616        *
*            (916) 756-1104             *
*                                       *
*****************************************
```


SHADY OAK
PRELIMINARY 100-YEAR DETENTION ANALYSIS

```
 IT          HYDROGRAPH TIME DATA
                   NMIN           2  MINUTES IN COMPUTATION INTERVAL
                  IDATE      1JAN90  STARTING DATE
                  ITIME        1200  STARTING TIME
                     NQ         200  NUMBER OF HYDROGRAPH ORDINATES
                 NDDATE      1JAN90  ENDING DATE
                 NDTIME        1838  ENDING TIME
                  ICENT          19  CENTURY MARK

            COMPUTATION INTERVAL      .03 HOURS
                TOTAL TIME BASE    6.63 HOURS

       ENGLISH UNITS
            DRAINAGE AREA          SQUARE MILES
            PRECIPITATION DEPTH    INCHES
            LENGTH, ELEVATION      FEET
            FLOW                   CUBIC FEET PER SECOND
            STORAGE VOLUME         ACRE-FEET
            SURFACE AREA           ACRES
```

TEMPERATURE DEGREES FAHRENHEIT

*** ***

```
          **************
          *            *
 4 KK     *    BASIN   *
          *            *
          **************
                    RATIONAL METHOD HYDROGRAPH PROGRAM
                    100-YEAR, 6-HOUR RAINFALL IS 3.75 INCHES
                    RATIONAL METHOD RUNOFF COEFFICIENT IS 0.418
                    RATIONAL METHOD TIME OF CONCENTRATION IS 14.514 MINUTES
                    DRAINAGE AREA IS 31.8 ACRES

 11 IN          TIME DATA FOR INPUT TIME SERIES
                     JXMIN        15  TIME INTERVAL IN MINUTES
                    JXDATE    1JAN90  STARTING DATE
                    JXTIME      1153  STARTING TIME

               SUBBASIN RUNOFF DATA

 10 BA           SUBBASIN CHARACTERISTICS
                      TAREA       .05  SUBBASIN AREA
```

***

****

HYDROGRAPH AT STATION BASIN

****

DA	MON	HRMN	ORD	FLOW	DA	MON	HRMN	ORD	FLOW	DA	MON	HRMN	ORD	FLOW	DA	MON	HRMN	ORD	FLOW
1	JAN	1200	1	1.	1	JAN	1340	51	4.	1	JAN	1520	101	9.	1	JAN	1700	151	5.
1	JAN	1202	2	2.	1	JAN	1342	52	4.	1	JAN	1522	102	9.	1	JAN	1702	152	5.
1	JAN	1204	3	2.	1	JAN	1344	53	4.	1	JAN	1524	103	9.	1	JAN	1704	153	5.
1	JAN	1206	4	3.	1	JAN	1346	54	4.	1	JAN	1526	104	10.	1	JAN	1706	154	5.
1	JAN	1208	5	3.	1	JAN	1348	55	4.	1	JAN	1528	105	10.	1	JAN	1708	155	5.
1	JAN	1210	6	3.	1	JAN	1350	56	4.	1	JAN	1530	106	11.	1	JAN	1710	156	4.
1	JAN	1212	7	3.	1	JAN	1352	57	4.	1	JAN	1532	107	11.	1	JAN	1712	157	4.
1	JAN	1214	8	3.	1	JAN	1354	58	4.	1	JAN	1534	108	12.	1	JAN	1714	158	4.
1	JAN	1216	9	3.	1	JAN	1356	59	4.	1	JAN	1536	109	12.	1	JAN	1716	159	4.
1	JAN	1218	10	3.	1	JAN	1358	60	4.	1	JAN	1538	110	13.	1	JAN	1718	160	4.
1	JAN	1220	11	3.	1	JAN	1400	61	5.	1	JAN	1540	111	13.	1	JAN	1720	161	4.
1	JAN	1222	12	3.	1	JAN	1402	62	5.	1	JAN	1542	112	14.	1	JAN	1722	162	4.
1	JAN	1224	13	3.	1	JAN	1404	63	5.	1	JAN	1544	113	14.	1	JAN	1724	163	4.
1	JAN	1226	14	3.	1	JAN	1406	64	5.	1	JAN	1546	114	15.	1	JAN	1726	164	4.
1	JAN	1228	15	3.	1	JAN	1408	65	5.	1	JAN	1548	115	15.	1	JAN	1728	165	4.
1	JAN	1230	16	3.	1	JAN	1410	66	5.	1	JAN	1550	116	16.	1	JAN	1730	166	4.
1	JAN	1232	17	3.	1	JAN	1412	67	5.	1	JAN	1552	117	16.	1	JAN	1732	167	4.
1	JAN	1234	18	3.	1	JAN	1414	68	5.	1	JAN	1554	118	20.	1	JAN	1734	168	4.
1	JAN	1236	19	3.	1	JAN	1416	69	5.	1	JAN	1556	119	27.	1	JAN	1736	169	4.
1	JAN	1238	20	3.	1	JAN	1418	70	5.	1	JAN	1558	120	33.	1	JAN	1738	170	4.
1	JAN	1240	21	3.	1	JAN	1420	71	5.	1	JAN	1600	121	40.	1	JAN	1740	171	3.
1	JAN	1242	22	3.	1	JAN	1422	72	5.	1	JAN	1602	122	46.	1	JAN	1742	172	3.
1	JAN	1244	23	3.	1	JAN	1424	73	5.	1	JAN	1604	123	53.	1	JAN	1744	173	3.
1	JAN	1246	24	3.	1	JAN	1426	74	5.	1	JAN	1606	124	60.	1	JAN	1746	174	3.
1	JAN	1248	25	3.	1	JAN	1428	75	5.	1	JAN	1608	125	66.	1	JAN	1748	175	3.
1	JAN	1250	26	3.	1	JAN	1430	76	5.	1	JAN	1610	126	59.	1	JAN	1750	176	3.
1	JAN	1252	27	3.	1	JAN	1432	77	5.	1	JAN	1612	127	51.	1	JAN	1752	177	3.
1	JAN	1254	28	3.	1	JAN	1434	78	6.	1	JAN	1614	128	44.	1	JAN	1754	178	3.
1	JAN	1256	29	3.	1	JAN	1436	79	6.	1	JAN	1616	129	36.	1	JAN	1756	179	3.
1	JAN	1258	30	3.	1	JAN	1438	80	6.	1	JAN	1618	130	29.	1	JAN	1758	180	2.
1	JAN	1300	31	3.	1	JAN	1440	81	6.	1	JAN	1620	131	21.	1	JAN	1800	181	2.
1	JAN	1302	32	4.	1	JAN	1442	82	6.	1	JAN	1622	132	14.	1	JAN	1802	182	1.
1	JAN	1304	33	4.	1	JAN	1444	83	6.	1	JAN	1624	133	10.	1	JAN	1804	183	1.
1	JAN	1306	34	4.	1	JAN	1446	84	6.	1	JAN	1626	134	10.	1	JAN	1806	184	0.
1	JAN	1308	35	4.	1	JAN	1448	85	6.	1	JAN	1628	135	9.	1	JAN	1808	185	0.
1	JAN	1310	36	4.	1	JAN	1450	86	6.	1	JAN	1630	136	9.	1	JAN	1810	186	0.
1	JAN	1312	37	4.	1	JAN	1452	87	6.	1	JAN	1632	137	8.	1	JAN	1812	187	0.
1	JAN	1314	38	4.	1	JAN	1454	88	6.	1	JAN	1634	138	8.	1	JAN	1814	188	0.
1	JAN	1316	39	4.	1	JAN	1456	89	7.	1	JAN	1636	139	7.	1	JAN	1816	189	0.
1	JAN	1318	40	4.	1	JAN	1458	90	7.	1	JAN	1638	140	7.	1	JAN	1818	190	0.
1	JAN	1320	41	4.	1	JAN	1500	91	7.	1	JAN	1640	141	7.	1	JAN	1820	191	0.
1	JAN	1322	42	4.	1	JAN	1502	92	7.	1	JAN	1642	142	7.	1	JAN	1822	192	0.
1	JAN	1324	43	4.	1	JAN	1504	93	7.	1	JAN	1644	143	6.	1	JAN	1824	193	0.
1	JAN	1326	44	4.	1	JAN	1506	94	8.	1	JAN	1646	144	6.	1	JAN	1826	194	0.
1	JAN	1328	45	4.	1	JAN	1508	95	8.	1	JAN	1648	145	6.	1	JAN	1828	195	0.
1	JAN	1330	46	4.	1	JAN	1510	96	8.	1	JAN	1650	146	6.	1	JAN	1830	196	0.
1	JAN	1332	47	4.	1	JAN	1512	97	8.	1	JAN	1652	147	6.	1	JAN	1832	197	0.
1	JAN	1334	48	4.	1	JAN	1514	98	8.	1	JAN	1654	148	5.	1	JAN	1834	198	0.
1	JAN	1336	49	4.	1	JAN	1516	99	8.	1	JAN	1656	149	5.	1	JAN	1836	199	0.
1	JAN	1338	50	4.	1	JAN	1518	100	8.	1	JAN	1658	150	5.	1	JAN	1838	200	0.

****

PEAK FLOW (CFS)	TIME (HR)		MAXIMUM AVERAGE FLOW 6-HR	24-HR	72-HR	6.63-HR
		(CFS)	8.	8.	8.	8.
66.	4.13	(INCHES)	1.555	1.559	1.559	1.559
		(AC-FT)	4.	4.	4.	4.

CUMULATIVE AREA = .05 SQ MI

*** ***

```
          **************
          *            *
 16 KK    *   DETAIN   *
          *            *
          **************
```

HYDROGRAPH ROUTING DATA

17 RS STORAGE ROUTING
NSTPS 1 NUMBER OF SUBREACHES
ITYP STOR TYPE OF INITIAL CONDITION
RSVRIC -1.00 INITIAL CONDITION
X .00 WORKING R AND D COEFFICIENT

18 SV STORAGE .0 .1

19 SQ DISCHARGE 0. 64.

20 SE ELEVATION 100.00 101.00

***

*** WARNING *** MODIFIED PULS ROUTING MAY BE NUMERICALLY UNSTABLE FOR OUTFLOWS BETWEEN 0. TO 64.
THE ROUTED HYDROGRAPH SHOULD BE EXAMINED FOR OSCILLATIONS OR OUTFLOWS GREATER THAN PEAK INFLOWS.
THIS CAN BE CORRECTED BY DECREASING THE TIME INTERVAL OR INCREASING STORAGE (USE A LONGER REACH.)

HYDROGRAPH AT STATION DETAIN

DA	MON	HRMN	ORD	OUTFLOW	STORAGE	STAGE	DA	MON	HRMN	ORD	OUTFLOW	STORAGE	STAGE	DA	MON	HRMN	ORD	OUTFLOW	STORAGE	STAGE
1	JAN	1200	1	1.	.0	100.0	1	JAN	1414	68	5.	.0	100.1	1	JAN	1628	135	9.	.0	100.1
1	JAN	1202	2	2.	.0	100.0	1	JAN	1416	69	5.	.0	100.1	1	JAN	1630	136	9.	.0	100.1
1	JAN	1204	3	2.	.0	100.0	1	JAN	1418	70	5.	.0	100.1	1	JAN	1632	137	8.	.0	100.1
1	JAN	1206	4	2.	.0	100.0	1	JAN	1420	71	5.	.0	100.1	1	JAN	1634	138	8.	.0	100.1
1	JAN	1208	5	3.	.0	100.0	1	JAN	1422	72	5.	.0	100.1	1	JAN	1636	139	8.	.0	100.1
1	JAN	1210	6	3.	.0	100.0	1	JAN	1424	73	5.	.0	100.1	1	JAN	1638	140	7.	.0	100.1
1	JAN	1212	7	3.	.0	100.0	1	JAN	1426	74	5.	.0	100.1	1	JAN	1640	141	7.	.0	100.1
1	JAN	1214	8	3.	.0	100.0	1	JAN	1428	75	5.	.0	100.1	1	JAN	1642	142	7.	.0	100.1
1	JAN	1216	9	3.	.0	100.0	1	JAN	1430	76	5.	.0	100.1	1	JAN	1644	143	6.	.0	100.1
1	JAN	1218	10	3.	.0	100.0	1	JAN	1432	77	5.	.0	100.1	1	JAN	1646	144	6.	.0	100.1
1	JAN	1220	11	3.	.0	100.0	1	JAN	1434	78	6.	.0	100.1	1	JAN	1648	145	6.	.0	100.1
1	JAN	1222	12	3.	.0	100.0	1	JAN	1436	79	6.	.0	100.1	1	JAN	1650	146	6.	.0	100.1
1	JAN	1224	13	3.	.0	100.0	1	JAN	1438	80	6.	.0	100.1	1	JAN	1652	147	6.	.0	100.1
1	JAN	1226	14	3.	.0	100.0	1	JAN	1440	81	6.	.0	100.1	1	JAN	1654	148	5.	.0	100.1
1	JAN	1228	15	3.	.0	100.0	1	JAN	1442	82	6.	.0	100.1	1	JAN	1656	149	5.	.0	100.1
1	JAN	1230	16	3.	.0	100.0	1	JAN	1444	83	6.	.0	100.1	1	JAN	1658	150	5.	.0	100.1
1	JAN	1232	17	3.	.0	100.1	1	JAN	1446	84	6.	.0	100.1	1	JAN	1700	151	5.	.0	100.1
1	JAN	1234	18	3.	.0	100.1	1	JAN	1448	85	6.	.0	100.1	1	JAN	1702	152	5.	.0	100.1
1	JAN	1236	19	3.	.0	100.1	1	JAN	1450	86	6.	.0	100.1	1	JAN	1704	153	5.	.0	100.1
1	JAN	1238	20	3.	.0	100.1	1	JAN	1452	87	6.	.0	100.1	1	JAN	1706	154	5.	.0	100.1
1	JAN	1240	21	3.	.0	100.1	1	JAN	1454	88	6.	.0	100.1	1	JAN	1708	155	5.	.0	100.1
1	JAN	1242	22	3.	.0	100.1	1	JAN	1456	89	7.	.0	100.1	1	JAN	1710	156	4.	.0	100.1
1	JAN	1244	23	3.	.0	100.1	1	JAN	1458	90	7.	.0	100.1	1	JAN	1712	157	4.	.0	100.1
1	JAN	1246	24	3.	.0	100.1	1	JAN	1500	91	7.	.0	100.1	1	JAN	1714	158	4.	.0	100.1
1	JAN	1248	25	3.	.0	100.1	1	JAN	1502	92	7.	.0	100.1	1	JAN	1716	159	4.	.0	100.1
1	JAN	1250	26	3.	.0	100.1	1	JAN	1504	93	7.	.0	100.1	1	JAN	1718	160	4.	.0	100.1
1	JAN	1252	27	3.	.0	100.1	1	JAN	1506	94	7.	.0	100.1	1	JAN	1720	161	4.	.0	100.1
1	JAN	1254	28	3.	.0	100.1	1	JAN	1508	95	8.	.0	100.1	1	JAN	1722	162	4.	.0	100.1
1	JAN	1256	29	3.	.0	100.1	1	JAN	1510	96	8.	.0	100.1	1	JAN	1724	163	4.	.0	100.1
1	JAN	1258	30	3.	.0	100.1	1	JAN	1512	97	8.	.0	100.1	1	JAN	1726	164	4.	.0	100.1
1	JAN	1300	31	3.	.0	100.1	1	JAN	1514	98	8.	.0	100.1	1	JAN	1728	165	4.	.0	100.1
1	JAN	1302	32	4.	.0	100.1	1	JAN	1516	99	8.	.0	100.1	1	JAN	1730	166	4.	.0	100.1
1	JAN	1304	33	4.	.0	100.1	1	JAN	1518	100	8.	.0	100.1	1	JAN	1732	167	4.	.0	100.1
1	JAN	1306	34	4.	.0	100.1	1	JAN	1520	101	8.	.0	100.1	1	JAN	1734	168	4.	.0	100.1
1	JAN	1308	35	4.	.0	100.1	1	JAN	1522	102	9.	.0	100.1	1	JAN	1736	169	4.	.0	100.1
1	JAN	1310	36	4.	.0	100.1	1	JAN	1524	103	9.	.0	100.1	1	JAN	1738	170	4.	.0	100.1
1	JAN	1312	37	4.	.0	100.1	1	JAN	1526	104	9.	.0	100.1	1	JAN	1740	171	3.	.0	100.1
1	JAN	1314	38	4.	.0	100.1	1	JAN	1528	105	10.	.0	100.2	1	JAN	1742	172	3.	.0	100.1
1	JAN	1316	39	4.	.0	100.1	1	JAN	1530	106	10.	.0	100.2	1	JAN	1744	173	3.	.0	100.1
1	JAN	1318	40	4.	.0	100.1	1	JAN	1532	107	11.	.0	100.2	1	JAN	1746	174	3.	.0	100.1
1	JAN	1320	41	4.	.0	100.1	1	JAN	1534	108	12.	.0	100.2	1	JAN	1748	175	3.	.0	100.1
1	JAN	1322	42	4.	.0	100.1	1	JAN	1536	109	12.	.0	100.2	1	JAN	1750	176	3.	.0	100.1
1	JAN	1324	43	4.	.0	100.1	1	JAN	1538	110	13.	.0	100.2	1	JAN	1752	177	3.	.0	100.1
1	JAN	1326	44	4.	.0	100.1	1	JAN	1540	111	13.	.0	100.2	1	JAN	1754	178	3.	.0	100.0
1	JAN	1328	45	4.	.0	100.1	1	JAN	1542	112	14.	.0	100.2	1	JAN	1756	179	3.	.0	100.0
1	JAN	1330	46	4.	.0	100.1	1	JAN	1544	113	14.	.0	100.2	1	JAN	1758	180	2.	.0	100.0
1	JAN	1332	47	4.	.0	100.1	1	JAN	1546	114	15.	.0	100.2	1	JAN	1800	181	2.	.0	100.0
1	JAN	1334	48	4.	.0	100.1	1	JAN	1548	115	15.	.0	100.2	1	JAN	1802	182	1.	.0	100.0
1	JAN	1336	49	4.	.0	100.1	1	JAN	1550	116	16.	.0	100.2	1	JAN	1804	183	1.	.0	100.0
1	JAN	1338	50	4.	.0	100.1	1	JAN	1552	117	16.	.0	100.3	1	JAN	1806	184	1.	.0	100.0
1	JAN	1340	51	4.	.0	100.1	1	JAN	1554	118	18.	.0	100.3	1	JAN	1808	185	0.	.0	100.0
1	JAN	1342	52	4.	.0	100.1	1	JAN	1556	119	24.	.0	100.4	1	JAN	1810	186	0.	.0	100.0
1	JAN	1344	53	4.	.0	100.1	1	JAN	1558	120	31.	.0	100.5	1	JAN	1812	187	0.	.0	100.0
1	JAN	1346	54	4.	.0	100.1	1	JAN	1600	121	37.	.0	100.6	1	JAN	1814	188	0.	.0	100.0
1	JAN	1348	55	4.	.0	100.1	1	JAN	1602	122	44.	.0	100.7	1	JAN	1816	189	0.	.0	100.0
1	JAN	1350	56	4.	.0	100.1	1	JAN	1604	123	51.	.0	100.8	1	JAN	1818	190	0.	.0	100.0
1	JAN	1352	57	4.	.0	100.1	1	JAN	1606	124	57.	.1	100.9	1	JAN	1820	191	0.	.0	100.0
1	JAN	1354	58	4.	.0	100.1	1	JAN	1608	125	64.	.1	101.0	1	JAN	1822	192	0.	.0	100.0
1	JAN	1356	59	4.	.0	100.1	1	JAN	1610	126	62.	.1	101.0	1	JAN	1824	193	0.	.0	100.0
1	JAN	1358	60	4.	.0	100.1	1	JAN	1612	127	54.	.1	100.8	1	JAN	1826	194	0.	.0	100.0
1	JAN	1400	61	5.	.0	100.1	1	JAN	1614	128	46.	.0	100.7	1	JAN	1828	195	0.	.0	100.0
1	JAN	1402	62	5.	.0	100.1	1	JAN	1616	129	39.	.0	100.6	1	JAN	1830	196	0.	.0	100.0
1	JAN	1404	63	5.	.0	100.1	1	JAN	1618	130	31.	.0	100.5	1	JAN	1832	197	0.	.0	100.0
1	JAN	1406	64	5.	.0	100.1	1	JAN	1620	131	24.	.0	100.4	1	JAN	1834	198	0.	.0	100.0
1	JAN	1408	65	5.	.0	100.1	1	JAN	1622	132	17.	.0	100.3	1	JAN	1836	199	0.	.0	100.0
1	JAN	1410	66	5.	.0	100.1	1	JAN	1624	133	11.	.0	100.2	1	JAN	1838	200	0.	.0	100.0
1	JAN	1412	67	5.	.0	100.1	1	JAN	1626	134	10.	.0	100.2							

PEAK FLOW	TIME		MAXIMUM AVERAGE FLOW			
			6-HR	24-HR	72-HR	6.63-HR
(CFS)	(HR)	(CFS)				
64.	4.13		8.	8.	8.	8.
		(INCHES)	1.555	1.559	1.559	1.559
		(AC-FT)	4.	4.	4.	4.

PEAK STORAGE	TIME	MAXIMUM AVERAGE STORAGE			
		6-HR	24-HR	72-HR	6.63-HR
(AC-FT)	(HR)				
0.	4.13	0.	0.	0.	0.

PEAK STAGE	TIME	MAXIMUM AVERAGE STAGE			
		6-HR	24-HR	72-HR	6.63-HR
(FEET)	(HR)				
101.00	4.13	100.13	100.12	100.12	100.12

CUMULATIVE AREA = .05 SQ MI

1

RUNOFF SUMMARY
FLOW IN CUBIC FEET PER SECOND
TIME IN HOURS, AREA IN SQUARE MILES

OPERATION	STATION	PEAK FLOW	TIME OF PEAK	AVERAGE FLOW FOR MAXIMUM PERIOD			BASIN AREA	MAXIMUM STAGE	TIME OF MAX STAGE
				6-HOUR	24-HOUR	72-HOUR			
HYDROGRAPH AT	BASIN	66.	4.13	8.	8.	8.	.05		
ROUTED TO	DETAIN	64.	4.13	8.	8.	8.	.05	101.00	4.13

*** NORMAL END OF HEC-1 ***

MIRAR DE VALLE

OLD MIRAR DE VALLE

VALLEY CENTER ROAD

2.8 AC

7.3 AC

9.6 AC

11.8 AC

0.1 AC

0.1 AC

0.1 AC

105

Q_{100}=63.92 CFS
A=31.8 ACRES
Tc= 14.5 min.

104

122

Q_{100}=8.67 CFS
A=2.9 ACRES
Tc= 13.42 min.

103

Q_{100}=40.85 CFS
A=21.5 ACRES
Tc= 14.37 min.

Q_{100}=15.83 CFS
A=7.4 ACRES
Tc= 12.64 min.

102

Q_{100}=27.54 CFS
A=11.9 ACRES
Tc= 9.74 min.

121

Q_{100}=0.30 CFS
A=0.1 ACRES
Tc= 4.92 min.

120

111

Q_{100}=0.30 CFS
A=0.1 ACRES
Tc= 4.92 min.

110

101

Q_{100}=0.30 CFS
A=0.1 ACRES
Tc= 6.66 min.

100

TYPE C SOIL

TYPE D SOIL

LEGEND

- PROPERTY BOUNDARY
- MAJOR DRAINAGE BOUNDARY
- MINOR DRAINAGE BOUNDARY
- SOIL TYPE BOUNDARY
- DIRECTION OF FLOW
- NODE NUMBER
- BASIN AREA

100
7.4 AC

N

50 25 0 50

GRAPHIC SCALE
1" = 50'

PREPARED BY:
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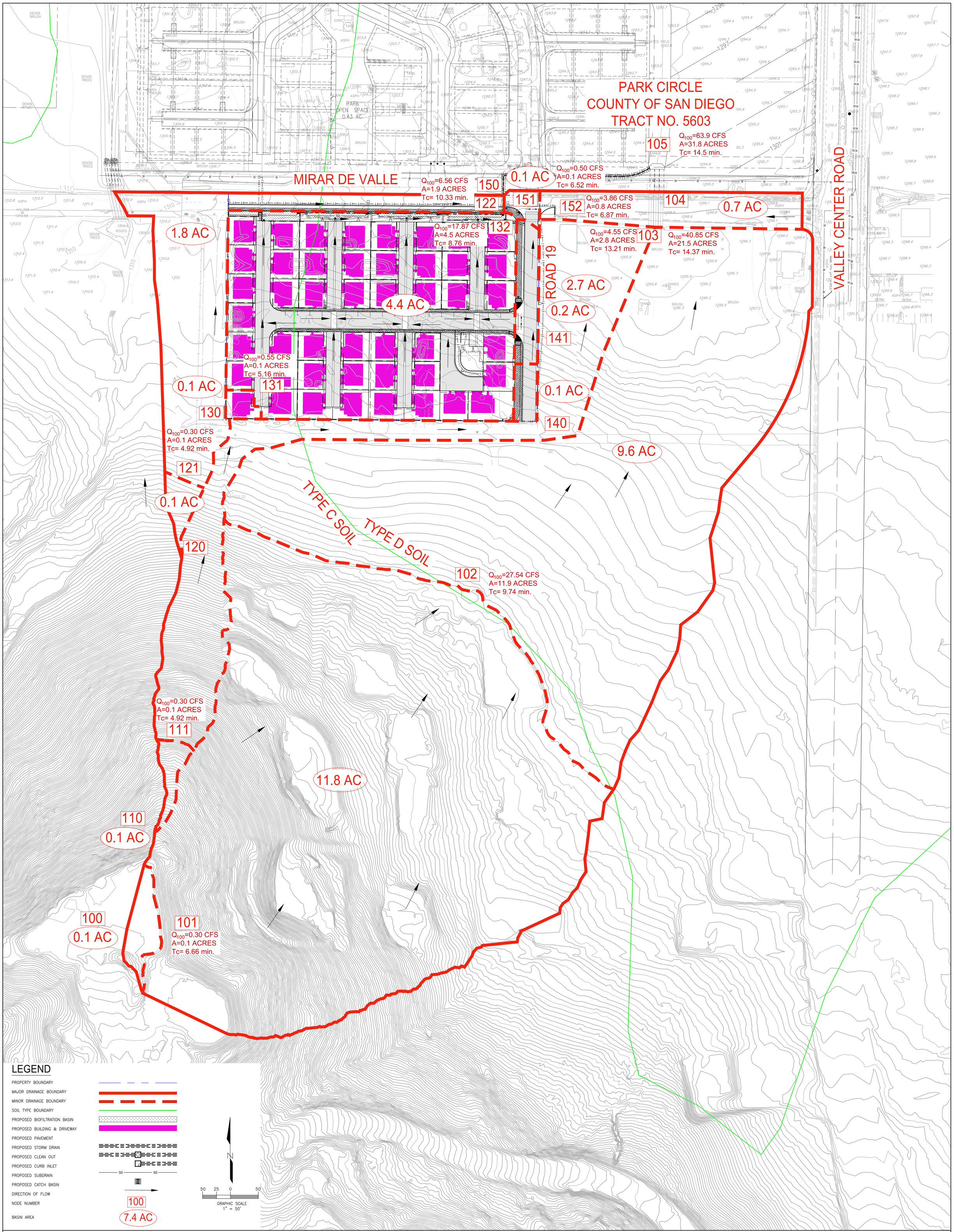
PRE-PROJECT DRAINAGE MAP FOR SHADY OAK



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POST-PROJECT DRAINAGE MAP FOR SHADY OAK