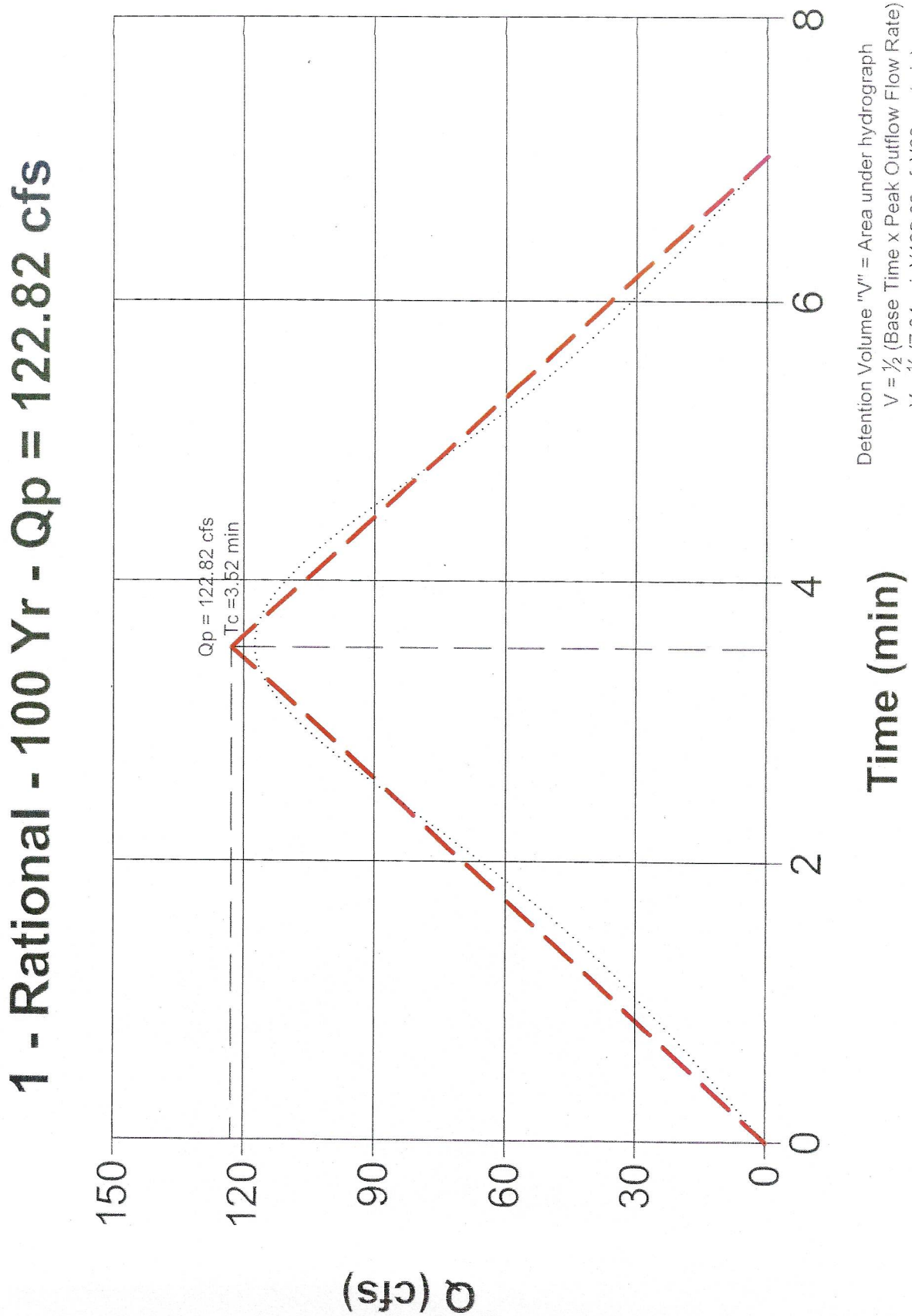
HYDROGRAPH - EX. CONDITIONS - 100 YR EVENT ON-SITE



Detention Volume "V" = Area under hydrograph
V = ½ (Base Time x Peak Outflow Flow Rate)
V = ½ (7.04 min)(122.82 cfs)(60sec/min)

V = 51,879.168 cuft.

TIME TO DRAIN STORMWATER RUNOFF – ON-SITE

RUNOFF VOLUME

Given:
Peak Runoff flow rate (see previous page for calculation), $Q_p = 256.49$ cfs

Time of Concentration (see previous page for calc), $T_c = 9.71$ min

Required:
Runoff Volume

Solution:
$V_{runoff} = Q_p \times T_c = 122.82 \text{ cfs} \times \frac{1}{2} \times 2 \times (3.52 \text{ min} \times 60 \text{sec/min})$

$V_{runoff} = 51{,}880$ cuft.

TIME TO DRAIN

Given:
2-6" PVC pipes @ 3% slope, Q_{pipe} 2.8 cfs (see flowmaster calc on subsequent page)

Required:
Time to Drain

Solution:

$$T = \frac{V_{runoff}}{Q_{pipe}} = \frac{51{,}880 \text{ cuft}}{2.8 \text{ cfs}} \times \frac{1\text{hr}}{3{,}600 \text{ sec}} = 5.147 \text{ hours}$$

T = 5.15 hours (flow through both pipes)

In the case of one 6" pipe plugging:

$$T = \frac{V_{runoff}}{Q_{pipe}} = \frac{51{,}880 \text{ cuft}}{1.4 \text{ cfs}} \times \frac{1\text{hr}}{3{,}600 \text{ sec}} = 10.29 \text{ hours}$$

T = 10.29 hours (one pipe plugged)

6" pipe
Worksheet for Circular Channel

Project Description	
Project File	c:\haestad\fmw\490 japa.fm2
Worksheet	6" Pipe
Flow Element	Circular Channel
Method	Manning's Formula
Solve For	Full Flow Capacity

Input Data		
Mannings Coefficient	0.009	
Channel Slope	0.030000	ft/ft
Diameter	6.00	in

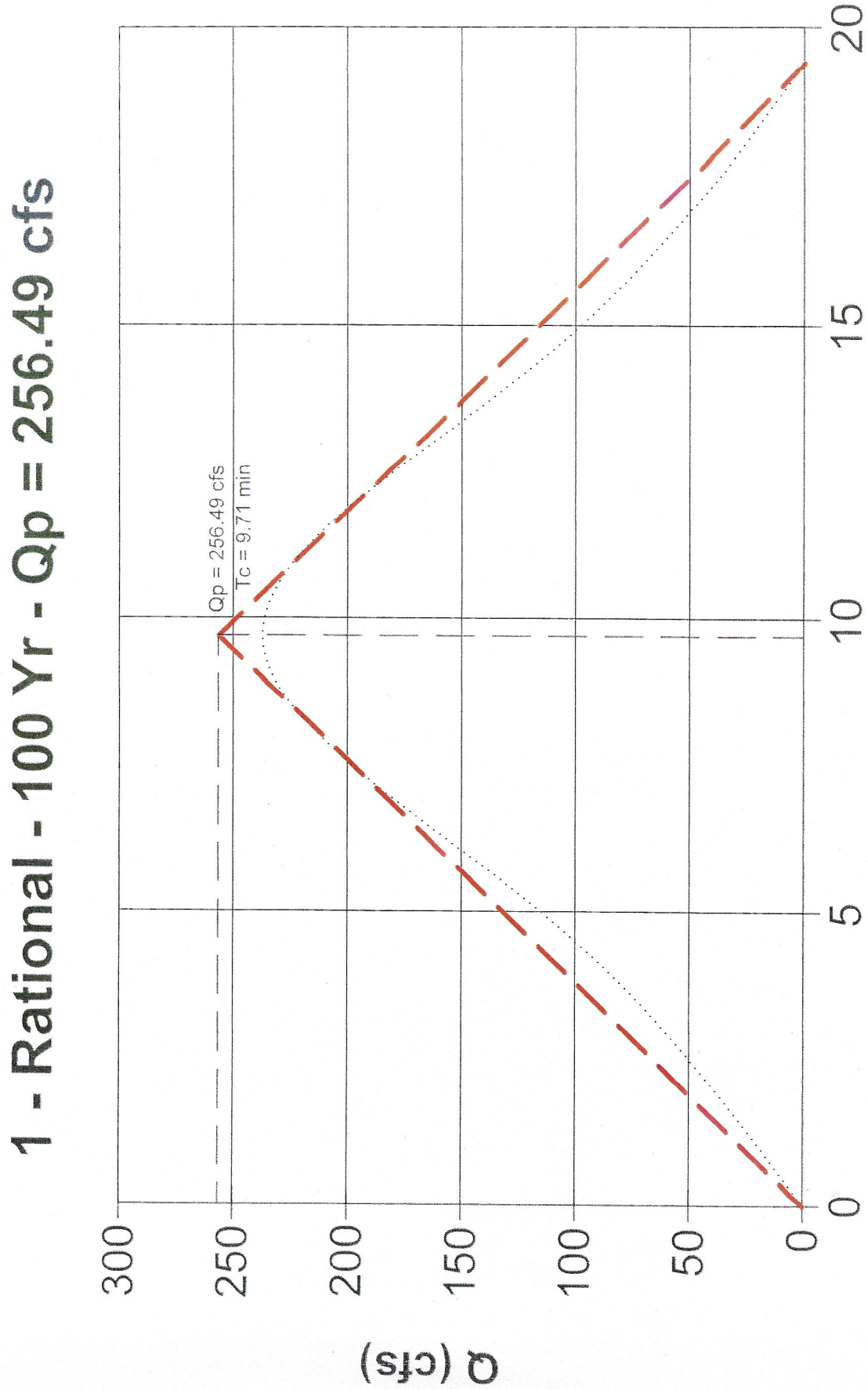
Results		
Depth	0.50	ft
Discharge	1.40	cfs
Flow Area	0.20	ft^2
Wetted Perimeter	1.57	ft
Top Width	0.00	ft
Critical Depth	0.49	ft
Percent Full	100.00	
Critical Slope	0.027179	ft/ft
Velocity	7.15	ft/s
Velocity Head	0.79	ft
Specific Energy	FULL	ft
Froude Number	FULL	
Maximum Discharge	1.51	cfs
Full Flow Capacity	1.40	cfs
Full Flow Slope	0.030000	ft/ft

TWO Pipes

2 x 1.40 CFS = 2.80 CFS

SECTION 5.4
PROPOSED DESILT POND STORM WATER RUNOFF (BASIN)

HYDROGRAPH - EX. CONDITIONS - 100 YR EVENT BASIN



Detention Volume "V" = Area under hydrograph
V = ½ (Base Time x Peak Outflow Flow Rate)
V = ½ (19.42 min)(256.49 cfs)(60sec/min)

V = 149,431.074 cuft.

TIME TO DRAIN STORMWATER RUNOFF – BASIN

RUNOFF VOLUME

Given:
Peak Runoff flow rate (see previous page for calculation), $Q_p = 256.49$ cfs

Time of Concentration (see previous page for calc), $T_c = 9.71$ min

Required:
Runoff Volume

Solution:
$V_{runoff} = Q_p \times T_c = 256.49 \text{ cfs} \times \frac{1}{2} \times 2 \times (9.71 \text{ min} \times 60\text{sec/min})$

$$\underline{\underline{V_{runoff} = 149{,}431 \text{ cuft.}}}$$

TIME TO DRAIN

Given:
2-6" PVC pipes @ 3% slope, Q_{pipe} 2.8 cfs (see flowmaster calc on subsequent page)

Required:
Time to Drain

Solution:

$$T = \frac{V_{runoff}}{Q_{pipe}} = \frac{149{,}431 \text{ cuft}}{2.8 \text{ cfs}} \times \frac{1\text{hr}}{3{,}600 \text{ sec}} = 14.82 \text{ hours}$$

T = 14.82 hours (flow through both pipes)

In the case of one 6" pipe plugging:

$$T = \frac{V_{runoff}}{Q_{pipe}} = \frac{149{,}431 \text{ cuft}}{1.4 \text{ cfs}} \times \frac{1\text{hr}}{3{,}600 \text{ sec}} = 29.64 \text{ hours}$$

T = 29.64 hours (one pipe plugged)

6" pipe
Worksheet for Circular Channel

Project Description	
Project File	c:\haestad\fmw\490 japa.fm2
Worksheet	6" Pipe
Flow Element	Circular Channel
Method	Manning's Formula
Solve For	Full Flow Capacity

Input Data		
Mannings Coefficient	0.009	
Channel Slope	0.030000	ft/ft
Diameter	6.00	in

Results		
Depth	0.50	ft
Discharge	1.40	cfs
Flow Area	0.20	ft^2
Wetted Perimeter	1.57	ft
Top Width	0.00	ft
Critical Depth	0.49	ft
Percent Full	100.00	
Critical Slope	0.027179	ft/ft
Velocity	7.15	ft/s
Velocity Head	0.79	ft
Specific Energy	FULL	ft
Froude Number	FULL	
Maximum Discharge	1.51	cfs
Full Flow Capacity	1.40	cfs
Full Flow Slope	0.030000	ft/ft

SECTION 5.5
PROPOSED DESILT POND CAPACITY CALCULATIONS

DESILT BASIN VOLUME

SUBAREA 1

Elevation Difference = 5 ft.

Avg area = $\frac{4{,}580' + 16{,}314'}{2}$ = 10,447 sqft

Volume = 10,447 sqft x 5 ft = 52,235 cuft.

SUBAREA 2

Elevation Difference = 5 ft.

Avg area = $\frac{16{,}314' + 36{,}810'}{2}$ = 26,562 sqft

Volume = 26,562 sqft x 5' = 132,810 cuft.

TOTAL VOLUME

Σ = 52,235 + 132,810 = 185,045 cuft

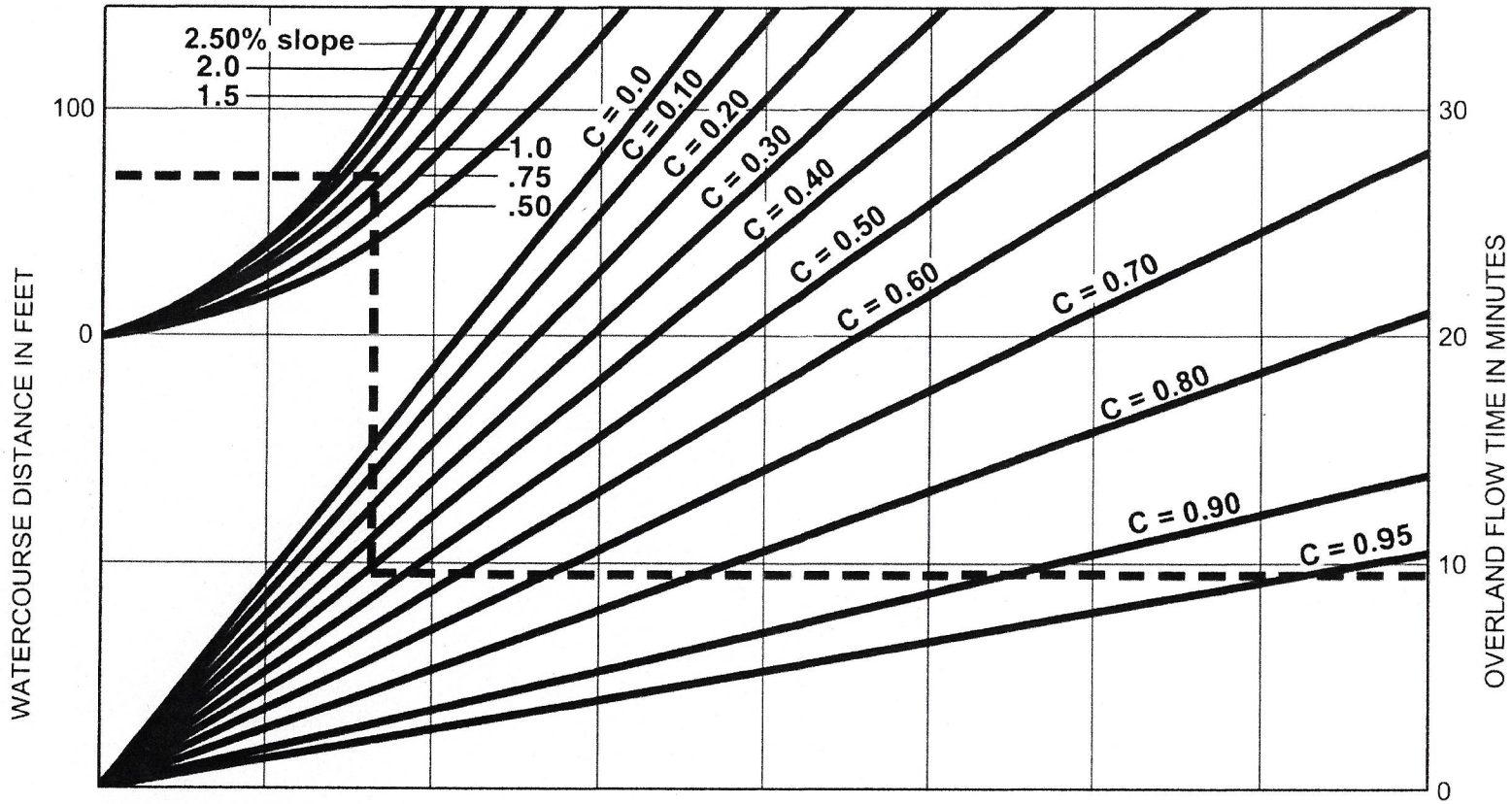
V_{pond} = 185,045 cuft.

APPENDIX

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



EXAMPLE:

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

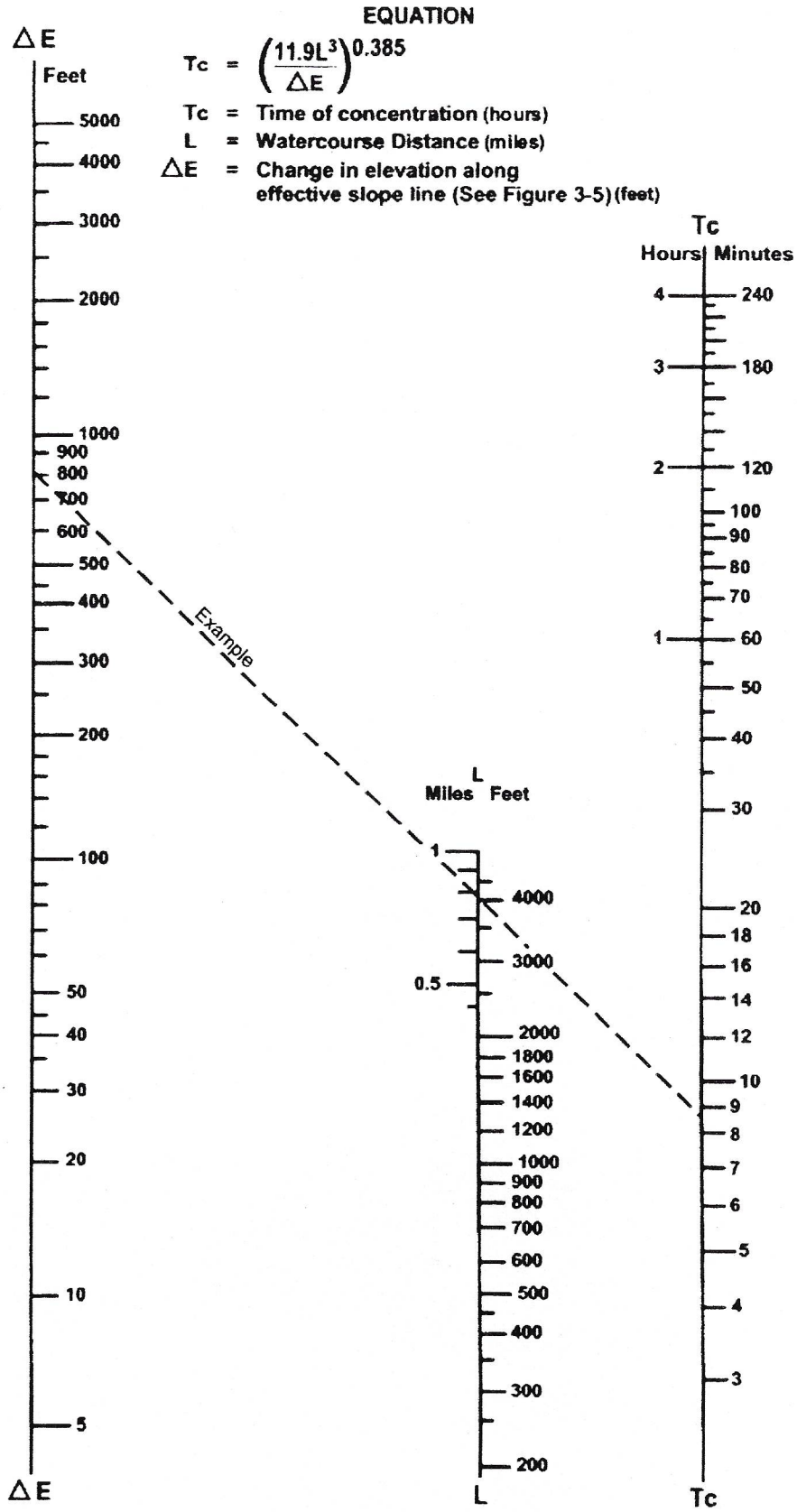
$$T = \frac{1.8\,(1.1-C)\sqrt{D}}{\sqrt[3]{s}}$$

SOURCE: Airport Drainage, Federal Aviation Administration, 1965

FIGURE

Rational Formula - Overland Time of Flow Nomograph

3-3

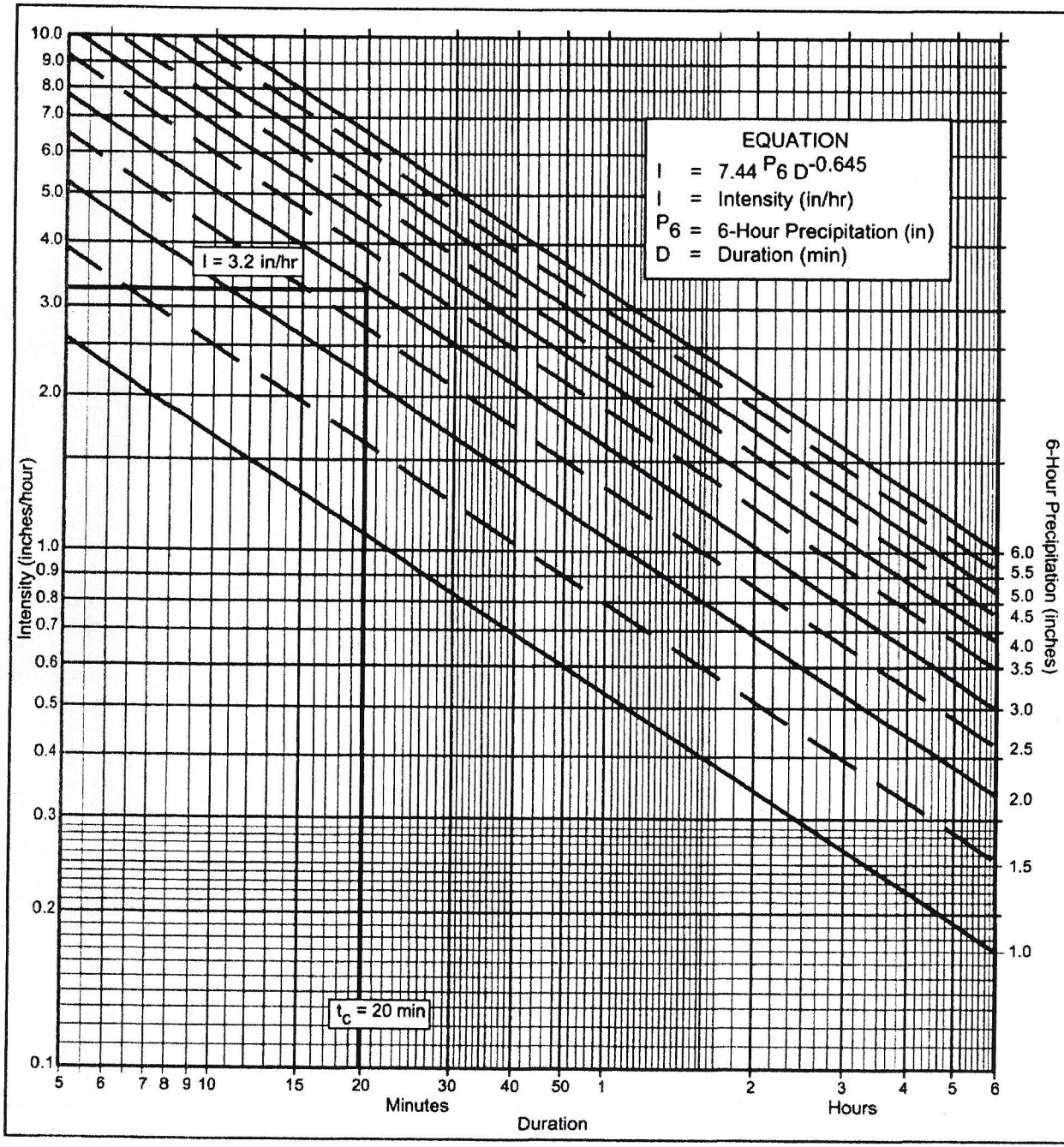


SOURCE: California Division of Highways (1941) and Kirpich (1940)

FIGURE

3-4

Nomograph for Determination of
Time of Concentration (Tc) or Travel Time (Tt) for Natural Watersheds



Directions for Application:

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

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

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

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

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

Application Form:

(a) Selected frequency 50 year

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

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

(d) t_x = 20 min.

(e) I = 3.2 in./hr.

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

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

Intensity-Duration Design Chart - Example

FIGURE

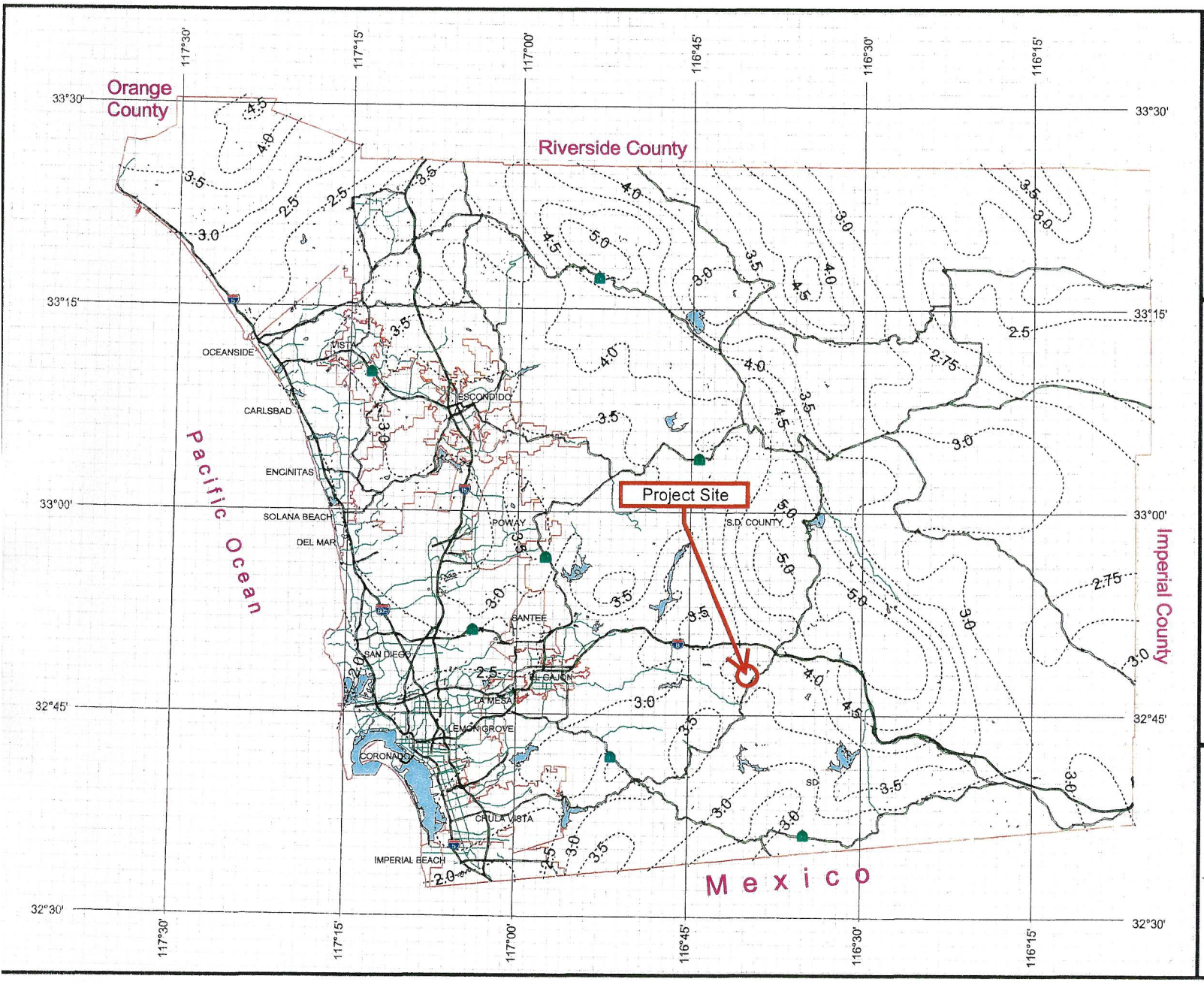
3-2

County of San Diego Hydrology Manual

Rainfall Isopluvials

100 Year Rainfall Event - 6 Hours

Isopluvial (inches)



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N W E S

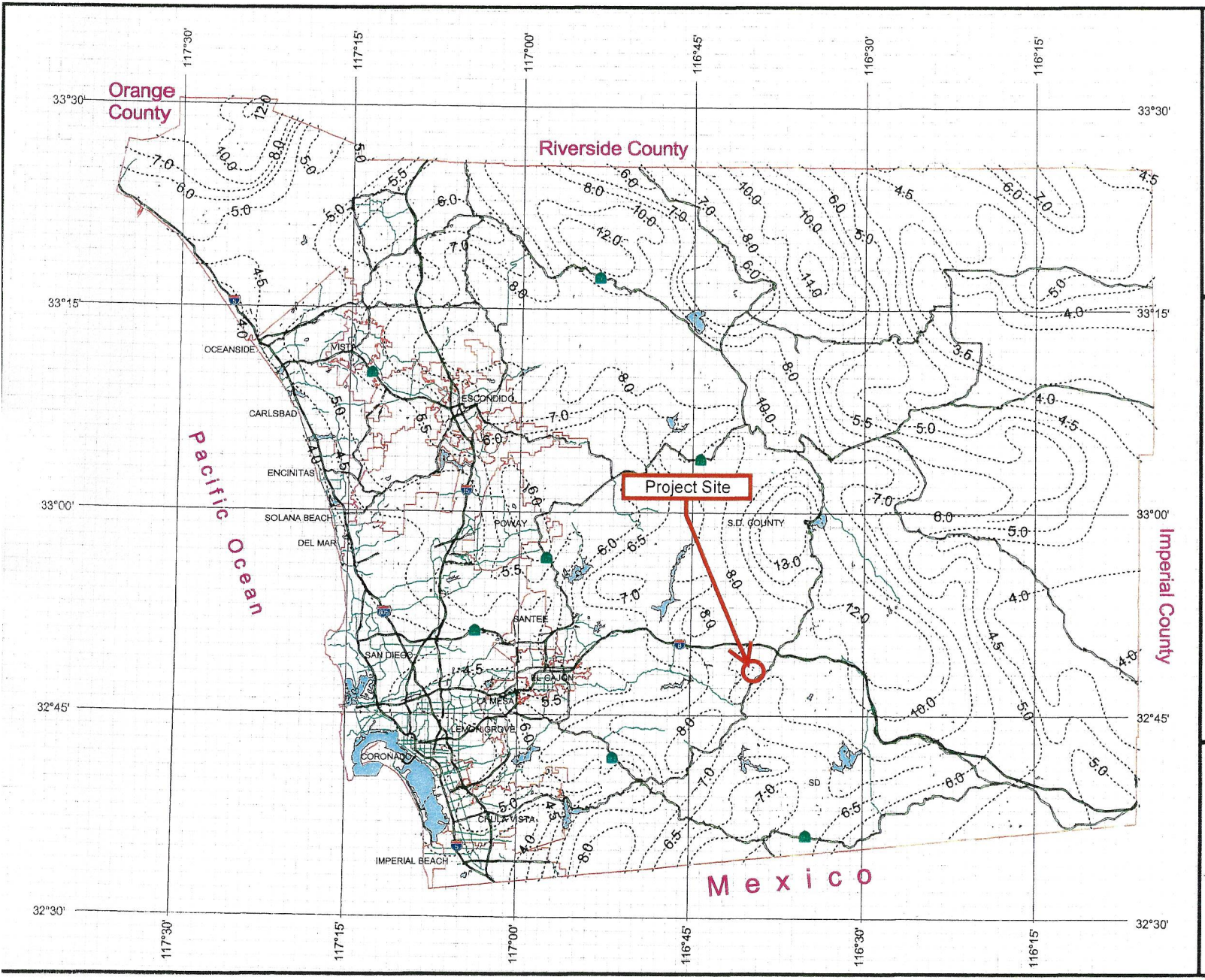
3 0 3 Miles

County of San Diego Hydrology Manual

Rainfall Isopluvials

100 Year Rainfall Event - 24 Hours

Isopluvial (inches)



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3 0 3 Miles

NFIP

NATIONAL FLOOD INSURANCE PROGRAM

PANEL 1725G

FIRM

FLOOD INSURANCE RATE MAP

SAN DIEGO COUNTY, CALIFORNIA

AND INCORPORATED AREAS

PANEL 1725 OF 2375

(SEE MAP INDEX FOR FIRM PANEL LAYOUT)

CONTAINS:

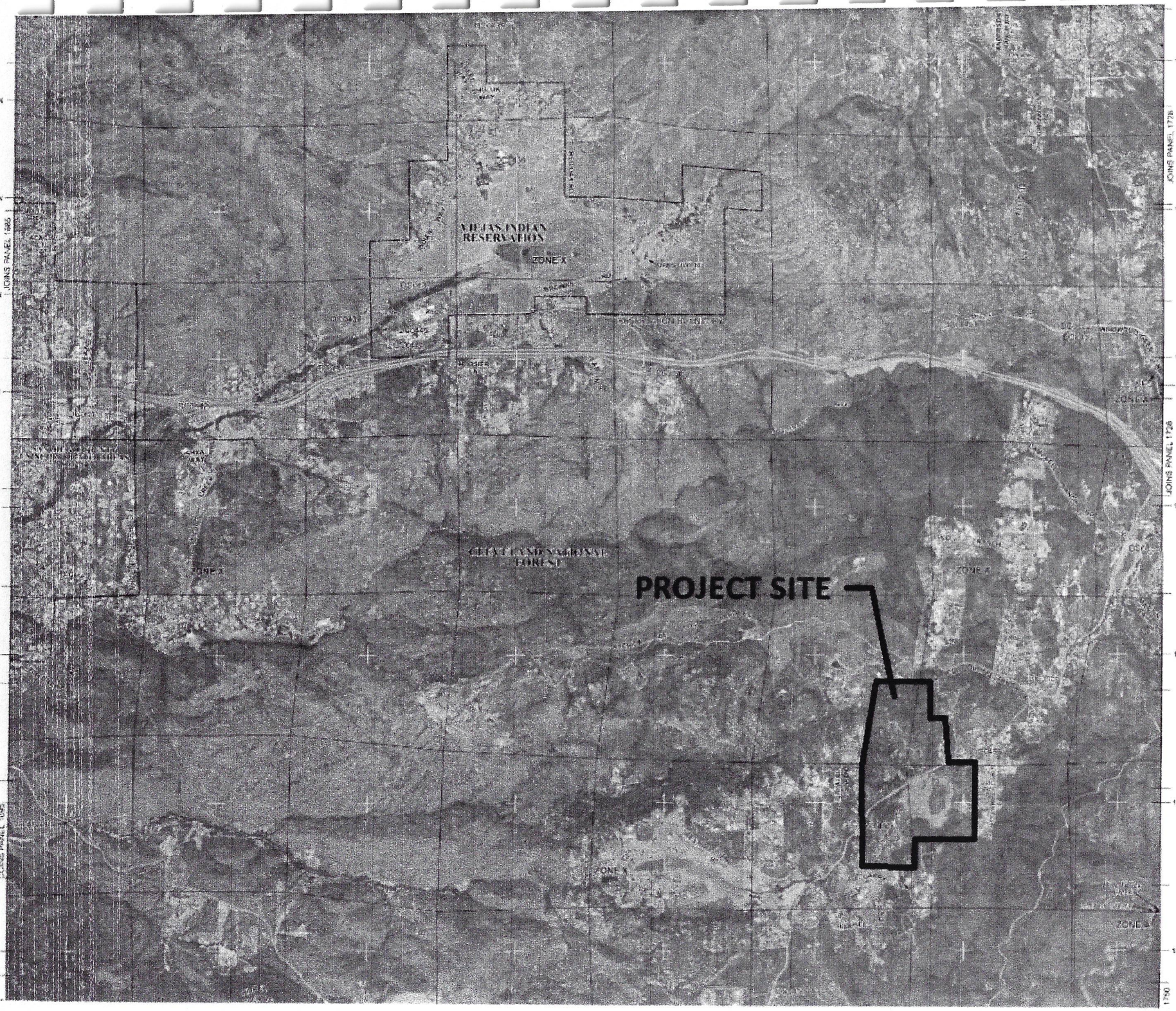
COMMUNITY	NUMBER	PANEL	SUFFIX
SAN DIEGO COUNTY	060284	1725	G

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
06073C1725G

MAP REVISED
MAY 16, 2012

Federal Emergency Management Agency

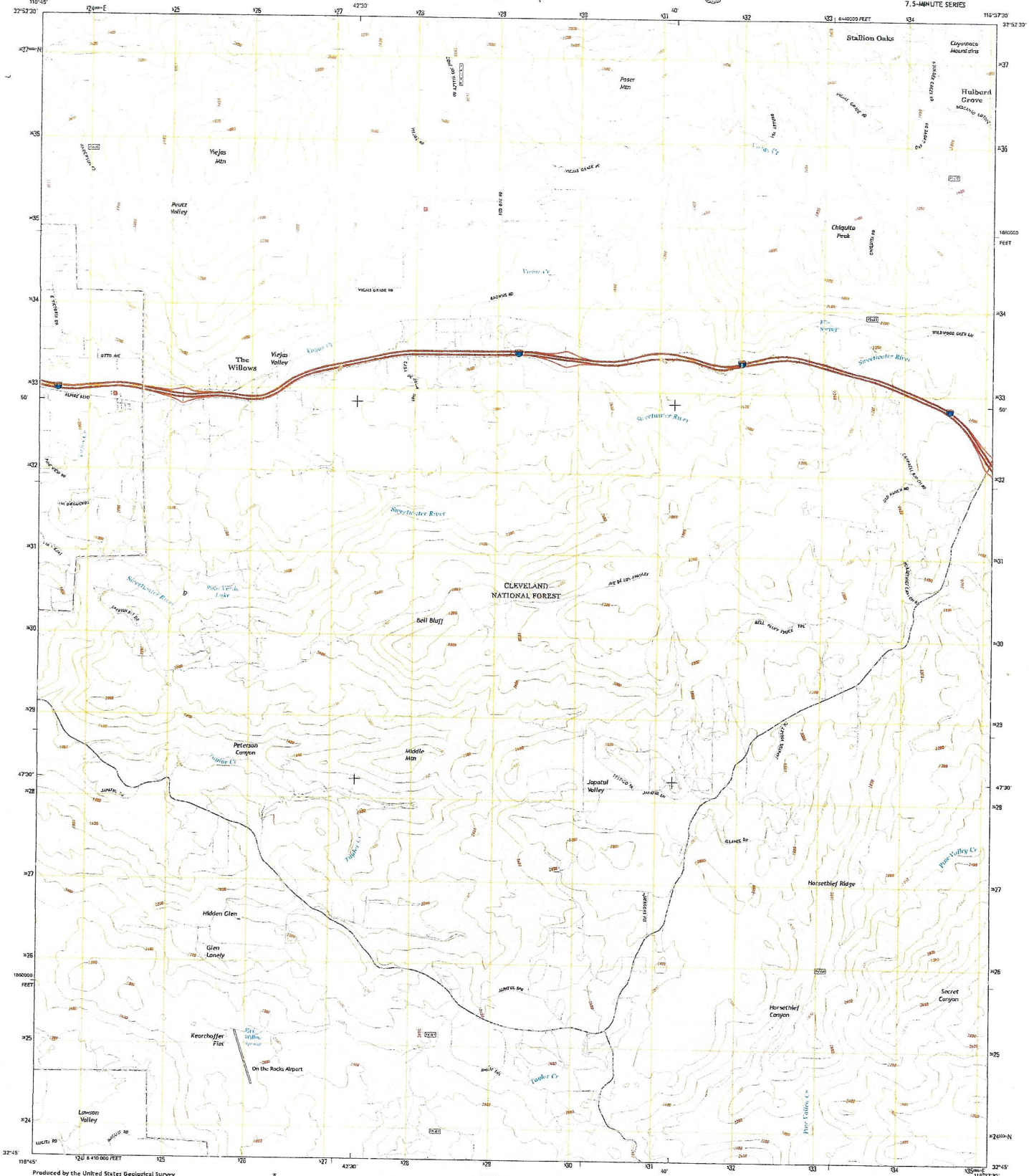

PROJECT SITE
ZONE X
ZONE A
JOINS PANEL 1726
1895000 FT
1890000 FT
1885000 FT
1880000 FT
1875000 FT
1870000 FT
1865000 FT

A.5

U.S. DEPARTMENT OF THE INTERIOR
U.S. GEOLOGICAL SURVEY

The National Map US Topo

VIEJAS MOUNTAIN QUADRANGLE
CALIFORNIA-SAN DIEGO CO.
7.5-MINUTE SERIES



Produced by the United States Geological Survey
North American Datum of 1983 (NAD83)
World Geodetic System of 1984 (WGS84). Projection and
1 000-meter grid: Universal Transverse Mercator, Zone 11S
10 000-foot ticks: California Coordinate System of 1983 (Zone 6)

This map is not a legal document. Boundaries may be generalized for this map scale. Private lands within government reservations may not be shown. Obtain permission before entering private lands.

Imagery.....NAIP, May 2012
Roads.....HERE, C.2013 - 2014
Roads within US Forest Service Lands.....FSTopo Data with limited Forest Service updates, 2012 - 2015
Names.....GNIS, 2015
Hydrography.....National Hydrography Dataset, 2012
Contours.....National Elevation Dataset, 2004
Boundaries.....Multiple sources; see metadata file 1972 - 2015
Public Land Survey System.....BLM, 2011

MEAN DECLINATION 2011 MAGNETIC NORTH DECLINATION AT CENTER OF SHEET

U.S. National Grid
Zone Designation
11S

SCALE 1:24 000

CONTOUR INTERVAL 40 FEET
NORTH AMERICAN VERTICAL DATUM OF 1988

This map was produced to conform with the National Geospatial Program US Topo Product Standard, 2011. A metadata file associated with this product is draft version 0.6.16

1	2	3
4		5
6	7	8

1 El Cajon Mountain
2 Tule Springs
3 Guatamaca Peak
4 Alpine
5 Descanso
6 Dulzura
7 Barrett Lake
8 Morena Reservoir

ROAD CLASSIFICATION
Expressway — Local Connector
Secondary Hwy — Local Road
Ramp — 4WD
Interstate Route — US Route — State Route
FS Primary Route — FS Passenger Route — FS High Clearance Route

Check with local Forest Service unit for current travel conditions and restrictions.

VIEJAS MOUNTAIN, CA
2015