TPM 20914
LOG NO. 05-02-006
ENANDER

DRAINAGE STUDY

Prepared by:

5/31/06

REGISTERED PROFESSIONAL ENGINEER
HADLEY JOHNSON
NO. 14870
Exp. 3-31-07
CIVIL
STATE OF CALIFORNIA

Hadley Johnson
RCE 14870
05/16/05

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ENANDER DRAINAGE STUDY

Enander TPM 20914 is affected by two very small drainage areas.

A drainage area through the property is 3+/- acres and will drain across and along the access road and then westerly through a natural drainage swale.

The flow increases will be mitigated by the onsite bio filters.

A small drainage area 2+/- acres will drain southerly along the access road to Elder Street and then westerly along Elder Street to a natural drainage swale.

Again the flow increases will be mitigated by the onsite bio filters.

Prepared by:

5/31/06

Hadley Johnson
RCE 14870
5/16/2005

REGISTERED PROFESSIONAL ENGINEER
HADLEY JOHNSON
NO. 14870
Exp. 3-31-07
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STATE OF CALIFORNIA

TPM 20914
HYDRAULIC CALCULATIONS
LOG NO. 05-02-006

Area 3 acres Northerly portion TPM 20914

Soil Group C

Watershed Length 400'
Watershed Height 25'

7.3 du/ac

C = 0.54

Slope = 6%

Pre Construction

$Q_{85} = 0.54(1.5)(3)$
$Q_{85} = 2.4$ cfs.

$Q_{100} = 0.54(5.5)(3)$
$Q_{100} = 8.9$ cfs.

$Tc = 2.4 + 5.8$
$Tc = 8.2$ mins.

$I_{85\%} = 1.5$ in/hr
$I_{100} = 5.5$ in/hr

Pre Construction

$$C_R = \frac{0.5(0.84) + 2.5(0.54)}{1.74}$$

$C_R = 0.59$
$Q_{85} = 0.59(1.5)(3)$
$Q_{85} = 2.65$ cfs.
$Q_{100} = 0.59(5.5)(3)$
$Q_{100} = 9.7$ cfs

Increase flow
$Q_{85} = 0.2$ cfs
$Q_{100} = 0.8$ cfs

Increase flow will be mitigated by grass lined swale.

Southerly portion TPM 20914

Area = 2 acres

Watershed Length 400'
Watershed Height 20'

Pre Construction

$Q_{85} = 0.54(1.5)(2)$

$Q_{85} = 1.6$ cfs

$Q_{100} = 0.54(5.5)(2)$

$Q_{100} = 5.9$ cfs.

$Tc = 2.2 + 6.0$

$Tc = 8.2$ mins.

$I_{85\%} = 1.5$ in/hr

$I_{100} = 5.5$ in/hr

$Q_{85} = 0.59(1.5)(2)$
$Q_{85} = 1.8$ cfs.
$Q_{100} = 0.59(5.5)(2)$
$Q_{100} = 6.5$ cfs

Increase flow
$Q_{85} = 0.2$ cfs
$Q_{100} = 0.6$ cfs

Increase flow will be mitigated by grass lined swale

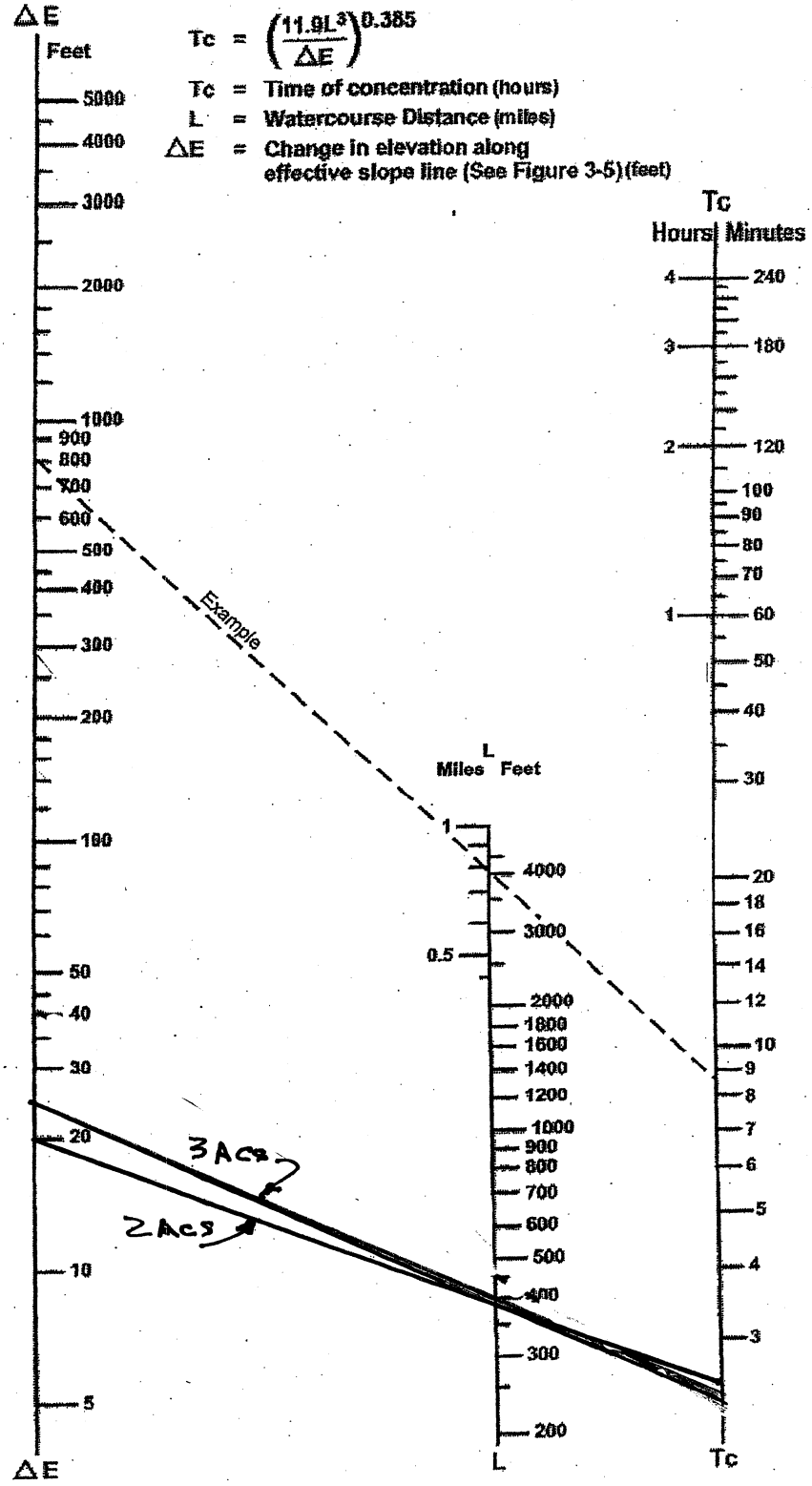
EQUATION

$$T_c = \left(\frac{11.9L^3}{\Delta E}\right)^{0.385}$$

T_c = Time of concentration (hours)

L = Watercourse Distance (miles)

ΔE = Change in elevation along effective slope line (See Figure 3-5) (feet)



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

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

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

Table 3-2

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

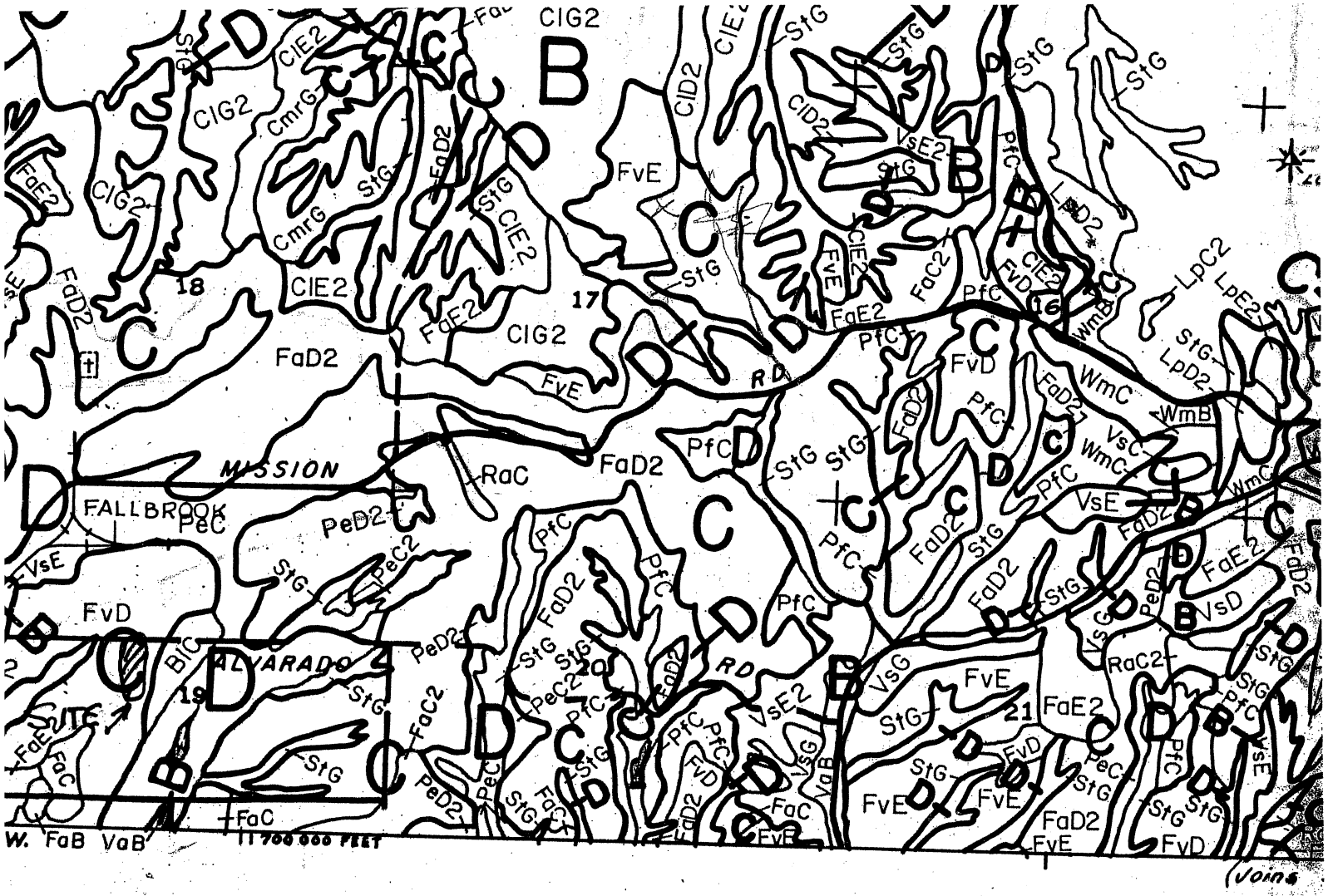
Element*	DU/	.5%		1%		2%		3%		5%		10%	
	Acre	L_M	T_i	L_M	T_i	L_M	T_i	L_M	T_i	L_M	T_i	L_M	T_i
Natural		50	13.2	70	12.5	85	10.9	100	10.3	100	8.7	100	6.9
LDR	1	50	12.2	70	11.5	85	10.0	100	9.5	100	8.0	100	6.4
LDR	2	50	11.3	70	10.5	85	9.2	100	8.8	100	7.4	100	5.8
LDR	2.9	50	10.7	70	10.0	85	8.8	95	8.1	100	7.0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

*See Table 3-1 for more detailed description

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

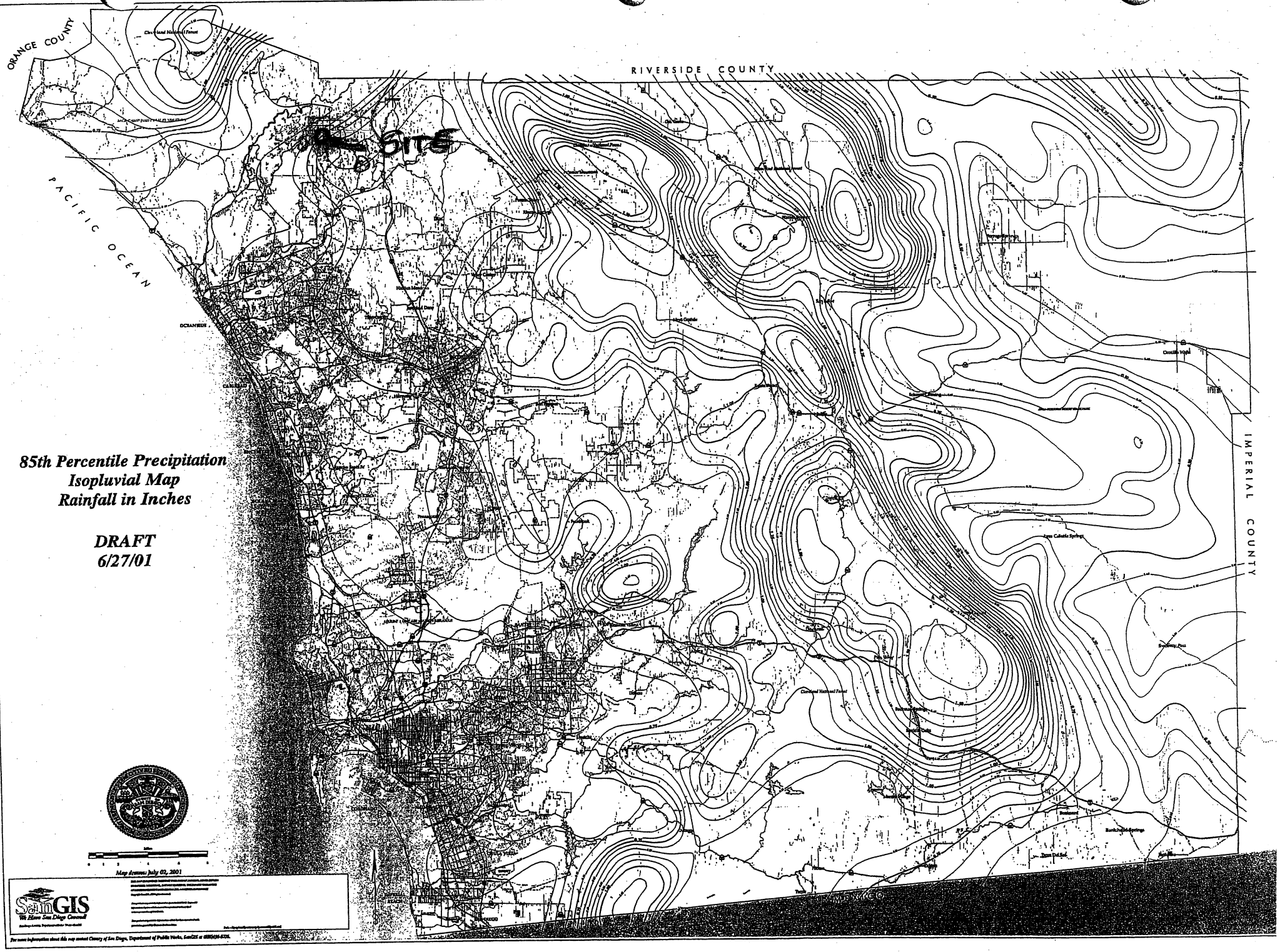


go County Soils Interpretation Study

.OGIC SOIL GROUPS - Runoff Potential

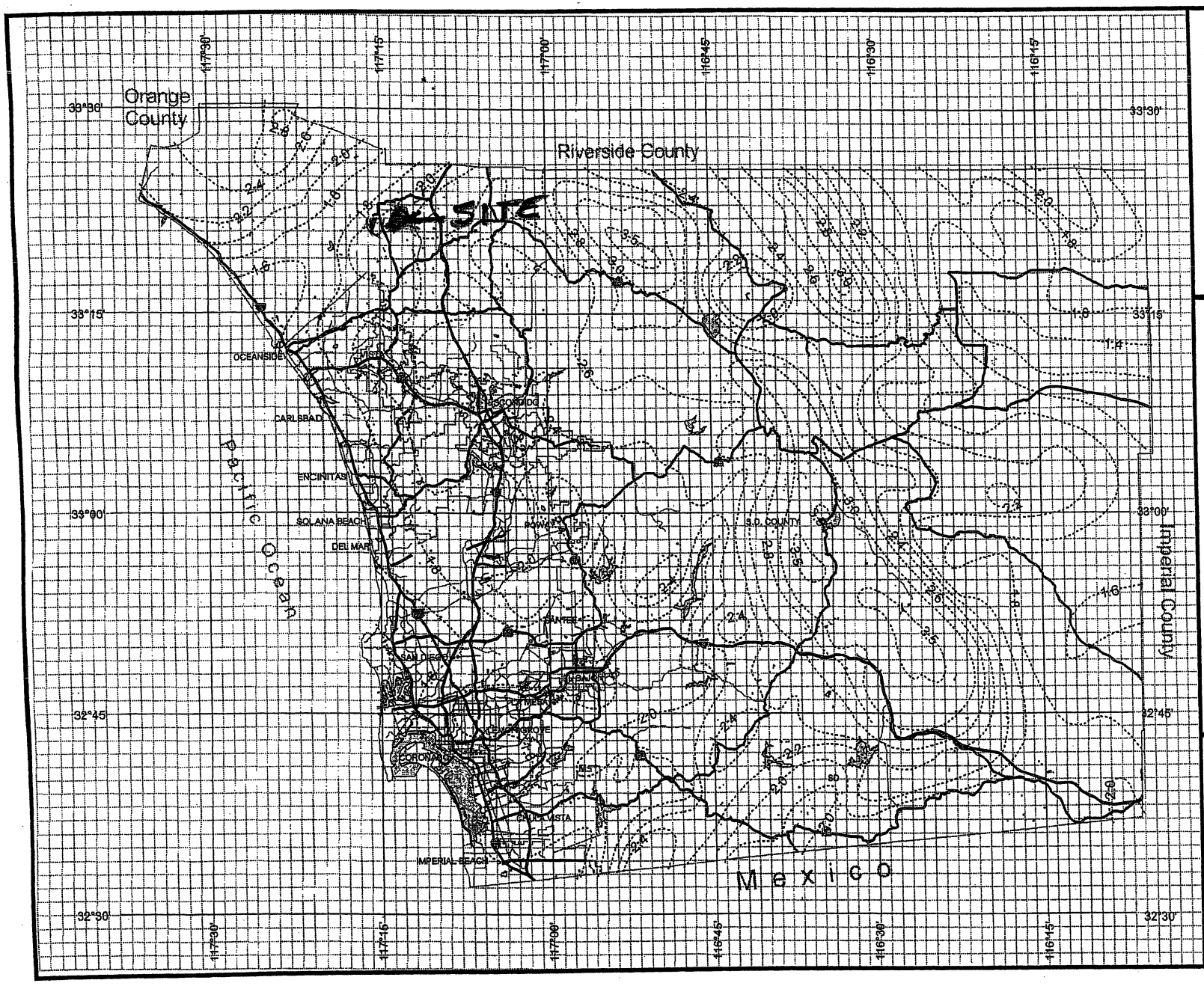
SEE CAUTION NO

B	Group B Moderate Runoff Potential	C	Group C High Runoff Potential	D	Gro Very Pote



85th Percentile Precipitation
Isopluvial Map
Rainfall in Inches

DRAFT
6/27/01



County of San Diego Hydrology Manual

Rainfall Isopluvials

10 Year Rainfall Event - 6 Hours

Isopluvial (Inches)

DPW GIS
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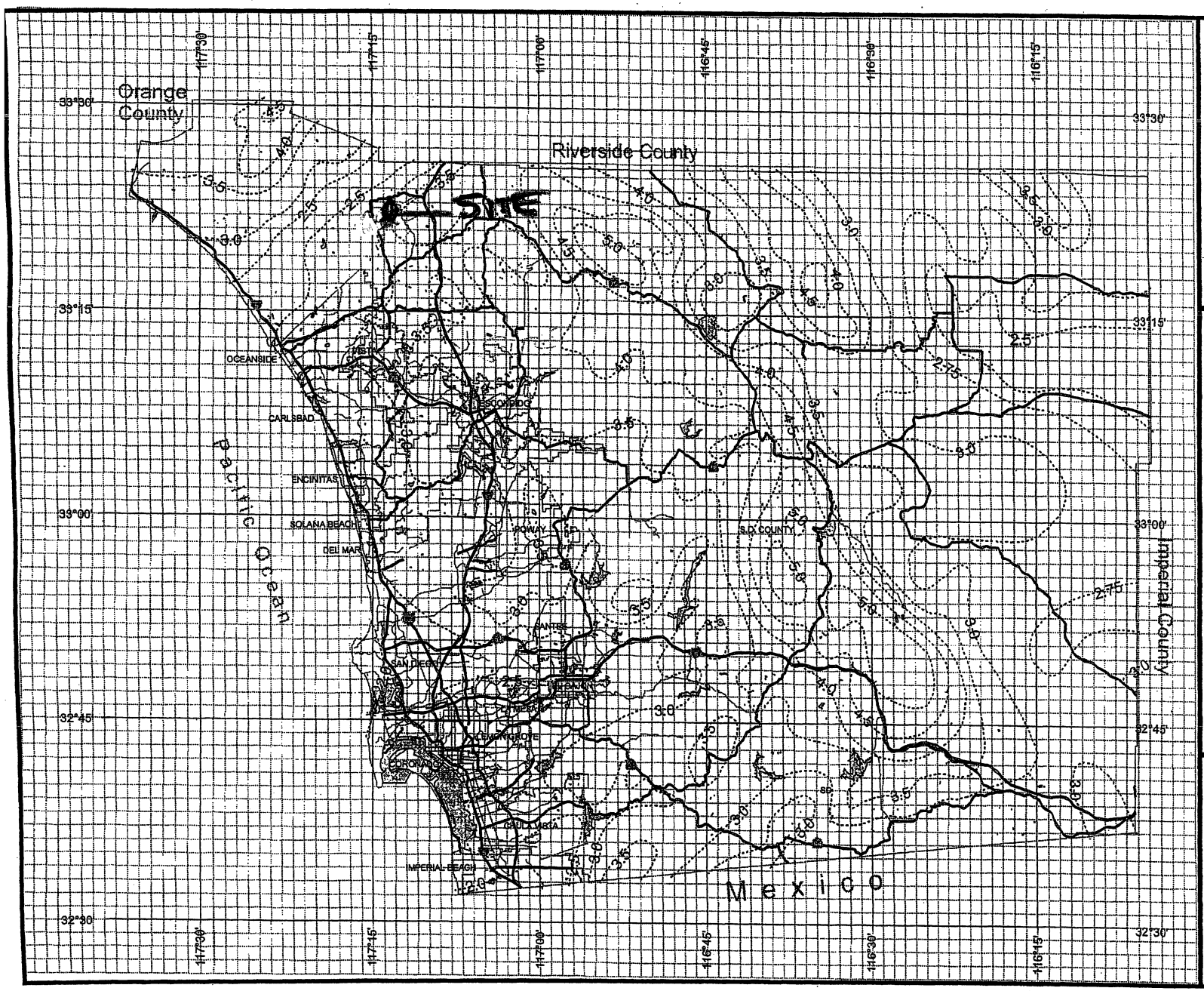

County of San Diego Hydrology Manual

Rainfall Isopluvials

100 Year Rainfall Event - 6 Hours

Isopluvial (Inches)

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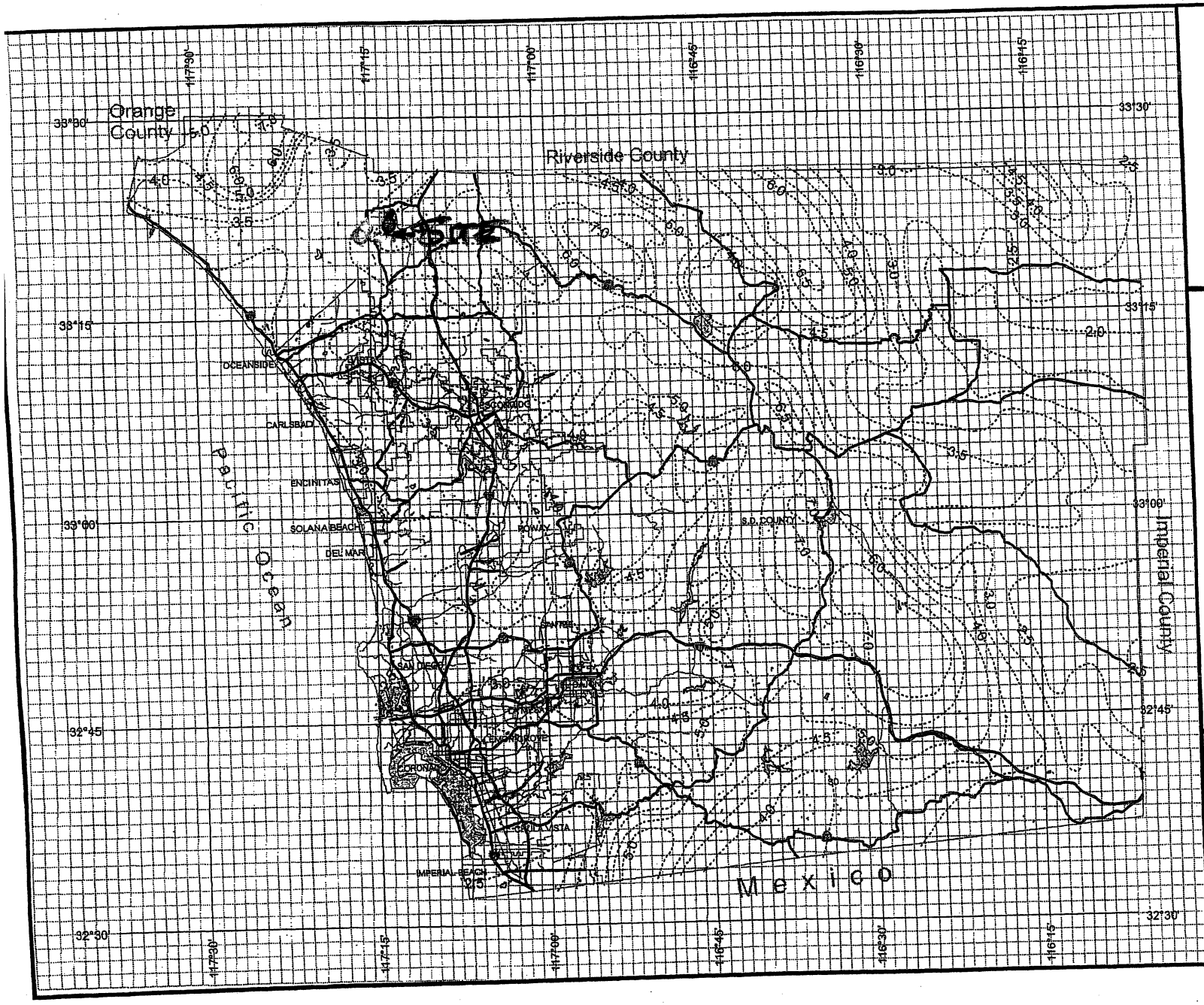

County of San Diego Hydrology Manual

Rainfall Isopluvials

10 Year Rainfall Event - 24 Hours

Isopluvial (inches)

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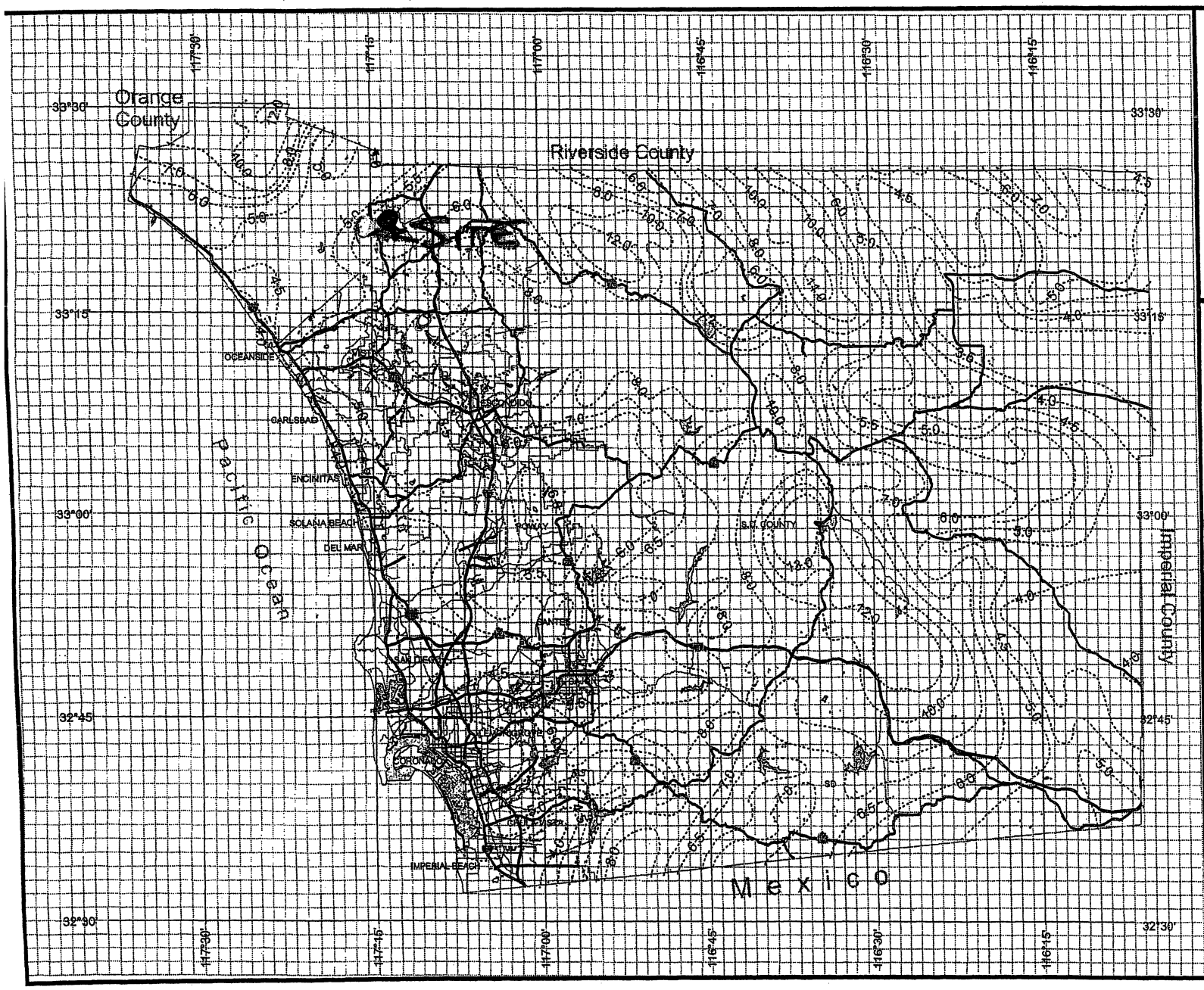

County of San Diego Hydrology Manual

Rainfall Isopluvials

100 Year Rainfall Event - 24 Hours

Isopluvial (inches)

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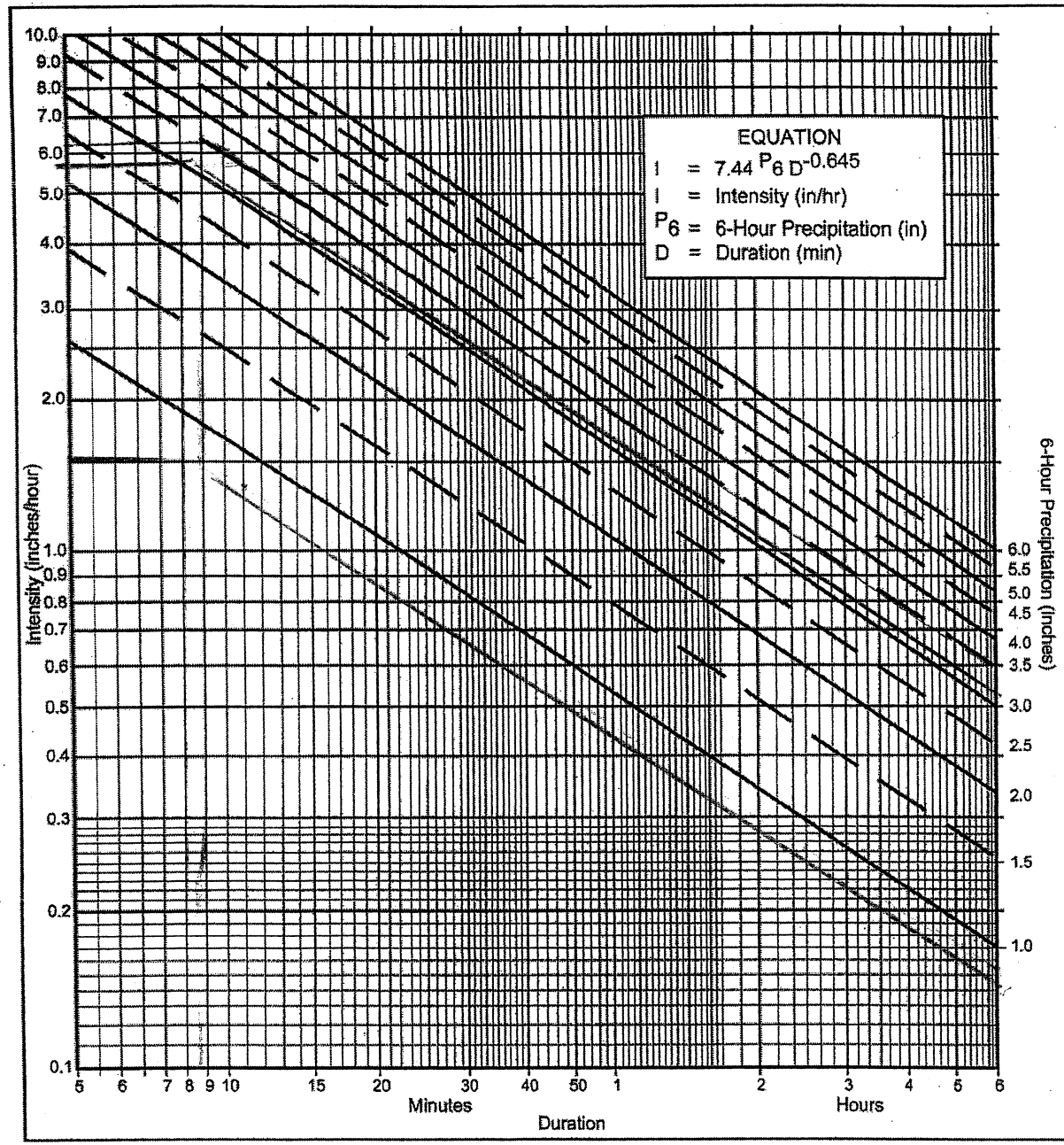


Directions for Application:

(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. 85th PERCENTILE = 0.75 IN/HR

Application Form:

(a) Selected frequency 10/100 year

(b) P_6 = 2.2/3.2 in., P_{24} = 4.5/6.0, $\frac{P_6}{P_{24}}$ = 49/53 %(2)

(c) Adjusted P_6(2) = 2.2/3.2 in.

(d) t_x = 8.2 min.

(e) I_{100} = 5.5 in./hr. I_{85} = 1.5 IN/HR

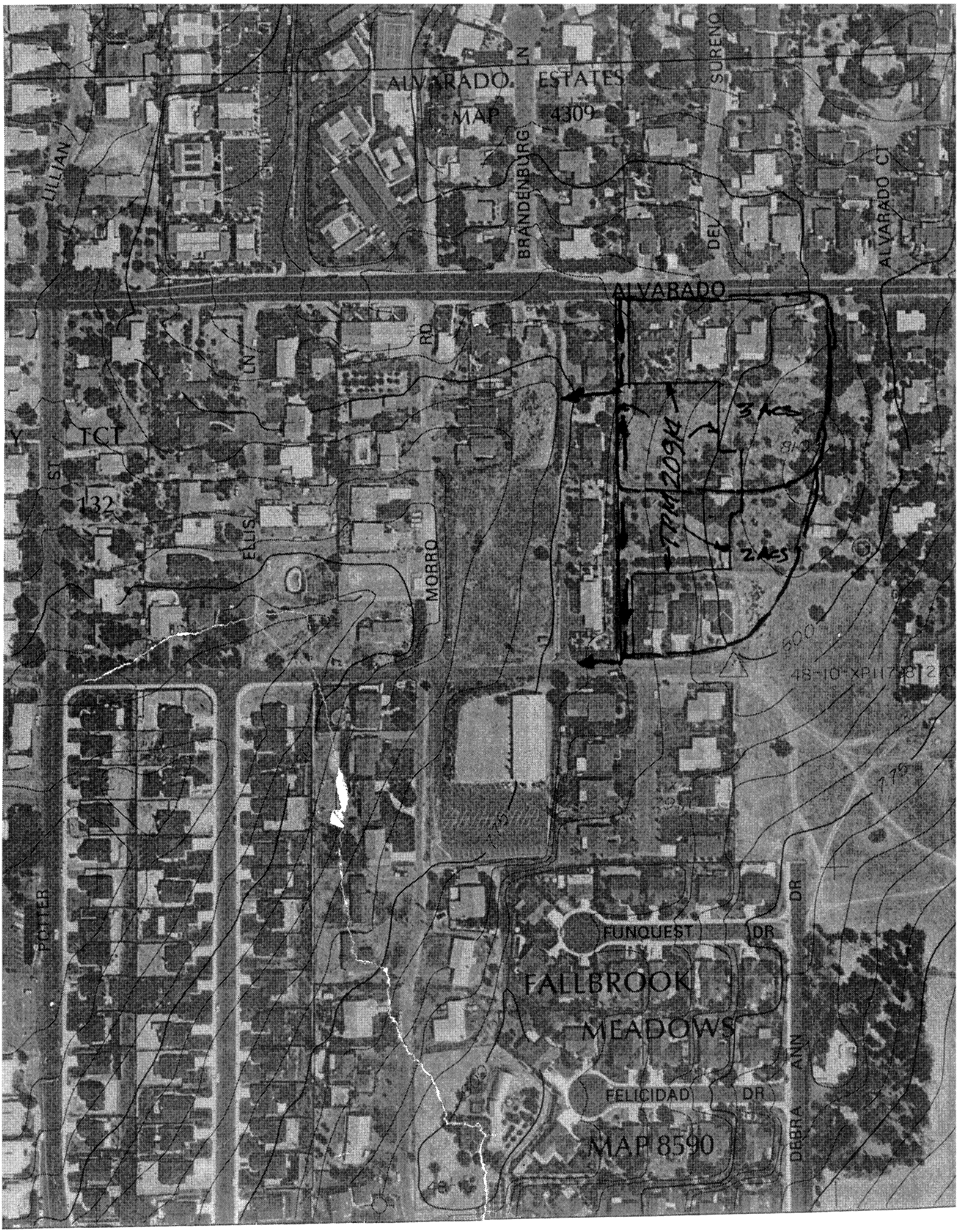
Note: This chart replaces the Intensity-Duration-Frequency curves used since 1965.

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


ALVARADO ESTATES
MAP 4309
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SORENO
LILLIAN
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POTTER
FUNQUEST
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FALLBROOK
MEADOWS
FELICIDAD
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MAP 8590
ANN
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