HYDROLOGY – HYDRAULICS REPORT

TPM 21047 ER 07-02-001
AMERICAN LOTUS BUDDHIST ASSOC.

APN 107-370-38

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DEPARTMENT OF PLANNING
AND LAND USE

PREPARED BY:
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January 4, 2008

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HADLEY JOHNSON
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STATE OF CALIFORNIA

HYDROLOGY – HYDRAULIC REPORT TPM 21047

PROJECT DESCRIPTION:

The project is a tentative parcel map to divide a 20 acre parcel into 4 smaller parcels plus a remainder parcel. The project is subject to the Regional Land Policy (EDA) Estate Development Area and General Plan Use Designation 17 Estate, which permits 1 dwelling unit per 2 & 4 acres. The current zone for the property is A70, which requires that a minimum lot size of 2 acres be maintained. The project is located in the Fallbrook Community Planning Area northerly and adjacent to Reche Road and 760' easterly of Via Vista Drive.

A drainage swale of 130+/- acres flows along the northwesterly property line. Two smaller swales 13 acres and 14 acres, flow across the property. There are no structures on the property although a pad and terrace have been graded as part of the previous agricultural operation. Two small ponds exist on the property. One drainage Area "B" (see map Appendix "A") drains an area of 13 acres and has always been dry during the processing of this project. The other pond parallel to Reche Road collects runoff from Area "B" & "C" combined area of 27 acres.

HYDROLOGY – HYDRAULIC REPORT TPM 21047

DRAINAGE AREA "A" = 130 ACRES

SOIL GROUP ¾ C ¼ D

$C_{AVG} = 0.75(0.36) + 0.25(0.41)$

$C_{AVG} = 0.27 + 10$

$C_{AVG} = 0.373$

USE RATIONAL METHOD

$Q = CIA$

PRE CONSTRUCTION

$Q_{100} = 0.373(3.8)(130)$

$Q_{100} = 184$ CFS

WATERSHED L-4300

WATERSHED H = 951 – 585 = 366

S = 8.5%

LOWER 2/3 S = 4.8%

TC = 13 + 8 = 21 MINS.

$I_{100} = 3.8$ IN/HR

$I_{WQ} = 0.9$ IN/HR

POST CONSTRUCTION

INCREASE IMPERVIOUS

AREA = 0.17 ACS.

ASSUME C = 0.87

$$C_R = \frac{129.8(0.373) + 0.2(0.87)}{130}$$

$$C_R = \frac{48.41 + 0.17}{130} = 0.374$$

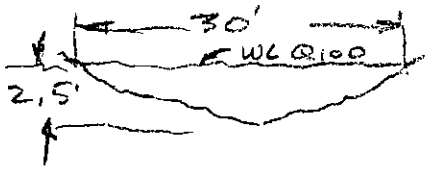
$Q_{100} = 0.374(3.8)(180)$

$Q_{100} = 184.8$ CFS

CAPACITY SWALE
ALONG NORTHWEST PROPERTY LINE

$$Q = \frac{1.486}{n} A\ R\ 2/3\ S\ ½$$

S = 3.9%
S ½ = 0.197
Use n = 0.060



a = 37.5 sq ft. wp = 30 ft.

$$r = \frac{37.5}{30} = 1.25$$

r 2/3 = 1.16

$$Q = \frac{1.486}{0.060}(37.5)(1.16)(0.197)$$

Q = 212 cfs exceeds 184 cfs ∴ ok

Drainage "B" Area = 13 acs.

SOIL GROUP 2/3 C 1/3 D

$C_{AVG} = 0.67(0.36) + 0.33(0.41)$

$C_{AVG} = 0.241 + 0.135$

$C_{AVG} = 0.376$

PRE CONSTRUCTION

$Q_{100} = 0.376(5.1)(13)$

$Q_{100} = 2\ 4.9$ CFS

CAPACITY 24" CULVERT UNDER

STREET "A" WITH HEADWALL

$\frac{HW}{D} = 2.2$

CAPACITY = 28 CFS
EXCEEDS 27.1 CFS
∴ OK

WATERSHED L-1700

WATERSHED H = 775 – 600 = 175

S = 10%

TC = 6 + 6.4 = 12.4 MINS.

$I_{100} = 5.1$ IN/HR

$I_{WQ} = 1.3$ IN/HR

POST CONSTRUCTION

REVISED CR

ADDITIONAL IMPERVIOUS AREA

ROAD & DRIVEWAY = 0.41 ACS.

BUILDINGS = 0.45 ACS.

TOTAL = 0.86 ACS

ASSUME C = 0.87

$$C_R = \frac{121.4(0.376) + 0.87(0.86)}{13}$$

$C_R = 0.409$

$Q_{100} = 0.409(5.1)(13)$
$Q_{100} = 27.1$ CFS

Drainage "C" Area = 14 acs.

SOIL GROUP ¾ C ¼ D

$C_{avg} = 0.373$

PRE CONSTRUCTION

$Q_{100} = 0.373(5.2)(14)$

$Q_{100} = 27.2$ CFS

WATERSHED L-1600'

WATERSHED H = 775 – 600 = 175

S = 10%

TC = 5.6 + 6.4 = 12 MINS.

$I_{100} = 5.2$ IN/HR

POST CONSTRUCTION

REVISED CR

PAVED ROADWAY 0.11
ASSUME C = 0.87

$$C_R = \frac{13.9(0.373) + 0.87(0.11)}{14}$$

$C_R = 0.377$

$Q_{100} = 0.377(5.2)(14)$
$Q_{100} = 27.4$ CFS

CAPACITY 24" CULVERT
UNDER STREET "A"

$\frac{HW}{D} = 2.2$ WITH HEADWLL
CAPACITY = 28 CFS
EXCEEDS 27.4 ∴ OK

DRAINAGE AREA "B" & "C"
COMBINE AREA "B" & "C"
AREA = 28 ACRES
$C_{AVG} = 0.376$

$Q_{100} = 0.376(5.0)(28)$
$Q_{100} = 52.6$ CFS

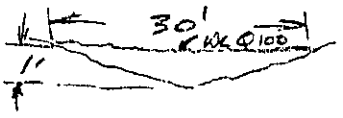
WATERSHED L = 2000'
WATERSHED H = 775 – 585 = 190
S = 9.5%

TC = 7 + 6.4 = 13.4
$I_{100} = 5.0$ IN/HR

$$C_R = \frac{0.377(14) + 0.409(13)}{27}$$

$C_R = 0.392$
Q100 = 0.392(5.0)(28)
$Q_{100} = 54.9$ cfs

CAPACITY SWALE



S = 5% S ½ = 0.22
a = 15 SF
wp = 30
r = 0.5
r 2/3 = 0.68

$$Q = \frac{1.486}{0.06}(15)(0.68)(0.22)$$

= 55 CFS EXCEEDS 54.9 ∴ OK

Table of Runoff

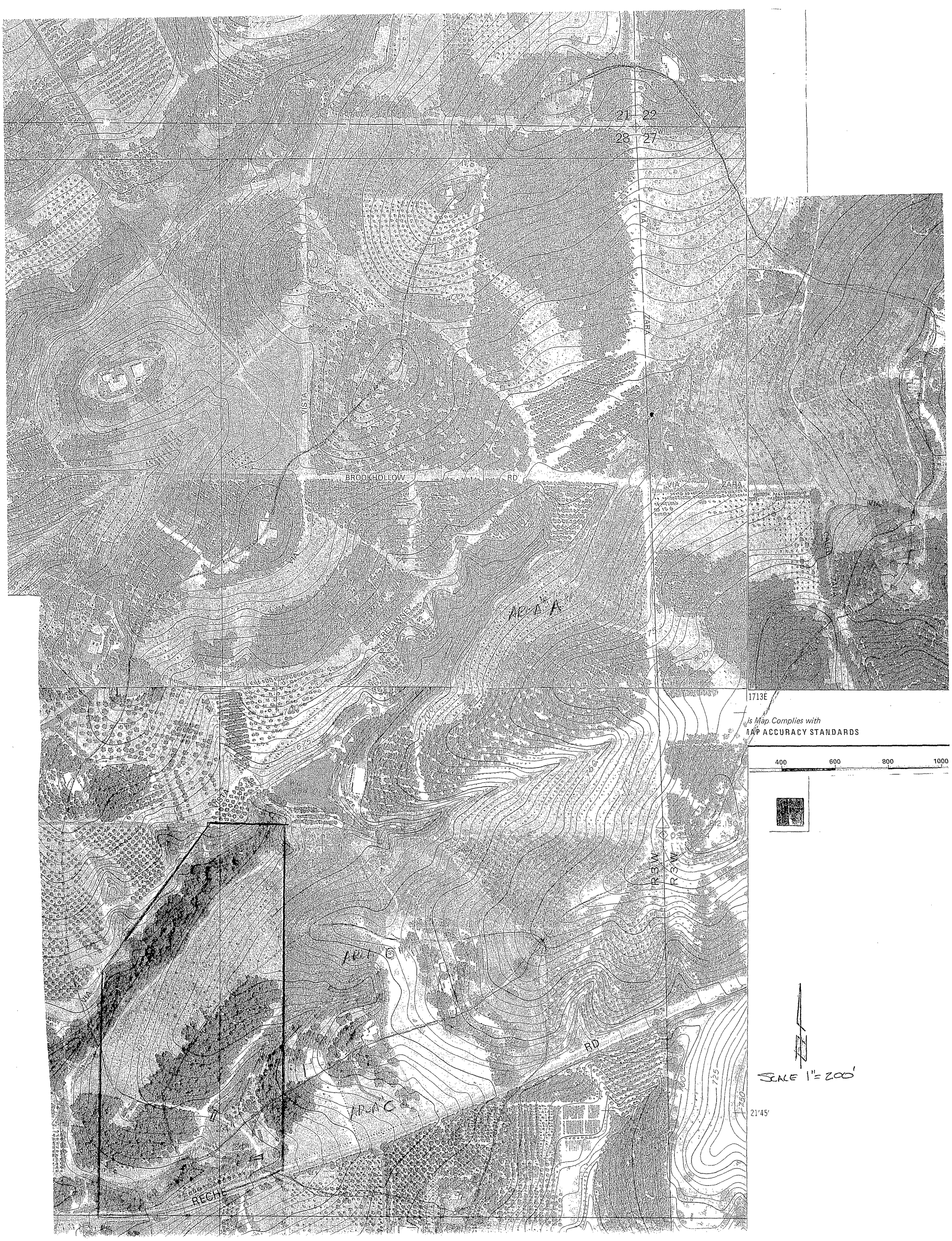
		Pre construction				Post construction				Increases	
	Area	C	Tc	I_{100}	Q_{100}	C_R	Tc	I100	Q100	Q_{100}	%
AREA "A"	130 ac	0.373	21	3.8	184	0.374	21	3.8	0.8	0.4	0.4
AREA "B"	13 ac	0.375	12.4	5.1	24.9	0.409	12.4	5.1	27.1	2.2	8.8
AREA "C"	14 ac	0.373	12	5.2	27.2	0.377	12	5.2	27.4	0.2	0.7
COMBINE B & C	28 ac	0.376	13.4	5.0	52.6	0.392	13.4	5.0	54.9	2.3	4.3

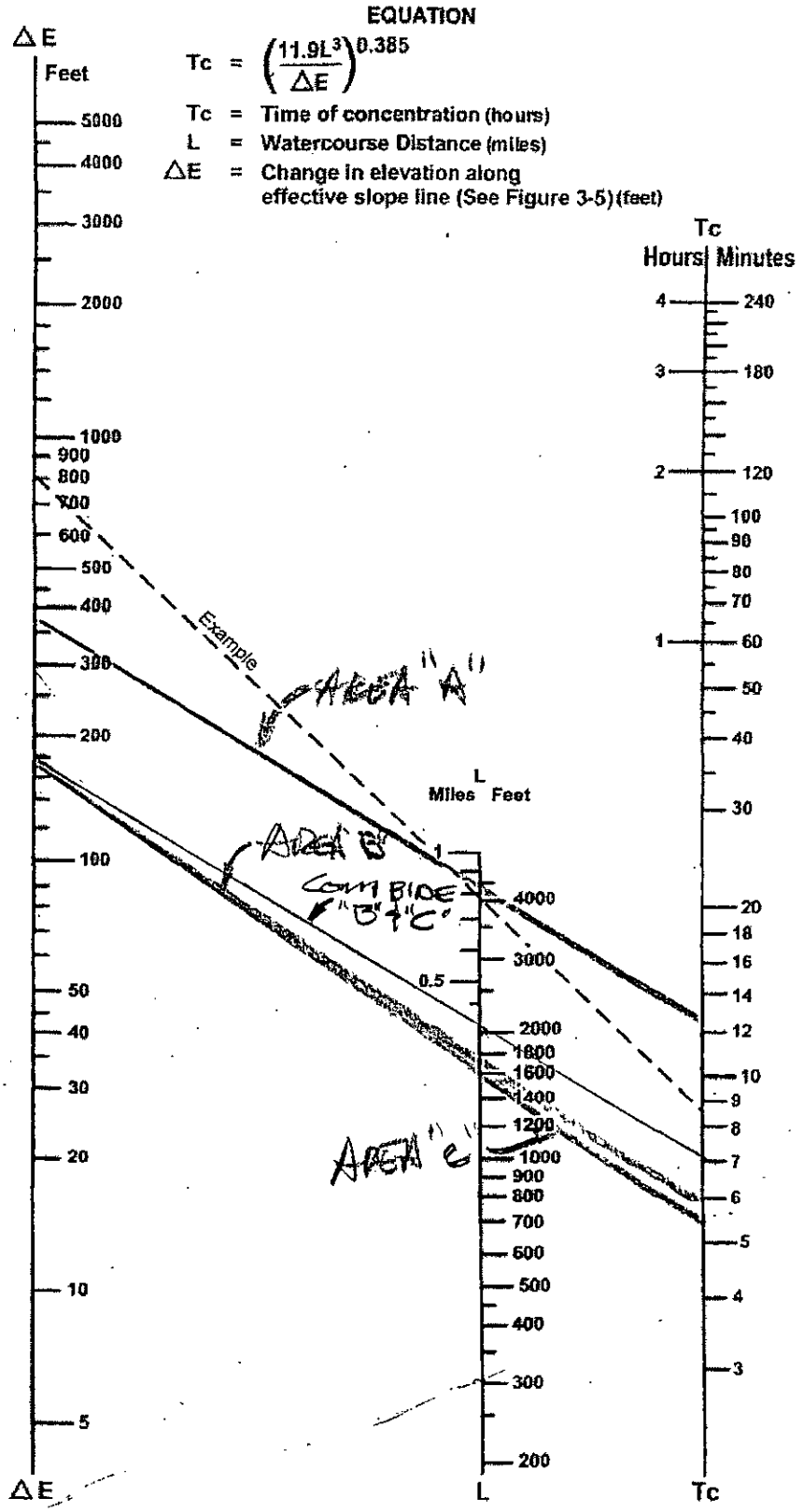
The increase flows to areas A & C are insignificant, and mitigated by bio swales. The combined increase flow in Area B & C will be mitigated by the proposed bio filters grass lined swales. The 100 year flow Area "A" along the northwesterly property line will be contained with the existing 30 ft. wide swale.

The 100 year flow area "B" & "C" 13 & 14 acs will be contained within the existing swales. Culverts of 24" in size under Street "A" will be sufficient for flows from these drainage areas.

The combination 100 year flow Area "B" & "C" 28 acs at the westerly property line northerly of Reche Road will be contained within the existing 30 ft. wide swale.

Summary/Conclusion: The combination of proposed construction and post-construction BMPs will reduce, to the maximum extent practicable, the expected pollutants and will not adversely impact the beneficial uses or water quality of the receiving waters. The increase flows Area "A" 0.4% & Area "B" & "C" 4.3% are less than 5% and considered insignificant. These increases will be mitigated by the proposed bio filters.


21
22
28
27
VIA
ZARA
VISTA
BROOKHOLLOW
RD
VIA
ZARA
VIA
TRELAWNEY
AREA A
1713E
is Map Complies with
AP ACCURACY STANDARDS
400
600
800
1000
R 3 W
R 3 W
AREA B
RD
SCALE 1"= 200'
21'45'
AREA C
RECHE



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

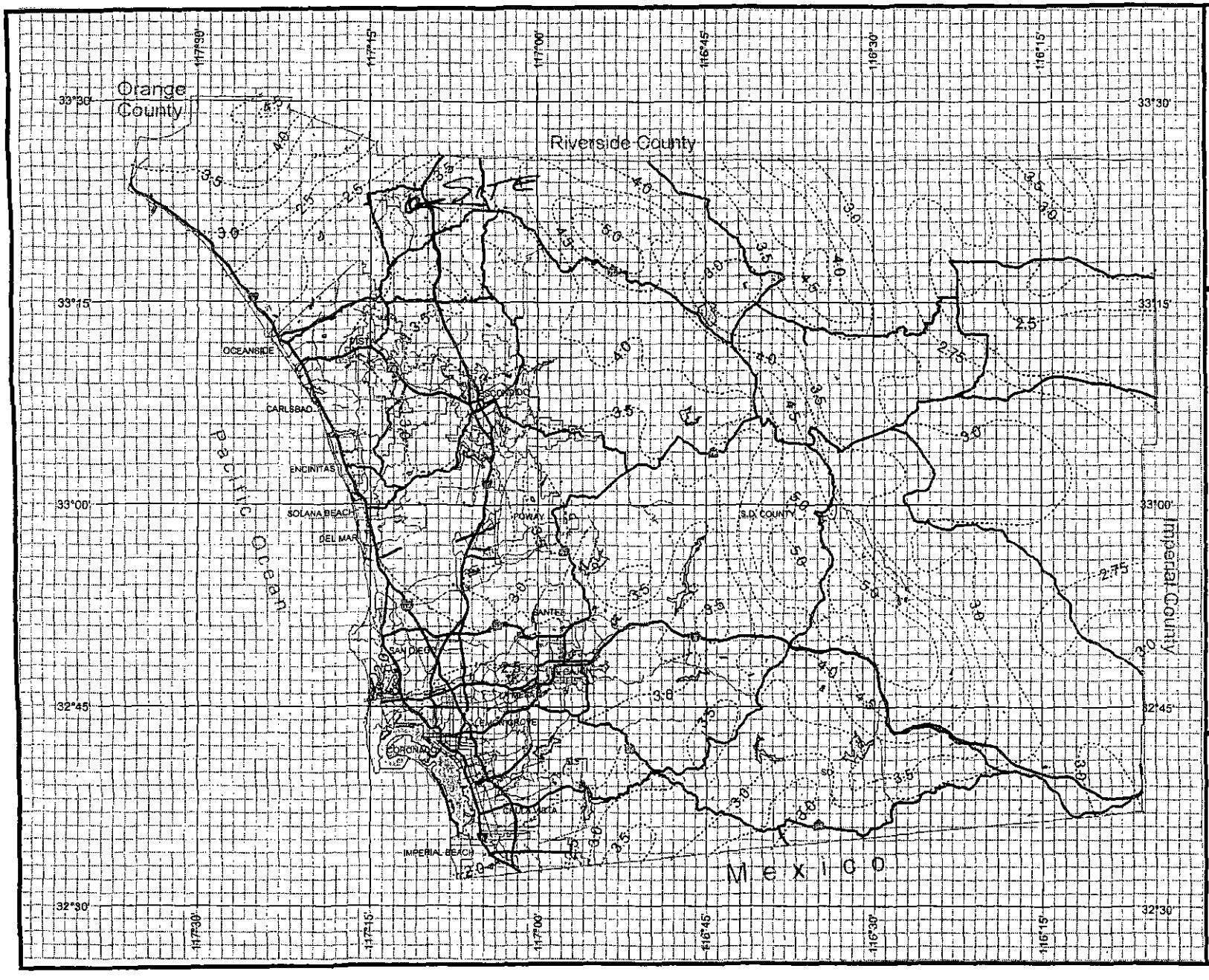
Table 3-1
RUNOFF COEFFICIENTS FOR URBAN AREAS

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

Bonsall

San Diego County, California



County of San Diego Hydrology Manual

Rainfall Isopluvials

100 Year Rainfall Event - 6 Hours

Isopluvial (inches)

DPW GIS

SanGIS
We Have San Diego Covered!

N
W E
S

3 0 3 Miles

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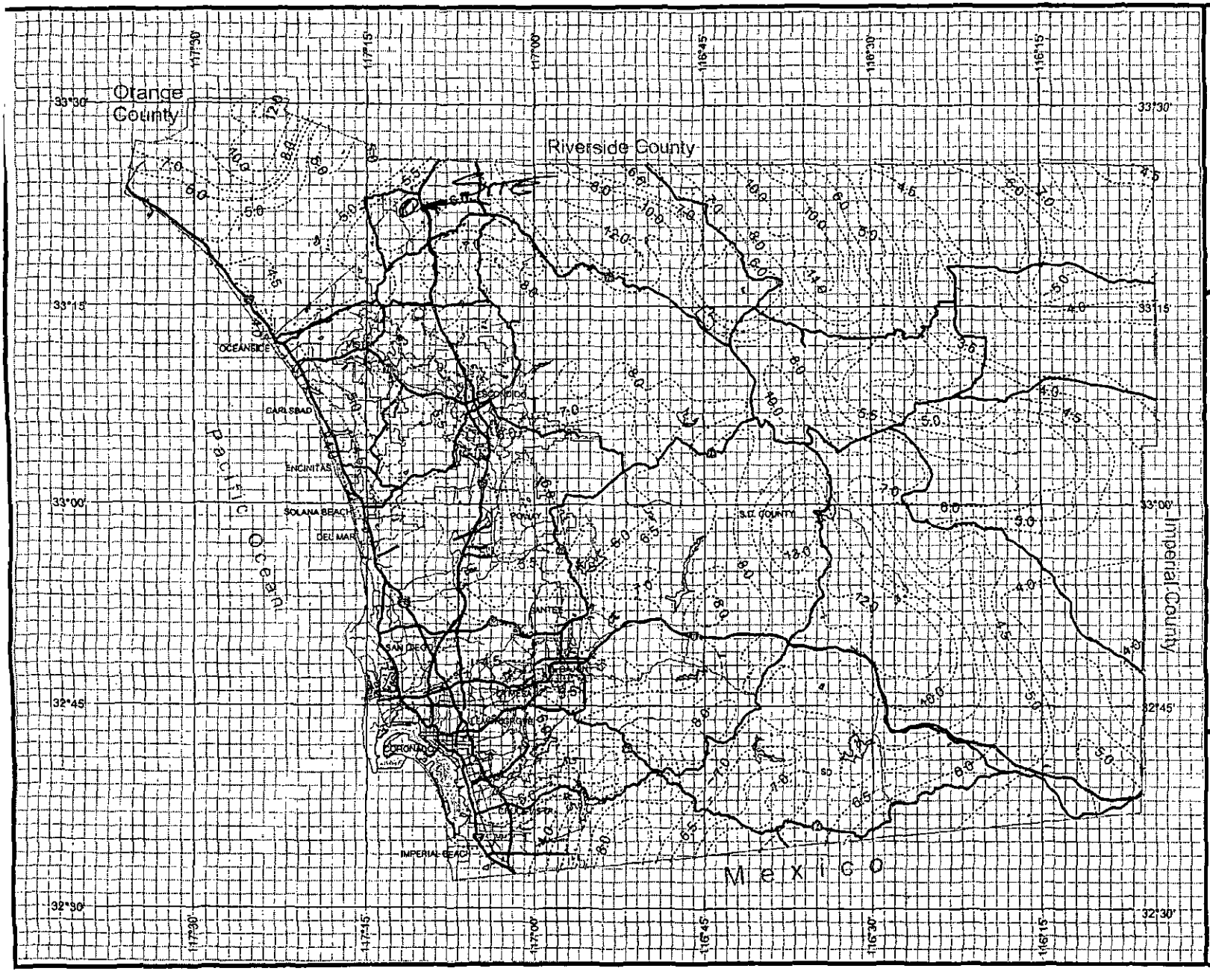

County of San Diego Hydrology Manual

Rainfall Isopluvials

100 Year Rainfall Event - 24 Hours

Isopluvial (Inches)

DPW GIS

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N W E S

3 0 3 Miles

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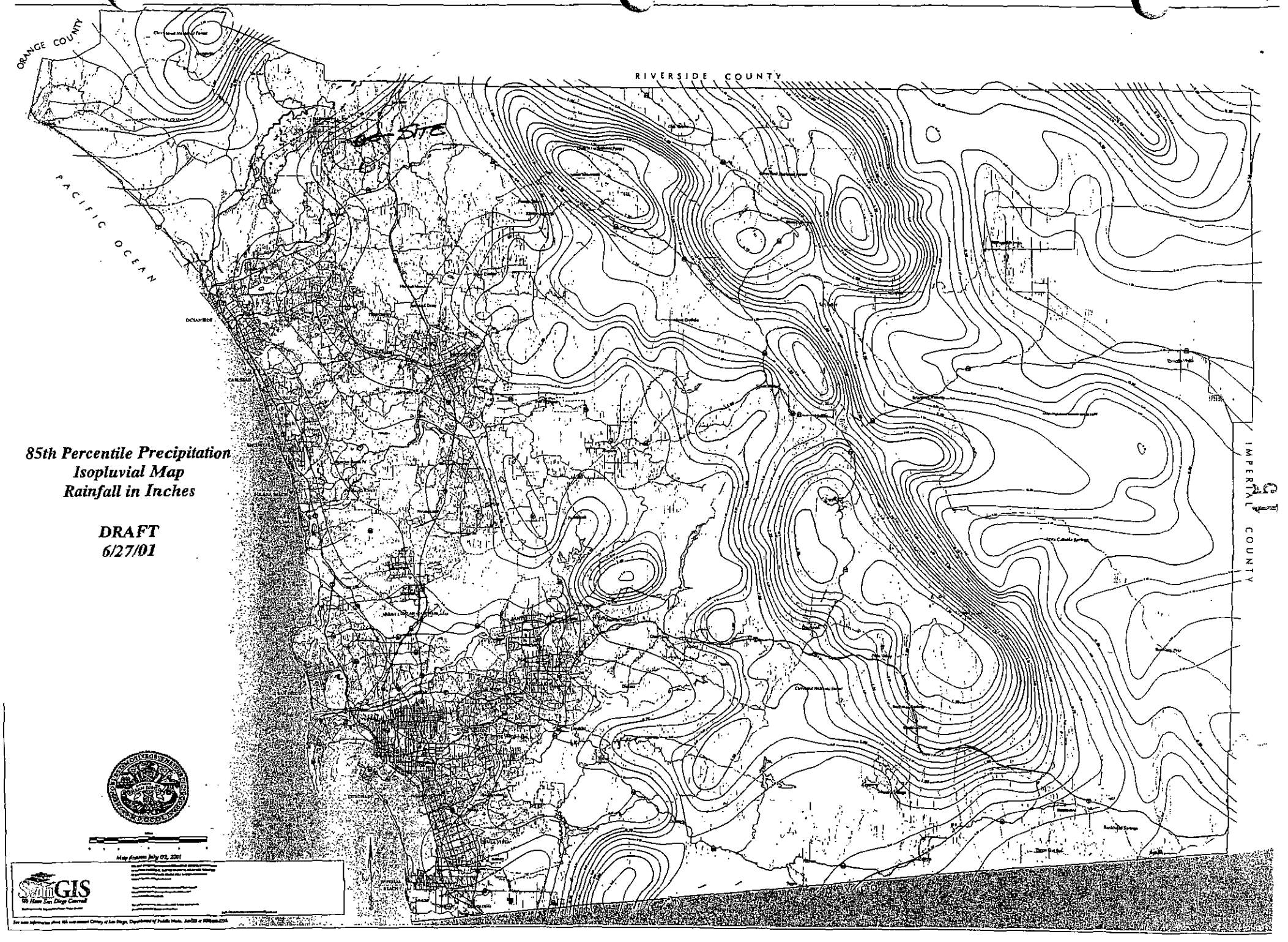
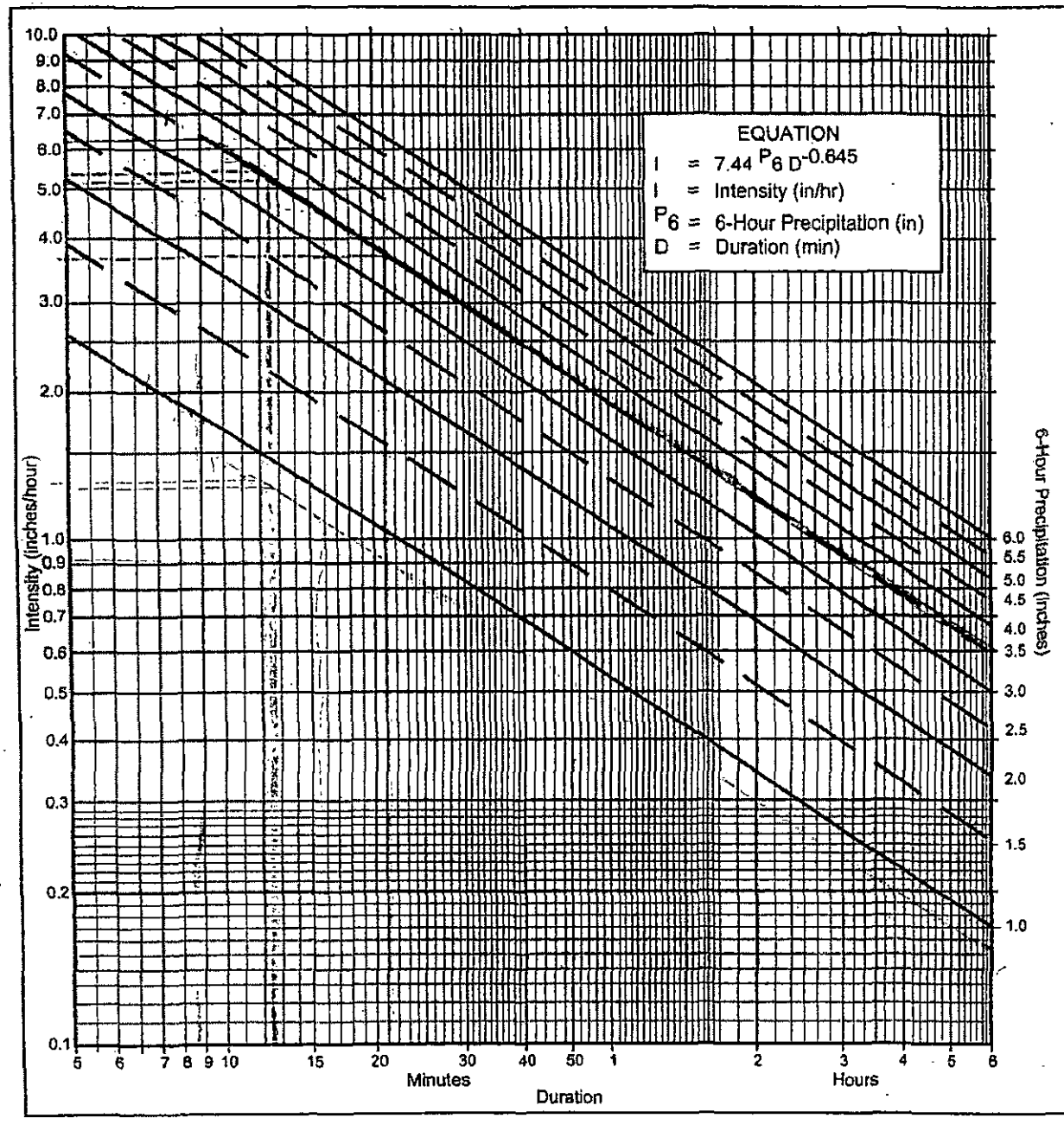

ORANGE COUNTY
RIVERSIDE COUNTY
PACIFIC OCEAN
IMPERIAL COUNTY
SITE
85th Percentile Precipitation
Isopluvial Map
Rainfall in Inches
DRAFT
6/27/01
SwinGIS



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 = 3.5 in., P_{24} = 6.0, $\frac{P_6}{P_{24}}$ = 58 %(2)

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

(d) t_x = 21 min.

(e) I = _____ in./hr.
100

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