ACAL Engineering & Surveying
CIVIL ENGINEERS PLANNERS LAND SURVEYORS

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HYDROLOGY AND HYDRAULIC CALCULATIONS FOR:

County TPM 20901RPL[1]
APN 105-841-32
Rosemere Lane
Fallbrook, CA 92028

TPM 20901
ER# 05-02-001

OWNER:
Brian Castelli
24311 Blue Ridge Road
Lake Forrest, CA 92630

RECEIVED
AUG 08 2006
DEPARTMENT OF PLANNING AND LAND USE

PREPARED BY:

DAVID H. LOWEN, RCE31915
MY LICENSE EXPIRES: 12/31/06

REGISTERED PROFESSIONAL ENGINEER
DAVID H. LOWEN
No. 31915
Exp. 12/31/06
CIVIL
STATE OF CALIFORNIA

04/22/05
DATE

- LAND SURVEYS
- FEMA CERTIFICATIONS
- PARCEL MAPS
- GRADING PLANS
- SUBDIVISIONS
- PERCOLATION TESTING

HYDRAULIC CALCULATIONS AND RECOMMENDATIONS:

DRAINAGE AREA: "Rosemere Lane"

LAND AREA = 0.24 ACRES
Delta E = 11.5 FEET
LENGTH = 0.0163 miles
PRE $T_C = t_i + t_c = 8.7 + 0.52 = 9.22$ MINUTES
POST $T_C = t_i + t_c = 6.7 + 0.52 = 7.22$ MINUTES
PRE-DEVELOPMENT "C" = 0.30
POST-DEVELOPMENT "C" = 0.48
PRE-DEVELOPMENT INTENSITY = 6.21
POST-DEVELOPMENT INTENSITY = 7.28
PRE-DEVELOPMENT Q_{100} = 0.45 C.F.S.
POST-DEVELOPMENT Q_{100} = 0.84 C.F.S.
INCREASE Q_{100} DUE TO DEVELOPMENT = 0.39 C.F.S.

RECOMMENDATIONS:

Construct catch basin near Southwest corner of proposed Remainder Parcel on Rosemere Lane with bio-filter.

DRAINAGE AREA: "Parcel 1 pad"

LAND AREA = 0.22 ACRES
Delta E = 3.0 FEET
LENGTH = 0.0047 miles
PRE $T_C = t_i + t_c = 8.7 + 0.21 = 8.91$ MINUTES
POST $T_C = t_i + t_c = 6.7 + 0.21 = 6.91$ MINUTES
PRE-DEVELOPMENT "C" = 0.30
POST-DEVELOPMENT "C" = 0.48
PRE-DEVELOPMENT INTENSITY = 6.35
POST-DEVELOPMENT INTENSITY = 7.48
PRE-DEVELOPMENT Q_{100} = 0.42 C.F.S.
POST-DEVELOPMENT Q_{100} = 0.79 C.F.S.
INCREASE Q_{100} DUE TO DEVELOPMENT = 0.37 C.F.S.

RECOMMENDATIONS:

Use rain gardens on the proposed pad to mitigate the increase of surface runoff and infiltrative vegetated swales to provide for sediment/silt control. The increase in surface runoff is not significant and the existing drainage pattern is to be maintained.

HYDRAULIC CALCULATIONS AND RECOMMENDATIONS:

DRAINAGE AREA: "Parcel 2 pad"

LAND AREA = 0.22 ACRES
Delta E = 3.0 FEET
LENGTH = 0.0047 miles
PRE $T_C = t_i + t_c = 8.7 + 0.21 = 8.91$ MINUTES
POST $T_C = t_i + t_c = 6.7 + 0.21 = 6.91$ MINUTES
PRE-DEVELOPMENT "C" = 0.30
POST-DEVELOPMENT "C" = 0.48
PRE-DEVELOPMENT INTENSITY = 6.35
POST-DEVELOPMENT INTENSITY = 7.48
PRE-DEVELOPMENT Q_{100} = 0.42 C.F.S.
POST-DEVELOPMENT Q_{100} = 0.79 C.F.S.
INCREASE Q_{100} DUE TO DEVELOPMENT = 0.37 C.F.S.

RECOMMENDATIONS:

Use rain gardens on the proposed pad to mitigate the increase of surface runoff and infiltrative vegetated swales to provide for sediment/silt control. The increase in surface runoff is not significant and the existing drainage pattern is to be maintained.

DRAINAGE AREA: "Parcel 3 pad"

LAND AREA = 0.26 ACRES
Delta E = 3.5 FEET
LENGTH = 0.0066 miles
PRE $T_C = t_i + t_c = 8.7 + 0.29 = 8.99$ MINUTES
POST $T_C = t_i + t_c = 6.7 + 0.29 = 6.99$ MINUTES
PRE-DEVELOPMENT "C" = 0.30
POST-DEVELOPMENT "C" = 0.48
PRE-DEVELOPMENT INTENSITY = 6.32
POST-DEVELOPMENT INTENSITY = 7.49
PRE-DEVELOPMENT Q_{100} = 0.49 C.F.S.
POST-DEVELOPMENT Q_{100} = 0.93 C.F.S.
INCREASE Q_{100} DUE TO DEVELOPMENT = 0.44 C.F.S.

HYDRAULIC CALCULATIONS AND RECOMMENDATIONS:

RECOMMENDATIONS:

Use rain gardens on the proposed pad to mitigate the increase of surface runoff and infiltrative vegetated swales to provide for sediment/silt control. The increase in surface runoff is not significant and the existing drainage pattern is to be maintained.

DRAINAGE AREA: "Parcel 4 pad"

LAND AREA = 0.22 ACRES
Delta E = 3.0 FEET
LENGTH = 0.0058 miles
PRE $T_C = t_i + t_c = 8.7 + 0.27 = 8.97$ MINUTES
POST $T_C = t_i + t_c = 6.7 + 0.27 = 6.97$ MINUTES
PRE-DEVELOPMENT "C" = 0.30
POST-DEVELOPMENT "C" = 0.48
PRE-DEVELOPMENT INTENSITY = 6.33
POST-DEVELOPMENT INTENSITY = 7.44
PRE-DEVELOPMENT Q_{100} = 0.42 C.F.S.
POST-DEVELOPMENT Q_{100} = 0.79 C.F.S.
INCREASE Q_{100} DUE TO DEVELOPMENT = 0.37 C.F.S.

RECOMMENDATIONS:

Use rain gardens on the proposed pad to mitigate the increase of surface runoff and infiltrative vegetated swales to provide for sediment/silt control. The increase in surface runoff is not significant and the existing drainage pattern is to be maintained.

HYDRAULIC CALCULATIONS AND RECOMMENDATIONS:

DRAINAGE AREA: "Remainder Parcel pad"

LAND AREA = 0.31 ACRES
Delta E = 4.0 FEET
LENGTH = 0.0152 miles
PRE $T_C = t_i + t_c = 8.7 + 0.73 = 9.43$ MINUTES
POST $T_C = t_i + t_c = 6.7 + 0.73 = 7.43$ MINUTES
PRE-DEVELOPMENT "C" = 0.30
POST-DEVELOPMENT "C" = 0.48
PRE-DEVELOPMENT INTENSITY = 6.12
POST-DEVELOPMENT INTENSITY = 7.14
PRE-DEVELOPMENT Q_{100} = 0.57 C.F.S.
POST-DEVELOPMENT Q_{100} = 1.06 C.F.S.
INCREASE Q_{100} DUE TO DEVELOPMENT = 0.49 C.F.S.

RECOMMENDATIONS:

Use rain gardens on the proposed pad to mitigate the increase of surface runoff and infiltrative vegetated swales to provide for sediment/silt control. The increase in surface runoff is not significant and the existing drainage pattern is to be maintained.

Table 3-1

RUNOFF COEFFICIENTS FOR URBAN AREAS

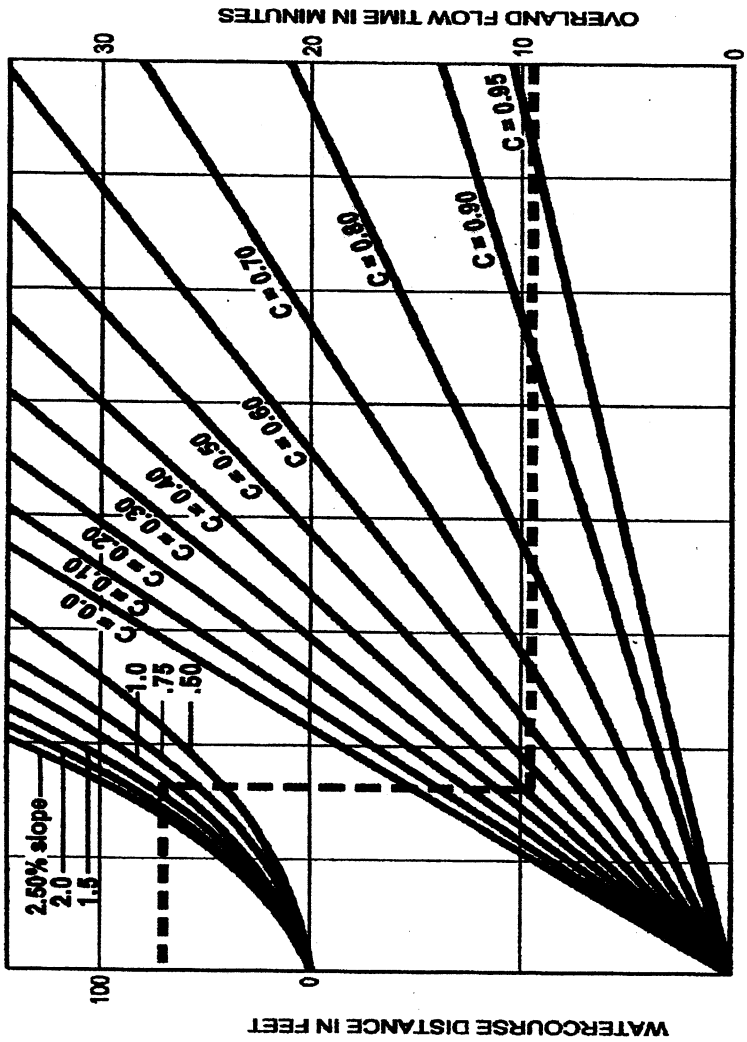
Land Use			Runoff Coefficient "C"			
			Soil Type			
NRCS Elements	County Elements	% IMPER.	A	B	C	D
Undisturbed Natural Terrain	Permanent Open Space	0*	0.20	0.25	0.30	0.35 PRE
Low	Residential, 1.0 DU/A or less	10	0.27	0.32	0.36	0.41
Low	Residential, 2.0 DU/A or less	20	0.34	0.38	0.42	0.46
Low	Residential, 2.9 DU/A or less	25	0.38	0.41	0.45	0.49
Medium Density Residential	Residential, 4.3 DU/A or less	30	0.41	0.45	0.48	0.52 POST
Medium Density Residential	Residential, 7.3 DU/A or less	40	0.48	0.51	0.54	0.57
Medium Density Residential	Residential, 10.9 DU/A or less	45	0.52	0.54	0.57	0.60
Medium Density Residential	Residential, 14.5 DU/A or less	50	0.55	0.58	0.60	0.63
High Density Residential	Residential, 24.0 DU/A or less	65	0.66	0.67	0.69	0.71
High Density Residential	Residential, 43.0 DU/A or less	80	0.76	0.77	0.78	0.79
Commercial/Industrial	Neighborhood Commercial	80	0.76	0.77	0.78	0.79
Commercial/Industrial	General Commercial	85	0.80	0.80	0.81	0.82
Commercial/Industrial	Office Professional/Commercial	90	0.83	0.84	0.84	0.85
Commercial/Industrial	Limited Industrial	90	0.83	0.84	0.84	0.85
Commercial/Industrial	General Industrial	95	0.95	0.95	0.95	0.95

*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

TPM
20901
117°15'
33°22'30"
R. 4 W.
R. 3 W.
1 700 000 FEET
440 000 FEET
T. 9 S.
T. 10 S.
NAVAL RES.
FALLBROOK
MACDONALD
RECHE
STAGE
WINTER
HAVEN
MISSION
HILL
GREEN
CANYON
VIA
ENCINOS
24
19
20
25
30
29
36
1
7
12
B
C
D
M
O
N

TIME OF CONCENTRATION - INITIAL TIME (T_i)



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

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

SOURCE: Airport Drainage, Federal Aviation Administration, 1965

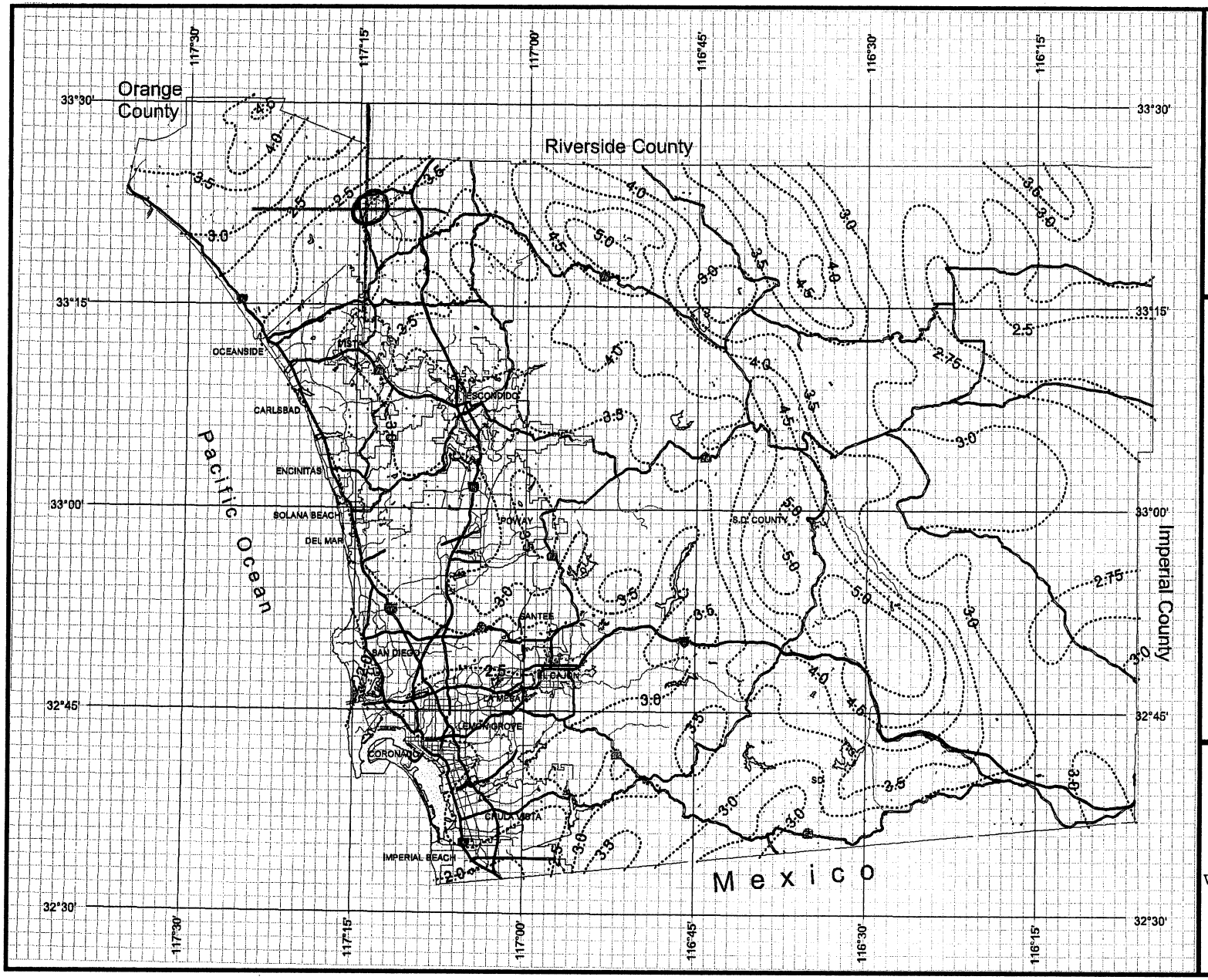
FIGURE 3-3

Rational Formula - Overland Time of Flow Nomograph

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

Element*	DU/ Acre	.5%		1%		2%		3%		5%		10%		
		L_M	T_i	L_M	T_i	L_M	T_i	L_M	T_i	L_M	T_i	L_M	T_i	
Natural		50	13.2	70	12.5	85	10.9	100	10.3	100	8.7	100	6.9	PRE
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	POST
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



County of San Diego Hydrology Manual

Rainfall Isopluvials

100 Year Rainfall Event - 6 Hours

Isopluvial (inches)

$P_6 = 3.5$

DPW GIS
Department of Public Works
Geographic Information Services

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N
W E
S

3 0 3 Miles

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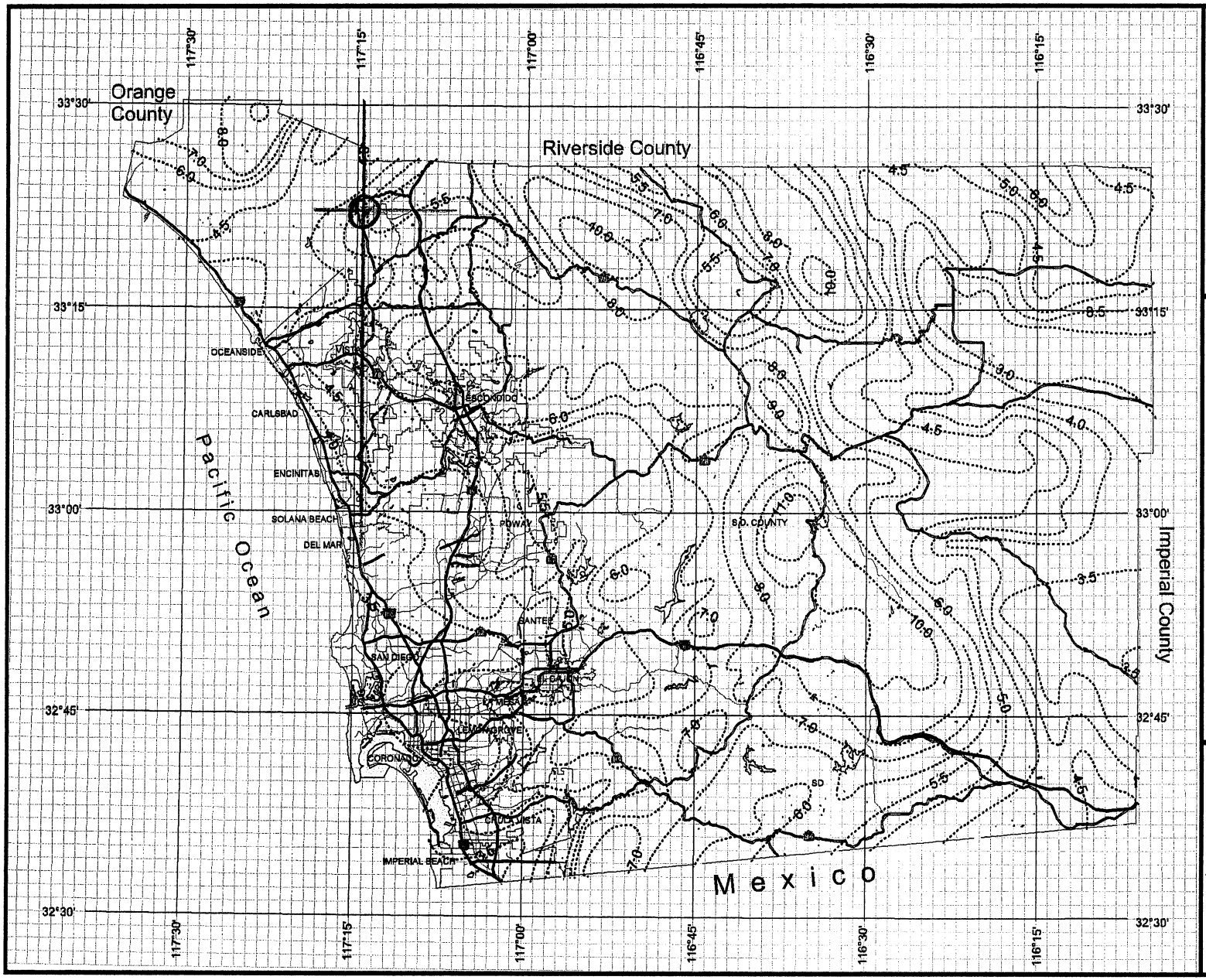

County of San Diego Hydrology Manual

Rainfall Isopluvials

50 Year Rainfall Event - 24 Hours

Isopluvial (inches)

$P_{24} = 5.3$

DPW GIS
Department of Public Works
Geographic Information Services

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N
W E
S

3 0 3 Miles

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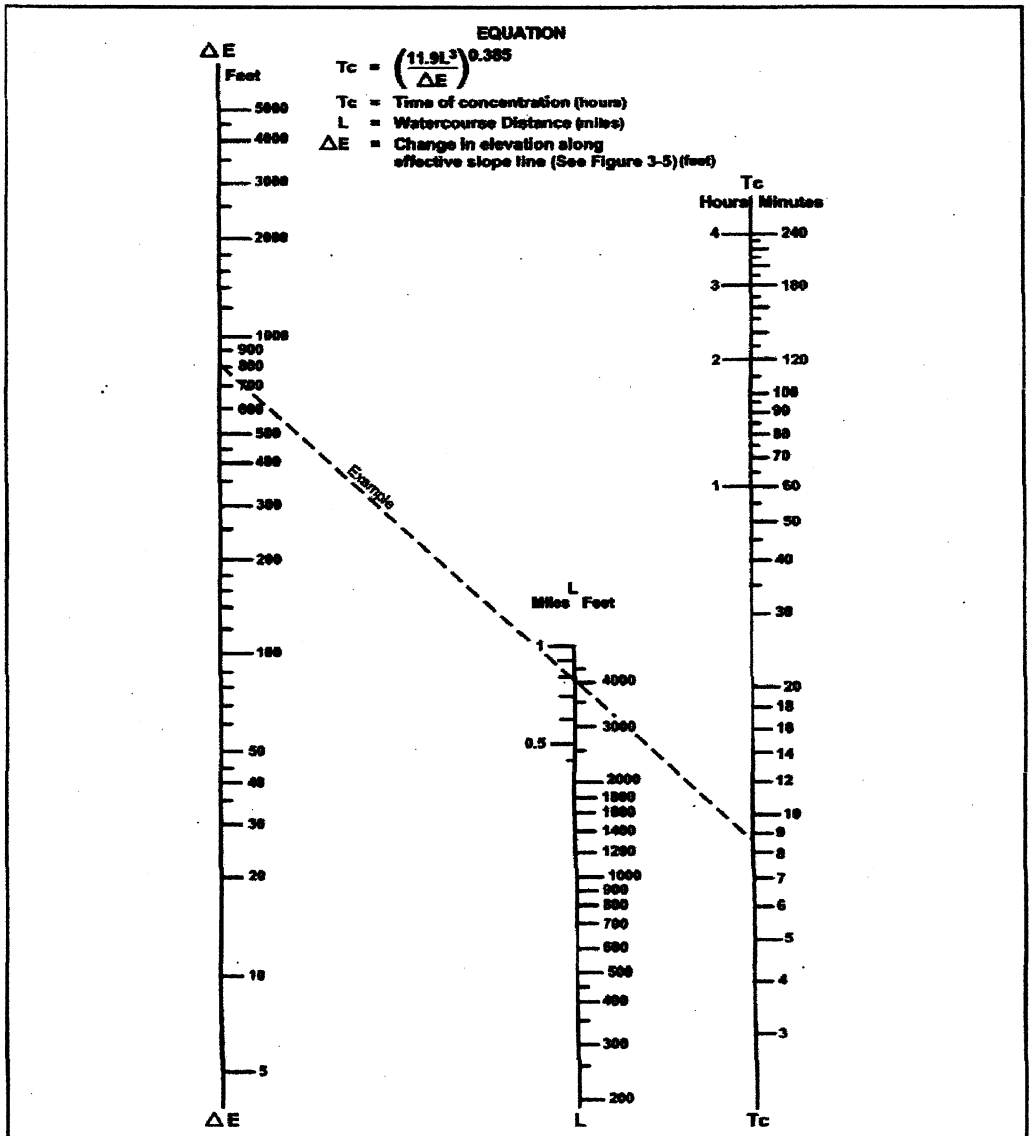
TIME OF CONCENTRATION - TRAVEL TIME (T_t)

USE EQUATION:

Rosemere Lane, L=0.0163 miles, H= 11.5 feet, T_t = **0.52 minutes**
Parcel 1, L=0.0047 miles, H= 3.0 feet, T_t = **0.21 minutes**
Parcel 2, L=0.0047 miles, H= 3.0 feet, T_t = **0.21 minutes**
Parcel 3, L=0.0066 miles, H= 3.5 feet, T_t = **0.29 minutes**
Parcel 4, L=0.0058 miles, H= 3.0 feet, T_t = **0.27 minutes**
Rem Parcel, L=0.0152 miles, H= 4.0 feet, T_t = **0.73 minutes**



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

USE EQUATION TO CALCULATE INTENSITY [$I_{100} = 7.44(P_6)(D^{-0.645})$]:

Where $P_6/P_{24} = (3.5/6.1)x100 = 57.3\%$

Rosemere Lane (Pre):	Where $P_6 = 3.5$, $D = T_t + T_i = 9.22$ minutes, $I_{100} = 6.21$
Rosemere Lane (Post):	Where $P_6 = 3.5$, $D = T_t + T_i = 7.22$ minutes, $I_{100} = 7.28$
Parcel 1 (Pre):	Where $P_6 = 3.5$, $D = T_t + T_i = 8.91$ minutes, $I_{100} = 6.35$
Parcel 1 (Post):	Where $P_6 = 3.5$, $D = T_t + T_i = 6.91$ minutes, $I_{100} = 7.48$
Parcel 2 (Pre):	Where $P_6 = 3.5$, $D = T_t + T_i = 8.91$ minutes, $I_{100} = 6.35$
Parcel 2 (Post):	Where $P_6 = 3.5$, $D = T_t + T_i = 6.91$ minutes, $I_{100} = 7.48$
Parcel 3 (Pre):	Where $P_6 = 3.5$, $D = T_t + T_i = 8.99$ minutes, $I_{100} = 6.32$
Parcel 3 (Post):	Where $P_6 = 3.5$, $D = T_t + T_i = 6.99$ minutes, $I_{100} = 7.49$
Parcel 4 (Pre):	Where $P_6 = 3.5$, $D = T_t + T_i = 8.97$ minutes, $I_{100} = 6.33$
Parcel 4 (Post):	Where $P_6 = 3.5$, $D = T_t + T_i = 6.97$ minutes, $I_{100} = 7.44$
Remainder Parcel (Pre):	Where $P_6 = 3.5$, $D = T_t + T_i = 9.43$ minutes, $I_{100} = 6.12$
Remainder Parcel (Post):	Where $P_6 = 3.5$, $D = T_t + T_i = 7.43$ minutes, $I_{100} = 7.14$

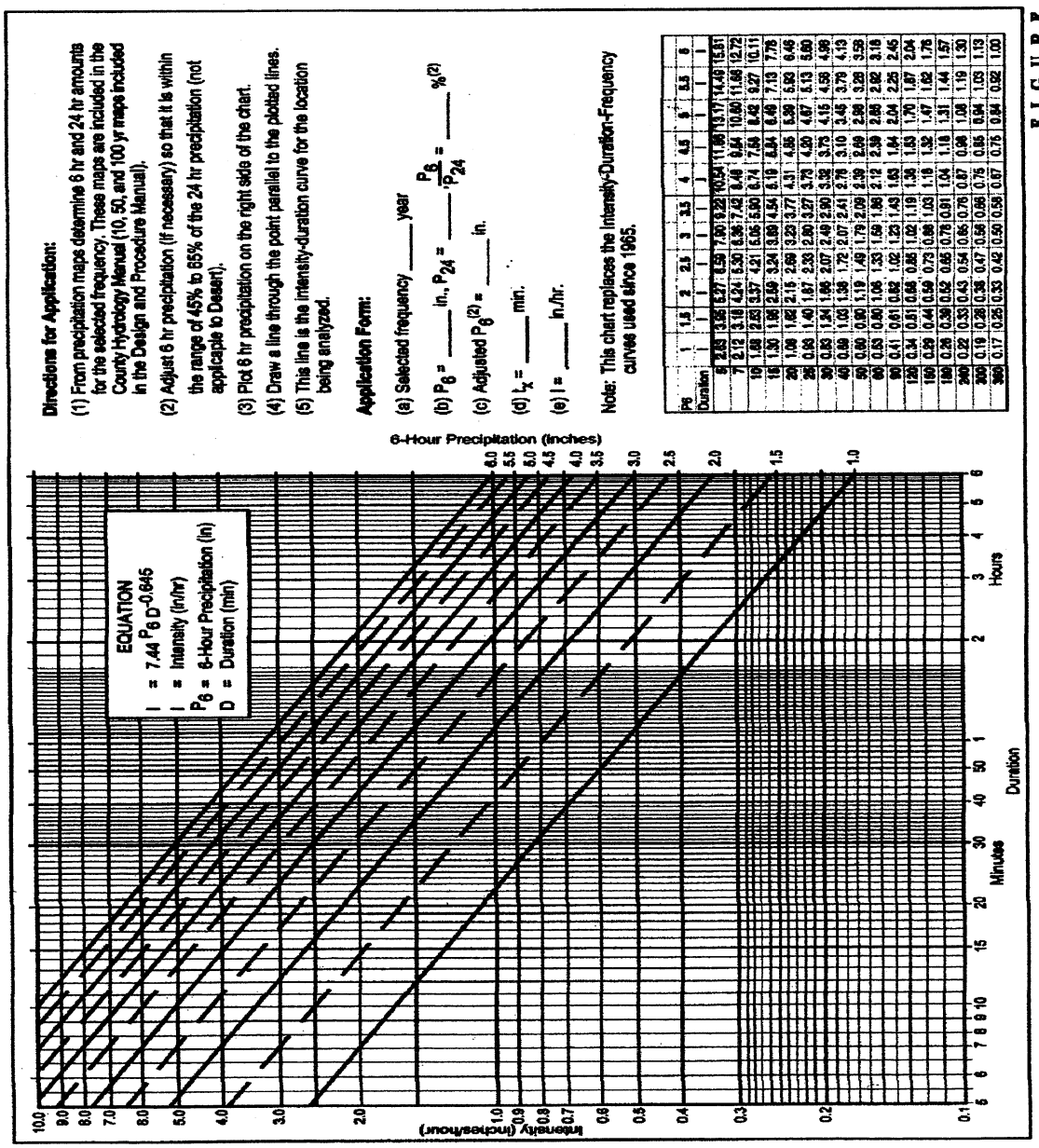
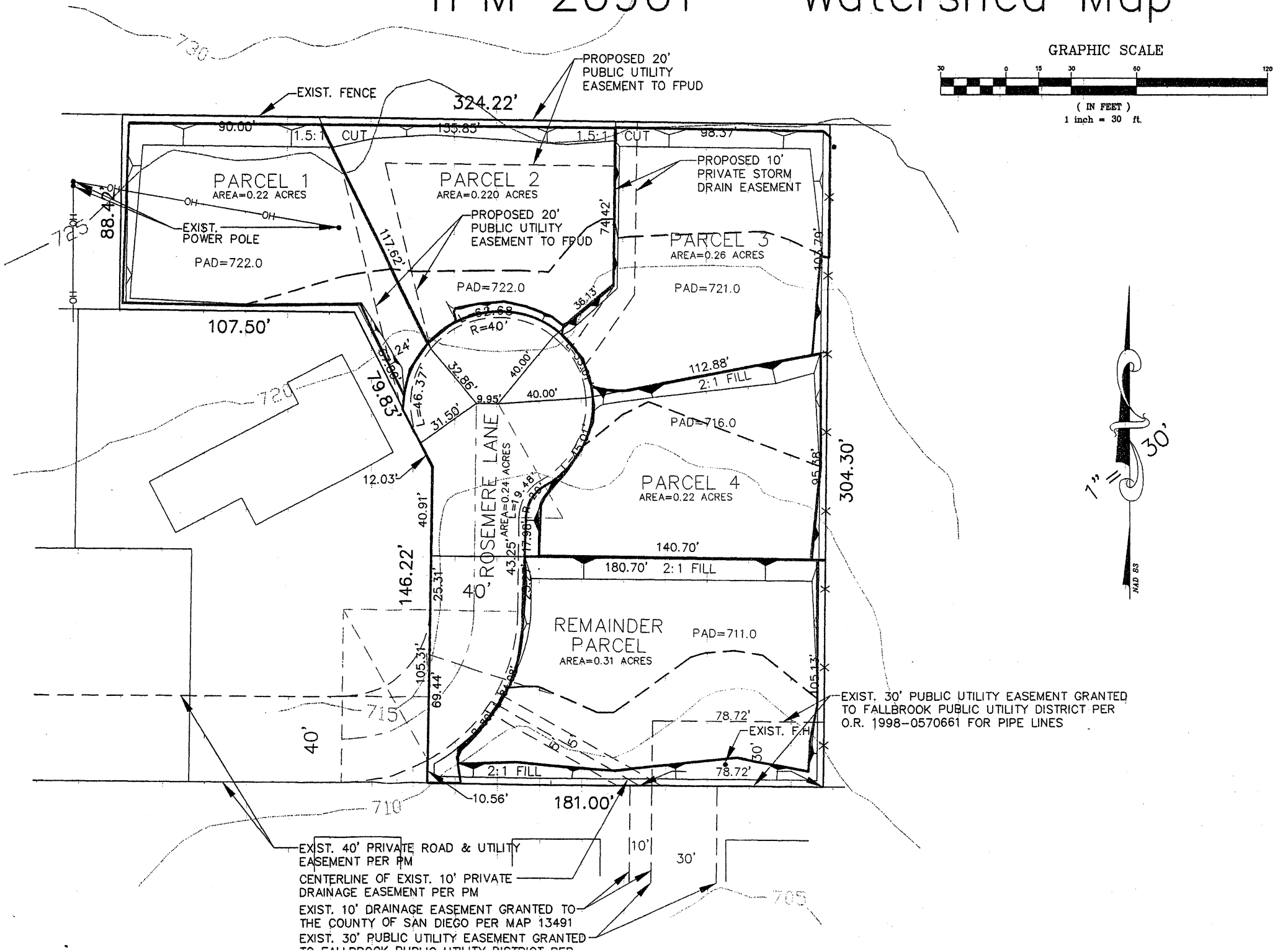


FIGURE 3-1

Intensity-Duration Design Chart - Template

TPM 20901 – Watershed Map