PRELIMINARY DRAINAGE STUDY

FOR

STYLLI RESIDENCE

APN: 344-030-13

PREPARED BY:

SOWARDS AND BROWN ENGINEERING, INC.
CONSULTING ENGINEERS
2187 NEWCASTLE AVENUE, SUITE 103, CARDIFF, CA 92007
(760) 436-8500

17-049
3/20/18

STYLLI RESIDENCE

DRAINAGE STUDY FOR:

LOT 1 OF LA JOLLA BLUFFS, IN THE CITY OF SAN DIEGO, COUNTY OF SAN DIEGO, STATE OF CALIFORNIA, ACCORDING TO MAP THEREOF NO. 8883, FILED IN THE OFFICE OF THE COUNTY RECORDER OF SAN DIEGO COUNTY, JUNE 7, 1978.

APN: 344-030-13

CRITERIA:

1. USE THE CURRENT COUNTY OF SAN DIEGO HYDROLOGY MANUAL "RATIONAL METHOD".

2. DESIGN FOR A 100-YEAR FREQUENCY STORM USING THE COUNTY OF SAN DIEGO 6 HOUR AND 24 HOUR PRECIPITATION ISOPLUVIALS, AND THE INTENSITY-DURATION FORMULA. SEE ATTACHED MAPS.

3. RUNOFF COEFFICIENT FACTORS HAVE BEEN WEIGHTED BASED ON THE INDIVIDUAL "C" FACTORS FOR DIFFERENT SURFACES (I.E. CONCRETE=0.90), AND THE AREAS OF THE INDIVIDUAL SURFACES. OFFSITE RUNOFF COEFFICIENTS ARE BASED ON LOW DENSITY RESIDENTIAL (1.0 DU/AC OR LESS) COEFFICIENTS PER TABLE 3-1.

4. RUNOFF COEFFICIENT FOR PERVIOUS SURFACES (LANDSCAPING AND PERVIOUS PAVERS) ARE BASED ON SOIL TYPE "D" BASED ON USDA WEB SOIL SURVEY WEBSITE AND TABLE 3-1. SEE ATTACHED USDA REPORT.

5. TIMES OF CONCENTRATION (TC) ARE DETERMINED FROM THE URBAN OVERLAND FLOW FORMULA AND NATURAL WATERSHED FLOW FORMULA.

6. REFER TO THE ATTACHED DRAINAGE MAPS FOR BASIN AREAS AND LOCATIONS.

SITE SPECIFIC:

1. THE PROJECT PROPOSES TO REDEVELOP THE EXISTING PROPERTY BY, INCREASING THE SIZE OF THE GARAGE, ADDING ADDITION LIVABLE SPACE ABOVE THE NEW PORTION OF THE GARAGE, A BALCONY ABOVE THE GARAGE AND ALONG THE SOUTH SIDE OF THE GARAGE, A ROOM ADDITION, AND A ROOF OVER AN EXISTION STAIR CASE EXPOSED TO THE SKY.

2. CURRENTLY APPROXIMATLY HALF OF THE SITE WHICH LIES EAST OF THE TOP OF BLUFF DRAINS SOUTHERLY AND WESTERLY TO SOUTH WEST CORNER OF THE SITE, COLLECTS INTO A SLOT DRAIN, AND ONCE THE SLOT DRAIN REACHES CAPACITY, DRAINS OVER THE BLUFF. THE REMAINING HALF DRAINS TO THE STORM WATER DRAINAGE SYSTEM ON LA JOLLA SHORES LANE. THE PORTION OF THE SITE WHICH LIES WEST TOP OF BLUFF DRAINS DOWN THE BLUFF AND TO THE OCEAN.

3. THE PROPOSED DEVELOPMENT WILL MAINTAIN THE AMOUNT OF DISCHARGE (Q) FROM PREVIOUSLY EXISTING DEVELOPMENT, AND REDIRECT STORMWATER WHICH PREVIOUSLY WAS DIRECTED OVER BLUFF, TO THE STORM WATER DRAINAGE SYSTEM ON LA JOLLA SHORES LANE.

DECLARATION OF RESPONSIBLE CHARGE

I HEREBY DECLARE THAT I AM THE 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 PROJECT DRAWINGS AND SPECIFICATIONS BY THE COUNTY OF SAN DIEGO IS CONFINED TO REVIEW ONLY AND DOES NOT RELIEVE ME, AS ENGINEER OF WORK, OF MY RESPONSIBILITIES FOR PROJECT DESIGN.

RANDY R. BROWN, RCE 36190 DATE

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CARDIFF BY THE SEA, CALIFORNIA 92007

JOB 17-049 STYLLI RESIDENCE
SHEET NO. 4 OF
CALCULATED BY SRT DATE 3/20/18
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SCALE NTS

Hydrology Calculations: BASED on SD County Hydrology MANUAL (JUNE 2015)

Pre-Development Drainage: BASED on limited site observations AND Grading & Public improvement Plans # 26960-2-D ; DATED 1993-06-08.

BASIN A: TOTAL AREA = 74916 SF ≈ 1.72 AC

Soil TYPE "D"

AREA IMP = 574 SF < 10% IMP

* PER TABLE 3-1 ; C = 0.41

* PER Figure 3-4 (Eq.) for Natural watersheds

$$T_c = \left[\frac{11.9 L^3}{\Delta E}\right]^{0.385} = \left[\frac{11.9\left(\frac{320}{5280}\right)^3}{244}\right]^{0.385} \times 60 = 0.7 \text{ min} < 5.0 \text{ min}$$

$\therefore T_c = 5.0$ MIN.

$I_{100} = 7.44 P_6 \cdot D^{-0.645}$; where $P_6 = 2.5$

$I_{100} = 7.44(2.5)\cdot(5)^{-0.645}$

$= 6.59$ in/HR

$Q_{100} = C I A$

$= 0.42(6.59)(1.72) = 4.76$ CFS

BASIN B: Soil TYPE "D"

Total AREA = 11540 SF ≈ 0.26 AC

$C_{WT} = \frac{0.9(3847) + 0.41(7693)}{11540} = 0.57$

• BY inspection; $T_c < 5.0$ min ∴ $T_c = 5$ min

$I_{100} = 6.59$ in/HR (SEE BASIN A CALC)

$Q_{100} = 0.57(6.59)(0.26) = 0.98$ CFS

BASIN C: Soil TYPE "D"

Total AREA = 8493 SF ≈ 0.19 AC

PERVIOUS AREA < 10% ∴ C = 0.90

$T_c < 5.0$ Min ∴ $T_c = 5.0$ MIN

$I_{100} = 6.59$ in/HR

$Q_{100} = 0.9(6.58)(0.19) = 1.13$ CFS

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BASIN "D": Soil TYPE "D"

Total AREA = 52860 SF ≐ **1.21 AC**

Imp AREA = 17590 SF • For lots 1 & 2 only
• DATA NOT AVAILABLE FOR lots 3 & 4
• ASSUME Imp AREA = 35,000 SF > 10%; USE C_{WT}

$$C_{WT} = \frac{0.9(35{,}000) + 0.41(17860)}{52860} = \boxed{0.73}$$

$T_c = T_i + T_t$; $T_i = 5$ min By inspec. (overland Flow)

T_t = Pipe Flow @ 9 fps for 230 ft (SEE SHEET 7)

$$T_t = \frac{230}{9(60)} = 0.43 \text{ min} \simeq 0.4 \text{ min}$$

$\boxed{T_c = 5.4 \text{ MIN}}$

$$I_{100} = 7.44(2.5)(5.4)^{-0.645} = \boxed{6.27 \text{ IN/HR}}$$

$$Q_{100} = 0.73(6.27)(1.21) = \boxed{5.54 \text{ CFS}}$$

Circular Channel Analysis & Design
Solved with Manning's Equation

Open Channel - Uniform flow

Worksheet Name: 1

Comment: Basin D pipe flow

Solve For Actual Depth

Given Input Data:

Diameter..........	0.67 ft
Slope.............	0.0500 ft/ft
Manning's n.......	0.011
Discharge.........	1.50 cfs

Computed Results:

Depth.............	0.32 ft
Velocity..........	9.00 fps
Flow Area.........	0.17 sf
Critical Depth....	0.57 ft
Critical Slope....	0.0100 ft/ft
Percent Full......	47.84 %
Full Capacity.....	3.24 cfs
QMAX @.94D........	3.48 cfs
Froude Number.....	3.18 (flow is Supercritical)

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JOB 17-049 STYLLI RESIDENCE
SHEET NO. 8 OF
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PRE-DEVELOPMENT Hydrology Summary

BASIN	C	T_c (MIN)	I_{100} (IN/HR)	A (AC)	Q_{100} (CFS)
A	0.41	5.0	6.59	1.72	4.76
B	0.57	5.0	6.59	0.26	0.98
C	0.90	5.0	6.59	0.19	1.13
D	0.73	5.4	6.27	1.21	5.54

Flood Routing (PRE-DEV.)

Junction 1: BASIN A & B (W/ B Draining over bluff)

$T_A = T_B \therefore Q_{J1} = \sum Q_i = 5.74\text{ CFS}$

$Q_{100} = 5.74$ CFS
$I_{100} = 6.59$ IN/HR

Junction 2: BASINS C & D

$T_C < T_D$

$Q_C = Q_C + \frac{T_C}{T_D} Q_D = 0.98 + \left(\frac{5.0}{5.4}\right) 5.54 = 6.11\text{ CFS}$

$Q_D = Q_D + \frac{I_D}{I_C} Q_C = 5.54 + \frac{6.27}{6.59}(1.13) = 6.62\text{ CFS}$

$Q_{100} = 6.62$ CFS
$I_{100} = 6.27$ IN/HR

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Post-Development Drainage:

Basin 1:

- SAME AS BASIN A in PRE-DEVELOPMENT Drainage Calcs.
  - SEE SHEET 4

$A = 1.72$ AC
$C = 0.41$
$T_c = 5.0$ Min
$I_{100} = 6.59$ IN/HR
$Q_{100} = 4.76$ CFS

Basin 2:

- SAME AS BASIN B, PRE-DEVELOPMENT CALCS.
  - SEE SHEET 5

$A = 0.26$
$C = 0.57$
$T_c = 5.0$ Min
$I_{100} = 6.59$ IN/HR
$Q_{100} = 0.98$ CFS

Basin 3:

AREA = 10076 SF ≈ 0.23 AC
- By Inspection < 10% Pervious AREA ; $C = 0.90$
- By Inspection ; $T_c < 5.0$ Min ∴ $T_c = 5.0$ min
∴ $I_{100} = 6.59$ IN/HR

$Q_{100} = 0.90(6.59)(0.23) = 1.36$ CFS

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BASIN 4:

TOTAL AREA = 51581 SF ≅ **1.18 AC**

- IMP AREA increase of 585 SF DUE to Room Addition.
  - DATA NOT AVAIL. For Lots 3 & 4
  - Assume IMP AREA = 35,585 SF > 10%, USE C_{WT}.

$$C_{WT} = \frac{0.9(35{,}585) + 0.41(15996)}{51581\ SF} = \boxed{0.75}$$

$T_C = 5.4$ MIN, (SEE BASIN D CALCS on SHEET 6)

$I_{100} = \boxed{6.27\ IN/HR}$

$Q_{100} = 0.75(6.27)(1.18) = \boxed{5.55\ CFS}$

POST-DEVELOPMENT Hydrology SUMMARY

BASIN	AREA (AC)	C	T_c (MIN)	I_{100} (IN/HR)	Q_{100} (CFS)
1	1.72	0.41	5.0	6.59	4.76
2	0.26	0.57	5.0	6.59	0.98
3	0.23	0.90	5.0	6.59	1.36
4	1.18	0.75	5.4	6.27	5.55

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JOB 17-049 STYLLI RESIDENCE
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FLOOD ROUTING (POST-DEVELOPMENT)

- CHECK STORM DRAIN PIPE # 3, @ 1.0% slope
  - SEE SHEET 12 ATTACHED FOR Hydraulic calcs.
  - AT 1.0% STORM DRAIN PIPE #3 must be 8in (SEE SHEET 13 ATTACHED)

- CHECK STORM DRAIN PIPE #4, @ 2.4%
  - 8in PIPE is OK For PIPE# 4
    → SEE ATTACHED sheet 14

PRODUCT 204-1 NEBS Inc., Groton, Mass. 01471.

Circular Channel Analysis & Design
Solved with Manning's Equation

Open Channel - Uniform flow

Worksheet Name: Stylli Res.

Comment: SD #3 - Slope Req'

Solve For Full Flow Slope

Given Input Data:

Diameter..........	0.50 ft
Manning's n.......	0.011
Discharge.........	0.98 cfs

Computed Results:

Full Flow Channel Slope	0.0218 ft/ft N.G.
Full Flow Depth........	0.50 ft
Velocity..........	4.99 fps
Flow Area.........	0.20 sf
Critical Depth....	0.47 ft
Critical Slope....	0.0189 ft/ft
Percent Full......	100.00 %
Full Capacity.....	0.98 cfs
QMAX @.94D........	1.05 cfs
Froude Number.....	FULL

Circular Channel Analysis & Design
Solved with Manning's Equation

Open Channel - Uniform flow

Worksheet Name: Stylli Res.

Comment: SD #3 - Slope Req'for 8in.

Solve For Full Flow Slope

Given Input Data:

Diameter..........	0.67 ft
Manning's n.......	0.011
Discharge.........	0.98 cfs

Computed Results:

Full Flow Channel Slope	0.0046 ft/ft OK
Full Flow Depth........	0.67 ft
Velocity..........	2.78 fps
Flow Area.........	0.35 sf
Critical Depth....	0.47 ft
Critical Slope....	0.0065 ft/ft
Percent Full......	100.00 %
Full Capacity.....	0.98 cfs
QMAX @.94D........	1.05 cfs
Froude Number.....	FULL

Circular Channel Analysis & Design
Solved with Manning's Equation

Open Channel - Uniform flow

Worksheet Name: Stylli Res.

Comment: SD #4 - 8in.

Solve For Full Flow Capacity

Given Input Data:

Diameter..........	0.67 ft
Slope.............	0.0240 ft/ft
Manning's n.......	0.011
Discharge.........	2.24 cfs

Computed Results:

Full Flow Capacity.....	2.24 cfs
Full Flow Depth........	0.67 ft
Velocity..........	6.36 fps
Flow Area.........	0.35 sf
Critical Depth....	0.64 ft
Critical Slope....	0.0209 ft/ft
Percent Full......	100.00 %
Full Capacity.....	2.24 cfs
QMAX @.94D........	2.41 cfs
Froude Number.....	FULL

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Flood Rating (Post - Development)

Junction A: Basin 1 only

$I_{100} = 6.59$ IN/HR
$Q_{100} = 4.76$ CFS

Junction B: Basins 2, 3, & 4

$T_2 = T_3 < T_4 \therefore$ $Q_{2+3} = 2.34$ CFS $T_{2+3} = 5.0$ MIN
$Q_4 = 5.55$ $T_4 = 5.4$ min

$Q_{2+3} = 2.34 + \left(\frac{5.0}{5.4}\right) 5.55 = 7.48$ CFS

$Q_4 = 5.55 + \left(\frac{6.27}{6.59}\right)(2.34) = 7.78$ CFS

Junction B
$T_c = 5.4$ MIN
$I_{100} = 6.27$ IN/HR
$Q_{100} = 7.78$ CFS

PRODUCT 204-1 NEBS Inc., Groton, Mass. 01471.

Summary:

Pre Development Hydrology

Junction 1: $I_{100} = 6.59$ IN/HR
$Q_{100} = 5.74$ CFS

* Includes BASIN B runoff over bluff *

Junction 2: $I_{100} = 6.27$ IN/HR
$Q_{100} = 6.62$ CFS

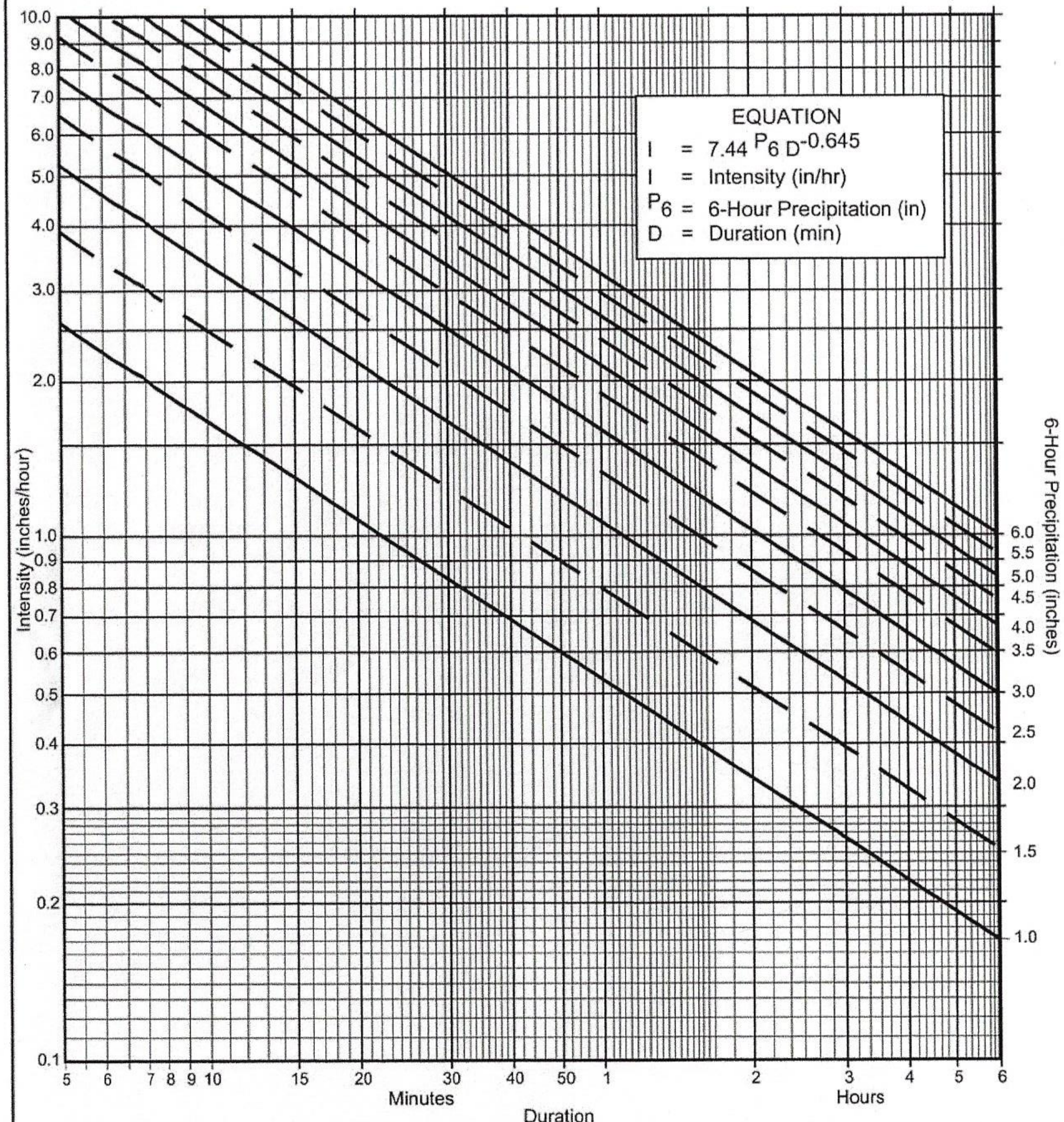
Post Development Hydrology

Junction A: $I_{100} = 6.59$ IN/HR
$Q_{100} = 4.79$

* only BASIN 1; BLUFF Runoff will be diverted to street.

Junction B: $I_{100} = 6.27$ IN/HR
$Q_{100} = 7.78$ CFS

* Increase in stormwater, due primarily to re-routing of water run-off directed over bluff.



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 = 2.0 in., P_{24} = 4.0 , $\frac{P_6}{P_{24}}$ = 50 %(2)

(c) Adjusted $P_6^{(2)}$ = N/A 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

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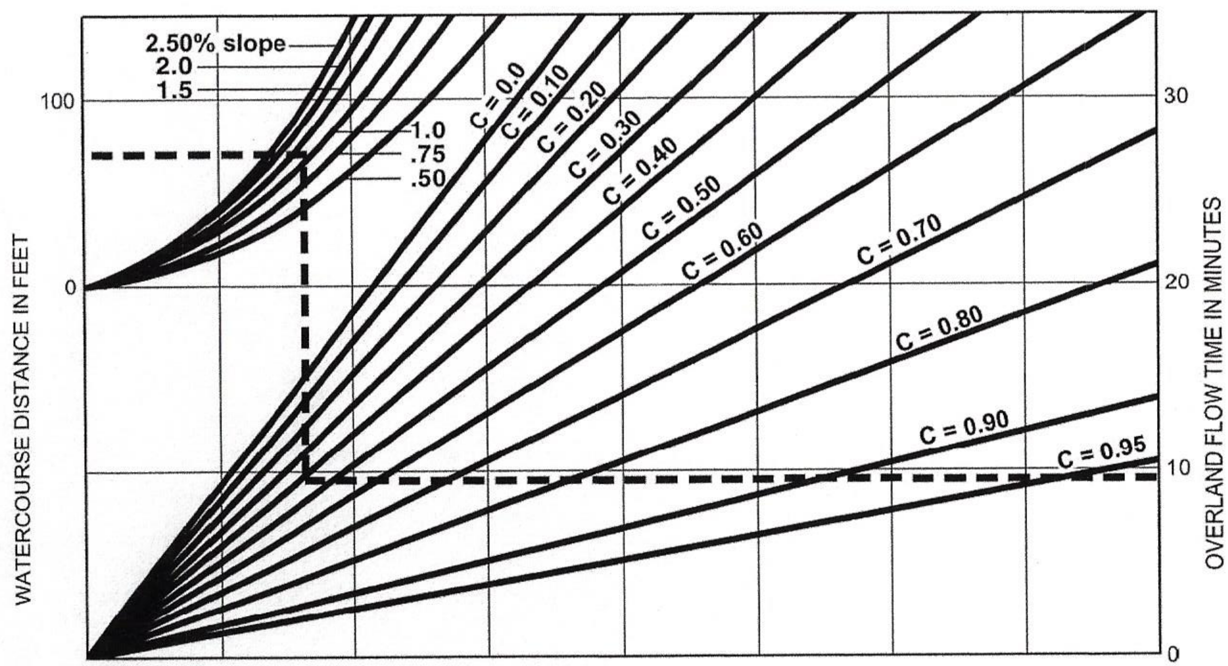


EXAMPLE:

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 **3-3**

Rational Formula - Overland Time of Flow Nomograph

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.

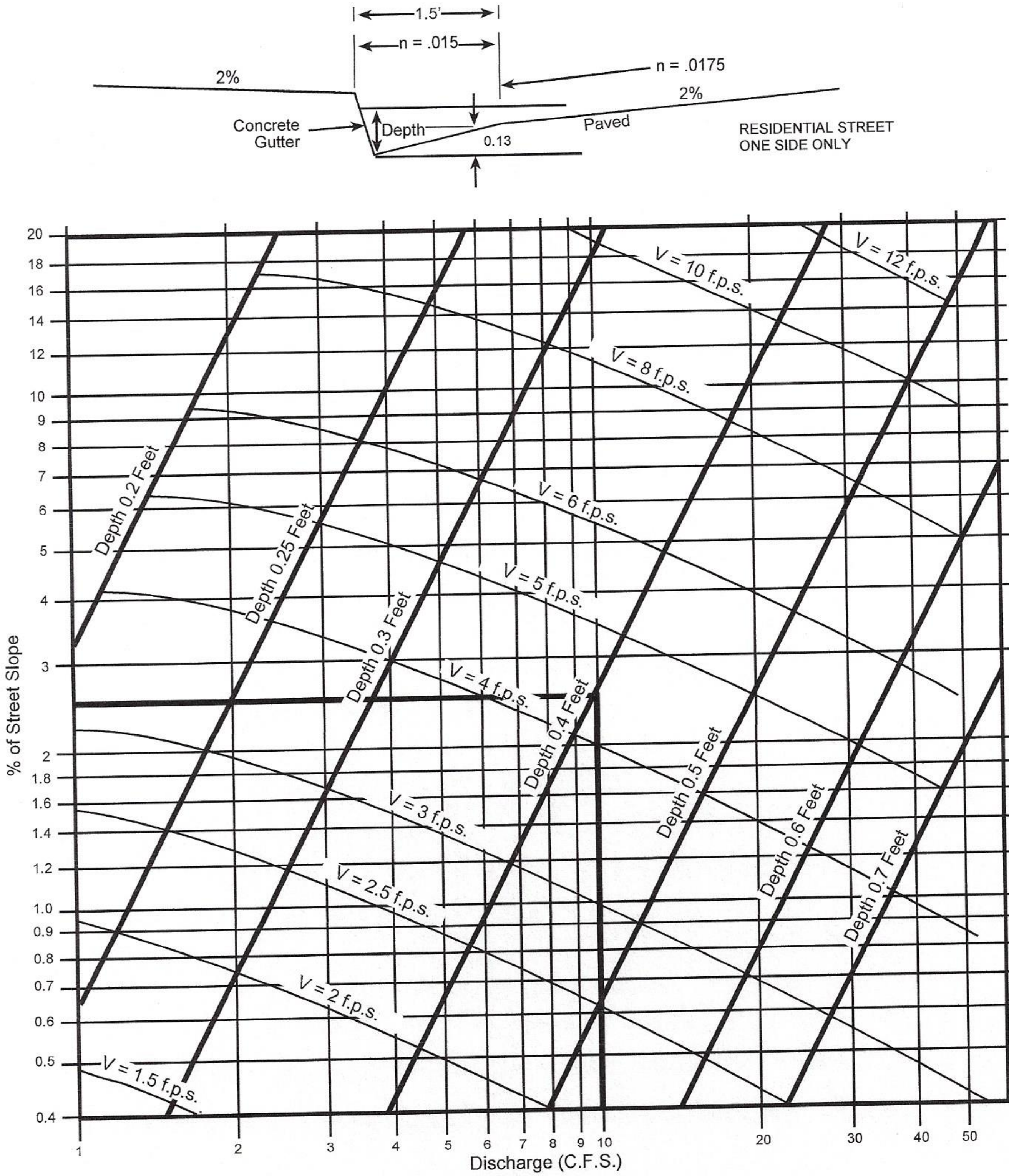
Table 3-2 provides limits of the length (Maximum Length (L_M)) of sheet flow to be used in hydrology studies. Initial T_i values based on average C values for the Land Use Element are also included. These values can be used in planning and design applications as described below. Exceptions may be approved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



EXAMPLE:
Given: Q = 10 S = 2.5%
Chart gives: Depth = 0.4, Velocity = 4.4 f.p.s.

SOURCE: San Diego County Department of Special District Services Design Manual

Gutter and Roadway Discharge - Velocity Chart

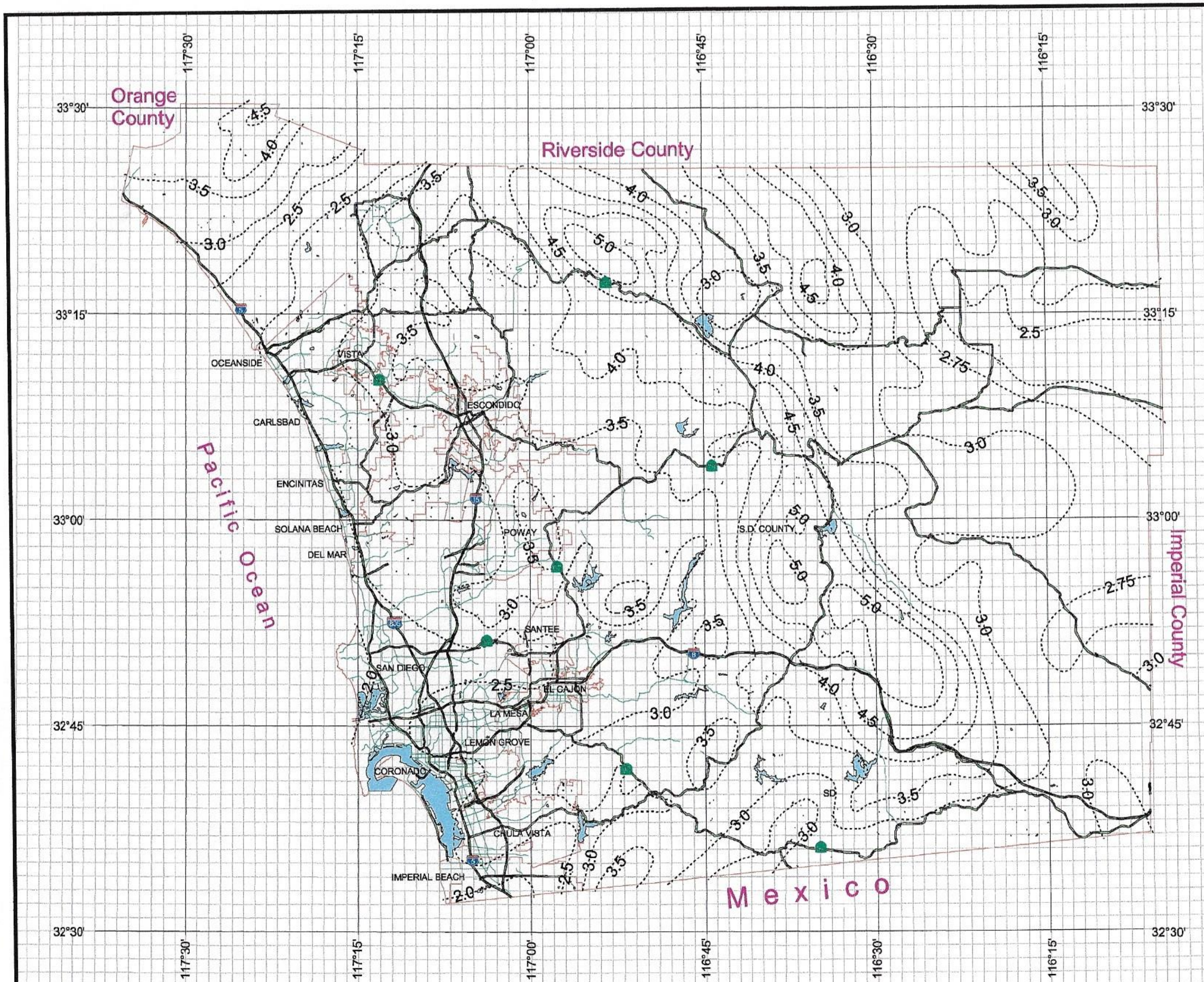
FIGURE **3-6**

County of San Diego
Hydrology Manual

Rainfall Isopluvials

100 Year Rainfall Event - 6 Hours

------- Isopluvial (inches)

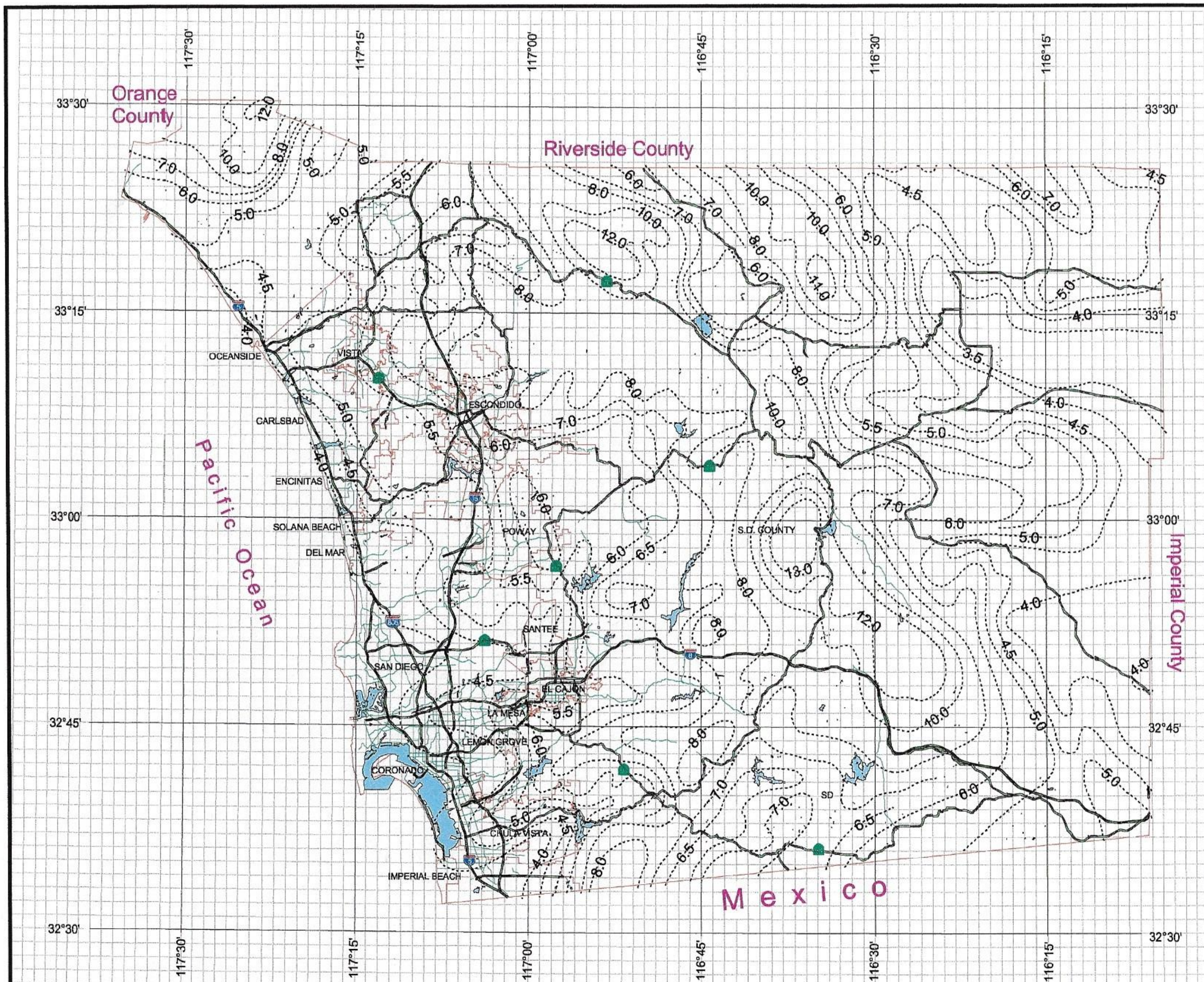


DPW GIS
Department of Public Works
Geographic Information Services

SanGIS
We Have San Diego Covered!

N E S W

3 0 3 Miles



County of San Diego Hydrology Manual

Rainfall Isopluvials

100 Year Rainfall Event - 24 Hours

-------- Isopluvial (inches)

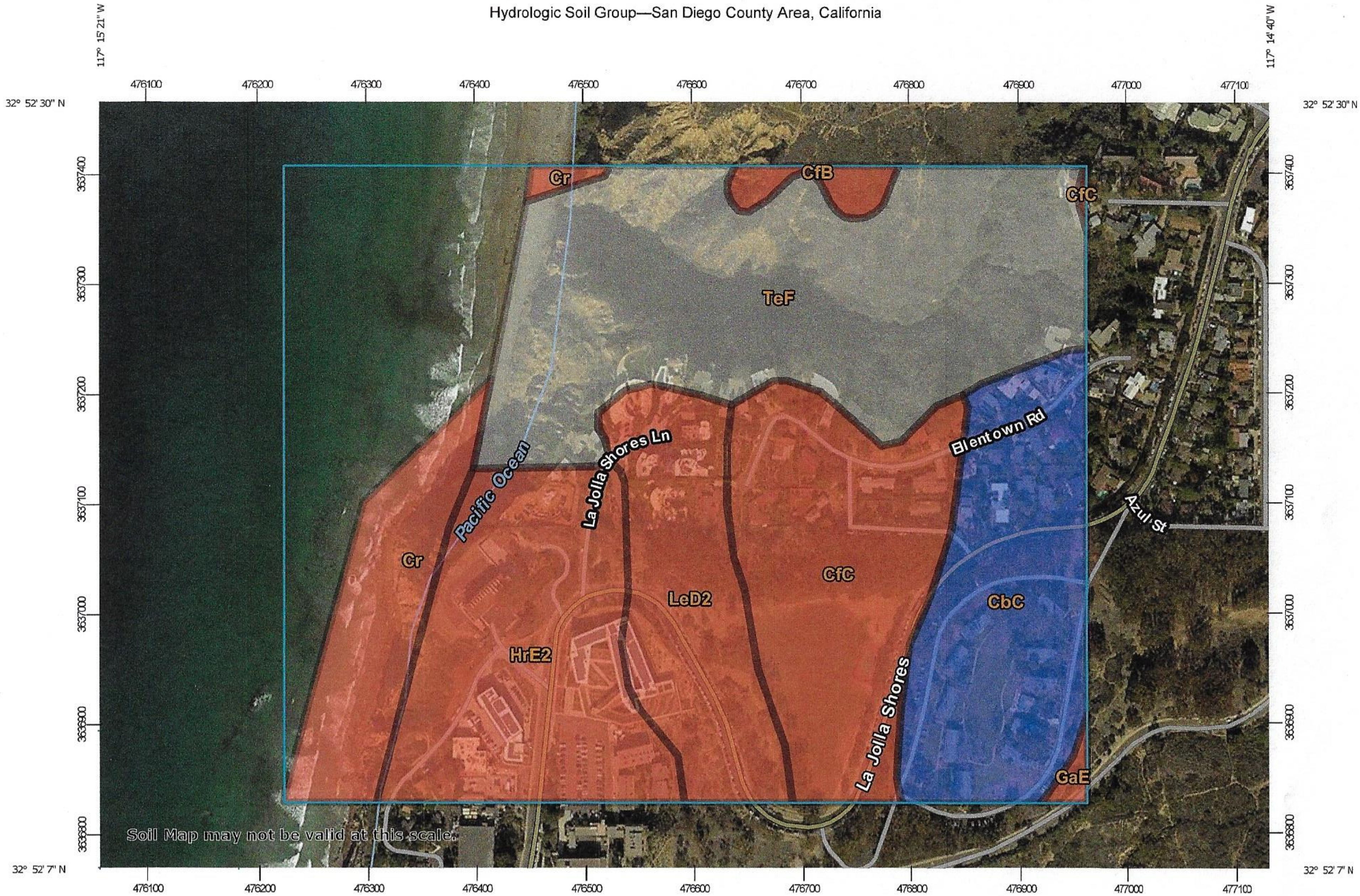
DPW GIS
Department of Public Works Geographic Information Services

SanGIS
We Have San Diego Covered!

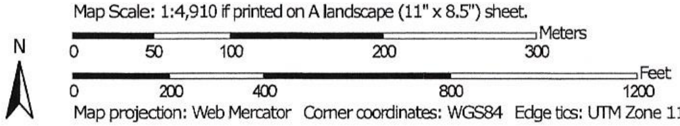
N E S W

3 0 3 Miles

Hydrologic Soil Group—San Diego County Area, California



Map Scale: 1:4,910 if printed on A landscape (11" x 8.5") sheet.



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:
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 12, Sep 13, 2017

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

Date(s) aerial images were photographed: Dec 7, 2014—Jan 4, 2015

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

Map unit symbol	Map unit name	Rating	Acres in AOI	Percent of AOI
CbC	Carlsbad gravelly loamy sand, 5 to 9 percent slopes	B	13.6	12.8%
CfB	Chesterton fine sandy loam, 2 to 5 percent slopes	D	1.2	1.1%
CfC	Chesterton fine sandy loam, 5 to 9 percent slopes	D	14.6	13.8%
Cr	Coastal beaches	D	7.5	7.1%
GaE	Gaviota fine sandy loam, 9 to 30 percent slopes	D	0.4	0.3%
HrE2	Huerhuero loam, 15 to 30 percent slopes, eroded	D	15.1	14.2%
LeD2	Las Flores loamy fine sand, 9 to 15 percent slopes, eroded	D	10.1	9.5%
TeF	Terrace escarpments		27.5	25.9%
Totals for Area of Interest			**106.2**	**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