PRELIMINARY HYDROLOGY and HYDRAULIC REPORT

FOR

Wayne Beauvais
1050 Maryland Drive
Vista, CA 92083

PROJECT

Old Castle Road Project
County Tract 5315
CP 16217
ER 03–02-035

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8/21/08

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Exp. 12/31/09

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DEPARTMENT OF PLANNING AND LAND USE

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PROJECT DESCRIPTION

The undeveloped site is 23.2 acres with natural slopes varying from mild to steep. The existing terrain drains in a southwesterly direction toward lands which contain rural home sites.

The proposed development includes7 residential pads and a private street. The proposed grading impacts 3.5 acres or 15.1 % of the site. The proposed imperious area is 0.94 acres or 4.1 % of the site.

A Table summarizing the results of this is included for your review.

The design maintains the existing drainage patterns and does not alter the current point of concentrations as the drainage flows discharge from the site boundary. The site is covered by three drainage basin. Each basins drain in the westerly direction. For reference, we have described the subject basins as follows:

Pre-construction	*Post-construction*
Basin Pre A-1, A-2	Basin A-1, A-2
Basin Pre A-3	Basin A-3
Basin Pre B-1, B-2, B-3	Basin B-1,B-2, B-3
Basin Pre-C	Basin C

Basin A-1 and A-2, follows the existing drainage pattern and outlets the site to the an existing 18" culvert which crosses Castle Road.
Basin A-3, follows the existing drainage pattern and outlets the site to the pavement section of Old Castle Road.
Basin B, follows the existing drainage pattern and outlets the site to a natural drainage course.
No development is proposed within Basin Pre-C (Basin C), consequently the storm water discharge volume and outlet location are unchanged.

The storm waters collected on the impervious surfaces are discharged onsite and conveyed through grass or rock lined channels and ditches to removed all polluting contaminants before leaving the project. The post development discharging velocities are 4.5 fps for Basin A and 5.9 for Basin B and are considered non-erosive for the soil group classification "B". The Impact to downstream properties under the post development condition will be negligible because the drainage pipe discharge points area minimum of 450 feet from the downstream property line. In that distance the drainage flow characteristic will be the same as the existing condition.

Grass lined Infiltration channels have been incorporated in the design for basin A-1 and basin A-2. The onsite flows from the onsite private street shall be cleansed before entering the existing culvert in Old Castle Road and discharging northerly. Also, the surface flow within the pavement section of Old Castle Road shall be redirected into a infiltration channel for cleansing on the south side of the Old Castle Road Right of Way. As the flow in the infiltration channel continues westerly, the flow will be redirected back into the pavement section exiting the site along the pre-development drainage pattern.

As an extra measure, to avoid the downstream impacts of the post construction discharge, the storm flows will be channeled through rock or grass lined channels with a series of rock-filled check dams to control the velocities prior to leaving the site.

There is no historical evidence that the downstream water courses are inadequate to handle the storm flows. Due to the minimal modification of the site development, we do not believe that any downstream properties will be adversely impacted by the proposed development. Letter(s) of waiver and release from downstream property owners are not required.

The project site is not located near a floodway or floodplain or a water course plotted on any official floodway map.

Hydrology & Hydraulics Report
County of San Diego

This Hydraulics and Hydrology Report was prepared using the following Manuals:

Hydrology Manual, County of San Diego
Drainage of Highway Pavements, U.S. Dept. of Transportation

The Rational Method was used to determine the 100 yr. storm Q values.

The Rational Method uses the following formula to establish 100 year flow:

$$Q = CIA$$

where,

Q = the peak runoff in cubic feet per second

C = Runoff coefficient representing the ratio of runoff to rainfall

I = time average intensity in inches per hour

A = Area of the subbasin in acres

SUMMARY TABLE

SUMMARY TABLE OF HYDROLOGY CALCULATIONS
TM-5315, CP 16217

PRE -CONSTRUCTION	*POST -CONSTRUCTION*	*C*	*Tc (min.)*	*I ("/hr)*	*A (acres)*	*Q (cfs)*	*V (fps)*	*ΔQ (cfs)*
BASIN PRE-A-1, A-2		0.25	12.17	5.94	8.22	12.2	-	
	BASIN A-1, A-2	0.29	15.27	5.13	8.48	12.6	4.5	0.4
BASIN PRE-A-3		0.25	8.73	7.63	1.98	3.6	-	
	BASIN A-3,	0.25	9.83	6.81	1.32	2.3	4.5	<1.3>
BASIN PRE-B-1,B-2		0.25	9.57	6.09	13.3	23.0	-	
	BASIN B-1, B-2	0.29	12.76	5.79	13.4	20.9	5.9	<2.1>
BASIN PRE-C		0.25	10.2	6.7	8.2	13.7	-	
	BASIN C	0.25	10.2	6.7	8.2	13.7	-	-0-

HYDROLOGY REPORT

Aquaterra Engineering Inc.

PROJECT TM5315 DATE: 11/15/01

Rev 2/8/05

HYDROLOGY CALCS - POST CONSTRUCTION

BASIN A-1

AREA = 4.22 Acres. LAND USE = 1 DU/Acre

SOIL GROUP B C (NATIVE) = 0.25 (4.13 Acres) 98%

C (1 DU/Acre) = 0.32 (0.09 Acres) 2%

IMPERVIOUS SURFACE = 0.09 Acres = 2%

COMPOSIT C = 0.9 (0.02) + 0.25 (0.98) =
0.018 0.245 = 0.26

TIME OF CONCENTRATION

T_i (INITIAL) @ 2% (LM = 100') = 10.0 MIN

T_c' (OVERLAND)

$h = 1255 - 1204 = 51'$

$l = 5251'$

$$T_c' = \left[\frac{11.9\left(\frac{525}{5280}\right)^3}{51}\right]^{-0.385} \times 60 = 2.38$$

T_c (TOTAL) = $T_i + T_c'$ = 10.0 + 2.38 = 12.38 MIN

$$I_{100} = 7.44\,(4)\,(12.38)^{-0.645} = 5.87 \text{ in/hr}$$

$Q_{100} = 4.22\,(0.26)\,5.87 = 6.44$ CFS.

PROJECT TM 5315 DATE: 11/15/04

Rev 2/8/05

HYDROLOGY CALCS - POST CONSTRUCTION

BASIN A-1 + A-2

TOTAL AREA = 4.22 + 4.26 = 8.48 Acres

LAND USE = 1 DU/ACRE

SOIL GROUP B C (NATIVE) = 0.25

C (1 DU/Acre) = 0.32

IMPERVIOUS AREA: A-1 (0.09), A-2 (0.45) > 0.54 Acres

IMPERVIOUS RATIO = 0.54 / 8.48 = 0.06

COMPOSITE C = 0.90(0.06) + 0.25(0.94)
0.054 + 0.235 = 0.29

TIME OF CONCENTRATION

T_c (INITIAL) @ 2% (LM = 100') = 10.0 MIN

T_c' (OVERLAND) h = 1255 - 1200 = 55'

l = 1071'

$$T_c' \left[\frac{11.9 \left(\frac{1071}{5280}\right)^3}{55} \right]^{0.385} \times 60 = 5.27 \text{ MIN}$$

T_c (TOTAL) = 10.00 + 5.27 = 15.27 MIN

$I_{100} = 7.44 (4) (15.27)^{-0.645} = 5.13$ /HR

$Q_{100} = CIA = 0.29 (5.13)\ 8.48 = 12.61$ CFS

PROJECT TM 5315 DATE: 11/15/04

HYDROLOGY CALCULATIONS - POST CONST.

BASIN A-3

AREA = 1.32 ACRES

LAND USE 1 DU/ACRE

SOIL GROUP B C (NATIVE) = 0.25
C (1 DU/ACRE) = 0.32

IMPERVIOUS AREA = ZERO

C = 0.25

TIME OF CONCENTRATION

T_c (INITIAL) @ 5% (L = 100) = 8.0 MIN

T_c' (OVERLAND) h = 1288 - 1198 = 90'
l = 504'

$$T_c' = \left[\frac{1.9\left(\frac{504}{5280}\right)^{3}}{90} \right]^{0.385} \times 60 = 1.83 \text{ MIN}$$

TC (TOTAL) = 8.0 + 1.83 = 9.83 MIN

$$I_{100} = 7.44(4)(9.83)^{-0.645} = 6.81 \text{ "/MIN}$$

Q = CIA = 0.25(6.81)(1.32) = 2.25 cfs.

Aquaterra Engineering Inc.

PROJECT TM 5315 DATE: 11/15/04

Rev 2/8/05
Rev 4/3/07

HYDROLOGY CALCS - POST CONSTRUCTION

BASIN B-1

AREA = 5.33 Acres. LAND USE 1 DU/ACRE

SOIL GROUP B: C (NATIVE) = 0.25
C (1 DU/ACRE) = 0.32

IMPERVIOUS AREA: 0.31 ACRE

IMPERVIOUS RATIO = 0.31/5.33 = 0.06

COMPOSITE C = 0.9 (0.06) + 0.25 (0.94)
0.05 + 0.24 = 0.29

TIME OF CONCENTRATION

T_c (INITIAL) @ 10% (L M = 100') = 10.0 MIN

T_c' (OVERLAND) h = 1325 - 1220 = 105
l = 508

$$T_c' = \left[\frac{11.9\left(\frac{508}{5280}\right)^{3}}{105}\right]^{0.385} \times 60 = 1.7 \text{ MIN}$$

T_c (TOTAL) = 10.0 + 1.7 = 11.7 MIN

$$I_{100} = 7.44(4)(11.7)^{-0.645} = 6.09 \text{ IN/HR}$$

$Q_{100} = CIA = 0.29(6.09)(5.33) = 9.41$ cfs

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PROJECT TM 5315 DATE: 11/15/04

Rev 2/08/05

Rev 4/3/07

HYDROLOGY CALCS - POST CONSTRUCTION

BASIN B5-2

Area = 8.04 Acres

Land Use = 1 DU/Acre

Soil Group B C (Native) = 0.25
C (1 DU/Acre) = 0.32

Impervious Area = 0.09 Acres

Impervious Ratio = 0.09/8.04 = 0.01

Composite C = 0.90 (0.01) + 0.25 (0.99)
= 0.009 + 0.25 = 0.26

Time of Concentration

T_c (Initial) @ 2% (LM = 100') = 10.0 Min

T_c' (Overland) h = 1325 - 1166 = 159'
l = 809'

$$T_c' = \left[\frac{1.9\left(\frac{809}{5280}\right)^3}{159}\right]^{0.385} \times 60 = 2.53 \text{ Min}$$

Tc (Total) = 10.0 + 2.5 = 12.5 Min

$I_{100} = 7.49(4)(12.5)^{-0.645} = 5.83$ "/Hrs

$Q_{100} = CIA = 0.26(5.83)\,8.04 = 12.2$ cfs

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PROJECT TM 5315

DATE: 11/15/04
Rev 2/8/05

HYDROLOGY CALCULATIONS - POST CONSTRUCTION
Rev 4/3/07

BASIN BS-1, BS-2,

TOTAL AREA = 5.33 + 8.04 = = 13.4 Acres

LAND USE = 1 DU/Acre

SOIL GROUP B ⇒ C (NATIVE) = 0.25
C (1 DU/ACRE) = 0.32

IMPERVIOUS AREA BS-1 0.31 Acre
BS-2 0.09
0.40

IMPERVIOUS RATIO = 0.40/13.4 = 0.03

COMPOSITE C = 0.90(0.03) + 0.25(0.97)
0.027 + 0.243 = 0.27

TIME OF CONCENTRATION

Tc (INITIAL) @ 10% (LM = 100') = 10.0 MIN

Tc (OVERLAND) h = 1375 - 1166 = 159'
l = 847

$$T_c' = \left[\frac{11.9\left(\frac{847}{5280}\right)^3}{159}\right]^{0.385} \times 60 = 2.67$$

Tc (TOTAL) = 10.0 + 2.67 = 12.67 MIN

$$I_{100} = 7.44(4)(12.67)^{-0.645} = 5.79 \text{ "/HRS}$$

$$Q_{100} = CIA = 0.27(5.79)13.4 = 20.94 \text{ cfs.}$$

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PROJECT TM 5315 DATE: 2/15/04

PRECONSTRUCTION

BASIN PRE-C + POST CONSTRUCTION BASIN C

AREA = 8.2 ACRES LAND USE: NATIVE

SOIL GROUP B ⇒ C = 0.25

TIME OF CONCENTRATION CALCS

T_a (INITIAL)

$h = 1356 - 1174 = 182'$ $\Big\rangle \frac{182}{1050} = 17.3\%$

$l = 1050$

See TABLE 3-2 $T_a(10') = 6.9$ MIN ($l_m = 100'$)

$$T_c = \left[\frac{11.9\left(\frac{1050}{5280}\right)^3}{182}\right]^{0.385} \times 60 = 3.25 \text{ MIN}$$

$T_{TOTAL} = T_a + T_c = 6.9 + 3.3 = 10.2$ MIN

$I_{100} = 7.44(4)(10.2)^{-0.645} = 6.7''/\text{HRS}$

$Q_{100} = CAI = 0.25(8.2)6.7 = 13.7$ cfs

THE DEVELOPMENT SHALL HAVE NO IMPACT ON BASIN DESCRIBED AS "PRE-C" AND POST CONSTRUCTION "BASIN C"

Aquaterra Engineering Inc.

PROJECT TM 5315

DATE: 11/15/02
Rev 2/8/05

HYDROLOGY CALC. PRE DEVELOPMENT

BASIN PRE A-1, A-2

AREA = 8.22 ACRES SOIL GROUP B

LAND USE: (NATIVE) ⇒ C = 0.25

TIME OF CONCENTRATION

T_c (INITIAL) @ 10% (LM = 100') = 6.9 MIN

T_c' (OVERLAND) $h = 1255 - 1200 = 55'$

$l = 1071'$

$$T_c' = \left[\frac{11.9 \left(\frac{1071}{5280}\right)^3}{55} \right]^{0.385} \times 60 = 5.27 \text{ MIN}$$

T_c (TOTAL) = 6.9 + 5.27 = 12.17 MIN

$$I_{100} = 7.44 (4) (12.17)^{-0.645} = 5.94 \text{ IN/HRS}$$

$$Q_{100} = C I A = 0.25 (5.94) 8.22 = 12.2 \text{ CFS.}$$

PROJECT TM 5315 DATE: 11/15/04

HYDRAULIC CALCS. - PRE CONSTRUCTION

BASIN PRE A-3

AREA: 1.98 Acres. SOIL GROUP B

LAND USE: (NATIVE) = C = 0.25

TIME OF CONCENTRATION

Tc (INITIAL) @ 10% (LM = 100') = 6.9 MIN

Tc' (OVERLAND) h = 1288 - 1198 = 90

l = 504

$$Tc' = \left[\frac{11.9\left(\frac{504}{5280}\right)^{3}}{90}\right]^{0.385} \times 60 = 1.83 \text{ MIN}$$

Tc (TOTAL) = 6.9 + 1.83 = 8.73 MIN

$$I_{100} = 7.44(4)(8.73)^{-0.645} = 7.36 \text{ "/HR}$$

$$Q_{100} = CIA = 0.25(7.36)\,1.98 = 3.6 \text{ cfs.}$$

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PROJECT TM 5315

DATE: 11/15/04
Rev 2/8/05

HYDROLOGY CALCS. - PRE CONSTRUCTION

BASIN PRE-RS-1, RS-2

AREA = 13.3 ACRES SOIL GROUP B

LAND USE (NATIVE) ⇒ C = 0.25

T_c (INITIAL) @ 10% (L M = 100') = 6.9 MIN

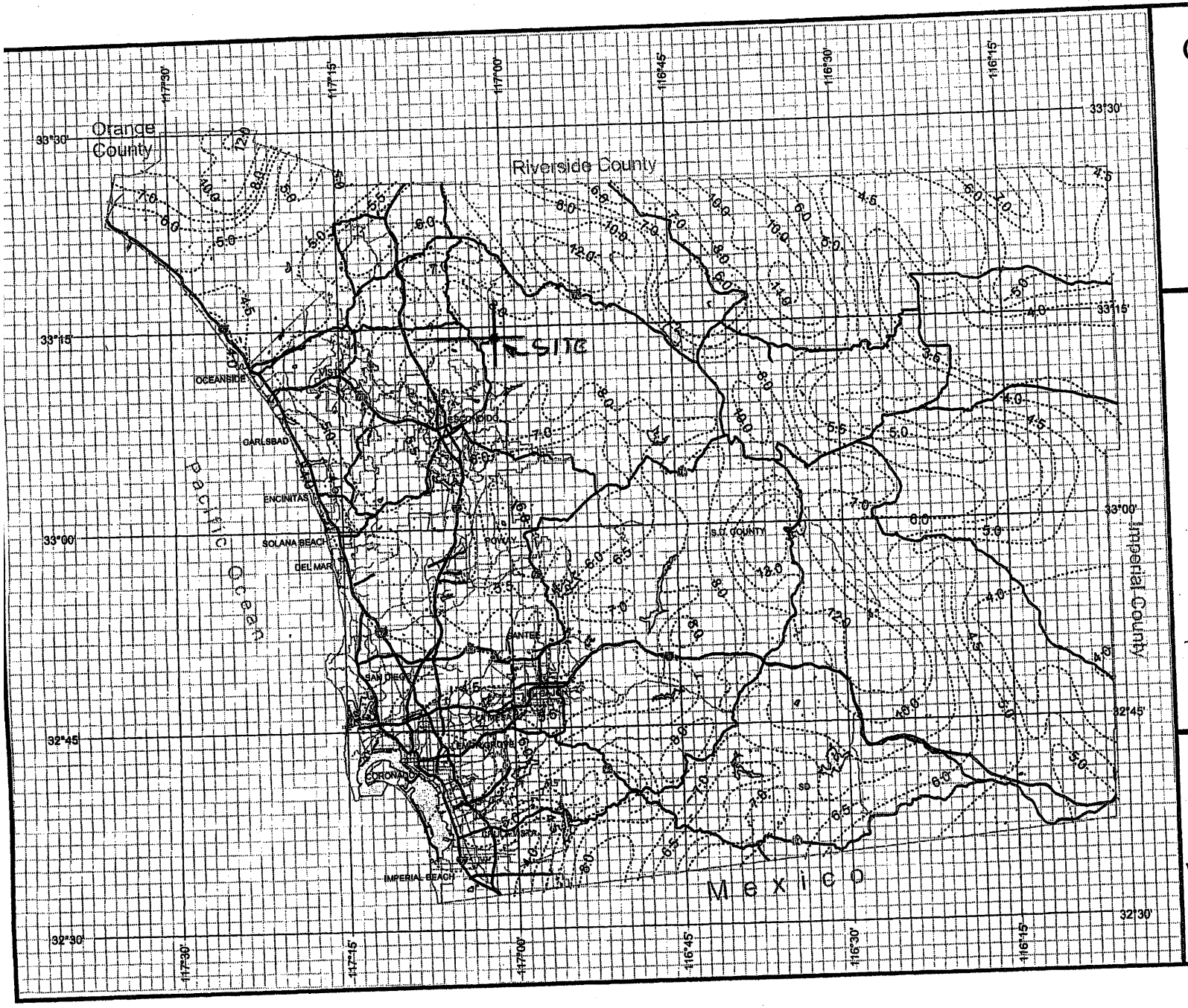
T_c' (OVERLAND) l_1 = 1325 - 1166 = 159
l = 847

$$T_c' = \left[\frac{11.9\left(\frac{847}{5280}\right)^3}{159}\right]^{0.385} \times 60 = 2.67 \text{ MIN}$$

T_c (TOTAL) = 6.9 + 2.67 = 9.57 MIN

$$I_{100} = 7.44(4)(9.57)^{-0.645} = 6.93 \text{ IN/HRS}$$

$$Q_{100} = C\,I\,A = 0.25(6.93)\,13.3 = 23.0 \text{ CFS}$$



County of San Diego Hydrology Manual

Rainfall Isopluvials

100 Year Rainfall Event - 24 Hours

Isopluvial (inches)

LAT 33°14'15"
LONG 117°00'45"

DPW GIS
Department of Public Works
Geographic Information Services

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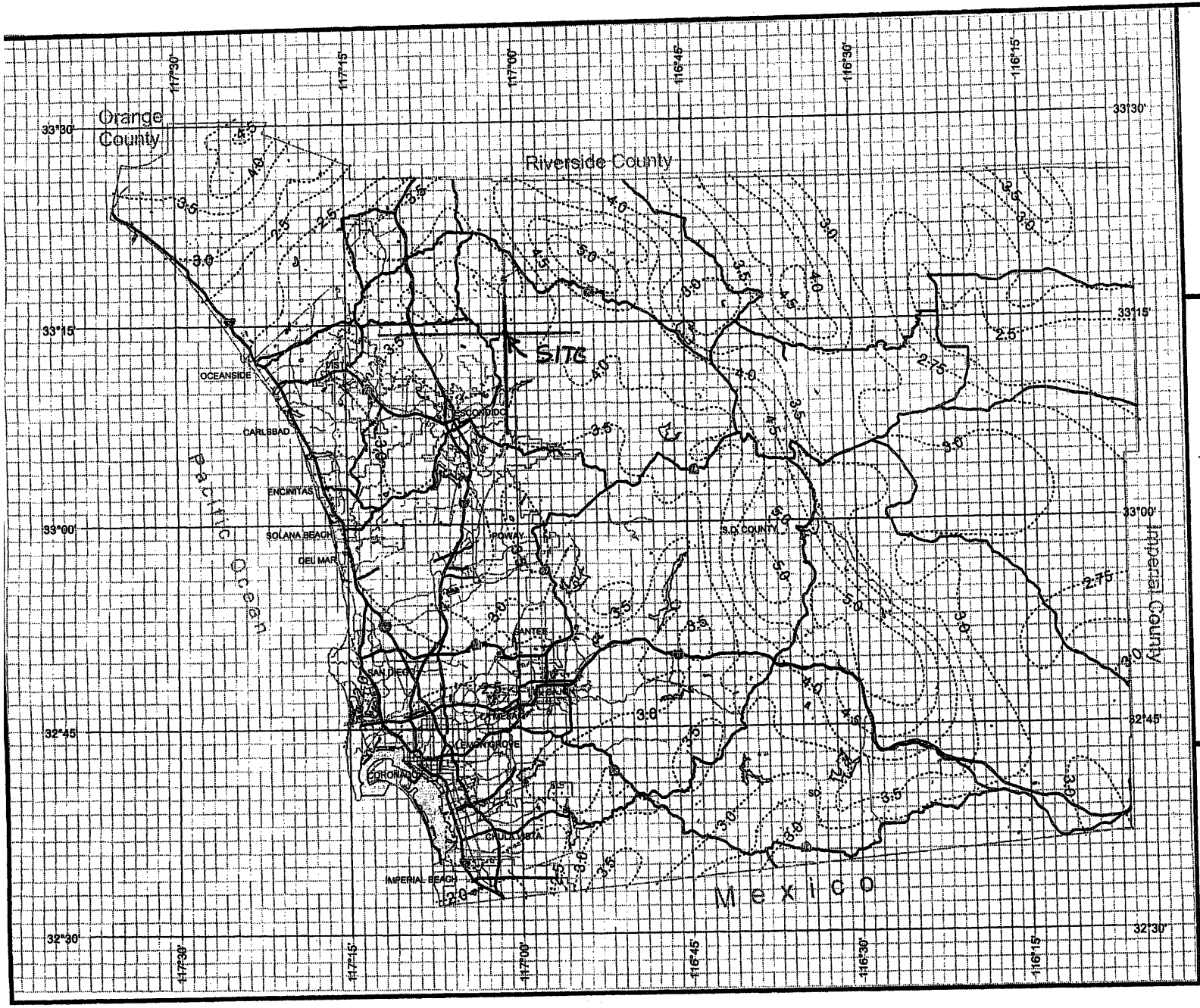

County of San Diego Hydrology Manual

Rainfall Isopluvials

100 Year Rainfall Event - 6 Hours

Isopluvial (inches)

LAT 33°14'15"
LONG 117°00'45"

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Department of Public Works Geographic Information Services

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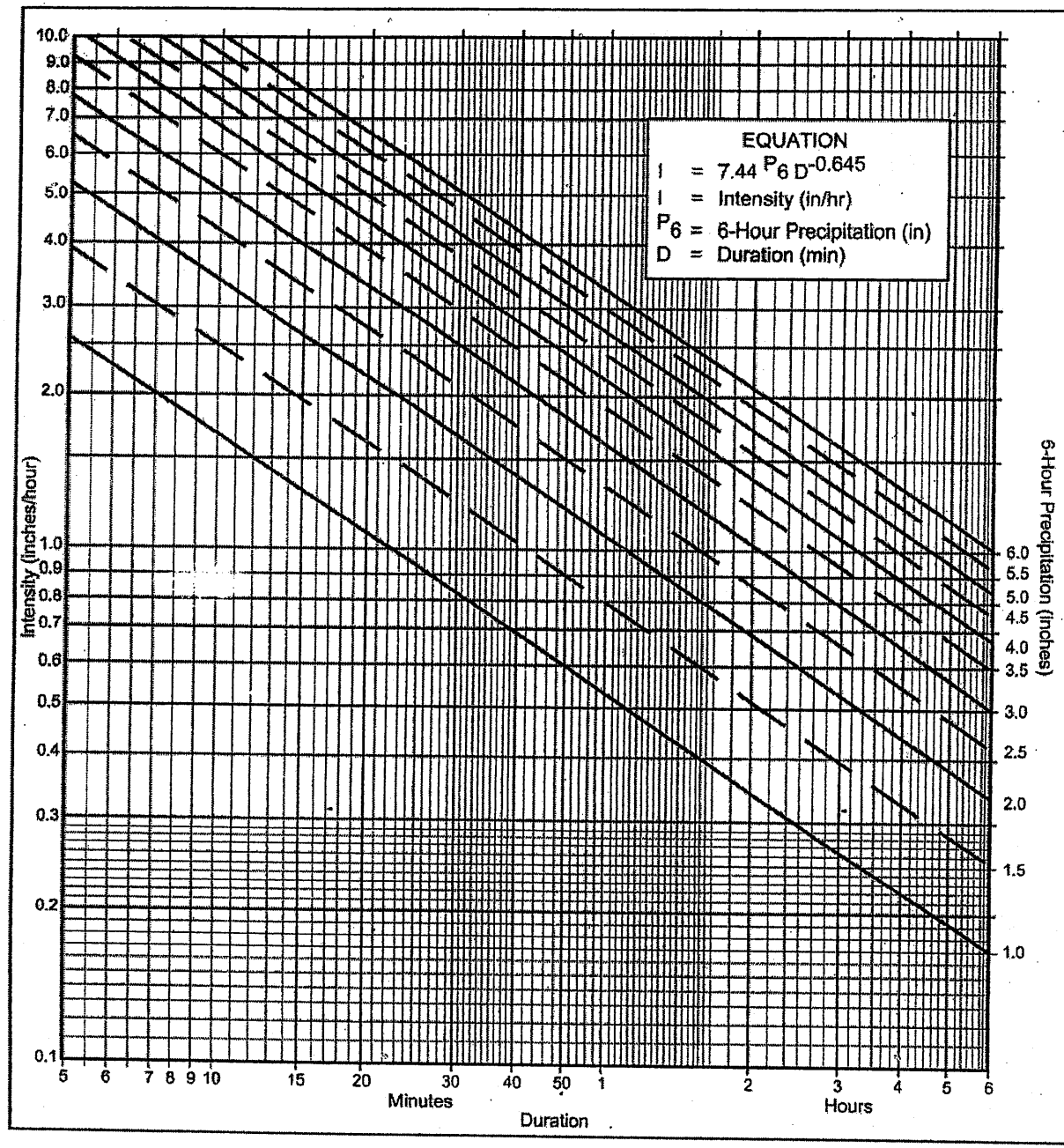


Directions for Application:

(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.

Application Form:

(a) Selected frequency 100 year

(b) P_6 = 4.0 in., P_{24} = 8.0, $\frac{P_6}{P_{24}}$ = 50 %(2)

(c) Adjusted P_6(2) = 4.0 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

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

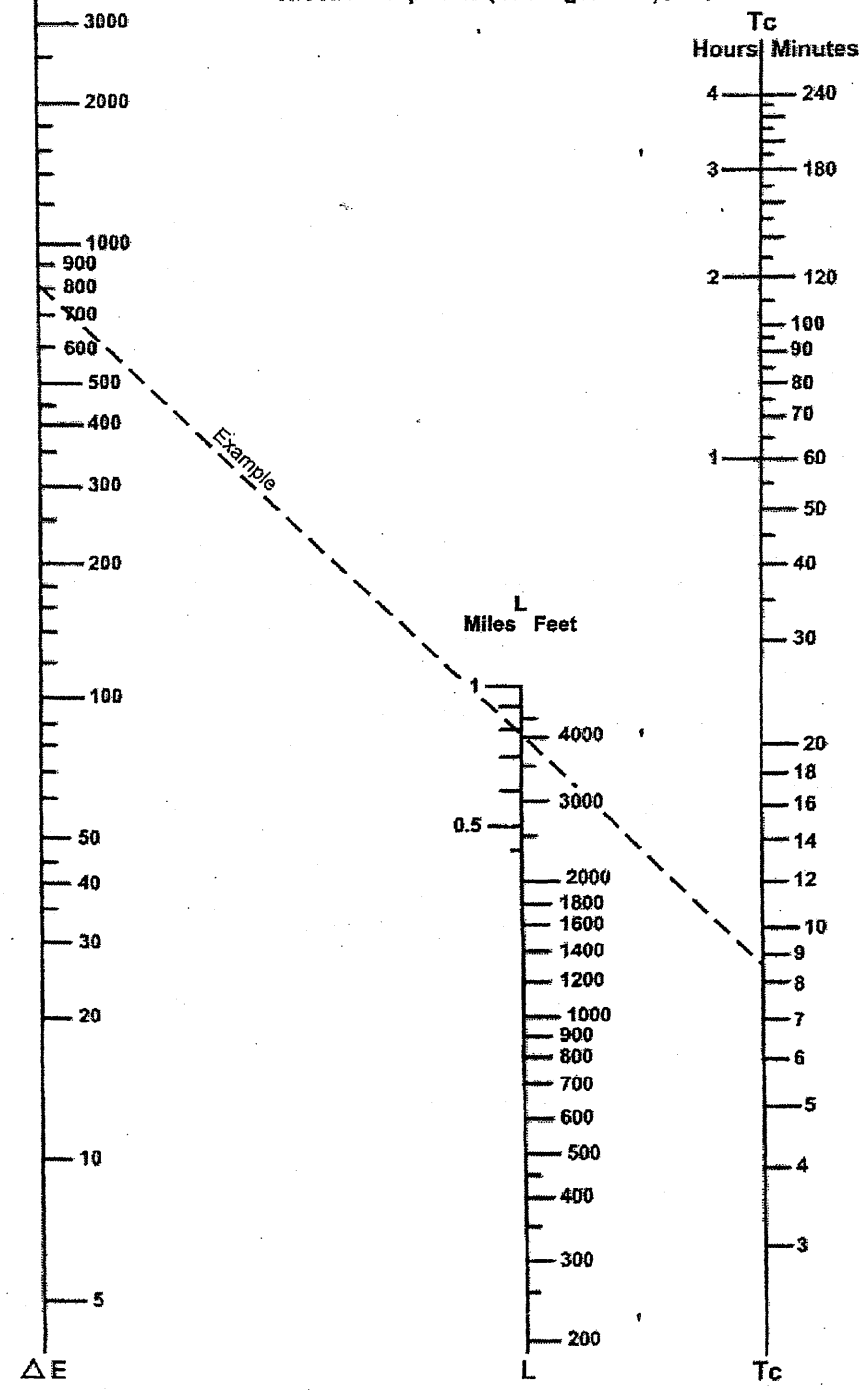
EQUATION

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

T_c = Time of concentration (hours)

L = Watercourse Distance (miles)

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

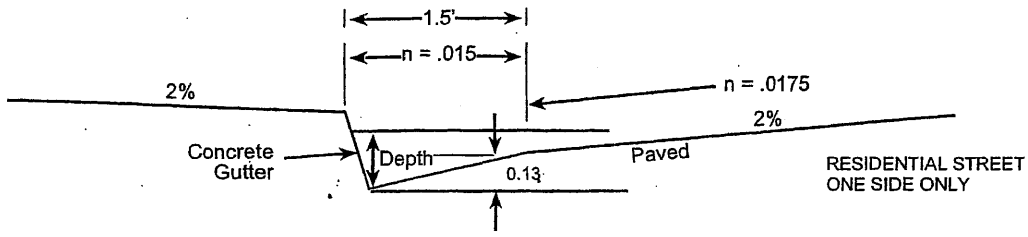


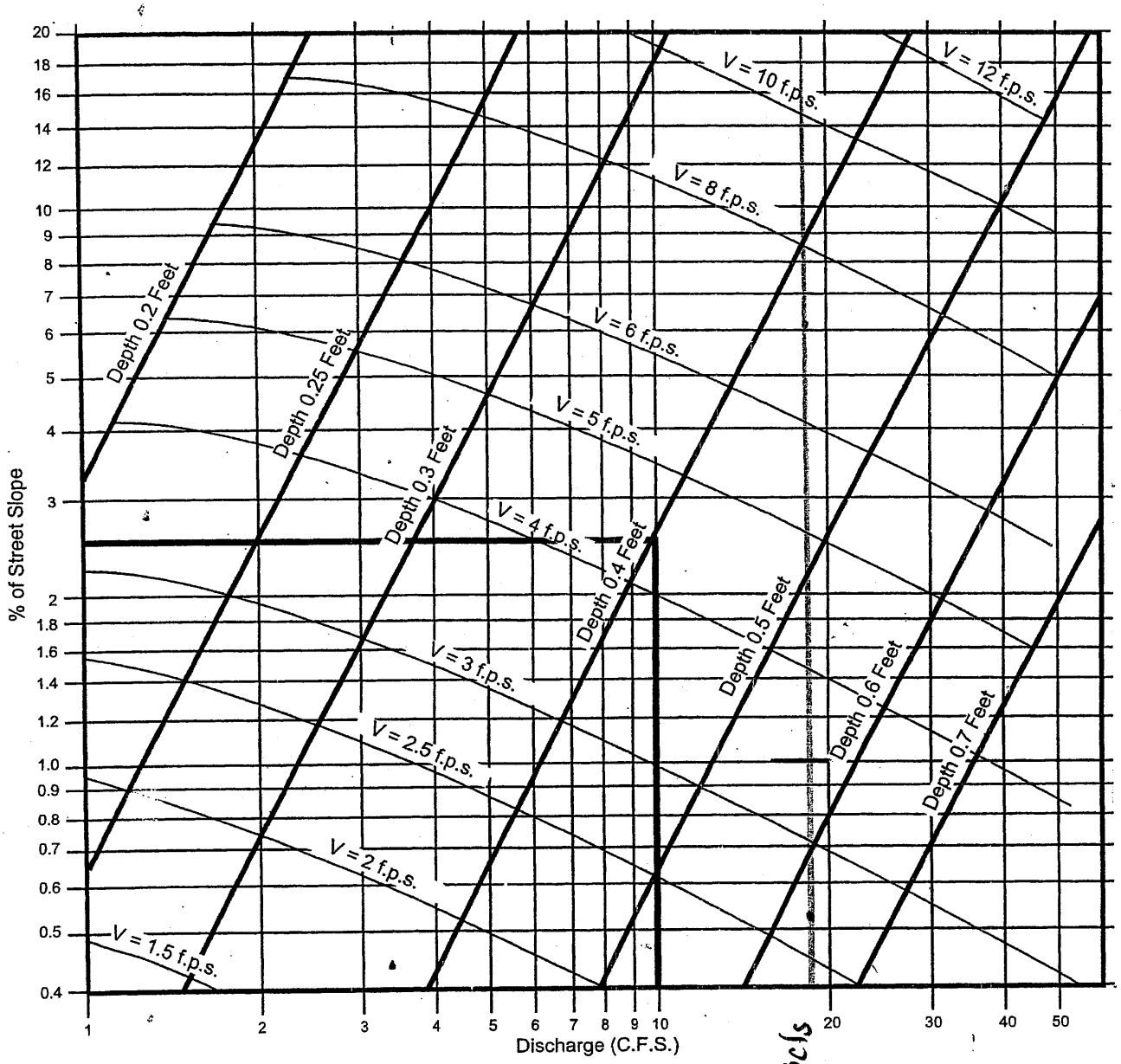
SOURCE: California Division of Highways (1941) and Kirpich (1940)

FIGURE

3-4

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





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

FIGURE

Gutter and Roadway Discharge - Velocity Chart

3-6

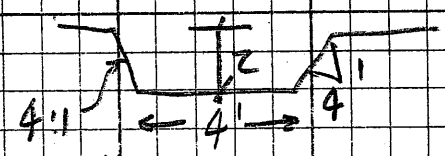
HYDRAULICS REPORT

Aquaterra Engineering Inc.

PROJECT TM 5315 DATE: 2/15/04

Hydraulic Calcs – Post Construction

Basin A-1
Grass Lined
Channel Flow Q = 12 cfs



$S_o = 1\%$ $S^{1/2} = 0.1$
$n = 0.03$ $b = 4'$ $b^{8/3} = 40.3$

See Kings Table 7-11 Depth of Flow

$$K = \frac{Qn}{b^{8/3} S^{1/2}} = \frac{12(0.030)}{40.3(0.1)} = 0.089 \Rightarrow D/b = 0.16$$

Depth of Flow = 4(0.16) = 0.64'

$$\text{Velocity} = \frac{12}{0.64(4 + 4(0.64))} = \frac{12}{6.56} = 1.83'/\text{sec}$$

Channel Length = 162'

$$T_{c_2} = \frac{162'}{1.83'/\text{sec}} \times \frac{\text{min}}{60\text{ sec}} = 1.5\text{ min}$$

Aquaterra Engineering Inc.

PROJECT TM 5315 DATE: 2/15/04

POST CONSTRUCTION HYDRAULIC CALS

BASIN A-1

18" PVC STORM DRAIN

Q = 12 cfs

S_o = 2% $S^{1/2}$ = 0.141 n = 0.013

d = 1.5' $d^{8/3}$ = 2.95

See KWBS TABLE 7-14

$K = \frac{Qn}{d^{8/3} S^{1/2}} = \frac{12 (0.013)}{2.95 (0.1414)} = 0.374 \Rightarrow D/d = 0.68$

DEPTH OF FLOW = 0.68 (1.5) = 1.02'

VELOCITY CALCS.

See KWBS TABLE 7-4

AREA = $(1.5)^2 \times 0.569 = 1.28^{\square}$

VELOCITY = $Q/A = \frac{12}{1.28} = 9.4'/sec$

LENGTH OF PIPE = 56'

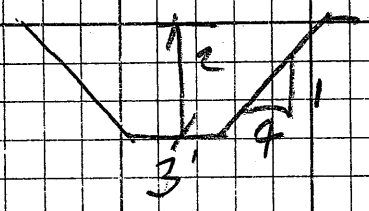
$T_{c_3} = \frac{56'}{9.4'/sec \times 60 sec} min = 0.1 min$

PROJECT TM 5315 DATE: 2/15/04

HYDRAULIC CALCS

BASIN B5-3

CHANNEL FLOW



$Q = 27.8$ cfs

$S_o = 25\%$ $S^{1/2} = 0.5$

$n = 0.03$

$b = 3$ $b^{8/3} = 18.7$

See Knos Table 7-11

$K = \frac{Qn}{b^{8/3} S^{1/2}} = \frac{27.8\ (0.03)}{18.7\ 0.5} = 0.089 \Rightarrow D/b = 0.16$

Depth of Flow $= 0.16\ (3) = 0.48'$

Area $= 0.48(3 + 4(0.48)) = 2.36\ ft^2$

Velocity $= Q/A = \frac{27.8}{2.36} = 11.8$ '/sec

Use Check Dams @ 25' to Reduce Velocity: Use $11.8/2 = 5.9$ '/sec

Aquaterra Engineering Inc.

PROJECT TM 5315 DATE: 2/15/04

Revised 11/15/04

HYDRAULIC CALCS

BASIN B-3

PIPE FLOW 24" PVC

Q_{100} BASIN B-1 & B-2 = 12.4 + 4.5 = 16.9 cfs

$S_o = 6.0\%$ $S^{1/2} = 0.245$

PIPE DIA = 24" ⇒ d = 2' $d^{8/3} = 6.35$

$N = 0.013$

See KINGS TABLE 7-14

$$K = \frac{Qn}{d^{8/3}(S^{1/2})} = \frac{16.9\,(0.013)}{6.35\,(0.245)} = 0.1412 \Rightarrow D/d = 0.38$$

DEPTH OF FLOW = 2 × 0.38 = 0.76

VELOCITY CALCS (See KINGS TABLE 7-4)

AREA = $2^2(0.2739) = 1.10\square'$

$$V = Q/A = \frac{16.9}{1.10} = 15.4 \text{ '/sec}$$

Aquaterra Engineering Inc.

PROJECT TM 5315 DATE: 11/15/04

HYDRAULIC CALCS

VERIFY CAPACITY OF EXIST 18" CULVERT

OLD CASTLE ROAD

Q_{100} (POST DEVELOPMENT) = 11.9 cfs

$S_o = 5\%$, $S^{1/2} = 0.22$

$n = 0.013$ $d = 1.5'$ $d^{8/3} = 2.95$

SEE KNOWS TABLE

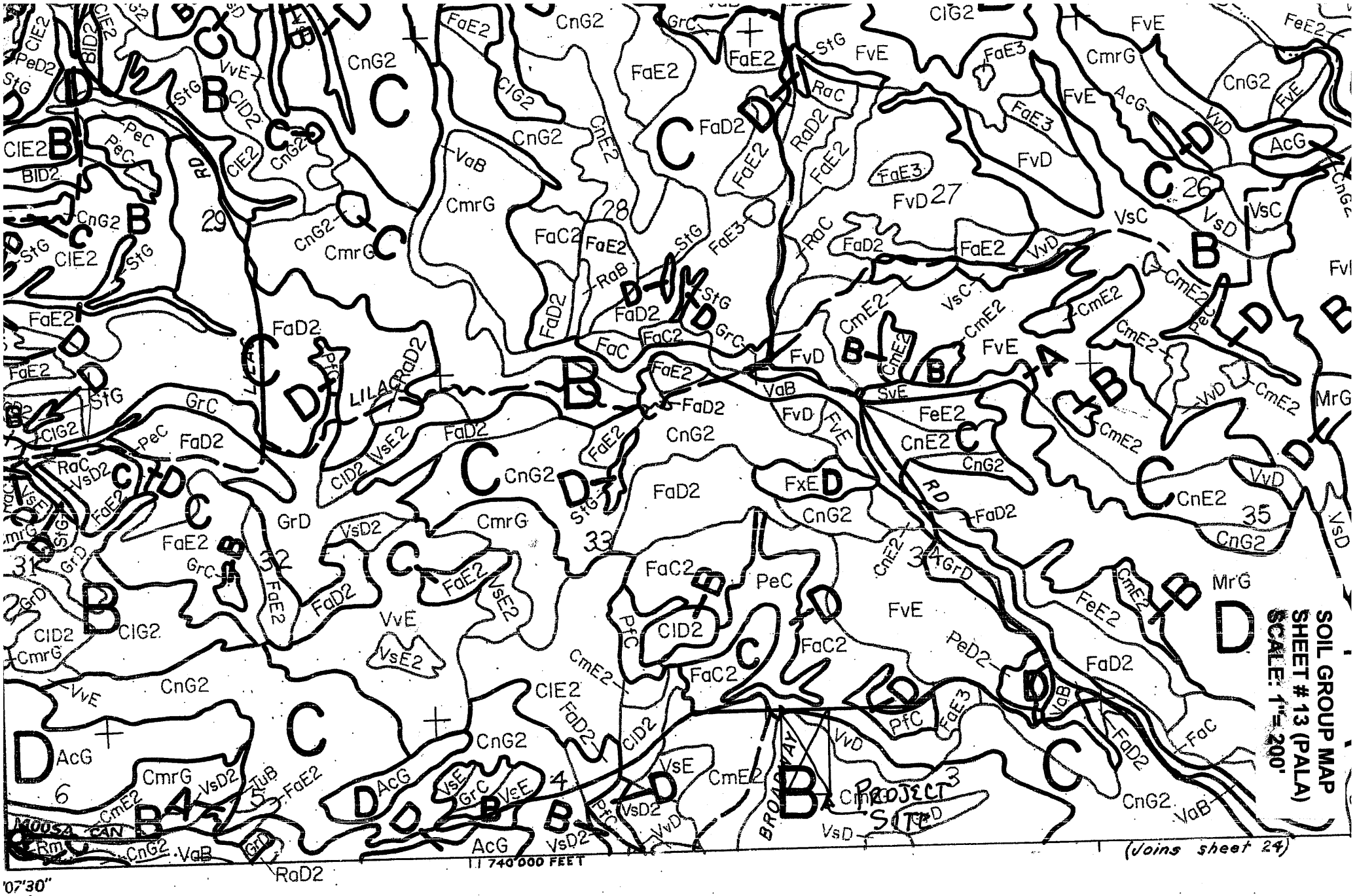
$$K = \frac{Q\,n}{d^{8/3}\,S^{1/2}} = \frac{11.9\,(0.013)}{2.95\,(0.22)} = 0.238 \Rightarrow D/d = 0.51$$

DEPTH OF FLOW = 0.51 (1.5) = 0.77'

OK

EXIST CULVERT HAS CAPACITY

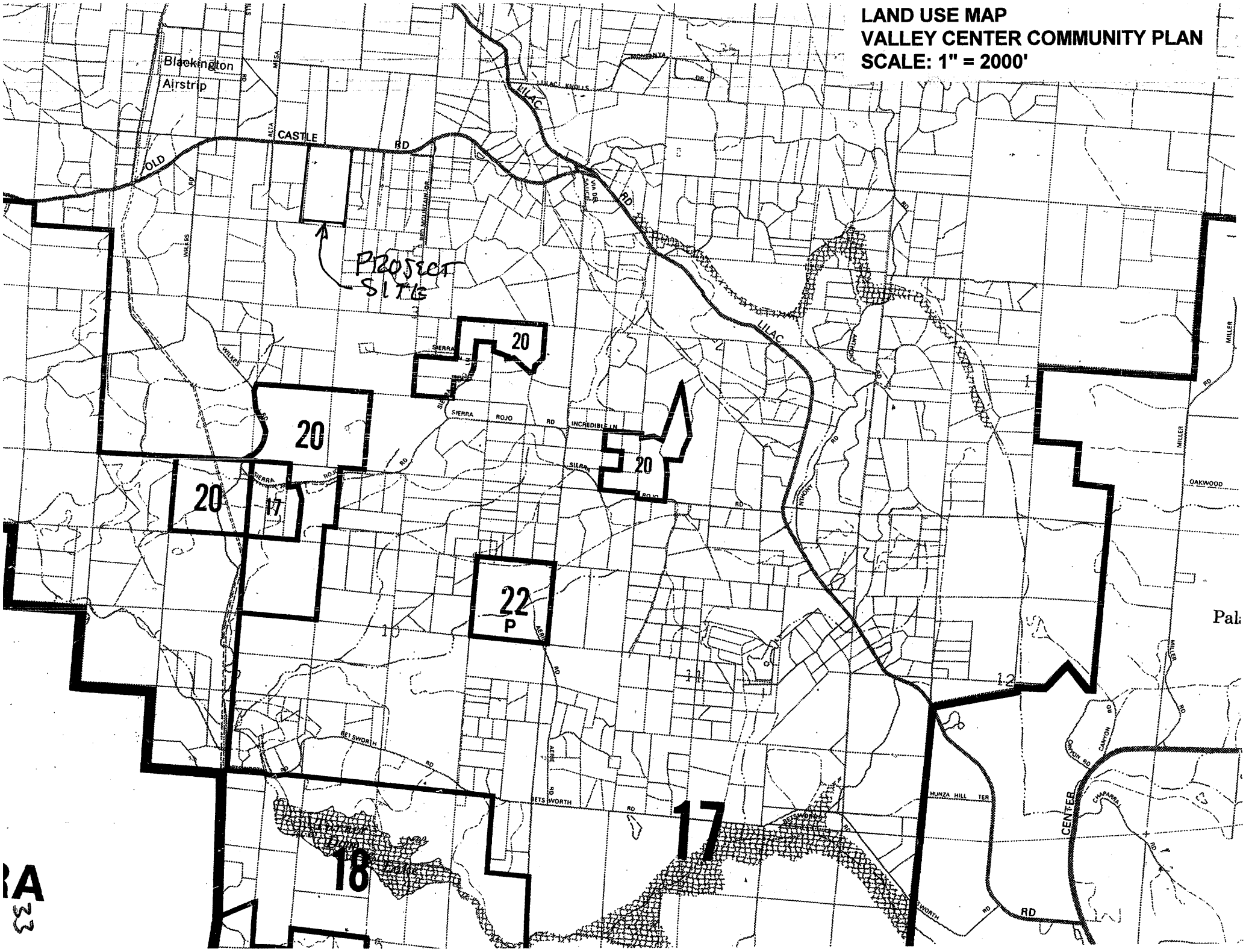
SOILS SURVEY MAP



San Diego County Soils Interpretation Study

HYDROLOGIC SOIL GROUPS - Runoff Potential

SEE CAUTION NOTES


LAND USE MAP
VALLEY CENTER COMMUNITY PLAN
SCALE: 1" = 2000'
Blackington
Airstrip
OLD
CASTLE
RD
LILAC
RD
LILAC
PROJECT
SITE
20
20
20
20
17
22
P
17
18
SIERRA
ROJO
RD
INCREDIBLE LN
BETSWORTH
RD
HUNZA HILL TER
CENTER
RD
OAKWOOD
MILLER
CANYON
CHAPARRAL
Pal
RA
33

WATER QUALITY CALCULATIONS

Aquaterra Engineering Inc.

PROJECT TM 5315 DATE: 2/15/09

WATER QUALITY CALCS

VOLUME BASED ⇒ V = AREA x C x PRECIP.

BASIN A-1, A-2, A-3

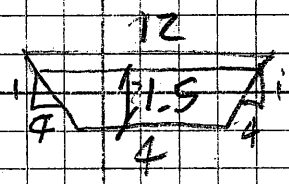
AREA OF IMPERVIOUS SURFACE

STREET + DRIVEWAYS = 25078 SF.

C = 1.0

PRECIPITATION = 1.0" = 0.0833'

VOLUME = 25078 x 1 x 0.0833 = 2089 CF.



AREA OF CHANNEL

$= 1.5\left(\frac{(4+12)}{2}\right) = 12$ CF/L.F.

LENGTH OF CHANNEL REQUIRED = $\frac{2089}{12}$ = 174'

ACTUAL CHANNEL PROPOSED = 282' > 174'

OK

Aquaterra Engineering Inc.

PROJECT T.M. 5315

DATE: 2/15/04

Revised 11/15/04

Rev 4/3/07

WATER QUALITY CALCS - BASINS A-1, A-2,

FLOW BASED SIZING = Q = C I A

Q = DISCHARGE

C = COEF. OF RUN OFF = 1.0

A = AREA OF IMPERVIOUS SURFACE = 23522 SF = 0.54 Acre

I = 0.2 IN/HR FOR 6 HR EVENT = 0.2 IN

$Q_{REQUIRED} = (1.0)(0.2)(0.54) = 0.11$ CFS

Aquaterra Engineering Inc.

PROJECT TM 5315

DATE 2/15/04
Revised 11/15/04
Rev 4/3/07

Water Quality Calcs

[Basins B-1, B-2,]

Volume Based Calcs

Area of Impervious Surface

Street, Driveway, Structures = 17424 S.F
= 0.40 Acres

Vol = A a C P

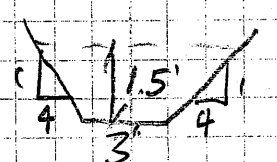
A = Area of Impervious Surface

a = 1.0

C = Coeff. of Runoff = 1.0

P = Precipitation = 1" = 0.0833'

$V = 17424\ (1.0) \times (1.0) \times 0.0833 = 1451\ ft^3$



Area of Channel

$(1.5) \times (3 + 4(1.5)) = 13.5\ ^{\square'}/_{LF}$

Length Required $= \frac{1451}{13.5} = 107'$

Actual Channel Propose = 107' = 107'

010

Aquaterra Engineering Inc.

PROJECT TM 5315

DATE: 2/15/04
Revised 11/15/04

WATER QUALITY CALCS

BASIN B-1, B-2, B-3

FLOW BASED SIZING - Q = C I A

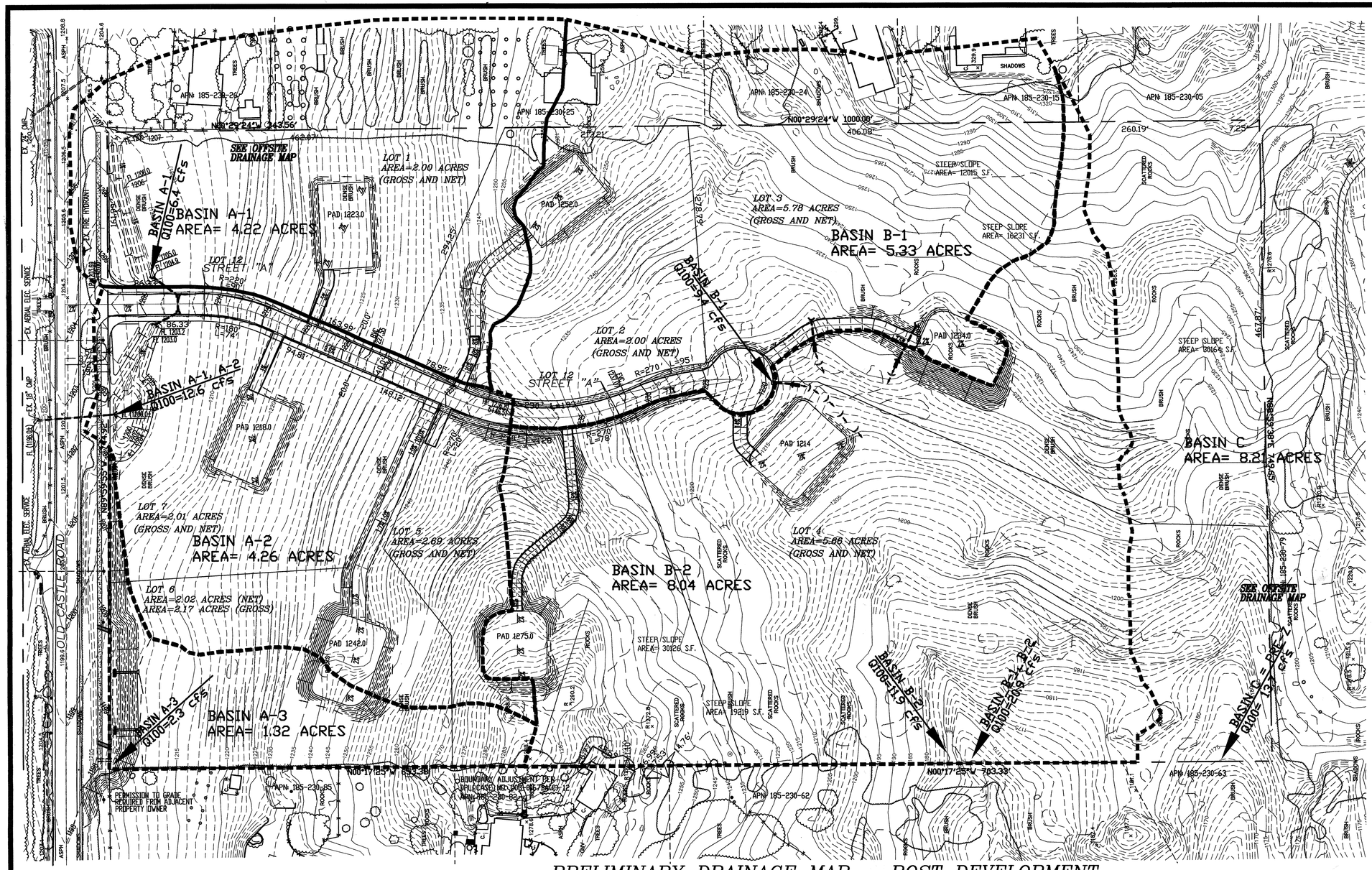
Q = DISCHARGE =

C = COEF OF RUN OFF = 1.0

A = AREA OF IMPERVIOUS SURFACE = 17424 SF
= 0.40 ACRES

I = 0.2"/HR FOR 6 HOUR EVENT = 0.2"/HR

$Q_{REQUIRED}$ = (1.0) (0.2) (0.40) = 0.80 cfs



PRELIMINARY DRAINAGE MAP – POST DEVELOPMENT

SCALE: 1'= 60'

60 0 60 120

Scale: 1' = 60'

CIVIL ENGINEERING • LAND PLANNING
Aquaterra Engineering Inc.
1843 Campesino Place
Oceanside, CA 92054
Tele: (760) 439-2802
Fax: (760) 439-2866

SYMBOL LEGEND

EXISTING CONTOURS	(330)
PROPOSED CONTOURS	312
PROPOSED RETAINING WALL	TW 100
EXISTING SITE BOUNDARY	
PARKING SPACE COUNT	11
CATCH BASIN/ DRAIN PIPE	
PARKING LIGHT STANDARD	
BROW DITCH (D-75)	

PROPERTY OWNER INFORMATION

NAME: X

ADDRESS: X

X

TELEPHONE NUMBER: X
(24 HOUR CONTACT NUMBER)

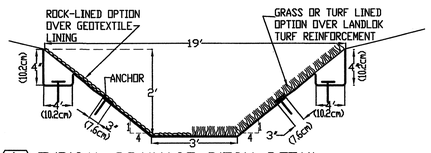
SITE A.P.N. NUMBER: X

SITE ADDRESS: xxxxx OLD CASTLE ROAD

SYMBOL LEGEND

DESCRIPTION	SYMBOL
ELEVATION, TOP OF FOOTING	TF
ELEVATION, TOP OF WALL	TW
ELEVATION, TOP OF CURB	TC
ELEVATION, FINISH SURFACE	FS
ELEVATION, FINISH GRADE	FG
ELEVATION, TOP OF GRATE	TG
ELEVATION, BOTTOM OF FOOTING	BF
ELEVATION, FLOW LINE	FL
ELEVATION, INVERT ELEVATION	IE
ELEVATION LABEL, EXISTING	(596.00)
ELEVATION LABEL, PROPOSED	596.00

DETAIL REFERENCE C/2 DETAIL LABEL / SHEET NO.



A/— TYPICAL DRAINAGE DITCH DETAIL

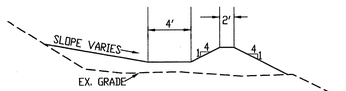
NO SCALE

NOTES:

1) PLACE 3 ANCHORS PER SQUARE YARD OF MATERIAL

2) FOR ROCK-LINED OPTION, INSTALL GEOTEX WOVEN MONOFILAMENT GEOTEXTILE (NO. 117F OR EQUAL)

3) FOR GRASS OR TURF OPTION, INSTALL LANDLOK TRM 450 TURF REINFORCEMENT MAT.



B/— TYPICAL DRAINAGE CHANNEL DETAIL

NO SCALE

REGISTERED PROFESSIONAL ENGINEER GARY LIPSKA No. 23080 CIVIL STATE OF CALIFORNIA

PLAN CHECK/PERMITS

BUILDING PERMIT
PLAN CHECK NUMBER:

PARCEL MAP NUMBER:

ENGINEER OF WORK

I HEREBY DECLARE THAT I AM THE ENGINEER OF WORK FOR THIS PROJECT AND THAT I HAVE EXERCISED RESPONSIBLE CHARGE OVER THE DESIGN OF THE PROJECT.

NAME: GARY LIPSKA DATE: 4/4/07

RCE NO: RCE 23080 EXPIRES: 12/31/07

PRIVATE CONTRACT

COUNTY OF SAN DIEGO
DEPARTMENT OF PLANNING AND LAND USE

DRAINAGE MAP FOR:

COUNTY TRACT NO. TM 5315

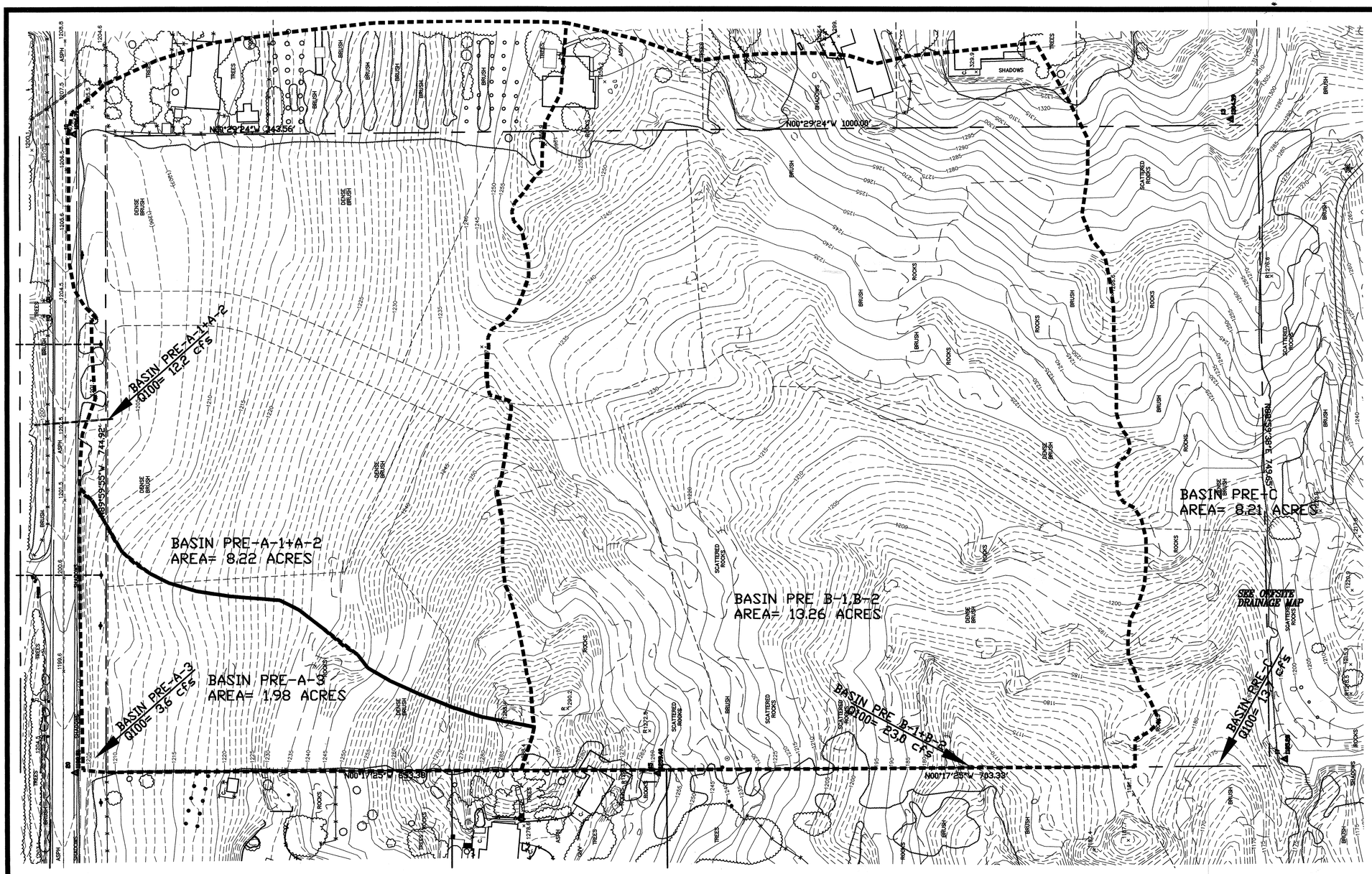
SHEET: 1 OF SHEETS: 1

APPROVED
DIRECTOR OF PLANNING AND LAND USE

BY: DATE:

GRADING PERMIT NUMBER:

plot date: 4-3-07



60 0 60 120

Scale: 1" = 60'

PRE-DEVELOPMENT DRAINAGE MAP

SCALE: 1"= 60'

CIVIL ENGINEERING • LAND PLANNING
Aquaterra Engineering Inc.
1843 Campesino Place
Oceanside, CA 92054
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Fax: (760) 439-2866

SYMBOL LEGEND

DESCRIPTION	SYMBOL
ELEVATION, TOP OF FOOTING	TF
ELEVATION, TOP OF WALL	TW
ELEVATION, TOP OF CURB	TC
ELEVATION, FINISH SURFACE	FS
ELEVATION, FINISH GRADE	FG
ELEVATION, TOP OF GRATE	TG
ELEVATION, BOTTOM OF FOOTING	BF
ELEVATION, FLOW LINE	FL
ELEVATION, INVERT ELEVATION	IE
ELEVATION LABEL, EXISTING	(596.00)
ELEVATION LABEL, PROPOSED	596.00

DETAIL REFERENCE — C/2 — DETAIL LABEL / SHEET NO.

PROPERTY OWNER INFORMATION

NAME: X

ADDRESS: X

X

TELEPHONE NUMBER: X
(24 HOUR CONTACT NUMBER)

SITE A.P.N. NUMBER: X

SITE ADDRESS: xxxxx OLD CASTLE ROAD

REGISTERED PROFESSIONAL ENGINEER
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CIVIL
STATE OF CALIFORNIA

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NAME: GARY LIPSKA DATE: 4/3/07

RCE NO: RCE 23080 EXPIRES: 12/31/11

PRIVATE CONTRACT

COUNTY OF SAN DIEGO
DEPARTMENT OF PLANNING AND LAND USE

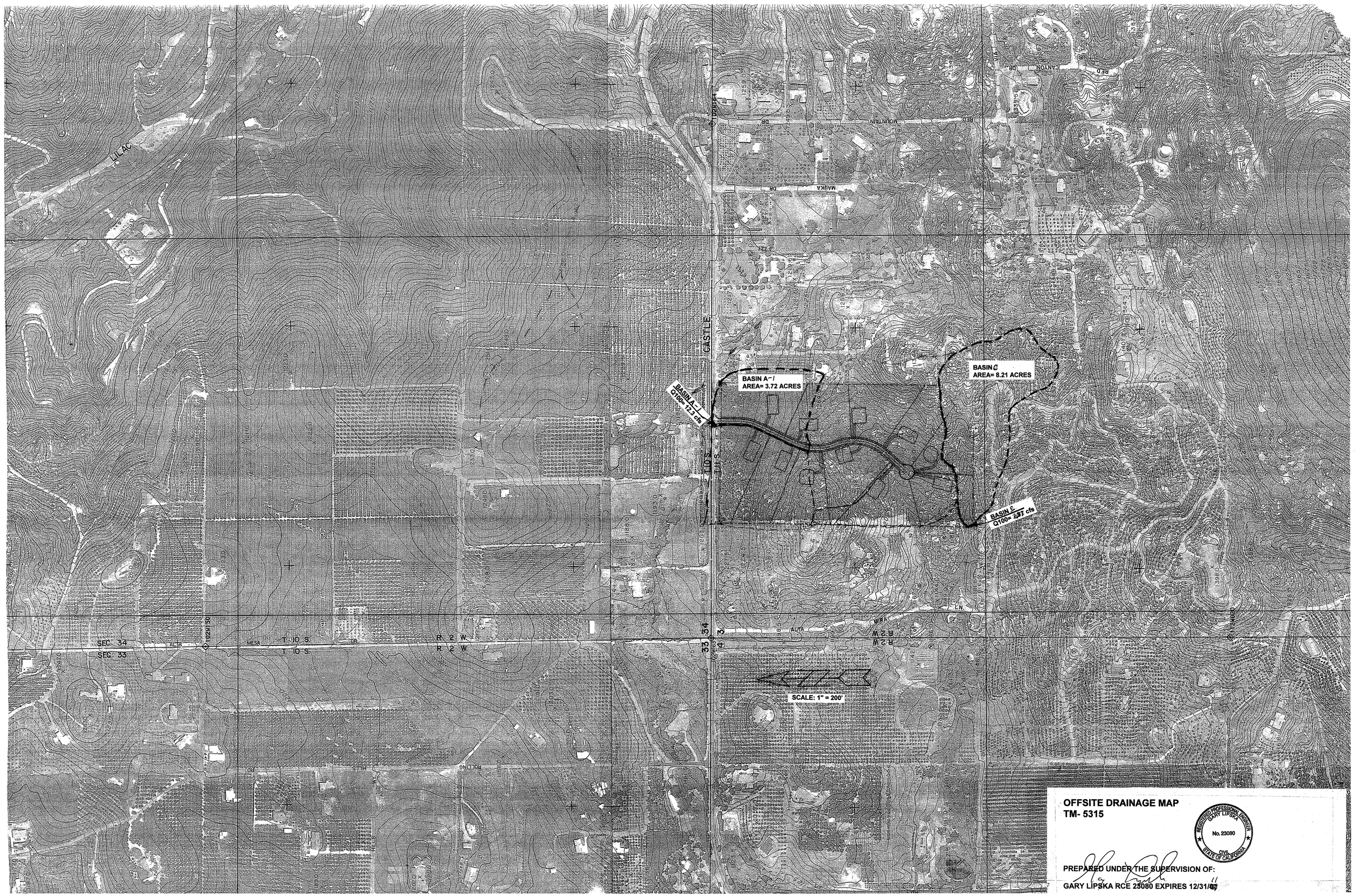
DRAINAGE MAP FOR:
TM 5315

SHEET: 1 OF SHEETS: 1

APPROVED
DIRECTOR OF PLANNING AND LAND USE
BY: DATE:

GRADING PERMIT NUMBER:

plot date: 4-3-07



OFFSITE DRAINAGE MAP
TM- 5315

REGISTERED PROFESSIONAL ENGINEER
GARY LIPSKA
No. 23080
CIVIL
STATE OF CALIFORNIA

PREPARED UNDER THE SUPERVISION OF:

GARY LIPSKA RCE 23080 EXPIRES 12/31/[illegible]