ERB ENGINEERING, INC.
12320 STOWE DRIVE, SUITE E
POWAY, CALIFORNIA 92064
(858) 748-2130 • Fax (858)748-6089

Preliminary Hydrology/Drainage Study
For Tentative Parcel Map

TPM 20962
LOG NO. 05-09-021

Prepared for:

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18489 Ramona View Drive
Ramona, CA. 92065

Charles S. Little PE 65129

2/22/07
Date

REGISTERED PROFESSIONAL ENGINEER
CHARLES STARK LITTLE
C 65129
EXP. 9/30/07
CIVIL
STATE OF CALIFORNIA

FILE COPY

Revisions per SD County 11-03-05

01-25

Table of Contents

I. INTRODUCTION..... 1
II. DESIGN CRITERIA..... 2
III. EXISTING STORM DRAIN SYSTEM..... 3
IV. WATERSHED BASIN DELINEATION..... 4
V. PROPOSED STORM DRAIN SYSTEM..... 5
VI. HYDRAULICS 6

List of Exhibits

FIGURES

FIGURE 1 Vicinity Map..... 1a

FIGURE 2 Hydrology Map Onsite ..... Sheet 1

FIGURE 3 200 Scale Hydrology Map ..... Sheet 2

FIGURE 4 200 Scale Hydrology Map ..... Sheet 3

APPENDICES

APPENDIX A Hydrologic Model (AES 2004) -100 year storm event

APPENDIX B --Responses to San Diego County 11-03-2005 scoping letter

--Comparison chart of Pre and Post development runoff rates and velocities

--Lines of inundation calculations

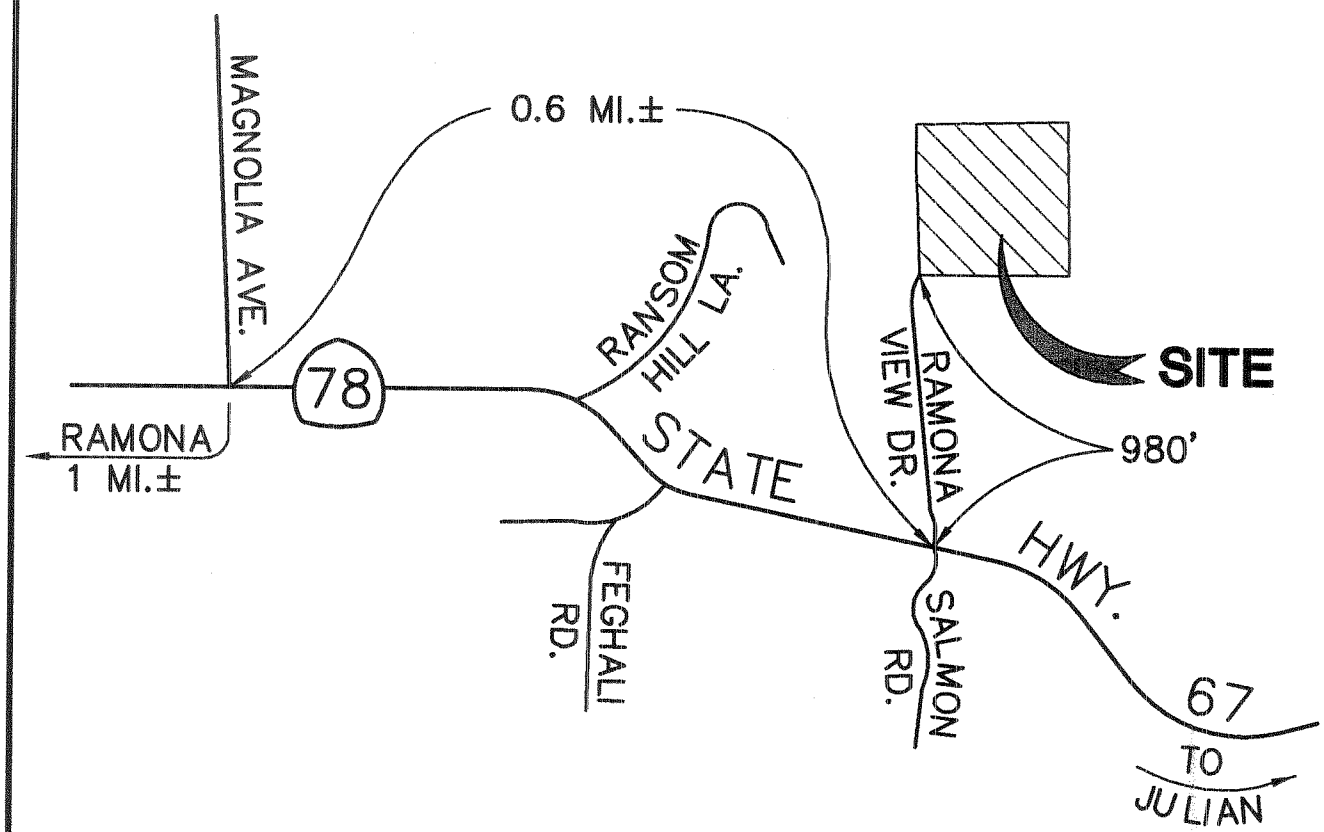
--Driveway runoff rate calculations

I. INTRODUCTION

This preliminary hydrology/drainage study attempts to identify any adverse drainage conditions that might be caused or worsened by the proposed development of this parcel of land. The proposed development involves subdividing a 39 acre parcel into four separate parcels; Parcel 1 for 3.9 acres, Parcel 2 for 8.1 acres, Parcel 3 for 11.8 acres, and Parcel 4 for 3.9 acres.

Parcels 1 and 2 are developed with existing single family homes. The existing and proposed residences are accessed off of a private road called Ramona View Drive. This private road will be extended to Parcel 4 from there driveways will serve Parcels 3 and 4. The extension to Ramona View Drive will be widened to 24 ft and transitioned to 16 ft after connecting to an existing driveway for Parcel 1.

The calculations in this report provide for 100-year flow rates for design of the storm drain system within the site.



VICINITY MAP

NO SCALE

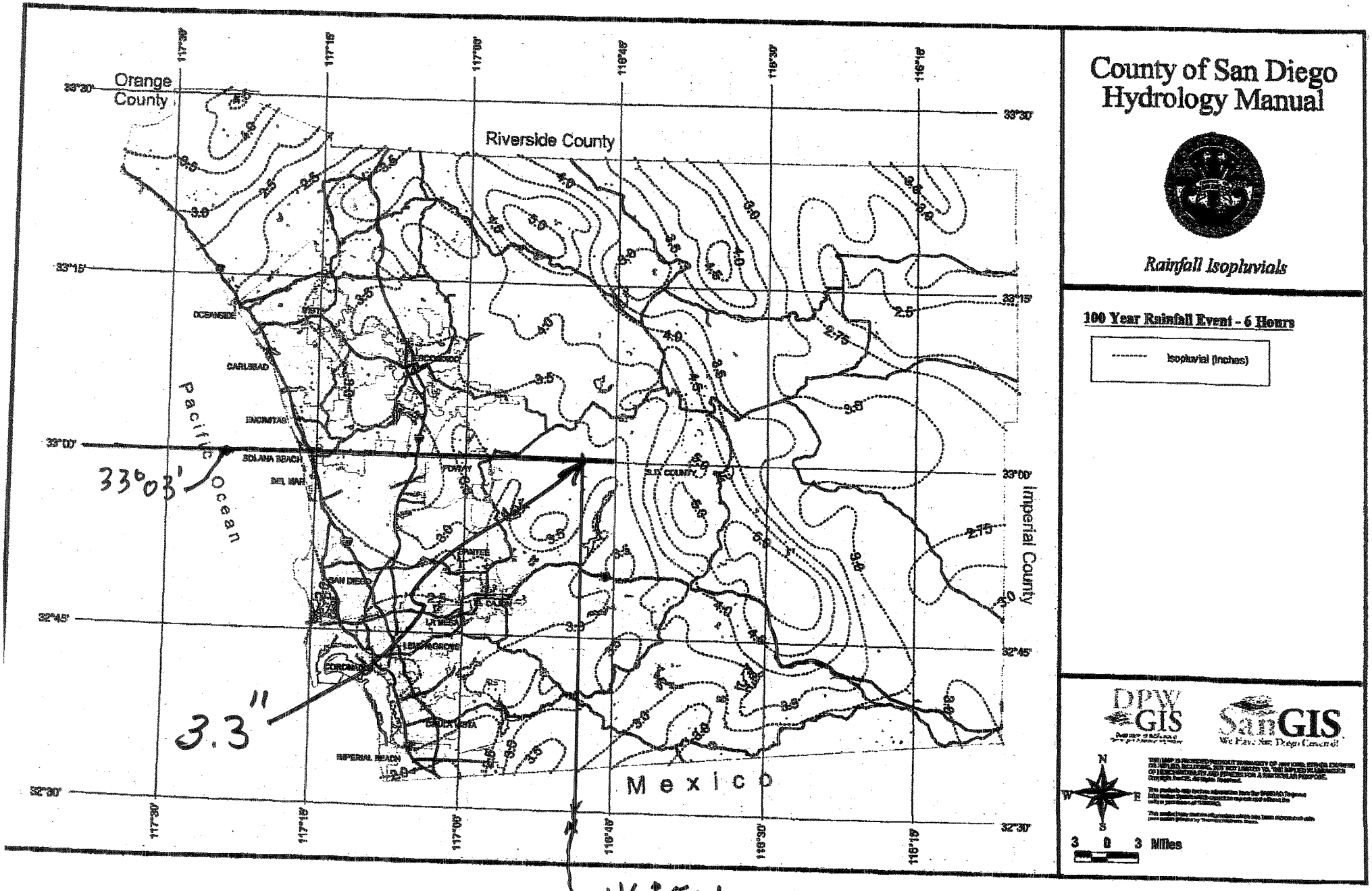
THOS. BROS., P. 1153, B-4

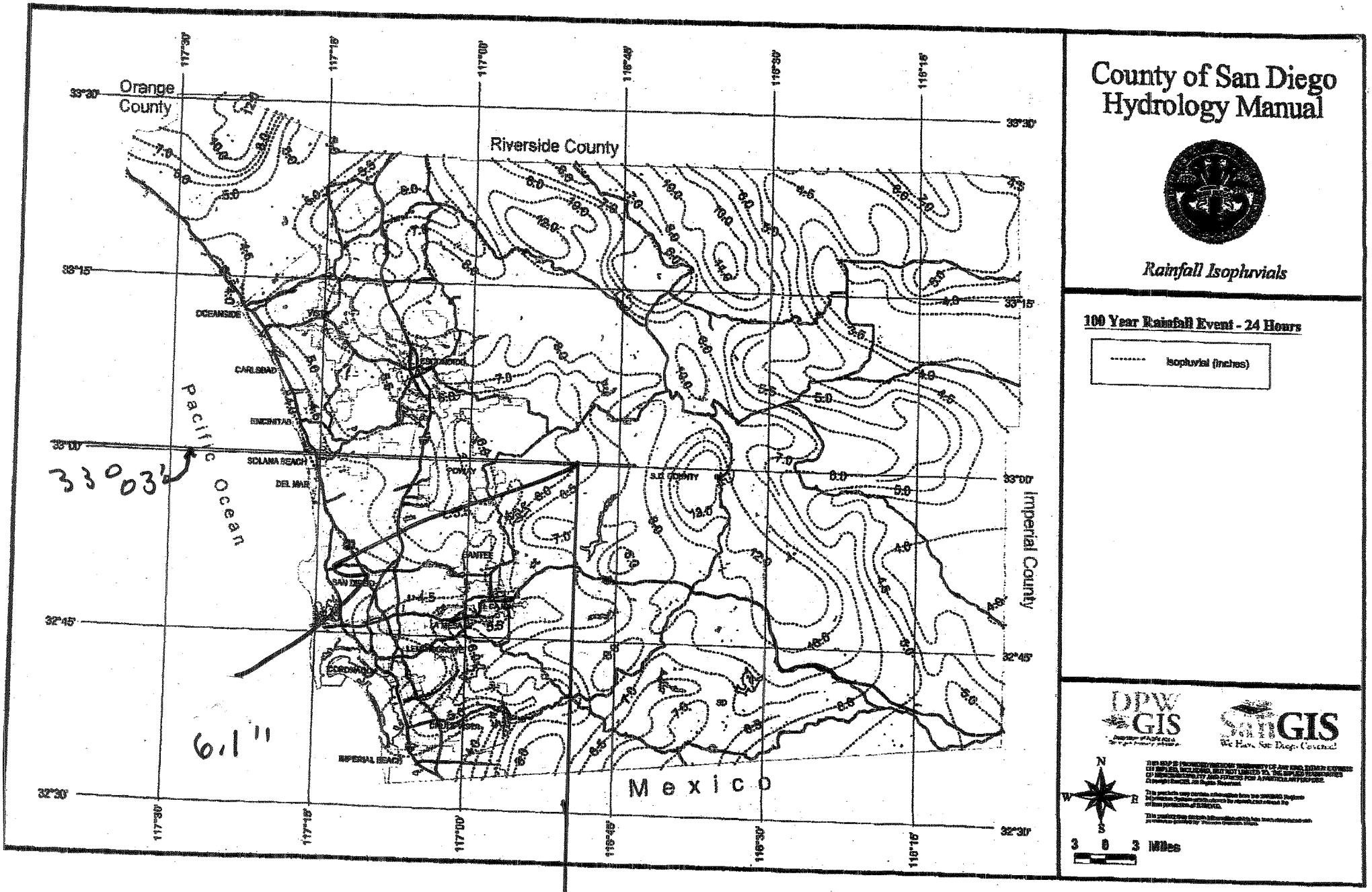
II. DESIGN CRITERIA

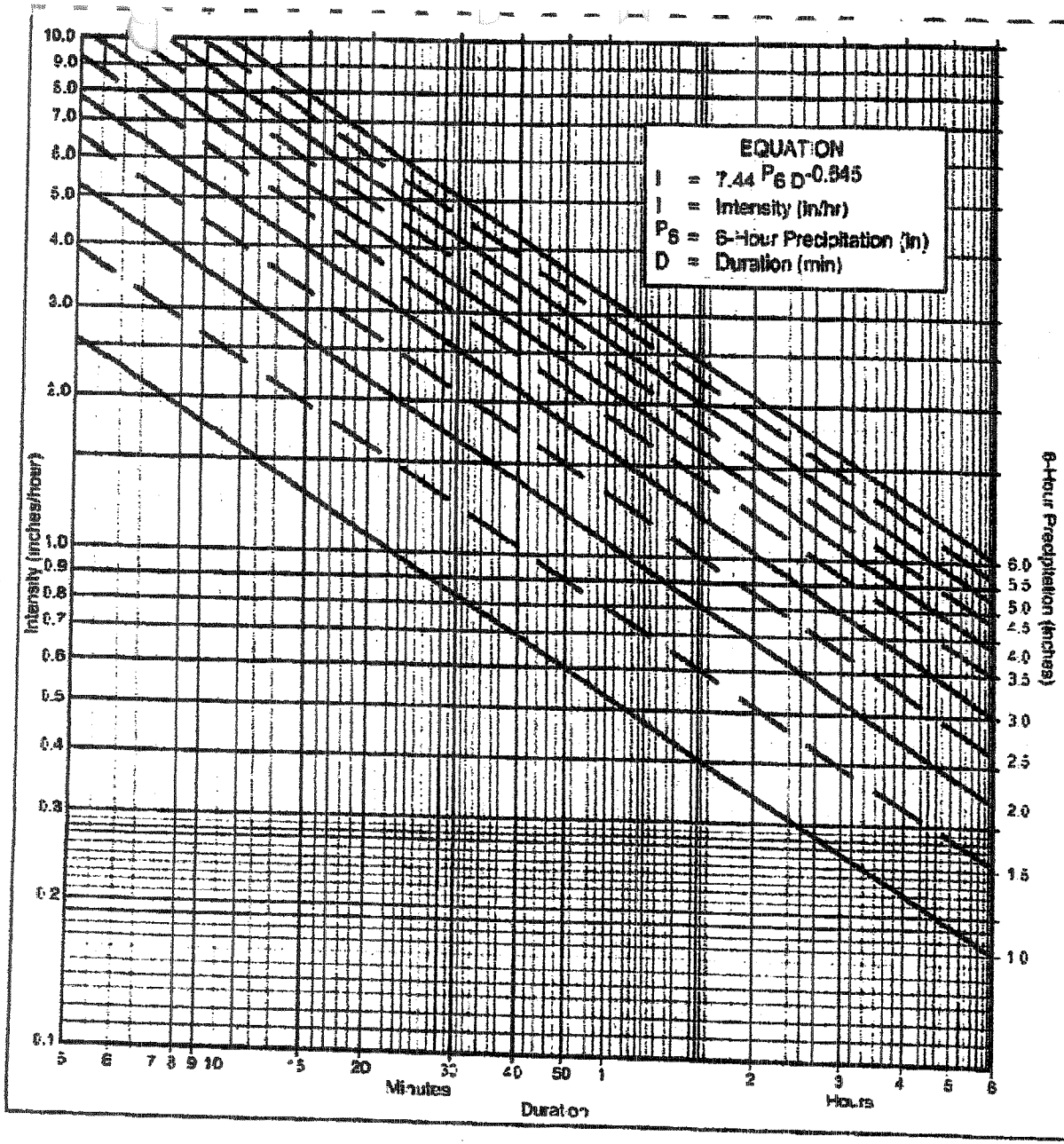
Runoff values were calculated based on the 100-year storm event using the Rational Method. This method calculates times of concentration and runoff values using the criteria specified in the San Diego County's Hydrology Manual, 2003 edition.

Precipitation values are based on the County manual criteria. The following sheets show the Rainfall Isopluvials and calculation of the 100-year, 6-hour and 24-hour; and 85th Percentile precipitation depth for the project site. For this soil adsorption rate, the Otay Mesa area generally is overlain by clay soils with low absorption rates so the most conservative soil type "D" was used for all runoff calculations.

The computer program that was used to calculate the proposed flows is Advanced Engineering Software's RATSC (1999). The program has been specifically tailored to utilize the design parameters from the San Diego County's Hydrology Manual, 2003 edition. The precipitation depths are calculated on the following pages are input into the program, and these values are then used by the program to calculate rainfall intensities base on a computerized version of the County's Intensity-Duration Design chart. Flow rates throughout the pre-developed and post-developed systems are calculated based on the modified Rational Method. The printouts resulting from these calculations are presented in Appendix A.


County of San Diego
Hydrology Manual
Rainfall Isopluvials
100 Year Rainfall Event - 6 Hours
Isopluvial (inches)
Orange County
Riverside County
Imperial County
Pacific Ocean
Mexico
OCEANSIDE
CARLSBAD
ENCINITAS
SOLANA BEACH
DEL MAR
POWAY
SAN DIEGO
LA MESA
LEMON GROVE
CORONADO
IMPERIAL BEACH
33°03'
3.3"
116°50'
33°30'
33°15'
33°00'
32°45'
32°30'
117°30'
117°15'
117°00'
116°45'
116°30'
116°15'
3 0 3 Miles
DPW GIS
SanGIS


County of San Diego
Hydrology Manual
Rainfall Isopluvials
100 Year Rainfall Event - 24 Hours
Isopluvial (inches)
Orange County
Riverside County
Imperial County
Pacific Ocean
Mexico
OCEANSIDE
CARLSBAD
ENCINITAS
SOLANA BEACH
DEL MAR
POWAY
S.D. COUNTY
SANTEE
SAN DIEGO
LA MESA
LEMON GROVE
CORONADO
IMPERIAL BEACH
33°30'
33°15'
33°00'
32°45'
32°30'
117°30'
117°15'
117°00'
116°45'
116°30'
116°15'
DPW GIS
SanGIS
We Have San Diego Covered
N
W
E
S
3 0 3 Miles
33°03'
6.1"
116°50'



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 applicable 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 _____ year

(b) P_6 = 3.3 in., P_{24} = 6.1, $\frac{P_6}{P_{24}}$ = 54% (2)

(c) Adjusted P_6 (2) = 3.3 in.

(d) t_x = _____ min.

(e) I = _____ in./hr

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

P6 / Duration	1	1.5	2	2.5	3	3.5	4	4.5	5	5.5	6
5	2.63	3.95	5.27	6.59	7.90	9.22	10.54	11.85	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	5.06	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.

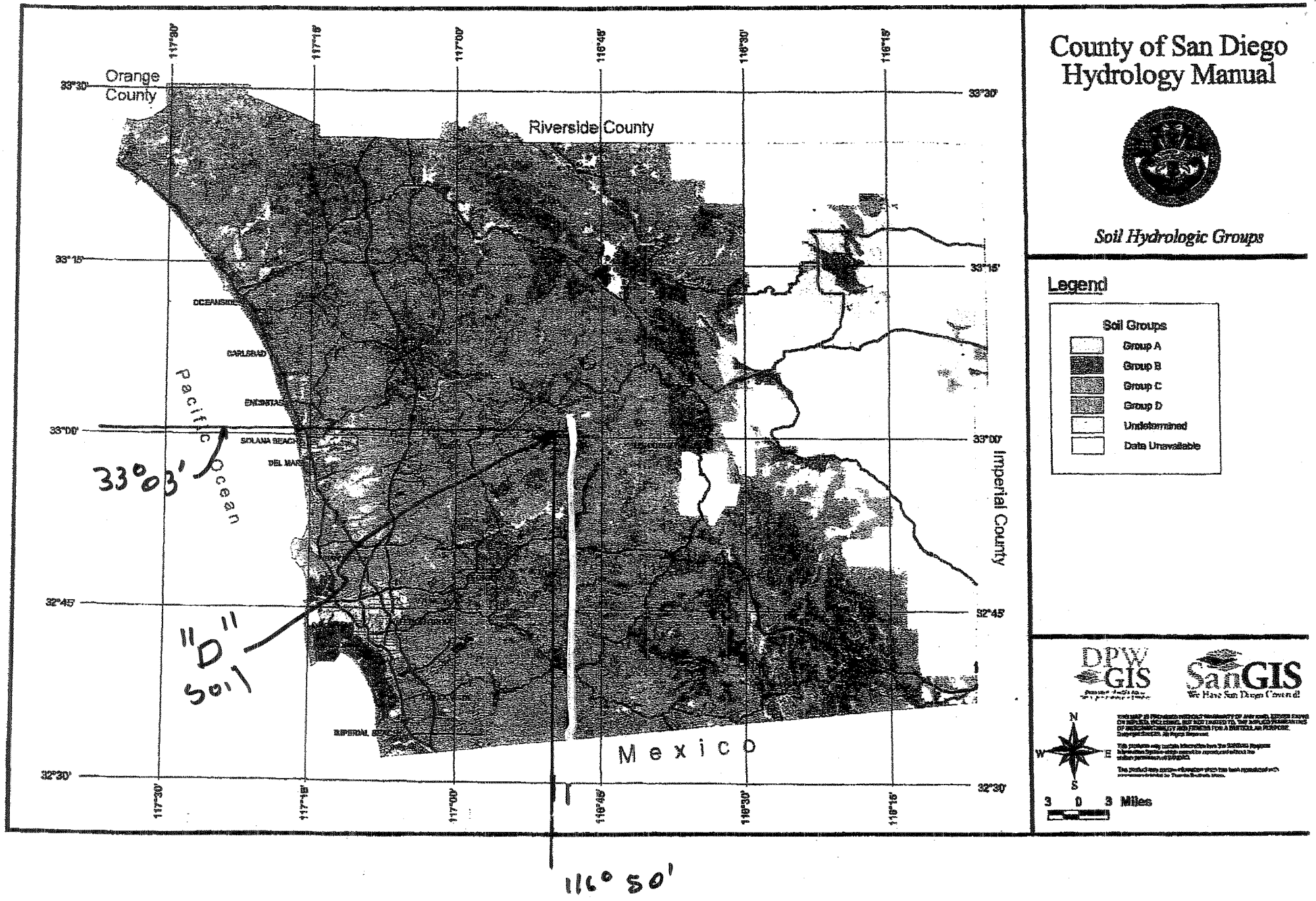
Table 3-2 provides limits of the length (Maximum Length (L_M)) of sheet flow to be used in hydrology studies. Initial T_i values based on average C values for the Land Use Element are also included. These values can be used in planning and design applications as described below. Exceptions may be approved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


County of San Diego
Hydrology Manual
Soil Hydrologic Groups
Legend
Soil Groups
Group A
Group B
Group C
Group D
Undetermined
Data Unavailable
Orange County
Riverside County
Imperial County
Mexico
Pacific Ocean
OCEANSIDE
CARLSBAD
ENCINITAS
SOLANA BEACH
DEL MAR
33°30'
33°15'
33°00'
32°45'
32°30'
117°30'
117°15'
117°00'
116°45'
116°30'
116°15'
33°03'
"D" Soil
116° 50'
DPW GIS
SanGIS
We Have San Diego Covered!
N
S
E
W
3 0 3 Miles

III. EXISTING STORM DRAIN SYSTEM

The site has several intermittingly flowing natural drainage channels that drain areas to the east of the 36 acre parcel. One of these natural drainage channels that flow south of existing development for parcel 1 has an existing culvert beneath the driveway that serves that development. The only other existing storm drain systems for the existing development for parcels 1 and 2 consist of localized open systems for each of the developed areas. Both parcels have driveways with AC berms that channel runoff to Ramona View Drive where it is discharged into natural drainage channels.

The underdeveloped areas mainly consist of sheet runoff that is collected in the natural channels.

IV. WATERSHED BASIN DELINATION

The existing watershed basins before development were delineated to study the historical drainage conditions (See Figures 3 and 4) using San Diego County's 200 scale mapping system. The proposed watershed basins after development were delineated to study drainage conditions after development (See Figure 2 On Site Hydrology) using aerial topography flown specifically for this project.

Runoff values for both the existing and proposed watershed basins were calculated assuming Type "D: soil. "General Industrial" with a 95% impervious rate runoff coefficients were used for all proposed areas. Advanced Engineering Software was used to model the hydrology for the project (See Appendix A for model output of the Pre-Developed conditions and Appendix b for model output of the Post-Developed conditions.

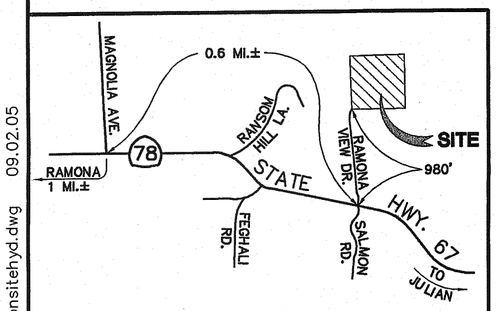
V. PROPOSED STORM DRAIN SYSTEM

ON SITE HYDROLOGY

HYDROLOGY LEGEND

35	DRAINAGE AREA
902	NODE NUMBER
→	DIRECTION OF DRAINAGE
	INITIAL AREA

A.P.N. 280-130-03



VICINITY MAP

NO SCALE

THOS. BROS., P. 1153, B-4

0125onsitehyd.dwg 09.02.05

SHEET 1 OF 1

01-25

01-25

ERB ENGINEERING INC.

ERB ENGINEERING, INC.
CIVIL ENGINEERS & LAND SURVEYORS
12320 STOWE DRIVE, STE. E, POWAY, CA. 92064
(858) 748-2130 FAX: (858) 748-6089

COUNTY OF SAN DIEGO — TOPOGRAPHIC SURVEY

-LEGEND-

- Horizontal Control Monument, *Third Order*; Vertical Control Monument, *Second Order or Better*
- Horizontal Control Monument, *Second Order or Better*; Vertical Control Monument, *Third Order*
- Horizontal Control Monument, *Second Order or Better*
- Horizontal Control Monument & Bench Mark, *Second Order or Better*
- Horizontal Control Monument, *Third Order*
- Horizontal Control Monument & Bench Mark, *Third Order*
- Bench Mark, *Second Order or Better*
- Vertical Control Monument, *Third Order*
- 36 31 T 16 S T 17 S R 2 W R 1 W — Found Section, Grant or Subdivision Corner
- Photograph, Nadir Point
- Geographic Tick

BOUNDARIES IN ORDER OF PRECEDENCE
(Land Lines Shown are Approximate)

- .025" — National
- Name .025" Name — County
- .015" — City
- Name within Bdry. .015" — Reservation
- Name within Bdry. .015" — National, State or County Park
- Name within Bdry. .015" — Land Grant
- T 2 S T 3 S .015" — Township, Range, Section or Subdivision *(Name of Subdivision within Bdry.)*

PREPARED UNDER THE DIRECTION
of
DEPARTMENT OF TRANSPORTATION
County of San Diego

CONTROL DATA FURNISHED
by
SURVEY SECTION
Department of Transportation

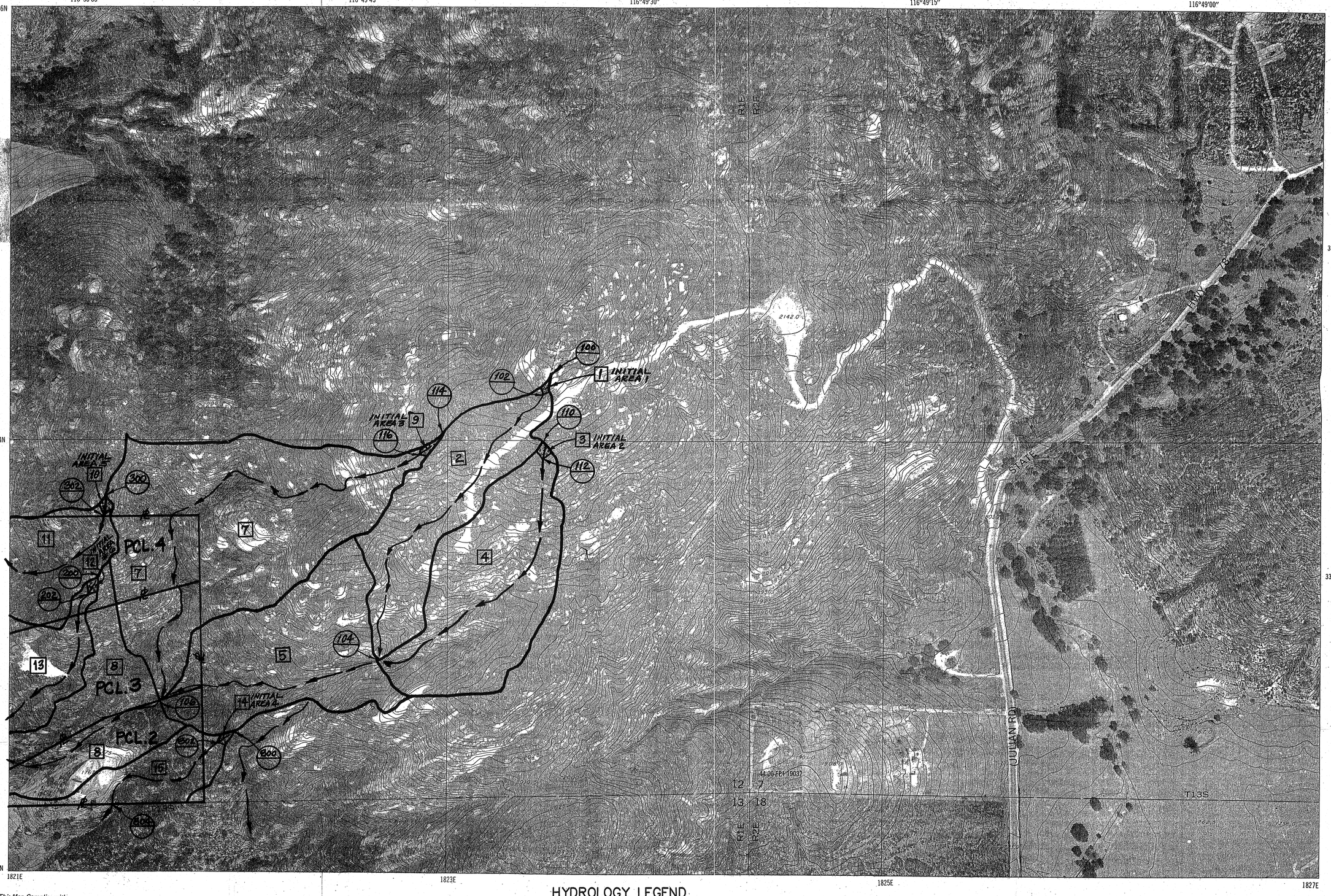
HORIZONTAL CONTROL BASED
on
NORTH AMERICAN 1927 DATUM

VERTICAL CONTROL BASED
on
U.S.C. & G.S. 1929 SEA LEVEL DATUM

ORTHOPHOTO IMAGE PREPARED
from
PHOTOGRAPHY DATED: 4-21-77
by
INLAND AERIAL SURVEYS

TOPOGRAPHY COMPILED
by
PHOTOGRAMMETRIC METHODS
from
PHOTOGRAPHY DATED: 4-21-77
by
INLAND AERIAL SURVEYS

FINAL MAP PREPARED
by
MAPPING SECTION
Department of Transportation



(SEE SHEET 2)

This Map Complies with
NATIONAL MAP ACCURACY STANDARDS

(Feet) 200 0 200 400 600 800 1000
(Meters) 100 0 100 200 300

SCALE 1: 2400 (1" = 200')
INDEX CONTOUR INTERVAL: 25 FEET
CONTOUR INTERVAL: 5 FEET
TWO THOUSAND FOOT CALIFORNIA RECTANGULAR GRID (ZONE VI)
THE LAST THREE DIGITS OF THE GRID NUMBERS ARE OMITTED
THE RECTANGULAR COORDINATE VALUES ARE SHOWN ON THE SOUTH AND WEST MARGINS
THE GEOGRAPHIC VALUES ARE SHOWN ON THE NORTH AND EAST MARGINS

HYDROLOGY LEGEND

- 4 — DRAINAGE AREA
- 100 — NODE NUMBER
- DIRECTION OF DRAINAGE
- INITIAL AREA

SHEET 1 OF 2

INDEX TO ADJOINING SHEETS

326-1815	326-1821	326-1827
322-1815	322-1821	322-1827
318-1815	318-1821	318-1827

SAN DIEGO COUNTY CALIFORNIA

SHEET NO. 322-1821

01-25

COUNTY OF SAN DIEGO

TOPOGRAPHIC SURVEY

-LEGEND-

- Horizontal Control Monument *Third Order*
- Vertical Control Monument *Second Order or Better*
- Horizontal Control Monument *Second Order or Better*
- Vertical Control Monument *Third Order*
- Horizontal Control Monument *Second Order or Better*
- Horizontal Control Monument & Bench Mark *Second Order or Better*
- Horizontal Control Monument *Third Order.*
- Horizontal Control Monument & Bench Mark *Third Order*
- Bench Mark *Second Order or Better*
- Vertical Control Monument *Third Order*
- Found Section, Grant or Subdivision Corner. (4 3 9 10 T 10 S T 11 S R 1 W R 2 W)
- Photograph, Nadir Point
- Geographic Tick

BOUNDARIES IN ORDER OF PRECEDENCE

- .025" National
- Name .025" Name County
- .015 City (*Use at Border with County*)
- Name within Bdry .015" Reservation
- Name within Bdry. .015" National, State or County Park
- Name within Bdry. .015" Land Grant
- T 2 S / T 3 S .015" Township, Range, Section or Subdivision (*Name of Subdivision within Bdry.*)

PREPARED UNDER THE DIRECTION OF THE COUNTY ENGINEER OF THE COUNTY OF SAN DIEGO, CALIFORNIA. 323,610

MAP CONTROL DATA FURNISHED BY THE COUNTY OF SAN DIEGO.

HORIZONTAL CONTROL IS BASED ON NORTH AMERICAN 1927 DATUM.

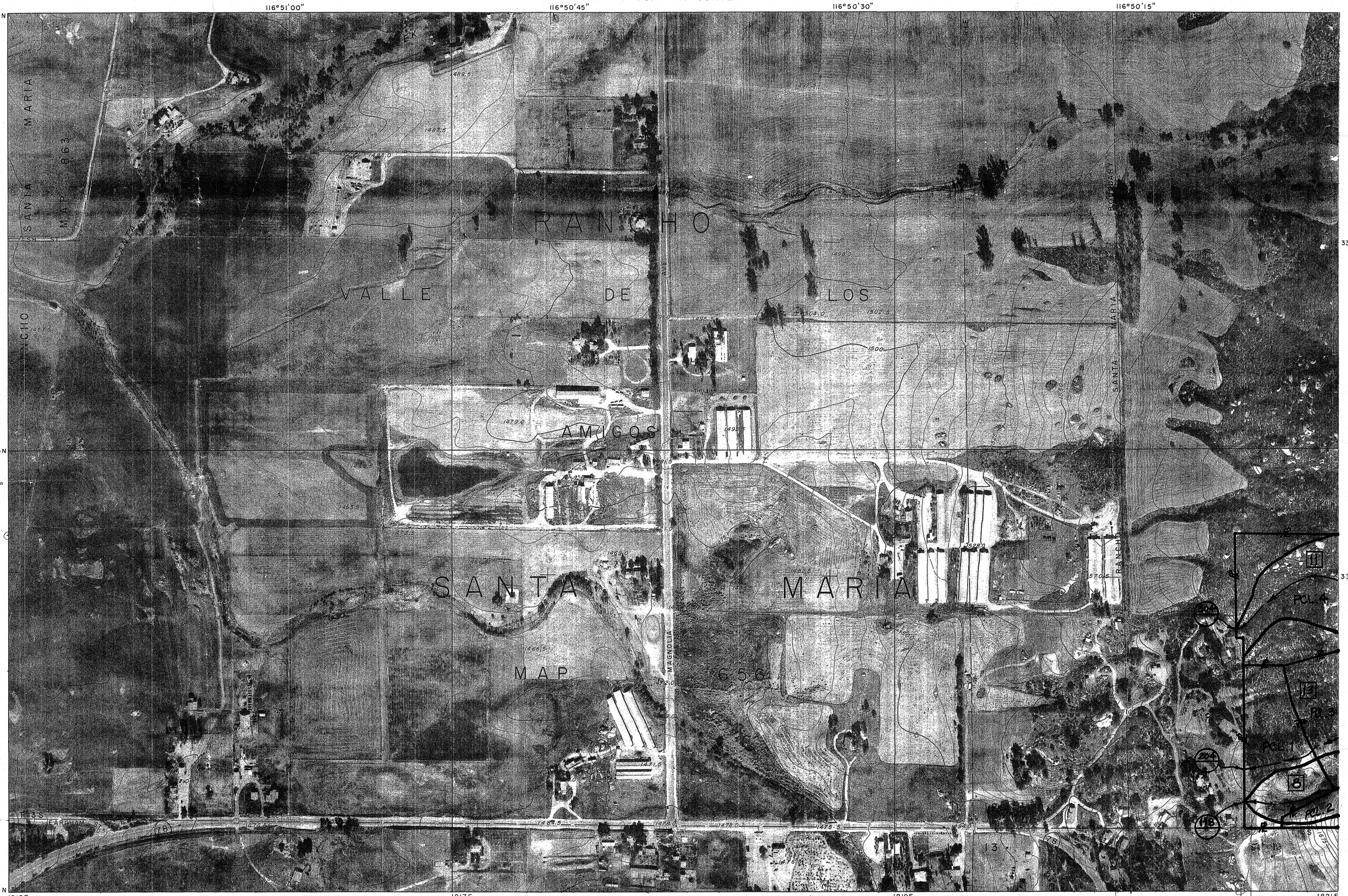
LAND LINES SHOWN ARE APPROXIMATE. 325

TOPOGRAPHY COMPILED BY PHOTOGRAMMETRIC METHODS FROM PHOTOGRAPHY DATED 11-7-74 BY

INLAND AERIAL SURVEYS, INC.
5826 Magnolia Avenue
Riverside, California 92506

ORTHOPHOTO IMAGE PREPARED FROM PHOTOGRAPHY DATED 11-7-74 BY 321,323

CALIFORNIA AERO TOPO, INC.



SCALE 1:2400

200 0 200 400 600 800 1000

CONTOUR INTERVAL 5 FEET

U.S.C. & G.S. SEA LEVEL DATUM OF 1929

TWO THOUSAND FOOT CALIFORNIA RECTANGULAR GRID (ZONE VI)
THE LAST THREE DIGITS OF THE GRID NUMBERS ARE OMITTED
THE RECTANGULAR COORDINATE VALUES ARE SHOWN ON THE SOUTH AND WEST MARGINS
THE GEOGRAPHIC VALUES ARE SHOWN ON THE NORTH AND EAST MARGINS

(SHEET 2 OF 2)

INDEX TO ADJOINING SHEETS

326-1809	326-1815	326-1821
322-1809	322-1815	322-1821
318-1809	318-1815	318-1821

HYDROLOGY LEGEND

- 4 DRAINAGE AREA
- 100 NODE NUMBER
- DIRECTION OF DRAINAGE
- INITIAL AREA

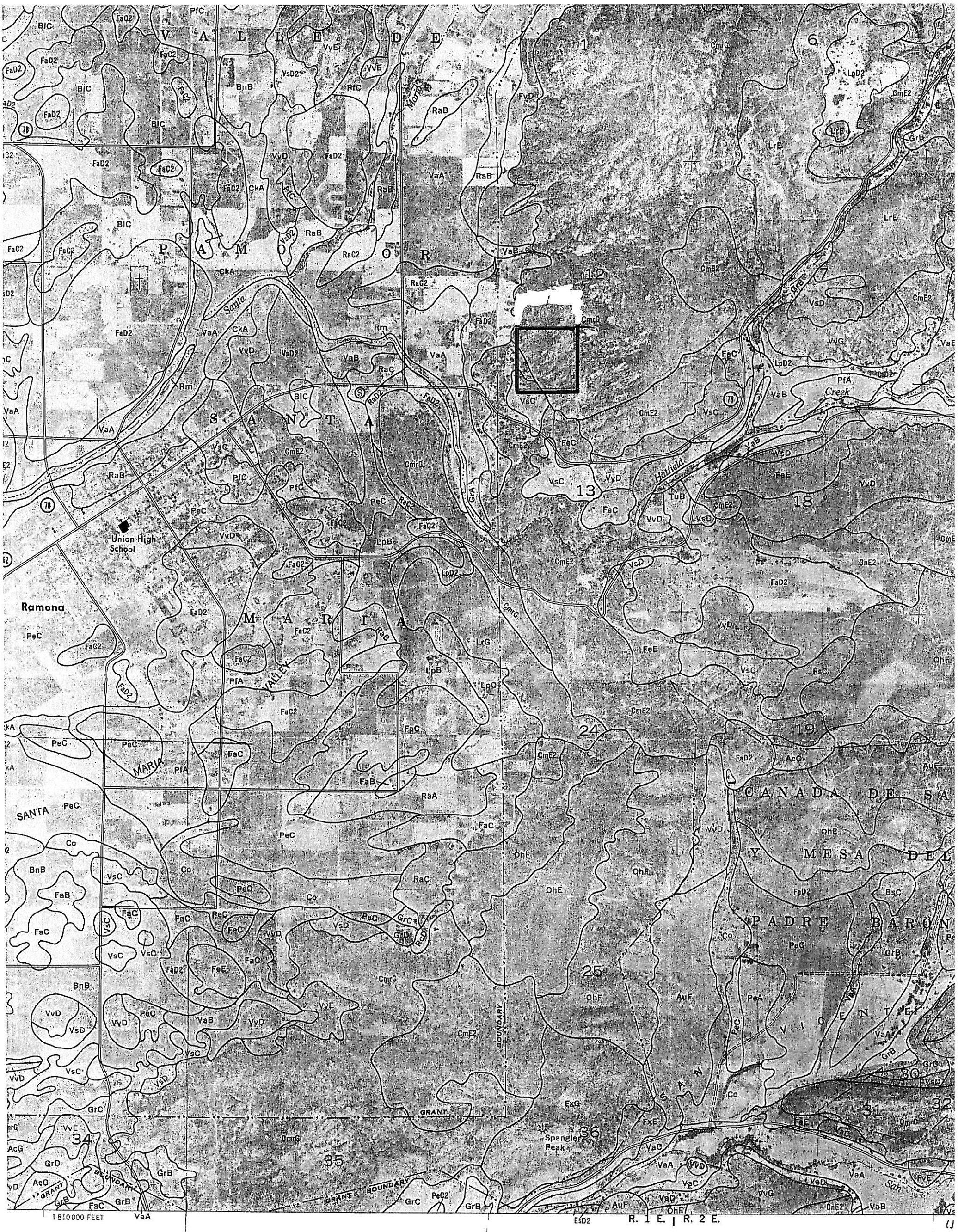
SAN DIEGO COUNTY
CALIFORNIA

EDITION OF 1975

SHEET 322-1815

01-25

5



urvey by USDA, Soil Conservation Service in cooperation
he University of California Agricultural Experiment Station.
base compiled 1970 from 1967-68 aerial photography.
ol from USGS and USC & GS.
onic projection. 1927 North American datum.
-foot grid based on California plane coordinate
, zone 6.
livision corners are approximate.

Scale 1:24 000

1 ¾ ½ ¼ 0 1

5 000 4 000 3 000 2 000 1 000 0 5 000

This map is one of a set of 76 compiled 1969-70 by the Soil Conservatio

SAN DIEGO AREA, CALIFORNIA NO. 3

01-25

Sheet No 37

TABLE 11.--INTERPRETATIONS FOR LAND MANAGEMENT

[Numerals indicate soil properties or qualities that affect erodibility. Numeral 1 refers to slope; 2 to surface layer texture; 9 to depth to hard rock, or a hardpan, or any layer that restricts permeability; 16 to grade of structure in the surface layer. Absence of rating means no valid interpretations can be made]

Map symbol	Soil	Hydro-logic group	Erodibility	Limitations for conversion from brush to grass
AcG	Acid igneous rock land	D	Severe 1-----	Severe.
AtC	Altamont clay, 5 to 9 percent slopes	D	Slight-------	Slight. 1/
AtD	Altamont clay, 9 to 15 percent slopes	D	Slight-------	Slight. 1/
AtD2	Altamont clay, 9 to 15 percent slopes, eroded	D	Slight-------	Slight. 1/
AtE	Altamont clay, 15 to 30 percent slopes	D	Moderate 1---	Slight. 1/
AtE2	Altamont clay, 15 to 30 percent slopes, eroded	D	Moderate 1---	Slight. 1/
AtF	Altamont clay, 30 to 50 percent slopes	D	Severe 1-----	Moderate. 1/
AuC	Anderson very gravelly sandy loam, 5 to 9 percent slopes.	A	Severe 16----	Slight.
AuF	Anderson very gravelly sandy loam, 9 to 45 percent slopes.	A	Severe 16----	Moderate. 2/
AvC	Arlington coarse sandy loam, 2 to 9 percent slopes	C	Severe 16----	Slight.
AwC	Auld clay, 5 to 9 percent slopes	D	Slight-------	Slight.
AwD	Auld clay, 9 to 15 percent slopes	D	Slight-------	Slight.
AyE	Auld stony clay, 9 to 30 percent slopes	D	Moderate 1---	Slight.
BaG	Badland	D	Severe 1-----	Severe.
BbE	Bancas stony loam, 5 to 30 percent slopes	C	Severe 16----	Moderate.
BbE2	Bancas stony loam, 5 to 30 percent slopes, eroded	C	Severe 16----	Moderate.
BbG	Bancas stony loam, 30 to 65 percent slopes	C	Severe 1-----	Moderate.
BbG2	Bancas stony loam, 30 to 65 percent slopes, eroded	C	Severe 1-----	Moderate.
BeE	Blasingame loam, 9 to 30 percent slopes	D	Severe 16----	Slight.
BgE	Blasingame stony loam, 9 to 30 percent slopes	D	Severe 16----	Moderate.
BgF	Blasingame stony loam, 30 to 50 percent slopes	D	Severe 1-----	Moderate.
BlC	Bonsall sandy loam, 2 to 9 percent slopes	D	Severe 9-----	Slight.
BlC2	Bonsall sandy loam, 2 to 9 percent slopes, eroded	D	Severe 9-----	Slight.
BlD2	Bonsall sandy loam, 9 to 15 percent slopes, eroded	D	Severe 9-----	Slight.
BmC	Bonsall sandy loam, thick surface, 2 to 9 percent slopes.	D	Moderate 2---	Slight.
BnB	Bonsall-Fallbrook sandy loams, 2 to 5 percent slopes:			
	Bonsall	D	Severe 9-----	Slight.
	Fallbrook	C	Severe 9-----	Slight.
BoC	Boomer loam, 2 to 9 percent slopes	C	Moderate 2---	Slight.
BoE	Boomer loam, 9 to 30 percent slopes	C	Moderate 1---	Slight.
BrE	Boomer stony loam, 9 to 30 percent slopes	C	Moderate 1---	Slight.
BrG	Boomer stony loam, 30 to 65 percent slopes	C	Severe 1-----	Moderate.
BsC	Bosanko clay, 2 to 9 percent slopes	D	Moderate 16--	Slight. 1/
BsD	Bosanko clay, 9 to 15 percent slopes	D	Moderate 16--	Slight. 1/
BsE	Bosanko clay, 15 to 30 percent slopes	D	Moderate 1---	Slight. 1/
BtC	Bosanko stony clay, 5 to 9 percent slopes	D	Moderate 16--	Slight. 3/
BuB	Bull Trail sandy loam, 2 to 5 percent slopes	C	Severe 16----	Slight. 4/
BuC	Bull Trail sandy loam, 5 to 9 percent slopes	C	Severe 16----	Slight. 4/
BuD2	Bull Trail sandy loam, 9 to 15 percent slopes, eroded	C	Severe 16----	Slight. 4/
BuE2	Bull Trail sandy loam, 15 to 30 percent slopes, eroded	C	Severe 16----	Slight. 4/
CaB	Calpine coarse sandy loam, 2 to 5 percent slopes	B	Moderate 2---	Slight. 4/
CaC	Calpine coarse sandy loam, 5 to 9 percent slopes	B	Moderate 2---	Slight. 4/
CaC2	Calpine coarse sandy loam, 5 to 9 percent slopes, eroded.	B	Moderate 2---	Slight. 4/

See footnotes at end of table.

TABLE 11.--INTERPRETATIONS FOR LAND MANAGEMENT--Continued

Map symbol	Soil	Hydro-logic group	Erodibility	Limitations for conversion from brush to grass
CaD2	Calpine coarse sandy loam, 9 to 15 percent slopes, eroded.	B	Moderate 2---	Slight. 4/
CbB	Carlsbad gravelly loamy sand, 2 to 5 percent slopes	C	Severe 2-----	Slight.
CbC	Carlsbad gravelly loamy sand, 5 to 9 percent slopes	C	Severe 2-----	Slight.
CbD	Carlsbad gravelly loamy sand, 9 to 15 percent slopes	C	Severe 2-----	Slight.
CbE	Carlsbad gravelly loamy sand, 15 to 30 percent slopes	C	Severe 2-----	Slight.
CcC	Carlsbad-Urban land complex, 2 to 9 percent slopes	D		
CcE	Carlsbad-Urban land complex, 9 to 30 percent slopes	D		
CeC	Carrizo very gravelly sand, 0 to 9 percent slopes	A	Severe 2	
CfB	Chesterton fine sandy loam, 2 to 5 percent slopes	D	Severe 9-----	Slight.
CfC	Chesterton fine sandy loam, 5 to 9 percent slopes	D	Severe 9-----	Slight.
CfD2	Chesterton fine sandy loam, 9 to 15 percent slopes, eroded.	D	Severe 9-----	Moderate.
CgC	Chesterton-Urban land complex, 2 to 9 percent slopes:			
	Chesterton	D		
	Urban land	D		
ChA	Chino fine sandy loam, 0 to 2 percent slopes	C	Severe 16----	Slight.
ChB	Chino fine sandy loam, 2 to 5 percent slopes	C	Severe 16----	Slight.
CkA	Chino silt loam, saline, 0 to 2 percent slopes	C	Moderate 2---	Moderate.
ClD2	Cieneba coarse sandy loam, 5 to 15 percent slopes, eroded.	B	Severe 16----	Severe.
ClE2	Cieneba coarse sandy loam, 15 to 30 percent slopes, eroded.	B	Severe 16----	Severe.
ClG2	Cieneba coarse sandy loam, 30 to 65 percent slopes, eroded.	B	Severe 1-----	Severe.
CmE2	Cieneba rocky coarse sandy loam, 9 to 30 percent slopes, eroded.	B	Severe 16----	Severe.
CmrG	Cieneba very rocky coarse sandy loam, 30 to 75 percent slopes.	B	Severe 1-----	Severe.
CnE2	Cieneba-Fallbrook rocky sandy loams, 9 to 30 percent slopes, eroded:			
	Cieneba	B	Severe 16----	Severe.
	Fallbrook	C	Severe 16----	Severe.
CnG2	Cieneba-Fallbrook rocky sandy loams, 30 to 65 percent slopes, eroded:			
	Cieneba	B	Severe 1-----	Severe.
	Fallbrook	C	Severe 1-----	Severe.
Co	Clayey alluvial land	D	Moderate 2---	Slight.
Cr	Coastal beaches	A	Severe 2	
CsB	Corralitos loamy sand, 0 to 5 percent slopes	A	Severe 2-----	Slight.
CsC	Corralitos loamy sand, 5 to 9 percent slopes	A	Severe 2-----	Slight.
CsD	Corralitos loamy sand, 9 to 15 percent slopes	A	Severe 2-----	Slight.
CtE	Crouch coarse sandy loam, 5 to 30 percent slopes	B	Severe 16----	Slight.
CtF	Crouch coarse sandy loam, 30 to 50 percent slopes	B	Severe 1-----	Moderate.
CuE	Crouch rocky coarse sandy loam, 5 to 30 percent slopes.	B	Severe 16----	Moderate.
CuG	Crouch rocky coarse sandy loam, 30 to 70 percent slopes.	B	Severe 1-----	Moderate.
CvG	Crouch stony fine sandy loam, 30 to 75 percent slopes.	B	Severe 1-----	Moderate.
DaC	Diablo clay, 2 to 9 percent slopes	D	Slight--------	Slight. 1/
DaD	Diablo clay, 9 to 15 percent slopes	D	Slight--------	Slight. 1/
DaE	Diablo clay, 15 to 30 percent slopes	D	Moderate------	Slight. 1/
DaE2	Diablo clay, 15 to 30 percent slopes, eroded	D	Moderate 1---	Slight. 1/
DaF	Diablo clay, 30 to 50 percent slopes	D	Severe 1-----	Moderate. 1/

See footnotes at end of table.

01-25

TABLE 11.--INTERPRETATIONS FOR LAND MANAGEMENT--Continued

Map symbol	Soil	Hydrologic group	Erodibility	Limitations for conversion from brush to grass
VaB	Visalia sandy loam, 2 to 5 percent slopes	B	Severe 16	Slight.
VaC	Visalia sandy loam, 5 to 9 percent slopes	B	Severe 16	Slight.
VaD	Visalia sandy loam, 9 to 15 percent slopes	B	Severe 16	Slight.
VbB	Visalia gravelly sandy loam, 2 to 5 percent slopes	B	Severe 16	Slight.
VbC	Visalia gravelly sandy loam, 5 to 9 percent slopes	B	Severe 16	Slight.
VsC	Vista coarse sandy loam, 5 to 9 percent slopes	B	Moderate 2	Slight.
VsD	Vista coarse sandy loam, 9 to 15 percent slopes	B	Moderate 2	Slight.
VsD2	Vista coarse sandy loam, 9 to 15 percent slopes, eroded.	B	Moderate 2	Slight.
VsE	Vista coarse sandy loam, 15 to 30 percent slopes	B	Moderate 2	Slight.
VsE2	Vista coarse sandy loam, 15 to 30 percent slopes, eroded.	B	Moderate 2	Slight.
VsG	Vista coarse sandy loam, 30 to 65 percent slopes	B	Severe 1	Moderate.
VvD	Vista rocky coarse sandy loam, 5 to 15 percent slopes.	B	Moderate 2	Moderate. 3/
VvE	Vista rocky coarse sandy loam, 15 to 30 percent slopes.	B	Moderate 2	Moderate. 3/
VvG	Vista rocky coarse sandy loam, 30 to 65 percent slopes.	B	Severe 1	Moderate. 3/
WmB	Wyman loam, 2 to 5 percent slopes	C	Moderate 2	Slight.
WmC	Wyman loam, 5 to 9 percent slopes	C	Moderate 2	Slight.
WmD	Wyman loam, 9 to 15 percent slopes	C	Moderate 2	Slight.

1/ Typically a grassland soil; conversion from brush usually not necessary.

2/ Moderate if slope is more than 30 percent, slight if less than 30 percent.

3/ Stoniness or rockiness not a serious impediment to use of grass-planting equipment.

4/ On desert-facing mountain slopes and in valleys, in the eastern part of land resource area 20, the degree of limitation is severe because of climate, regardless of soil properties.

Only soil properties are considered in the ratings in table 11. Climate, plant cover, and physiographic features are not considered. For this reason, the ratings of erodibility may not agree with the ratings of erosion hazard given in the soil descriptions in Part I of this survey or with the erosion hazard indicated under the heading "Homesites" in Part II. The criteria used for rating soil erodibility are shown in table 12.

TABLE 12.--CRITERIA FOR RATING SOIL ERODIBILITY

Soil properties affecting erodibility	Erodibility		
	Slight	Moderate 1/	Severe 1/ 2/
Surface layer texture 3/	Clay	Clay loam, sandy loams, or loam.	Sands, or loamy sands.
Grade of granular, crumb, or blocky structure in the surface layer.	Strong	Moderate	Weak and massive and single grain.
Depth to material that restricts permeability.	More than 40 inches	40 to 20 inches	Less than 20 inches.
Slope	Less than 15 percent	15 to 30 percent	More than 30 percent.

1/ Rating is slight for clay loam, sandy loams, loam, sands, and loamy sands if coarse fragments cover more than 75 percent of surface.

2/ Rating is moderate for sands and loamy sands if coarse fragments cover 25 to 75 percent of surface.

3/ Rating is according to surface layer texture if coarse fragments cover only 1 to 25 percent of surface.

Conversion from Brush to Grass 4/

The primary benefit of converting areas of brush to grass is the prevention and control of fires. Other benefits include a decrease in runoff and an improvement in wildlife habitat and recreational areas. Conversion to grass or grass and legumes is stressed because these are the major adapted plants for which seed is readily available and techniques have been developed for establishing this type of cover after the brush has been destroyed (4).

The establishment of a grass cover adequate for soil protection depends on the climate and soil properties. The climate of the western and central parts of the survey area, land resource area 19 and the western part of land resource area 20, is suited to adapted annual grasses and, in some locations, to perennial grasses. However, the Desert, land resource area 30, is not climatically suited to grass. The desert-facing mountain slopes and valleys in the eastern part of land resource area 20 are subject to high temperatures and desiccating winds, and the establishment of new cover is more difficult there than in the western part. Within a suitable climatic zone, the properties of the soils affect the relative difficulty of establishing and maintaining a grass cover that is adequate for erosion control and fire abatement once the brush is removed.

In table 11, the limitations of each soil for conversion from brush to grass are rated slight, moderate, and severe. Ratings are based on such soil properties as slope, rooting depth, available water holding capacity, presence of rock outcrops or stones, and degree of erosion. Ratings are not given for desert soils or for soils and land types on which conversion is not applicable, such as Coastal beaches or Urban land. All other soils and land types are rated regardless of present use or plant cover.

In determining the ratings in table 11, it is assumed that--

4/ By IRVING L. SEALANDER, range conservationist, Soil Conservation Service. Interpretations are for use in San Diego County only.

V. PROPOSED STORM DRAIN SYSTEM

The extension of the private road off of Ramona View Drive will require culverts at eight locations.

The proposed development of parcels 3 and 4 will employ standard site drainage that will either drain to the proposed driveway or to natural channels. Energy dissipators will be installed downstream of the culverts.

VI. HYDRUALIC CALCULATIONS

Culverts will be sized to assure adequate capacity to hand a 100-year storm event. The following sheets provide calculations to demonstrate the capacity of each ditch to convey the post development flow rates.

Hydraulic calculations for the channels and swales were performed by using the Hydrology module inside SurvCADD to evaluate culvert capacity. The results of these calculations are presented in the following pages.

C. Little
2/22/07

Hydraulics
Neumann Parcel Map

Culvert No.	Q(100) cfs	Node	Length
1	96.0	406	57'
2	3.1	1104	40'
3	12.9	506	46'
4	2.5	604	28'
5	8.7	706	33'
6	8.0	704	30'
7	4.1	504	45'
8	5.2	412	35'

Note: Culvert grades minimum of 2%.

Culvert No.	Recommended Number & Size
1	3-36" CMP
2	1-18" CMP
3	2-18" CMP
4	1-12" CMP
5	2-18" CMP
6	2-18" CMP
7	1-18" CMP
8	1-18" CMP

C lvert Design Culvert #1:

F ?:

Design Parameters

Section

Shape:	Circular	
Material:	CMP/Aluminum	
Diameter:	36.00	in
Manning's n:	0.0260	
Number of Barrels:	3	

Inlet

Inlet Type:	Headwall	
Ke:	0.50	

Inverts

Inlet Invert Elevation:	100.00	ft
Outlet Invert Elevation:	98.86	ft
Length:	57.00	ft
Slope:	0.020000	ft/ft

Culvert Calculation

Discharge:	96.13	cfs	> 96 cfs (node 406)
Headwater Elevation:	103.00	ft	
Tailwater Elevation:	98.90	ft	
Downstream Velocity:	7.19	ft/s	
Downstream Flow Depth:	1.81	ft	
Flow Control Type:	Outlet Control		

C lvert Design Culvert #2:

E e:

Design Parameters

Section

Shape:	Circular	
Material:	CMP/Aluminum	
Diameter:	18.00	in
Manning's n:	0.0260	
Number of Barrels:	1	

Inlet

Inlet Type:	Headwall	
Ke:	0.50	

Inverts

Inlet Invert Elevation:	100.00	ft
Outlet Invert Elevation:	99.20	ft
Length:	40.00	ft
Slope:	0.020000	ft/ft

C lvert Calculation

Discharge:	5.79	cfs
Headwater Elevation:	101.50	ft
Tailwater Elevation:	99.46	ft
Downstream Velocity:	5.04	ft/s
Downstream Flow Depth:	0.93	ft
Flow Control Type:	Outlet Control	

> 3.1 cfs (0.5 Node 1104)
+
2.6 cfs Driveway

C lvert Design Culvert #3:

E e:

Design Parameters

Section

Shape:	Circular	
Material:	CMP/Aluminum	
Diameter:	18.00	in
Manning's n:	0.0260	
Number of Barrels:	2	

Inlet

Inlet Type:	Headwall	
Ke:	0.50	

Inverts

Inlet Invert Elevation:	100.00	ft
Outlet Invert Elevation:	99.08	ft
Length:	46.00	ft
Slope:	0.020000	ft/ft

Culvert Calculation

Discharge:	16.36	cfs > 12.9 (Node 506)
Headwater Elevation:	102.00	ft
Tailwater Elevation:	99.46	ft
Downstream Velocity:	5.84	ft/s
Downstream Flow Depth:	1.11	ft
Flow Control Type:	Outlet Control	

C lvert Design Culvert #4:

E 'e:

Design Parameters

Section

Shape:	Circular	
Material:	CMP/Aluminum	
Diameter:	12.00	in
Manning's n:	0.0260	
Number of Barrels:	1	

Inlet

Inlet Type:	Headwall	
Ke:	0.50	

Inverts

Inlet Invert Elevation:	100.00	ft
Outlet Invert Elevation:	99.40	ft
Length:	30.00	ft
Slope:	0.020000	ft/ft

'vert Calculation

Discharge:	3.05	cfs > 2.5cfs (Node 604)
Headwater Elevation:	101.50	ft
Tailwater Elevation:	99.46	ft
Downstream Velocity:	4.83	ft/s
Downstream Flow Depth:	0.75	ft
Flow Control Type:	Outlet Control	

Culvert Design Culvert #5:

Type:

Design Parameters

Section

Shape:	Circular	
Material:	CMP/Aluminum	
Diameter:	18.00	in
Manning's n:	0.0260	
Number of Barrels:	2	

Inlet

Inlet Type:	Headwall	
Ke:	0.50	

Inverts

Inlet Invert Elevation:	100.00	ft
Outlet Invert Elevation:	99.40	ft
Length:	30.00	ft
Slope:	0.020000	ft/ft

Culvert Calculation

Discharge:	10.31	cfs > 8.7 cfs (Node 706)
Headwater Elevation:	101.40	ft
Tailwater Elevation:	99.46	ft
Downstream Velocity:	4.82	ft/s
Downstream Flow Depth:	0.87	ft
Flow Control Type:	Outlet Control	

C lvert Design Culvert #6:

E e:

Design Parameters

Section

Shape:	Circular	
Material:	CMP/Aluminum	
Diameter:	18.00	in
Manning's n:	0.0260	
Number of Barrels:	2	

Inlet

Inlet Type:	Headwall	
Ke:	0.50	

Inverts

Inlet Invert Elevation:	100.00	ft
Outlet Invert Elevation:	99.40	ft
Length:	30.00	ft
Slope:	0.020000	ft/ft

Culvert Calculation

Discharge:	11.58	cfs > 8.0 cfs (Node 704)
Headwater Elevation:	101.50	ft
Tailwater Elevation:	99.46	ft
Downstream Velocity:	5.04	ft/s
Downstream Flow Depth:	0.93	ft
Flow Control Type:	Outlet Control	

Culvert Design Culvert #7:

File:

Design Parameters

Section

Shape:	Circular	
Material:	CMP/Aluminum	
Diameter:	18.00	in
Manning's n:	0.0260	
Number of Barrels:	1	

Inlet

Inlet Type:	Headwall	
Ke:	0.50	

Inverts

Inlet Invert Elevation:	100.00	ft
Outlet Invert Elevation:	99.10	ft
Length:	45.00	ft
Slope:	0.020000	ft/ft

Culvert Calculation

Discharge:	5.79	cfs > 4.1 cfs (Node 504)
Headwater Elevation:	101.50	ft
Tailwater Elevation:	99.46	ft
Downstream Velocity:	5.04	ft/s
Downstream Flow Depth:	0.93	ft
Flow Control Type:	Outlet Control	

C lvert Design Culvert #8:

E `e:

Design Parameters

Section

Shape:	Circular	
Material:	CMP/Aluminum	
Diameter:	18.00	in
Manning's n:	0.0260	
Number of Barrels:	1	

Inlet

Inlet Type:	Headwall	
Ke:	0.50	

Inverts

Inlet Invert Elevation:	100.00	ft
Outlet Invert Elevation:	99.30	ft
Length:	35.00	ft
Slope:	0.020000	ft/ft

C lvert Calculation

Discharge:	5.79	cfs > 5.2 cfs (Node 412)
Headwater Elevation:	101.50	ft
Tailwater Elevation:	99.46	ft
Downstream Velocity:	5.04	ft/s
Downstream Flow Depth:	0.93	ft
Flow Control Type:	Outlet Control	

APPENDIX A

COMPUTER CODES

SUBAREA HYDROLOGIC PROCESSES:

1: Confluence analysis at node
2: Initial subarea analysis
3: Pipeflow traveltime (COMPUTER ESTIMATED pipesize)
4: Pipeflow traveltime . . . . . (USER SPECIFIED pipesize)
5: Trapezoidal channel travel time
6: Street-Flow analysis thru subarea
7: User-specified information at node
8: Addition of subarea runoff to mainline
9: V-gutter flow thru subarea

01-25 4/25/05

ERB ENGINEERING, INC.
12320 STOWE DRIVE, SUITE E
POWAY, CALIFORNIA 92064
(619) 748-2130 • FAX (619) 748-6069

W.O. No. 01-25
DATE: 4/26/05
BY: EW CK:
SHEET 1 OF: 2

DRAINAGE DATA WORKSHEET FOR: 100 year Storm
SURFACE FLOW TABLE

ANALYSIS PT FROM	TO	LINK DESC.	CODE	HIGH PT (ft)	LOW PT (ft)	FLOW PATH (ft)	AREA (acs)	"C"	REMARKS
100	102	Init Area #1	2	2220	2207	80	0.1		Area 1
102	104	Channel	5	2207	1975	1580			
104	104	Add Area	8				9.5		Area 2
104	104	Confl	1						1 of 2
110	112	Init Area #2	2	2176	2173	60'	0.07		Area 3
112	104	Channel	5	2173	1975	1300			
112	104	Add Area	8				12.4		Area 4
104	104	Confl	1						2 of 2
104	106	Channel	5	1975	1795	1060			
106	106	Add Area	8				11.9		Area 5
106	106	Confl	1						1 of 2
114	116	Init Area #3	2	2175	2172	100	0.17		Area 9
116	106	Channel	5	2172	1975	2230			
106	106	Add Area	8				21.6		Area 7

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W.O. No. 01-25
DATE: 4.26.05
BY: EMJ CK:
SHEET 2 OF: 2

DRAINAGE DATA WORKSHEET FOR: 100 year
SURFACE FLOW TABLE

ANALYSIS PT FROM	TO	LINK DESC.	CODE	HIGH PT (ft)	LOW PT (ft)	FLOW PATH (ft)	AREA (acs)	"C"	REMARKS
106	106	Confl	1						2 of 2
106	118	Channel	5	1795	1618	1240			
106	118	Add Area	8				1.04		Area 8
200	202	Init Area #6	2	1925	1915	70	.05		Area 12
202	204	Channel	5	1915	1630	1230			
204	204	Add Area	8				9.7		Area 13
300	302	Init Area #5	2	1982	1980	70	.05		Area 10
302	304	Channel	5	1980	1645	1190			
302	304	Add Area	8				8.1		Area 11

Note: Area 6 = 0.7 Acres and Area 4 = 1.2 Acres don't contribute To development & drainage will remain the same

```
****************************************************************************

            RATIONAL METHOD HYDROLOGY COMPUTER PROGRAM PACKAGE
            Reference: SAN DIEGO COUNTY FLOOD CONTROL DISTRICT
                        2003,1985,1981 HYDROLOGY MANUAL
        (c) Copyright 1982-2004 Advanced Engineering Software (aes)
            Ver. 2.0 Release Date: 01/01/2004  License ID 1432

                        Analysis prepared by:



 ************************* DESCRIPTION OF STUDY *************************
* 100 YEAR STORM                                                        *
* JOB 0125                                                              *
* 4.26.05                                                               *
 ************************************************************************

  FILE NAME: 0125.DAT
  TIME/DATE OF STUDY: 19:33 04/26/2005
----------------------------------------------------------------------------
  USER SPECIFIED HYDROLOGY AND HYDRAULIC MODEL INFORMATION:
----------------------------------------------------------------------------
  2003 SAN DIEGO MANUAL CRITERIA

  USER SPECIFIED STORM EVENT(YEAR) = 100.00
  6-HOUR DURATION PRECIPITATION (INCHES) =   3.300
  SPECIFIED MINIMUM PIPE SIZE(INCH) =   6.00
  SPECIFIED PERCENT OF GRADIENTS(DECIMAL) TO USE FOR FRICTION SLOPE = 0.95
  SAN DIEGO HYDROLOGY MANUAL "C"-VALUES USED FOR RATIONAL METHOD
  NOTE: USE MODIFIED RATIONAL METHOD PROCEDURES FOR CONFLUENCE ANALYSIS
  *USER-DEFINED STREET-SECTIONS FOR COUPLED PIPEFLOW AND STREETFLOW MODEL*
     HALF-  CROWN TO   STREET-CROSSFALL:   CURB  GUTTER-GEOMETRIES:  MANNING
     WIDTH  CROSSFALL  IN-  / OUT-/PARK-  HEIGHT  WIDTH  LIP   HIKE  FACTOR
NO.   (FT)     (FT)    SIDE / SIDE/ WAY    (FT)    (FT)  (FT)  (FT)    (n)
===  =====  =========  =================  ======  =====  ======  =====  =======
  1   30.0     20.0    0.018/0.018/0.020   0.67    2.00 0.0313 0.167 0.0150

  GLOBAL STREET FLOW-DEPTH CONSTRAINTS:
    1. Relative Flow-Depth =  0.00 FEET
       as (Maximum Allowable Street Flow Depth) - (Top-of-Curb)
    2. (Depth)*(Velocity) Constraint =  6.0 (FT*FT/S)
  *SIZE PIPE WITH A FLOW CAPACITY GREATER THAN
   OR EQUAL TO THE UPSTREAM TRIBUTARY PIPE.*

****************************************************************************
  FLOW PROCESS FROM NODE    100.00 TO NODE    102.00 IS CODE =  21
----------------------------------------------------------------------------
  >>>>>RATIONAL METHOD INITIAL SUBAREA ANALYSIS<<<<<
============================================================================
  USER-SPECIFIED RUNOFF COEFFICIENT = .4600
  S.C.S. CURVE NUMBER (AMC II) =  84
  INITIAL SUBAREA FLOW-LENGTH(FEET) =    80.00
  UPSTREAM ELEVATION(FEET) =   2220.00
  DOWNSTREAM ELEVATION(FEET) =   2207.00
```

```
  ELEVATION DIFFERENCE(FEET) =      13.00
  SUBAREA OVERLAND TIME OF FLOW(MIN.) =     4.783
  WARNING: THE MAXIMUM OVERLAND FLOW SLOPE, 10.%, IS USED IN Tc CALCULATION!
   100 YEAR RAINFALL INTENSITY(INCH/HOUR) =  8.695
  NOTE: RAINFALL INTENSITY IS BASED ON Tc = 5-MINUTE.
  SUBAREA RUNOFF(CFS) =       0.40
  TOTAL AREA(ACRES) =       0.10   TOTAL RUNOFF(CFS) =       0.40

****************************************************************************
  FLOW PROCESS FROM NODE    102.00 TO NODE    104.00 IS CODE =  53
----------------------------------------------------------------------------
  >>>>>COMPUTE NATURAL MOUNTAIN CHANNEL FLOW<<<<<
  >>>>>TRAVELTIME THRU SUBAREA<<<<<
============================================================================
  ELEVATION DATA: UPSTREAM(FEET) =   2207.00  DOWNSTREAM(FEET) =   1975.00
  CHANNEL LENGTH THRU SUBAREA(FEET) =  1580.00   CHANNEL SLOPE =  0.1468
  SLOPE ADJUSTMENT CURVE USED:
  EFFECTIVE SLOPE = .1329 (PER LACFCD/RCFC&WCD HYDROLOGY MANUAL)
  NOTE: CHANNEL FLOW OF 1. CFS WAS ASSUMED IN VELOCITY ESTIMATION
  CHANNEL FLOW THRU SUBAREA(CFS) =       0.40
  FLOW VELOCITY(FEET/SEC) =   2.04 (PER LACFCD/RCFC&WCD HYDROLOGY MANUAL)
  TRAVEL TIME(MIN.) =  12.90   Tc(MIN.) =  17.68
  LONGEST FLOWPATH FROM NODE    100.00 TO NODE    104.00 =  1660.00 FEET.

****************************************************************************
  FLOW PROCESS FROM NODE    104.00 TO NODE    104.00 IS CODE =  81
----------------------------------------------------------------------------
  >>>>>ADDITION OF SUBAREA TO MAINLINE PEAK FLOW<<<<<
============================================================================
   100 YEAR RAINFALL INTENSITY(INCH/HOUR) =  3.850
  USER-SPECIFIED RUNOFF COEFFICIENT = .4600
  S.C.S. CURVE NUMBER (AMC II) =  84
  AREA-AVERAGE RUNOFF COEFFICIENT = 0.4600
  SUBAREA AREA(ACRES) =     9.50   SUBAREA RUNOFF(CFS) =   16.82
  TOTAL AREA(ACRES) =       9.60   TOTAL RUNOFF(CFS) =   17.00
  TC(MIN.) =  17.68

****************************************************************************
  FLOW PROCESS FROM NODE    104.00 TO NODE    104.00 IS CODE =   1
----------------------------------------------------------------------------
  >>>>>DESIGNATE INDEPENDENT STREAM FOR CONFLUENCE<<<<<
============================================================================
  TOTAL NUMBER OF STREAMS =  2
  CONFLUENCE VALUES USED FOR INDEPENDENT STREAM  1 ARE:
  TIME OF CONCENTRATION(MIN.) =  17.68
  RAINFALL INTENSITY(INCH/HR) =   3.85
  TOTAL STREAM AREA(ACRES) =      9.60
  PEAK FLOW RATE(CFS) AT CONFLUENCE =      17.00

****************************************************************************
  FLOW PROCESS FROM NODE    110.00 TO NODE    112.00 IS CODE =  21
----------------------------------------------------------------------------
  >>>>>RATIONAL METHOD INITIAL SUBAREA ANALYSIS<<<<<
============================================================================
  USER-SPECIFIED RUNOFF COEFFICIENT = .4600
  S.C.S. CURVE NUMBER (AMC II) =  84
  INITIAL SUBAREA FLOW-LENGTH(FEET) =     60.00
  UPSTREAM ELEVATION(FEET) =   2176.00
  DOWNSTREAM ELEVATION(FEET) =   2173.00
```

```
ELEVATION DIFFERENCE(FEET) =       3.00
SUBAREA OVERLAND TIME OF FLOW(MIN.) =     5.219
 100 YEAR RAINFALL INTENSITY(INCH/HOUR) =  8.458
SUBAREA RUNOFF(CFS) =       0.27
TOTAL AREA(ACRES) =       0.07   TOTAL RUNOFF(CFS) =       0.27

****************************************************************************
FLOW PROCESS FROM NODE    112.00 TO NODE    104.00 IS CODE =  53
----------------------------------------------------------------------------
>>>>>COMPUTE NATURAL MOUNTAIN CHANNEL FLOW<<<<<
>>>>>TRAVELTIME THRU SUBAREA<<<<<
============================================================================
ELEVATION DATA: UPSTREAM(FEET) =   2173.00  DOWNSTREAM(FEET) =   1975.00
CHANNEL LENGTH THRU SUBAREA(FEET) =  1300.00   CHANNEL SLOPE =  0.1523
SLOPE ADJUSTMENT CURVE USED:
EFFECTIVE SLOPE = .1362 (PER LACFCD/RCFC&WCD HYDROLOGY MANUAL)
NOTE: CHANNEL FLOW OF 1. CFS WAS ASSUMED IN VELOCITY ESTIMATION
CHANNEL FLOW THRU SUBAREA(CFS) =       0.27
FLOW VELOCITY(FEET/SEC) =   2.07 (PER LACFCD/RCFC&WCD HYDROLOGY MANUAL)
TRAVEL TIME(MIN.) =  10.49   Tc(MIN.) =  15.70
LONGEST FLOWPATH FROM NODE    110.00 TO NODE    104.00 =  1360.00 FEET.

****************************************************************************
FLOW PROCESS FROM NODE    112.00 TO NODE    104.00 IS CODE =  81
----------------------------------------------------------------------------
>>>>>ADDITION OF SUBAREA TO MAINLINE PEAK FLOW<<<<<
============================================================================
 100 YEAR RAINFALL INTENSITY(INCH/HOUR) =  4.156
USER-SPECIFIED RUNOFF COEFFICIENT = .4600
S.C.S. CURVE NUMBER (AMC II) =  84
AREA-AVERAGE RUNOFF COEFFICIENT = 0.4600
SUBAREA AREA(ACRES) =   12.40   SUBAREA RUNOFF(CFS) =   23.70
TOTAL AREA(ACRES) =     12.47   TOTAL RUNOFF(CFS) =   23.84
TC(MIN.) =  15.70

****************************************************************************
FLOW PROCESS FROM NODE    104.00 TO NODE    104.00 IS CODE =   1
----------------------------------------------------------------------------
>>>>>DESIGNATE INDEPENDENT STREAM FOR CONFLUENCE<<<<<
>>>>>AND COMPUTE VARIOUS CONFLUENCED STREAM VALUES<<<<<
============================================================================
TOTAL NUMBER OF STREAMS =  2
CONFLUENCE VALUES USED FOR INDEPENDENT STREAM  2 ARE:
TIME OF CONCENTRATION(MIN.) =  15.70
RAINFALL INTENSITY(INCH/HR) =   4.16
TOTAL STREAM AREA(ACRES) =    12.47
PEAK FLOW RATE(CFS) AT CONFLUENCE =     23.84

** CONFLUENCE DATA **
STREAM     RUNOFF      Tc      INTENSITY      AREA
NUMBER      (CFS)    (MIN.)   (INCH/HOUR)    (ACRE)
    1       17.00    17.68        3.850         9.60
    2       23.84    15.70        4.156        12.47

RAINFALL INTENSITY AND TIME OF CONCENTRATION RATIO
CONFLUENCE FORMULA USED FOR  2 STREAMS.

** PEAK FLOW RATE TABLE **
STREAM     RUNOFF      Tc      INTENSITY
```

```
NUMBER       (CFS)     (MIN.)    (INCH/HOUR)
    1        38.94     15.70       4.156
    2        39.08     17.68       3.850

COMPUTED CONFLUENCE ESTIMATES ARE AS FOLLOWS:
PEAK FLOW RATE(CFS) =     39.08   Tc(MIN.) =   17.68
TOTAL AREA(ACRES) =     22.07
LONGEST FLOWPATH FROM NODE    100.00 TO NODE    104.00 =  1660.00 FEET.

****************************************************************************
FLOW PROCESS FROM NODE    104.00 TO NODE    106.00 IS CODE =  53
----------------------------------------------------------------------------
>>>>>COMPUTE NATURAL MOUNTAIN CHANNEL FLOW<<<<<
>>>>>TRAVELTIME THRU SUBAREA<<<<<
============================================================================
ELEVATION DATA: UPSTREAM(FEET) =   1975.00  DOWNSTREAM(FEET) =   1795.00
CHANNEL LENGTH THRU SUBAREA(FEET) =  1060.00   CHANNEL SLOPE =  0.1698
SLOPE ADJUSTMENT CURVE USED:
EFFECTIVE SLOPE = .1449 (PER LACFCD/RCFC&WCD HYDROLOGY MANUAL)
CHANNEL FLOW THRU SUBAREA(CFS) =     39.08
FLOW VELOCITY(FEET/SEC) =   7.23 (PER LACFCD/RCFC&WCD HYDROLOGY MANUAL)
TRAVEL TIME(MIN.) =   2.45   Tc(MIN.) =  20.13
LONGEST FLOWPATH FROM NODE    100.00 TO NODE    106.00 =  2720.00 FEET.

****************************************************************************
FLOW PROCESS FROM NODE    106.00 TO NODE    106.00 IS CODE =  81
----------------------------------------------------------------------------
>>>>>ADDITION OF SUBAREA TO MAINLINE PEAK FLOW<<<<<
============================================================================
 100 YEAR RAINFALL INTENSITY(INCH/HOUR) =  3.541
USER-SPECIFIED RUNOFF COEFFICIENT = .4600
S.C.S. CURVE NUMBER (AMC II) =  84
AREA-AVERAGE RUNOFF COEFFICIENT = 0.4600
SUBAREA AREA(ACRES) =   11.90   SUBAREA RUNOFF(CFS) =   19.38
TOTAL AREA(ACRES) =     33.97   TOTAL RUNOFF(CFS) =   55.33
TC(MIN.) =  20.13

****************************************************************************
FLOW PROCESS FROM NODE    106.00 TO NODE    106.00 IS CODE =   1
----------------------------------------------------------------------------
>>>>>DESIGNATE INDEPENDENT STREAM FOR CONFLUENCE<<<<<
============================================================================
TOTAL NUMBER OF STREAMS =  2
CONFLUENCE VALUES USED FOR INDEPENDENT STREAM  1 ARE:
TIME OF CONCENTRATION(MIN.) =  20.13
RAINFALL INTENSITY(INCH/HR) =   3.54
TOTAL STREAM AREA(ACRES) =    33.97
PEAK FLOW RATE(CFS) AT CONFLUENCE =     55.33

****************************************************************************
FLOW PROCESS FROM NODE    114.00 TO NODE    116.00 IS CODE =  21
----------------------------------------------------------------------------
>>>>>RATIONAL METHOD INITIAL SUBAREA ANALYSIS<<<<<
============================================================================
USER-SPECIFIED RUNOFF COEFFICIENT = .4600
S.C.S. CURVE NUMBER (AMC II) =  84
INITIAL SUBAREA FLOW-LENGTH(FEET) =   100.00
UPSTREAM ELEVATION(FEET) =   1272.00
DOWNSTREAM ELEVATION(FEET) =   1270.00
```

```
ELEVATION DIFFERENCE(FEET) =      2.00
SUBAREA OVERLAND TIME OF FLOW(MIN.) =    8.430
WARNING: INITIAL SUBAREA FLOW PATH LENGTH IS GREATER THAN
         THE MAXIMUM OVERLAND FLOW LENGTH =    85.00
         (Reference: Table 3-1B of Hydrology Manual)
         THE MAXIMUM OVERLAND FLOW LENGTH IS USED IN Tc CALCULATION!
 100 YEAR RAINFALL INTENSITY(INCH/HOUR) =  6.208
SUBAREA RUNOFF(CFS) =      0.49
TOTAL AREA(ACRES) =      0.17   TOTAL RUNOFF(CFS) =      0.49

****************************************************************************
FLOW PROCESS FROM NODE    116.00 TO NODE    106.00 IS CODE =  53
----------------------------------------------------------------------------
>>>>>COMPUTE NATURAL MOUNTAIN CHANNEL FLOW<<<<<
>>>>>TRAVELTIME THRU SUBAREA<<<<<
============================================================================
ELEVATION DATA: UPSTREAM(FEET) =   2172.00  DOWNSTREAM(FEET) =   1975.00
CHANNEL LENGTH THRU SUBAREA(FEET) =  2230.00   CHANNEL SLOPE =  0.0883
SLOPE ADJUSTMENT CURVE USED:
EFFECTIVE SLOPE = .0883 (PER LACFCD/RCFC&WCD HYDROLOGY MANUAL)
NOTE: CHANNEL FLOW OF 1. CFS WAS ASSUMED IN VELOCITY ESTIMATION
CHANNEL FLOW THRU SUBAREA(CFS) =      0.49
FLOW VELOCITY(FEET/SEC) =   1.66 (PER LACFCD/RCFC&WCD HYDROLOGY MANUAL)
TRAVEL TIME(MIN.) =  22.33   Tc(MIN.) =  30.76
LONGEST FLOWPATH FROM NODE    114.00 TO NODE    106.00 =  2330.00 FEET.

****************************************************************************
FLOW PROCESS FROM NODE    106.00 TO NODE    106.00 IS CODE =  81
----------------------------------------------------------------------------
>>>>>ADDITION OF SUBAREA TO MAINLINE PEAK FLOW<<<<<
============================================================================
 100 YEAR RAINFALL INTENSITY(INCH/HOUR) =  2.694
USER-SPECIFIED RUNOFF COEFFICIENT = .4600
S.C.S. CURVE NUMBER (AMC II) =  84
AREA-AVERAGE RUNOFF COEFFICIENT = 0.4600
SUBAREA AREA(ACRES) =    21.60   SUBAREA RUNOFF(CFS) =    26.76
TOTAL AREA(ACRES) =      21.77   TOTAL RUNOFF(CFS) =    26.97
TC(MIN.) =  30.76

****************************************************************************
FLOW PROCESS FROM NODE    106.00 TO NODE    106.00 IS CODE =   1
----------------------------------------------------------------------------
>>>>>DESIGNATE INDEPENDENT STREAM FOR CONFLUENCE<<<<<
>>>>>AND COMPUTE VARIOUS CONFLUENCED STREAM VALUES<<<<<
============================================================================
TOTAL NUMBER OF STREAMS =  2
CONFLUENCE VALUES USED FOR INDEPENDENT STREAM  2 ARE:
TIME OF CONCENTRATION(MIN.) =  30.76
RAINFALL INTENSITY(INCH/HR) =   2.69
TOTAL STREAM AREA(ACRES) =    21.77
PEAK FLOW RATE(CFS) AT CONFLUENCE =     26.97

** CONFLUENCE DATA **
STREAM     RUNOFF      Tc      INTENSITY      AREA
NUMBER      (CFS)    (MIN.)   (INCH/HOUR)    (ACRE)
    1       55.33    20.13       3.541         33.97
    2       26.97    30.76       2.694         21.77

RAINFALL INTENSITY AND TIME OF CONCENTRATION RATIO
```

```
CONFLUENCE FORMULA USED FOR  2 STREAMS.

** PEAK FLOW RATE TABLE **
STREAM     RUNOFF      Tc       INTENSITY
NUMBER      (CFS)    (MIN.)   (INCH/HOUR)
    1       72.99    20.13       3.541
    2       69.07    30.76       2.694

COMPUTED CONFLUENCE ESTIMATES ARE AS FOLLOWS:
PEAK FLOW RATE(CFS) =     72.99   Tc(MIN.) =   20.13
TOTAL AREA(ACRES) =     55.74
LONGEST FLOWPATH FROM NODE    100.00 TO NODE    106.00 =  2720.00 FEET.

****************************************************************************
FLOW PROCESS FROM NODE    106.00 TO NODE    118.00 IS CODE =  53
----------------------------------------------------------------------------
>>>>>COMPUTE NATURAL MOUNTAIN CHANNEL FLOW<<<<<
>>>>>TRAVELTIME THRU SUBAREA<<<<<
============================================================================
ELEVATION DATA: UPSTREAM(FEET) =   1795.00  DOWNSTREAM(FEET) =   1618.00
CHANNEL LENGTH THRU SUBAREA(FEET) =  1240.00   CHANNEL SLOPE =  0.1427
SLOPE ADJUSTMENT CURVE USED:
EFFECTIVE SLOPE = .1302 (PER LACFCD/RCFC&WCD HYDROLOGY MANUAL)
CHANNEL FLOW THRU SUBAREA(CFS) =     72.99
FLOW VELOCITY(FEET/SEC) =   8.43 (PER LACFCD/RCFC&WCD HYDROLOGY MANUAL)
TRAVEL TIME(MIN.) =   2.45   Tc(MIN.) =  22.58
LONGEST FLOWPATH FROM NODE    100.00 TO NODE    118.00 =  3960.00 FEET.

****************************************************************************
FLOW PROCESS FROM NODE    106.00 TO NODE    118.00 IS CODE =  81
----------------------------------------------------------------------------
>>>>>ADDITION OF SUBAREA TO MAINLINE PEAK FLOW<<<<<
============================================================================
 100 YEAR RAINFALL INTENSITY(INCH/HOUR) =  3.288
USER-SPECIFIED RUNOFF COEFFICIENT = .4600
S.C.S. CURVE NUMBER (AMC II) =  84
AREA-AVERAGE RUNOFF COEFFICIENT = 0.4600
SUBAREA AREA(ACRES) =   10.40   SUBAREA RUNOFF(CFS) =   15.73
TOTAL AREA(ACRES) =     66.14   TOTAL RUNOFF(CFS) =  100.04
TC(MIN.) =  22.58

****************************************************************************
FLOW PROCESS FROM NODE    200.00 TO NODE    202.00 IS CODE =  21
----------------------------------------------------------------------------
>>>>>RATIONAL METHOD INITIAL SUBAREA ANALYSIS<<<<<
============================================================================
USER-SPECIFIED RUNOFF COEFFICIENT = .4600
S.C.S. CURVE NUMBER (AMC II) =  84
INITIAL SUBAREA FLOW-LENGTH(FEET) =    70.00
UPSTREAM ELEVATION(FEET) =   1925.00
DOWNSTREAM ELEVATION(FEET) =   1915.00
ELEVATION DIFFERENCE(FEET) =     10.00
SUBAREA OVERLAND TIME OF FLOW(MIN.) =    4.474
WARNING: THE MAXIMUM OVERLAND FLOW SLOPE, 10.%, IS USED IN Tc CALCULATION!
 100 YEAR RAINFALL INTENSITY(INCH/HOUR) =  8.695
NOTE: RAINFALL INTENSITY IS BASED ON Tc = 5-MINUTE.
SUBAREA RUNOFF(CFS) =      0.20
TOTAL AREA(ACRES) =      0.05   TOTAL RUNOFF(CFS) =      0.20
```

```
****************************************************************************
  FLOW PROCESS FROM NODE    202.00 TO NODE    204.00 IS CODE =  53
----------------------------------------------------------------------------
  >>>>>COMPUTE NATURAL MOUNTAIN CHANNEL FLOW<<<<<
  >>>>>TRAVELTIME THRU SUBAREA<<<<<
============================================================================
  ELEVATION DATA: UPSTREAM(FEET) =   1915.00  DOWNSTREAM(FEET) =   1630.00
  CHANNEL LENGTH THRU SUBAREA(FEET) =  1230.00   CHANNEL SLOPE =  0.2317
  SLOPE ADJUSTMENT CURVE USED:
  EFFECTIVE SLOPE = .1739 (PER LACFCD/RCFC&WCD HYDROLOGY MANUAL)
  NOTE: CHANNEL FLOW OF 1. CFS WAS ASSUMED IN VELOCITY ESTIMATION
  CHANNEL FLOW THRU SUBAREA(CFS) =      0.20
  FLOW VELOCITY(FEET/SEC) =   2.34 (PER LACFCD/RCFC&WCD HYDROLOGY MANUAL)
  TRAVEL TIME(MIN.) =   8.78   Tc(MIN.) =  13.25
  LONGEST FLOWPATH FROM NODE    200.00 TO NODE    204.00 =  1300.00 FEET.

****************************************************************************
  FLOW PROCESS FROM NODE    204.00 TO NODE    204.00 IS CODE =  81
----------------------------------------------------------------------------
  >>>>>ADDITION OF SUBAREA TO MAINLINE PEAK FLOW<<<<<
============================================================================
   100 YEAR RAINFALL INTENSITY(INCH/HOUR) =  4.637
  USER-SPECIFIED RUNOFF COEFFICIENT = .4600
  S.C.S. CURVE NUMBER (AMC II) =  84
  AREA-AVERAGE RUNOFF COEFFICIENT = 0.4600
  SUBAREA AREA(ACRES) =     9.70   SUBAREA RUNOFF(CFS) =   20.69
  TOTAL AREA(ACRES) =       9.75   TOTAL RUNOFF(CFS) =   20.80
  TC(MIN.) =  13.25

****************************************************************************
  FLOW PROCESS FROM NODE    300.00 TO NODE    302.00 IS CODE =  21
----------------------------------------------------------------------------
  >>>>>RATIONAL METHOD INITIAL SUBAREA ANALYSIS<<<<<
============================================================================
  USER-SPECIFIED RUNOFF COEFFICIENT = .4600
  S.C.S. CURVE NUMBER (AMC II) =  84
  INITIAL SUBAREA FLOW-LENGTH(FEET) =    70.00
  UPSTREAM ELEVATION(FEET) =   1982.00
  DOWNSTREAM ELEVATION(FEET) =   1980.00
  ELEVATION DIFFERENCE(FEET) =      2.00
  SUBAREA OVERLAND TIME OF FLOW(MIN.) =    6.793
   100 YEAR RAINFALL INTENSITY(INCH/HOUR) =  7.135
  SUBAREA RUNOFF(CFS) =      0.16
  TOTAL AREA(ACRES) =       0.05   TOTAL RUNOFF(CFS) =      0.16

****************************************************************************
  FLOW PROCESS FROM NODE    302.00 TO NODE    304.00 IS CODE =  53
----------------------------------------------------------------------------
  >>>>>COMPUTE NATURAL MOUNTAIN CHANNEL FLOW<<<<<
  >>>>>TRAVELTIME THRU SUBAREA<<<<<
============================================================================
  ELEVATION DATA: UPSTREAM(FEET) =   1980.00  DOWNSTREAM(FEET) =   1645.00
  CHANNEL LENGTH THRU SUBAREA(FEET) =  1190.00   CHANNEL SLOPE =  0.2815
  SLOPE ADJUSTMENT CURVE USED:
  EFFECTIVE SLOPE = .1904 (PER LACFCD/RCFC&WCD HYDROLOGY MANUAL)
  NOTE: CHANNEL FLOW OF 1. CFS WAS ASSUMED IN VELOCITY ESTIMATION
  CHANNEL FLOW THRU SUBAREA(CFS) =      0.16
  FLOW VELOCITY(FEET/SEC) =   2.44 (PER LACFCD/RCFC&WCD HYDROLOGY MANUAL)
  TRAVEL TIME(MIN.) =   8.12   Tc(MIN.) =  14.91
```

```
 LONGEST FLOWPATH FROM NODE    300.00 TO NODE    304.00 =  1260.00 FEET.

****************************************************************************
 FLOW PROCESS FROM NODE    302.00 TO NODE    304.00 IS CODE =  81
----------------------------------------------------------------------------
 >>>>>ADDITION OF SUBAREA TO MAINLINE PEAK FLOW<<<<<
============================================================================
  100 YEAR RAINFALL INTENSITY(INCH/HOUR) =  4.297
 USER-SPECIFIED RUNOFF COEFFICIENT = .4600
 S.C.S. CURVE NUMBER (AMC II) =  84
 AREA-AVERAGE RUNOFF COEFFICIENT = 0.4600
 SUBAREA AREA(ACRES) =     8.10   SUBAREA RUNOFF(CFS) =   16.01
 TOTAL AREA(ACRES) =       8.15   TOTAL RUNOFF(CFS) =   16.11
 TC(MIN.) =  14.91
============================================================================
 END OF STUDY SUMMARY:
 TOTAL AREA(ACRES)      =      8.15  TC(MIN.) =     14.91
 PEAK FLOW RATE(CFS)    =     16.11
============================================================================
============================================================================
 END OF RATIONAL METHOD ANALYSIS
```

ERB ENGINEERING, INC.
12320 STOWE DRIVE, SUITE E
POWAY, CALIFORNIA 92064
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W.O. No. 01-25
DATE: 4/30/05
BY: EJ CK:
SHEET 1 OF: 3

DRAINAGE DATA WORKSHEET FOR: 100 year Storm
SURFACE FLOW TABLE
On Site

ANALYSIS PT FROM	TO	LINK DESC.	CODE	HIGH PT (ft)	LOW PT (ft)	FLOW PATH (ft)	AREA (acs)	"C"	REMARKS
106	106	User Input							See off Site
		Q(100) = 73.0 cfs Tc = 20.1 min							
		Area = 55.7 Ac. Area [5]							
106	400	Channel	5	1801.1	1655.6	780			
26	400	Add Area	8				4.2		Area [23]
400	400	Confl	1						1 of 2
402	404	Init. Area	2	1976.4	1970.0	30'	.01		Area [20]
404	400	Channel	5	1970.0	1655.6	1145'			
404	400	Add Area	8				3.7		Area [21]
400	400	Confl	1						2 of 2
400	406	Channel	5	1655.6	1625	460			
400	406	Add Area	8				1.1		Area [22]
406	406	Confl	1						1 of 2
408	410	Init Area	2	1897.5	1889.8	25'	.01		Area [24]
410	412	Channel	5	1889.8	1750	450			

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W.O. No. 101-25
DATE: 4/30/05
BY: EJ CK:
SHEET 2 OF: 3

DRAINAGE DATA WORKSHEET FOR: 100 year on site
SURFACE FLOW TABLE

ANALYSIS PT FROM	TO	LINK DESC.	CODE	HIGH PT (ft)	LOW PT (ft)	FLOW PATH (ft)	AREA (acs)	"C"	REMARKS
410	412	Add Area	8				1.3		Area 25
412	406	Channel	5	1750	1625	565			
412	406	Add Area	8				1.0		Area 26
406	406	Confl	1						2 of 2
20	502	Init Area	2	1900	1890	25'	.01		Area 27
502	504	Channel	5	1890	1750	387			
502	504	Add Area	8				1.02		Area 28
504	506	Channel	5	1750	1638	500			
504	506	Add Area	8				2.2		Area 29
00	602	Init Area	2	1700	1695	35	.01		Area 30
602	604	Channel	5	1695	1640	290			
602	604	Add Area	8				0.6		Area 31
0	702	Init Area	2	1944	1936	33'	.01		Area 32
702	704	Channel	5	1936	1681	913			

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W.O. No. 01-25
DATE: 4/20/05
BY: ____ CK: ____
SHEET 3 OF: 3

DRAINAGE DATA WORKSHEET FOR: 100 year Storm
SURFACE FLOW TABLE

on Site

ANALYSIS PT FROM	ANALYSIS PT TO	LINK DESC.	CODE	HIGH PT (ft)	LOW PT (ft)	FLOW PATH (ft)	AREA (acs)	"C"	REMARKS
702	704	Add Area	8				2.9		Area 33
704	706	Channel	5	1681	1640	175			
704	706	Add Area					0.4		Area 34
808	812	Init Area	2	1670	1650	105	0.13		Area 37
20	902	Init Area	2	1722	1686	88'	.04		Area 35
006	304	Init Area	2	1686	1650	183'	0.4		Area 36
100	1102	Init Area	2	1686	1664	48'	.01		Area 38
1102	1104	Channel	5	1664	1634	352'			
802	1104	Add Area	8				0.5		Area 39

```
****************************************************************************

            RATIONAL METHOD HYDROLOGY COMPUTER PROGRAM PACKAGE
            Reference: SAN DIEGO COUNTY FLOOD CONTROL DISTRICT
                         2003,1985,1981 HYDROLOGY MANUAL
        (c) Copyright 1982-2004 Advanced Engineering Software (aes)
            Ver. 2.0 Release Date: 01/01/2004  License ID 1432

                          Analysis prepared by:



 ************************** DESCRIPTION OF STUDY **************************
* 100 YEAR STORM ON SITE HYDROLOGY                                        *
* 5.3.05                                                                  *
* NEUMAN PROPERTY                                                         *
 **************************************************************************

  FILE NAME: 0125OS.DAT
  TIME/DATE OF STUDY: 10:58 05/03/2005
----------------------------------------------------------------------------
  USER SPECIFIED HYDROLOGY AND HYDRAULIC MODEL INFORMATION:
----------------------------------------------------------------------------
  2003 SAN DIEGO MANUAL CRITERIA

  USER SPECIFIED STORM EVENT(YEAR) = 100.00
  6-HOUR DURATION PRECIPITATION (INCHES) =   3.300
  SPECIFIED MINIMUM PIPE SIZE(INCH) =   6.00
  SPECIFIED PERCENT OF GRADIENTS(DECIMAL) TO USE FOR FRICTION SLOPE = 0.95
  SAN DIEGO HYDROLOGY MANUAL "C"-VALUES USED FOR RATIONAL METHOD
  NOTE: USE MODIFIED RATIONAL METHOD PROCEDURES FOR CONFLUENCE ANALYSIS
  *USER-DEFINED STREET-SECTIONS FOR COUPLED PIPEFLOW AND STREETFLOW MODEL*
     HALF-  CROWN TO   STREET-CROSSFALL:   CURB  GUTTER-GEOMETRIES:  MANNING
     WIDTH  CROSSFALL  IN-  / OUT-/PARK-  HEIGHT  WIDTH  LIP   HIKE  FACTOR
NO.   (FT)     (FT)    SIDE / SIDE/ WAY    (FT)    (FT)  (FT)  (FT)    (n)
===  =====  =========  ==================  ======  =====  =====  =====  =======
  1   30.0     20.0    0.018/0.018/0.020   0.67    2.00 0.0313 0.167 0.0150

  GLOBAL STREET FLOW-DEPTH CONSTRAINTS:
    1. Relative Flow-Depth =  0.00 FEET
       as (Maximum Allowable Street Flow Depth) - (Top-of-Curb)
    2. (Depth)*(Velocity) Constraint =  6.0 (FT*FT/S)
  *SIZE PIPE WITH A FLOW CAPACITY GREATER THAN
   OR EQUAL TO THE UPSTREAM TRIBUTARY PIPE.*

****************************************************************************
  FLOW PROCESS FROM NODE    106.00 TO NODE    106.00 IS CODE =   7
----------------------------------------------------------------------------
  >>>>>USER SPECIFIED HYDROLOGY INFORMATION AT NODE<<<<<
============================================================================
  USER-SPECIFIED VALUES ARE AS FOLLOWS:
  TC(MIN) =  20.10   RAIN INTENSITY(INCH/HOUR) =  3.54
  TOTAL AREA(ACRES) =    55.70   TOTAL RUNOFF(CFS) =     73.00
```

```
****************************************************************************
  FLOW PROCESS FROM NODE    106.00 TO NODE    400.00 IS CODE =  53
----------------------------------------------------------------------------
  >>>>>COMPUTE NATURAL MOUNTAIN CHANNEL FLOW<<<<<
  >>>>>TRAVELTIME THRU SUBAREA<<<<<
============================================================================
  ELEVATION DATA: UPSTREAM(FEET) =   1801.10  DOWNSTREAM(FEET) =   1655.60
  CHANNEL LENGTH THRU SUBAREA(FEET) =   780.00   CHANNEL SLOPE =  0.1865
  SLOPE ADJUSTMENT CURVE USED:
  EFFECTIVE SLOPE = .1533 (PER LACFCD/RCFC&WCD HYDROLOGY MANUAL)
  CHANNEL FLOW THRU SUBAREA(CFS) =     73.00
  FLOW VELOCITY(FEET/SEC) =   9.15 (PER LACFCD/RCFC&WCD HYDROLOGY MANUAL)
  TRAVEL TIME(MIN.) =   1.42   Tc(MIN.) =  21.52
  LONGEST FLOWPATH FROM NODE      0.00 TO NODE    400.00 =   780.00 FEET.

****************************************************************************
  FLOW PROCESS FROM NODE    106.00 TO NODE    400.00 IS CODE =  81
----------------------------------------------------------------------------
  >>>>>ADDITION OF SUBAREA TO MAINLINE PEAK FLOW<<<<<
============================================================================
   100 YEAR RAINFALL INTENSITY(INCH/HOUR) =  3.392
  USER-SPECIFIED RUNOFF COEFFICIENT = .4600
  S.C.S. CURVE NUMBER (AMC II) =  84
  AREA-AVERAGE RUNOFF COEFFICIENT = 0.3761
  SUBAREA AREA(ACRES) =    4.20   SUBAREA RUNOFF(CFS) =    6.55
  TOTAL AREA(ACRES) =     59.90   TOTAL RUNOFF(CFS) =   76.41
  TC(MIN.) =  21.52

****************************************************************************
  FLOW PROCESS FROM NODE    400.00 TO NODE    400.00 IS CODE =   1
----------------------------------------------------------------------------
  >>>>>DESIGNATE INDEPENDENT STREAM FOR CONFLUENCE<<<<<
============================================================================
  TOTAL NUMBER OF STREAMS =  2
  CONFLUENCE VALUES USED FOR INDEPENDENT STREAM  1 ARE:
  TIME OF CONCENTRATION(MIN.) =  21.52
  RAINFALL INTENSITY(INCH/HR) =   3.39
  TOTAL STREAM AREA(ACRES) =    59.90
  PEAK FLOW RATE(CFS) AT CONFLUENCE =     76.41

****************************************************************************
  FLOW PROCESS FROM NODE    402.00 TO NODE    404.00 IS CODE =  21
----------------------------------------------------------------------------
  >>>>>RATIONAL METHOD INITIAL SUBAREA ANALYSIS<<<<<
============================================================================
  USER-SPECIFIED RUNOFF COEFFICIENT = .4600
  S.C.S. CURVE NUMBER (AMC II) =  84
  INITIAL SUBAREA FLOW-LENGTH(FEET) =    30.00
  UPSTREAM ELEVATION(FEET) =   1976.40
  DOWNSTREAM ELEVATION(FEET) =   1970.00
  ELEVATION DIFFERENCE(FEET) =      6.40
  SUBAREA OVERLAND TIME OF FLOW(MIN.) =    2.929
  WARNING: THE MAXIMUM OVERLAND FLOW SLOPE, 10.%, IS USED IN Tc CALCULATION!
   100 YEAR RAINFALL INTENSITY(INCH/HOUR) =  8.695
  NOTE: RAINFALL INTENSITY IS BASED ON Tc = 5-MINUTE.
  SUBAREA RUNOFF(CFS) =      0.04
```

```
  TOTAL AREA(ACRES) =       0.01   TOTAL RUNOFF(CFS) =       0.04

****************************************************************************
  FLOW PROCESS FROM NODE    404.00 TO NODE    400.00 IS CODE =  81
----------------------------------------------------------------------------
  >>>>>ADDITION OF SUBAREA TO MAINLINE PEAK FLOW<<<<<
============================================================================
   100 YEAR RAINFALL INTENSITY(INCH/HOUR) =  8.695
  NOTE: RAINFALL INTENSITY IS BASED ON Tc = 5-MINUTE.
  USER-SPECIFIED RUNOFF COEFFICIENT = .4600
  S.C.S. CURVE NUMBER (AMC II) =  84
  AREA-AVERAGE RUNOFF COEFFICIENT = 0.4600
  SUBAREA AREA(ACRES) =     3.70   SUBAREA RUNOFF(CFS) =   14.80
  TOTAL AREA(ACRES) =       3.71   TOTAL RUNOFF(CFS) =   14.84
  TC(MIN.) =   2.93

****************************************************************************
  FLOW PROCESS FROM NODE    400.00 TO NODE    400.00 IS CODE =   1
----------------------------------------------------------------------------
  >>>>>DESIGNATE INDEPENDENT STREAM FOR CONFLUENCE<<<<<
  >>>>>AND COMPUTE VARIOUS CONFLUENCED STREAM VALUES<<<<<
============================================================================
  TOTAL NUMBER OF STREAMS =  2
  CONFLUENCE VALUES USED FOR INDEPENDENT STREAM  2 ARE:
  TIME OF CONCENTRATION(MIN.) =   2.93
  RAINFALL INTENSITY(INCH/HR) =   8.69
  TOTAL STREAM AREA(ACRES) =     3.71
  PEAK FLOW RATE(CFS) AT CONFLUENCE =     14.84

  ** CONFLUENCE DATA **
  STREAM     RUNOFF      Tc      INTENSITY      AREA
  NUMBER      (CFS)    (MIN.)   (INCH/HOUR)    (ACRE)
     1       76.41    21.52        3.392         59.90
     2       14.84     2.93        8.695          3.71

  RAINFALL INTENSITY AND TIME OF CONCENTRATION RATIO
  CONFLUENCE FORMULA USED FOR  2 STREAMS.

  ** PEAK FLOW RATE TABLE **
  STREAM     RUNOFF      Tc      INTENSITY
  NUMBER      (CFS)    (MIN.)   (INCH/HOUR)
     1       25.24     2.93       8.695
     2       82.19    21.52       3.392

  COMPUTED CONFLUENCE ESTIMATES ARE AS FOLLOWS:
  PEAK FLOW RATE(CFS) =     82.19   Tc(MIN.) =   21.52
  TOTAL AREA(ACRES) =     63.61
  LONGEST FLOWPATH FROM NODE      0.00 TO NODE    400.00 =   780.00 FEET.

****************************************************************************
  FLOW PROCESS FROM NODE    400.00 TO NODE    406.00 IS CODE =  53
----------------------------------------------------------------------------
  >>>>>COMPUTE NATURAL MOUNTAIN CHANNEL FLOW<<<<<
  >>>>>TRAVELTIME THRU SUBAREA<<<<<
============================================================================
  ELEVATION DATA: UPSTREAM(FEET) =   1655.60  DOWNSTREAM(FEET) =   1625.00
  CHANNEL LENGTH THRU SUBAREA(FEET) =   460.00   CHANNEL SLOPE =  0.0665
```

```
  SLOPE ADJUSTMENT CURVE USED:
  EFFECTIVE SLOPE = .0665 (PER LACFCD/RCFC&WCD HYDROLOGY MANUAL)
  CHANNEL FLOW THRU SUBAREA(CFS) =      82.19
  FLOW VELOCITY(FEET/SEC) =   6.27 (PER LACFCD/RCFC&WCD HYDROLOGY MANUAL)
  TRAVEL TIME(MIN.) =   1.22   Tc(MIN.) =  22.74
  LONGEST FLOWPATH FROM NODE      0.00 TO NODE    406.00 =  1240.00 FEET.

****************************************************************************
  FLOW PROCESS FROM NODE    400.00 TO NODE    406.00 IS CODE =  81
----------------------------------------------------------------------------
  >>>>>ADDITION OF SUBAREA TO MAINLINE PEAK FLOW<<<<<
============================================================================
   100 YEAR RAINFALL INTENSITY(INCH/HOUR) =  3.273
  USER-SPECIFIED RUNOFF COEFFICIENT = .4600
  S.C.S. CURVE NUMBER (AMC II) =  84
  AREA-AVERAGE RUNOFF COEFFICIENT = 0.3906
  SUBAREA AREA(ACRES) =     8.80   SUBAREA RUNOFF(CFS) =   13.25
  TOTAL AREA(ACRES) =      72.41   TOTAL RUNOFF(CFS) =   92.56
  TC(MIN.) =  22.74

****************************************************************************
  FLOW PROCESS FROM NODE    406.00 TO NODE    406.00 IS CODE =   1
----------------------------------------------------------------------------
  >>>>>DESIGNATE INDEPENDENT STREAM FOR CONFLUENCE<<<<<
============================================================================
  TOTAL NUMBER OF STREAMS =  2
  CONFLUENCE VALUES USED FOR INDEPENDENT STREAM  1 ARE:
  TIME OF CONCENTRATION(MIN.) =  22.74
  RAINFALL INTENSITY(INCH/HR) =   3.27
  TOTAL STREAM AREA(ACRES) =    72.41
  PEAK FLOW RATE(CFS) AT CONFLUENCE =      92.56

****************************************************************************
  FLOW PROCESS FROM NODE    408.00 TO NODE    410.00 IS CODE =  21
----------------------------------------------------------------------------
  >>>>>RATIONAL METHOD INITIAL SUBAREA ANALYSIS<<<<<
============================================================================
  USER-SPECIFIED RUNOFF COEFFICIENT = .4600
  S.C.S. CURVE NUMBER (AMC II) =  84
  INITIAL SUBAREA FLOW-LENGTH(FEET) =    25.00
  UPSTREAM ELEVATION(FEET) =   1897.50
  DOWNSTREAM ELEVATION(FEET) =   1889.80
  ELEVATION DIFFERENCE(FEET) =      7.70
  SUBAREA OVERLAND TIME OF FLOW(MIN.) =    2.674
  WARNING: THE MAXIMUM OVERLAND FLOW SLOPE, 10.%, IS USED IN Tc CALCULATION!
   100 YEAR RAINFALL INTENSITY(INCH/HOUR) =  8.695
  NOTE: RAINFALL INTENSITY IS BASED ON Tc = 5-MINUTE.
  SUBAREA RUNOFF(CFS) =      0.04
  TOTAL AREA(ACRES) =      0.01   TOTAL RUNOFF(CFS) =      0.04

****************************************************************************
  FLOW PROCESS FROM NODE    410.00 TO NODE    412.00 IS CODE =  81
----------------------------------------------------------------------------
  >>>>>ADDITION OF SUBAREA TO MAINLINE PEAK FLOW<<<<<
============================================================================
   100 YEAR RAINFALL INTENSITY(INCH/HOUR) =  8.695
  NOTE: RAINFALL INTENSITY IS BASED ON Tc = 5-MINUTE.
```

```
  USER-SPECIFIED RUNOFF COEFFICIENT = .4600
  S.C.S. CURVE NUMBER (AMC II) =  84
  AREA-AVERAGE RUNOFF COEFFICIENT = 0.4600
  SUBAREA AREA(ACRES) =     1.30   SUBAREA RUNOFF(CFS) =     5.20
  TOTAL AREA(ACRES) =       1.31   TOTAL RUNOFF(CFS) =     5.24
  TC(MIN.) =   2.67

****************************************************************************
  FLOW PROCESS FROM NODE    412.00 TO NODE    406.00 IS CODE =  53
----------------------------------------------------------------------------
  >>>>>COMPUTE NATURAL MOUNTAIN CHANNEL FLOW<<<<<
  >>>>>TRAVELTIME THRU SUBAREA<<<<<
============================================================================
  ELEVATION DATA: UPSTREAM(FEET) =   1750.00  DOWNSTREAM(FEET) =   1625.00
  CHANNEL LENGTH THRU SUBAREA(FEET) =   565.00   CHANNEL SLOPE =  0.2212
  SLOPE ADJUSTMENT CURVE USED:
  EFFECTIVE SLOPE = .1704 (PER LACFCD/RCFC&WCD HYDROLOGY MANUAL)
  CHANNEL FLOW THRU SUBAREA(CFS) =       5.24
  FLOW VELOCITY(FEET/SEC) =   4.01 (PER LACFCD/RCFC&WCD HYDROLOGY MANUAL)
  TRAVEL TIME(MIN.) =   2.35   Tc(MIN.) =   5.02
  LONGEST FLOWPATH FROM NODE    408.00 TO NODE    406.00 =   590.00 FEET.

****************************************************************************
  FLOW PROCESS FROM NODE    412.00 TO NODE    406.00 IS CODE =  81
----------------------------------------------------------------------------
  >>>>>ADDITION OF SUBAREA TO MAINLINE PEAK FLOW<<<<<
============================================================================
   100 YEAR RAINFALL INTENSITY(INCH/HOUR) =  8.672
  USER-SPECIFIED RUNOFF COEFFICIENT = .4600
  S.C.S. CURVE NUMBER (AMC II) =  84
  AREA-AVERAGE RUNOFF COEFFICIENT = 0.4600
  SUBAREA AREA(ACRES) =     1.00   SUBAREA RUNOFF(CFS) =     3.99
  TOTAL AREA(ACRES) =       2.31   TOTAL RUNOFF(CFS) =     9.21
  TC(MIN.) =   5.02

****************************************************************************
  FLOW PROCESS FROM NODE    406.00 TO NODE    406.00 IS CODE =   1
----------------------------------------------------------------------------
  >>>>>DESIGNATE INDEPENDENT STREAM FOR CONFLUENCE<<<<<
  >>>>>AND COMPUTE VARIOUS CONFLUENCED STREAM VALUES<<<<<
============================================================================
  TOTAL NUMBER OF STREAMS =  2
  CONFLUENCE VALUES USED FOR INDEPENDENT STREAM  2 ARE:
  TIME OF CONCENTRATION(MIN.) =   5.02
  RAINFALL INTENSITY(INCH/HR) =   8.67
  TOTAL STREAM AREA(ACRES) =     2.31
  PEAK FLOW RATE(CFS) AT CONFLUENCE =      9.21

  ** CONFLUENCE DATA **
  STREAM     RUNOFF      Tc      INTENSITY      AREA
  NUMBER      (CFS)    (MIN.)   (INCH/HOUR)    (ACRE)
     1       92.56    22.74        3.273        72.41
     2        9.21     5.02        8.672         2.31

  RAINFALL INTENSITY AND TIME OF CONCENTRATION RATIO
  CONFLUENCE FORMULA USED FOR  2 STREAMS.
```

```
** PEAK FLOW RATE TABLE **
STREAM     RUNOFF      Tc      INTENSITY
NUMBER      (CFS)    (MIN.)   (INCH/HOUR)
    1       44.15     5.02       8.672
    2       96.04    22.74       3.273

COMPUTED CONFLUENCE ESTIMATES ARE AS FOLLOWS:
PEAK FLOW RATE(CFS) =     96.04   Tc(MIN.) =   22.74
TOTAL AREA(ACRES) =     74.72
LONGEST FLOWPATH FROM NODE      0.00 TO NODE    406.00 =  1240.00 FEET.

****************************************************************************
FLOW PROCESS FROM NODE    500.00 TO NODE    502.00 IS CODE =  21
----------------------------------------------------------------------------
>>>>>RATIONAL METHOD INITIAL SUBAREA ANALYSIS<<<<<
============================================================================
USER-SPECIFIED RUNOFF COEFFICIENT = .4600
S.C.S. CURVE NUMBER (AMC II) =  84
INITIAL SUBAREA FLOW-LENGTH(FEET) =    25.00
UPSTREAM ELEVATION(FEET) =   1900.00
DOWNSTREAM ELEVATION(FEET) =   1890.00
ELEVATION DIFFERENCE(FEET) =     10.00
SUBAREA OVERLAND TIME OF FLOW(MIN.) =    2.674
WARNING: THE MAXIMUM OVERLAND FLOW SLOPE, 10.%, IS USED IN Tc CALCULATION!
 100 YEAR RAINFALL INTENSITY(INCH/HOUR) =  8.695
NOTE: RAINFALL INTENSITY IS BASED ON Tc = 5-MINUTE.
SUBAREA RUNOFF(CFS) =      0.04
TOTAL AREA(ACRES) =      0.01   TOTAL RUNOFF(CFS) =      0.04

****************************************************************************
FLOW PROCESS FROM NODE    502.00 TO NODE    504.00 IS CODE =  81
----------------------------------------------------------------------------
>>>>>ADDITION OF SUBAREA TO MAINLINE PEAK FLOW<<<<<
============================================================================
 100 YEAR RAINFALL INTENSITY(INCH/HOUR) =  8.695
NOTE: RAINFALL INTENSITY IS BASED ON Tc = 5-MINUTE.
USER-SPECIFIED RUNOFF COEFFICIENT = .4600
S.C.S. CURVE NUMBER (AMC II) =  84
AREA-AVERAGE RUNOFF COEFFICIENT = 0.4600
SUBAREA AREA(ACRES) =    1.02   SUBAREA RUNOFF(CFS) =    4.08
TOTAL AREA(ACRES) =      1.03   TOTAL RUNOFF(CFS) =    4.12
TC(MIN.) =   2.67

****************************************************************************
FLOW PROCESS FROM NODE    504.00 TO NODE    506.00 IS CODE =  53
----------------------------------------------------------------------------
>>>>>COMPUTE NATURAL MOUNTAIN CHANNEL FLOW<<<<<
>>>>>TRAVELTIME THRU SUBAREA<<<<<
============================================================================
ELEVATION DATA: UPSTREAM(FEET) =   1750.00  DOWNSTREAM(FEET) =   1638.00
CHANNEL LENGTH THRU SUBAREA(FEET) =   500.00   CHANNEL SLOPE =  0.2240
SLOPE ADJUSTMENT CURVE USED:
EFFECTIVE SLOPE = .1713 (PER LACFCD/RCFC&WCD HYDROLOGY MANUAL)
CHANNEL FLOW THRU SUBAREA(CFS) =      4.12
FLOW VELOCITY(FEET/SEC) =   3.71 (PER LACFCD/RCFC&WCD HYDROLOGY MANUAL)
TRAVEL TIME(MIN.) =   2.24   Tc(MIN.) =   4.92
LONGEST FLOWPATH FROM NODE    500.00 TO NODE    506.00 =   525.00 FEET.
```

```
****************************************************************************
  FLOW PROCESS FROM NODE    504.00 TO NODE    506.00 IS CODE =  81
----------------------------------------------------------------------------
  >>>>>ADDITION OF SUBAREA TO MAINLINE PEAK FLOW<<<<<
============================================================================
   100 YEAR RAINFALL INTENSITY(INCH/HOUR) =  8.695
  NOTE: RAINFALL INTENSITY IS BASED ON Tc = 5-MINUTE.
  USER-SPECIFIED RUNOFF COEFFICIENT = .4600
  S.C.S. CURVE NUMBER (AMC II) =  84
  AREA-AVERAGE RUNOFF COEFFICIENT = 0.4600
  SUBAREA AREA(ACRES) =     2.20   SUBAREA RUNOFF(CFS) =     8.80
  TOTAL AREA(ACRES) =       3.23   TOTAL RUNOFF(CFS) =   12.92
  TC(MIN.) =   4.92

****************************************************************************
  FLOW PROCESS FROM NODE    600.00 TO NODE    602.00 IS CODE =  21
----------------------------------------------------------------------------
  >>>>>RATIONAL METHOD INITIAL SUBAREA ANALYSIS<<<<<
============================================================================
  USER-SPECIFIED RUNOFF COEFFICIENT = .4600
  S.C.S. CURVE NUMBER (AMC II) =  84
  INITIAL SUBAREA FLOW-LENGTH(FEET) =    35.00
  UPSTREAM ELEVATION(FEET) =   1700.00
  DOWNSTREAM ELEVATION(FEET) =   1695.00
  ELEVATION DIFFERENCE(FEET) =      5.00
  SUBAREA OVERLAND TIME OF FLOW(MIN.) =    3.164
  WARNING: THE MAXIMUM OVERLAND FLOW SLOPE, 10.%, IS USED IN Tc CALCULATION!
   100 YEAR RAINFALL INTENSITY(INCH/HOUR) =  8.695
  NOTE: RAINFALL INTENSITY IS BASED ON Tc = 5-MINUTE.
  SUBAREA RUNOFF(CFS) =      0.04
  TOTAL AREA(ACRES) =       0.01   TOTAL RUNOFF(CFS) =      0.04

****************************************************************************
  FLOW PROCESS FROM NODE    602.00 TO NODE    604.00 IS CODE =  81
----------------------------------------------------------------------------
  >>>>>ADDITION OF SUBAREA TO MAINLINE PEAK FLOW<<<<<
============================================================================
   100 YEAR RAINFALL INTENSITY(INCH/HOUR) =  8.695
  NOTE: RAINFALL INTENSITY IS BASED ON Tc = 5-MINUTE.
  USER-SPECIFIED RUNOFF COEFFICIENT = .4600
  S.C.S. CURVE NUMBER (AMC II) =  84
  AREA-AVERAGE RUNOFF COEFFICIENT = 0.4600
  SUBAREA AREA(ACRES) =     0.60   SUBAREA RUNOFF(CFS) =     2.40
  TOTAL AREA(ACRES) =       0.61   TOTAL RUNOFF(CFS) =    2.44
  TC(MIN.) =   3.16

****************************************************************************
  FLOW PROCESS FROM NODE    700.00 TO NODE    702.00 IS CODE =  21
----------------------------------------------------------------------------
  >>>>>RATIONAL METHOD INITIAL SUBAREA ANALYSIS<<<<<
============================================================================
  USER-SPECIFIED RUNOFF COEFFICIENT = .4600
  S.C.S. CURVE NUMBER (AMC II) =  84
  INITIAL SUBAREA FLOW-LENGTH(FEET) =    33.00
  UPSTREAM ELEVATION(FEET) =   1944.00
  DOWNSTREAM ELEVATION(FEET) =   1936.00
```

```
  ELEVATION DIFFERENCE(FEET) =       8.00
  SUBAREA OVERLAND TIME OF FLOW(MIN.) =     3.072
  WARNING: THE MAXIMUM OVERLAND FLOW SLOPE, 10.%, IS USED IN Tc CALCULATION!
   100 YEAR RAINFALL INTENSITY(INCH/HOUR) =  8.695
  NOTE: RAINFALL INTENSITY IS BASED ON Tc = 5-MINUTE.
  SUBAREA RUNOFF(CFS) =       0.40
  TOTAL AREA(ACRES) =       0.10   TOTAL RUNOFF(CFS) =       0.40

****************************************************************************
  FLOW PROCESS FROM NODE    702.00 TO NODE    704.00 IS CODE =  53
----------------------------------------------------------------------------
  >>>>>COMPUTE NATURAL MOUNTAIN CHANNEL FLOW<<<<<
  >>>>>TRAVELTIME THRU SUBAREA<<<<<
============================================================================
  ELEVATION DATA: UPSTREAM(FEET) =   1936.00  DOWNSTREAM(FEET) =   1681.00
  CHANNEL LENGTH THRU SUBAREA(FEET) =   913.00   CHANNEL SLOPE =  0.2793
  SLOPE ADJUSTMENT CURVE USED:
  EFFECTIVE SLOPE = .1898 (PER LACFCD/RCFC&WCD HYDROLOGY MANUAL)
  NOTE: CHANNEL FLOW OF 1. CFS WAS ASSUMED IN VELOCITY ESTIMATION
  CHANNEL FLOW THRU SUBAREA(CFS) =       0.40
  FLOW VELOCITY(FEET/SEC) =   2.44 (PER LACFCD/RCFC&WCD HYDROLOGY MANUAL)
  TRAVEL TIME(MIN.) =   6.24   Tc(MIN.) =   9.31
  LONGEST FLOWPATH FROM NODE    700.00 TO NODE    704.00 =   946.00 FEET.

****************************************************************************
  FLOW PROCESS FROM NODE    702.00 TO NODE    704.00 IS CODE =  81
----------------------------------------------------------------------------
  >>>>>ADDITION OF SUBAREA TO MAINLINE PEAK FLOW<<<<<
============================================================================
   100 YEAR RAINFALL INTENSITY(INCH/HOUR) =  5.823
  USER-SPECIFIED RUNOFF COEFFICIENT = .4600
  S.C.S. CURVE NUMBER (AMC II) =  84
  AREA-AVERAGE RUNOFF COEFFICIENT = 0.4600
  SUBAREA AREA(ACRES) =     2.90   SUBAREA RUNOFF(CFS) =     7.77
  TOTAL AREA(ACRES) =       3.00   TOTAL RUNOFF(CFS) =     8.04
  TC(MIN.) =   9.31

****************************************************************************
  FLOW PROCESS FROM NODE    704.00 TO NODE    706.00 IS CODE =  53
----------------------------------------------------------------------------
  >>>>>COMPUTE NATURAL MOUNTAIN CHANNEL FLOW<<<<<
  >>>>>TRAVELTIME THRU SUBAREA<<<<<
============================================================================
  ELEVATION DATA: UPSTREAM(FEET) =   1681.00  DOWNSTREAM(FEET) =   1640.00
  CHANNEL LENGTH THRU SUBAREA(FEET) =   175.00   CHANNEL SLOPE =  0.2343
  SLOPE ADJUSTMENT CURVE USED:
  EFFECTIVE SLOPE = .1748 (PER LACFCD/RCFC&WCD HYDROLOGY MANUAL)
  CHANNEL FLOW THRU SUBAREA(CFS) =       8.04
  FLOW VELOCITY(FEET/SEC) =   4.69 (PER LACFCD/RCFC&WCD HYDROLOGY MANUAL)
  TRAVEL TIME(MIN.) =   0.62   Tc(MIN.) =   9.93
  LONGEST FLOWPATH FROM NODE    700.00 TO NODE    706.00 =  1121.00 FEET.

****************************************************************************
  FLOW PROCESS FROM NODE    704.00 TO NODE    706.00 IS CODE =  81
----------------------------------------------------------------------------
  >>>>>ADDITION OF SUBAREA TO MAINLINE PEAK FLOW<<<<<
============================================================================
```

```
 100 YEAR RAINFALL INTENSITY(INCH/HOUR) =  5.585
USER-SPECIFIED RUNOFF COEFFICIENT = .4600
S.C.S. CURVE NUMBER (AMC II) =  84
AREA-AVERAGE RUNOFF COEFFICIENT = 0.4600
SUBAREA AREA(ACRES) =     0.40   SUBAREA RUNOFF(CFS) =     1.03
TOTAL AREA(ACRES) =       3.40   TOTAL RUNOFF(CFS) =     8.73
TC(MIN.) =    9.93
```

808 812

```
****************************************************************************
FLOW PROCESS FROM NODE    808.00 TO NODE    812.00 IS CODE =  21
----------------------------------------------------------------------------
>>>>>RATIONAL METHOD INITIAL SUBAREA ANALYSIS<<<<<
============================================================================
USER-SPECIFIED RUNOFF COEFFICIENT = .4600
S.C.S. CURVE NUMBER (AMC II) =  84
INITIAL SUBAREA FLOW-LENGTH(FEET) =   105.00
UPSTREAM ELEVATION(FEET) =   1670.00
DOWNSTREAM ELEVATION(FEET) =   1650.00
ELEVATION DIFFERENCE(FEET) =     20.00
SUBAREA OVERLAND TIME OF FLOW(MIN.) =    5.348
WARNING: INITIAL SUBAREA FLOW PATH LENGTH IS GREATER THAN
         THE MAXIMUM OVERLAND FLOW LENGTH =   100.00
         (Reference: Table 3-1B of Hydrology Manual)
         THE MAXIMUM OVERLAND FLOW LENGTH IS USED IN Tc CALCULATION!
 100 YEAR RAINFALL INTENSITY(INCH/HOUR) =  8.326
SUBAREA RUNOFF(CFS) =      0.50
TOTAL AREA(ACRES) =      0.13   TOTAL RUNOFF(CFS) =      0.50

****************************************************************************
FLOW PROCESS FROM NODE    900.00 TO NODE    902.00 IS CODE =  21
----------------------------------------------------------------------------
>>>>>RATIONAL METHOD INITIAL SUBAREA ANALYSIS<<<<<
============================================================================
USER-SPECIFIED RUNOFF COEFFICIENT = .4600
S.C.S. CURVE NUMBER (AMC II) =  84
INITIAL SUBAREA FLOW-LENGTH(FEET) =     0.04
UPSTREAM ELEVATION(FEET) =   1722.00
DOWNSTREAM ELEVATION(FEET) =   1686.00
ELEVATION DIFFERENCE(FEET) =     36.00
SUBAREA OVERLAND TIME OF FLOW(MIN.) =    0.107
WARNING: THE MAXIMUM OVERLAND FLOW SLOPE, 10.%, IS USED IN Tc CALCULATION!
 100 YEAR RAINFALL INTENSITY(INCH/HOUR) =  8.695
NOTE: RAINFALL INTENSITY IS BASED ON Tc = 5-MINUTE.
SUBAREA RUNOFF(CFS) =      0.16
TOTAL AREA(ACRES) =      0.04   TOTAL RUNOFF(CFS) =      0.16

****************************************************************************
FLOW PROCESS FROM NODE   1006.00 TO NODE    304.00 IS CODE =  21
----------------------------------------------------------------------------
>>>>>RATIONAL METHOD INITIAL SUBAREA ANALYSIS<<<<<
============================================================================
USER-SPECIFIED RUNOFF COEFFICIENT = .4600
S.C.S. CURVE NUMBER (AMC II) =  84
INITIAL SUBAREA FLOW-LENGTH(FEET) =   183.00
UPSTREAM ELEVATION(FEET) =   1686.00
DOWNSTREAM ELEVATION(FEET) =   1650.00
ELEVATION DIFFERENCE(FEET) =     36.00
```

```
SUBAREA OVERLAND TIME OF FLOW(MIN.) =    5.348
WARNING: INITIAL SUBAREA FLOW PATH LENGTH IS GREATER THAN
         THE MAXIMUM OVERLAND FLOW LENGTH =   100.00
         (Reference: Table 3-1B of Hydrology Manual)
         THE MAXIMUM OVERLAND FLOW LENGTH IS USED IN Tc CALCULATION!
 100 YEAR RAINFALL INTENSITY(INCH/HOUR) =  8.326
SUBAREA RUNOFF(CFS) =      1.53
TOTAL AREA(ACRES) =      0.40   TOTAL RUNOFF(CFS) =      1.53

****************************************************************************
FLOW PROCESS FROM NODE   1100.00 TO NODE   1102.00 IS CODE =  21
----------------------------------------------------------------------------
>>>>>RATIONAL METHOD INITIAL SUBAREA ANALYSIS<<<<<
============================================================================
USER-SPECIFIED RUNOFF COEFFICIENT = .4600
S.C.S. CURVE NUMBER (AMC II) =  84
INITIAL SUBAREA FLOW-LENGTH(FEET) =    48.00
UPSTREAM ELEVATION(FEET) =   1686.00
DOWNSTREAM ELEVATION(FEET) =   1664.00
ELEVATION DIFFERENCE(FEET) =     22.00
SUBAREA OVERLAND TIME OF FLOW(MIN.) =    3.705
WARNING: THE MAXIMUM OVERLAND FLOW SLOPE, 10.%, IS USED IN Tc CALCULATION!
 100 YEAR RAINFALL INTENSITY(INCH/HOUR) =  8.695
NOTE: RAINFALL INTENSITY IS BASED ON Tc = 5-MINUTE.
SUBAREA RUNOFF(CFS) =      0.40
TOTAL AREA(ACRES) =      0.10   TOTAL RUNOFF(CFS) =      0.40

****************************************************************************
FLOW PROCESS FROM NODE   1102.00 TO NODE   1104.00 IS CODE =  53
----------------------------------------------------------------------------
>>>>>COMPUTE NATURAL MOUNTAIN CHANNEL FLOW<<<<<
>>>>>TRAVELTIME THRU SUBAREA<<<<<
============================================================================
ELEVATION DATA: UPSTREAM(FEET) =   1664.00  DOWNSTREAM(FEET) =   1634.00
CHANNEL LENGTH THRU SUBAREA(FEET) =   352.00   CHANNEL SLOPE =  0.0852
SLOPE ADJUSTMENT CURVE USED:
EFFECTIVE SLOPE = .0852 (PER LACFCD/RCFC&WCD HYDROLOGY MANUAL)
NOTE: CHANNEL FLOW OF 1. CFS WAS ASSUMED IN VELOCITY ESTIMATION
CHANNEL FLOW THRU SUBAREA(CFS) =      0.40
FLOW VELOCITY(FEET/SEC) =   1.63 (PER LACFCD/RCFC&WCD HYDROLOGY MANUAL)
TRAVEL TIME(MIN.) =   3.59   Tc(MIN.) =   7.29
LONGEST FLOWPATH FROM NODE   1100.00 TO NODE   1104.00 =   400.00 FEET.

****************************************************************************
FLOW PROCESS FROM NODE   1102.00 TO NODE   1104.00 IS CODE =  81
----------------------------------------------------------------------------
>>>>>ADDITION OF SUBAREA TO MAINLINE PEAK FLOW<<<<<
============================================================================
 100 YEAR RAINFALL INTENSITY(INCH/HOUR) =  6.816
USER-SPECIFIED RUNOFF COEFFICIENT = .4600
S.C.S. CURVE NUMBER (AMC II) =  84
AREA-AVERAGE RUNOFF COEFFICIENT = 0.4600
SUBAREA AREA(ACRES) =     0.05   SUBAREA RUNOFF(CFS) =     0.16
TOTAL AREA(ACRES) =      0.15   TOTAL RUNOFF(CFS) =    0.47
TC(MIN.) =   7.29
============================================================================
END OF STUDY SUMMARY:
```

```
TOTAL AREA(ACRES)      =      0.15  TC(MIN.) =      7.29
PEAK FLOW RATE(CFS)    =      0.47
================================================================================
================================================================================
END OF RATIONAL METHOD ANALYSIS
```

APPENDIX B

C. Little
2/22/07

Addendum to Preliminary Hydrology/Drainage Study for Tentative Parcel Map

This addendum is in response to the County of San Diego's scoping letter of 11/03/2005. The comments and response to those comments are as follows:

1. All proposed culverts utilizing HDPE are required to comply with the County of San Diego Department of Public Works Material Lab report dated January 14, 2004.

   Response: All culverts are called out as CMP(corrugated metal pipe) on the Preliminary Grading Plan. The culvert capacities have been re-calculated in the Preliminary Hydrology/Drainage Study.

2. Show 100-year flood lines of inundation on map of channel with basins greater than 25 sq. miles.

   Response: The approximate 100-year line of inundation is now shown on the Tentative Parcel Map and Preliminary Grading Plan. The calculations are also included in the study.

3. Include peak runoff rates (cfs) and velocities (fps) for pre-development and post-development. The comparison should be made about the same discharge points fore each drainage basin affecting the site and adjacent properties.

   Response: A list comparing peak runoff rates and velocities between the pre and post development at common nodes is now included in this study. However, the difference between the pre-development drainage study that was done delineating the water shed off of the 200 scale topography maps and the post-development drainage study that was done delineating the water shed off of the 40 scale aerial topography is negligible. The proposed development will only increase impervious areas negligibly, about a half of an acre from the asphalt and concrete driveway.

Comparison of Pre-development and Post-development Nodes

Pre-development Node	Post-development Node	Post-development Q(cfs)&V(fps)		Pre-development Q(cfs)&V(fps)
304	304	16.1	2.4	16.1
	812	0.5		
	706	8.7	5.8	
	604	2.4	7.6	
204	506	12.9	5.7	20.7
	1104	0.5		
118	406	96.0	8.0	100

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2/22/07

1/3

* Evaluate Watersheds > 25 acres

Node 106 to major tributarion
From the north Watershed Area = ?
From Drainage Study Areas 9, 7 contribute
A_9 = 0.17 acres
A_7 = 21.6 acres
A_{total} = 21.8 acres < 25 acres
From the east Watershed Area = ?
From Drainage Study Areas 1, 2, 3, 4, and 5
A_1 = 0.1 acre
A_2 = 9.5 acre
A_3 = 0.07 acre
A_4 = 12.40 acre
A_5 = 11.90 acre
A_{total} = 33.97 acres > 25 acres

* Calculate line of inundation during a 100 year storm event
Locate thalweg, Station thalweg, make cross sections, from Drainage Study determine flows at cross section, use Manning's formula to determine (trial & error solution) wetted perimeter
Evaluate flow characteristics at Sta.'s 2+00, 6+00, 12+00, 14+00

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2/22/07 2/3

Flows from Drainage Study
@ Sta. 2+00 Q = 39 cfs
@ Sta. 6+00 Q = 100 cfs
@ Sta. 12+00 Q = 100 cfs
@ Sta. 14+00 Q = 100 cfs

Thalweg ℄ located and stationed. Profile generated, see attached station w/ elevations and slopes generated from profile of thalweg.

Cross Sections generated. See attached w/ final results for each cross section.

Mannings Equations for Open Channels

$$Q = A\left(\frac{1.486}{n}\right)\left(R^{2/3}\right)\left(S^{1/2}\right)$$

n = manning coefficient see attached Table 7.4 use .055

A = area

R = hydraulic radius = $\frac{A}{P}$ (area of wetted section / wetted perimeter)

S = slope

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2/22/07
3/3

For each cross section, a depth was assumed and the wetted areas and perimeter calculated. Trial and error calculations to equal the flow requirements at that cross section

For example Sta. 6+00
Dept = 2.5 ft S = .0375
Area = 24.45 ft^2
P = 38.17 ft

$$Q = (24.45)\left(\frac{1.486}{.055}\right)\left(\frac{24.45}{38.17}\right)^{2/3}(.0375)^{1/2}$$

$$= 95.23 \text{ cfs} \simeq 100 \text{ cfs}$$

of thalweg Use following stations

Profile Station Report 2/21/2007 16:04

ation> 2+00.00 Elevation> 1808.53 Slope> -8.75%
Station> 4+00.00 Elevation> 1793.59 Slope> -5.00%
Station> 6+00.00 Elevation> 1791.01 Slope> -3.75%
Station> 8+00.00 Elevation> 1758.96 Slope> -18.75%
ation> 10+00.00 Elevation> 1677.18 Slope> -38.75%
Station> 12+00.00 Elevation> 1658.10 Slope> -6.88%
Station> 14+00.00 Elevation> 1635.16 Slope> -2.15%

TABLE 7.14 Values of n to Be Used with Manning Formula

Surface	Best	Good	Fair	Bad
Uncoated cast-iron pipe	0.012	0.013	0.014	0.015
Coated cast-iron pipe	0.011	0.012*	0.013*	
Commercial wrought-iron pipe, black	0.012	0.013	0.014	0.015
Commercial wrought-iron pipe, galvanized	0.013	0.014	0.015	0.017
Smooth brass and glass pipe	0.009	0.010	0.011	0.013
Smooth lockbar and welded "OD" pipe	0.010	0.011*	0.013*	
Riveted and spiral steel pipe	0.013	0.015*	0.017*	
Vitrified sewer pipe	{0.010, 0.011}	0.013*	0.015	0.017
Common clay drainage tile	0.011	0.012*	0.014*	0.017
Glazed brickwork	0.011	0.012	0.013*	0.015
Brick in cement mortar, brick sewers	0.012	0.013	0.015*	0.017
Neat cement surfaces	0.010	0.011	0.012	0.013
Cement mortar surfaces	0.011	0.012	0.013*	0.015
Concrete pipe	0.012	0.013	0.015*	0.016
Wood stave pipe	0.010	0.011	0.012	0.013
Plank flumes:				
Planed	0.010	0.012*	0.013	0.014
Unplaned	0.011	0.013*	0.014	0.015
With battens	0.012	0.015*	0.016	
Concrete-lined channels	0.012	0.014*	0.016*	0.018
Cement-rubble surface	0.017	0.020	0.025	0.030
Dry-rubble surface	0.025	0.030	0.033	0.035
Dressed-ashlar surface	0.013	0.014	0.015	0.017
Semicircular metal flumes, smooth	0.011	0.012	0.013	0.015
Semicircular metal flumes, corrugated	0.0225	0.025	0.0275	0.030
Canals and ditches:				
Earth, straight and uniform	0.017	0.020	0.0225*	0.025
Rock cuts, smooth and uniform	0.025	0.030	0.033*	0.035
Rock cuts, jagged and irregular	0.035	0.040	0.045	
Winding sluggish canals	0.0225	0.025*	0.0275	0.030
Dredged earth channels	0.025	0.0275*	0.030	0.033
Canals with rough stony beds, weeds on earth banks	0.025	0.030	0.035*	0.040
Earth bottom, rubble sides	0.028	0.030*	0.033*	0.035
Natural stream channels:				
(1) Clean, straight bank, full stage, no rifts or deep pools	0.025	0.0275	0.030	0.033
(2) As (1), but some weeds and stones	0.030	0.033	0.035	0.040
(3) Winding, some pools and shoals, clean	0.033	0.035	0.040	0.045
(4) As (3), lower stages, more ineffective slope and sections	0.040	0.045	0.050	0.055
(5) As (3), some weeds and stones	0.035	0.040	0.045	0.050
(6) As (4), stony sections	0.045	0.050	0.055	0.060
(7) Sluggish river reaches, rather weedy or with very deep pools	0.050	0.060	0.070	0.080
(8) Very weedy reaches	0.075	0.100	0.125	0.150

*Values commonly used in design.

Noneroding Velocities

Fortier and Scobey[7] pointed out that there is no sharp line of demarcation between the velocities that can no longer maintain silt in movement and those that will scour a canal bed. It is believed that there is a broad belt of velocities between these two "critical" velocities within which silt already loosened or brought in through a headgate will remain in suspension while the bed will not be scoured. In general, old and well-seasoned canals will stand much higher velocities than new ones. This is true particularly if the canal bed or the silt conveyed by the stream contains colloidal matter. Colloids, as applied to soils, give the properties of plasticity, cohesion, toughness when wet, and hardness when dry that are essential to an erosion-resisting soil.

Table 7.15 contains canal velocities that are recommended. The following conclusions were drawn by Fortier and Scobey.

1. The laws of hydraulics governing the movement of loose silt and detritus in open channels are only distantly related to the laws governing the scouring of a canal bed and are not directly applicable.

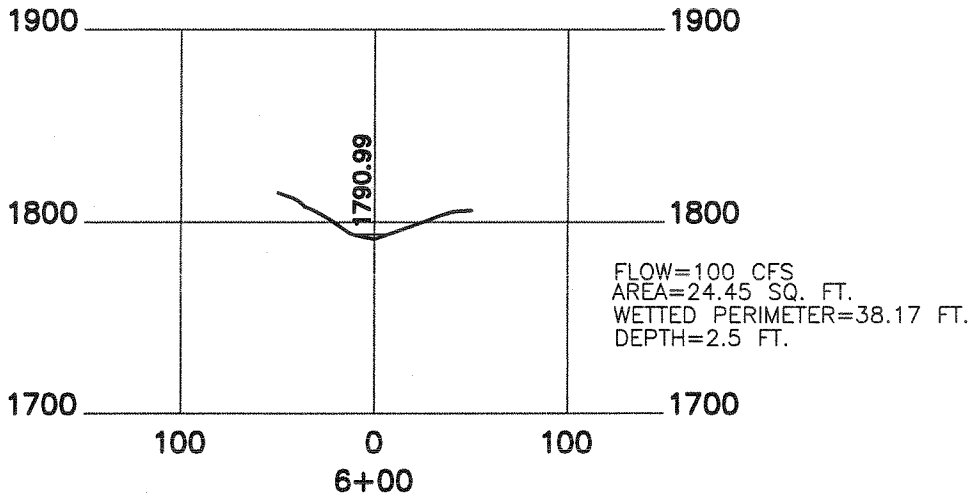
2. The material of seasoned canal beds is composed of particles of different sizes, and when the interstices of the larger are filled by the smaller, the mass becomes more dense, stable, and less subject to the erosive action of water.

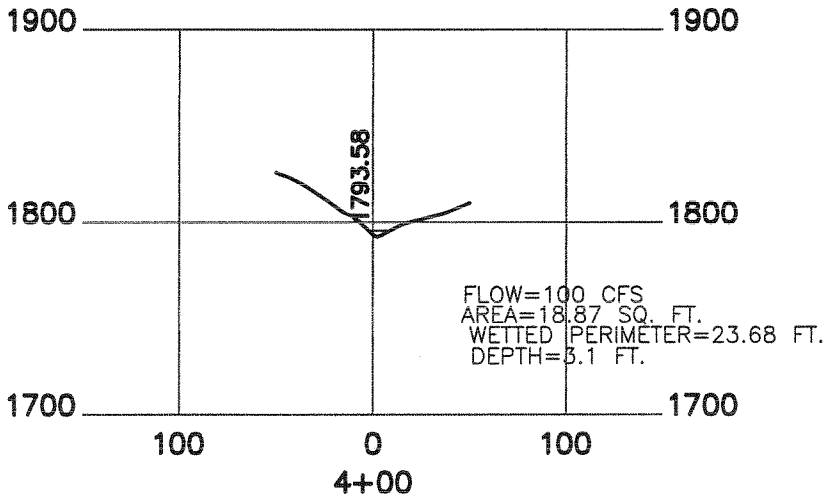
3. The velocity required to ravel and scour a well-bedded canal in any material is much greater than the velocity required to maintain movement of particles of that same material before becoming bedded or that have been raveled off by higher velocities than the bed would stand.

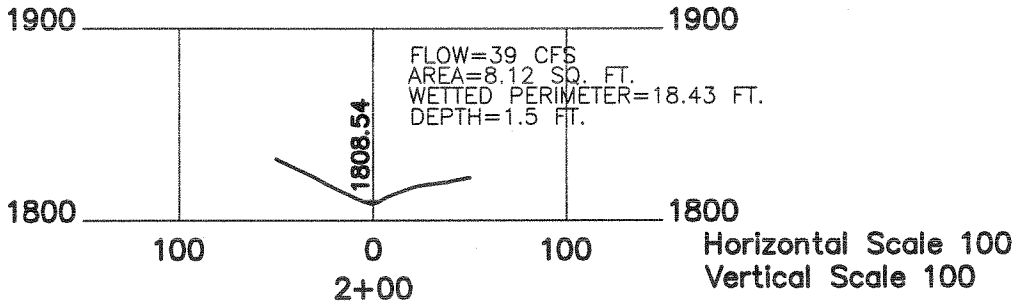
4. Colloids in either the material of the canal bed or the water conveyed by it, or in both, tend to cement particles of clay, silt, sand, and gravel in such a way as to resist erosive effects.

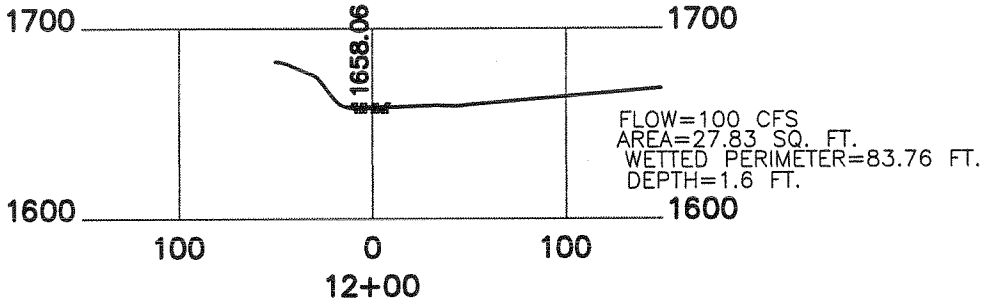
5. The grading of material running from fine to coarse, coupled with the adhesion between particles brought about by colloids, makes possible high mean velocities without any appreciable scouring effect.

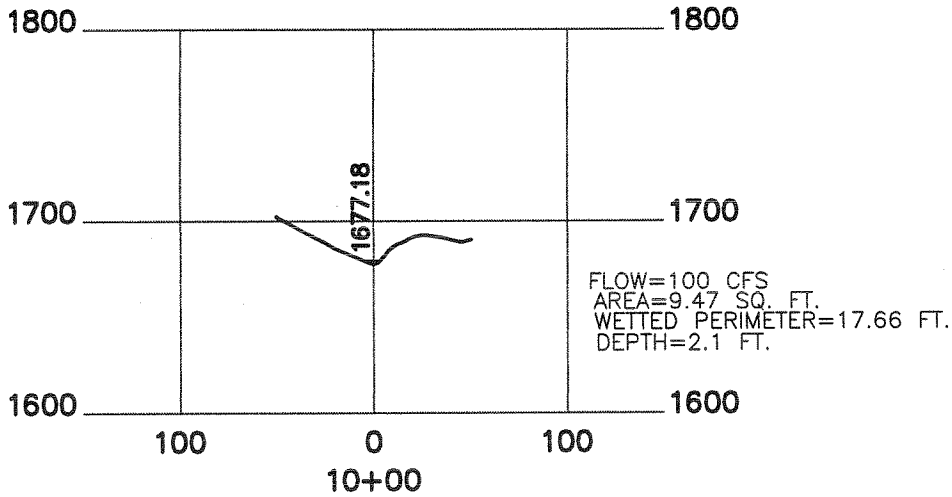
6. Irrigation canals may be designed for the velocity that is permissible when seasoned by age, as the demand for water grows with the age of the canal and the maximum mean velocity grows with the supply necessary to satisfy this demand.

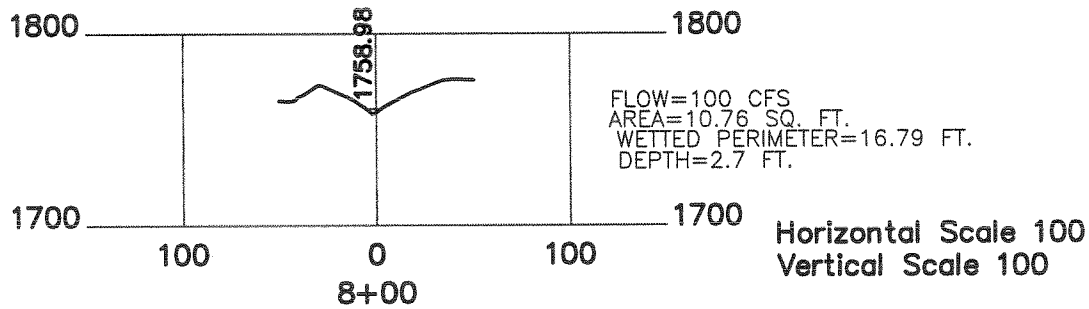

1900
1800
1700
1790.99
FLOW=100 CFS
AREA=24.45 SQ. FT.
WETTED PERIMETER=38.17 FT.
DEPTH=2.5 FT.
100
0
100
6+00

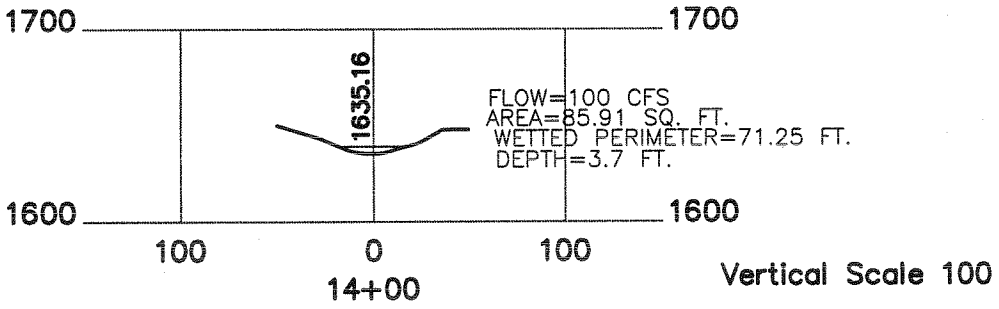

1900
1800
1700
1793.58
FLOW=100 CFS
AREA=18.87 SQ. FT.
WETTED PERIMETER=23.68 FT.
DEPTH=3.1 FT.
100
0
100
4+00


1900
1800
1808.54
FLOW=39 CFS
AREA=8.12 SQ. FT.
WETTED PERIMETER=18.43 FT.
DEPTH=1.5 FT.
100
0
100
2+00
Horizontal Scale 100
Vertical Scale 100


1700
1700
1658.06
FLOW=100 CFS
AREA=27.83 SQ. FT.
WETTED PERIMETER=83.76 FT.
DEPTH=1.6 FT.
1600
1600
100
0
100
12+00


1800
1800
1677.18
1700
1700
FLOW=100 CFS
AREA=9.47 SQ. FT.
WETTED PERIMETER=17.66 FT.
DEPTH=2.1 FT.
1600
1600
100
0
100
10+00


1800
1800
1758.98
FLOW=100 CFS
AREA=10.76 SQ. FT.
WETTED PERIMETER=16.79 FT.
DEPTH=2.7 FT.
1700
1700
100
0
100
8+00
Horizontal Scale 100
Vertical Scale 100


1700
1700
1635.16
FLOW=100 CFS
AREA=85.91 SQ. FT.
WETTED PERIMETER=71.25 FT.
DEPTH=3.7 FT.
1600
1600
100
0
100
14+00
Vertical Scale 100

C. Little
2/22/07

Calculate Runoff from Driveway

$A = 0.48$ acres impervious

$(P_6)_{100} = 3.3$ inches

$C = 0.90$

$L = 1690 - 570 = 1120'$ Avg Slope = 14.9%

$\Delta e = 1803 - 1636 = 167$ ft elev Δ

$T = T_i + T_t$

Use Table 3-2 SDCHM June 2003

MDR = 1 10% $T_i = 6.4$ min

$L_i = 100$

T_t = travel time in curb & gutter

Assume $Q = 3$ cfs

From Fig. 3-6 See attached $V = 7.8$ fps

$$T_t = \frac{1120'}{7.8 f/s} \cdot \frac{1 min}{60 sec} = 2.4 \text{ min}$$

$T = T_i + T_t = 6.4$ min $+ 2.4$ min $= 8.8$ min

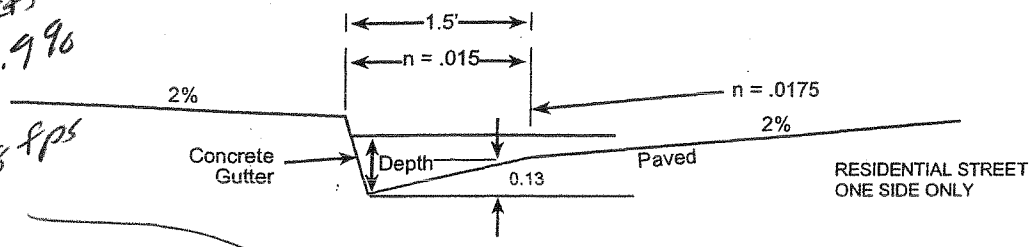
$$I = 7.44 (3.3)^{-0.695} 8.8$$

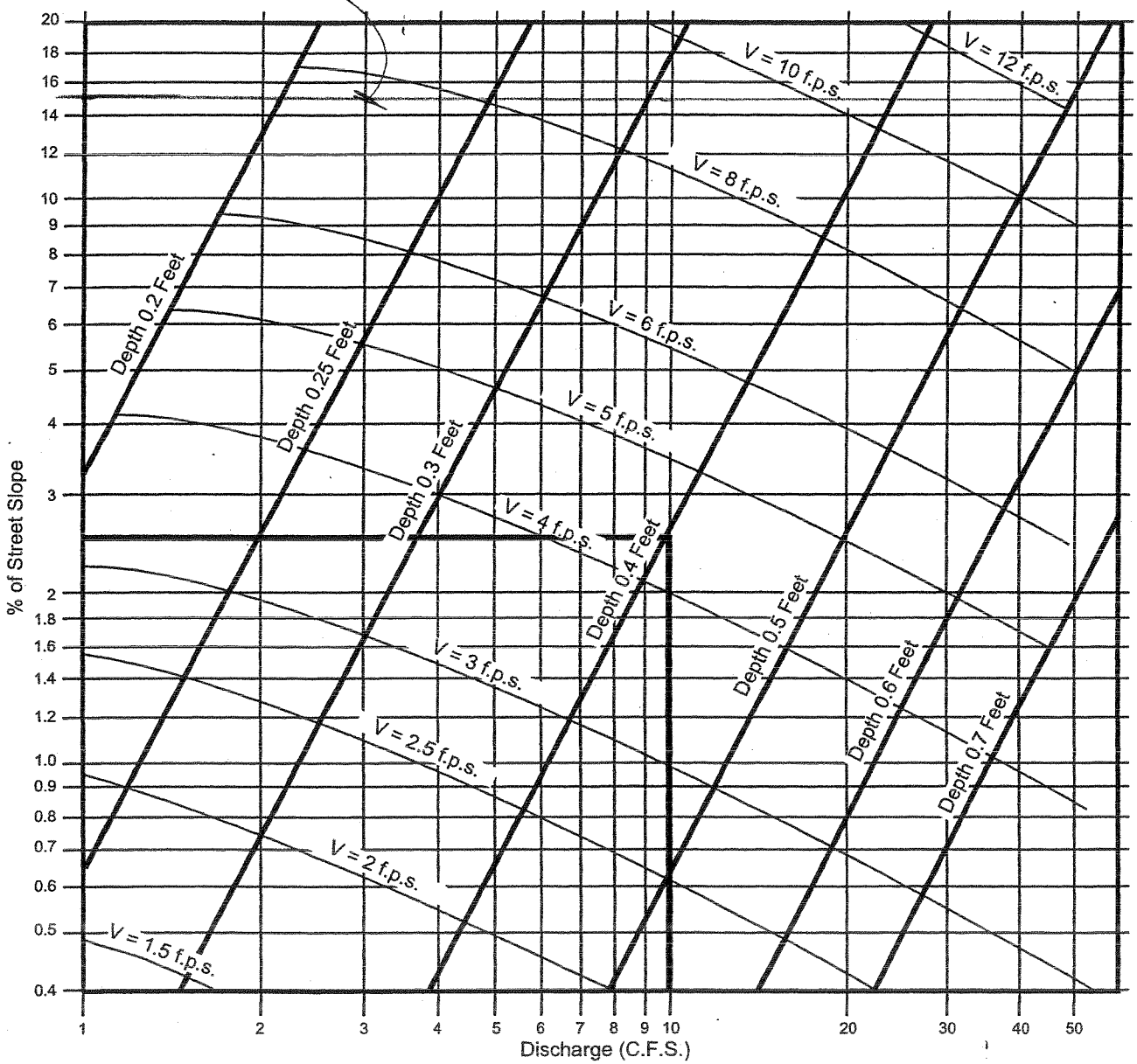
$= 6.0$ in/hr

$$Q_{100} = CIA = 0.90 (6.0)(0.45)$$

$= 2.6$ cfs

Q = 3cfs
S = 14.9%
V = 7.8 fps





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