civil engineering
structural design
land surveying

WYNN ENGINEERING

PRELIMINARY DRAINAGE STUDY

04-197 Ms. Jerilyn Dodge Lagus
13391 Anthony Ridge Road
Valley Center, California 92082
TPM 20966; ER 05-03-004
APN: 133-390-01 & 02

May 23, 2007

REGISTERED PROFESSIONAL ENGINEER
JOHN W. STARLIN
29723
Exp. 3-31-09
CIVIL
STATE OF CALIFORNIA

SDC DPLU RCVD 6-7-07
TPM20966 RR1

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MS. JERILYN DODGE LAGUS
HYDROLOGY STUDY FOR TPM 20966; ER 05-03-004

INTRODUCTION

The subject property is located off Villa Sierra Road in Valley Center, east of Cole Grade Road. The nearest cross street is Villa Sierra Lane. Two parcels (APN 133-390-01 and 02) will be split into three parcels. The parcels will be utilized for single family detached dwellings. Two of the parcels will be served by a private easement road. Postdevelopment site drainage areas, designated A through H, are identified on a 200-scale County topography map provided in this study. Since the drainage area/watershed is less than 1 sq. mi., the Rational Method shall be used for hydrologic analysis.

DESIGN SUMMARY AND CONCLUSIONS

The site is located on the northeast facing slope of a northwest flowing drainage. There are two drainage channels which flow northeast to the main channel. As shown on the preliminary grading plan, these channels will not be disturbed and only the southern one will be influenced by the development. No flow will be diverted from its existing discharge points. Therefore, the proposed project will not alter existing drainage patterns of the site or area, including through the alteration of the course of a stream or river, in a manner which would result in substantial erosion or siltation on or off-site. Further, the proposed project will not alter existing drainage patterns of the site or area, including through the alteration of the course of a stream or river, or substantially increase the rate or amount of surface runoff in a manner which would result in flooding on- or off-site (see summary table below).

The potential for increased runoff flow or velocity will be mitigated through the use of pervious pavement and bio-swales. Pervious pavement will mitigate the potential for increases in runoff due to increased impervious surfaces. Bio-swales will be used in lieu of brow ditches whenever velocities permit. The bio-swales will be designed per specifications provided by the appropriate BMP fact sheet. This will increase infiltration help ensure no net increase in stormwater runoff. The swales will increase flow path length which will decrease the predicted peak flow. The bio swales and gunite brow ditches are more than adequate to handle all runoff from the 100 year design storm. The attached trapezoidal channel calculations predict that they would only reach approximately 10% of their capacity during the 100 year design storm. Riprap energy dissipators will be used to mitigate potential erosion at the outfall of any bio-swale or brow ditch where discharge velocity exceeds 6 feet per second.

The following table summarizes the predevelopment versus postdevelopment runoff characteristics. As mentioned above, there are two distinct drainage channels on the site, but only one drains an area where development will occur. Additionally, most of the development is located the southern portion of the site where no distinct channels have formed. The absence of distinct channels indicates that flow is distributed enough to

prevent erosive velocities. The proposed vegetated swales and rip rap engergy dissipators will maintain this flow regime. Therefore, predevelopment versus postdevelopment parameters are evaluated at only one discharge point along the project boundary. This catchment and its boundary discharge point are shown on a 200-scale topo map derived from the preliminary grading plan.

SUMMARY OF DISCHARGES ALONG SUBDIVISION BOUNDARY									
Discharge Point	Pre/Post	H (ft)	L (ft)	Tc (min)	C	I (in/hr)	A (ac)	V(ft/s)	Q (ft^3/s)
1	Pre	93	670	11.2	0.30	5.79	3.79	7.3	6.6
	Post	93	735	12.8	0.32	5.32	3.79	7.3	6.5

The summary shows that the slight increase in impervious surface is offset by the flattening of the initial subarea and the lengthening of the flow path by the house pad.

REFERENCES

San Diego County Hydrology Manual, Prepared for the County of San Diego, Department of Public Works, Flood Control Section June 2003.

Brater & King, *Handbook of Hydraulics*, 6th ed.

DECLARATION OF RESPONSIBLE CHARGE

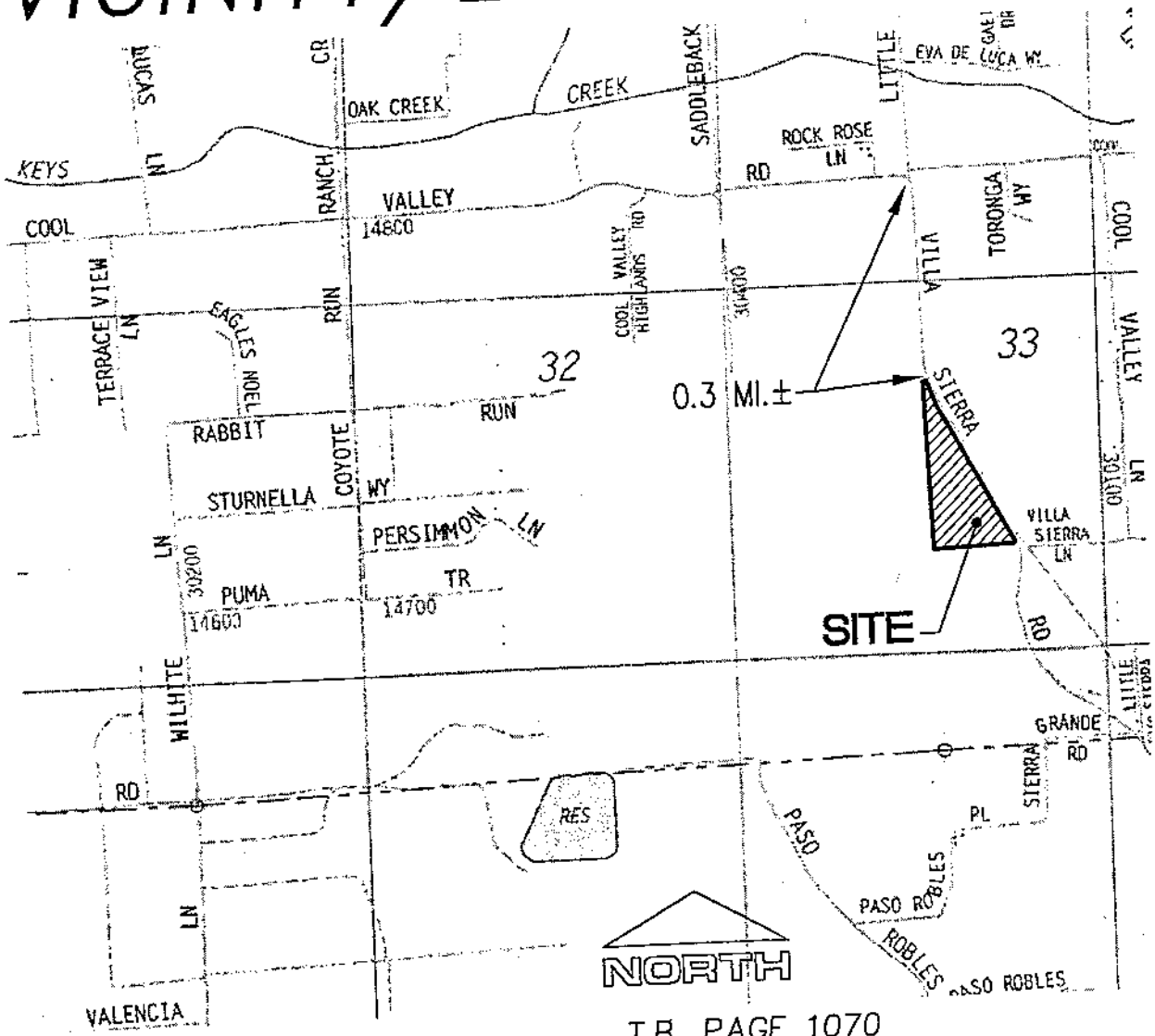
I hereby declare that I am the engineer of work for this project, that I have exercised responsible charge over the design of the project as defined in Section 6703 of the Business and Professions code, and that the design is consistent with current standards.

I understand that the check of project drawings and specifications by the County of San Diego is confined to a review only and does not relieve me, as engineer of work, of my responsibilities for project design.

JOHN W. STARLIN
REGISTERED CIVIL ENGINEER

4/1/07
DATE

VICINITY/LOCATION MAP

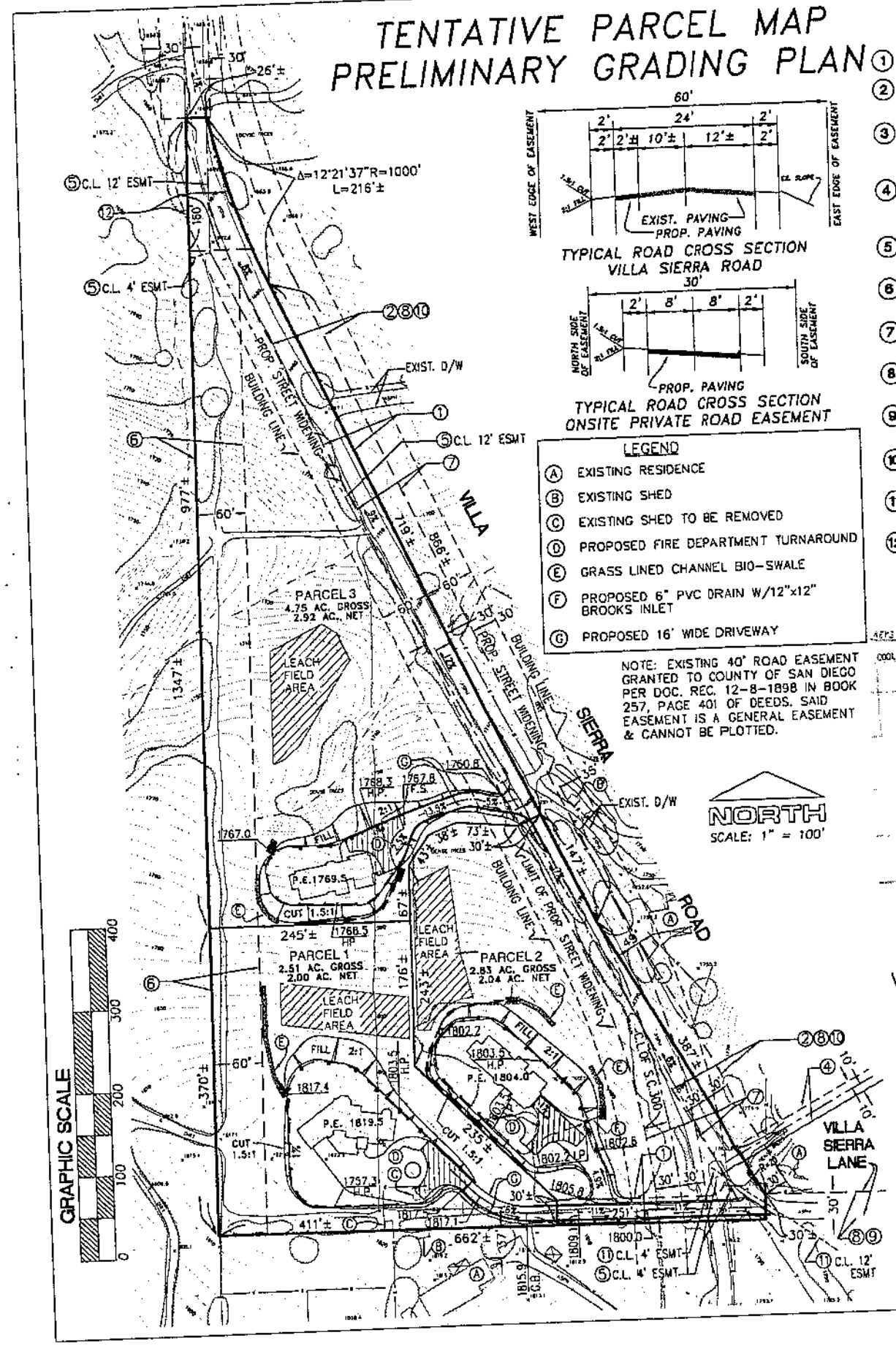


VICINITY MAP
NO SCALE

T.B. PAGE 1070
GRID J-4

D.E.H. NO. PO-VPM226

TENTATIVE PARCEL MAP
PRELIMINARY GRADING PLAN



TYPICAL ROAD CROSS SECTION
VILLA SIERRA ROAD

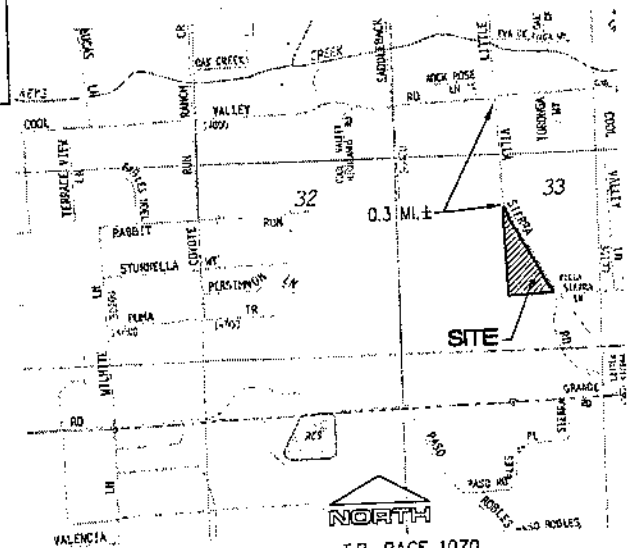
TYPICAL ROAD CROSS SECTION
ONSITE PRIVATE ROAD EASEMENT

LEGEND

- (A) EXISTING RESIDENCE
- (B) EXISTING SHED
- (C) EXISTING SHED TO BE REMOVED
- (D) PROPOSED FIRE DEPARTMENT TURNAROUND
- (E) GRASS LINED CHANNEL BIO-SWALE
- (F) PROPOSED 6" PVC DRAIN W/12"x12" BROOKS INLET
- (G) PROPOSED 16' WIDE DRIVEWAY

NOTE: EXISTING 40' ROAD EASEMENT GRANTED TO COUNTY OF SAN DIEGO PER DOC. REC. 12-8-1898 IN BOOK 257, PAGE 401 OF DEEDS. SAID EASEMENT IS A GENERAL EASEMENT & CANNOT BE PLOTTED.

1. PROPOSED 30' PRIVATE ROAD & UTILITY EASEMENT
2. EXISTING 60' PRIVATE ROAD & UTILITY EASEMENT PER PM 5018
3. EXISTING 20' VALLEY CENTER MUNICIPAL WATER DISTRICT EASEMENT PER DOC. REC. 2-19-64 AS FILE NO. 31633 OF O.R.
4. EXISTING 20' VALLEY CENTER MUNICIPAL WATER DISTRICT EASEMENT PER DOC. REC. 8-2-65 AS FILE NO. 137799 OF O.R.
5. EXISTING S.D.G.&E. EASEMENT PER DOC. REC. 3-14-68 AS FILE NO. 43350 OF O.R.
6. EXISTING 60' PRIVATE ROAD & UTILITY EASEMENT PER DOC. REC. 9-4-75 AS FILE NO. 75-237940 OF O.R.
7. EXISTING 60' PRIVATE ROAD & UTILITY EASEMENT PER DOC. REC. 9-17-76 AS FILE NO. 76-305280 OF O.R.
8. EXISTING S.D.G.&E. EASEMENT PER DOC. REC. 11-9-76 AS FILE NO. 76-374113 OF O.R.
9. EXISTING 30' PRIVATE ROAD & UTILITY EASEMENT PER PM 5018
10. EXISTING 60' PRIVATE ROAD & UTILITY EASEMENT PER DOC. REC. 4-1-77 AS FILE NO. 77-120977 OF O.R.
11. EXISTING S.D.G.&E. EASEMENT PER DOC. REC. 8-11-83 AS FILE NO. 83-281206 OF O.R.
12. EXISTING PRIVATE ROAD & UTILITY EASEMENT PER DOC. REC. 10-26-77 AS FILE NO. 77-442596 OF O.R.



VICINITY MAP
NO SCALE

T.B. PAGE 1070
GRID J-4

REGISTERED PROFESSIONAL ENGINEER
GARY R. WYNN
No. CO 43202
EXP. 3-31-08
CIVIL
STATE OF CALIFORNIA

LAND DIVISION STATEMENT
Owner's Certificate

I hereby certify that I am the record owner, as shown on the latest equalized County assessment of the property shown on the Tentative Parcel Map. All of my contiguous ownership within and beyond the boundaries of the tentative parcel map is shown. The basis of creation of the lots in my ownership (e.g. parcel map, final map, certificate of compliance, recorded deed before 2/1/71) as indicated on the Tentative Parcel Map. I understand that property is considered as contiguous even if it is separated by roads, streets, utility easements or railroad right-of-way. "Freeway" as defined in Section 23.5 of the Streets and Highways Code, shall not be considered as roads or streets. I further certify that I will not, by this application, create or cause to be created, or will not have participated in the creation of more than four parcels on contiguous property unless such contiguous parcels were created by major subdivision. For purposes of this certification, the term "participated" means having cooperated with or acted in a planning, coordinating or decision-making capacity in any formal or informal association or partnership for the purpose of dividing real property. I certify under penalty of perjury that the foregoing is true and correct.
Executed this day of , at Valley Center, California.

(ALL OWNERS MUST SIGN)

JERILYN D. LAGUS, TRUSTEE

1. OWNER: JERILYN D. LAGUS, TRUSTEE OF THE LAGUS FAMILY TRUST DATED APRIL 28, 2003
2. ADDRESS: 13391 ANTHONY RIDGE ROAD, VALLEY CENTER, CA 92082
3. PHONE: (760) 749-3604
4. Complete Tax Assessor's numbers are 133-390-01 & 02
5. Abbreviated legal description of the land shown on the Tentative Parcel Map: Parcel 1 of Parcel Map No. 5018, recorded in the County of San Diego, State of California.
6. General Plan Regional Category: EDA
7. Community/Subregional Plan Area: Valley Center
8. Land Use Designation(s): 17
9. Existing zoning: A70 T.R.A.# 094075, 094042
10. Grading: SEE PRELIMINARY GRADING PLAN
11. Topography: 398-1767 and Aerial by Towill
12. Associated Permits: None
13. Location and status of existing legal access to subject property from a publicly maintained road. (i.e. recorded easement, unrecorded easement – identify and specify width): Access from Cool Valley Road, which is a publicly maintained road, to the boundary of subject property is by existing 60' easement granted to the County of San Diego for roadway purposes.
14. Water Source/Water District: Valley Center Municipal Water District
15. Septic/Sewer District: Septic
16. Fire District: Valley Center Fire Protection District
17. School District(s): Valley Center-Pauma Unified School District
18. Proposed use: SINGLE FAMILY DWELLINGS

USE REGULATIONS	A-70
NEIGHBORHOOD REGS.	L
Density	5 AC.
Lot Size	2 AC.
Building Type	C
Max Flr Area	–
Flr Area Ratio	–
Height	G
Coverage	–
Setback	C
Open Space	–
SPECIAL AREA REGS.	–

"ALL LOTS WITHIN THIS SUBDIVISION HAVE A MINIMUM OF 100 SQUARE FEET OF SOLAR ACCESS FOR EACH FUTURE DWELLING/COMMERCIAL/INDUSTRIAL UNIT ALLOWED BY THIS SUBDIVISION (WITH EXCEPTIONS OF PARCEL(s)_____

NOTE: GRADING AND DRAINAGE SHOWN HEREON IS CONCEPTUAL. THIS PLAN IS PROVIDED TO ALLOW FOR FULL AND ADEQUATE DISCRETIONARY REVIEW OF A PROPOSED DEVELOPMENT PROJECT. THE PROPERTY OWNER ACKNOWLEDGES THAT ACCEPTANCE OR APPROVAL OF THIS PLAN DOES NOT CONSTITUTE AN APPROVAL TO PERFORM ANY GRADING SHOWN HEREON, AND AGREES TO OBTAIN VALID GRADING PERMISSIONS BEFORE COMMENCING SUCH ACTIVITY.

LEGEND

- BROW DITCH PER D-75
- RIP-RAP ENERGY DISSIPATOR
- BERM AT TOP OF SLOPE
- DIRECTION OF FLOW (1% MIN.) 1%
- GRASS LINED CHANNEL BIO-SWALE

GRADING (C.Y.)

5685	TOTAL CUT
5685	TOTAL FILL
0	IMPORT/EXPORT

Signature of person who prepared the tentative parcel map.

Name: Gary R. Wynn, PE
Wynn Engineering, Inc.
Address: 27315 Valley Center Road
Valley Center, CA 92082
Phone: (760) 749-8722
License/Reg. No.: CO 43202

Same
Signature of Applicant
(If not the owner)

Name:

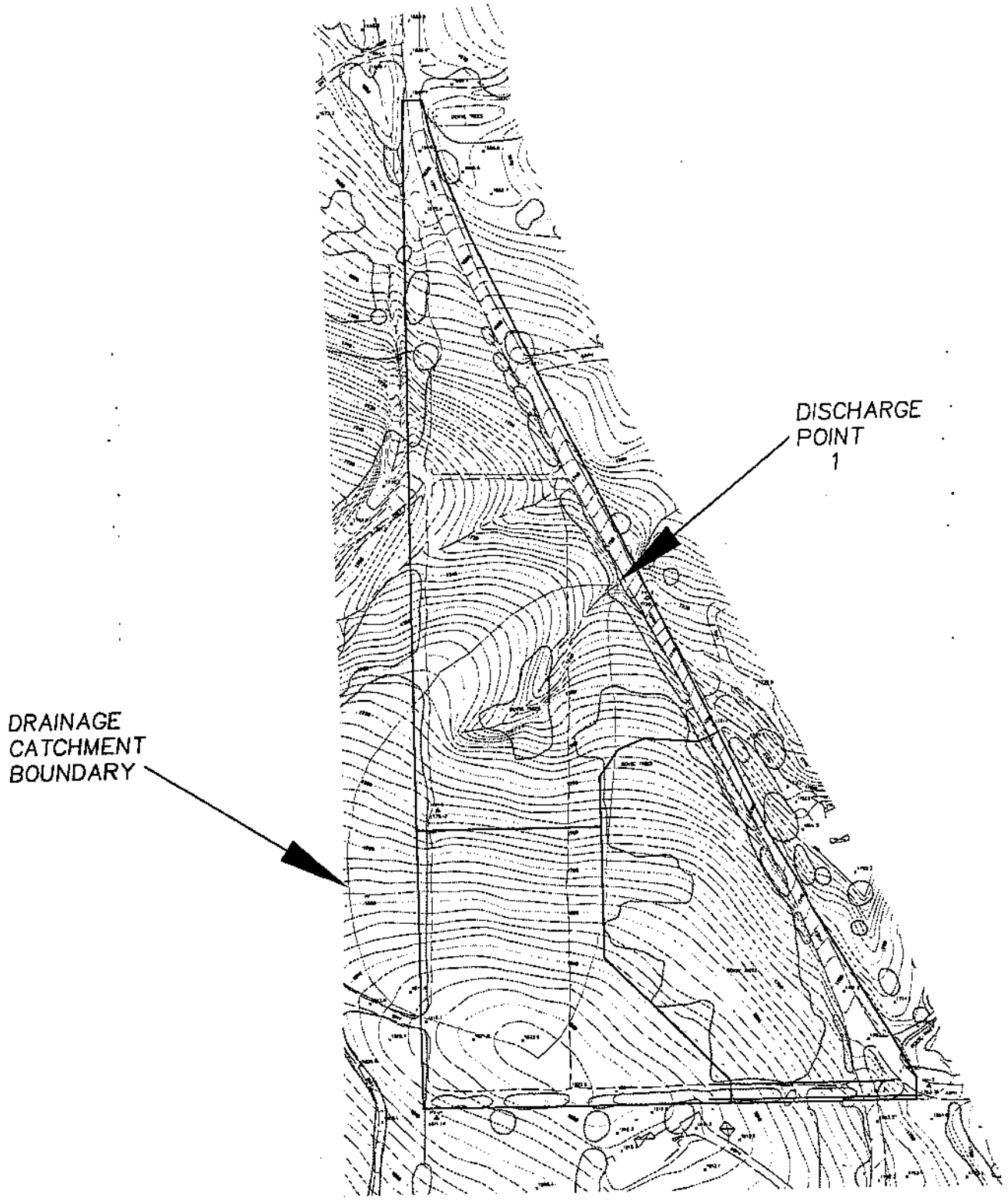
Address: SAME

Phone:

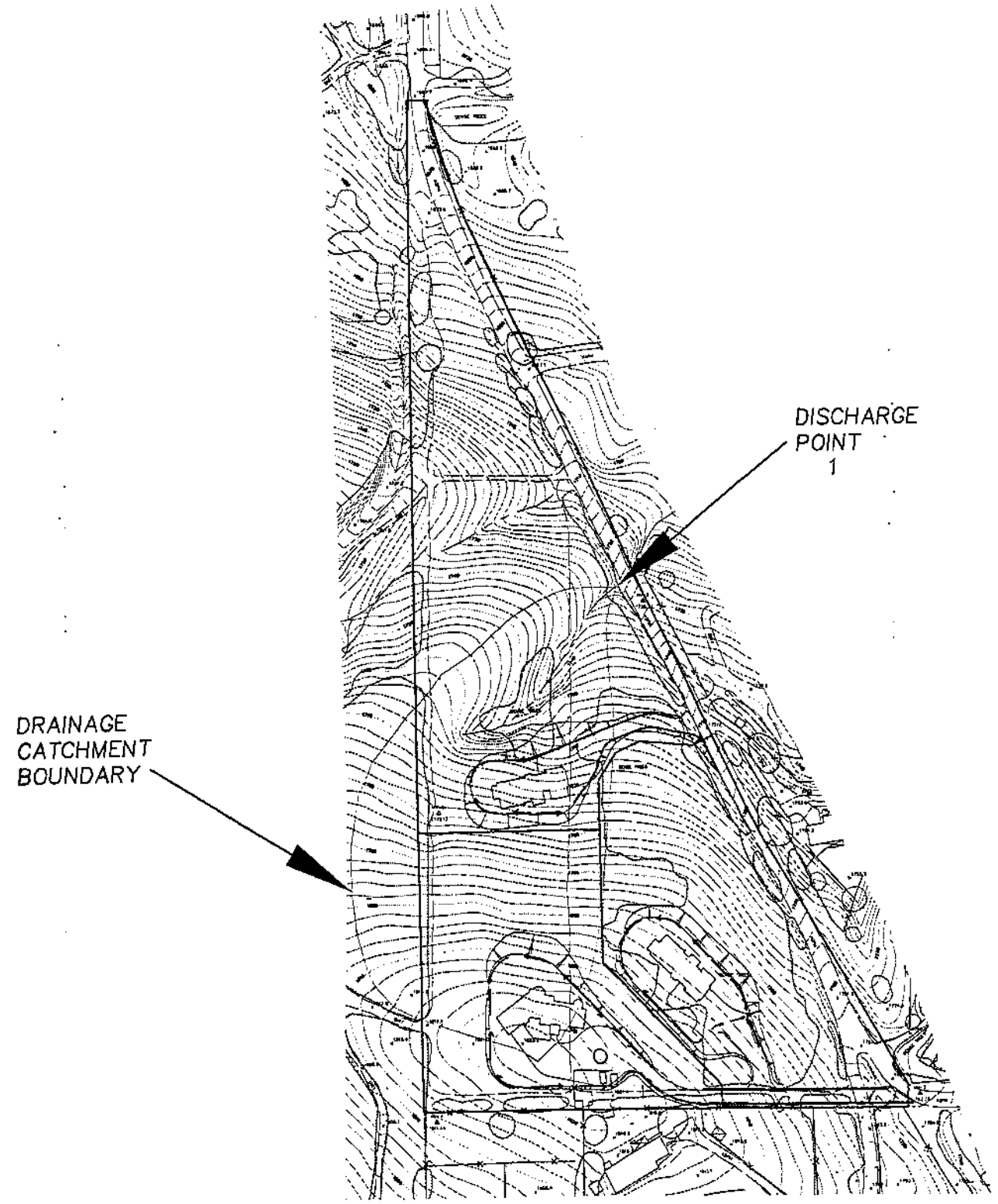
WYNN ENGINEERING, INC.
JOB NO. 04-197 LAGUS
DATE: 4-12-07

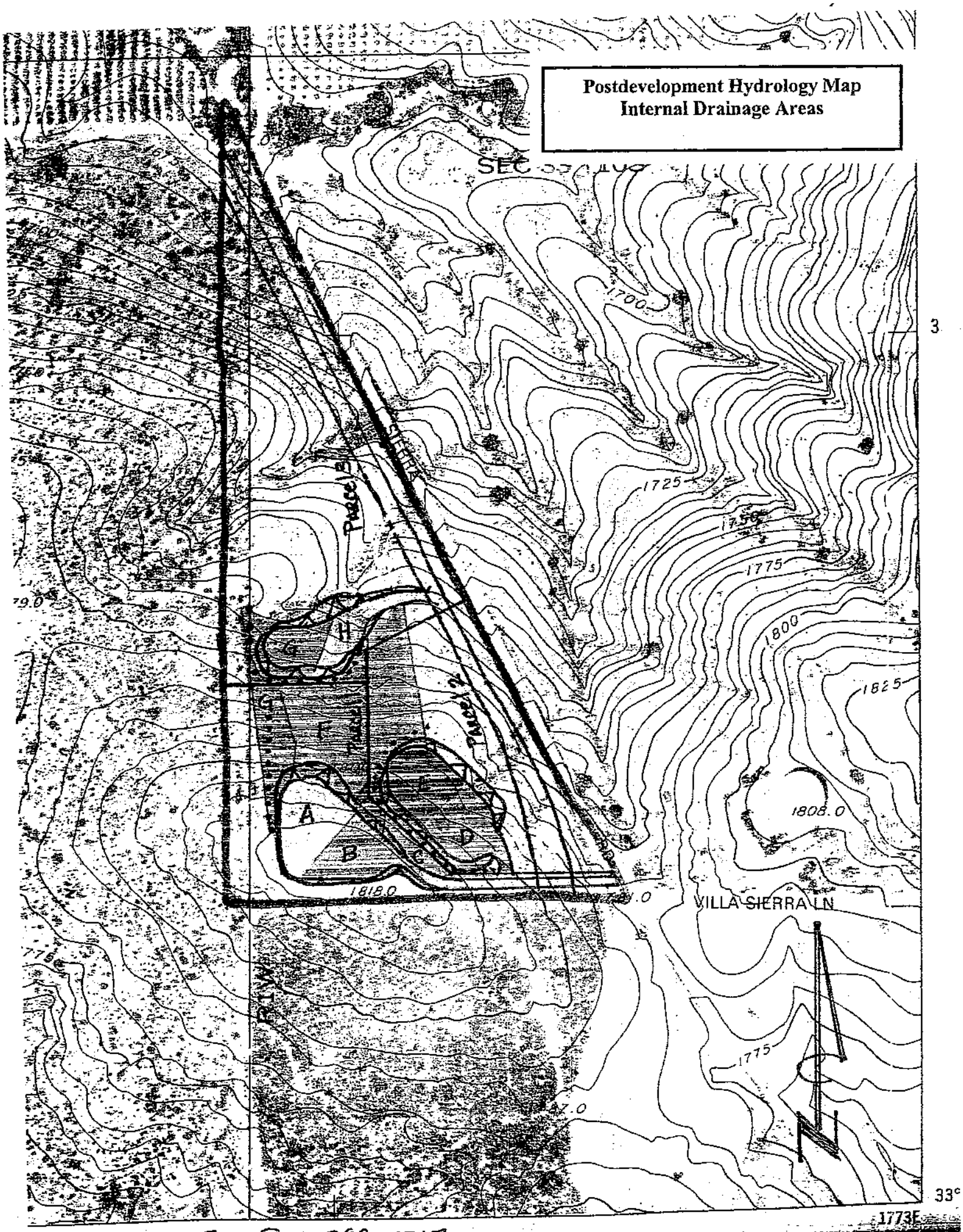
PRE/POSTDEVELOPMENT HYDROLOGY MAP

PREDEVELOPMENT



POSTDEVELOPMENT





Topo Page 398 - 1767

Wynn Engineering, Inc.
27315 Valley Center Road
Valley Center, CA 92082

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PRE-CONSTRUCTION

HYDROLOGY CALCULATIONS

DATE 8-31-05
Job # 04-197
Name DODGE LAGUS

TPM
LAT LON

100 YR	Area No.	Area (ACRES)	H (FT)	L (FT)	Tct10 (MIN)	P6 (IN)	P24 (IN)	P_6/P_{24} (%)	ADJ P6 (IN)	Tc (MIN)	I (in/hr)	C	Q (CFS)
	A	0.29	45	130		3.7	8.2	45		9.2	6.58	0.30	0.57
	B	0.41	100	500		3.7	8.2	45		10.4	6.06	0.30	0.90
	C	0.18	40	200		3.7	8.2	45		7.8	7.32	0.30	0.40
	D	0.41	80	260		3.7	8.2	45		7.8	7.32	0.30	0.90
	E	0.37	90	200		3.7	8.2	45		7.5	7.51	0.30	0.83
	F	1.10	200	400		3.7	8.2	45		7.9	7.26	0.30	2.40
	G	0.52	220	400		3.7	8.2	45		8.8	6.77	0.30	1.06
	H	0.21	160	300		3.7	8.2	45		7.7	7.38	0.30	0.46

Wynn Engineering, Inc.
27315 Valley Center Road
Valley Center, CA 92082

(760) 749-8722
FAX (760) 749-9412

Post-Construction

HYDROLOGY CALCULATIONS

DATE 8-31-05
Job # Dodge Lagus
Name 04-197

TPM
LAT LON

100 YR	Area No.	Area (ACRES)	H (FT)	L (FT)	Tc10 (MIN)	P6 (IN)	P24 (IN)	P_6/P_{24} (%)	ADJ P6 (IN)	Tc (MIN)	I (in/hr)	C	Q (CFS)
	A	0.29	45	130		3.7	8.2	45		9.2	6.58	0.36	0.69
	B	0.41	100	500		3.7	8.2	45		10.4	6.06	0.36	0.89
	C	0.18	40	200		3.7	8.2	45		7.8	7.32	0.36	0.47
	D	0.41	80	260		3.7	8.2	45		7.8	7.32	0.36	1.08
	E	0.37	90	200		3.7	8.2	45		7.5	7.51	0.36	1.00
	F	1.10	200	400		3.7	8.2	45		7.9	7.26	0.36	2.87
	G	0.52	220	400		3.7	8.2	45		8.8	6.77	0.36	1.27
	H	0.21	160	300		3.7	8.2	45		7.7	7.38	0.36	0.56

Wynn Engineering, Inc.
27315 Valley Center Road
Valley Center, CA 92082

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HYDROLOGY CALCULATIONS

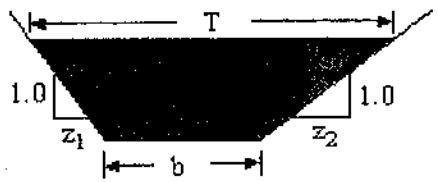
Water Quality

DATE May 16, 2007
Job # 04-197
Name Dodge Lagus
TPM 20966
LAT 33.260702°
LON -116.996366°

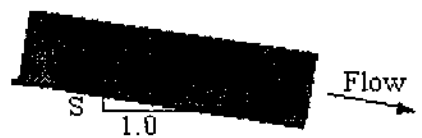
Return Period (yrs)	Area No.	Area (ACRES)	H (FT)	L (FT)	P6 (IN)	P24 (IN)	P_6/P_{24} (%)	ADJ P6 (IN)	Tc (MIN)	I (in/hr)	C	Q (CFS)
	A	0.29								0.20	0.32	0.019
	B	0.41								0.20	0.32	0.026
	C	0.18								0.20	0.32	0.012
	D	0.41		Water quality flows are based on a rainfall intensity of 0.2 in/hr per the San Diego County SUSMP						0.20	0.32	0.026
	E	0.37								0.20	0.32	0.024
	F	1.1								0.20	0.32	0.070
	G	0.52								0.20	0.32	0.033
	H	0.21								0.20	0.32	0.013

Area A Vegetated Swale											
S	n	b (ft)	y (ft)	z left	z right	P (ft)	T (ft)	A (ft^2)	R (ft)	V (ft/s)	Q (ft^3)
0.165	0.025	2	0.08	3	3	2.489	2.464	0.173	0.069	4.1	0.7

Cross-Section of Channel



Channel Side View



$$Q=VA \qquad V=\frac{k}{n}R^{2/3}S^{1/2} \qquad R=\frac{A}{P} \qquad A=\frac{y}{2}(b+T)$$

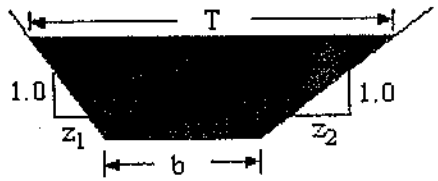
$$P=b+y\left(\sqrt{1+z_1^2}+\sqrt{1+z_2^2}\right) \qquad T=b+y(z_1+z_2)$$

$$F=V\sqrt{\frac{T}{gA\cos\theta}} \qquad \theta=Tan^{-1}(S)$$

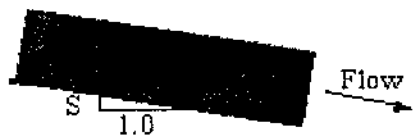
Velocity < 6 fps Therefore no energy dissipator required. Vegetated swale maintains low velocity.

Area D-E Vegetated Swales											
S	n	b (ft)	y (ft)	z left	z right	P (ft)	T (ft)	A (ft^2)	R (ft)	V (ft/s)	Q (ft^3)
0.025	0.025	3	0.13	3	3	3.832	3.790	0.447	0.117	2.2	1.0

Cross-Section of Channel



Channel Side View



$$Q=VA \qquad V=\frac{k}{n}R^{2/3}S^{1/2} \qquad R=\frac{A}{P} \qquad A=\frac{y}{2}(b+T)$$

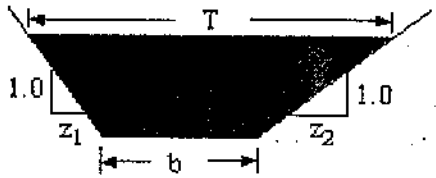
$$P=b+y\left(\sqrt{1+z_1^2}+\sqrt{1+z_2^2}\right) \qquad T=b+y(z_1+z_2)$$

$$F=V\sqrt{\frac{T}{gA\cos\theta}} \qquad \theta=Tan^{-1}(S)$$

Velocity < 6 fps Therefore no energy dissipator required. Vegetated swale maintains low velocity.

Area G Vegetated Swale											
S	n	b (ft)	y (ft)	z left	z right	P (ft)	T (ft)	A (ft^2)	R (ft)	V (ft/s)	Q (ft^3)
0.158	0.025	3	0.09	3	3	3.565	3.536	0.292	0.082	4.5	1.3

Cross-Section of Channel



Channel Side View

$$Q=VA \qquad V=\frac{k}{n}R^{2/3}S^{1/2} \qquad R=\frac{A}{P} \qquad A=\frac{y}{2}(b+T)$$

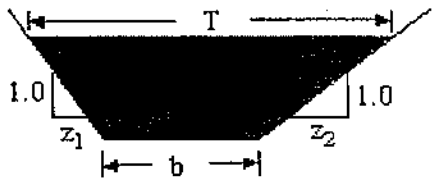
$$P=b+y\left(\sqrt{1+z_1^2}+\sqrt{1+z_2^2}\right) \qquad T=b+y(z_1+z_2)$$

$$F=V\sqrt{\frac{T}{gA\cos\theta}} \qquad \theta=Tan^{-1}(S)$$

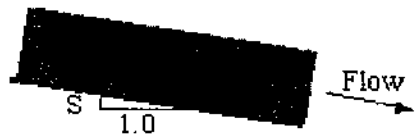
Velocity < 6 fps Therefore no energy dissipator required.

Area E Gunite Brow Ditch											
S	n	b (ft)	y (ft)	z left	z right	P (ft)	T (ft)	A (ft^2)	R (ft)	V (ft/s)	Q (ft^3)
0.107	0.016	0	0.32	1.25	1.25	1.036	0.809	0.131	0.126	7.6	1.0

Cross-Section of Channel



Channel Side View



$$Q=VA \qquad V=\frac{k}{n}R^{2/3}S^{1/2} \qquad R=\frac{A}{P} \qquad A=\frac{y}{2}(b+T)$$

$$P=b+y\left(\sqrt{1+z_1^2}+\sqrt{1+z_2^2}\right) \qquad T=b+y(z_1+z_2)$$

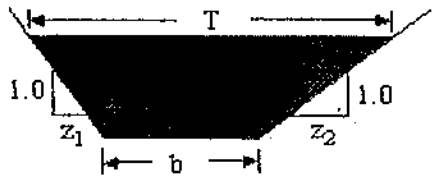
$$F=V\sqrt{\frac{T}{gA\cos\theta}} \qquad \theta=Tan^{-1}(S)$$

6 fps < Velocity < 11 fps Therefore rip rap energy dissipator required:

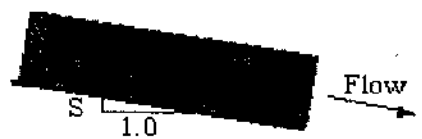
RIPRAP: No. 2 Backing 10' x 4.5' x 1' Thick
FILTER BLANKET: D.G. 1' Thick
Note that after passing through the energy dissipator, flow enters vegetated swale which will maintain low velocity. See next calculation sheet.

Area F Gunite Brow Ditch											
S	n	b (ft)	y (ft)	z left	z right	P (ft)	T (ft)	A (ft^2)	R (ft)	V (ft/s)	Q (ft^3)
0.142	0.016	0	0.46	1.25	1.25	1.464	1.144	0.262	0.179	11.1	2.9

Cross-Section of Channel



Channel Side View



$$Q=VA \qquad V=\frac{k}{n}R^{2/3}S^{1/2} \qquad R=\frac{A}{P} \qquad A=\frac{y}{2}(b+T)$$

$$P=b+y\left(\sqrt{1+z_1^2}+\sqrt{1+z_2^2}\right) \qquad T=b+y(z_1+z_2)$$

$$F=V\sqrt{\frac{T}{gA\cos\theta}} \qquad \theta=Tan^{-1}(S)$$

11 fps < Velocity < 13 fps Therefore Rip rap energy dissipator required:

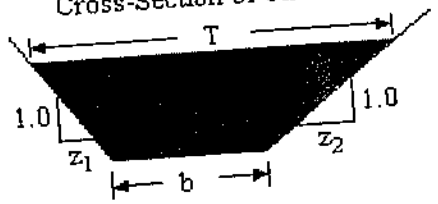
RIPRAP: 1/4 Ton 10' x 4.5' x 2.7' Thick
FILTER BLANKET: 3/4" rock 0.5' Thick over SAND 0.5' Thick

04-197 DODGE-LAGUS

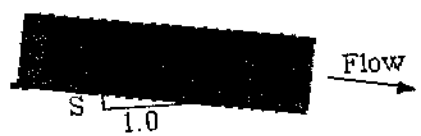
Discharge Point 1 Predevelopment

S	n	b (ft)	y (ft)	z left	z right	P (ft)	T (ft)	A (ft^2)	R (ft)	V (ft/s)	Q (ft^3)
0.217	0.030	3	0.23	4.545	4.545	5.095	5.046	0.906	0.178	7.3	6.6

Cross-Section of Channel



Channel Side View



$$Q=VA \qquad V=\frac{k}{n}R^{2/3}S^{1/2} \qquad R=\frac{A}{P} \qquad A=\frac{y}{2}(b+T)$$

$$P=b+y\left(\sqrt{1+z_1^2}+\sqrt{1+z_2^2}\right) \qquad T=b+y(z_1+z_2)$$

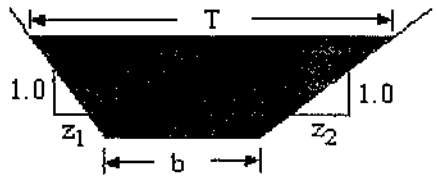
$$F=V\sqrt{\frac{T}{gA\cos\theta}} \qquad \theta=Tan^{-1}(S)$$

6 fps < Velocity < 11 fps Therefore rip rap energy dissipator required:

RIPRAP: No. 2 Backing 10' x 4.5' x 1' Thick
FILTER BLANKET: D.G. 1' Thick

Discharge Point 1 Postdevelopment											
S	n	b (ft)	y (ft)	z left	z right	P (ft)	T (ft)	A (ft^2)	R (ft)	V (ft/s)	Q (ft^3)
0.217	0.030	3	0.22	4.545	4.545	5.078	5.030	0.897	0.177	7.3	6.5

Cross-Section of Channel



Channel Side View

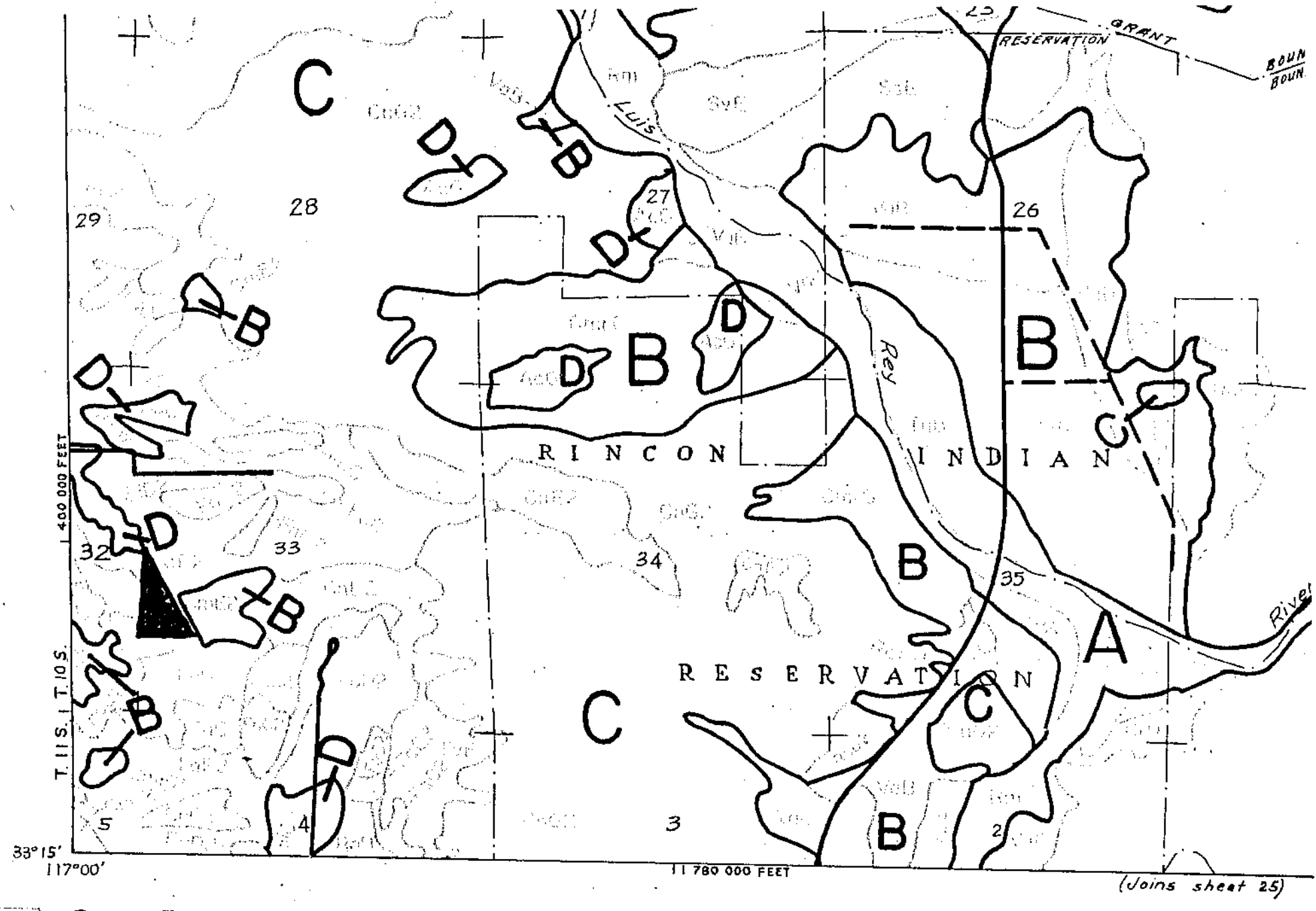
$$Q=VA \qquad V=\frac{k}{n}R^{2/3}S^{1/2} \qquad R=\frac{A}{P} \qquad A=\frac{y}{2}(b+T)$$

$$P=b+y\left(\sqrt{1+z_1^2}+\sqrt{1+z_2^2}\right) \qquad T=b+y(z_1+z_2)$$

$$F=V\sqrt{\frac{T}{gA\cos\theta}} \qquad \theta=Tan^{-1}(S)$$

6 fps < Velocity < 11 fps Therefore rip rap energy dissipator required:

RIPRAP: No. 2 Backing 10' x 4.5' x 1' Thick
FILTER BLANKET: D.G. 1' Thick



San Diego County Soils Interpretation Study

HYDROLOGIC SOIL GROUPS - Runoff Potential

SEE CAUTION NOTES

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

$C_{EXISTING} = 0.3$

$C_{PROPOSED} = \frac{0.3(9.22) + 0.9(0.94)}{10.16} = 0.355 = 0.36$

WYNN ENGINEERING INC.
27315 Valley Center Road
Valley Center, CA 92082
(760) 749-8722
(760) 749-9412 Fax

JOB 04-197 DODGE / AGUA
SHEET NO. ____ OF ____
CALCULATED BY J. Justis DATE 8-31-05
CHECKED BY ____ DATE ____
SCALE ____

TIME & INTENSITY CALCULATIONS

A

$$t_t = \left[\frac{11.9\left(\frac{130}{5280}\right)^3}{45}\right]^{.385} \times 60 = 0.50 \text{ MIN}$$

$t_c = 0.5 + 8.7 = 9.2$ min

$I_{85} = 7.44(1)9.2^{-.645} = 1.78$ in/hr

$I_{100} = 7.44(3.7)9.2^{-.645} = 6.58$ in/hr

B

$$t_t = \left[\frac{11.9\left(\frac{500}{5280}\right)^3}{100}\right]^{.385} \times 60 = 1.74 \text{ MIN}$$

$t_c = 1.74 + 8.7 = 10.44$ min

$I_{85} = 7.44(1)10.44^{-.645} = 1.64$ in/hr

$I_{100} = 7.44(3.7)10.44^{-.645} = 6.06$ in/hr

C

$$t_t = \left[\frac{11.9\left(\frac{200}{5280}\right)^3}{40}\right]^{.385} \times 60 = 0.86 \text{ MIN}$$

$t_c = 0.86 + 6.9 = 7.8$ min

$I_{85} = 7.44(1)7.8^{-.645} = 1.98$ in/hr

$I_{100} = 7.44(3.7)7.8^{-.645} = 7.32$ in/hr

D

$$t_t = \left[\frac{11.9\left(\frac{260}{5280}\right)^3}{80}\right]^{.385} \times 60 = 0.89 \text{ min}$$

$t_c = 0.89 + 6.9 = 7.8$ min

(See Area "C" for Intensity Calc)

E

$$t_t = \left[\frac{11.9\left(\frac{200}{5280}\right)^3}{90}\right]^{.385} \times 60 = 0.63 \text{ min}$$

$t_c = 0.63 + 6.9 = 7.5$ min

$I_{85} = 7.44(1)7.5^{-.645} = 2.03$ in/hr

$I_{100} = 7.44(3.7)7.5^{-.645} = 7.51$ in/hr

WYNN ENGINEERING INC.
27315 Valley Center Road
Valley Center, CA 92082
(760) 749-8722
(760) 749-9412 Fax

JOB Dorge Lagoon 04-197
SHEET NO. _____ OF _____
CALCULATED BY [signature] DATE _____
CHECKED BY _____ DATE _____
SCALE _____

F

$$t_t = \left[\frac{11.9\left(\frac{400}{5280}\right)^3}{200}\right]^{.385} \times 60 = 1.03\,min$$

$$t_c = 1.03 + 6.9 = 7.9\,min$$

$$I_{85} = 7.44(1)\,7.9^{-.645} = 1.96\ in/hr$$

$$I_{100} = 7.44(3.7)\,7.9^{-.645} = 7.26\ in/hr$$

G

$$t_t = \left[\frac{11.9\left(\frac{400}{5280}\right)^3}{220}\right]^{.385} \times 60 = 1.0\,min$$

$$t_c = 1 + 8.7 = 8.8\,min$$

$$I_{85} = 7.44(1)\,8.8^{-.645} = 1.83\ in/hr$$

$$I_{100} = 7.44(3.7)\,8.8^{-.645} = 6.77\ in/hr$$

H

$$t_t = \left[\frac{11.9\left(\frac{300}{5280}\right)^3}{160}\right]^{.385} \times 60 = 0.80\,min$$

$$t_c = 6.9 + 0.8 = 7.7\,min$$

$$I_{85} = 7.44(1)\,7.7^{-.645} = 2.00\,min$$

$$I_{100} = 7.44(3.7)\,7.7^{-.645} = 7.38\ in/hr$$

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

Time of Concentration Calculation
Discharge Point 1

MAXIMUM OVERLAND FLOW LENGTH (LM) & INITIAL TIME OF CONCENTRATION (Ti)													
	DU/	0.50%		1%		2%		3%		5%		10%	
Element	Acre	LM	Ti	LM	Ti	LM	Ti	LM	Ti	LM	Ti	LM	Ti
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**	100	9.5	100	8	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	85	8.8	95	8.1	100	7	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	100	6	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	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	85	3.8	95	3.4	100	2.7
N. Com		50	5.3	60	4.5	75	4	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

Note: Table reprinted from SDCo Hydrology Manual

Predevelopment

Postdevelopment

	Ti (from table)	Elev diff	L (ft)	Tt (hrs)	Tt (min)	Tc
Pre	8.7	93	670	0.041754	2.51	11.21
Post	10	93	735	0.046466	2.79	12.79

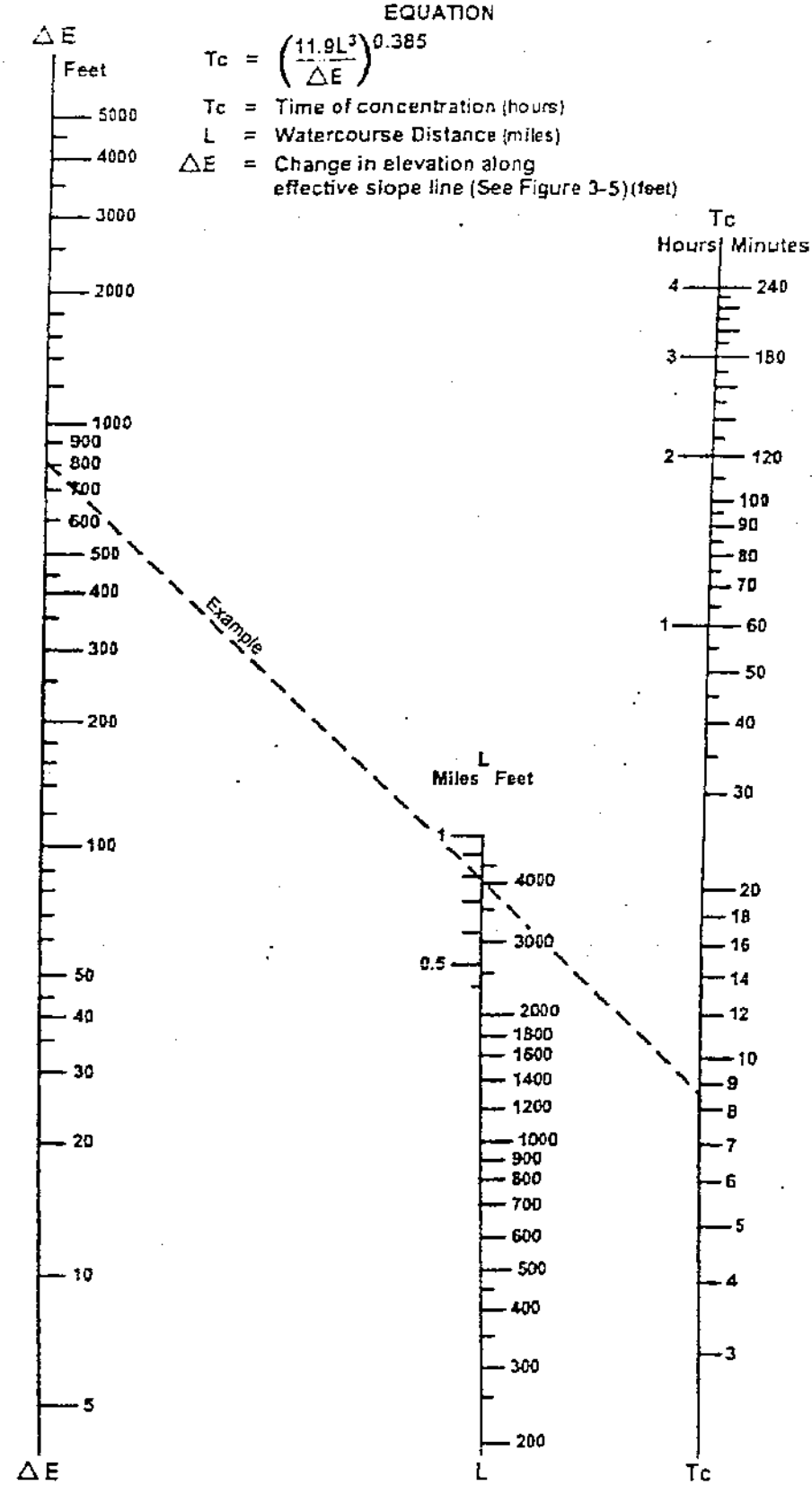
EQUATION

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

T_c = Time of concentration (hours)

L = Watercourse Distance (miles)

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

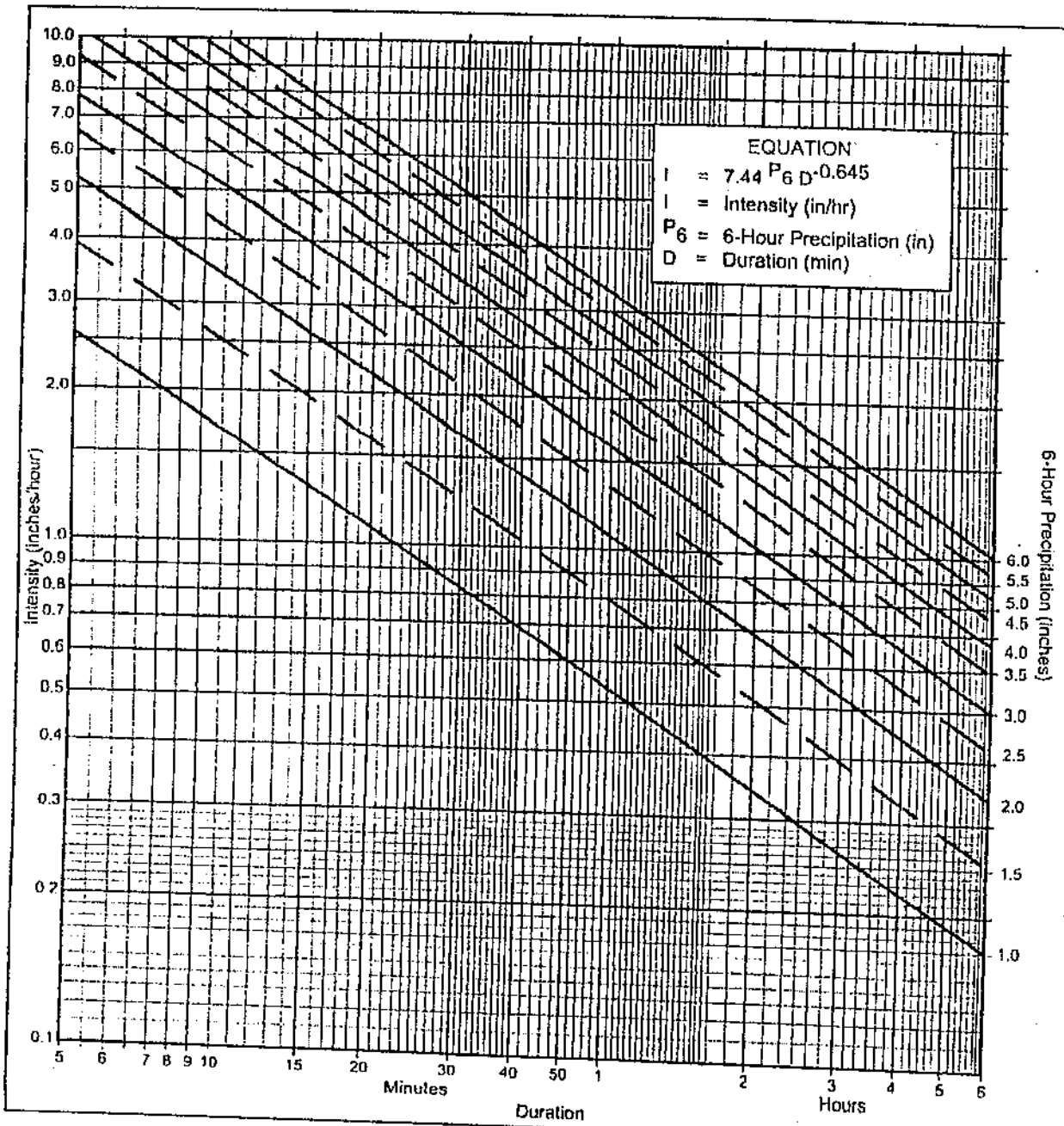


SOURCE: California Division of Highways (1941) and Kirpich (1940)

FIGURE

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

3-4



Directions for Application:

(1) From precipitation maps determine 6 hr and 24 hr amounts for the selected frequency. These maps are included in the County Hydrology Manual (10, 50, and 100 yr maps included in the Design and Procedure Manual).

(2) Adjust 6 hr precipitation (if necessary) so that it is within the range of 45% to 65% of the 24 hr precipitation (not applicaple to Desert).

(3) Plot 6 hr precipitation on the right side of the chart.

(4) Draw a line through the point parallel to the plotted lines.

(5) This line is the intensity-duration curve for the location being analyzed.

Application Form:

(a) Selected frequency _____ year

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

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

(d) t_x = _____ min.

(e) I = _____ in./hr.

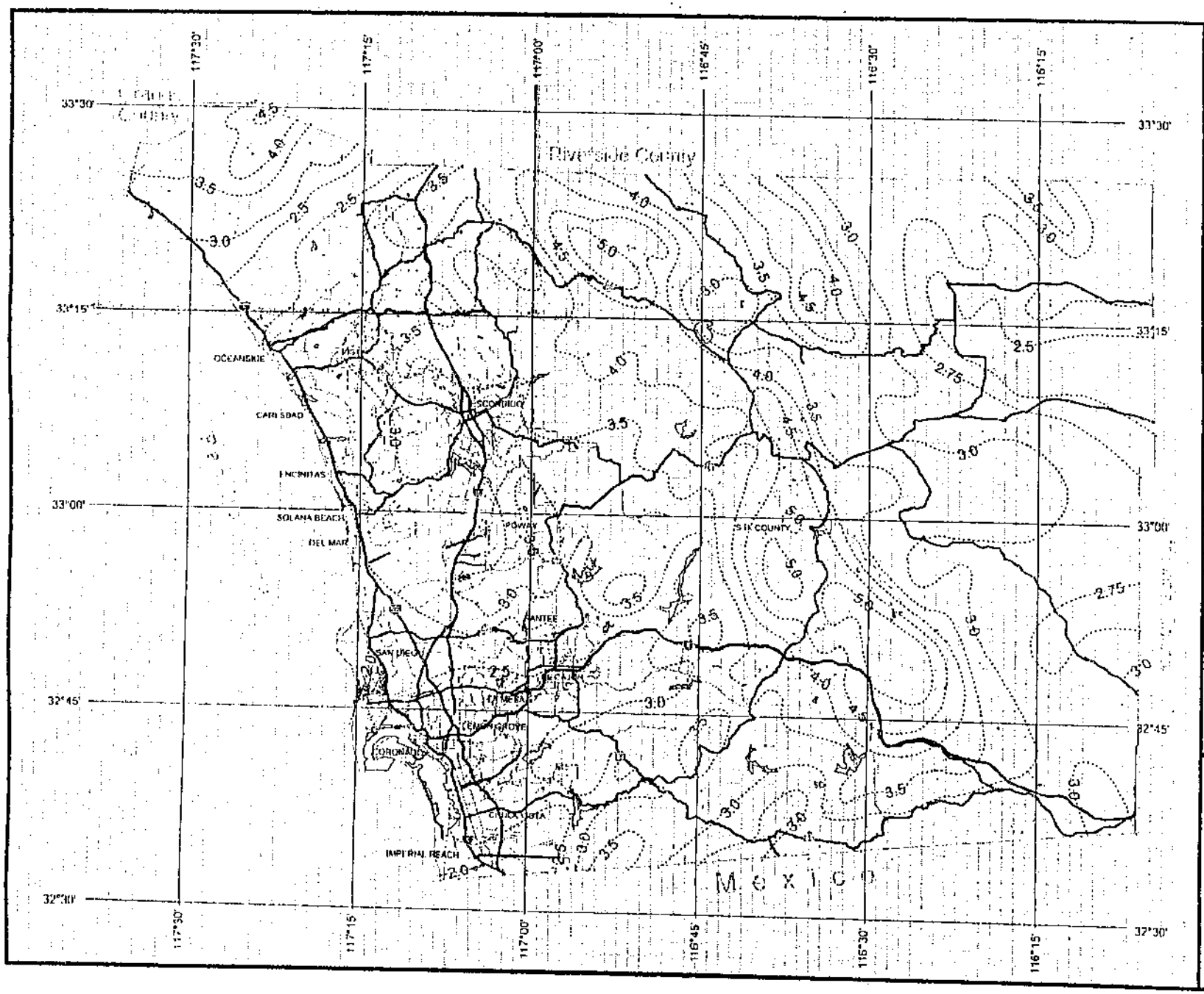
Note: This chart replaces the Intensity-Duration-Frequency curves used since 1965.

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	11.86	13.17	14.49	15.81
7	2.12	3.18	4.24	5.30	6.36	7.42	8.48	9.54	10.60	11.66	12.72
10	1.68	2.53	3.37	4.21	5.05	5.90	6.74	7.58	8.42	9.27	10.11
15	1.30	1.95	2.59	3.24	3.89	4.54	5.19	5.84	6.49	7.13	7.78
20	1.08	1.62	2.15	2.69	3.23	3.77	4.31	4.85	5.39	5.93	6.46
25	0.93	1.40	1.87	2.33	2.80	3.27	3.73	4.20	4.67	5.13	5.60
30	0.83	1.24	1.66	2.07	2.49	2.90	3.32	3.73	4.15	4.56	4.98
40	0.69	1.03	1.38	1.72	2.07	2.41	2.76	3.10	3.45	3.79	4.13
50	0.60	0.90	1.19	1.49	1.79	2.09	2.39	2.69	2.98	3.28	3.58
60	0.53	0.80	1.06	1.33	1.59	1.86	2.12	2.39	2.65	2.92	3.18
90	0.41	0.61	0.82	1.02	1.23	1.43	1.63	1.84	2.04	2.25	2.45
120	0.34	0.51	0.68	0.85	1.02	1.19	1.36	1.53	1.70	1.87	2.04
150	0.29	0.44	0.59	0.73	0.88	1.03	1.18	1.32	1.47	1.62	1.76
180	0.26	0.39	0.52	0.65	0.78	0.91	1.04	1.18	1.31	1.44	1.57
240	0.22	0.33	0.43	0.54	0.65	0.76	0.87	0.98	1.08	1.19	1.30
300	0.19	0.28	0.38	0.47	0.56	0.66	0.75	0.85	0.94	1.03	1.13
360	0.17	0.25	0.33	0.42	0.50	0.58	0.67	0.75	0.84	0.92	1.00

Intensity-Duration Design Chart - Template

FIGURE

3-1



County of San Diego Hydrology Manual

Rainfall Isopluvials

100 Year Rainfall Event - 6 Hours

Isopluvial (inches)

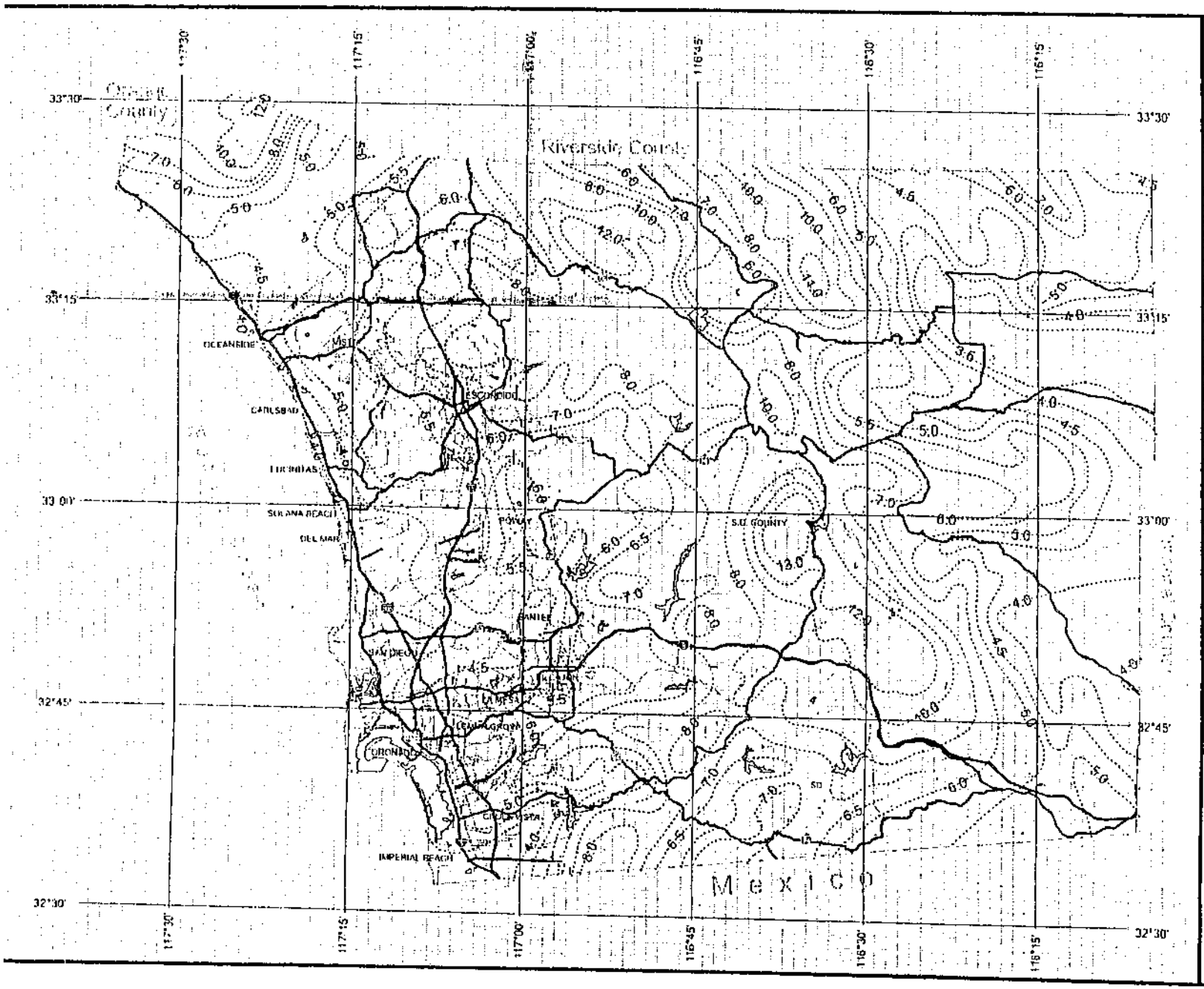
3.7

GIS

GIS

N
W
E
S

3 0 3 Miles



County of San Diego Hydrology Manual

Rainfall Isopluvials

100 Year Rainfall Event - 24 Hours

Isopluvial (inches)

8.2

GIS GIS

N W E S

3 0 3 Miles