CEQA PRELIMINARY HYDROLOGY STUDY for the Van Cleve Project [TPM 20702]

San Diego County, California

LOG NO 02-20-001

Prepared for:

Mr. Russell Van Cleve
19491 Deerhorn Valley Road
Jamul, California 91935

By:

Edgar Monroy L., P.E.
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DEPARTMENT OF PLANNING AND LAND USE

REGISTERED PROFESSIONAL ENGINEER
EDGAR MONROY L.
No. 27188
Exp. 3/31/05
CIVIL
STATE OF CALIFORNIA

Date: November 18, 2003

To: Hydraulics Reviewer

From: Edgar Monroy

Subject: Hydrology Study for the Van Cleve Access Road Culverts [TPM 20702]

There is a large watercourse that on the 200 scale topo maps appears to cross the Van Cleve Access Road just south of Deerhorn Valley Road. However, the watercourse actually crosses Deerhorn Valley Road west of the access road and for this reason no calculations were done for it.

Calculations were made for four 48 inch concrete pipes to carry the 100 year flow of 530 cfs. The owner has indicated that he might consider putting in an equivalent box culvert [approximately 4 ft by 10 ft] depending on subsequent cost estimates by contractors.

If there any questions please call me at 619/660-1901.

Van Cleve Culvert Calculations

TPM 20702

BASIN	AREA sq. in.	AREA SF	acres	sq. miles	ELEVATIONS high	ELEVATIONS low	Length of reach, L feet	100 year frequency 6 hour precip.	100 year frequency 24 hour precip.	100 year frequency adjusted P_6	Tc time of concentr.	I rainfall intensity
2	31.06	1,242,400	28.5	0.045	2810	2455	2500	3.5	7.5	3.5 in.	16.7	4.3
3	13.88	555,200	12.7	0.020	2816	2490	1300	3.5	7.5	3.5 in.	13.3	5.0

1 sq. mile = 27,878,400 sf

<<>> <<>> <<>> <<>> <<>> <<>> <<>> <<>> <<>> <<>> <<>> <<>> <<>>

$Q = C \times I \times A = cfs$

BASIN	Q	C	I	A	PROPOSED CULVERTS size	type	velocity	d Load
2	55.2	0.45	4.3	28.5	36inch	concrete	9.6 fps	III-2500
3	28.7	0.45	5.0	12.7	30 inch	concrete	8.0 fps	III-2500

eml 04.11.03

Van Cleve TPM [20702]- Culvert Sizing Calculations

BASIN 2 Pipe Size 36" } 84"

HWA = 48"

Slope = 1%

Q = 55.2 cfs

d_c/D = 0.79 from C2 d_n/D = 0.64 from C5 $d_c > d_n$ therefore inlet control

HW/D = 1.48 from C7 HW = 53.3" < 84" ∴ OK

Velocity Calculations: $Q = k'/n(d^{8/3})(s^{1/2})$ and $k' = Q\,n/(d^{8/3})(s^{1/2})$

$$K' = \frac{55.2(0.015)}{3^{8/3}\ 0.01^{1/2}} = 0.44$$

from Table 7-14, D/d = 0.78

from Table 7-4, C_a = 0.637 Area = $C_a D^2$ = 0.637(3)^2 = 5.73 sf

Velocity = Q/A = $\frac{55.2}{5.73}$ = 9.6 fps

Rip Rap: Light Rip Rap

dLoad: use type III - 2500

Calc by Edgar Monroy
~~March 31~~, 2003
April 12

Van Cleve TPM [20702]- Culvert Sizing Calculations

BASIN 3 Pipe Size 30" } 54"

HWA = 24"

Slope = 1%

Q = 28.7 cfs

d_c/D = 0.74 from C2 d_n/D = 0.57 from C5 $d_c > d_n$ therefore inlet control

HW/D = 1.23 from C7 HW = 37" 37 < 54" ∴ ok

Velocity Calculations: $Q = k'/n(d^{8/3})(s^{1/2})$ and $k' = Q\,n/(d^{8/3})(s^{1/2})$

$$K' = \frac{28.7(0.015)}{(2.5)^{8/3}(0.01)^{1/2}} = \frac{0.4305}{11.55(0.1)}$$

$$K' = 0.3727$$

from Table 7-14, D/d = 0.68

from Table 7-4, C_a = 0.569 Area = $C_a D^2$ $= 0.569(2.5)^2$

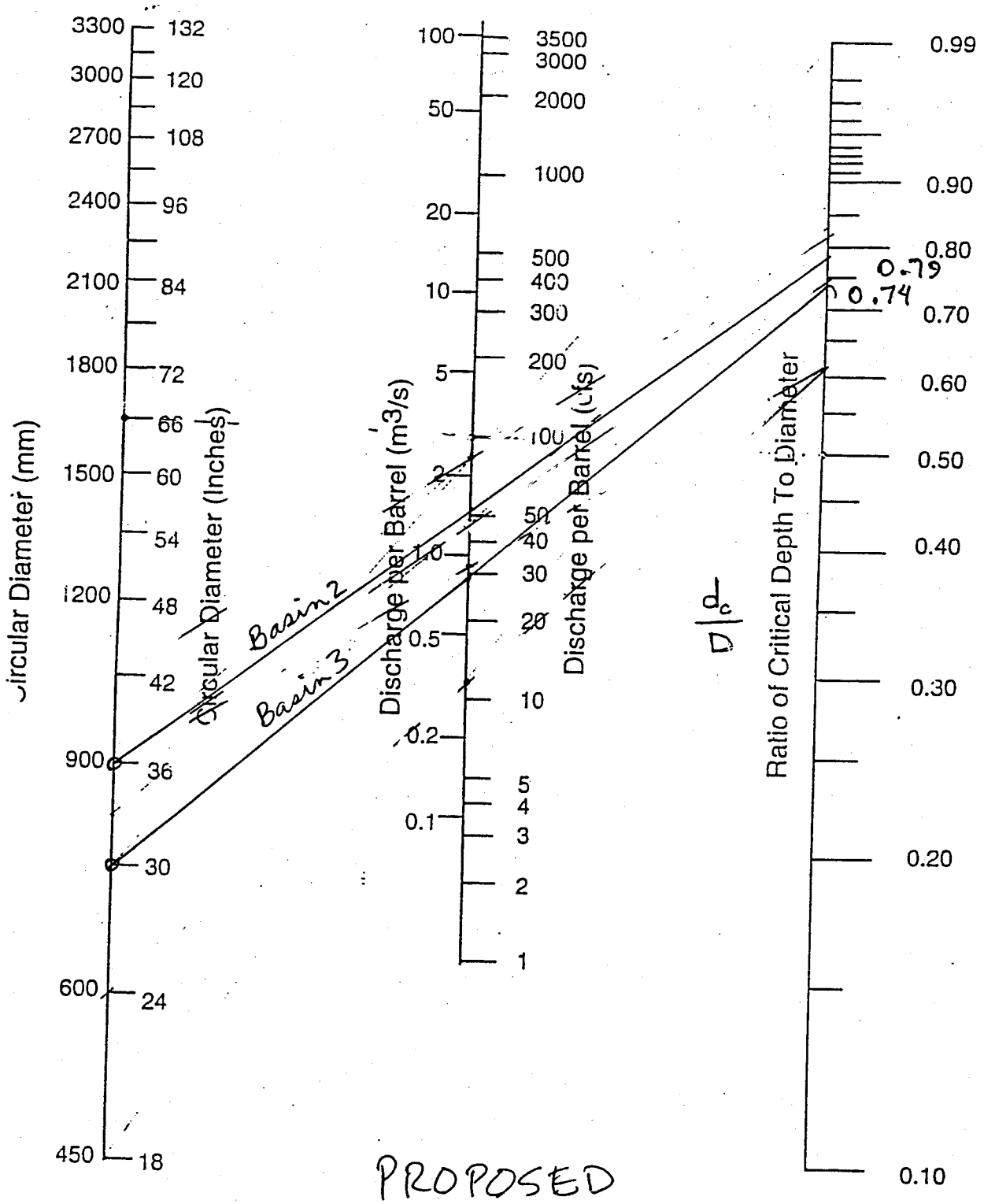
$A = 3.6$ sf

Velocity = Q/A = $\frac{28.7}{3.6} = 8.0$ fps

Rip Rap: use No. 2 backing

dLoad: use Type III - 2500

Calc by Edgar Monroy
March 31, 2003

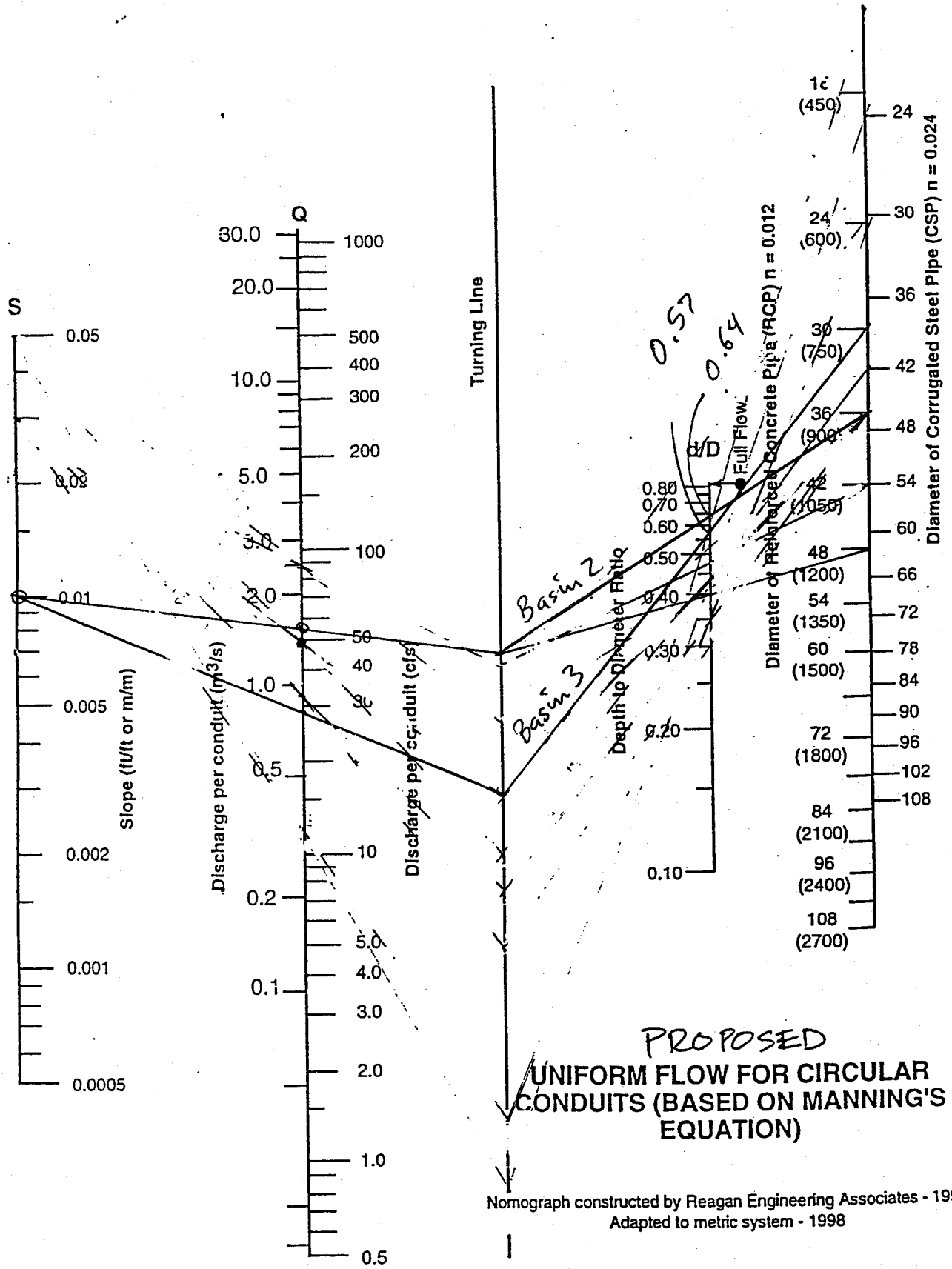


PROPOSED

CRITICAL DEPTH - CIRCULAR PIPE

Appendix C2

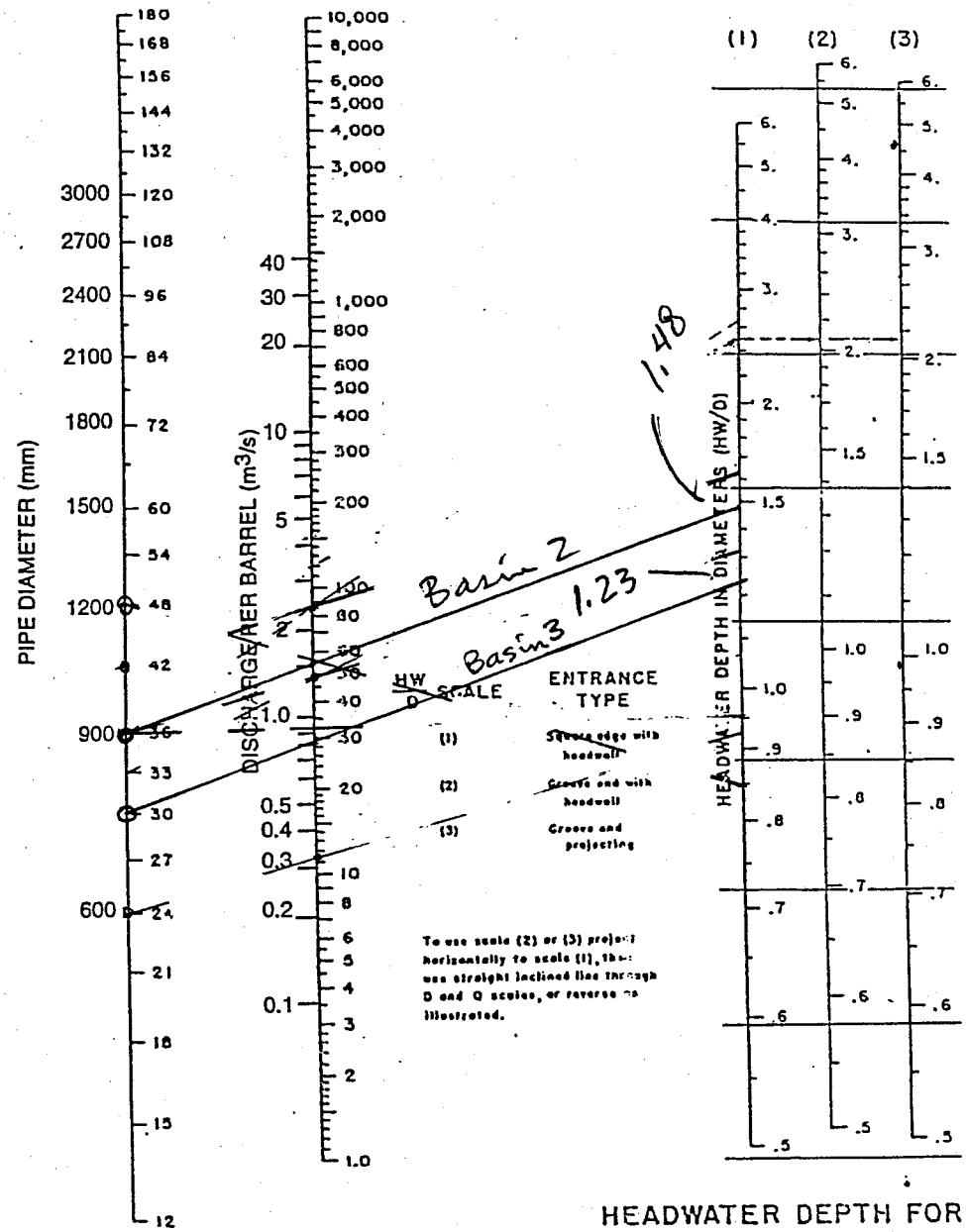
Reagan Engineering Associates
Adapted to Metric System 1998



PROPOSED

UNIFORM FLOW FOR CIRCULAR CONDUITS (BASED ON MANNING'S EQUATION)

Nomograph constructed by Reagan Engineering Associates - 1993
Adapted to metric system - 1998



FHWA
ADAPTED TO METRIC SYSTEM
REA - 1998

HEADWATER DEPTH FOR
CONCRETE PIPE CULVERTS
WITH INLET CONTROL
PROPOSED

Road Profile

VanCleve Project

TPM 20702

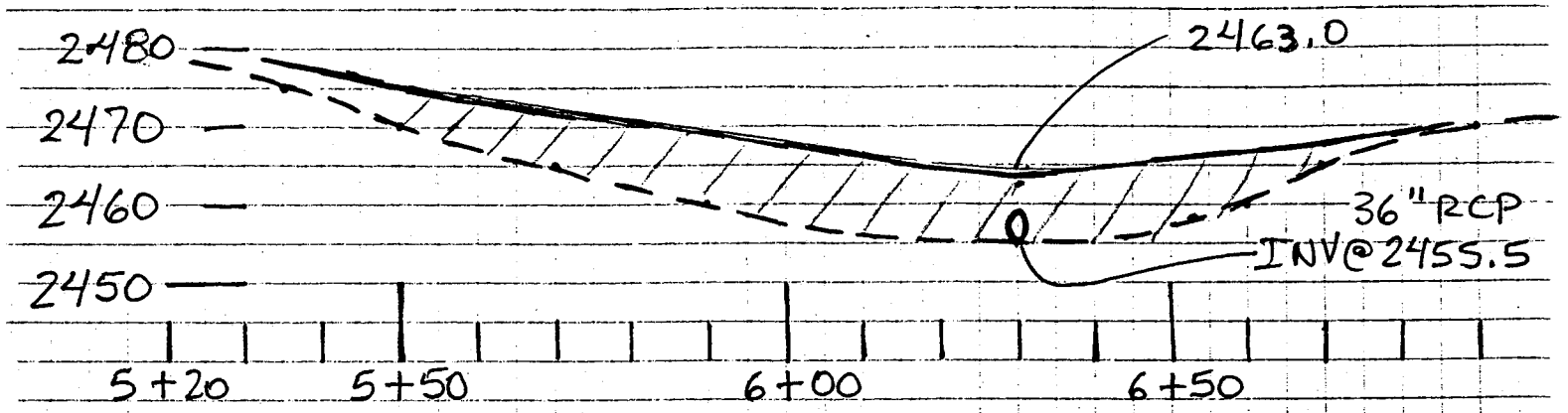
Station	Elevation	Station	Elevation
0 + 00	24 69	6 + 90	24 70
0 + 12	24 70	7 + 20	24 72
0 + 60	24 71	7 + 60	24 70
1 + 10	24 75	8 + 20	24 68
1 + 47	24 80	8 + 45	24 70
1 + 90	24 85	8 + 95	24 75
2 + 50	24 89	9 + 40	24 80
3 + 15	24 85	10 + 20	24 85
3 + 30	24 80	10 + 40	24 90
3 + 60	24 75	10 + 75	24 95
4 + 10	24 80	11 + 00	24 96
4 + 50	24 85	11 + 30	24 95
5 + 10	24 80	11 + 45	24 91
5 + 35	24 75	11 + 60	24 95
5 + 50	24 70	11 + 90	25 00
5 + 70	24 65	12 + 25	25 05
5 + 90	24 60	12 + 70	25 10
6 + 30	24 55	13 + 0	25 15
6 + 60	24 60	13 + 25	25 20
6 + 70	24 65	13 + 65	25 25

eml 10APR03

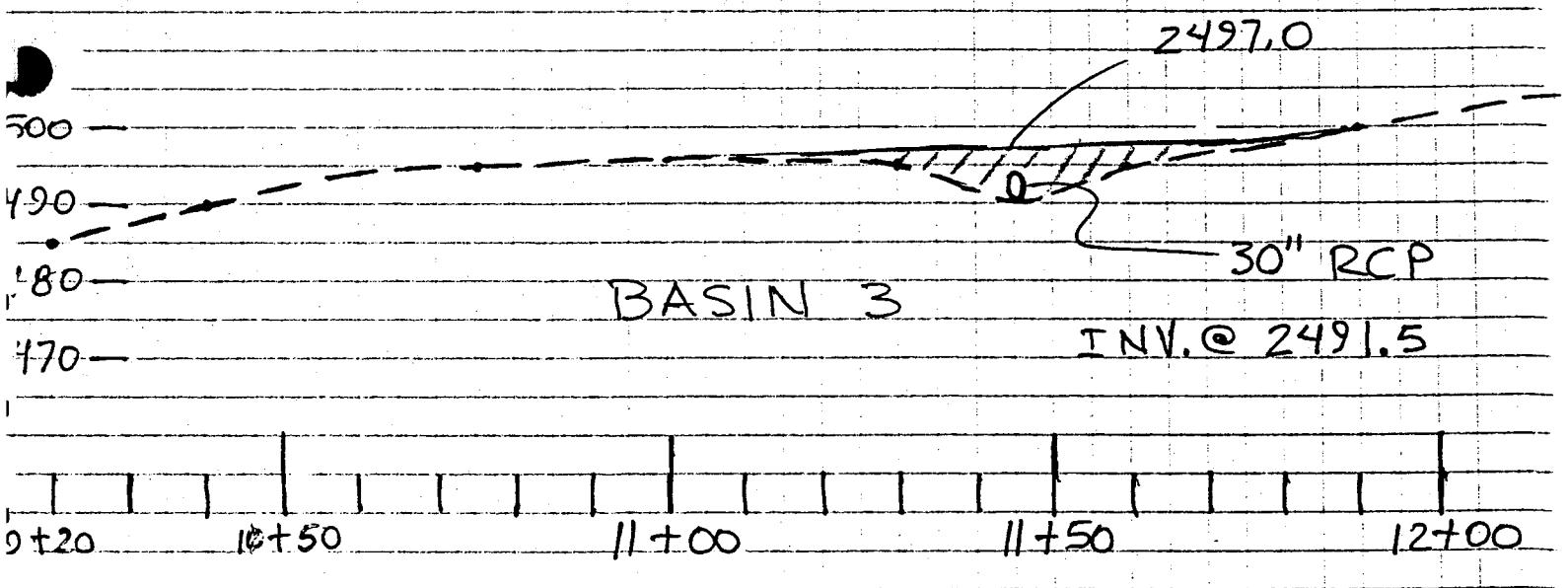
VAN CLEVE/CHASE PROJE

10 APR 03

EML



BASIN 2



BASIN 3

AREA

Values of n to Be Used with the Manning Equation

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) Same 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) Same as (3), lower stages, more ineffective slope and sections	0.040	0.045	0.050	0.055
(5) Same as (3), some weeds and stones	0.035	0.040	0.045	0.050
(6) Same 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 designing.

Table 7-14. Values of K' for Circular Channels in the Formula

$$Q = \frac{K'}{n} d^{5/2} s^{1/2}$$

D = depth of water d = diameter of channel

$\frac{D}{d}$	.00	.01	.02	.03	.04	.05	.06	.07	.08	.09
.0		.00007	.00031	.00074	.00138	.00222	.00325	.00455	.00604	.00773
.1	.00967	.01185	.01427	.01687	.01965	.02258	.02567	.02891	.03227	.03566
.2	.04065	.04485	.04925	.05375	.05835	.06304	.06780	.07258	.07735	.08209
.3	.09075	.09665	.10275	.10895	.11525	.12165	.12804	.13442	.14075	.14705
.4	.15325	.15935	.16535	.17125	.17705	.18275	.18835	.19385	.19925	.20455
.5	.20975	.21485	.21985	.22475	.22955	.23425	.23885	.24335	.24775	.25205
.6	.25625	.26035	.26435	.26825	.27205	.27575	.27935	.28285	.28625	.28955
.7	.29275	.29585	.29885	.30175	.30455	.30725	.30985	.31235	.31475	.31705
.8	.31925	.32135	.32335	.32525	.32705	.32875	.33035	.33185	.33325	.33455
.9	.33575	.33685	.33785	.33875	.33955	.34025	.34085	.34135	.34175	.34205
1.0	.34225									

D/d, K'

Table 7-4. For Determining the Area c of the Cross Section of a Circular Conduit Flowing Part Full

Let $\frac{\text{depth of water}}{\text{diameter of channel}} = \frac{D}{d}$ and C_a = the tabulated value. Then $c = C_a d^2$.

$\frac{D}{d}$	.00	.01	.02	.03	.04	.05	.06	.07	.08	.09
.0	.0000	.0013	.0037	.0069	.0105	.0147	.0192	.0242	.0294	.0350
.1	.0409	.0470	.0534	.0600	.0668	.0739	.0811	.0885	.0961	.1039
.2	.1118	.1199	.1281	.1365	.1449	.1535	.1623	.1711	.1800	.1890
.3	.1982	.2074	.2167	.2260	.2355	.2450	.2546	.2642	.2739	.2836
.4	.2934	.3032	.3130	.3229	.3328	.3428	.3527	.3627	.3727	.3827
.5	.393	.403	.413	.423	.433	.443	.453	.462	.472	.482
.6	.492	.502	.512	.521	.531	.540	.550	.559	.569	.578
.7	.587	.596	.605	.614	.623	.632	.640	.649	.657	.666
.8	.674	.681	.689	.697	.704	.712	.719	.725	.732	.738
.9	.745	.750	.756	.761	.766	.771	.775	.779	.782	.784

200-1.6.1 Selection of Riprap and Filter Blanket Material

Table 200-1.6.1(A)

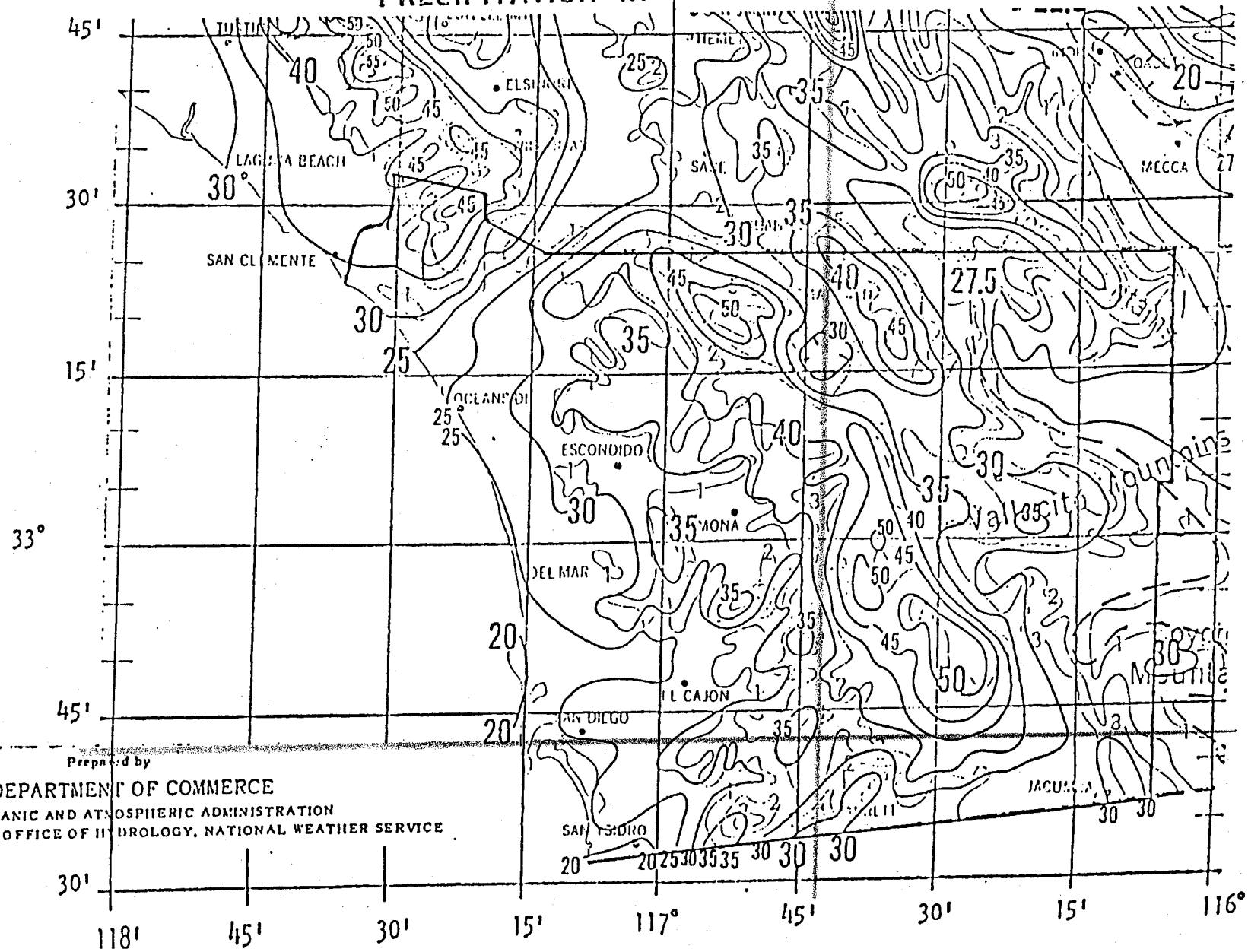
Vel. Ft/Sec (1)	Rock Class (2)	Riprap Thickness "T"	Filter Blanket (3) Upper Layer(s)			
			Opt.1 Sec. 200 (4)	Opt.2 Sec.400 (4)	Opt.3 (5)	Lower Layer (6)
6-7	No. 3 Backfill	.6	3/16"	—	D.G.	—
7-8	No. 2 Backfill	1.0	1/4"	B3	D.G.	—
8-9.5	Facefill	1.4	3/8"	—	D.G.	—
9.5-11	Light	2.0	1/2"	—	3/4" 1-1/2" P.B.	—
11-13	1/4 TON	2.7	3/4"	—	3/4" 1-1/2" P.B.	SAND
13-15	1/2 TON	3.4	1"	—	3/4" 1-1/2" P.B.	SAND
15-17	1 TON	4.3	1-1/2"	—	TYPE B	SAND
	ON	5.4	2"	—	TYPE B	SAN

COUNTY OF SAN DIEGO
DEPARTMENT OF SANITATION &
FLOOD CONTROL

100-YEAR 6-HOUR PRECIPITATION

~20~ ISOPLUVIALS OF 100-YEAR 6-HOUR PRECIPITATION IN TENTHS OF AN INCH

P=3.5



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SPECIAL STUDIES BRANCH, OFFICE OF HYDROLOGY, NATIONAL WEATHER SERVICE

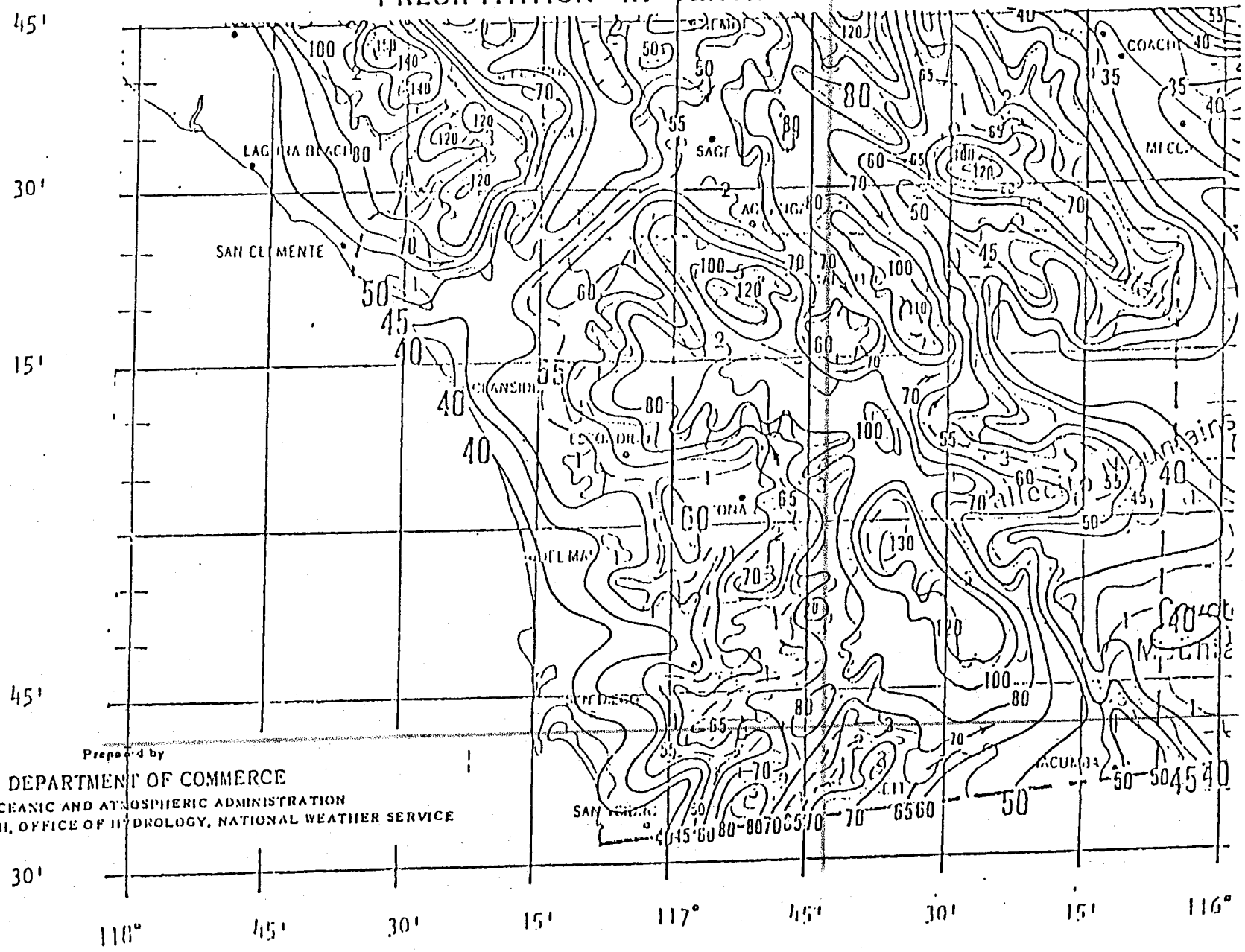
II

COUNTY OF SAN DIEGO
DEPARTMENT OF SANITATION &
FLOOD CONTROL

100-YEAR 24-HOUR PRECIPITATION

20 ISOPLUVIALS OF 100-YEAR 24-HOUR PRECIPITATION IN TENTHS OF AN INCH

P=7.5"



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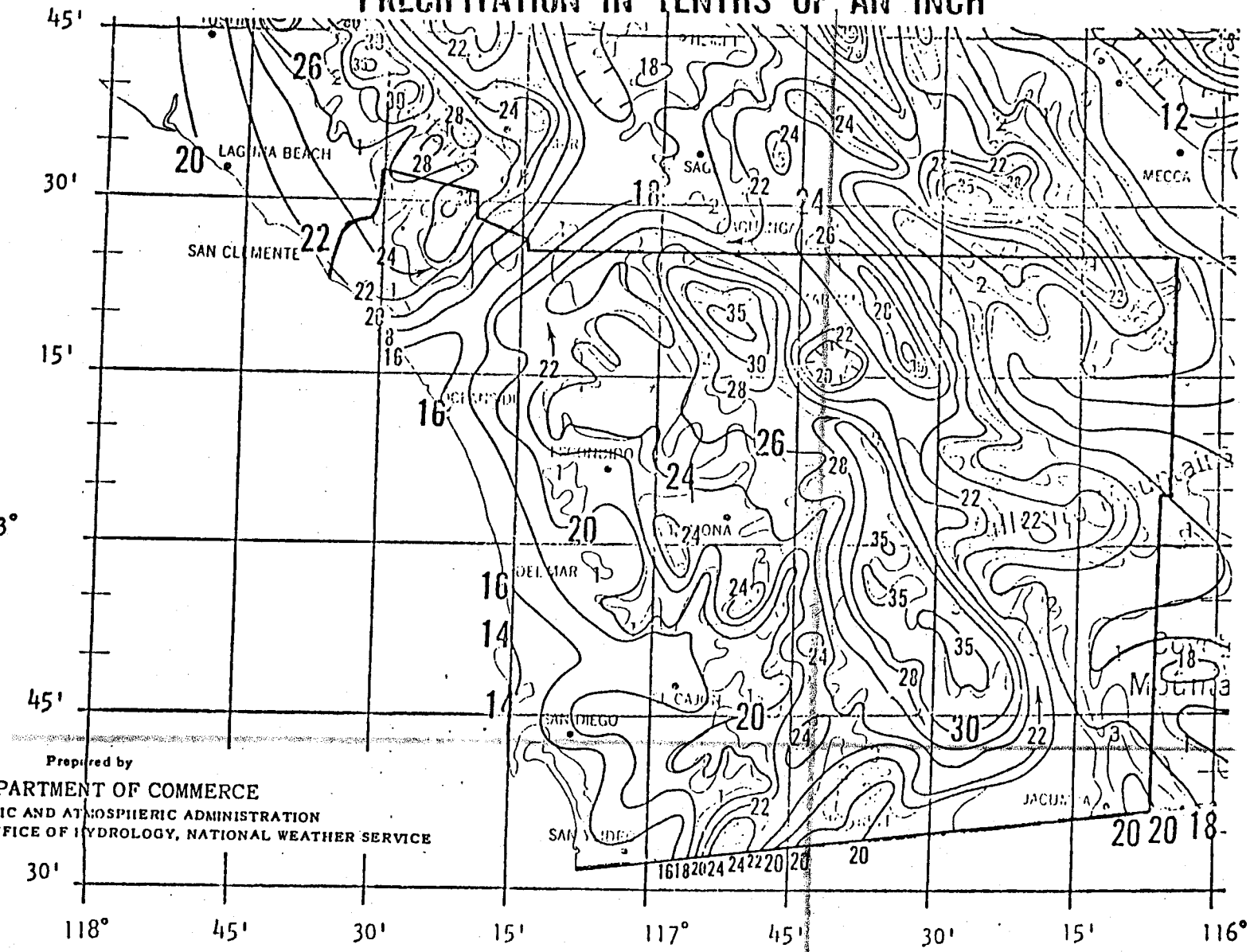
COUNTY OF SAN DIEGO
DEPARTMENT OF SANITATION &
FLOOD CONTROL

10-YEAR 6-HOUR PRECIPITATION

—16— ISOPLUVIALS OF 10-YEAR 6-HOUR PRECIPITATION IN TENTHS OF AN INCH



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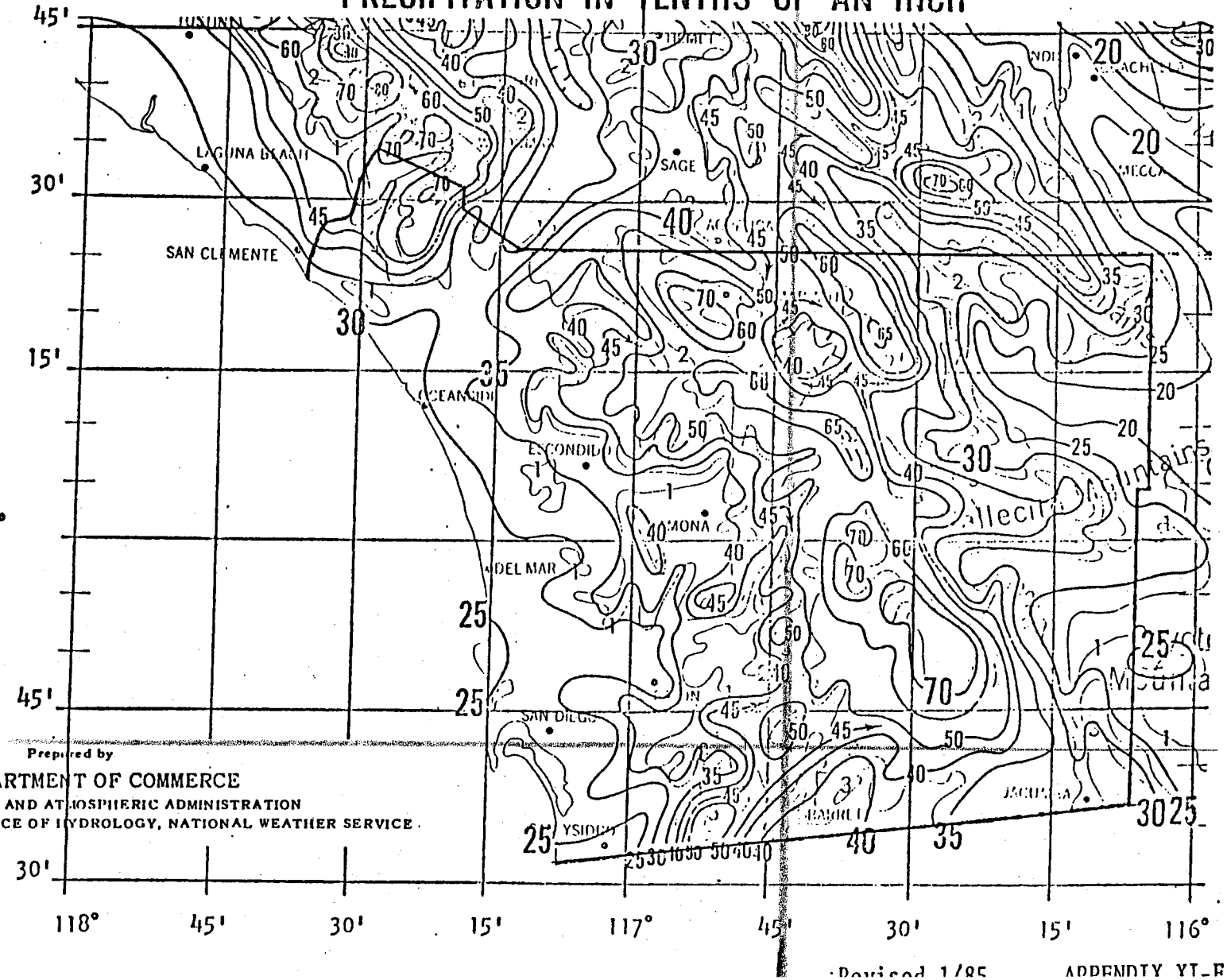
Revised 1/85 APPENDIX XI-C

COUNTY OF SAN DIEGO
DEPARTMENT OF SANITATION &
FLOOD CONTROL

10-YEAR 24-HOUR PRECIPITATION

(20) ISOPLUVIALS OF 10-YEAR 24-HOUR PRECIPITATION IN TENTHS OF AN INCH



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BASIN 2 — 100 YEAR FLOOD

A = 28.5 ACRES

C = .45 (SOIL GROUP D, RURAL)

FROM TABLE 3-2 T_c = 16.7 min

BASED ON INTENSITY - DURATION CHARTS - I = 4.3 in/hr.

Q = CIA

Q = (.45)(4.3 in/hr)(28.5 ACRES) = 55.2 cfs

BASIN 2 10 YEAR FLOOD

A= 28.5 ACRES

C= .45 (SOIL GROUP D, RURAL)

FROM TABLE 3-2 T_c = 16.7 min

BASED ON THE INTENSITY-DURATION CHARTS- I= 2.8 in/hr

Q= CIA

Q=(.45)(2.8 in/hr)(28.5 ACRES) = 35.9 cfs

TABLE 3-2

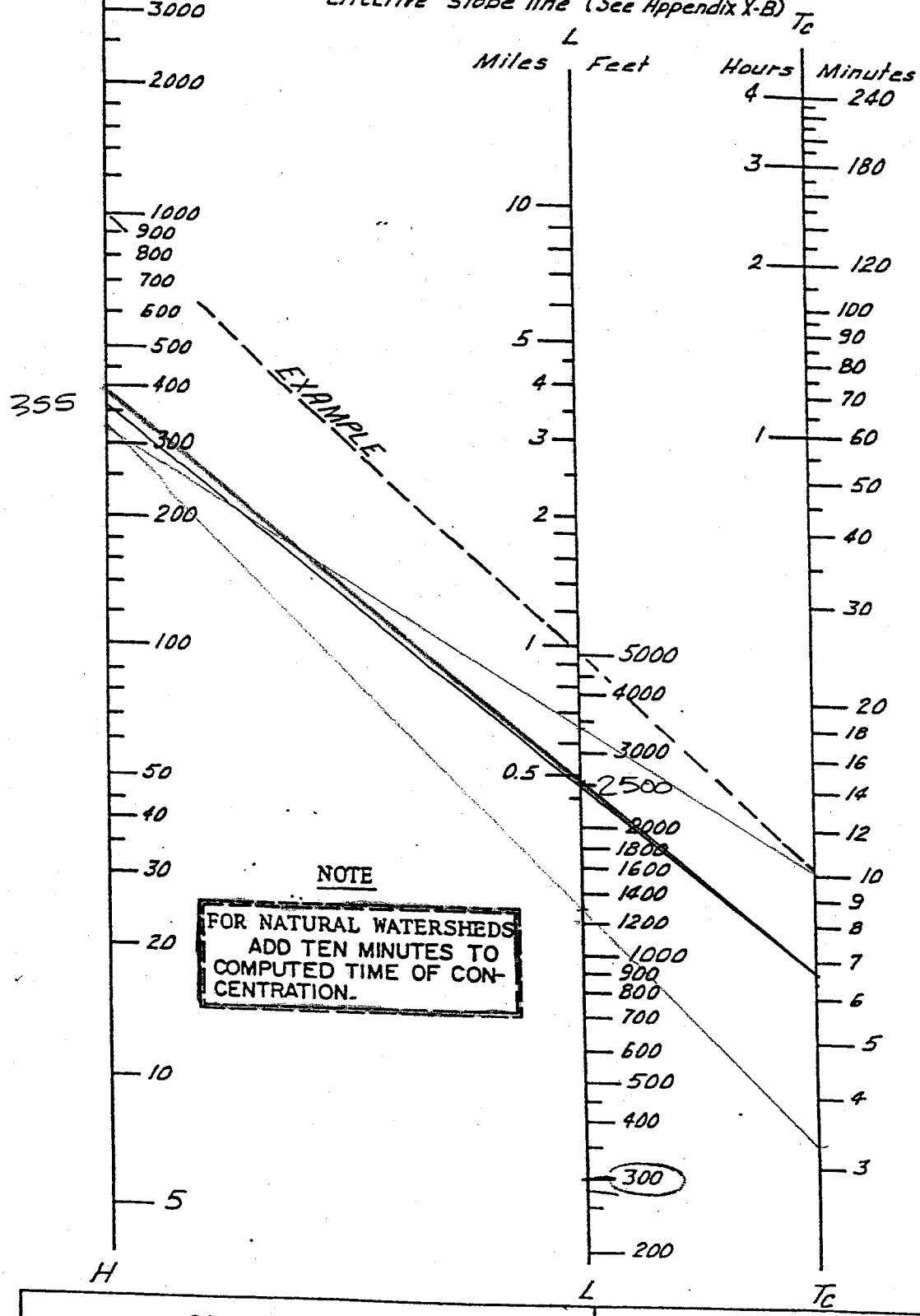
EQUATION

$$T_c = \left(\frac{11.9L^3}{H}\right)^{.385}$$

T_c = Time of concentration
L = Length of watershed
H = Difference in elevation along effective slope line (See Appendix X-B)

L=2500 FT

H=2810-2455=355 ft

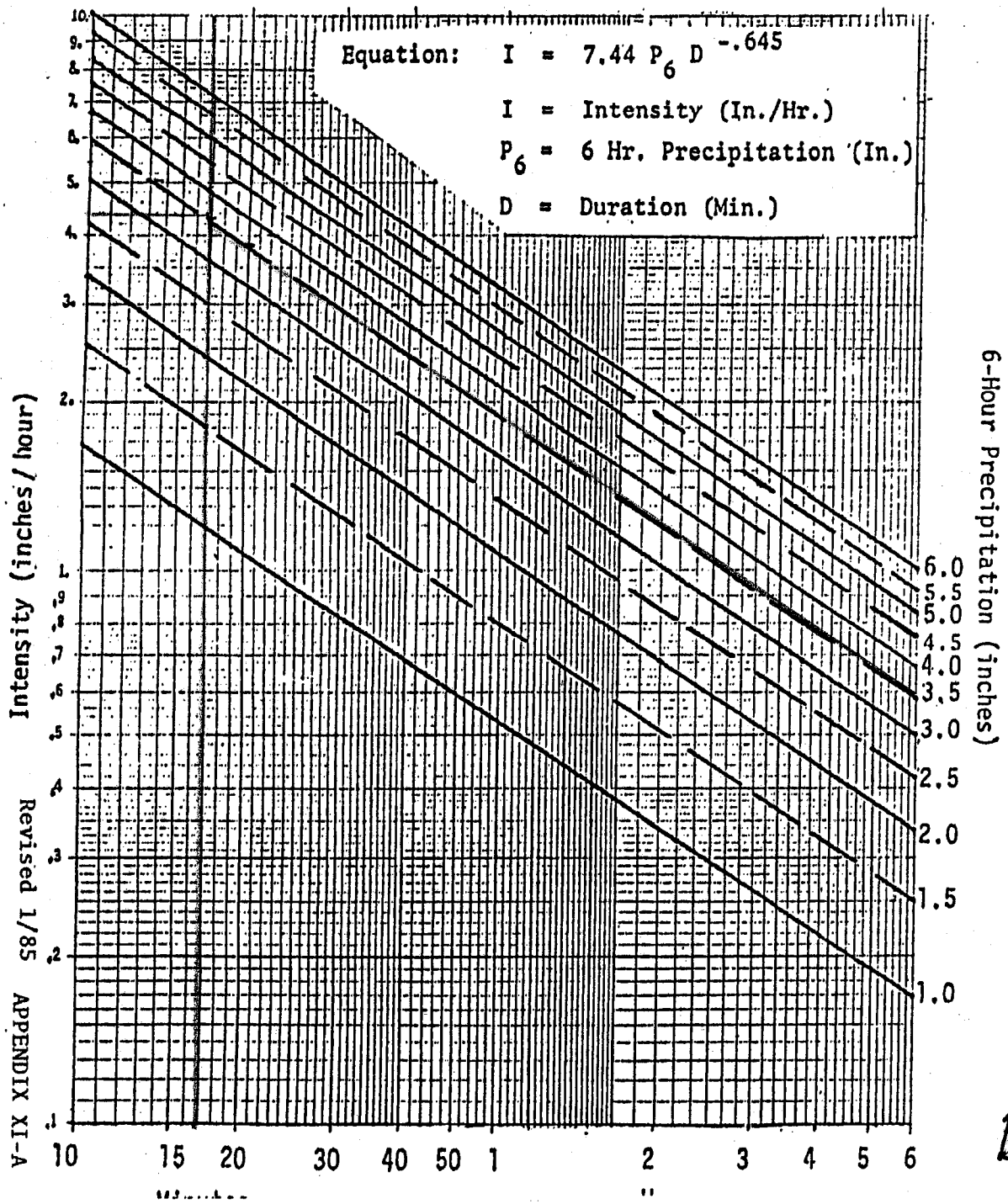


NOTE

FOR NATURAL WATERSHEDS ADD TEN MINUTES TO COMPUTED TIME OF CONCENTRATION.

SAN DIEGO COUNTY DEPARTMENT OF SPECIAL DISTRICT SERVICES DESIGN MANUAL APPROVED [illegible]	NOMOGRAPH FOR DETERMINATION OF TIME OF CONCENTRATION (Tc) FOR NATURAL WATERSHEDS DATE 12/1/69

INTENSITY-DURATION DESIGN CHART



Directions for Application:

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

2) Adjust 6 hr. precipitation (if necessary) sc 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 th plotted lines.

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

Application Form:

0) Selected Frequency 100 yr.

1) P_6 = 3.5 in., P_{24} = 7.5, $\frac{{}^{*}P_6}{P_{24}}$ = 47 %*

2) Adjusted $^{*}P_6$ = 3.5 in.

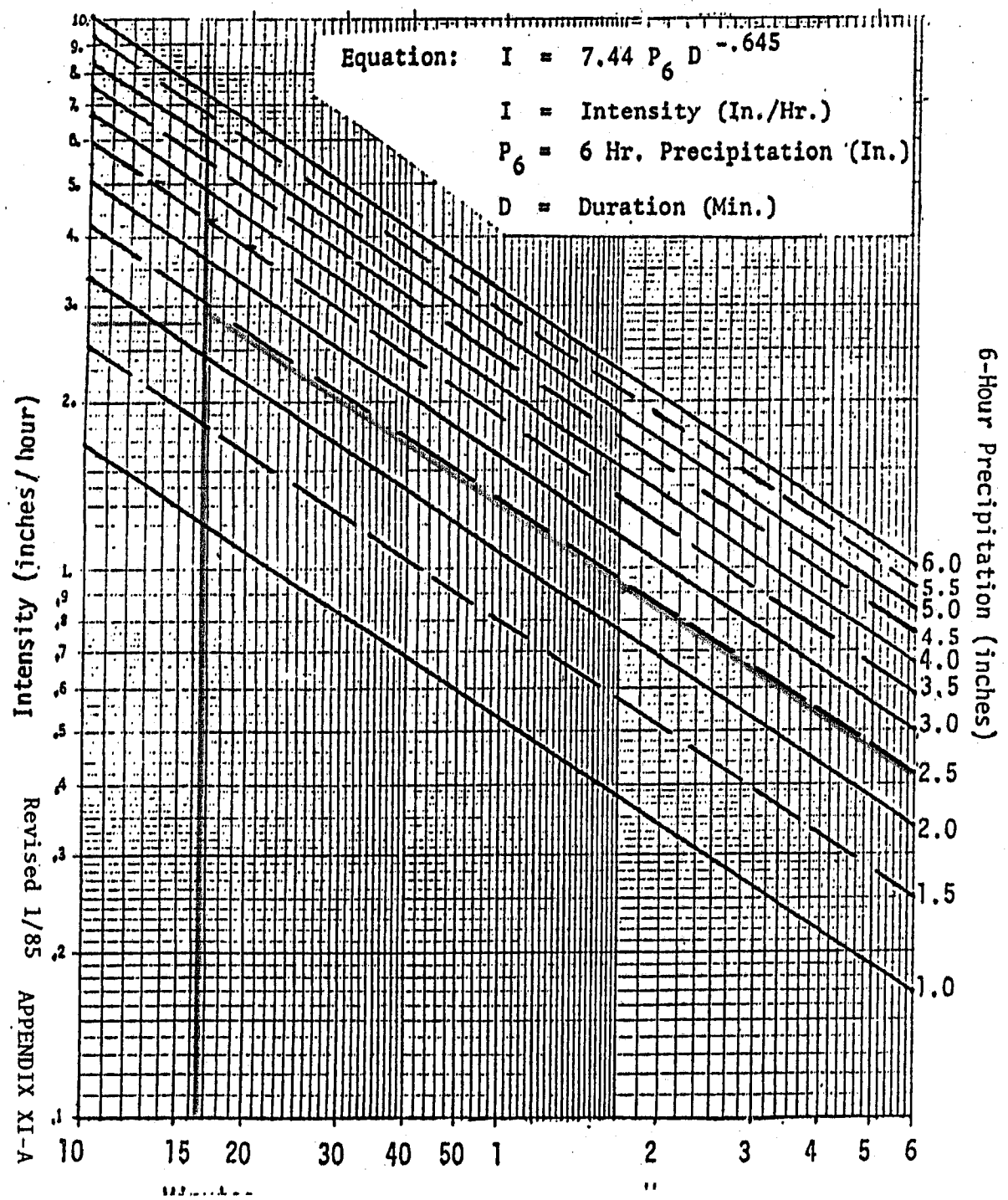
3) t_c = 16.7 min.

4) I = 4.3 in/hr.

*Not Applicable to Desert Region

BASIN 2 100 YEAR

INTENSITY-DURATION DESIGN CHART



Directions for Application:

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

2) Adjust 6 hr. precipitation (if necessary) sc 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 th plotted lines.

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

Application Form:

0) Selected Frequency 10 yr.

1) P_6 = 2.4 in., P_{24} = 5.0, $\frac{{}^*P_6}{P_{24}}$ = 48 %*

2) Adjusted $^*P_6$ = 2.4 in.

3) t_c = 16.7 min.

4) I = 2.8 in/hr.

*Not Applicable to Desert Region

BASIN 2 10 YEAR

BASIN 3 — 100 YEAR FLOOD

A = 12.7 ACRES

C = .45 (SOILS GROUP D, RURAL)

FROM TABLE 3-3 T_c = 13.3 min

BASED ON INTENSITY-DURATION CHART - I = 5.0 in/hr

Q = CIA

Q = (.45)(5.0 in/hr.)(12.7 ACRES) = 28.7 cfs

BASIN 3 10 YEAR FLOOD

A= 12.7 ACRES

C= .45 (SOILS GROUP D, RURAL)

FROM TABLE 3-3 t_c = 13.3 min

BASED ON INTENSITY-DURATION CHART - I = 3.4 in/hr

Q= C I A

Q = (.45)(3.4 in/hr)(12.7 ACRES) = 19.4 cfs

EQUATION

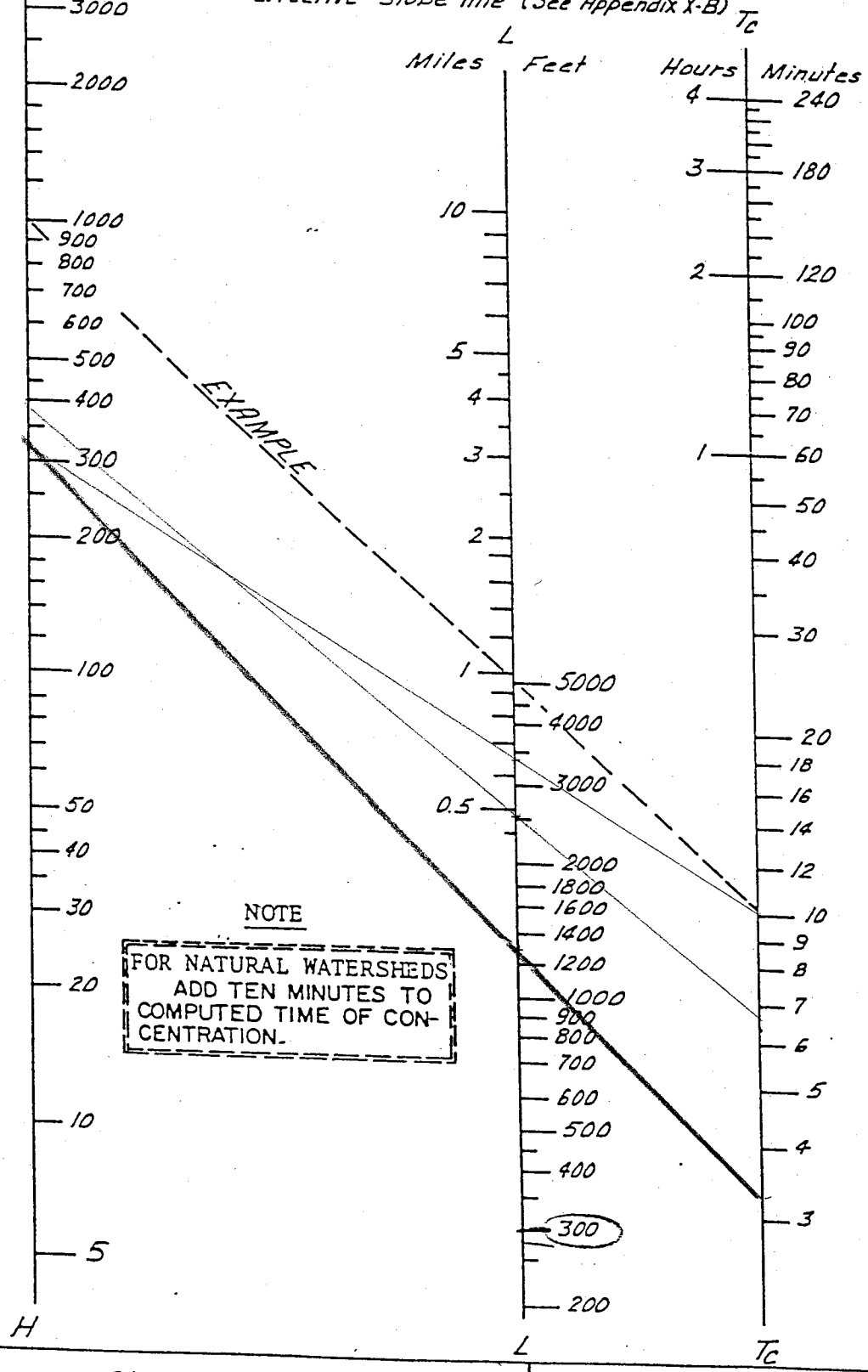
$$T_c = \left(\frac{11.9L^3}{H}\right)^{.385}$$

T_c = Time of concentration
L = Length of watershed
H = Difference in elevation along effective slope line (See Appendix X-B)

TABLE 3-3

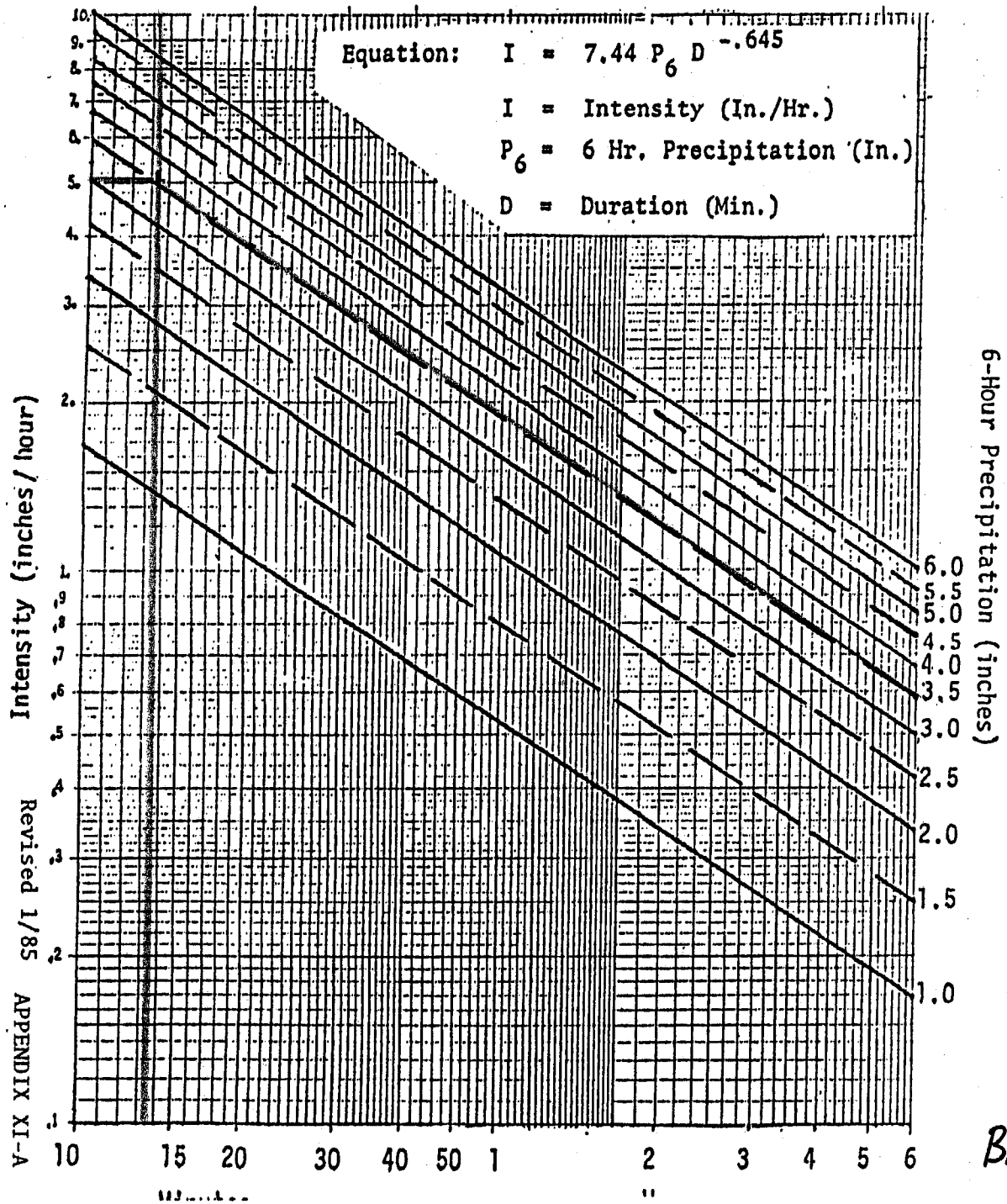
$L = 1300$ FT

$H = 2816 - 2490 = 326'$



SAN DIEGO COUNTY DEPARTMENT OF SPECIAL DISTRICT SERVICES DESIGN MANUAL APPROVED B. H. Hoffmaster	NOMOGRAPH FOR DETERMINATION OF TIME OF CONCENTRATION (Tc) FOR NATURAL WATERSHEDS
	DATE 12/1/69

INTENSITY-DURATION DESIGN CHART



Directions for Application:

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

2) Adjust 6 hr. precipitation (if necessary) sc 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 th plotted lines.

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

Application Form:

0) Selected Frequency 100 yr.

1) P_6 = 3.5 in., P_{24} = 7.5, $\frac{{}^*P_6}{P_{24}}$ = 47 %*

2) Adjusted $^*P_6$ = 3.5 in.

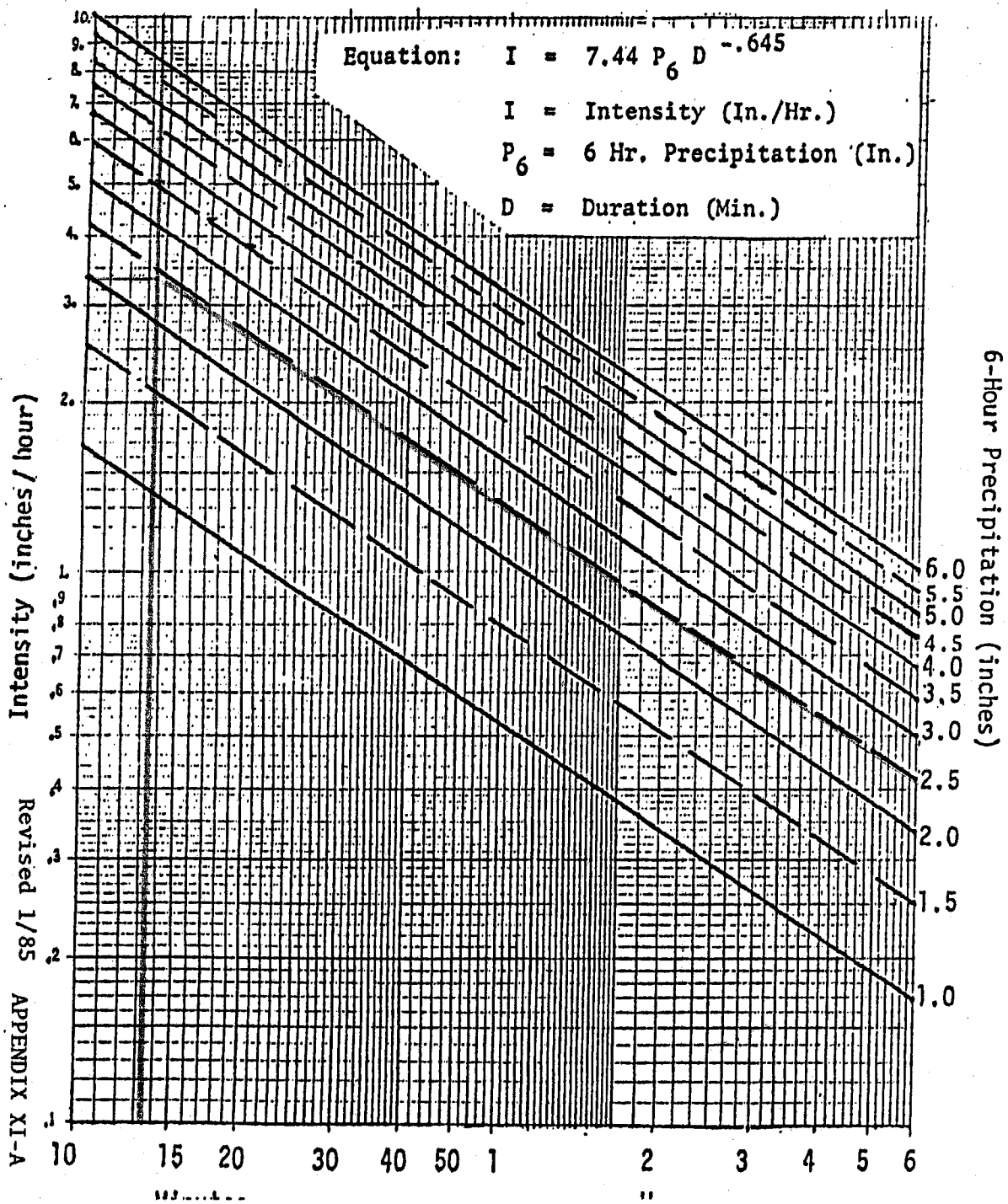
3) t_c = 13.3 min.

4) I = 5.0 in/hr.

*Not Applicable to Desert Region

BASIN 3 100 YEAR

INTENSITY-DURATION DESIGN CHART



Directions for Application:

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

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

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

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

Application Form:

0) Selected Frequency 10 yr.

1) P_6 = 2.4 in., P_{24} = 5.0, $\frac{{}^{*}P_6}{P_{24}}$ = 48 %*

2) Adjusted $^{*}P_6$ = 2.4 in.

3) t_c = 13.3 min.

4) I = 3.4 in/hr.

*Not Applicable to Desert Region

BASIN 3 10 YEAR

DRAINAGE IMPACTS	Project: Van Cleve TPM TPM 20702 Date: 6/23/03

EROSION AND SILTATION ASPECTS/ CONCENTRATION OF DRAINAGE

The Van Cleve property is located on the slope of a large hill with the south end having the high elevations and the runoff running northerly. Currently [and after the project] the runoff flows into a relatively flat area north of the Van Cleve property. An existing access road has not interfered with surface runoff. The new road will have fills of as much as 8 feet at the crossings with the two major drainage flows. The area off-site, to the north, receiving the runoff is wooded with seasonal grasses. [Please refer to the attached aerial photograph and the 200 scale hydrology map.]

BASIN 2

The house pads are proposed on the north edge of the property and the access road to the easterly pad will intercept two drainage flows. This westerly basin is approximately 29 acres and will have a 100 year flow of 55 cfs. A 36 inch RCP is proposed to handle this flow. The flow will not be redirected or obstructed.

Downstream, on the northerly neighbor's property, there would not be a change to the drainage flow. It is estimated that the depth of flow in the pipe will be 29 inches and have a velocity of 9.6 ft/sec. Because erosion is a concern at this velocity [>6ft/sec], Light Riprap will be installed downstream of the pipe. The access road forms a dam that will result in a shallow pond approximately 50 ft wide.

Erosion upstream would not change due to the project and Light Riprap will mitigate downstream erosion. There will be some siltation upstream that will need to be removed periodically so that the full capacity of the pipe is available.

BASIN 3

The east drainage basin [Basin 3] is approximately 13 acres and will have a 100 year flow of 29 cfs. A 30 inch RCP will be installed to handle this flow. The flow will not be redirected or obstructed. The neighbor's property will not be impacted because the runoff will continue as it is now.

Depth of flow is estimated at 21 inches and would form a pond of approximately 20 ft width. To mitigate the flow velocity of 8 ft/sec, No. 2 backing will be used for riprap.

Erosion upstream would not change and No. 2 backing riprap will mitigate downstream erosion. There will be some siltation upstream that will need to be removed periodically so that the full capacity of the pipe is available.

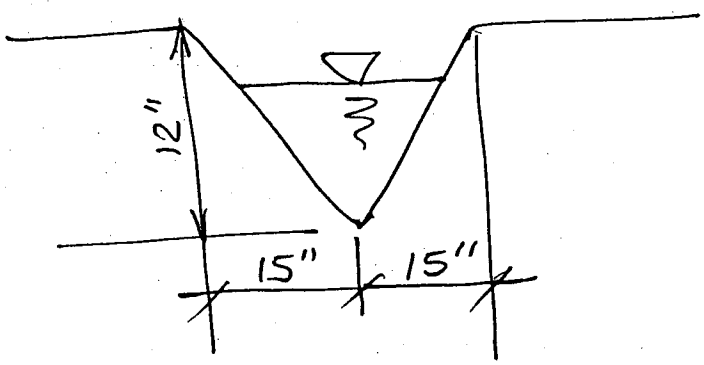
Edgar Monroy L., P.E.
RCE 27188, Exp. 03.31.05

ALL LOCATIONS ARE APPROXIMATE

TPM 20702
eml 6.24.03

BROW DITCH FOR EASTERLY PAD DEPTH OF FLOW CALCS	Project: Van Cleve TPM TPM 20702 Date: 6/22/03

BROW DITCHES WILL BE TRIANGULAR, UNLINED ($n = 0.03$) & SLOPE = 5% ±



Calcs were done using FLOWMASTER by Haestad Methods.

for $Q_{10} = 1.8$ cfs :

Velocity	Depth	Top Width
4.13 fps	7"	1.48'

for $Q_{100} = 2.8$ cfs :

Velocity	Depth	Top Width
4.66 fps	8"	1.74'

Thus, the brow ditches will be able to handle even a 100 yr flood.

Edgar Monroy L., P.E.
RCE 27188, Exp. 03.31.05

Flow for Easterly Pad Intercepted by Brow Ditches	Project: Van Cleve TPM TPM 20702 Date: 6/21/03

10 yr Flow

$Q_{10} = c\,I\,A$ where $c = 0.45$ (soil group D, rural)

$I = 3.5$ in/hr (Appendix XI-A)

$A = 1.27\ in^2$ at $1'' = 200'$

$= 50{,}800$ sf

$= 1.2$ Ac

$= (0.45)(3.5)(1.2)$

$Q_{10} = 1.9$ cfs

100 yr Flow

$Q_{100} = c\,I\,A$ where $c = 0.45$ (soil group D, rural)

$I = 5.3$ in/hr (Appendix XI-A)

$= (0.45)(5.3)(1.2)$

$Q_{100} = 2.9$ cfs

The Brow Ditch for the westerly pad intercepts runoff right at the ridge line. As a result, the amount of runoff is negligible because the drainage area is very small, less than an acre.

REGISTERED PROFESSIONAL ENGINEER
EDGAR MONROY L.
No. 27188
Exp. 3/31/05
CIVIL
STATE OF CALIFORNIA

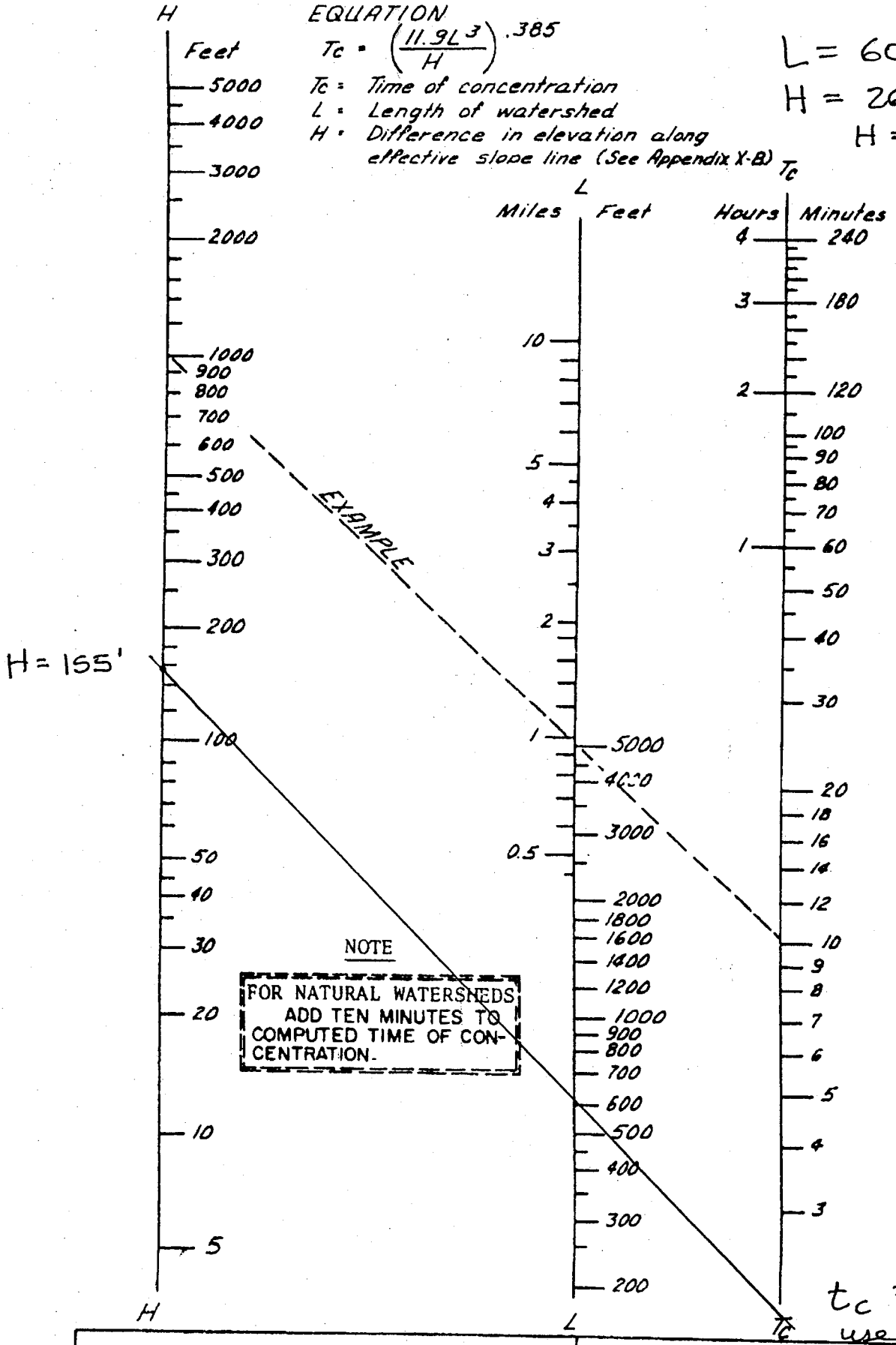
Edgar Monroy L., P.E.
RCE 27188, Exp. 03.31.05

EQUATION

$$T_c = \left(\frac{11.9L^3}{H}\right)^{.385}$$

T_c = Time of concentration
L = Length of watershed
H = Difference in elevation along effective slope line (See Appendix X-B)

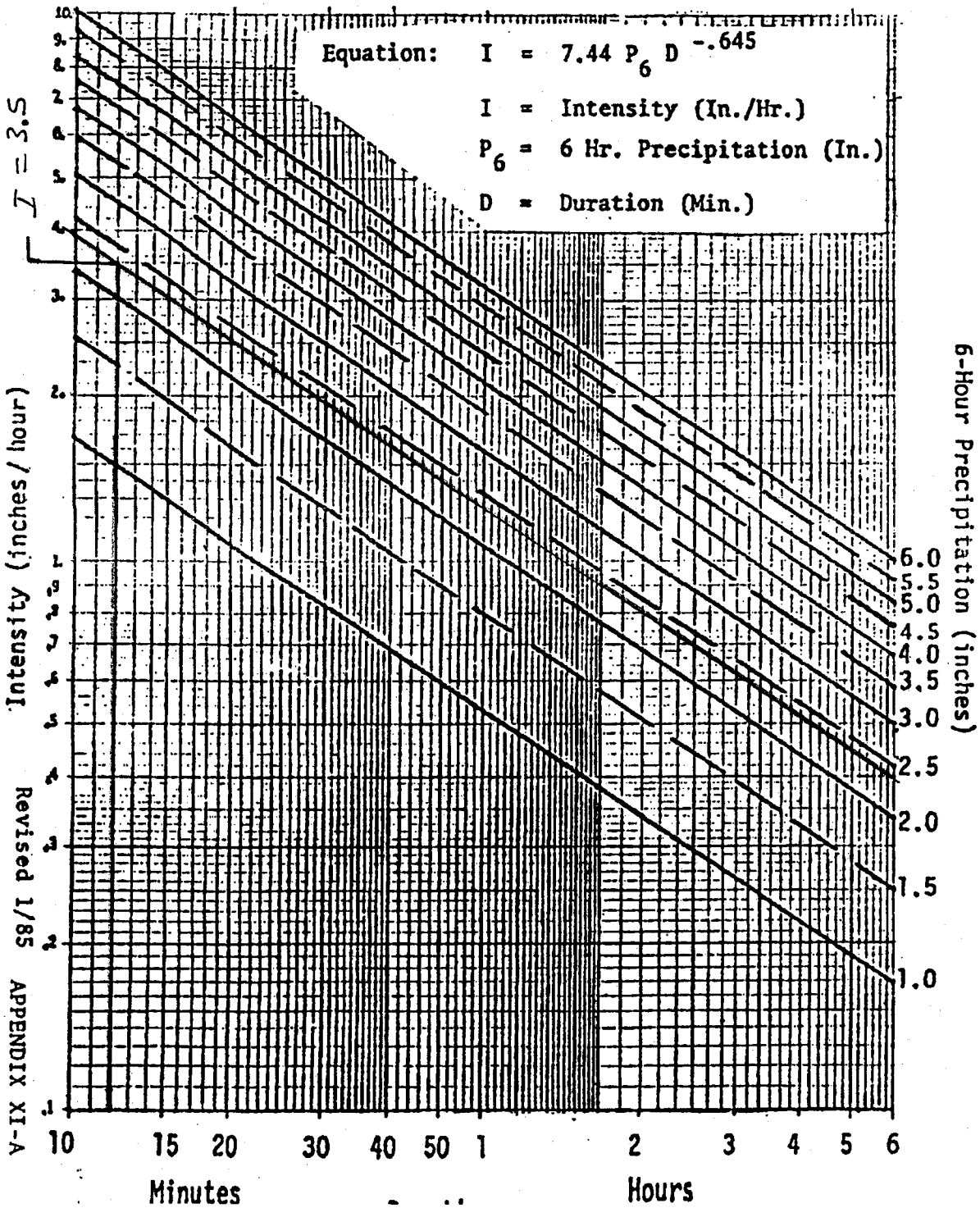
L = 600'
H = 2683 - 2528
H = 155'



t_c = 2 min.
use 12 min

SAN DIEGO COUNTY DEPARTMENT OF SPECIAL DISTRICT SERVICES DESIGN MANUAL APPROVED J. H. Hofmaster	NOMOGRAPH FOR DETERMINATION OF TIME OF CONCENTRATION (Tc) FOR NATURAL WATERSHEDS DATE 12/1/69 APPENDIX X-A

INTENSITY-DURATION DESIGN CHART



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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:

0) Selected Frequency 10 yr.

1) P_6 = 2.4 in., P_{24} = 5.0, $\frac{{}^{*}P_6}{P_{24}}$ = 48 %*

2) Adjusted $^{*}P_6$ = 2.4 in.

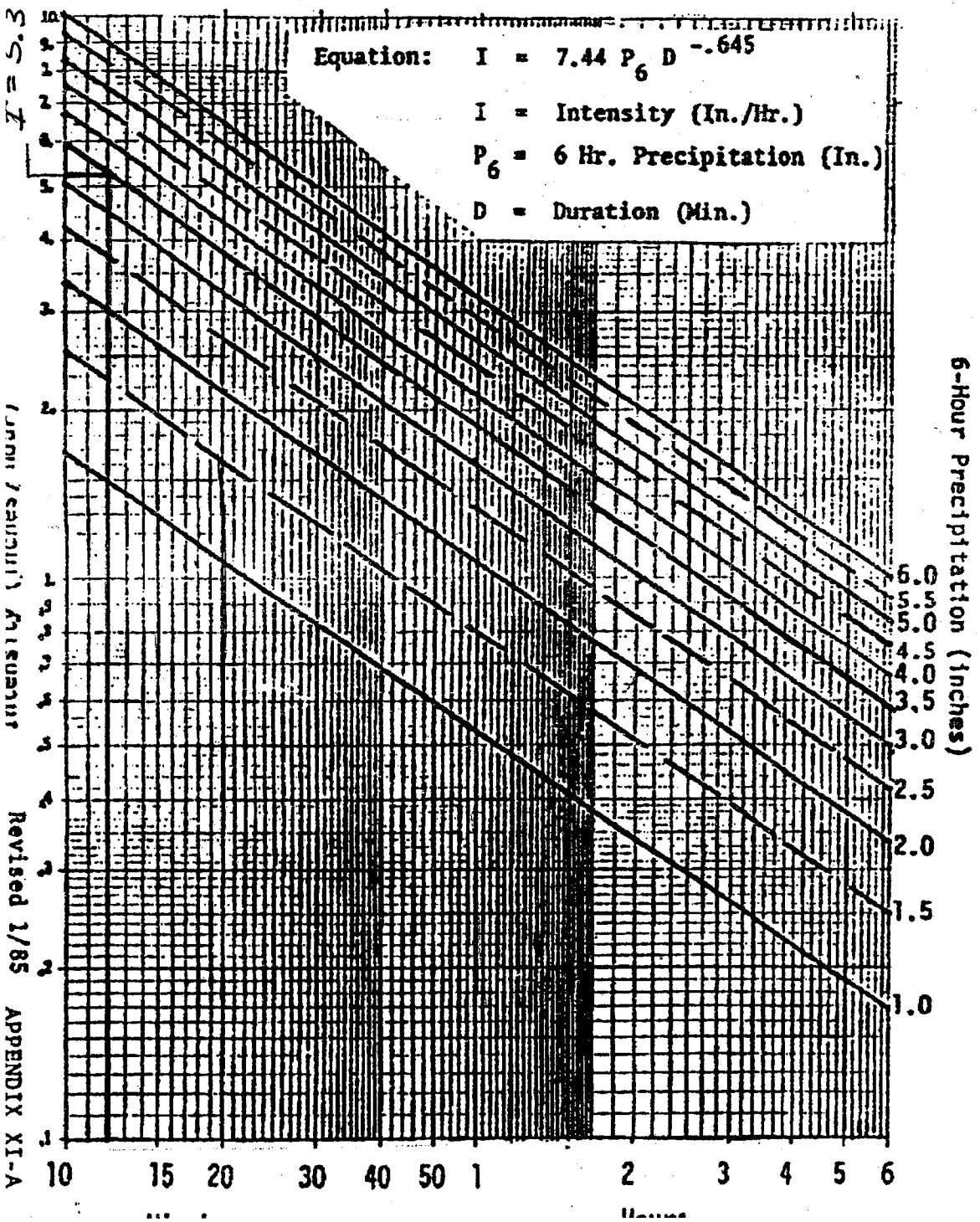
3) t_c = 12 min.

4) I = 3.5 in/hr.

*Not Applicable to Desert Region

Revised 1/85 APPENDIX XI-A

INTENSITY-DURATION DESIGN CHART



Directions for Application:

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

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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:

0) Selected Frequency 100 yr.

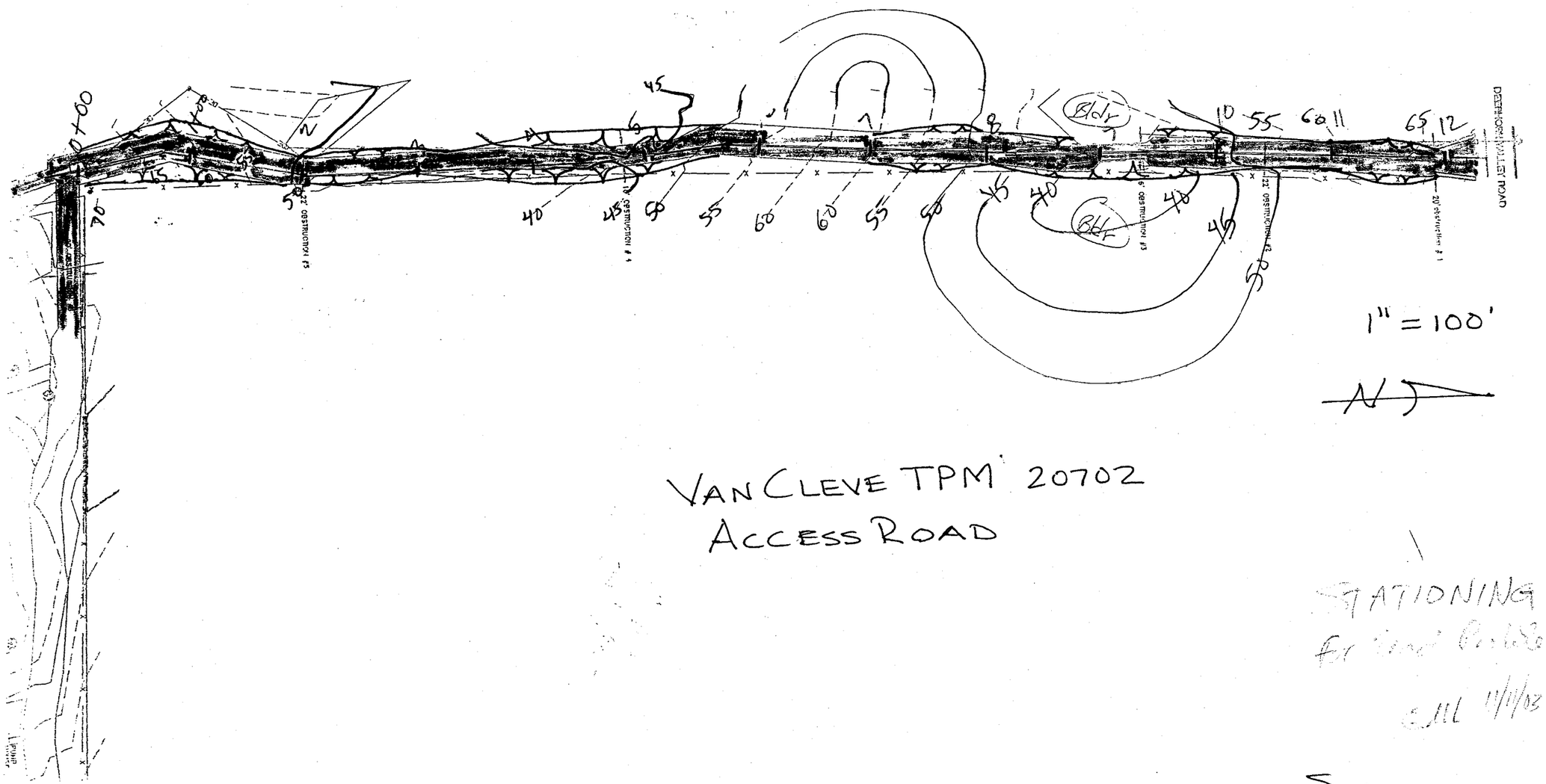
1) P_6 = 3.5 in., P_{24} = 7.5, $\frac{{}^{*}P_6}{P_{24}}$ = 47 %*

2) Adjusted $^{*}P_6$ = 3.5 in.

3) t_c = 12 min.

4) I = 5.3 in/hr.

*Not Applicable to Desert Region



VAN CLEVE TPM 20702
ACCESS ROAD

STATIONING
for Road Profile
EML 11/11/13

STATIONING for
ROAD PROFILE

EML 11/11/13

1/...

VAN CLEVE (TPM 20702)

ACCESS ROAD PROFILES

	Before Road Constr. (from 200 scale Topo)	After Road Constr. (from current survey)
STA 0 + 00	2464	2470
+ 30	2460	—
+ 55	—	2465
1 + 00	2455	2460
+ 50	—	2455
+ 90	—	2450
2 + 00	2455	—
+ 10	—	2445
+ 40	2459	—
+ 80	2455	—
3 + 07	2450	—
+ 18	2445	—
+ 55	2440	—
4 + 00	2436	—
+ 70	—	2445
5 + 00	2436	—
+ 43	2440	—
+ 50	—	2450
6 + 00	—	2455
+ 40	2445	—
+ 50	—	2460
7 + 00		2460
+ 30	2445	—
+ 40	—	2455
+ 85	2452	2450
8 + 25	2460	2445
+ 40	2465	—
+ 69	2469	—
+ 85	—	2440
9 + 00	2465	—
+ 30	2460	—
+ 55	2455	2440
+ 80	2450	2445
10 + 10	—	2450
+ 65	—	2455
11 + 15	—	2460
+ 75	2448	2465
12 + 40	2450	
+ 50	2455	
+ 60	2460	

eml 11/17/03

2/14

VANCLEVE (TPM 20702)
WATERSHED FOR EASEMENT ROAD CULVERT

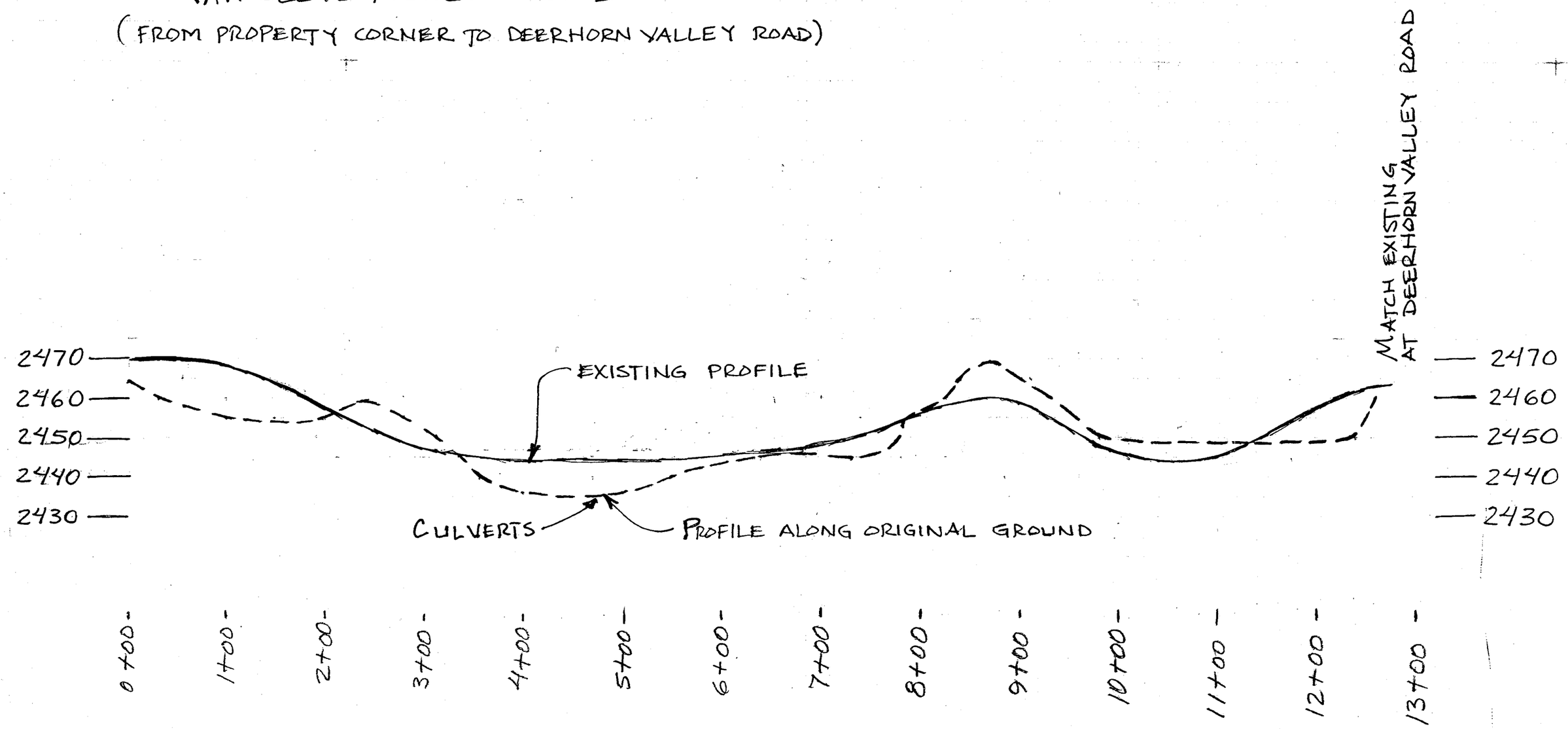
PROFILE FOR LONGEST WATERCOURSE

STA	ELEV		STA	ELEV
0+00	3000		42+00	2465
4+00	2850		44+15	2460
6+00	2775		45+10	2455
7+00	2758		46+50	2450
8+00	2739		48+00	2445
10+00	2721		52+50	2440
11+00	2713		56+60	2439
14+00	2640			
16+00	2614			
17+00	2601			
19+00	2585			
20+00	2560			
22+00	2554			
26+00	2520			
31+70	2502	@ Deerhorn Valley Rd (Road @ 2511)		
33+00	2500			
34+00	2493			
36+50	2485			
38+20	2475			
40+00	2470			

EML 11/11/03

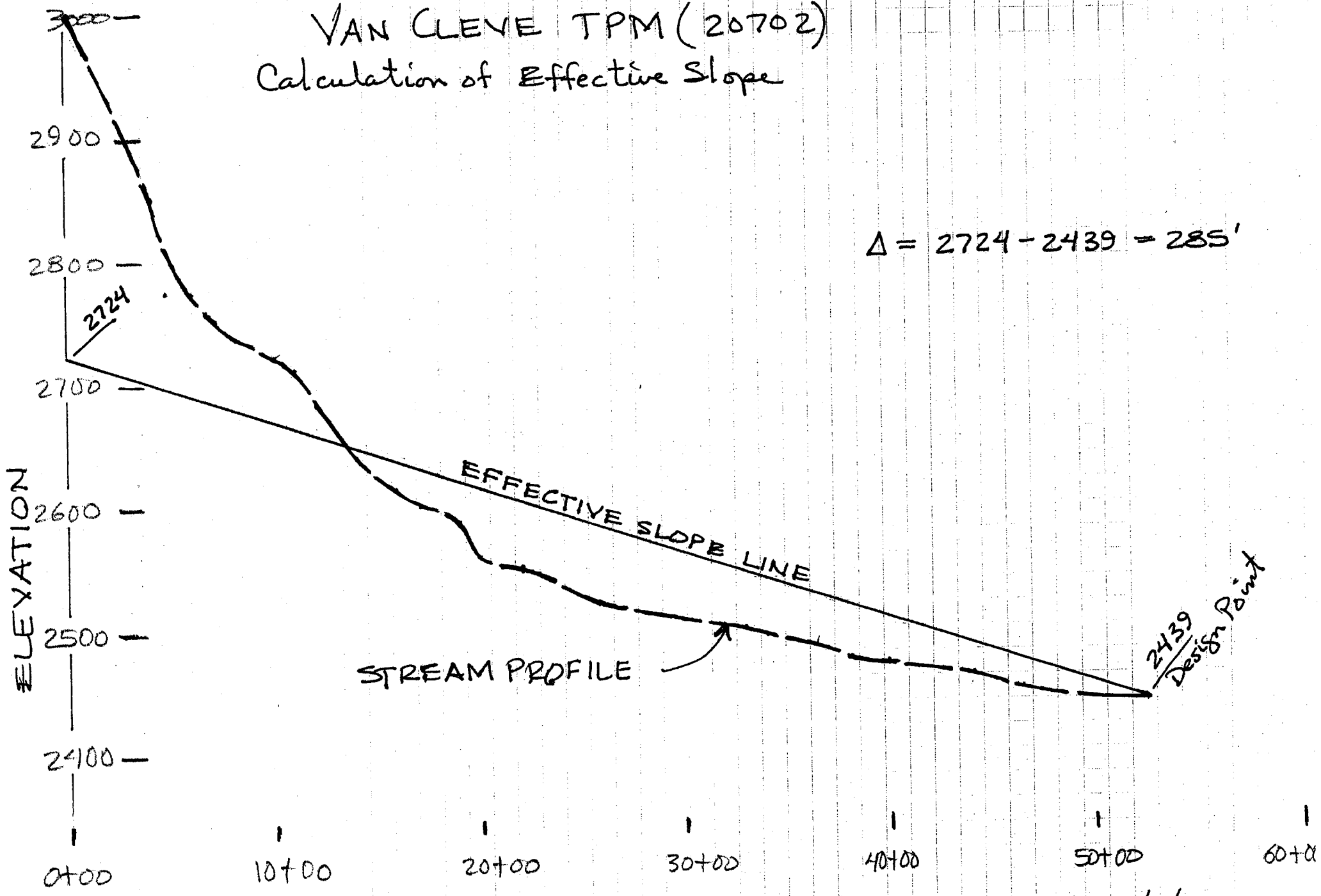
VAN CLEVE ACCESS ROAD

(FROM PROPERTY CORNER TO DEERHORN VALLEY ROAD)



EML 11/11/03

VAN CLEVE TPM (20702)
Calculation of Effective Slope



$\Delta = 2724 - 2439 = 285'$

EML 11/11/03

5/14

Watershed Area

AREA	In^2
A_1	16.47
A_2	16.20
A_3	24.54
A_4	22.20
A_5	27.64
A_6	22.41
A_7	39.08
A_8	38.67
A_9	30.16
A_{10}	18.05
A_{11}	21.25
A_{12}	19.50
A_{13}	26.40
A_{14}	16.80
A_{15}	16.41
A_{16}	27.29
A_{17}	15.41
A_{18}	14.08
	412.56

$1\ in^2 = 40000\ sf$

$A = 412.56\ in^2 \times 40{,}000\ sf/in^2$

$= 16{,}502{,}400\ sf$

$A = 378.8$ Acres

EML 11/11/03

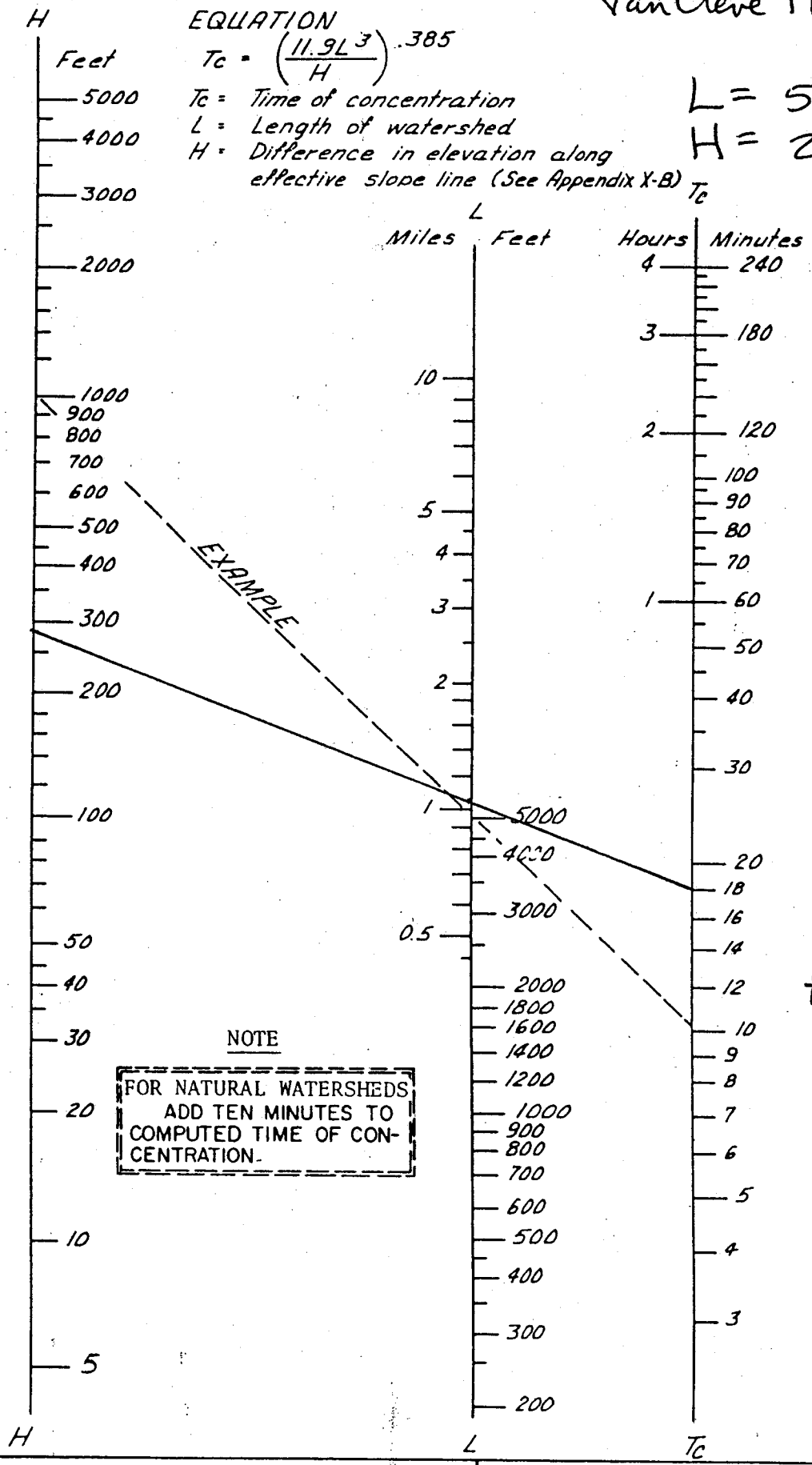
Van Cleve TPM (20702)

EQUATION

$$T_c = \left(\frac{11.9L^3}{H}\right)^{.385}$$

T_c = Time of concentration
L = Length of watershed
H = Difference in elevation along effective slope line (See Appendix X-B)

$L = 5660'$
$H = 285'$



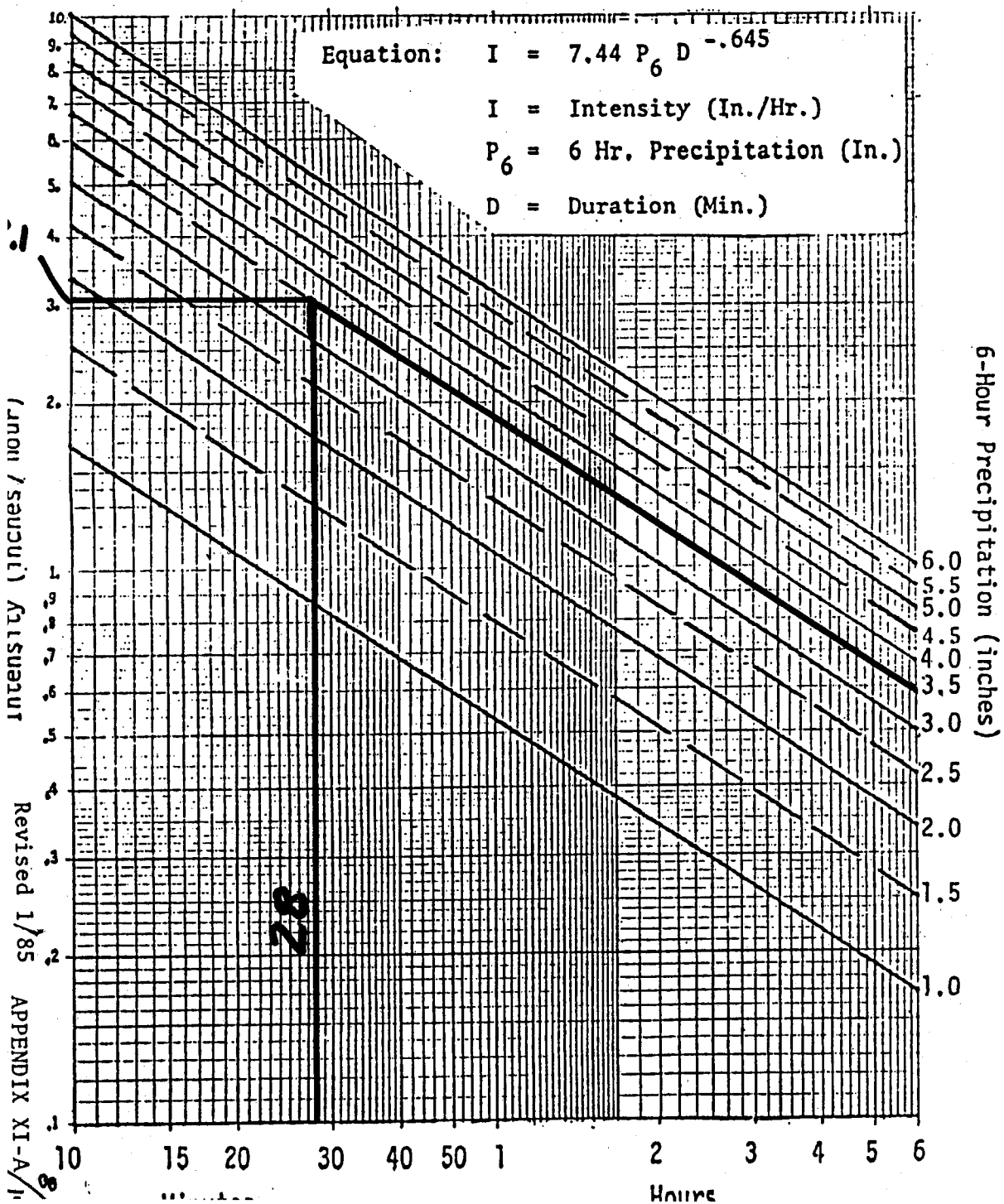
$t_c = 28$ min

NOTE

FOR NATURAL WATERSHEDS ADD TEN MINUTES TO COMPUTED TIME OF CONCENTRATION.

SAN DIEGO COUNTY DEPARTMENT OF SPECIAL DISTRICT SERVICES DESIGN MANUAL APPROVED J. H. Hoffmaster	NOMOGRAPH FOR DETERMINATION OF TIME OF CONCENTRATION (Tc) FOR NATURAL WATERSHEDS DATE 12/1/69 APPENDIX X-A 7/11

INTENSITY-DURATION DESIGN CHART



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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:

0) Selected Frequency 100 yr.

1) P_6 = 3.5 in., P_{24} = 7.5, $\frac{*P_6}{P_{24}}$ = 47 %*

2) Adjusted $*P_6$ = 3.5 in.

3) t_c = 28 min.

4) I = 3.1 in/hr.

*Not Applicable to Desert Region

Van Cleve (TPM 20702)

Van Cleve (TPM 20702)

100 Yr Flow

$Q = C i A$ where

$C = 0.45$ (Soils Group D, rural)

$i = 3.1$ in hour

(from intensity-duration chart, $t_c = 28$)

$A = 378.8$ Acres

$Q = (0.45)(3.1)(378.8)$

$Q = 528.43$ cfs

use 530 cfs

$Q/2 = 265$ cfs

$Q/3 = 177$ cfs

EML 11/11/03

Van Cleve (TPM 20702) - Culvert Sizing Calcs

Culvert at the Access Road Easement

Basin Area = 380 Acres and Q = 530 cfs

Assume Four 48" RCP ($Q/4 = 133$ cfs)

HWA = 60" (Total = 108")

Slope = 1.0%

$d_c/D = 0.83$ from C_2 $\quad$ $d_n/D = 0.66$ from C_5 $\quad$ $d_c > d_n$ ∴ inlet control

$HW/D = 1.81$ from C_7 $\quad$ HW = 87" < 108", OK

Velocity Calculations: $Q = \frac{K'}{n} d^{8/3} S^{1/2}$ & $K' = \frac{Q n}{d^{8/3} S^{1/2}}$

$$K' = \frac{133(0.012)}{4^{8/3}\ 0.010^{1/2}} = \frac{1.596}{(40.50)(0.1)} = 0.3941$$

from Table 7-14 $D/d = 0.71$, from Table 7-4 $C_a = 0.596$

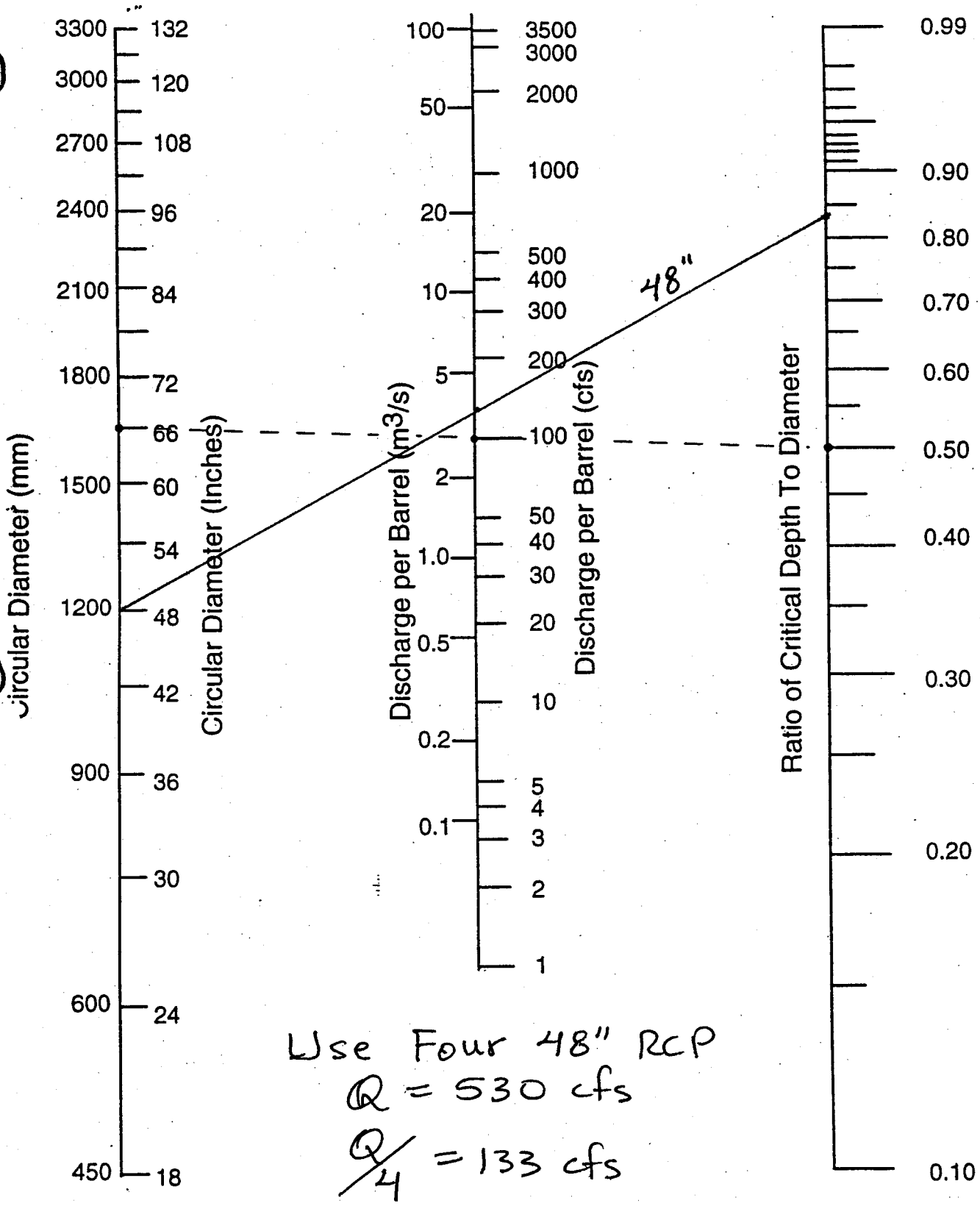
$$\text{Area} = C_a D^2$$
$$= 0.596(4^2)$$
$$A = 9.54$$
$$\text{Vel} = Q/A = 133/9.54 = 13.9 \text{ fps}$$

for Rip Rap use ½ Ton Rock, 3.4 thickness

for D-Load use Type IV - 3000

eml 11/17/03

10/14



Use Four 48" RCP

$Q = 530$ cfs

$Q/4 = 133$ cfs

CRITICAL DEPTH - CIRCULAR PIPE

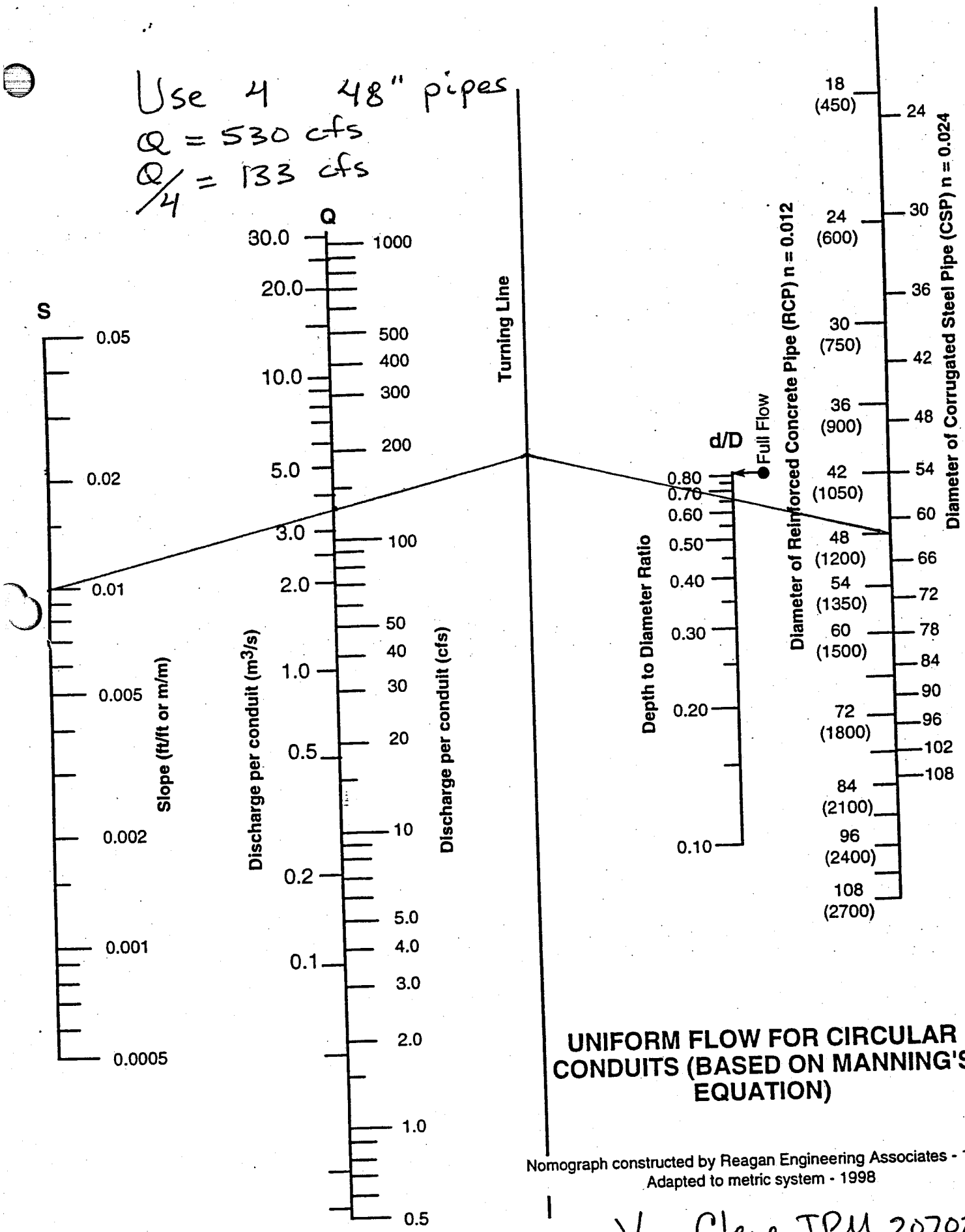
Appendix C2

Reagan Engineering Associates
Adapted to Metric System 1998

Van Cleve (TPM 20702)
Access Road Culvert

11/14

Use 4 48" pipes
Q = 530 cfs
Q/4 = 133 cfs



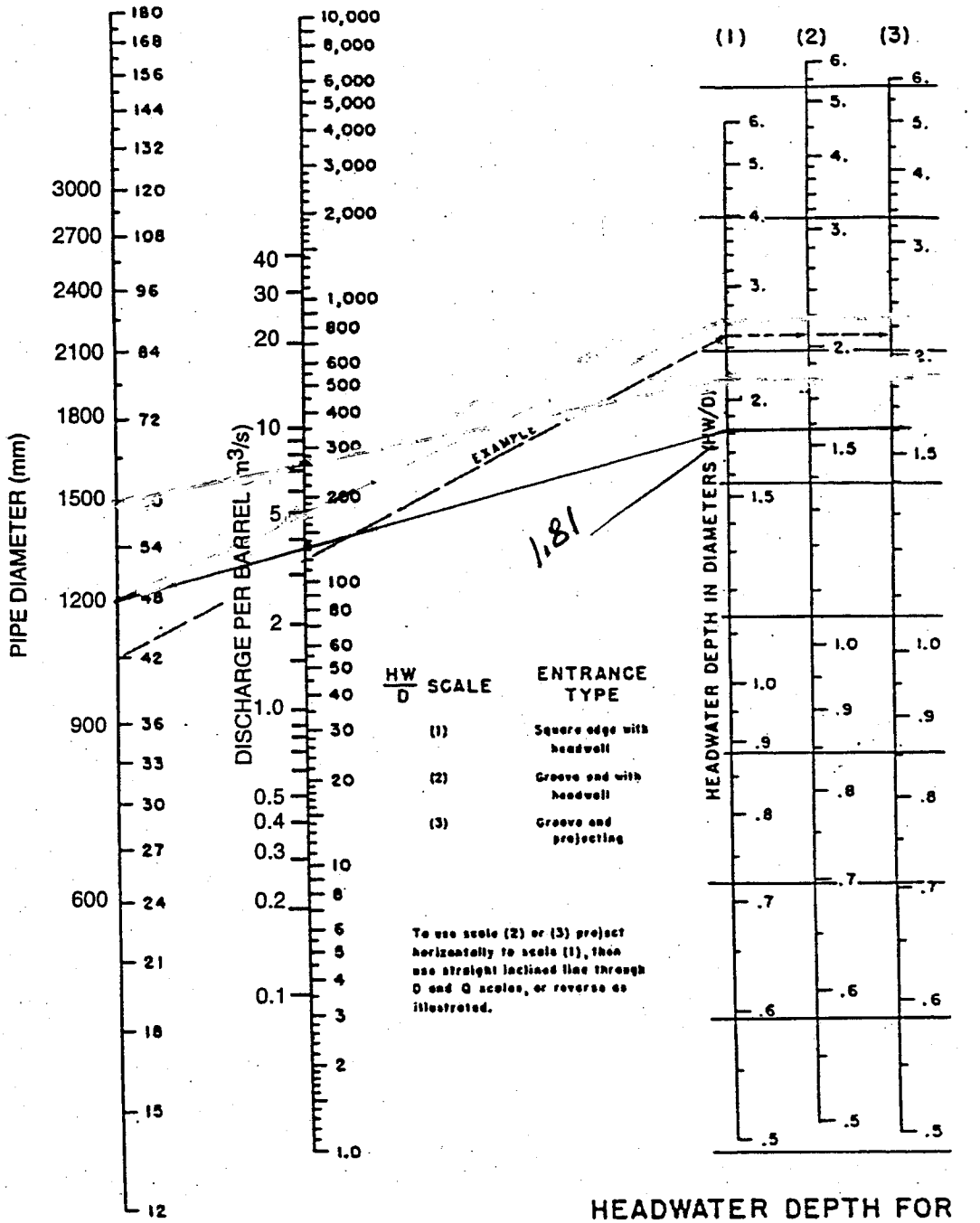
UNIFORM FLOW FOR CIRCULAR CONDUITS (BASED ON MANNING'S EQUATION)

Nomograph constructed by Reagan Engineering Associates - 1993
Adapted to metric system - 1998

Appendix C5

Van Cleve TPM 20702
Access Road Culvert 12/1

Van Cleve (TPM 20702)



4.5
2.6

HEADWATER DEPTH FOR CONCRETE PIPE CULVERTS WITH INLET CONTROL

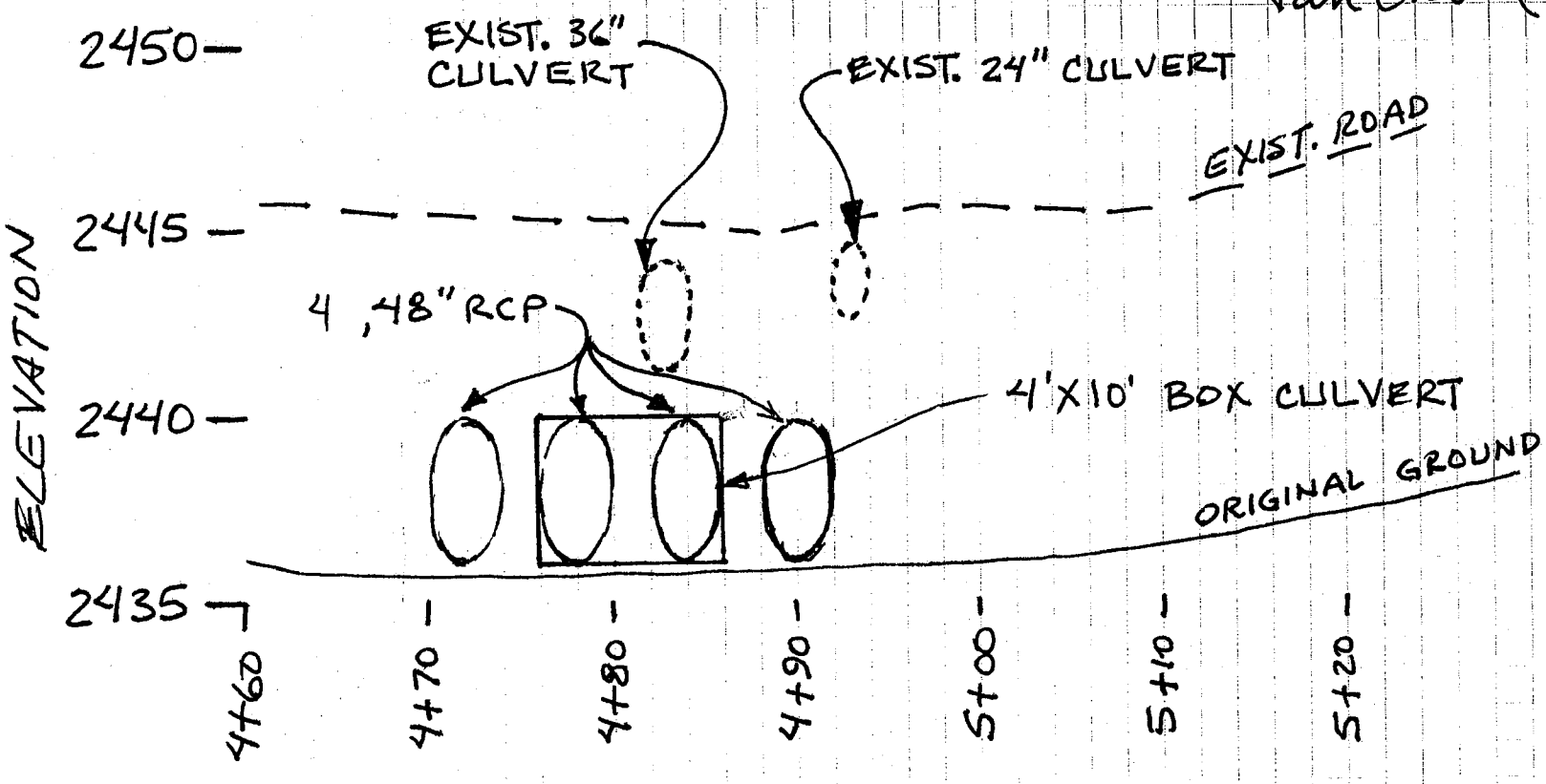
FHWA
ADAPTED TO METRIC SYSTEM
REA - 1998

Q = 530 cfs Q/4 = 133 cfs

assume 4, 48" pipes

Appendix C7

Van Cleve (TPM 20702)



emt 11/13/03

h'/h