DRAINAGE STUDY

FOR
Valley Center View Properties
3936 Hortensia Street
San Diego, CA 92110

PROJECT
NELSON PAD GRADING
PDS2008-2700-15413

Valley Center
San Diego County`

PREPARED BY:

Aquaterra Engineering Inc.
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October 22, 2013

Prepared under the supervision of:

10/22/13

Gary Lipska, RCE 23080 Date
Exp. 12/31/13

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

SDC PDS RCVD 04-14-14
2700-15413

Hydrology & Hydraulics Report
County of San Diego

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

Hydrology Manual, Dated June 2003, County of San Diego
Drainage of Highway Pavements, U.S. Dept. of Transportation

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

The Rational Method uses the following formula to establish drainage flow:

$$Q = CIA$$

where,

Q = the peak runoff in cubic feet per second

C = Runoff coefficient representing the ratio of runoff to rainfall

I = time average intensity in inches per hour

A = Area of the subbasin in acres

Declaration of Responsible Charge

I, hereby declare that I am the Civil Engineer of Work on 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 the design is consistent with current standards.

I understand that the check of project drawings by the County of San Diego is confined to a review only and does not relieve me as Engineer of Work of my responsibility for the project design.

Date 3/12/13

Gary Lipska RCE 23080 expires 12/31/13

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

Project Description
The 12± acre project site is currently vacant. The adjacent lands on the east and east have been partially developed and are occupied by scattered detached residential and appurtenant structures. Valley Center Road borders the project of the north.. The project is proposed to be a deposit site for soil material from a grading operation for a proposed commercial site located on the north side of Valley Center Road. No development or surface improvements are proposed under this permit. An offsite area of 1.1± square miles is collected by a triple box culvert in Valley Center Road discharges onto the site. The proposed grading design provides a rock lined channel to allow the offsite drainage flows to pass through the site unobstructed. The calculations to determine the 100 year peak discharge for the offsite basin, based on current standards, are included in this report

The existing site topography slopes in a southwesterly direction. The final graded condition will not modify the onsite drainage patterns. The points of discharge in the post-development condition will be the same as the pre-development condition.

Description of Study
We have prepared the attached calculations and exhibits in conjunction with an application for a grading permit to develop the site as indicated above. Impervious surface improvement are not proposed under this application. The results of the attached calculations show the following discharge rates:

	PRECONSTRUCTION (OUTFLOW)	POST-CONSTRUCTION (OUTFLOW)
BASIN A	3.87 cfs	5.81 cfs
BASIN B	5.90cfs	5.86 cfs
BASIN C	4.16cfs	1.63 cfs
TOTAL SITE	13.93cfs	13.30cfs

The post-development outflow is 0.63 cfs less than the pre-development condition.

The area designated as post construction Basin C covers primarily manufactured slopes. This area is located along the northwesterly area of the site. The discharge point of the drainage flows for the post construction are at the same location of the pre-construction discharge point. To avoid offsite adverse impacts the runoff if collected in a brow ditch and outlet for the site through a rip rap energy dissipater.

Conclusion
As a result of the project layout and the inclusion of design features, we do not anticipate any negative impacts to downstream properties.

HYDROLOGY CALCULATIONS

SUMMARY TABLE OF HYDROLOGY CALCULATIONS

NELSON MASS GRADING (L-15413)
OCTBER 22, 2013

PRE -CONSTRUCTION	*POST -CONSTRUCTION*	*C*	*Tc (min.)*	*I ("/hr)*	*A (acres)*	*Q (cfs)*	*Q** (cfs)*	*Q*** (cfs)*	*ΔQ ** (cfs)*	*ΔQ *** (cfs)*
BASIN A		0.35	17.2	4.75	2.27	3.87				
	BASIN A	0.35	16.6	4.86	3.50		5.81		1.94	
BASIN B		0.35	17.5	4.70	3.59	5.90				
	BASIN B	0.35	16.5	4.87	3.44		5.86		<0.04>	
BASIN C		0.35	12.3	5.89	2.02	4.16				
	BASIN B	0.35	11.8	6.06	0.77		1.63		<2.53>	
					BASIN A+B+C NET CHANGE				<0.63>	

** BEFORE DETENTION SYSTEM
*** AFTER DETENTION SYSTEM

Aquaterra Engineering Inc.

PROJECT Nelson Site DATE: 1/06/12

Basin A - Hydrology Calcs - Pre Construction

Area = ~~4.65~~ 2.77 acres

Soil Type D

Land Use - Natural

C per Table 3.1 = 0.35

Time of Concentration

t_i (initial) @ 3% = 10.3 min (L_m = 100')

T_c' (over land)

$h = 1330 - 1316 = 14'$

$l = 792$

$$T_c' = \left[\frac{11.4\left(\frac{792}{5280}\right)^3}{14}\right]^{0.385} \times 60 = 6.30\ m$$

T_c (total) = 10.3 + 6.3 = 16.6 min

$I_{100} = 7.44(4)(16.6)^{-0.645} = 4.86''/\text{hr}$

$Q_{100} = CIA = 0.35(4.86)\ \cancel{4.65}\ 2.77 = \cancel{7.88}\ 3.86\ cfs$

Aquaterra Engineering Inc.

PROJECT Nelson Pad DATE: 5/12/08

Hydrology Calcs - Post Construction Rev

Basin A

Soil Type D

Land Use = Natural ⇒ C per Table 3.1 = 0.35

Area - ~~4.72~~ 3.50 Acres

Time of Concentration

t_c (Initial) @ 1% (CN = 70) = 12.5 MW (Table 3.2

T_c' (Overland)

$h = 1340 - 1321 = 19'$

$l = 6.82'$

$$T_c' = \left[\frac{11.9\left(\frac{682}{5280}\right)^3}{19}\right]^{0.385} \times 60 = 4.71\ MW$$

T_c (Total) = 12.5 + 4.7 = 17.2 MW

$$T_{100} = 7.44(4)(17.2)^{-0.645} = 4.75''/hr$$

$$Q_{100} = CIA \quad 0.35 \times (4.75)\ \cancel{4.72}\ 3.50 = \cancel{7.85}\ 5.81\ cfs$$

Aquaterra Engineering Inc.

PROJECT: Nelson Site DATE: 1/06/12

Basin B

Hydrology Calcs - Pre Construction

Area = 3.59 Acres

Soil Type: D

Land Use: Natural

C from Table 5-1 = 0.35

Time of Concentration

t_c (initial)

See Table 5.7

t_c = (@ 2%) = 10.9 min (Lm = 10.9)

T_c (overland)

$h = 1329 - 1320 = 9'$

$l = 713'$

$$T_c' = \left[\frac{11.9\left(\frac{713}{5.00}\right)^{0.385}}{9}\right] \times 60 = 6.61 \text{ min}$$

T_c (total) = 10.9 + 6.61 = 17.51 min

$$I_{100} = 7.44(4)(17.51)^{-0.645} = 4.70 \text{ in/hr}$$

$Q_{100} = CIA = 0.35(4.70)3.59 = 5.90$ cfs

Aquaterra Engineering Inc.

PROJECT NELSON PAD DATE: 9/28/08

Rev 5/12/09
Rev 1/15/13
Rev 8/5/13

HYDROLOGY CALCS - POST CONSTRUCTION

BASIN B

AREA: ~~3.26~~ 3.44 ACRES

SOIL GROUP D

LAND USE - NATURAL

C PER TABLE 5.1 = 0.35

TIME OF CONCENTRATION

t_c (INITIAL) @ 1% (CN=70) = 12.5 MIN (TABLE 3-2)

T_c' (OVERLAND) $h = 1340 - 1320$, $\theta = 20$

$l = 606$

$$T_c' = \left[\frac{11.9\left(\frac{606}{5280}\right)^3}{20}\right]^{0.385} \times 60 = 4.03 \text{ MIN}$$

T_c (TOTAL) = 12.5 + 4.03 = 16.53 MIN

$$I_{100} = 7.44(4)(16.53)^{-0.645} = 4.87 \text{ IN/HRS}$$

$$Q_{100} = CIA = 0.35 \times 4.87 \times \cancel{3.26}\ \cancel{5.56} \text{ CFS}$$

3.44 5.86 CFS

Aquaterra Engineering Inc.

PROJECT Nelson Site DATE: 1/06/12

Hydrology Calcs - Pre Construction

Basin C

Area: 2.0 Acres

Soil Type: D

Cover: Natural

C per Table 5-1 = 0.35

Time of Concentration

t_c (min) See Table 3-2

t_c = (@ 5%) = 8.7 min (CN = 100

T_c Overland

$h = 1525 - 1510 = 15'$

$l = 507$

$$T_c' = \left[\frac{1.9\left(\frac{507}{5280}\right)^{3}}{15}\right]^{0.385} \times 60 = 3.67 \text{ min}$$

T_c (total) = 8.7 + 3.61 = 12.31 min

$$I_{100} = 7.44(4)(12.31)^{-0.645} = 5.89 \text{ in/hrs}$$

$$Q_{100} = CIA = 0.35(5.89)2.02 = 4.16 \text{ cfs}$$

Aquaterra Engineering Inc.

PROJECT Nelson Pad DATE: 1/15/13

Hydrology Calcs - Post Construction Rev 8/5/13

Basin C

Soil Group D

Area ~~0.75 Acres~~ 0.77

Land Use - Natural
(per Table 3.1 = 0.35

Time of Concentration

t_c (Within) @ 10% = 6.9 min (LM = 100'

T_c (Overland)

h = ~~1324~~ 1328 - 1310 = ~~19'~~ 18'

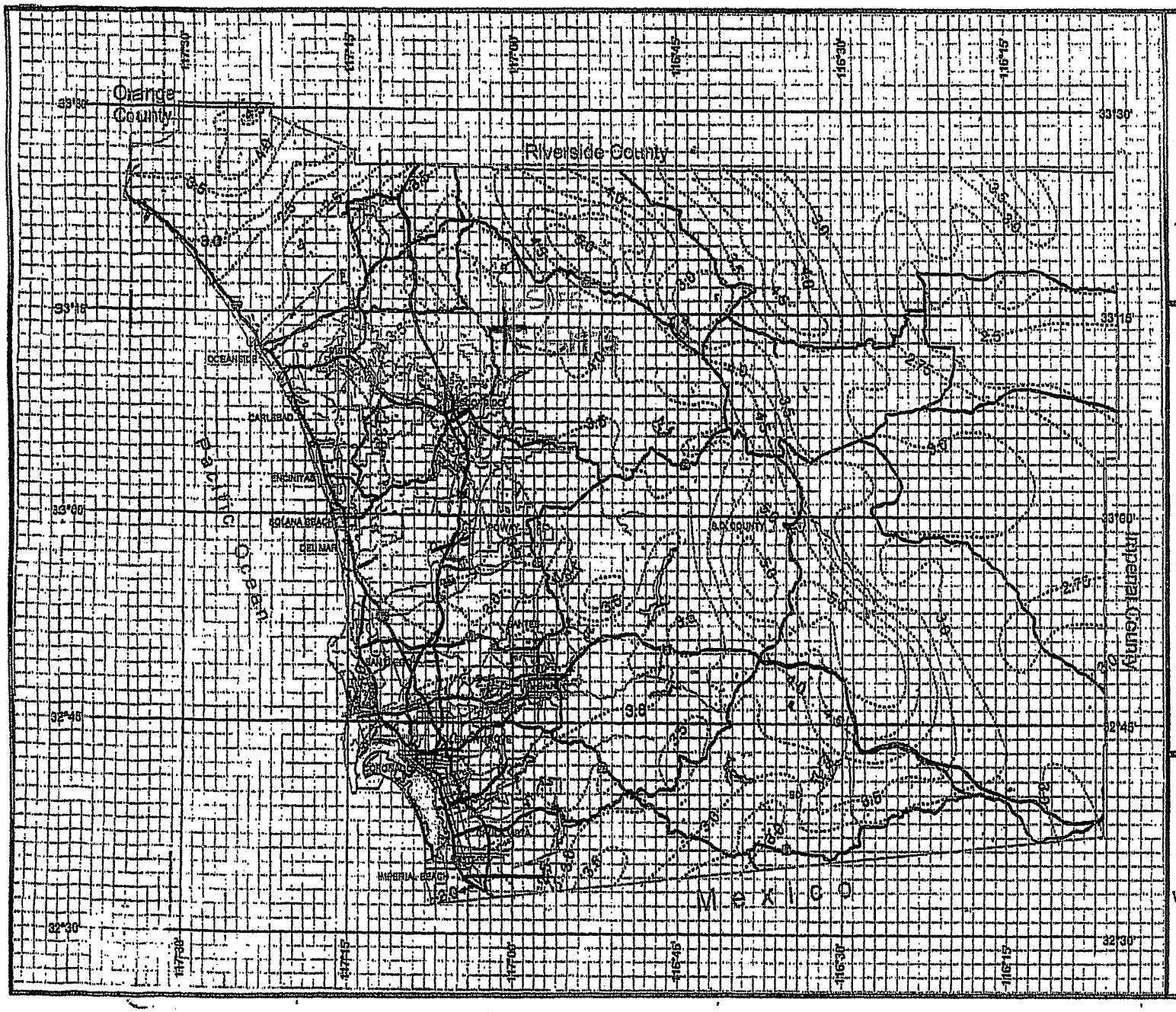
l = ~~213'~~ 690

$$T_c = \left[\frac{11.9\left(\frac{\cancel{213}\ 690}{5280}\right)^3}{\cancel{19}\ 18}\right]^{0.385} \times 60 = \cancel{1.23}\ 4.88 \text{ min}$$

T_c (Total) = 6.9 + ~~1.23~~ 4.88 = ~~8.13~~ 11.78 min

$$I_{100} = 7.44\,(4)\left(\cancel{8.13}\ 11.78\right)^{-0.645} = \cancel{7.70}\ 6.06 \text{ "/hour}$$

$$Q_{100} = CIA = 0.35\left(\cancel{7.70}\ 6.06\right)\cancel{0.75}\ 0.77 = \cancel{2.02}\ 1.63 \text{ cfs}$$



County of San Dieg Hydrology Manual

Rainfall Isopluvials

100 Year Rainfall Event - 6 Hours

Isopluvial (inches)

35°13'45"
117°01'15"

DPW GIS

SanGIS
We Have San Diego Covered

N
W E
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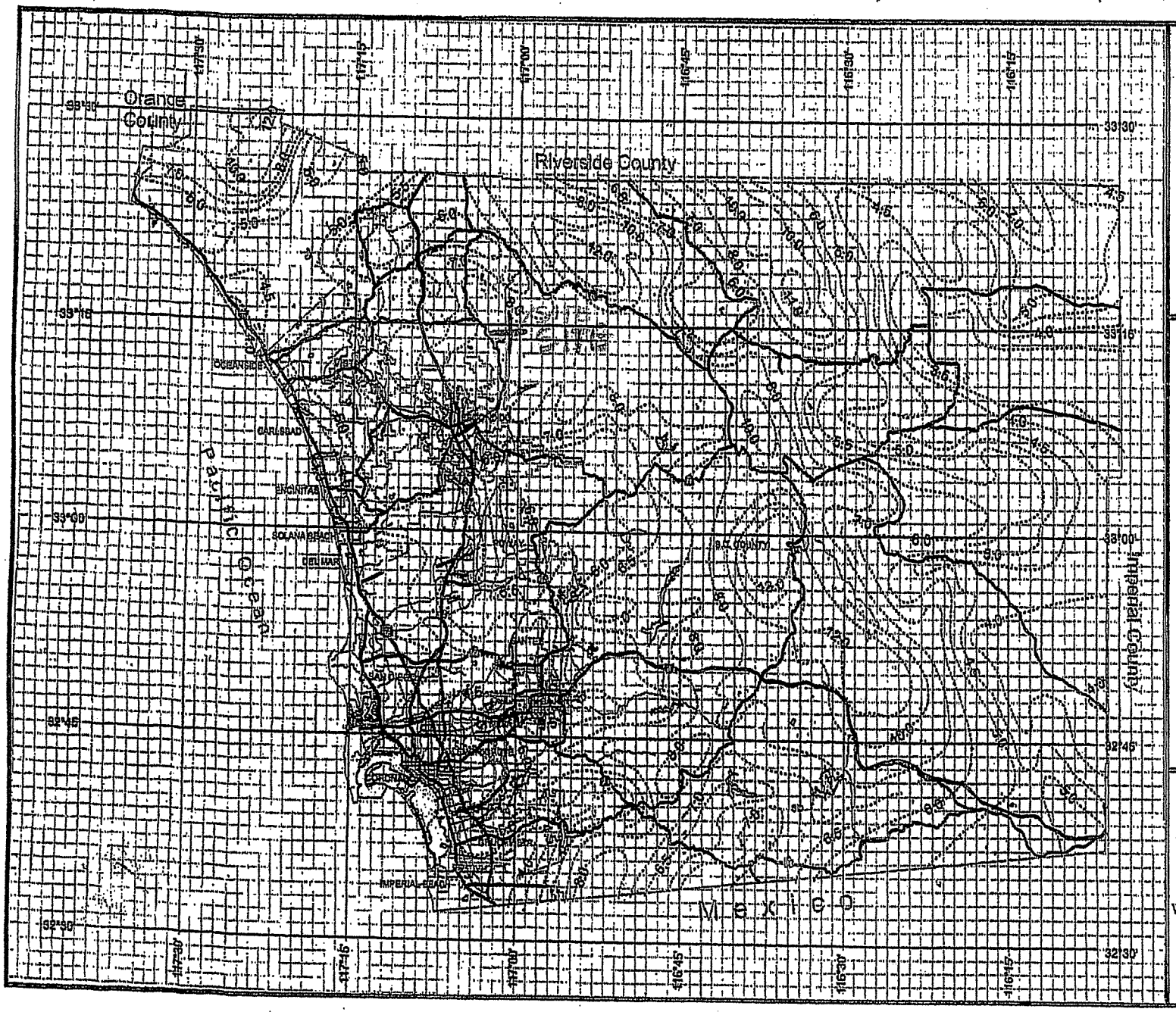
3 0 3 Miles



County of San Diego Hydrology Manual

Rainfall Isopluvials

100 Year Rainfall Event - 24 Hours

Isopluvial (inches)

33°13'45"
117°01'15"

DPW GIS
Department of Public Works

SanGIS
We Have San Diego Covered!

N
W E
S

3 0 3 Miles

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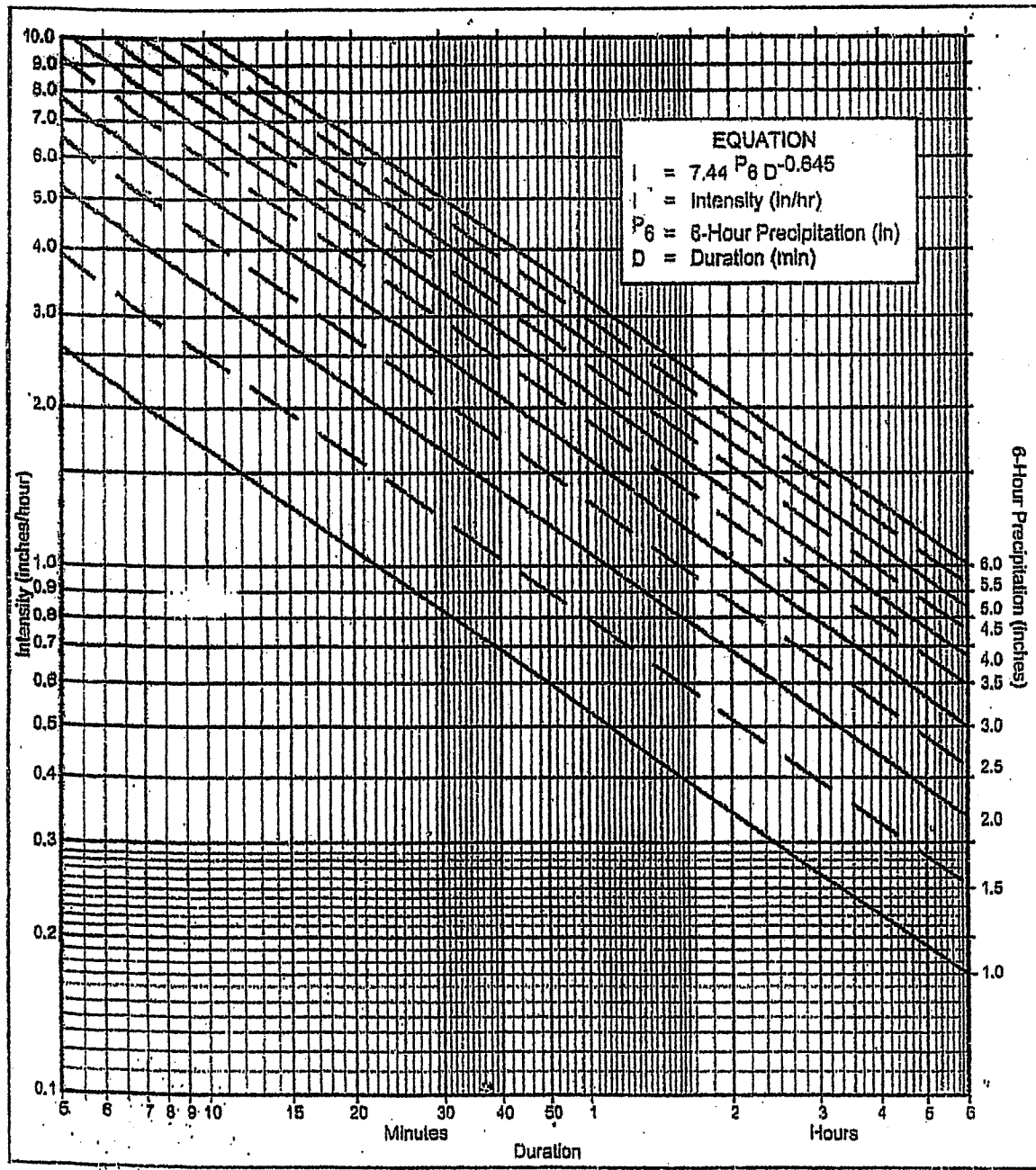


Directions for Application:

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

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

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

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

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

Application Form:

(a) Selected frequency 100 year

(b) P_6 = 4 in., P_{24} = 8, $\frac{P_6}{P_{24}}$ = 50 %(2)

(c) Adjusted P_6(2) = 4 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

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/ Acre	.5%		1%		2%		3%		5%		10%	
		L_M	T_i	L_M	T_i	L_M	T_i	L_M	T_i	L_M	T_i	L_M	T_i
Natural		50	13.2	70	12.5	85	10.9	100	10.3	100	8.7	100	6.9
LDR	1	50	12.2	70	11.5	85	10.0	100	9.5	100	8.0	100	6.4
LDR	2	50	11.3	70	10.5	85	9.2	100	8.8	100	7.4	100	5.8
LDR	2.9	50	10.7	70	10.0	85	8.8	95	8.1	100	7.0	100	5.6
MDR	4.3	50	10.2	70	9.6	80	8.1	95	7.8	100	6.7	100	5.3
MDR	7.3	50	9.2	65	8.4	80	7.4	95	7.0	100	6.0	100	4.8
MDR	10.9	50	8.7	65	7.9	80	6.9	90	6.4	100	5.7	100	4.5
MDR	14.5	50	8.2	65	7.4	80	6.5	90	6.0	100	5.4	100	4.3
HDR	24	50	6.7	65	6.1	75	5.1	90	4.9	95	4.3	100	3.5
HDR	43	50	5.3	65	4.7	75	4.0	85	3.8	95	3.4	100	2.7
N. Com		50	5.3	60	4.5	75	4.0	85	3.8	95	3.4	100	2.7
G. Com		50	4.7	60	4.1	75	3.6	85	3.4	90	2.9	100	2.4
O.P./Com		50	4.2	60	3.7	70	3.1	80	2.9	90	2.6	100	2.2
Limited I.		50	4.2	60	3.7	70	3.1	80	2.9	90	2.6	100	2.2
General I.		50	3.7	60	3.2	70	2.7	80	2.6	90	2.3	100	1.9

*See Table 3-1 for more detailed description

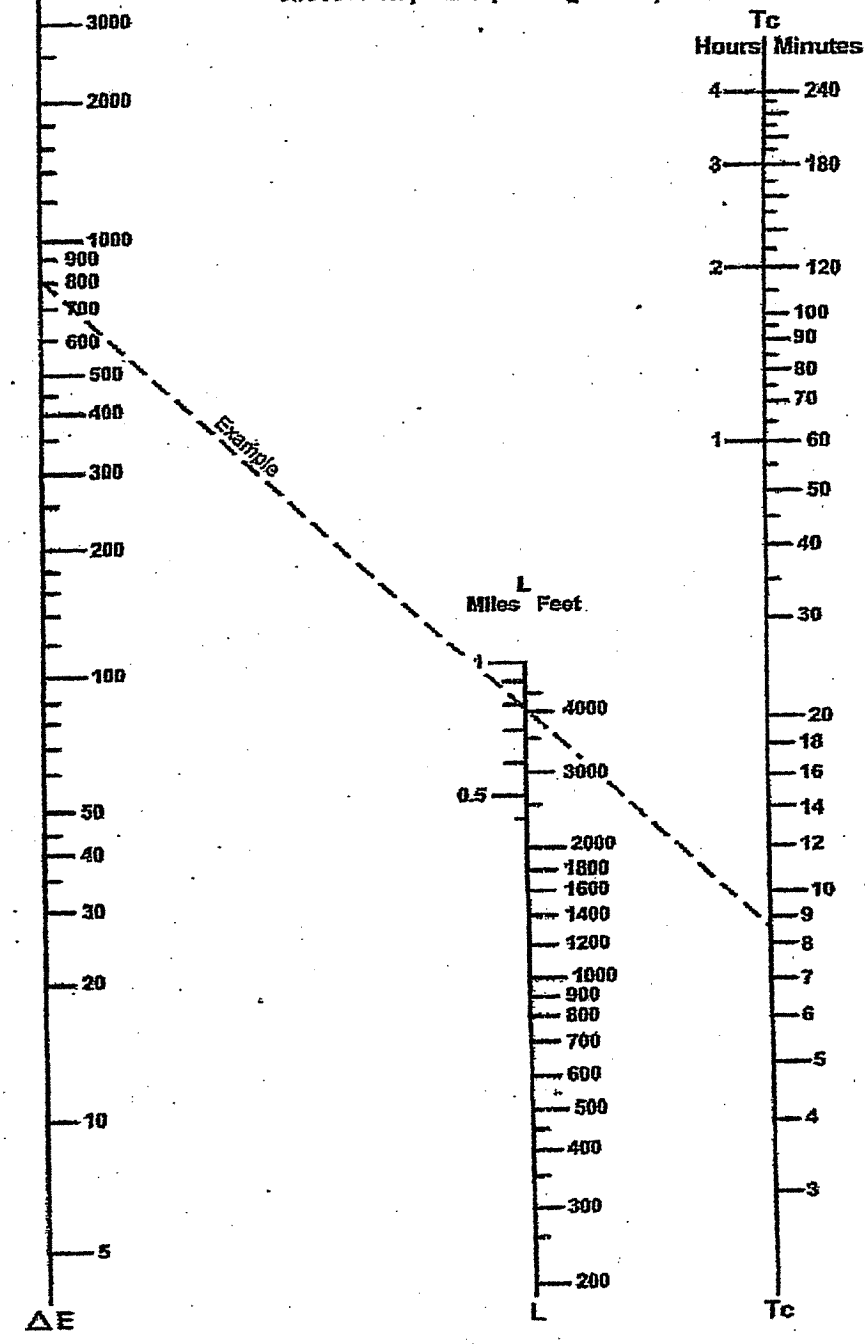
EQUATION

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

T_c = Time of concentration (hours)

L = Watercourse Distance (miles)

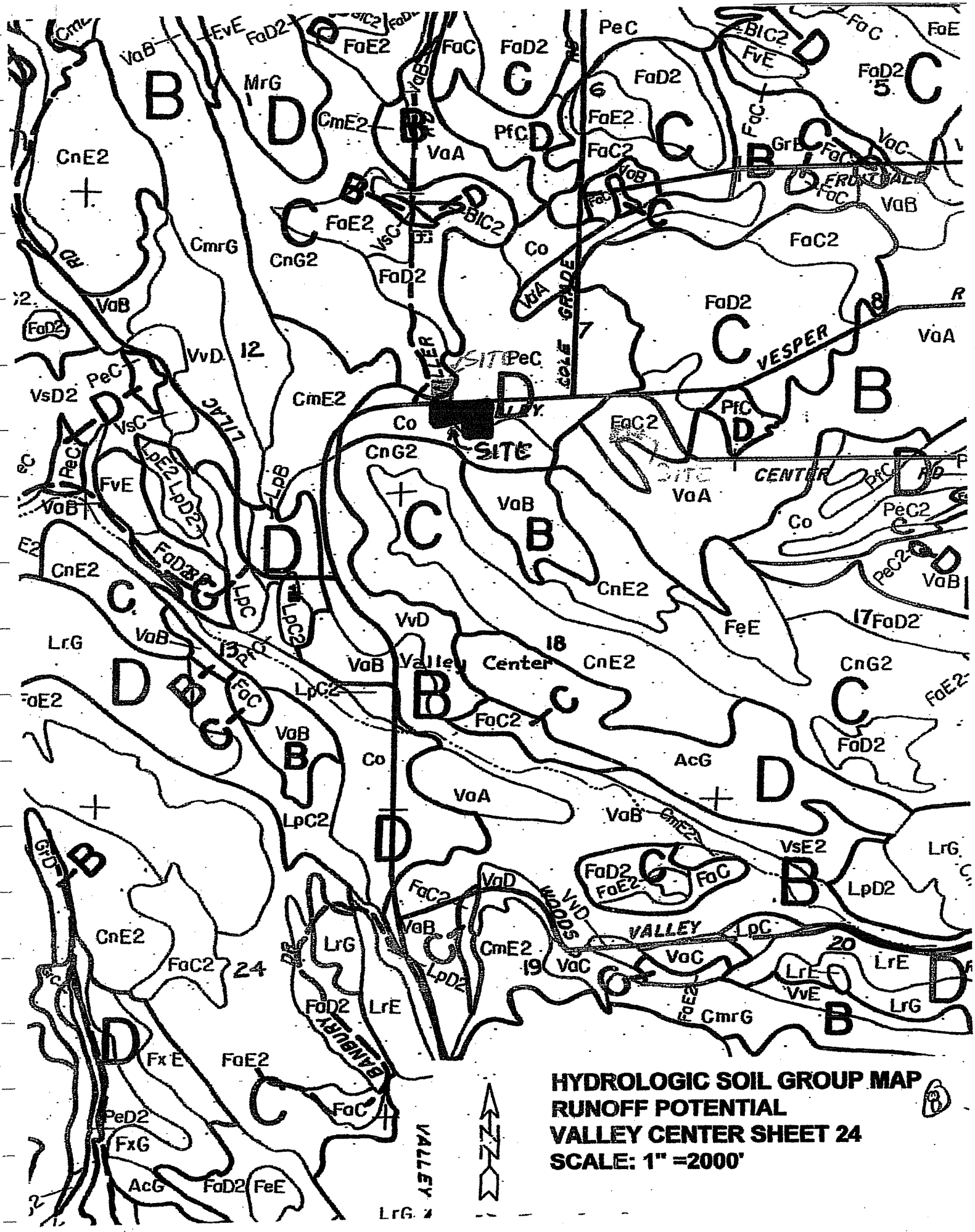
ΔE = Change in elevation along effective slope line (See Figure 3-5) (feet)



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

FIGURE 3-4

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



HYDROLOGIC SOIL GROUP MAP
RUNOFF POTENTIAL
VALLEY CENTER SHEET 24
SCALE: 1" =2000'

OFFSITE BASIN HYDROLOGY CALCULATIONS

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*********************************************************************
********
  * The San Diego Unit Hydrograph (SDUH) Peak Discharge Program uses
the       *
  * procedures described in Section 4 of the San Diego County
Hydrology        *
  * Manual for NRCS Hydrologic Method calculations.  The SDUH Peak
Discharge    *
  * Program may be used only for determination of peak flow rate, and
may not  *
  * be used for detention basin design or other routing purposes for
which a    *
  * hydrograph is required.  To generate a hydrograph, the calculation
method  *
  * described in Section 4 of the San Diego County Hydrology Manual
may be      *
  * used, or a computer program that includes good documentation of
the        *
  * calculations (see Section 1.7 of the San Diego County Hydrology
manual).    *
  * Note: the RATHYDRO computer program is not based on the
calculation method *
  * described in Section 4 of the San Diego County Hydrology Manual
and may     *
  * not be used to generate a hydrograph based on the SDUH Peak
Discharge       *
  * Program output.
      *

*********************************************************************
********

   Project Identification: NelsonMass Gradin

   Storm Frequency (years) =  100
   Drainage Area (square miles) =     1.070
   6-Hour Rainfall (inches) =      4.00
   6-Hour Depth-Area Factor =     0.997
   24-Hour Rainfall (inches) =      8.00
   24-Hour Depth-Area Factor =     0.998
   Adjusted Curve Number = 64
   Unit Interval (minutes) = 10
   Watershed Lag Time (hours) =     0.368
   Peak Flow Rate (cfs) =      1564.0
```

WORKSHEET 4-3 NELSON MASS GRADING **Peak Discharge Computation**
(name of project)

*****For use with NRCS Hydrologic Method Computations*****

Items in boxes are required input parameters for the SDUH Peak Discharge Program.

Computed by: GARY LIPSKA Date: 7/30/13

Project Identification (Drainage Area Name): VALLEY CENTER OFFSITE

Geographic location of center of drainage area: Long: 117°01'30" Lat: 33°19'00"

Drainage Area: 1.07 – square miles

Storm Frequency (Section 2.3): 100 – year

6-Hour Storm Duration Precipitation (Appendix B): 4 – inches

24-Hour Storm Duration Precipitation (Appendix B): 8 – inches

Precipitation Zone Number (PZN): (Section 4.1.2.4 and Appendix C) PZN = 1.0 ____ 2.0 2.3 3.0 ____ 4.0

PZN Ajustment Factor for 5-year to 35-year storm frequency (interpolate): (Section 4.1.2.4 and Table 4-6) 1.5 ____ 2.5 ____ 2.0 ____ 1.5

PZN Ajustment Factor for 35-year to 150-year storm frequency (interpolate): (Section 4.1.2.4 and Table 4-6) 2.0 ____ 3.0 3.0 3.0 ____ 2.0

PZN Adjusted Runoff Curve Number (interpolate between nearest whole number PZN conditions): (Sections 4.1.2.4 and 4.2.4, Tables 4-6 and 4-10) $CN_{1.0 \text{ or } 2.0}$ 81 CN_X 64 $CN_{2.0 \text{ or } 3.0}$ 92

Watershed Length (L) (Section 4.3.1): 1.89 – miles

Length to Centroid (L_c) (Section 4.3.1): 0.85 – miles

Slope (s) (Section 4.3.1): 198.4 – feet/mile

Basin $\bar{n}$ Factor (Section 4.3.5): 0.035

Corps lag (T_L) = 24 $\bar{n}$ $((L \times L_c)/s^{0.5})^m$ (Section 4.3.1.1)
OR
Corps lag (T_L) = 0.8 T_c (Section 4.3.1.2)

Lag Time: 0.368 – hours

Time to Peak = 0.862 x Corps lag (Section 4.1.5.5):

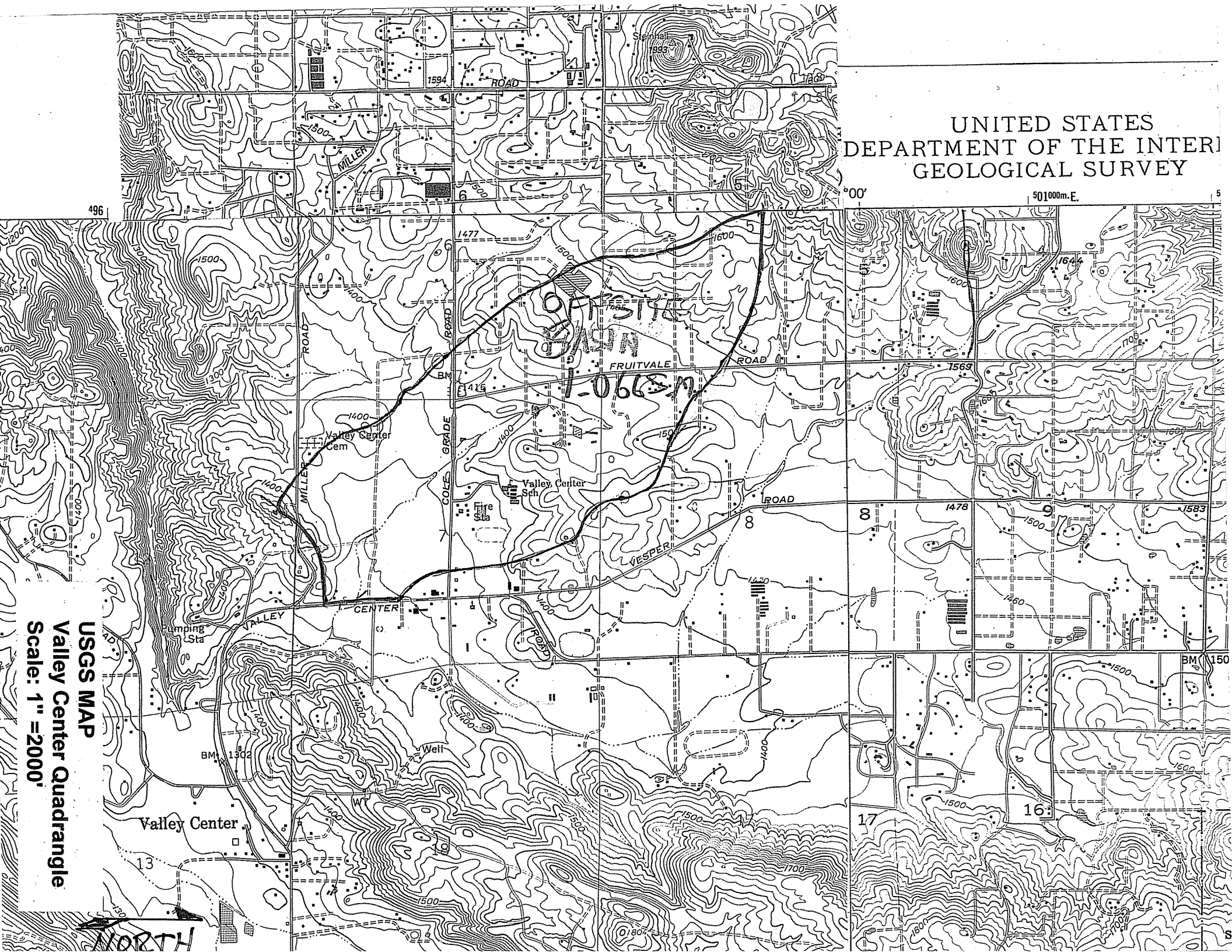
Time to Peak : 0.318 – hours

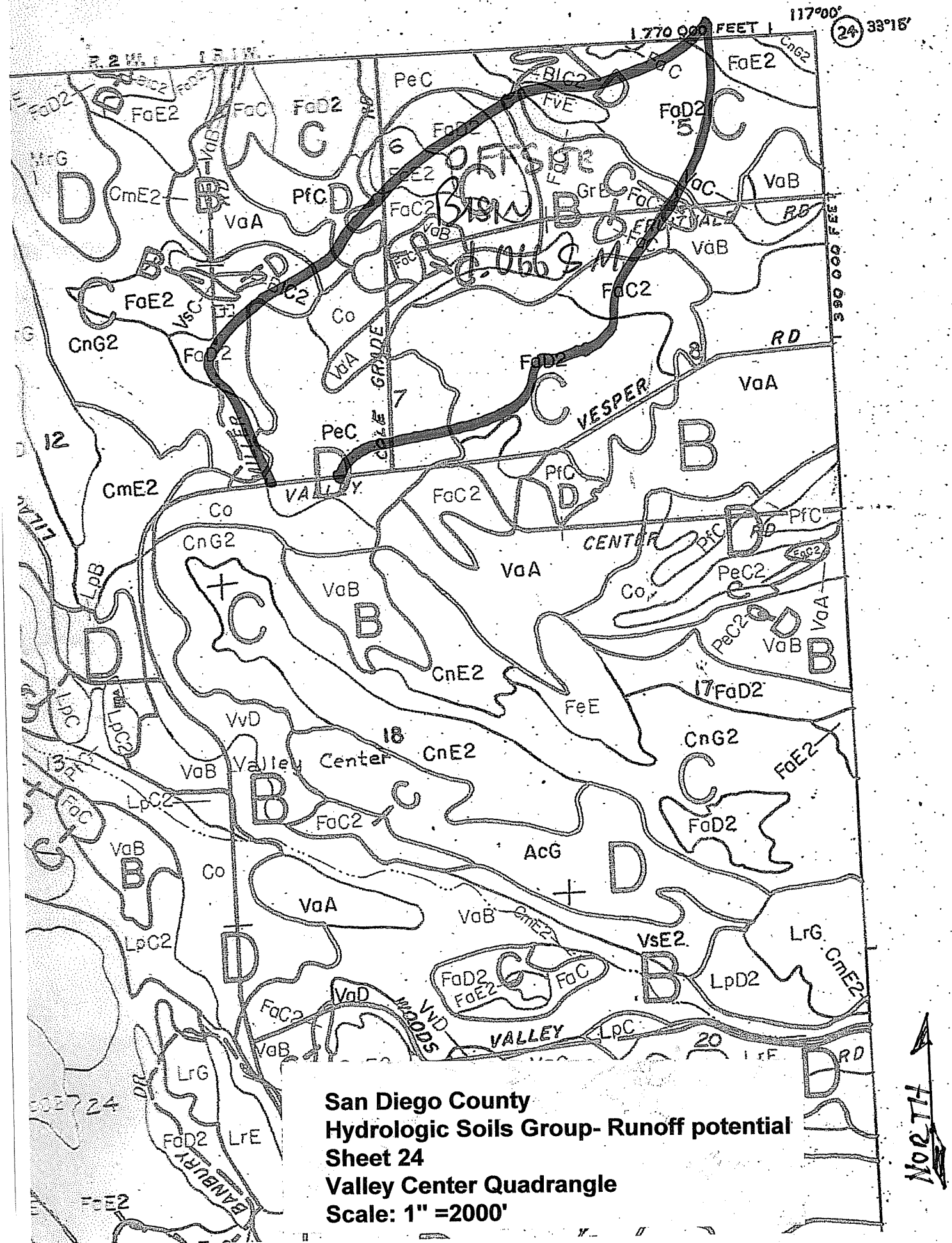
WORKSHEET 4-2 Nelson Miss Ground (name of project) **Curve Number Worksheet**

RUNOFF CURVE NUMBER (for PZN Condition = 2.0) CN_2:

column 1	column 2	column 3	column 4	column 5	column 6
GROUND COVER/ LAND USE	HYDROLOGIC CONDITION (field in-spection)	SOIL GROUP	CN_2 From Hydrology Manual, Table 4-2	FRACTION OF AREA A_i/A	PARTIAL CN_2 $CN_2 \times A_i/A$
Residential 1.0 DU/ACR	Fair	B C D	68 79 84	0.132 0.386 —	8.98 30.49 —
Residential 2.0 DU/ACR	Fair	B C D	70 80 85	0.035 0.115 0.012	2.45 9.20 1.02
Residential 4.0 DU/ACR	Fair	B C D	75 83 87	0.030 0.020 0.114	2.25 1.66 9.92
Commercial/ Business	Fair	B C D	92 94 95	— 0.004 0.152	— 0.38 14.44
			Sums =	1.000	80.79 ⇒ 81.0

For entire basin CN_2 = ___


UNITED STATES
DEPARTMENT OF THE INTERI
GEOLOGICAL SURVEY
USGS MAP
Valley Center Quadrangle
Scale: 1" =2000'
NORTH
Valley Center
Valley Center Cem
Valley Center Sch
Fire Sta
Pumping Sta
Well
Steinhall
FRUITVALE ROAD
VESPER ROAD
VALLEY CENTER ROAD
COLE GRADE ROAD
MILLER ROAD
OFFSITE BASIN
1.066 S.M.
501000m.E.
°00'



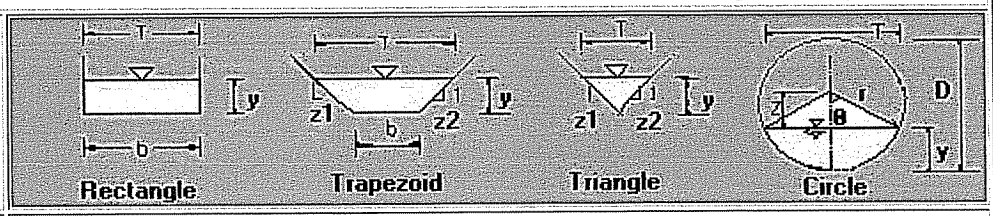
San Diego County
Hydrologic Soils Group- Runoff potential
Sheet 24
Valley Center Quadrangle
Scale: 1" =2000'

HYDRAULIC CALCULATIONS

The open channel flow calculator

ROCK LINED CHANNEL

Select Channel Type:
Trapezoid



Depth from Q

Select unit system: Feet(ft)

Channel slope: 0.004 ft/ft	Water depth(y): 4.65 ft	Bottom width(b) 45 ft
Flow velocity 5.735 ft/s	LeftSlope(Z1): 3 ft/ft	RightSlope(Z2): 3 ft/ft
Flow discharge 1570 ft^3/s	Input n value 0.039 or select n	
Calculate!	Status: Calculation finished	Reset
Wetted perimeter 74.38 ft	Flow area 273.77 ft^2	Top width(T) 72.87 ft
Specific energy 5.16 ft	Froude number 0.52	Flow status Subcritical flow
Critical depth 3.12 ft	Critical slope 0.0163 ft/ft	Velocity head 0.51 ft

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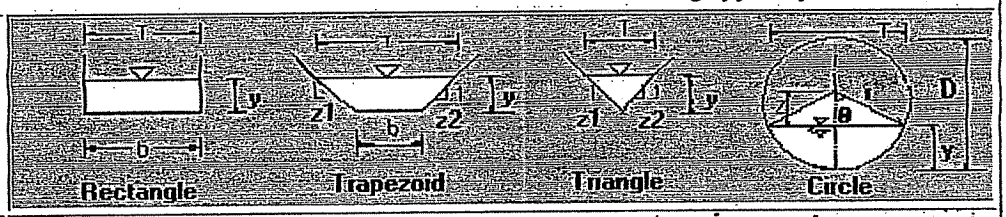
The open channel flow calculator

GRASS LINED CHANNEL

Select Channel Type:
Trapezoid



Depth from Q | Select unit system: Feet(ft)

Channel slope: 0.01 ft/ft	Water depth(y): 0.49 ft	Bottom width(b) 6 ft
Flow velocity 2.32163 ft/s	LeftSlope(Z1): 2 ft/ft	RightSlope(Z2): 2 ft/ft
Flow discharge 7.85 ft^3/s	Input n value 0.035 or select n	
Calculate!	Status: Calculation finished	Reset
Wetted perimeter 8.17 ft	Flow area 3.38 ft^2	Top width(T) 7.94 ft
Specific energy 0.57 ft	Froude number 0.63	Flow status Subcritical flow
Critical depth 0.36 ft	Critical slope 0.0263 ft/ft	Velocity head 0.08 ft

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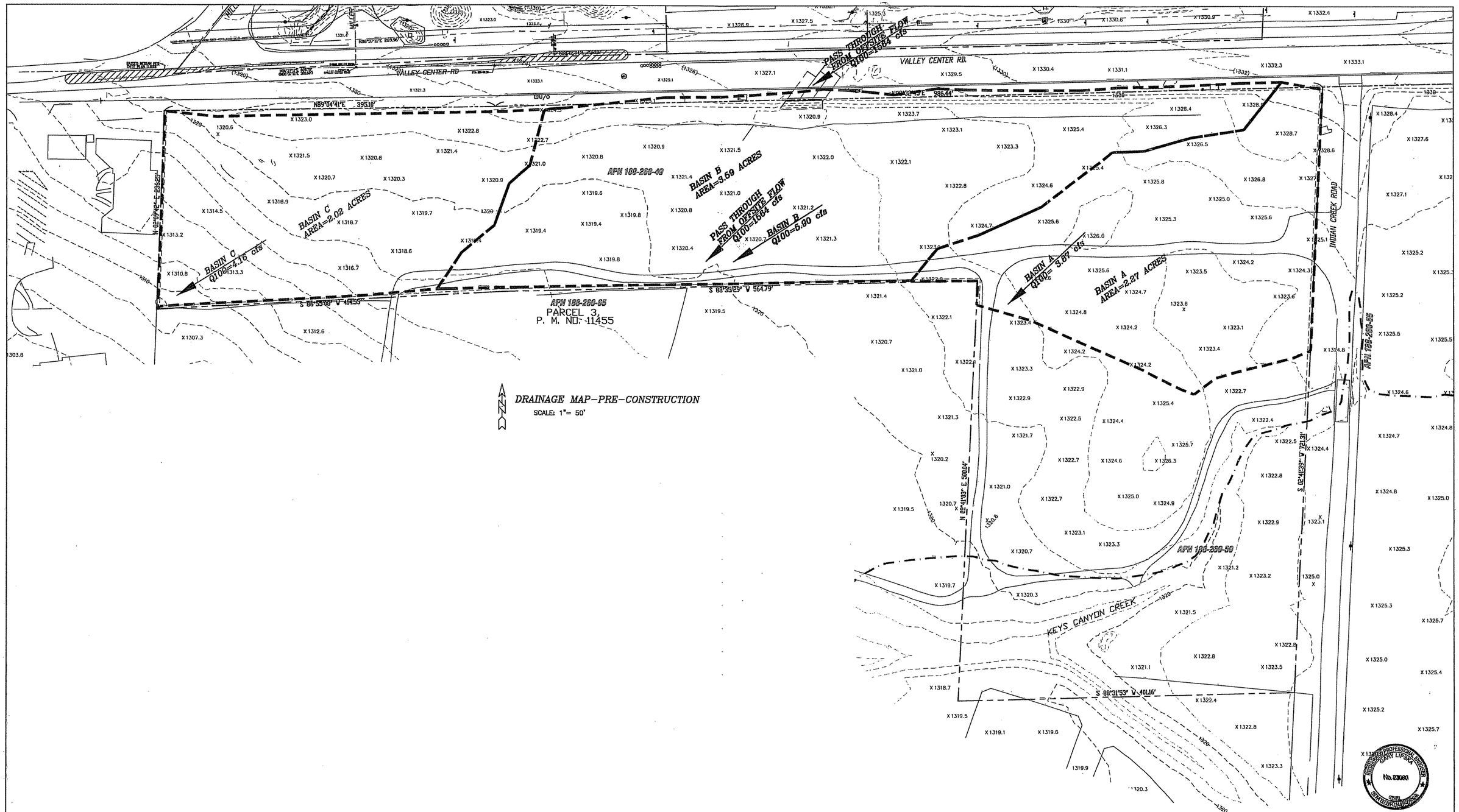


COUNTY APPROVED CHANGES			
NO	DESCRIPTION	APPROVED BY	DATE

PERMITS

REZONE PERMIT NO. N.A.
SPECIAL USE PERMIT NO. N.A.
GRADING PERMIT NO. N.A.

BENCH MARK

DESCRIPTION: XX
LOCATION: XX
XX
RECORD FROM: XX
ELEVATION: XX DATUM: M.S.L.

PRIVATE CONTRACT

SHEET 1 | COUNTY OF SAN DIEGO DEPARTMENT OF PUBLIC WORKS | 1 SHEETS

DRAINAGE MAP FOR:
NELSON PAD GRADING

CALIFORNIA COORDINATE INDEX 387-1762

APPROVED DIRECTOR OF PUBLIC WORKS BY:

ENGINEER OF WORK
GARY LIPSKA R.C.E. 23080 EXPIRES 12/31/13
10/22/13

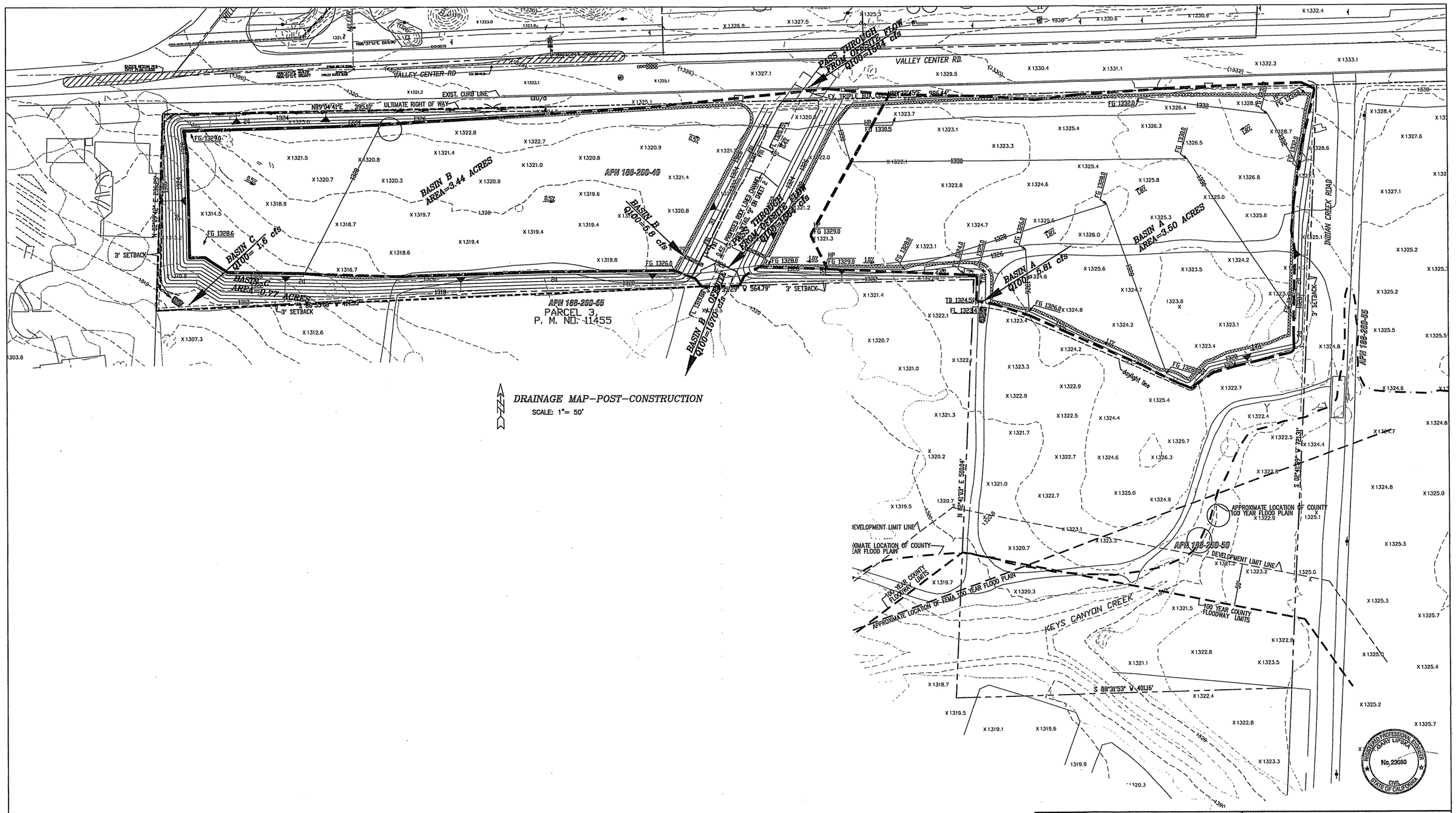
L-15413
GRADING PERMIT NO.

PLOT DATE: 10-22-13

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

50 0 50 100
Scale: 1" = 50'

ENGINEER: AQUATERRA ENGINEERING INC.
TELEPHONE: 760-439-2802



DRAINAGE MAP–POST–CONSTRUCTION

SCALE: 1"= 50'

COUNTY APPROVED CHANGES			
NO	DESCRIPTION	APPROVED BY	DATE

PERMITS

REZONE PERMIT NO. N.A.

SPECIAL USE PERMIT NO. N.A.

GRADING PERMIT NO. N.A.

BENCH MARK

DESCRIPTION: XX

LOCATION: XX

XX

RECORD FROM: XX

ELEVATION: XX DATUM: M.S.L.

PRIVATE CONTRACT

SHEET 1	COUNTY OF SAN DIEGO DEPARTMENT OF PUBLIC WORKS	1 SHEETS

DRAINAGE MAP FOR:

NELSON PAD GRADING

CALIFORNIA COORDINATE INDEX 387-1762

APPROVED
DIRECTOR OF PUBLIC WORKS
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Oceanside, CA 92054
Tele: (760) 439-2802
Fax: (760) 439-8886

50 0 50 100
Scale: 1' = 50'

ENGINEER: AQUATERRA ENGINEERING INC.
TELEPHONE: 760-439-2802