

LING YEN MOUNTAIN TEMPLE

IN THE COUNTY OF
SAN BERNARDINO, CA

PRELIMINARY DRAINAGE CALCULATIONS

Response to Land Development comments dated September 18, 2015

PREPARED FOR:
Ling Yen Mountain Temple
13938 Decliff Drive
Rancho Cucamonga, CA

PREPARED BY:

 The Altum Group

THE ALTUM GROUP
73710 FRED WARING DRIVE, SUITE 219
PALM DESERT, CA 92260
(760) 346-4750

MARCH 15, 2016

Prepared Under the Supervision of:
Dale Ross, P.E.

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LING YEN MOUNTAIN TEMPLE

Preliminary Drainage Analysis
Updated: Jan. 15, 2016

Based on original Preliminary Drainage Analysis (copy enclosed)

$$\text{Area Offsite } (A_1) = 4 \text{ ac}$$

$$\text{Area Onsite } (A_2) = \underline{8 \text{ ac}}$$

$$\text{Area Total} = 12 \text{ ac}$$

Using recommended calculation procedure (Rational Method)
from San Bernardino County Hydrology Manual:

$$Q = 0.9(I - F_m)A$$

where Q = Runoff (cfs)

I = 100yr-1hr intensity from NOAA

$$F_m = a_p F_p$$

A = area (ac)

From Table C.2 for Soil Type 'A' (Hydrologic Soil Map):

$$a_p = 1.0$$

$$F_m = 0.41$$

From NOAA, I for 100yr-1hr = 1.91 in/hr

$$Q = 0.9(I - F_m)A$$

$$= 0.9(1.91 - 0.41)12$$

$$Q = 16.2 \text{ cfs}$$

F_p , for the pervious area, and the effects of watershed detention. Runoff coefficient curves are developed using the relationship:

$$C = \begin{cases} 0.90 \left(a_i + \frac{(I - F_p)a_p}{I} \right), & \text{for } I \text{ greater than } F_p; \\ 0.90 a_i, & \text{for } I \text{ less than or equal to } F_p \end{cases} \quad (D.3)$$

where the proportion factor of 0.90 is a calibration constant determined by an average fit between the rational method and design storm unit hydrograph (see Section E) peak flow rate estimates, and where

- C = runoff coefficient
- I = rainfall intensity (inches/hour)
- F_p = infiltration rate for pervious areas (inches/hour)
(see section C.6.4)
- a_i = ratio of impervious area to total area (decimal fraction)
- a_p = ratio of pervious area to total area (decimal fraction), ($a_p = 1 - a_i$)

D.6. PEAK FLOW RATE FORMULA

Combining Equations (D.1) and (D.3), the peak flow estimate for Q is written in simpler terms by

$$Q = .90 (I - F_m)A \quad (D.4)$$

where $F_m = a_p F_p$ (see section C.6.5), and where in (D.4) it is understood that I is greater than F_p (otherwise $Q = .90 a_i I A$).

In (D.4), F_m represents the loss rate for the total watershed tributary to the point of concentration. Should the tributary area contain several runoff surfaces, an area-averaged F_m is calculated. Table D.1 illustrates such an area-averaged F_m computation.

When sufficient stream gauge information is available, infiltration rates for unit hydrograph hydrology can be estimated from a study of rainfall-runoff relationships of major storms. Where such data is not available, infiltration rates for pervious areas as a function of CN can be estimated using Figures C-3 and C-6. Loss rates for pervious areas estimated from the Figure C-6 curves are generally consistent with values developed from rainfall-runoff reconstitution studies in San Bernardino County watersheds.

C.6.5. Estimation of Catchment Maximum Loss Rates, F_m

The infiltration rate selected from Figure C-6 applies to the pervious area fraction of the watershed. The infiltration rate assumed for an impervious surface is 0.0 inch/hour. The maximum loss rate, F_m , for a catchment is therefore given by

$$F_m = a_p F_p \quad (C.7)$$

where a_p is the pervious area fraction, and F_p is the infiltration rate for the pervious area.

Should a catchment contain several F_p values, the composite F_m value is determined as a simple area average of the several F_m values. Table C.2 provides F_m values for a wide range of cover types and soil groups.

C.6.6. Design Storm Loss Rates

In design storm runoff hydrograph studies, a 24-hour duration storm pattern is used to develop the time distribution of effective rainfall over the watershed. The effective rainfall quantities are determined by subtracting the watershed losses from the design storm rainfall.

The loss rate used for a particular catchment is a combination of the maximum loss rate F_m and the low loss rate F^* . F^* is used as the loss rate unless F^* exceeds F_m , in which case F_m is used as the loss rate. That is, F_m serves as the maximum loss rate. Typically in 100-year storm studies, F^* serves as the loss rate for the entire storm pattern except for the most

**TABLE C.2. Fm (in/hr) VALUES
FOR TYPICAL COVER TYPES**

<u>COVER TYPE</u>	<u>SOIL GROUP</u>				
	<u>A_p(1)</u>	<u>A</u>	<u>B</u>	<u>C</u>	<u>D</u>
NATURAL:					
Barren	1.0	0.41	0.27	0.18	0.14
Row Crops (good)	1.0	0.59	0.41	0.29	0.22
Grass (fair)	1.0	0.82	0.56	0.40	0.31
Orchards (fair)	1.0	0.88	0.62	0.43	0.34
Woodland (fair)	1.0	0.95	0.69	0.50	0.40
URBAN:					
Residential (1 DU/AC)	0.80	0.78	0.60	0.45	0.37
Residential (2 DU/AC)	0.70	0.68	0.53	0.39	0.32
Residential (4 DU/AC)	0.60	0.58	0.45	0.34	0.28
Residential (10 DU/AC)	0.40	0.39	0.30	0.22	0.18
Condominium	0.35	0.34	0.26	0.20	0.16
Mobile Home Park	0.25	0.24	0.19	0.14	0.12
Apartments	0.20	0.19	0.15	0.11	0.09
Commercial/Industrial	0.10	0.10	0.08	0.06	0.05

NOTES:

- (1) Recommended a_p values from Figure C-4
- (2) AMC II assumed for all Fm values
- (3) CN values obtained from Figure C-3
- (4) DU/AC=dwelling unit per acre

POINT PRECIPITATION FREQUENCY (PF) ESTIMATES

WITH 90% CONFIDENCE INTERVALS AND SUPPLEMENTARY INFORMATION
NOAA Atlas 14, Volume 6, Version 2

PF tabular

PF graphical

Supplementary information

Print Page

PDS-based precipitation frequency estimates with 90% confidence intervals (in inches/hour)¹

Duration	Average recurrence interval (years)									
	1	2	5	10	25	50	100	200	500	1000
5-min	1.75 (1.45-2.12)	2.34 (1.94-2.84)	3.08 (2.56-3.76)	3.67 (3.01-4.51)	4.44 (3.53-5.65)	5.03 (3.90-6.53)	5.60 (4.25-7.46)	6.19 (4.56-8.50)	6.97 (4.92-9.98)	7.58 (5.16-11.2)
10-min	1.25 (1.04-1.52)	1.67 (1.39-2.03)	2.21 (1.83-2.69)	2.63 (2.16-3.23)	3.19 (2.53-4.05)	3.60 (2.80-4.68)	4.01 (3.04-5.35)	4.44 (3.26-6.09)	5.00 (3.53-7.16)	5.43 (3.70-8.06)
15-min	1.01 (0.840-1.23)	1.35 (1.12-1.64)	1.78 (1.48-2.17)	2.12 (1.74-2.60)	2.57 (2.04-3.27)	2.90 (2.26-3.78)	3.24 (2.45-4.32)	3.58 (2.63-4.91)	4.03 (2.84-5.77)	4.38 (2.98-6.50)
30-min	0.770 (0.640-0.934)	1.03 (0.854-1.25)	1.35 (1.12-1.65)	1.61 (1.32-1.98)	1.95 (1.55-2.48)	2.21 (1.72-2.87)	2.46 (1.87-3.28)	2.72 (2.00-3.73)	3.07 (2.16-4.39)	3.33 (2.27-4.94)
60-min	0.597 (0.497-0.725)	0.797 (0.663-0.969)	1.05 (0.870-1.28)	1.25 (1.03-1.54)	1.52 (1.20-1.93)	1.71 (1.33-2.23)	1.91 (1.45-2.55)	2.11 (1.55-2.90)	2.38 (1.68-3.41)	2.59 (1.76-3.84)
2-hr	0.468 (0.390-0.568)	0.620 (0.515-0.754)	0.810 (0.671-0.987)	0.960 (0.788-1.18)	1.15 (0.916-1.47)	1.30 (1.01-1.69)	1.44 (1.09-1.92)	1.59 (1.17-2.18)	1.78 (1.25-2.54)	1.92 (1.31-2.85)
3-hr	0.403 (0.335-0.489)	0.530 (0.441-0.645)	0.690 (0.572-0.841)	0.815 (0.670-1.00)	0.978 (0.777-1.24)	1.10 (0.853-1.43)	1.22 (0.922-1.62)	1.33 (0.983-1.83)	1.49 (1.05-2.14)	1.61 (1.10-2.39)
6-hr	0.304 (0.253-0.369)	0.399 (0.331-0.484)	0.517 (0.428-0.630)	0.609 (0.500-0.748)	0.728 (0.578-0.926)	0.816 (0.634-1.06)	0.902 (0.683-1.20)	0.988 (0.727-1.35)	1.10 (0.776-1.58)	1.19 (0.807-1.76)
12-hr	0.205 (0.170-0.249)	0.269 (0.224-0.327)	0.349 (0.289-0.425)	0.411 (0.338-0.505)	0.492 (0.390-0.625)	0.550 (0.428-0.716)	0.608 (0.451-0.811)	0.665 (0.490-0.913)	0.740 (0.522-1.06)	0.796 (0.542-1.18)
24-hr	0.142 (0.125-0.163)	0.188 (0.166-0.217)	0.246 (0.217-0.284)	0.291 (0.255-0.339)	0.350 (0.296-0.421)	0.393 (0.326-0.483)	0.435 (0.352-0.548)	0.477 (0.376-0.618)	0.532 (0.402-0.717)	0.573 (0.419-0.800)
2-day	0.087 (0.077-0.101)	0.118 (0.105-0.136)	0.158 (0.139-0.182)	0.189 (0.166-0.221)	0.231 (0.196-0.278)	0.262 (0.218-0.323)	0.294 (0.238-0.370)	0.326 (0.257-0.422)	0.368 (0.279-0.497)	0.401 (0.293-0.560)
3-day	0.063 (0.055-0.072)	0.086 (0.076-0.099)	0.117 (0.103-0.135)	0.141 (0.124-0.165)	0.175 (0.148-0.211)	0.201 (0.167-0.247)	0.227 (0.184-0.286)	0.254 (0.200-0.329)	0.291 (0.220-0.393)	0.320 (0.234-0.447)
4-day	0.050 (0.044-0.057)	0.069 (0.061-0.080)	0.095 (0.084-0.110)	0.116 (0.101-0.135)	0.145 (0.122-0.174)	0.167 (0.138-0.205)	0.190 (0.154-0.239)	0.213 (0.168-0.276)	0.246 (0.186-0.332)	0.272 (0.199-0.380)
7-day	0.032 (0.029-0.037)	0.046 (0.040-0.053)	0.063 (0.056-0.073)	0.078 (0.068-0.091)	0.098 (0.083-0.118)	0.114 (0.094-0.140)	0.130 (0.105-0.164)	0.147 (0.116-0.190)	0.171 (0.129-0.230)	0.189 (0.139-0.264)
10-day	0.024 (0.022-0.028)	0.035 (0.031-0.040)	0.049 (0.043-0.056)	0.060 (0.053-0.070)	0.076 (0.064-0.092)	0.089 (0.073-0.109)	0.102 (0.082-0.128)	0.115 (0.091-0.149)	0.134 (0.102-0.181)	0.150 (0.109-0.209)
20-day	0.015 (0.013-0.017)	0.021 (0.019-0.024)	0.030 (0.026-0.034)	0.037 (0.032-0.043)	0.047 (0.040-0.057)	0.055 (0.046-0.068)	0.064 (0.052-0.081)	0.073 (0.058-0.095)	0.086 (0.065-0.116)	0.096 (0.071-0.135)
30-day	0.011 (0.010-0.013)	0.016 (0.014-0.019)	0.023 (0.020-0.027)	0.029 (0.025-0.033)	0.037 (0.031-0.044)	0.043 (0.036-0.053)	0.050 (0.041-0.063)	0.058 (0.045-0.075)	0.068 (0.052-0.092)	0.077 (0.056-0.107)
45-day	0.009 (0.008-0.010)	0.013 (0.011-0.015)	0.018 (0.016-0.021)	0.023 (0.020-0.026)	0.029 (0.024-0.035)	0.034 (0.028-0.042)	0.040 (0.032-0.050)	0.046 (0.036-0.059)	0.054 (0.041-0.073)	0.062 (0.045-0.086)
60-day	0.008 (0.007-0.009)	0.011 (0.010-0.013)	0.015 (0.014-0.018)	0.019 (0.017-0.022)	0.025 (0.021-0.030)	0.029 (0.024-0.036)	0.034 (0.027-0.043)	0.039 (0.031-0.051)	0.047 (0.035-0.063)	0.053 (0.039-0.074)

¹ Precipitation frequency (PF) estimates in this table are based on frequency analysis of partial duration series (PDS). Numbers in parenthesis are PF estimates at lower and upper bounds of the 90% confidence interval. The probability that precipitation frequency estimates (for a given duration and average

NOAA's National Weather Service
Hydrometeorological Design Studies Center
 Precipitation Frequency Data Server (PFDS)

NOAA ATLAS 14 POINT PRECIPITATION FREQUENCY ESTIMATES: CA

DATA DESCRIPTION

Data type: precipitation intensity Units: english Time series type: partial duration

SELECT LOCATION

1. Manually:

- a) Enter location (decimal degrees, use "-" for S and W): latitude: 34.167563 longitude: -117.500206
- b) Select station (click here for a list of stations used in frequency analysis for CA): select station


2. Use map:

a) **Select location**
(move crosshair or double click)

b) **Click on station icon**
(show stations on map)

LOCATION INFORMATION:
 Name: Rancho Cucamonga, California, US*
 Latitude: 34.1676°
 Longitude: -117.5002°
 Elevation: 1837 ft

* source: Google Maps



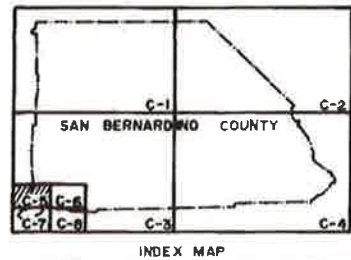
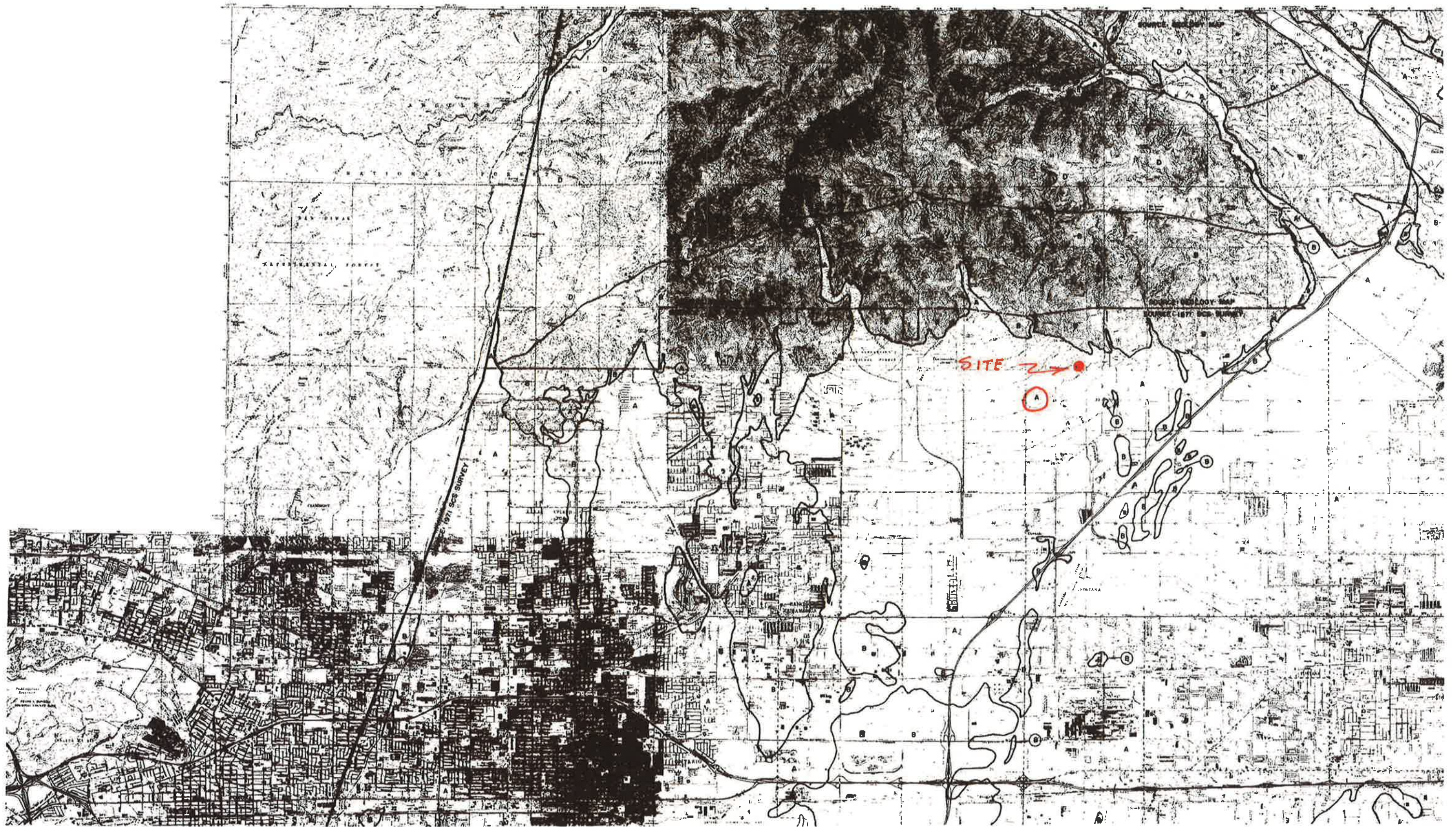
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- LEGEND
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 - A SOIL GROUP DESIGNATION
 - - - BOUNDARY OF INDICATED SOURCE

SCALE REDUCED BY 1/2

SCALE 1:48,000

HYDROLOGIC SOILS GROUP MAP
FOR
SOUTHWEST-A AREA