

DRAINAGE STUDY
FOR
JOSHUA SPRINGS CALVARY CHAPEL
New Gymnasium
Town of Yucca Valley, California
County of San Bernardino

Job No. 2750213-0PDB030600

April 30, 2025

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PREPARED UNDER THE SUPERVISION OF:
NV5, INC.

A handwritten signature in blue ink that reads "Vickie L. Bridenstine".

VICKIE L. BRIDENSTINE, P.E.



4/30/25

DATE

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Warner Engineering. (October 26,1999)

I. INTRODUCTION

A. Purpose of Study

The purpose of this study is to study the impacts that construction of a new gymnasium building on a now vacant graded pad (formerly the softball field) on the southwest portion of the property owned by Joshua Springs Calvary Chapel. The existing retention basin was sized to handle the incremental increase in runoff due to the development of the site. The current basin size was determined by a drainage report by Warner Engineering dated October 26, 1999 (included in Appendix A). The proposed 9,720 square foot building and adjacent hardscape improvements will add additional impervious area to the overall site and the increased runoff will be directed to a local onsite retention basin and ultimately to the project retention basin.

B. Scope

A Unit Hydrograph was run to compare storm water runoff to the original Unit Hydrograph included in the Warner Report. The new Unit Hydrograph made adjustments for the increase in proposed impervious area. The offsite drainage basin from the 1999 report was analyzed and the 100 year, 3-hour storm was calculated for comparison purposes. Hydrologic and hydraulic calculations were performed using methodologies defined in the *San Bernardino County Flood Control District Hydrology Manual* (August 1986) and County of San Bernardino Hydrology Manual Addendum for Arid Regions (April 2010).

In addition, a localized Unit Hydrograph analysis was performed on the building site to determine the size of a local retention basin to handle the incremental increase in runoff and minimize potential erosion.

The CivilDesign Hydrology-Hydraulics software, Rational Hydrology program package was used to perform the hydrologic calculations.

II. SITE AREA

A. Area Characteristics

The Joshua Springs Calvary Chapel campus is approximately 23 acres located south of Joshua Lane, north of Nagles Street and east of Hardesty Drive. The site is presently disturbed or developed with buildings, desert landscaping or parking. The drainage area tributary to the site from the south is largely undeveloped covered with natural desert vegetation with occasional single-family homes on large lots. The natural terrain slopes down to the north at approximately 5%.

The site accepts runoff from approximately 18 acres to the south and conveys runoff through the site to Joshua Lane through natural drain courses on the eastern edge of the property.

The existing retention basin was designed to accept the runoff volume for the 100year, 3 hour storm. The basin capacity is 171,000c.f., which includes a 40% bulking factor. Per the Warner report, the previous development generates 122,400 c.f. runoff volume.

B. Proposed Development

The proposed gymnasium and associated hardscape is proposed to be constructed on an existing vacant graded pad (formerly a softball field) located at the southwest corner of the property. The proposed construction adds an addition 14,350 sf. of impervious area to take into consideration during our analysis.

C. Soils Group

According to Plate C-2 of the San Bernardino County Flood Control District (SBCFCD) Hydrology Manual, the entirety of the watershed is within a Soil Type "B".

D. Land Use

The existing Land Use General Plan Designation for this site is RR-1 (Single Family Rural Residential, 1 acre minimum) and RR-2.5 (Single Family Rural Residential, 2.5 acre minimum). The existing land use is a church and school and accessory uses. The location of the proposed new gymnasium is a vacant existing graded pad directly south of the existing retention basin.

E. Rainfall Intensity

The rainfall data used in the study are per the San Bernardino County Isohyetals located in the Hydrology Manual as were the original study conducted in 1999. The NOAA Atlas 14, Volume 6, Version 2 rainfall information was reviewed as recommended for use by the San Bernardino County Hydrology Manual, Addendum for Arid Regions (April 2010) and it was determined that they are relatively the same as the Isohyetals from the hydrology manual. For comparison purposes, we used the same data as the original study. Data from the Yucca Valley Station ID: 79-9002 is included in Appendix I.

F. Antecedent Moisture Condition (AMC)

Per San Bernardino County Hydrology Manual, Addendum for Arid Regions (April 2010), this project lies within the area mapped as AMC2 on Figure ADD-1. However, in the interest of direct comparison, AMC 3 was used in our analysis to compare to the original study.

III. SUMMARY

A. Results

The Unit Hydrograph calculation which includes the additional 14,350 s.f. of impervious area created by the proposed development of the new gymnasium generates 123,275

c.f. runoff volume. The existing retention basin has a capacity of 171,000 c.f., therefore the basin has the capacity to accept the additional runoff as a result of this proposed construction.

In addition to the existing large retention basin, a localized retention basin has been proposed adjacent to the new gymnasium to handle the incremental increase due to this proposed construction in order to minimize potential erosion. The Pre-development storm volume was calculated to be 6,595 c.f. The Post-development storm volume is calculated to be 8,468 c.f. The incremental difference is 1,873 c.f. The basin was sized to add a 10% factor of safety. The basin is sized to be 2,060 c.f.

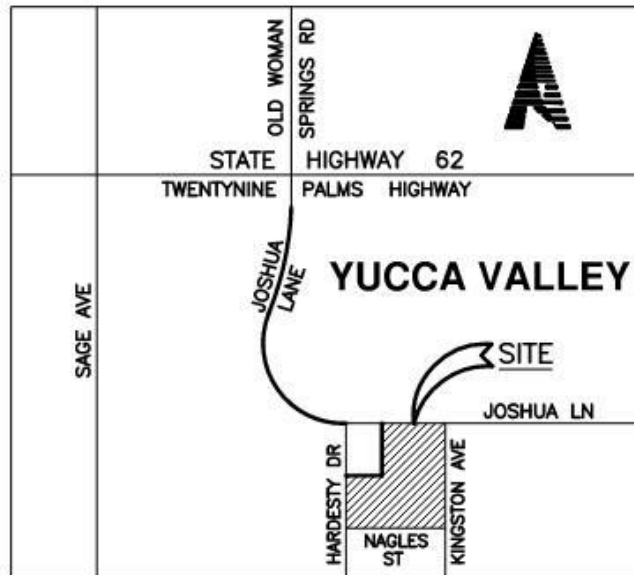
B. Conclusions

Development of the new gymnasium and associated hardscape can be accomplished in a manner that will maintain historical downstream flow patterns. The existing retention basin volume should be adequate to accommodate the additional volume of storm runoff due to the proposed development.

C. References

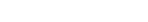
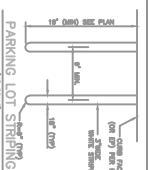
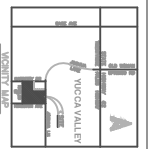
1. *CivilDesign Engineering Software, Rational Method Hydrology System Model*, © 1989-2001, Version 6.4.
2. County of San Bernardino, *Hydrology Manual*, ©August 1986.
3. SB County Hydrology Manual, Addendum for Arid Regions (April, 2010)
4. Drainage Study for Joshua Springs Calvary Chapel by Warner Engineering (October , 1999)

APPENDIX I



VICINITY MAP

(NO SCALE)



NOAA Atlas 14, Volume 6, Version 2 YUCCA
VALLEY C.D.F.



Station ID: 79-9002
Location name: Yucca Valley, California, USA*
Latitude: 34.1238°, Longitude: -116.4093°
Elevation:
Elevation (station metadata): 3420 ft**



* source: ESRI Maps
** source: USGS

POINT PRECIPITATION FREQUENCY ESTIMATES

Sanja Perica, Sarah Dietz, Sarah Heim, Lillian Hiner, Kazungu Maitaria, Deborah Martin, Sandra Pavlovic, Ishani Roy, Carl Trypaluk, Dale Unruh, Fenglin Yan, Michael Yekta, Tan Zhao, Geoffrey Bonnin, Daniel Brewer, Li-Chuan Chen, Tye Parzybok, John Yarchoan

NOAA, National Weather Service, Silver Spring, Maryland

[PF_tabular](#) | [PF_graphical](#) | [Maps & aerials](#)

PF tabular

PDS-based point precipitation frequency estimates with 90% confidence intervals (in inches) ¹										
Duration	Average recurrence interval (years)									
	1	2	5	10	25	50	100	200	500	1000
5-min	0.078 (0.065-0.095)	0.116 (0.096-0.142)	0.175 (0.145-0.215)	0.231 (0.189-0.285)	0.318 (0.252-0.406)	0.397 (0.308-0.517)	0.488 (0.369-0.651)	0.594 (0.437-0.816)	0.865 (0.611-1.24)	1.17 (0.800-1.74)
10-min	0.112 (0.093-0.136)	0.167 (0.138-0.204)	0.251 (0.207-0.308)	0.331 (0.271-0.408)	0.456 (0.361-0.582)	0.569 (0.441-0.741)	0.699 (0.529-0.934)	0.852 (0.627-1.17)	1.24 (0.876-1.77)	1.68 (1.15-2.49)
15-min	0.135 (0.112-0.165)	0.202 (0.167-0.246)	0.304 (0.251-0.372)	0.400 (0.327-0.494)	0.552 (0.437-0.704)	0.688 (0.533-0.897)	0.846 (0.640-1.13)	1.03 (0.758-1.41)	1.50 (1.06-2.14)	2.03 (1.39-3.01)
30-min	0.207 (0.172-0.253)	0.309 (0.256-0.378)	0.466 (0.384-0.571)	0.613 (0.501-0.757)	0.846 (0.670-1.08)	1.06 (0.818-1.37)	1.30 (0.981-1.73)	1.58 (1.16-2.17)	2.30 (1.62-3.29)	3.11 (2.12-4.61)
60-min	0.287 (0.237-0.349)	0.428 (0.354-0.522)	0.644 (0.531-0.789)	0.847 (0.693-1.05)	1.17 (0.926-1.49)	1.46 (1.13-1.90)	1.79 (1.36-2.39)	2.18 (1.61-3.00)	3.18 (2.24-4.55)	4.30 (2.94-6.37)
2-hr	0.402 (0.333-0.490)	0.568 (0.470-0.694)	0.813 (0.671-0.995)	1.03 (0.846-1.28)	1.37 (1.08-1.75)	1.66 (1.29-2.16)	1.98 (1.50-2.65)	2.35 (1.73-3.23)	3.21 (2.27-4.59)	4.35 (2.97-6.44)
3-hr	0.477 (0.395-0.582)	0.662 (0.548-0.808)	0.929 (0.766-1.14)	1.17 (0.954-1.44)	1.52 (1.20-1.94)	1.82 (1.41-2.37)	2.15 (1.63-2.87)	2.52 (1.85-3.46)	3.24 (2.29-4.64)	4.39 (3.00-6.50)
6-hr	0.617 (0.511-0.753)	0.843 (0.697-1.03)	1.16 (0.956-1.42)	1.43 (1.17-1.77)	1.84 (1.45-2.34)	2.17 (1.68-2.82)	2.52 (1.91-3.37)	2.91 (2.14-4.00)	3.48 (2.45-4.97)	4.44 (3.03-6.57)
12-hr	0.749 (0.620-0.914)	1.03 (0.850-1.26)	1.42 (1.17-1.74)	1.76 (1.44-2.17)	2.25 (1.78-2.87)	2.65 (2.06-3.46)	3.09 (2.34-4.12)	3.56 (2.62-4.89)	4.24 (3.00-6.07)	4.81 (3.28-7.12)
24-hr	0.920 (0.815-1.06)	1.28 (1.14-1.48)	1.80 (1.58-2.08)	2.25 (1.97-2.62)	2.91 (2.46-3.50)	3.46 (2.87-4.25)	4.06 (3.29-5.10)	4.72 (3.72-6.10)	5.68 (4.30-7.65)	6.49 (4.75-9.04)
2-day	0.988 (0.876-1.14)	1.40 (1.24-1.62)	2.00 (1.76-2.31)	2.52 (2.21-2.94)	3.29 (2.79-3.96)	3.93 (3.26-4.83)	4.63 (3.75-5.82)	5.40 (4.26-6.98)	6.53 (4.95-8.79)	7.48 (5.48-10.4)
3-day	1.08 (0.952-1.24)	1.55 (1.37-1.78)	2.22 (1.96-2.57)	2.82 (2.47-3.28)	3.69 (3.13-4.44)	4.42 (3.67-5.44)	5.22 (4.23-6.57)	6.10 (4.82-7.89)	7.40 (5.61-9.96)	8.49 (6.22-11.8)
4-day	1.12 (0.995-1.29)	1.63 (1.44-1.88)	2.36 (2.08-2.73)	3.00 (2.63-3.50)	3.95 (3.35-4.75)	4.74 (3.94-5.82)	5.60 (4.54-7.05)	6.56 (5.18-8.48)	7.97 (6.04-10.7)	9.15 (6.70-12.7)
7-day	1.24 (1.10-1.43)	1.84 (1.63-2.12)	2.70 (2.38-3.12)	3.46 (3.03-4.03)	4.59 (3.89-5.52)	5.53 (4.59-6.79)	6.56 (5.32-8.26)	7.70 (6.08-9.96)	9.39 (7.12-12.7)	10.8 (7.93-15.1)
10-day	1.34 (1.19-1.55)	2.00 (1.77-2.31)	2.95 (2.61-3.42)	3.79 (3.32-4.42)	5.04 (4.27-6.07)	6.09 (5.06-7.48)	7.23 (5.86-9.10)	8.50 (6.70-11.0)	10.4 (7.86-14.0)	12.0 (8.76-16.7)
20-day	1.50 (1.33-1.73)	2.25 (1.99-2.60)	3.33 (2.94-3.85)	4.28 (3.75-4.99)	5.69 (4.82-6.85)	6.86 (5.70-8.43)	8.14 (6.60-10.2)	9.55 (7.54-12.4)	11.6 (8.80-15.6)	13.3 (9.77-18.6)
30-day	1.68 (1.49-1.94)	2.52 (2.23-2.91)	3.73 (3.29-4.31)	4.79 (4.19-5.58)	6.35 (5.38-7.65)	7.65 (6.35-9.40)	9.05 (7.34-11.4)	10.6 (8.35-13.7)	12.8 (9.71-17.3)	14.7 (10.8-20.4)
45-day	1.95 (1.73-2.25)	2.91 (2.57-3.35)	4.26 (3.76-4.93)	5.45 (4.77-6.35)	7.19 (6.09-8.66)	8.63 (7.17-10.6)	10.2 (8.25-12.8)	11.9 (9.36-15.3)	14.3 (10.8-19.3)	16.3 (11.9-22.7)
60-day	2.24 (1.99-2.58)	3.31 (2.93-3.81)	4.81 (4.25-5.56)	6.12 (5.36-7.14)	8.03 (6.81-9.67)	9.61 (7.98-11.8)	11.3 (9.16-14.2)	13.1 (10.3-17.0)	15.7 (11.9-21.2)	17.9 (13.1-24.9)

¹ Precipitation frequency (PF) estimates in this table are based on frequency analysis of partial duration series (PDS).

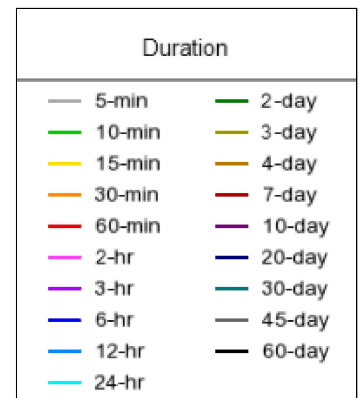
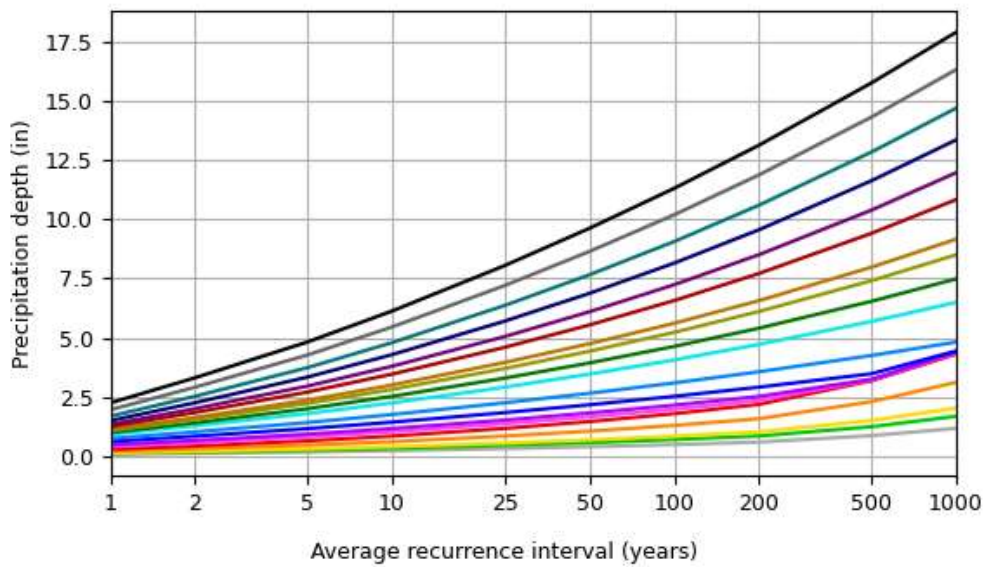
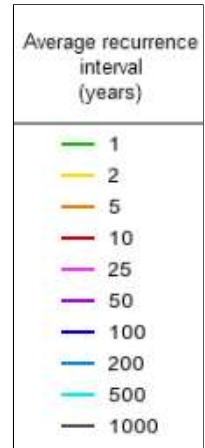
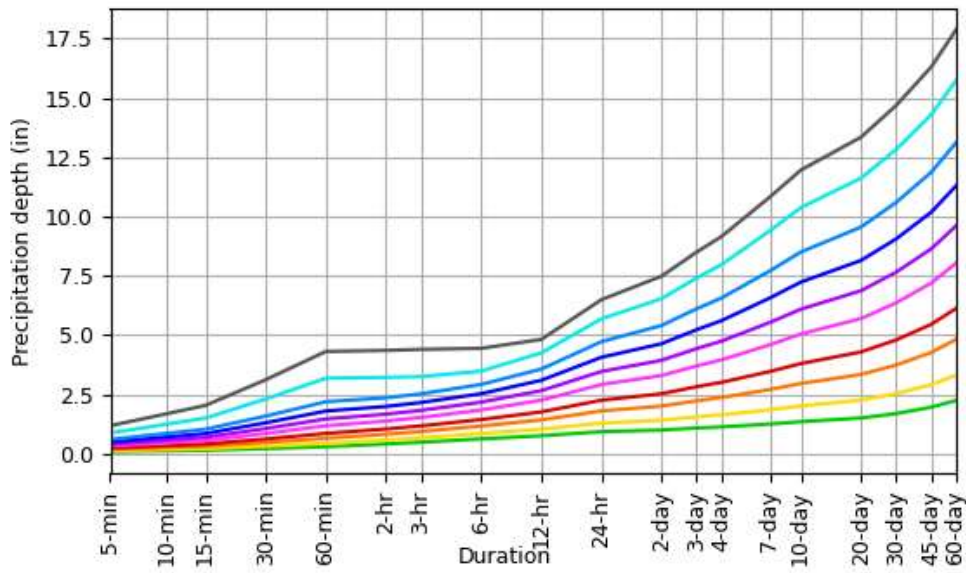
Numbers in parenthesis are PF estimates at lower and upper bounds of the 90% confidence interval. The probability that precipitation frequency estimates (for a given duration and average recurrence interval) will be greater than the upper bound (or less than the lower bound) is 5%. Estimates at upper bounds are not checked against probable maximum precipitation (PMP) estimates and may be higher than currently valid PMP values.

Please refer to NOAA Atlas 14 document for more information.

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PF graphical

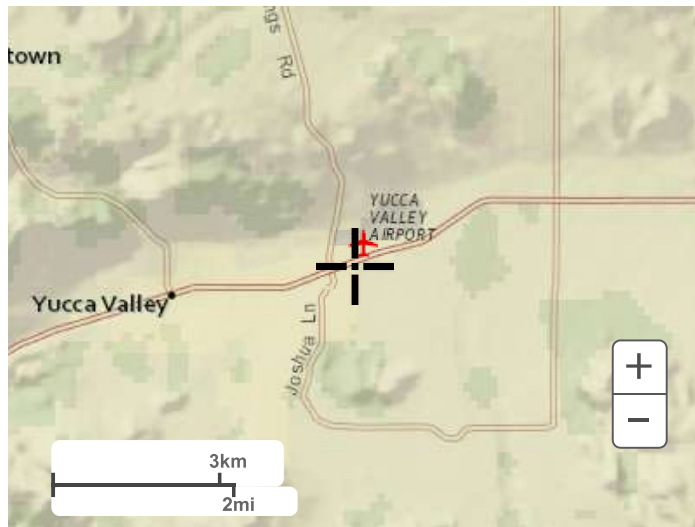
PDS-based depth-duration-frequency (DDF) curves
 Latitude: 34.1238°, Longitude: -116.4093°



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Maps & aeriels

Small scale terrain



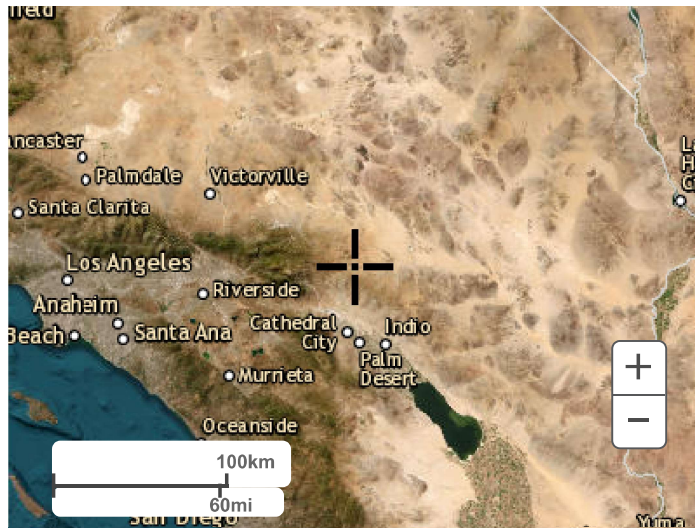
Large scale terrain



Large scale map



Large scale aerial



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APPENDIX II

Unit Hydrograph Analysis

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Study date 10/01/24

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San Bernardino County Synthetic Unit Hydrology Method
Manual date - August 1986

Program License Serial Number 6360

JOSHUA SPRINGS NEW GYMNASIUM 2024
100 YEAR 3 HOUR STORM, POST DEVELOPMENT
OCTOBER 1, 2024 VB

Storm Event Year = 100

Antecedent Moisture Condition = 3

English (in-lb) Input Units Used

English Rainfall Data (Inches) Input Values Used

English Units used in output format

Area averaged rainfall intensity isohyetal data:

Sub-Area (Ac.)	Duration (hours)	Isohyetal (In)

Rainfall data for year 10 20.00	1	0.91

Rainfall data for year 2 20.00	6	1.00

Rainfall data for year 2 20.00	24	1.30

Rainfall data for year 100 20.00	1	1.40

Rainfall data for year 100

20.00 6 2.50

Rainfall data for year 100

20.00 24 5.00

+++++
***** Area-averaged max loss rate, Fm *****

SCS curve No. (AMCII)	SCS curve NO. (AMC 3)	Area (Ac.)	Area Fraction	Fp(Fig C6) (In/Hr)	Ap (dec.)	Fm (In/Hr)
56.0	75.8	9.80	0.490	0.440	0.510	0.224
66.0	83.8	10.20	0.510	0.304	0.510	0.155

Area-averaged adjusted loss rate Fm (In/Hr) = 0.189

***** Area-Averaged low loss rate fraction, Yb *****

Area (Ac.)	Area Fract	SCS CN (AMC2)	SCS CN (AMC3)	S	Pervious Yield Fr
5.00	0.250	56.0	75.8	3.19	0.504
4.80	0.240	98.0	98.0	0.20	0.953
5.20	0.260	66.0	83.8	1.93	0.650
5.00	0.250	98.0	98.0	0.20	0.953

Area-averaged catchment yield fraction, Y = 0.762

Area-averaged low loss fraction, Yb = 0.238

+++++
Watercourse length = 3000.00(Ft.)

Length from concentration point to centroid = 1250.00(Ft.)

Elevation difference along watercourse = 150.00(Ft.)

Mannings friction factor along watercourse = 0.030

Watershed area = 20.00(Ac.)

Catchment Lag time = 0.116 hours

Unit interval = 5.000 minutes

Unit interval percentage of lag time = 71.5584

Hydrograph baseflow = 0.00(CFS)

Average maximum watershed loss rate(Fm) = 0.189(In/Hr)

Average low loss rate fraction (Yb) = 0.238 (decimal)

DESERT S-Graph Selected

Computed peak 5-minute rainfall = 0.664(In)

Computed peak 30-minute rainfall = 1.137(In)

Specified peak 1-hour rainfall = 1.400(In)

Computed peak 3-hour rainfall = 1.998(In)

Specified peak 6-hour rainfall = 2.500(In)

Specified peak 24-hour rainfall = 5.000(In)

Rainfall depth area reduction factors:

Using a total area of 20.00(Ac.) (Ref: fig. E-4)

5-minute factor = 0.999	Adjusted rainfall = 0.664(In)
30-minute factor = 0.999	Adjusted rainfall = 1.136(In)
1-hour factor = 0.999	Adjusted rainfall = 1.399(In)
3-hour factor = 1.000	Adjusted rainfall = 1.997(In)
6-hour factor = 1.000	Adjusted rainfall = 2.500(In)
24-hour factor = 1.000	Adjusted rainfall = 5.000(In)

Unit Hydrograph

+++++
Interval 'S' Graph Unit Hydrograph
Number Mean values ((CFS))

(K = 241.88 (CFS))

1	8.231	19.908
2	51.673	105.077
3	74.307	54.745
4	84.207	23.946
5	89.961	13.917
6	93.549	8.678
7	95.969	5.855
8	97.532	3.780
9	98.410	2.122
10	99.248	2.028
11	100.000	1.819

Total soil rain loss = 0.30(In)
Total effective rainfall = 1.70(In)
Peak flow rate in flood hydrograph = 80.78(CFS)

3 - H O U R S T O R M
Runoff Hydrograph

Hydrograph in 5 Minute intervals ((CFS))

Time(h+m)	Volume Ac. Ft	Q(CFS)	0	22.5	45.0	67.5	90.0
0+ 5	0.0019	0.28	Q				
0+10	0.0138	1.74	Q				
0+15	0.0313	2.53	VQ				
0+20	0.0516	2.95	VQ				
0+25	0.0738	3.22	Q				

0+30	0.0976	3.46	Q				
0+35	0.1227	3.65	Q				
0+40	0.1492	3.84	QV				
0+45	0.1768	4.01	QV				
0+50	0.2058	4.21	QV				
0+55	0.2361	4.40	Q V				
1+ 0	0.2679	4.62	QV				
1+ 5	0.3011	4.83	Q V				
1+10	0.3363	5.10	Q V				
1+15	0.3733	5.38	Q V				
1+20	0.4128	5.74	Q V				
1+25	0.4546	6.07	Q V				
1+30	0.4984	6.35	Q V				
1+35	0.5450	6.77	Q V				
1+40	0.5966	7.49	Q V				
1+45	0.6541	8.34	Q V				
1+50	0.7214	9.78	Q V				
1+55	0.8040	11.99	Q V				
2+ 0	0.9244	17.48	Q V				
2+ 5	1.1655	35.01	QV				
2+10	1.7218	80.78		Q	V		Q
2+15	2.0591	48.98			Q	V	
2+20	2.2487	27.52		Q		V	
2+25	2.3788	18.89		Q		V	
2+30	2.4760	14.11		Q		V	
2+35	2.5525	11.11		Q		V	
2+40	2.6135	8.85		Q		V	
2+45	2.6625	7.13		Q		V	
2+50	2.7066	6.40		Q		V	
2+55	2.7456	5.67		Q		V	
3+ 0	2.7746	4.20	Q				V
3+ 5	2.7992	3.58	Q				V
3+10	2.8123	1.90	Q				V
3+15	2.8193	1.02	Q				V
3+20	2.8236	0.63	Q				V
3+25	2.8264	0.39	Q				V
3+30	2.8281	0.25	Q				V
3+35	2.8291	0.15	Q				V
3+40	2.8297	0.09	Q				V
3+45	2.8301	0.06	Q				V
3+50	2.8303	0.03	Q				V

Unit Hydrograph Analysis

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Study date 03/26/25

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San Bernardino County Synthetic Unit Hydrology Method
Manual date - August 1986

Program License Serial Number 6360

JSCC NEW GYM LOCAL LOCATION
100 YEAR 24 HOUR STORM
PRE CONSTRUCTION
MARCH 26, 2025

Storm Event Year = 100

Antecedent Moisture Condition = 3

English (in-lb) Input Units Used

English Rainfall Data (Inches) Input Values Used

English Units used in output format

Area averaged rainfall intensity isohyetal data:

Sub-Area (Ac.)	Duration (hours)	Isohyetal (In)

Rainfall data for year 10 0.50	1	0.91

Rainfall data for year 2 0.50	6	1.00

Rainfall data for year 2 0.50	24	1.30

Rainfall data for year 100 0.50	1	1.40

Rainfall data for year 100

0.50 6 2.50

Rainfall data for year 100

0.50 24 5.00

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***** Area-averaged max loss rate, Fm *****

SCS curve No. (AMC II)	SCS curve NO. (AMC 3)	Area (Ac.)	Area Fraction	Fp(Fig C6) (In/Hr)	Ap (dec.)	Fm (In/Hr)
70.0	87.0	0.50	1.000	0.247	1.000	0.247

Area-averaged adjusted loss rate Fm (In/Hr) = 0.247

***** Area-Averaged low loss rate fraction, Yb *****

Area (Ac.)	Area Fract	SCS CN (AMC2)	SCS CN (AMC3)	S	Pervious Yield Fr
0.50	1.000	70.0	87.0	1.49	0.713

Area-averaged catchment yield fraction, Y = 0.713

Area-averaged low loss fraction, Yb = 0.287

User entry of time of concentration = 0.125 (hours)

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Watershed area = 0.50(Ac.)

Catchment Lag time = 0.100 hours

Unit interval = 5.000 minutes

Unit interval percentage of lag time = 83.3333

Hydrograph baseflow = 0.00(CFS)

Average maximum watershed loss rate(Fm) = 0.247(In/Hr)

Average low loss rate fraction (Yb) = 0.287 (decimal)

DESERT S-Graph Selected

Computed peak 5-minute rainfall = 0.664(In)

Computed peak 30-minute rainfall = 1.137(In)

Specified peak 1-hour rainfall = 1.400(In)

Computed peak 3-hour rainfall = 1.998(In)

Specified peak 6-hour rainfall = 2.500(In)

Specified peak 24-hour rainfall = 5.000(In)

Rainfall depth area reduction factors:

Using a total area of 0.50(Ac.) (Ref: fig. E-4)

5-minute factor = 1.000 Adjusted rainfall = 0.664(In)

30-minute factor = 1.000 Adjusted rainfall = 1.137(In)

1-hour factor = 1.000 Adjusted rainfall = 1.400(In)

3-hour factor = 1.000 Adjusted rainfall = 1.998(In)

6-hour factor = 1.000 Adjusted rainfall = 2.500(In)
 24-hour factor = 1.000 Adjusted rainfall = 5.000(In)

U n i t H y d r o g r a p h

Interval 'S' Graph Unit Hydrograph
 Number Mean values ((CFS))

(K = 6.05 (CFS))

1	11.774	0.712
2	59.344	2.876
3	79.039	1.191
4	87.838	0.532
5	92.728	0.296
6	95.763	0.184
7	97.597	0.111
8	98.603	0.061
9	99.514	0.055
10	100.000	0.029

Total soil rain loss = 1.23(In)
 Total effective rainfall = 3.77(In)
 Peak flow rate in flood hydrograph = 2.13(CFS)

24 - H O U R S T O R M
 R u n o f f H y d r o g r a p h

Hydrograph in 5 Minute intervals ((CFS))

Time(h+m)	Volume Ac. Ft	Q(CFS)	0	2.5	5.0	7.5	10.0
0+ 5	0.0000	0.00	Q				
0+10	0.0002	0.02	Q				
0+15	0.0004	0.03	Q				
0+20	0.0006	0.03	Q				
0+25	0.0009	0.03	Q				
0+30	0.0011	0.04	Q				
0+35	0.0014	0.04	Q				
0+40	0.0016	0.04	Q				
0+45	0.0019	0.04	Q				
0+50	0.0021	0.04	Q				
0+55	0.0024	0.04	Q				
1+ 0	0.0027	0.04	Q				
1+ 5	0.0029	0.04	Q				
1+10	0.0032	0.04	Q				

1+15	0.0035	0.04	Q
1+20	0.0037	0.04	Q
1+25	0.0040	0.04	QV
1+30	0.0043	0.04	QV
1+35	0.0045	0.04	QV
1+40	0.0048	0.04	QV
1+45	0.0051	0.04	QV
1+50	0.0054	0.04	QV
1+55	0.0056	0.04	QV
2+ 0	0.0059	0.04	QV
2+ 5	0.0062	0.04	QV
2+10	0.0065	0.04	QV
2+15	0.0067	0.04	QV
2+20	0.0070	0.04	QV
2+25	0.0073	0.04	QV
2+30	0.0076	0.04	QV
2+35	0.0078	0.04	QV
2+40	0.0081	0.04	Q V
2+45	0.0084	0.04	Q V
2+50	0.0087	0.04	Q V
2+55	0.0090	0.04	Q V
3+ 0	0.0093	0.04	Q V
3+ 5	0.0095	0.04	Q V
3+10	0.0098	0.04	Q V
3+15	0.0101	0.04	Q V
3+20	0.0104	0.04	Q V
3+25	0.0107	0.04	Q V
3+30	0.0110	0.04	Q V
3+35	0.0113	0.04	Q V
3+40	0.0116	0.04	Q V
3+45	0.0118	0.04	Q V
3+50	0.0121	0.04	Q V
3+55	0.0124	0.04	Q V
4+ 0	0.0127	0.04	Q V
4+ 5	0.0130	0.04	Q V
4+10	0.0133	0.04	Q V
4+15	0.0136	0.04	Q V
4+20	0.0139	0.04	Q V
4+25	0.0142	0.04	Q V
4+30	0.0145	0.04	Q V
4+35	0.0148	0.04	Q V
4+40	0.0151	0.04	Q V
4+45	0.0154	0.04	Q V
4+50	0.0157	0.04	Q V
4+55	0.0160	0.04	Q V
5+ 0	0.0164	0.04	Q V
5+ 5	0.0167	0.04	Q V
5+10	0.0170	0.05	Q V
5+15	0.0173	0.05	Q V
5+20	0.0176	0.05	Q V
5+25	0.0179	0.05	Q V

5+30	0.0182	0.05	Q	V
5+35	0.0185	0.05	Q	V
5+40	0.0189	0.05	Q	V
5+45	0.0192	0.05	Q	V
5+50	0.0195	0.05	Q	V
5+55	0.0198	0.05	Q	V
6+ 0	0.0201	0.05	Q	V
6+ 5	0.0205	0.05	Q	V
6+10	0.0208	0.05	Q	V
6+15	0.0211	0.05	Q	V
6+20	0.0214	0.05	Q	V
6+25	0.0218	0.05	Q	V
6+30	0.0221	0.05	Q	V
6+35	0.0224	0.05	Q	V
6+40	0.0228	0.05	Q	V
6+45	0.0231	0.05	Q	V
6+50	0.0234	0.05	Q	V
6+55	0.0238	0.05	Q	V
7+ 0	0.0241	0.05	Q	V
7+ 5	0.0245	0.05	Q	V
7+10	0.0248	0.05	Q	V
7+15	0.0252	0.05	Q	V
7+20	0.0255	0.05	Q	V
7+25	0.0258	0.05	Q	V
7+30	0.0262	0.05	Q	V
7+35	0.0265	0.05	Q	V
7+40	0.0269	0.05	Q	V
7+45	0.0273	0.05	Q	V
7+50	0.0276	0.05	Q	V
7+55	0.0280	0.05	Q	V
8+ 0	0.0283	0.05	Q	V
8+ 5	0.0287	0.05	Q	V
8+10	0.0291	0.05	Q	V
8+15	0.0294	0.05	Q	V
8+20	0.0298	0.05	Q	V
8+25	0.0302	0.05	Q	V
8+30	0.0305	0.05	Q	V
8+35	0.0309	0.05	Q	V
8+40	0.0313	0.05	Q	V
8+45	0.0317	0.05	Q	V
8+50	0.0320	0.06	Q	V
8+55	0.0324	0.06	Q	V
9+ 0	0.0328	0.06	Q	V
9+ 5	0.0332	0.06	Q	V
9+10	0.0336	0.06	Q	V
9+15	0.0340	0.06	Q	V
9+20	0.0344	0.06	Q	V
9+25	0.0348	0.06	Q	V
9+30	0.0352	0.06	Q	V
9+35	0.0356	0.06	Q	V
9+40	0.0360	0.06	Q	V

9+45	0.0364	0.06	Q	V			
9+50	0.0368	0.06	Q	V			
9+55	0.0372	0.06	Q	V			
10+ 0	0.0376	0.06	Q	V			
10+ 5	0.0380	0.06	Q	V			
10+10	0.0384	0.06	Q	V			
10+15	0.0389	0.06	Q	V			
10+20	0.0393	0.06	Q	V			
10+25	0.0397	0.06	Q	V			
10+30	0.0401	0.06	Q	V			
10+35	0.0406	0.06	Q	V			
10+40	0.0410	0.06	Q	V			
10+45	0.0415	0.06	Q	V			
10+50	0.0419	0.06	Q	V			
10+55	0.0423	0.07	Q	V			
11+ 0	0.0428	0.07	Q	V			
11+ 5	0.0433	0.07	Q	V			
11+10	0.0437	0.07	Q	V			
11+15	0.0442	0.07	Q	V			
11+20	0.0446	0.07	Q	V			
11+25	0.0451	0.07	Q	V			
11+30	0.0456	0.07	Q	V			
11+35	0.0461	0.07	Q	V			
11+40	0.0466	0.07	Q	V			
11+45	0.0470	0.07	Q	V			
11+50	0.0475	0.07	Q	V			
11+55	0.0480	0.07	Q	V			
12+ 0	0.0485	0.07	Q	V			
12+ 5	0.0490	0.07	Q	V			
12+10	0.0494	0.06	Q	V			
12+15	0.0498	0.05	Q	V			
12+20	0.0502	0.05	Q	V			
12+25	0.0505	0.05	Q	V			
12+30	0.0509	0.05	Q	V			
12+35	0.0512	0.05	Q	V			
12+40	0.0516	0.05	Q	V			
12+45	0.0520	0.05	Q	V			
12+50	0.0523	0.05	Q	V			
12+55	0.0527	0.06	Q	V			
13+ 0	0.0531	0.06	Q	V			
13+ 5	0.0535	0.06	Q	V			
13+10	0.0539	0.06	Q	V			
13+15	0.0543	0.06	Q	V			
13+20	0.0547	0.06	Q	V			
13+25	0.0552	0.06	Q	V			
13+30	0.0556	0.06	Q	V			
13+35	0.0560	0.06	Q	V			
13+40	0.0565	0.07	Q	V			
13+45	0.0570	0.07	Q	V			
13+50	0.0574	0.07	Q	V			
13+55	0.0579	0.07	Q	V			

14+ 0	0.0584	0.07	Q	V			
14+ 5	0.0589	0.07	Q	V			
14+10	0.0595	0.08	Q	V			
14+15	0.0600	0.08	Q	V			
14+20	0.0606	0.08	Q	V			
14+25	0.0611	0.08	Q	V			
14+30	0.0617	0.09	Q	V			
14+35	0.0623	0.09	Q	V			
14+40	0.0630	0.09	Q	V			
14+45	0.0636	0.10	Q	V			
14+50	0.0643	0.10	Q	V			
14+55	0.0650	0.10	Q	V			
15+ 0	0.0658	0.11	Q	V			
15+ 5	0.0666	0.11	Q	V			
15+10	0.0674	0.12	Q	V			
15+15	0.0683	0.13	Q	V			
15+20	0.0692	0.14	Q	V			
15+25	0.0702	0.14	Q	V			
15+30	0.0713	0.15	Q	V			
15+35	0.0724	0.16	Q	V			
15+40	0.0736	0.18	Q	V			
15+45	0.0750	0.20	Q	V			
15+50	0.0766	0.24	Q	V			
15+55	0.0786	0.29	Q	V			
16+ 0	0.0817	0.44	Q	V			
16+ 5	0.0886	1.00	Q	V			
16+10	0.1032	2.13	Q	V			
16+15	0.1107	1.09	Q	V			
16+20	0.1150	0.61	Q	V			
16+25	0.1178	0.41	Q	V			
16+30	0.1199	0.31	Q	V			
16+35	0.1215	0.23	Q	V			
16+40	0.1228	0.18	Q	V			
16+45	0.1239	0.16	Q	V			
16+50	0.1248	0.13	Q	V			
16+55	0.1255	0.10	Q	V			
17+ 0	0.1262	0.09	Q	V			
17+ 5	0.1268	0.09	Q	V			
17+10	0.1273	0.08	Q	V			
17+15	0.1279	0.08	Q	V			
17+20	0.1284	0.07	Q	V			
17+25	0.1288	0.07	Q	V			
17+30	0.1293	0.07	Q	V			
17+35	0.1297	0.06	Q	V			
17+40	0.1301	0.06	Q	V			
17+45	0.1305	0.06	Q	V			
17+50	0.1309	0.06	Q	V			
17+55	0.1313	0.05	Q	V			
18+ 0	0.1317	0.05	Q	V			
18+ 5	0.1320	0.05	Q	V			
18+10	0.1325	0.07	Q	V			

18+15	0. 1330	0. 07	Q			V
18+20	0. 1334	0. 07	Q			V
18+25	0. 1339	0. 07	Q			V
18+30	0. 1344	0. 07	Q			V
18+35	0. 1349	0. 07	Q			V
18+40	0. 1353	0. 07	Q			V
18+45	0. 1358	0. 07	Q			V
18+50	0. 1362	0. 07	Q			V
18+55	0. 1367	0. 06	Q			V
19+ 0	0. 1371	0. 06	Q			V
19+ 5	0. 1376	0. 06	Q			V
19+10	0. 1380	0. 06	Q			V
19+15	0. 1384	0. 06	Q			V
19+20	0. 1388	0. 06	Q			V
19+25	0. 1392	0. 06	Q			V
19+30	0. 1396	0. 06	Q			V
19+35	0. 1400	0. 06	Q			V
19+40	0. 1404	0. 06	Q			V
19+45	0. 1408	0. 06	Q			V
19+50	0. 1412	0. 06	Q			V
19+55	0. 1416	0. 06	Q			V
20+ 0	0. 1419	0. 05	Q			V
20+ 5	0. 1423	0. 05	Q			V
20+10	0. 1427	0. 05	Q			V
20+15	0. 1430	0. 05	Q			V
20+20	0. 1434	0. 05	Q			V
20+25	0. 1438	0. 05	Q			V
20+30	0. 1441	0. 05	Q			V
20+35	0. 1445	0. 05	Q			V
20+40	0. 1448	0. 05	Q			V
20+45	0. 1452	0. 05	Q			V
20+50	0. 1455	0. 05	Q			V
20+55	0. 1458	0. 05	Q			V
21+ 0	0. 1462	0. 05	Q			V
21+ 5	0. 1465	0. 05	Q			V
21+10	0. 1468	0. 05	Q			V
21+15	0. 1471	0. 05	Q			V
21+20	0. 1475	0. 05	Q			V
21+25	0. 1478	0. 05	Q			V
21+30	0. 1481	0. 05	Q			V
21+35	0. 1484	0. 05	Q			V
21+40	0. 1487	0. 05	Q			V
21+45	0. 1490	0. 05	Q			V
21+50	0. 1494	0. 04	Q			V
21+55	0. 1497	0. 04	Q			V
22+ 0	0. 1500	0. 04	Q			V
22+ 5	0. 1503	0. 04	Q			V
22+10	0. 1506	0. 04	Q			V
22+15	0. 1509	0. 04	Q			V
22+20	0. 1512	0. 04	Q			V
22+25	0. 1514	0. 04	Q			V

22+30	0. 1517	0. 04	Q				V
22+35	0. 1520	0. 04	Q				V
22+40	0. 1523	0. 04	Q				V
22+45	0. 1526	0. 04	Q				V
22+50	0. 1529	0. 04	Q				V
22+55	0. 1532	0. 04	Q				V
23+ 0	0. 1534	0. 04	Q				V
23+ 5	0. 1537	0. 04	Q				V
23+10	0. 1540	0. 04	Q				V
23+15	0. 1543	0. 04	Q				V
23+20	0. 1545	0. 04	Q				V
23+25	0. 1548	0. 04	Q				V
23+30	0. 1551	0. 04	Q				V
23+35	0. 1554	0. 04	Q				V
23+40	0. 1556	0. 04	Q				V
23+45	0. 1559	0. 04	Q				V
23+50	0. 1562	0. 04	Q				V
23+55	0. 1564	0. 04	Q				V
24+ 0	0. 1567	0. 04	Q				V
24+ 5	0. 1569	0. 03	Q				V
24+10	0. 1570	0. 02	Q				V
24+15	0. 1571	0. 01	Q				V
24+20	0. 1571	0. 00	Q				V
24+25	0. 1571	0. 00	Q				V
24+30	0. 1571	0. 00	Q				V
24+35	0. 1571	0. 00	Q				V
24+40	0. 1571	0. 00	Q				V
24+45	0. 1571	0. 00	Q				V

Unit Hydrograph Analysis

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Study date 03/26/25

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San Bernardino County Synthetic Unit Hydrology Method
Manual date - August 1986

Program License Serial Number 6360

JSCC NEW GYM LOCAL LOCATION
100 YEAR 24 HOUR STORM
POST CONSTRUCTION
MARCH 26, 2025

Storm Event Year = 100

Antecedent Moisture Condition = 3

English (in-lb) Input Units Used

English Rainfall Data (Inches) Input Values Used

English Units used in output format

Area averaged rainfall intensity isohyetal data:

Sub-Area (Ac.)	Duration (hours)	Isohyetal (In)

Rainfall data for year 10 0.50	1	0.91

Rainfall data for year 2 0.50	6	1.00

Rainfall data for year 2 0.50	24	1.30

Rainfall data for year 100 0.50	1	1.40

Rainfall data for year 100

0.50 6 2.50

Rainfall data for year 100

0.50 24 5.00

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***** Area-averaged max loss rate, Fm *****

SCS curve No. (AMC II)	SCS curve NO. (AMC 3)	Area (Ac.)	Area Fraction	Fp(Fig C6) (In/Hr)	Ap (dec.)	Fm (In/Hr)
74.0	90.2	0.50	1.000	0.189	0.200	0.038

Area-averaged adjusted loss rate Fm (In/Hr) = 0.038

***** Area-Averaged low loss rate fraction, Yb *****

Area (Ac.)	Area Fract	SCS CN (AMC2)	SCS CN (AMC3)	S	Pervious Yield Fr
0.10	0.200	74.0	90.2	1.09	0.779
0.40	0.800	98.0	98.0	0.20	0.953

Area-averaged catchment yield fraction, Y = 0.918

Area-averaged low loss fraction, Yb = 0.082

User entry of time of concentration = 0.080 (hours)

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Watershed area = 0.50(Ac.)

Catchment Lag time = 0.064 hours

Unit interval = 5.000 minutes

Unit interval percentage of lag time = 130.2083

Hydrograph baseflow = 0.00(CFS)

Average maximum watershed loss rate(Fm) = 0.038(In/Hr)

Average low loss rate fraction (Yb) = 0.082 (decimal)

DESERT S-Graph Selected

Computed peak 5-minute rainfall = 0.664(In)

Computed peak 30-minute rainfall = 1.137(In)

Specified peak 1-hour rainfall = 1.400(In)

Computed peak 3-hour rainfall = 1.998(In)

Specified peak 6-hour rainfall = 2.500(In)

Specified peak 24-hour rainfall = 5.000(In)

Rainfall depth area reduction factors:

Using a total area of 0.50(Ac.) (Ref: fig. E-4)

5-minute factor = 1.000 Adjusted rainfall = 0.664(In)

30-minute factor = 1.000 Adjusted rainfall = 1.137(In)

1-hour factor = 1.000 Adjusted rainfall = 1.400(In)

3-hour factor = 1.000 Adjusted rainfall = 1.998(In)
 6-hour factor = 1.000 Adjusted rainfall = 2.500(In)
 24-hour factor = 1.000 Adjusted rainfall = 5.000(In)

 U n i t H y d r o g r a p h

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Interval Number	'S' Graph Mean values	Unit Hydrograph ((CFS))
(K = 6.05 (CFS))		
1	26.489	1.602
2	76.395	3.018
3	89.977	0.821
4	95.624	0.341
5	98.153	0.153
6	100.000	0.112

Total soil rain loss = 0.33(In)
 Total effective rainfall = 4.67(In)
 Peak flow rate in flood hydrograph = 2.30(CFS)

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 24 - H O U R S T O R M
 R u n o f f H y d r o g r a p h

 Hydrograph in 5 Minute intervals ((CFS))

Time(h+m)	Volume	Ac. Ft	Q(CFS)	0	2.5	5.0	7.5	10.0
0+ 5	0.0001	0.01	Q					
0+10	0.0003	0.04	Q					
0+15	0.0006	0.04	Q					
0+20	0.0010	0.05	Q					
0+25	0.0013	0.05	Q					
0+30	0.0016	0.05	Q					
0+35	0.0020	0.05	Q					
0+40	0.0023	0.05	Q					
0+45	0.0026	0.05	Q					
0+50	0.0030	0.05	Q					
0+55	0.0033	0.05	Q					
1+ 0	0.0037	0.05	Q					
1+ 5	0.0040	0.05	Q					
1+10	0.0043	0.05	Q					
1+15	0.0047	0.05	Q					
1+20	0.0050	0.05	QV					
1+25	0.0054	0.05	QV					

1+30	0.0057	0.05	QV
1+35	0.0061	0.05	QV
1+40	0.0064	0.05	QV
1+45	0.0068	0.05	QV
1+50	0.0071	0.05	QV
1+55	0.0075	0.05	QV
2+ 0	0.0078	0.05	QV
2+ 5	0.0082	0.05	QV
2+10	0.0085	0.05	QV
2+15	0.0089	0.05	QV
2+20	0.0092	0.05	QV
2+25	0.0096	0.05	QV
2+30	0.0100	0.05	Q V
2+35	0.0103	0.05	Q V
2+40	0.0107	0.05	Q V
2+45	0.0110	0.05	Q V
2+50	0.0114	0.05	Q V
2+55	0.0118	0.05	Q V
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3+ 5	0.0125	0.05	Q V
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5+ 0	0.0213	0.06	Q V
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11+20	0. 0578	0. 09	Q	V			
11+25	0. 0584	0. 09	Q	V			
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18+10	0.1630	0.09	Q				V	
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22+ 0	0.1854	0.06	Q				V
22+ 5	0.1858	0.06	Q				V
22+10	0.1861	0.06	Q				V
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22+20	0.1869	0.05	Q				V
22+25	0.1873	0.05	Q				V
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24+20	0. 1944	0. 00	Q				V
24+25	0. 1944	0. 00	Q				V

APPENDIX III

7245 Joshua Lane, Suite B
Yucca Valley, California 92284
Phone (760)365-7638
Fax (760)365-2146

73-185 Highway 111, Suite A
Palm Desert, California 92260
Phone (760)341-3101
Fax (760)341-5999



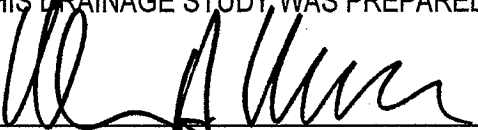
DRAINAGE STUDY
FOR
JOSHUA SPRINGS CALVARY CHAPEL
GYMNASIUM AND SPORTS FIELD

PREPARED FOR:

JOSHUA SPRINGS CALVARY CHAPEL
57373 JOSHUA LANE
YUCCA VALLEY, CALIFORNIA 92284
PHONE: (760) 365-0769

Tuesday, October 26, 1999

THIS DRAINAGE STUDY WAS PREPARED UNDER THE DIRECTION OF:


WILLIAM H. WARNER, R.C.E. 23256

10/27/1999
DATE

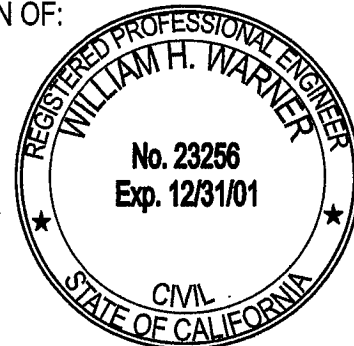


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AREA DRAINAGE MAPS AND COMPUTER RUNS 11 - 22

SITE LOCATION:

The proposed development is located on approximately 25 acres at 57373 Joshua Lane on the south side of the road bounded on the east by Kingston Road the south by Neagles Street and on the West by Hardesty Drive in Yucca Valley.

SITE DESCRIPTION:

Existing Site Conditions:

Approximately 8 acres of the 25 acre site is presently disturbed or developed with several buildings.

The site is bordered on the north by Joshua Lane, which receives runoff from the entire site.

The natural terrain slopes down to the north somewhat uniformly at approximately 5%, and supported (until recently stripped) coverage of desert scrub, weeds and Joshua trees.

The site accepts runoff from approximately 18 acres to the south, which is conveyed through the site to Joshua Lane along an existing dirt road and natural drainage course.

Proposed Development:

Development will occur on approximately 17 acres of the balance of the site, with the westerly 4± acres of the south portion of the site to remain undisturbed and vegetated.

A retention basin is proposed near the northeast corner of the site which is intended to retain the 100 year / 3 hour storm in order to reduce the impacts of developing the additional site area.

OBJECTIVE:

The objective of this study is to determine the rates of pre-development and post-development runoff and the amount of onsite stormwater retention required to maintain or reduce the amount of runoff onto downstream properties during the selected storm.

METHODOLOGY:

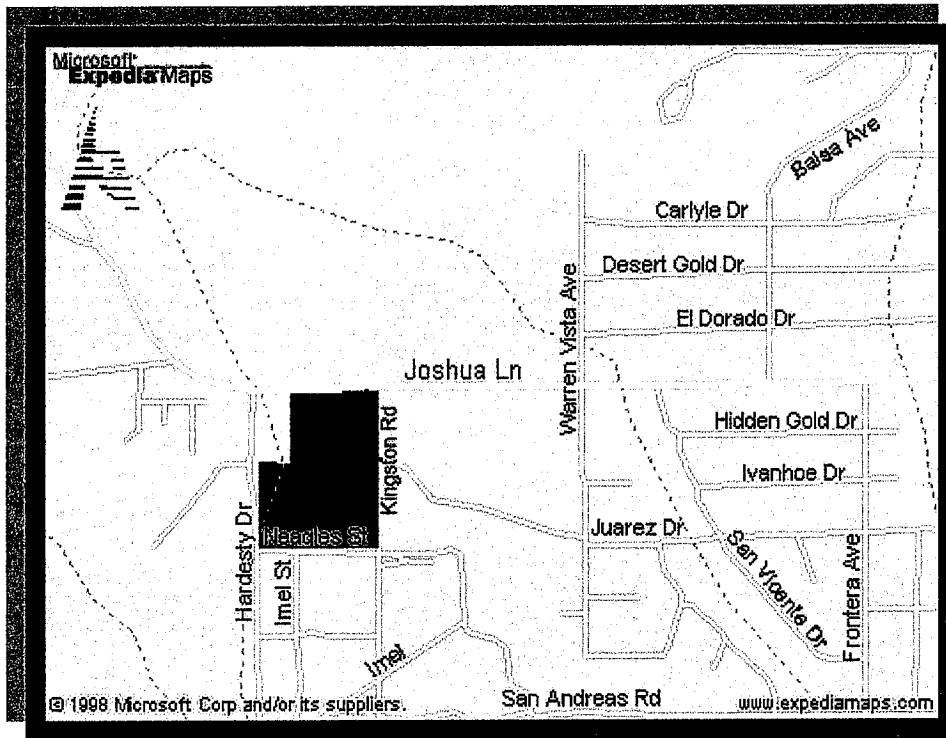
Hydrology – Rational and Unit Hydrograph:

Criteria for this study is based on the County of San Bernardino Hydrology Manual, dated August 1986. The Unit Hydrograph Method was used to determine flood volumes for sizing retention basins. The Rational Method was used to determine pre and post development runoffs. The Flood Hydrograph was used to size the retention basin. The calculations were performed using CIVILDESIGN/CIVILCADD, a computer program developed by Joseph E. Bonadiman and Associates Incorporated, which performs the above in accordance with San Bernardino County Hydrology criteria.

CONCLUSION:

Retention of the stormwater volume from the selected storm will result in the runoff from the project due to that storm being slightly lower than those prior to development.

SITE LOCATION MAP:



PEAK FLOW RATE SUMMARY

PRE AND POST DEVELOPED FLOWS TRIBUTARY TO JOSHUA LANE

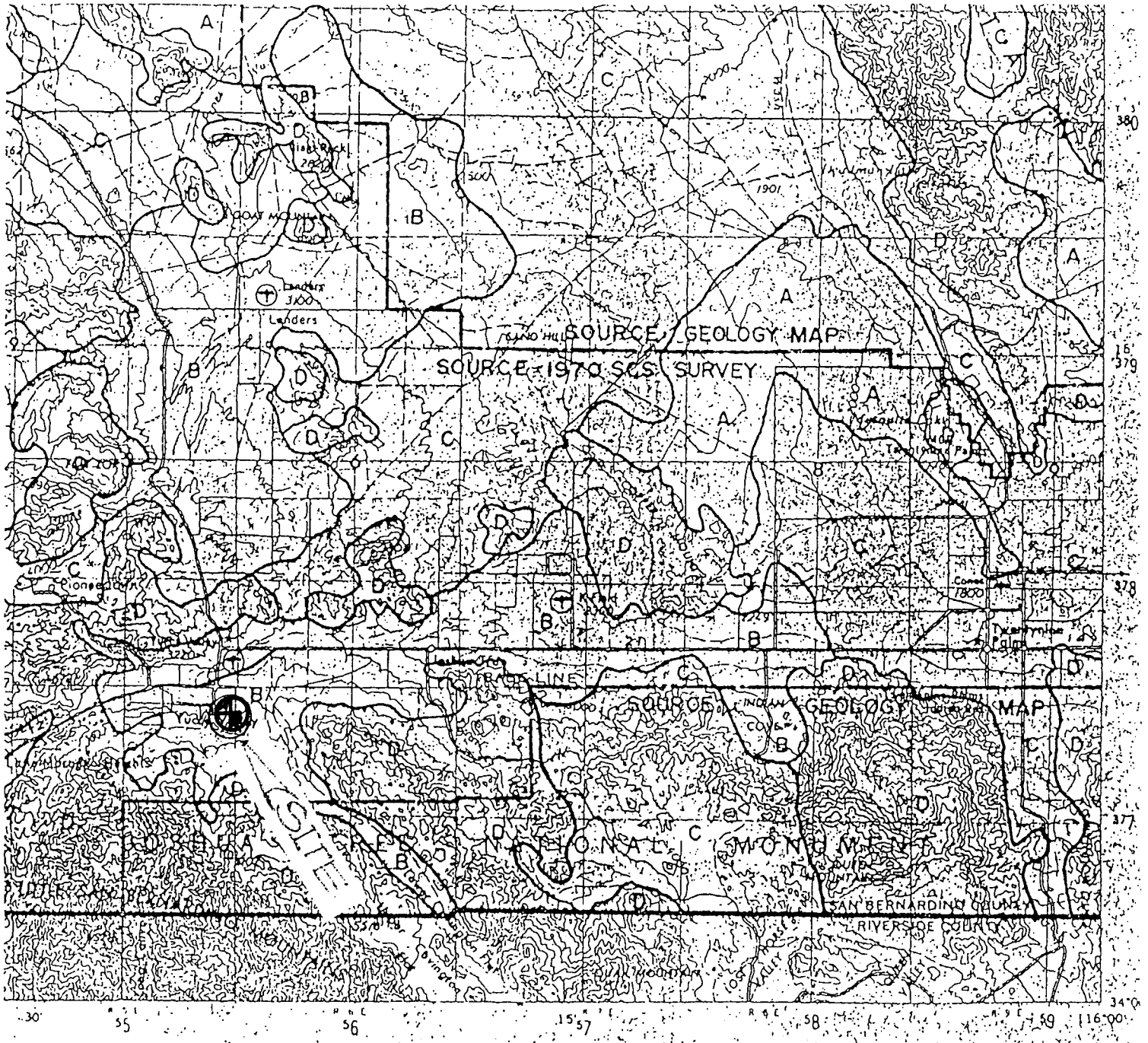
	Run No.	Flow (Q-100)	Difference (Pre to Post)
Pre-developed, entire site	331R1	47 cfs	- 3 cfs
Post-development, with basin	331R2	44 cfs	

Pre-developed flows exceed post-developed flows.

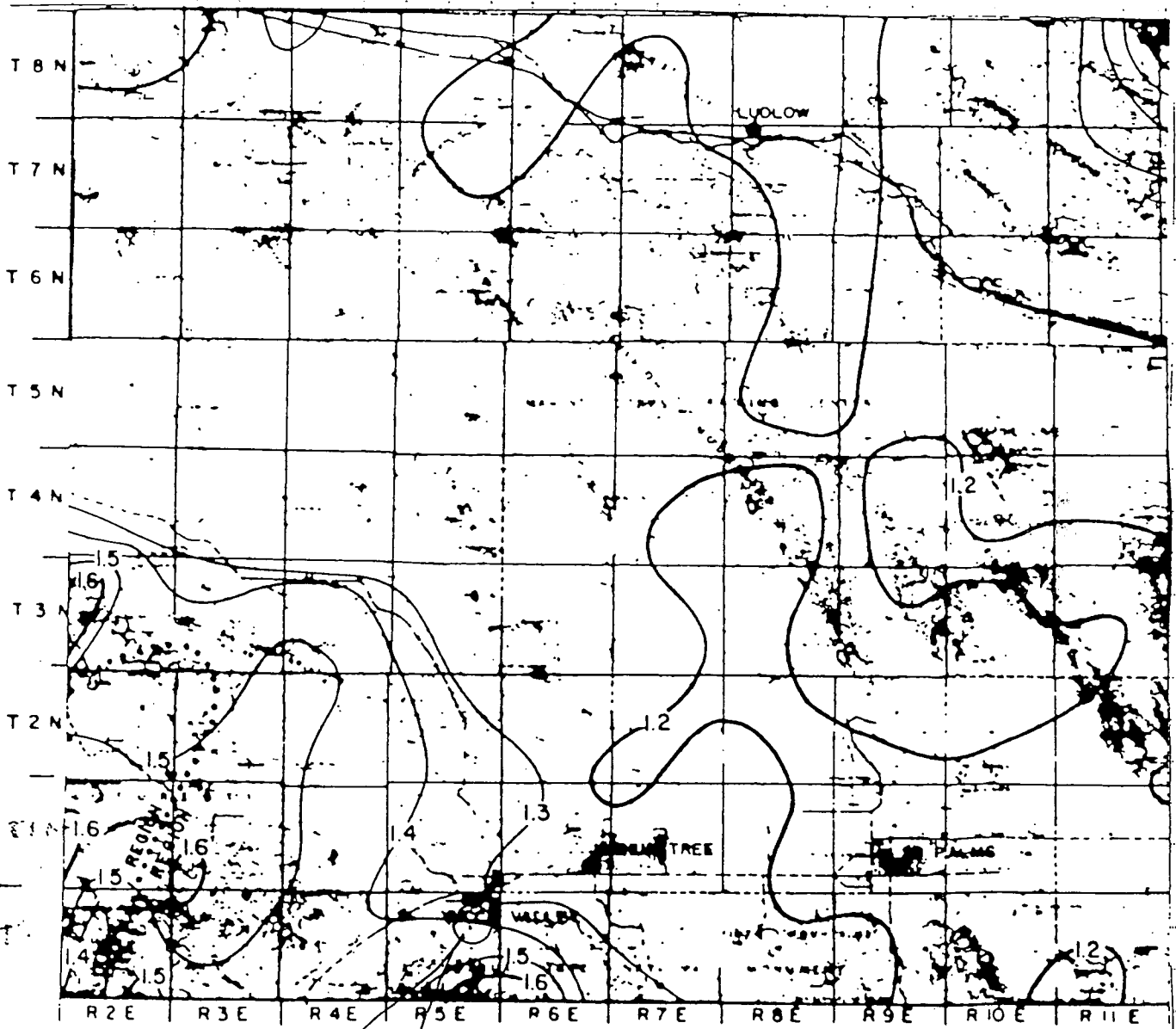
RETENTION BASIN

Runoff volume from 100 yr / 3 hr storm (Run 331U1) = 122,400 c.f.

Basin Capacity on Grading Plan: Total = 171,000 c.f., which includes a 40% bulking factor, or 48,600 c.f.



HYDROLOGIC SOILS GROUP MAP
FOR
SOUTHCENTRAL AREA



SITE

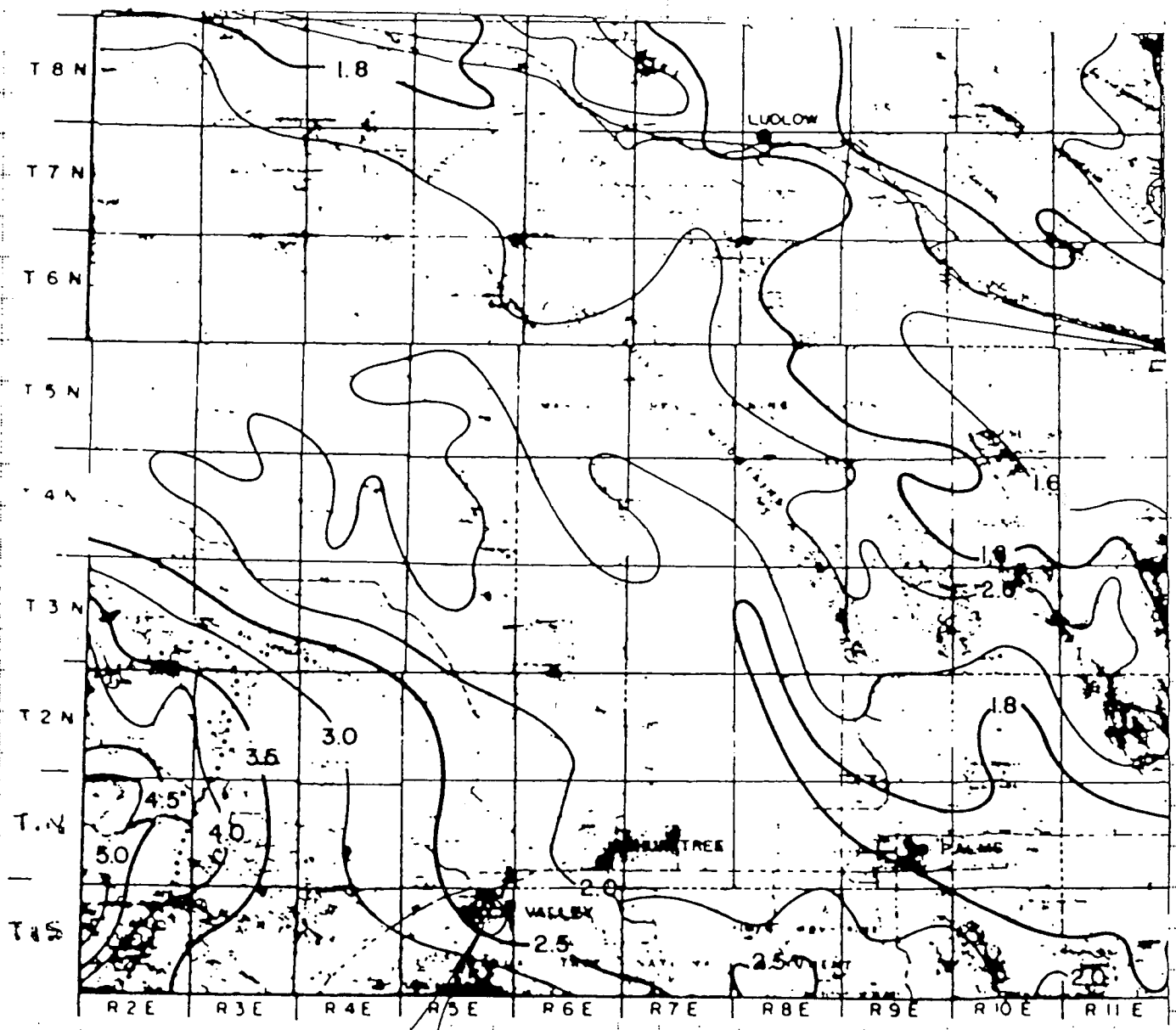
100% 14

SAN BERNARDINO COUNTY

**SAN BERNARDINO COUNTY
 FLOOD CONTROL DISTRICT**
DESERT AREA
 ISONYETALS
 Y₁₀₀-100 YEAR 1 HOUR
 BASED ON U.S.D.C. NOAA ATLAS 2, 1973

APPROVED BY *[Signature]*
 DATE 10-8-99
 SCALE 1" = 0.5 MI
 FILE NO. 8331 CN
 SHEET NO. 10 of 12

END
 ISOLINES PRECIPITATION (INCHES)



SAN BERNARDINO COUNTY

100/60 2.5

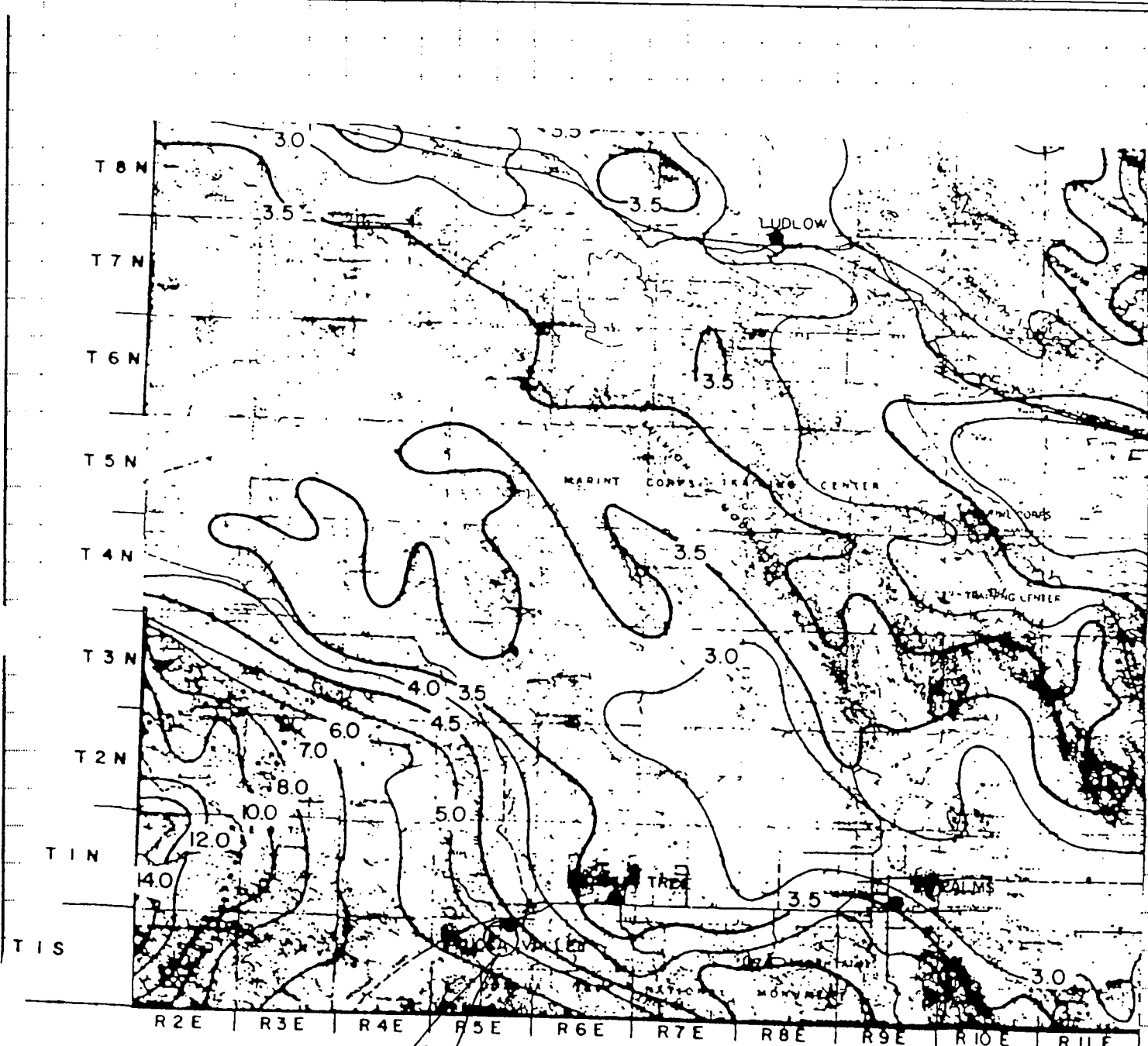
**SAN BERNARDINO COUNTY
 FLOOD CONTROL DISTRICT**

DESERT AREA
 ISOHYETALS
 X₂ - 100 YEAR 6 HOUR
 BASED ON U.S.D.C. NOAA ATLAS 2, 1973

APPROVED BY [Signature]
 FLOOD CONTROL ENGINEER

DATE 1982	SCALE 1" = 6 MI.	FILE NO. WFO-1	DRAWING NO. 11 of 12
--------------	---------------------	-------------------	-------------------------

LEGEND
 2.0 ISOLINES PRECIPITATION (INCHES)



SITE

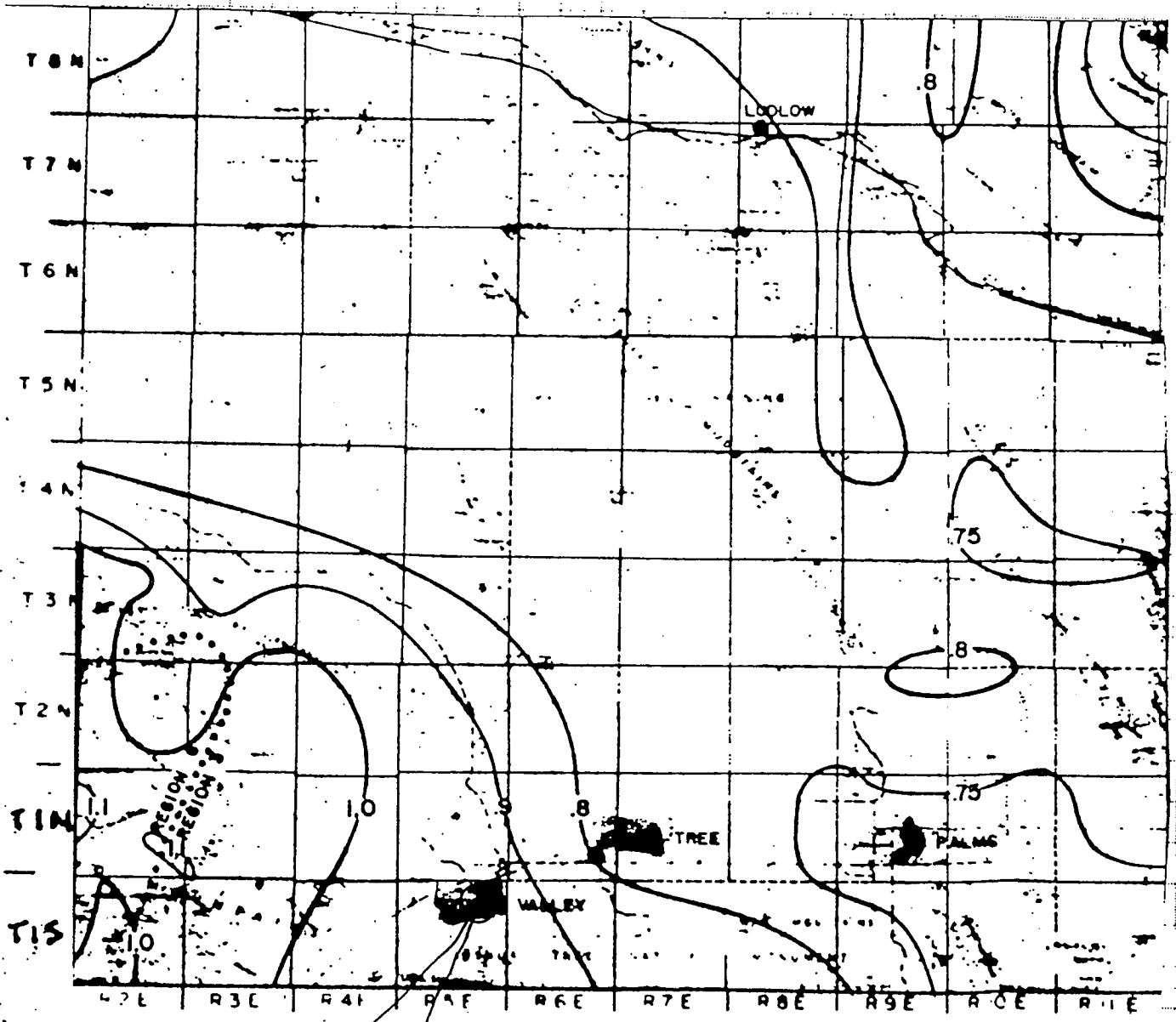
100/24 5.0"
 SAN BERNARDINO COUNTY
 FLOOD CONTROL DISTRICT
 DESERT AREA
 ISOHYETALS
 X. -100 YEAR 24 HOUR
 BASED ON USDC, NOAA ATLAS 2, 1973

SAN BERNARDINO COUNTY

1982	SCALE 1" = 600'	FILE NO WRD-1	DRAWG NO 12 of
------	--------------------	------------------	-------------------

WARNER ENGINEERING
 7245 Joshua Lane
 YUCCA VALLEY, CALIFORNIA 92284
 (619) 365-7638

JOB Joshua Springs Church
 SHEET NO. _____ OF _____
 CALCULATED BY MB DATE 10-8-99
 CHECKED BY _____ DATE _____
 SCALE _____



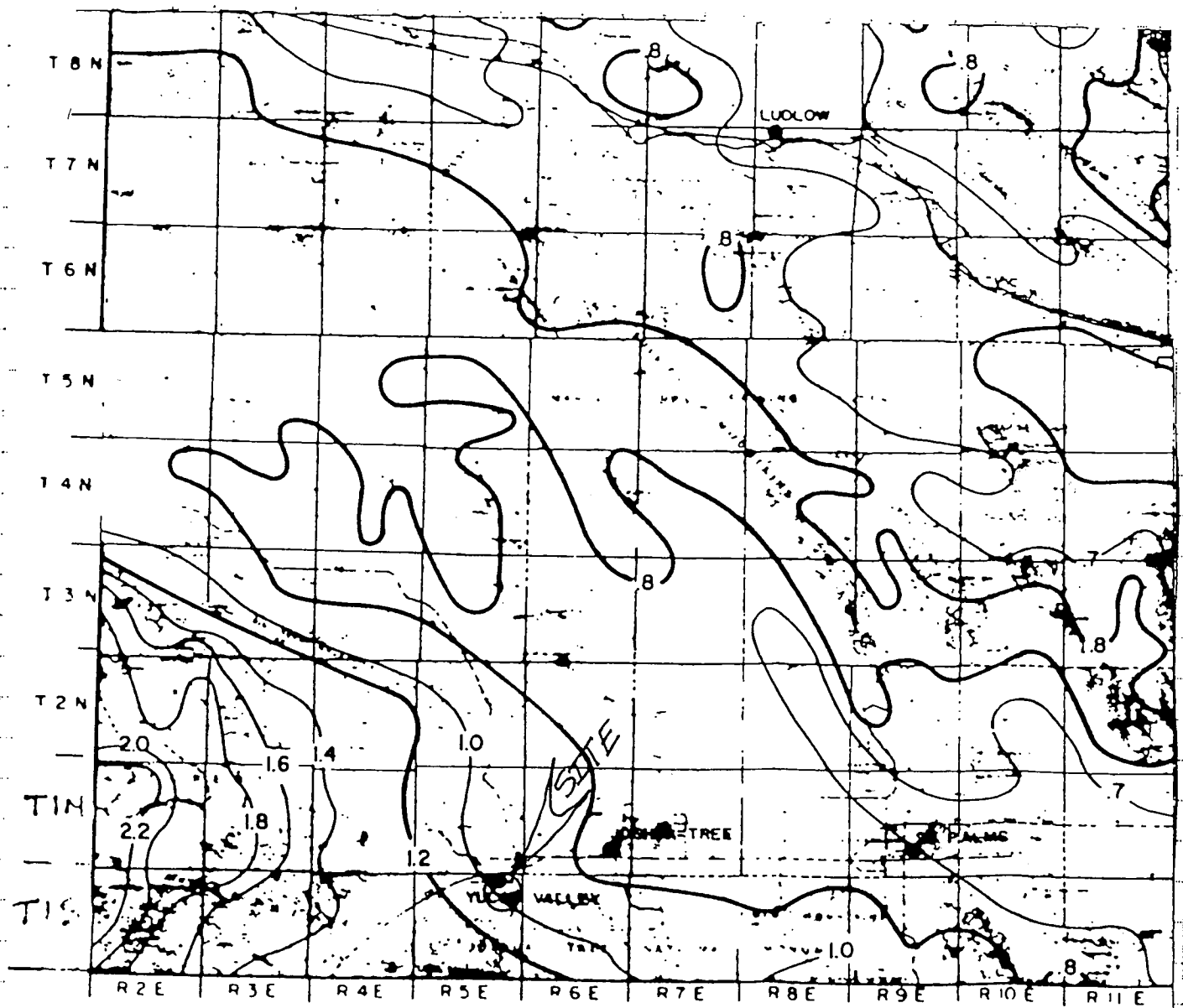
SAN BERNARDINO COUNTY

HYDROLOGICAL MAP

10/1 0.9L

SAN BERNARDINO COUNTY FLOOD CONTROL DISTRICT			
DESERT AREA			
ISOHYETALS			
Y ₁₀ - 10 YEAR 1 HOUR			
BASED ON U.S.D.C. NOAA ATLAS 2, 1973			
APPROVED BY <u>[Signature]</u>			
FLOOD CONTROL DISTRICT			
DATE	SCALE	FILE NO.	DRAWING NO.
1982	1" = 5 MI.	WRD-1	8 of 12
SEE REVISIONS PAGE			

LEGEND:
 8 ISOLINES PRECIPITATION (INCHES)

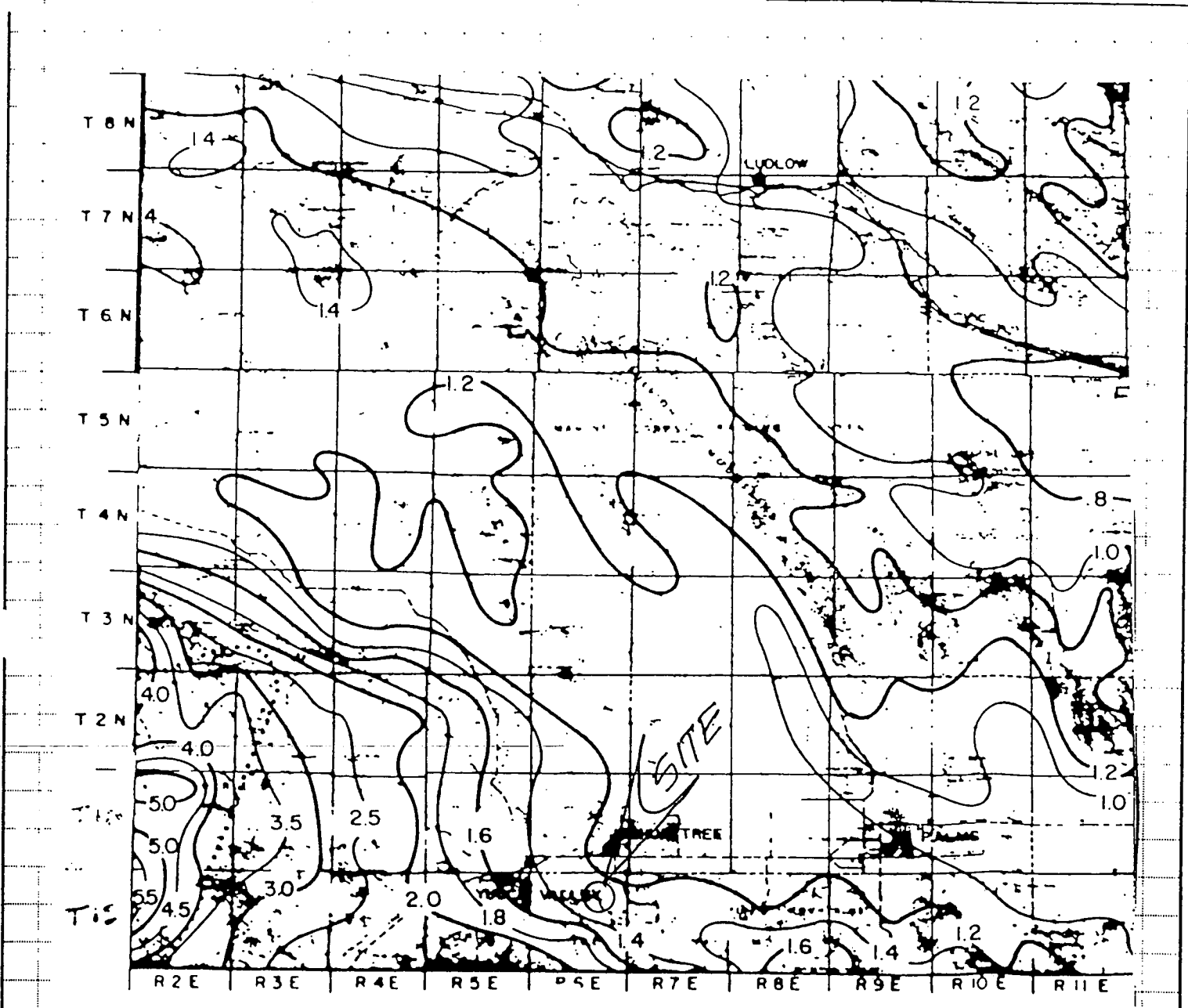


SAN BERNARDINO COUNTY
 HYDROLOGY MANUAL

1.0 ISOLINES FLD.

2/6 1"

SAN BERNARDINO COUNTY FLOOD CONTROL DISTRICT			
DESERT AREA			
ISOHYETALS			
X - 2 YEAR 6 HOUR			
BASED ON U.S.D.C. NOAA ATLAS 2, 1973			
APPROVED BY <i>[Signature]</i>			
DATE	SCALE	FILE NO.	DRAWING NO.
1982	1" = 6 MI.	WFD-4	7 of 12



2/24 1.3^u

SAN BERNARDINO COUNTY FLOOD CONTROL DISTRICT			
DESERT AREA			
ISOHYETALS			
X ₂ - 2 YEAR 24 HOUR			
BASED ON U.S.D.C. NOAA ATLAS 2, 1973			
APPROVED BY <u>[Signature]</u>			
SCALE	FILE NO.	DRAWING NO.	
1" = 600'	WRD-1	8 of 12	
WATER RESOURCES DIVISION			

SAN BERNARDINO COUNTY
 HYDROLOGIC MANUAL

LEGEND
 2 ISOLINES

San Bernardino County Rational Hydrology Program

(Hydrology Manual Date - August 1986)

CIVILCADD/CIVILDESIGN Engineering Software, (c) 1989-1998 Version 5.3
Rational Hydrology Study Date: 10/13/99

JOSHUA SPRINGS CHURCH, YUCCA VALLEY, CA WO 8331CN
100-YR, 1-HR STORM PRE-DEVELOPMENT, TRIBUTARY TO NW COR OF SITE
RUN NO. 331R1

Warner Engineering, Yucca Valley, California - S/N 598

***** Hydrology Study Control Information *****

Rational hydrology study storm event year is 100.0
Computed rainfall intensity:
Storm year = 100.00 1 hour rainfall = 1.400 (In.)
Slope used for rainfall intensity curve b = 0.7000
Soil antecedent moisture condition (AMC) = 3

+++++
Process from Point/Station 1.000 to Point/Station 2.000
**** INITIAL AREA EVALUATION ****

UNDEVELOPED (average cover) subarea
Decimal fraction soil group A = 0.000
Decimal fraction soil group B = 1.000
Decimal fraction soil group C = 0.000
Decimal fraction soil group D = 0.000
SCS curve number for soil(AMC 2) = 69.00
Adjusted SCS curve number for AMC 3 = 86.20
Pervious ratio(Ap) = 1.0000 Max loss rate(Fm)= 0.262 (In/Hr)
Initial subarea data:
Initial area flow distance = 950.000 (Ft.)
Top (of initial area) elevation = 3765.000 (Ft.)
Bottom (of initial area) elevation = 3715.000 (Ft.)
Difference in elevation = 50.000 (Ft.)
Slope = 0.05263 s(%) = 5.26
TC = k(0.706)*[(length^3)/(elevation change)]^0.2
Initial area time of concentration = 19.754 min.
Rainfall intensity = 3.047 (In/Hr) for a 100.0 year storm
Effective runoff coefficient used for area (Q=KCIA) is C = 0.823
Subarea runoff = 11.031 (CFS)
Total initial stream area = 4.400 (Ac.)
Pervious area fraction = 1.000
Initial area Fm value = 0.262 (In/Hr)

+++++
Process from Point/Station 2.000 to Point/Station 3.000
**** IMPROVED CHANNEL TRAVEL TIME ****

Upstream point elevation = 3715.000 (Ft.)
Downstream point elevation = 3660.000 (Ft.)
Channel length thru subarea = 1200.000 (Ft.)
Channel base width = 100.000 (Ft.)

Slope or 'Z' of left channel bank = 100.000
 Slope or 'Z' of right channel bank = 100.000
 Estimated mean flow rate at midpoint of channel = 18.301(CFS)
 Manning's 'N' = 0.020
 Maximum depth of channel = 1.000(Ft.)
 Flow(q) thru subarea = 18.301(CFS)
 Depth of flow = 0.068(Ft.), Average velocity = 2.535(Ft/s)
 Channel flow top width = 113.527(Ft.)
 Flow Velocity = 2.53(Ft/s)
 Travel time = 7.89 min.
 Time of concentration = 27.64 min.
 Critical depth = 0.098(Ft.)
 Adding area flow to channel
 UNDEVELOPED (average cover) subarea
 Decimal fraction soil group A = 0.000
 Decimal fraction soil group B = 1.000
 Decimal fraction soil group C = 0.000
 Decimal fraction soil group D = 0.000
 SCS curve number for soil(AMC 2) = 69.00
 Adjusted SCS curve number for AMC 3 = 86.20
 Pervious ratio(Ap) = 1.0000 Max loss rate(Fm) = 0.262(In/Hr)
 Rainfall intensity = 2.408(In/Hr) for a 100.0 year storm
 Effective runoff coefficient used for area, (total area with modified
 rational method)(Q=KCIA) is C = 0.802
 Subarea runoff = 8.677(CFS) for 5.800(Ac.)
 Total runoff = 19.707(CFS)
 Effective area this stream = 10.20(Ac.)
 Total Study Area (Main Stream No. 1) = 10.20(Ac.)
 Area averaged Fm value = 0.262(In/Hr)

++++++
 Process from Point/Station 3.000 to Point/Station 4.000
 **** IMPROVED CHANNEL TRAVEL TIME ****

Upstream point elevation = 3660.000(Ft.)
 Downstream point elevation = 3595.000(Ft.)
 Channel length thru subarea = 1350.000(Ft.)
 Channel base width = 100.000(Ft.)
 Slope or 'Z' of left channel bank = 100.000
 Slope or 'Z' of right channel bank = 100.000
 Estimated mean flow rate at midpoint of channel = 37.869(CFS)
 Manning's 'N' = 0.020
 Maximum depth of channel = 1.000(Ft.)
 Flow(q) thru subarea = 37.869(CFS)
 Depth of flow = 0.102(Ft.), Average velocity = 3.360(Ft/s)
 Channel flow top width = 120.449(Ft.)
 Flow Velocity = 3.36(Ft/s)
 Travel time = 6.70 min.
 Time of concentration = 34.34 min.
 Critical depth = 0.156(Ft.)
 Adding area flow to channel
 UNDEVELOPED (average cover) subarea
 Decimal fraction soil group A = 0.000
 Decimal fraction soil group B = 1.000
 Decimal fraction soil group C = 0.000
 Decimal fraction soil group D = 0.000
 SCS curve number for soil(AMC 2) = 69.00
 Adjusted SCS curve number for AMC 3 = 86.20
 Pervious ratio(Ap) = 1.0000 Max loss rate(Fm) = 0.262(In/Hr)
 Rainfall intensity = 2.069(In/Hr) for a 100.0 year storm

Effective runoff coefficient used for area, (total area with modified rational method) ($Q=KCIA$) is $C = 0.786$

Subarea runoff = 27.469 (CFS) for 18.800 (Ac.)

Total runoff = 47.176 (CFS)

Effective area this stream = 29.00 (Ac.)

Total Study Area (Main Stream No. 1) = 29.00 (Ac.)

Area averaged F_m value = 0.262 (In/Hr)

End of computations, Total Study Area = 29.00 (Ac.)

The following figures may

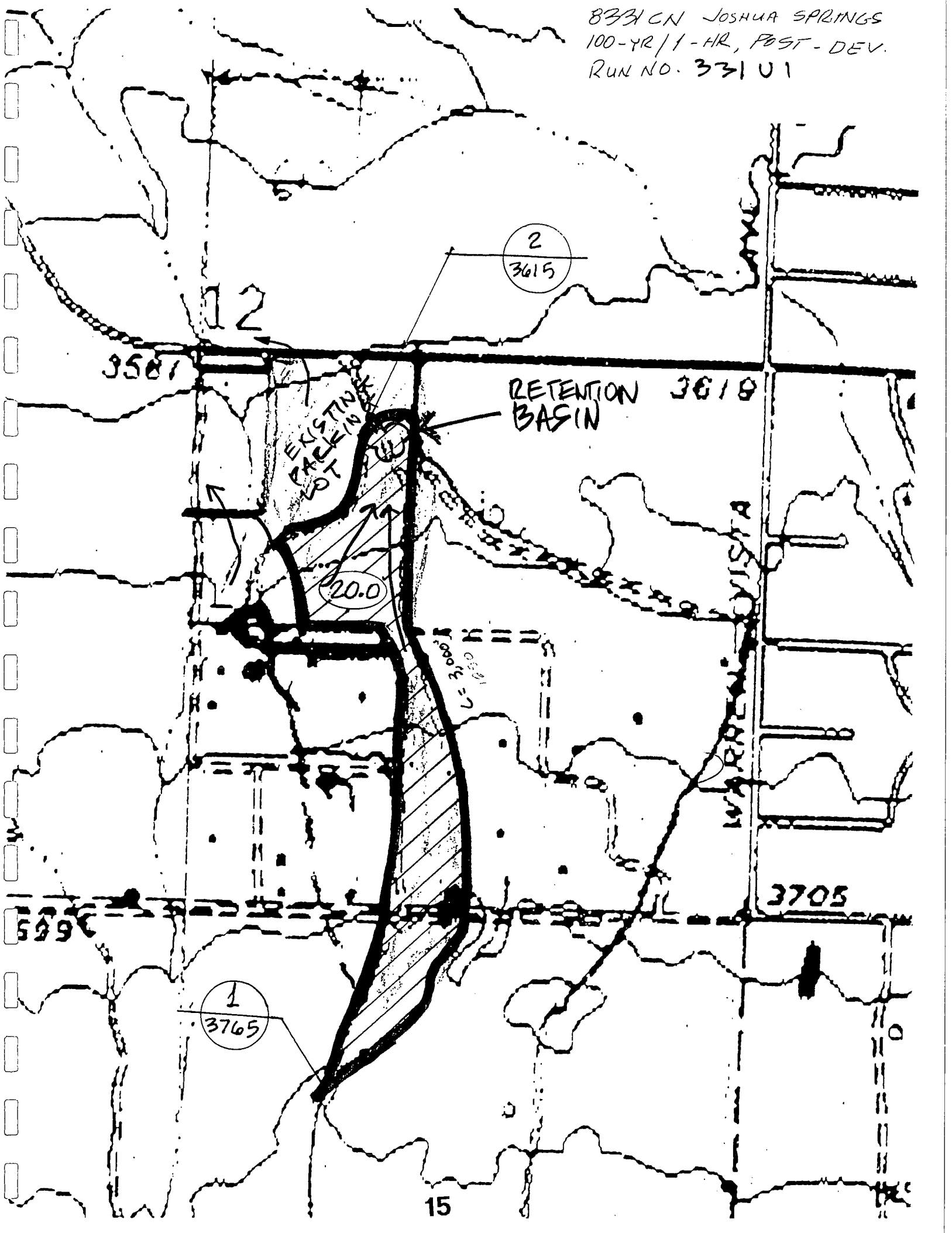
be used for a unit hydrograph study of the same area.

Note: These figures do not consider reduced effective area effects caused by confluences in the rational equation.

Area averaged pervious area fraction (A_p) = 1.000

Area averaged SCS curve number = 69.0

8331 CN JOSHUA SPRINGS
100-YR/1-HR, POST-DEV.
RUN NO. 33101



Unit Hydrograph Analysis

Copyright (c) CIVILCADD/CIVILDESIGN, 1989 - 1998, Version 5.2

Study date 10/13/99

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San Bernardino County Synthetic Unit Hydrology Method
Manual date - August 1986

Warner Engineering, Yucca Valley, California - S/N 598

JOSHUA SPRINGS CHRUCH, YUCCA VALLEY, CA WO 8331CN/DS
100-YR, 3-HR STORM, POST DEVELOPMENT
RUN NO. 331U1, 10-13-99, ME

Storm Event Year = 100

Antecedent Moisture Condition = 3

English (in-lb) Input Units Used

English Rainfall Data (Inches) Input Values Used

English Units used in output format

Area averaged rainfall intensity isohyetal data:

Sub-Area (Ac.)	Duration (hours)	Isohyetal (In)
Rainfall data for year 10		
20.00	1	0.91
Rainfall data for year 2		
20.00	6	1.00
Rainfall data for year 2		
20.00	24	1.30
Rainfall data for year 100		
20.00	1	1.40
Rainfall data for year 100		
20.00	6	2.50
Rainfall data for year 100		
20.00	24	5.00

+++++

***** Area-averaged max loss rate, Fm *****

SCS curve No. (AMCII)	SCS curve NO. (AMC 3)	Area (Ac.)	Area Fraction	Fp(Fig C6) (In/Hr)	Ap (dec.)	Fm (In/Hr)
56.0	75.8	9.80	0.490	0.440	0.200	0.088
66.0	83.8	10.20	0.510	0.304	1.000	0.304

Area-averaged adjusted loss rate Fm (In/Hr) = 0.198

***** Area-Averaged low loss rate fraction, Yb *****

Area (Ac.)	Area Fract	SCS CN (AMC2)	SCS CN (AMC3)	S	Pervious Yield Fr
1.96	0.098	56.0	75.8	3.19	0.504
7.84	0.392	98.0	98.0	0.20	0.953
10.20	0.510	66.0	83.8	1.93	0.650

Area-averaged catchment yield fraction, Y = 0.754

Area-averaged low loss fraction, Yb = 0.246

Watercourse length = 3000.00(Ft.)

Length from concentration point to centroid = 1250.00(Ft.)

Elevation difference along watercourse = 150.00(Ft.)

Mannings friction factor along watercourse = 0.030

Watershed area = 20.00(Ac.)

Catchment Lag time = 0.116 hours

Unit interval = 5.000 minutes

Unit interval percentage of lag time = 71.5584

Hydrograph baseflow = 0.00(CFS)

Average maximum watershed loss rate(Fm) = 0.198(In/Hr)

Average low loss rate fraction (Yb) = 0.246 (decimal)

DESERT S-Graph Selected

Computed peak 5-minute rainfall = 0.664(In)

Computed peak 30-minute rainfall = 1.137(In)

Specified peak 1-hour rainfall = 1.400(In)

Computed peak 3-hour rainfall = 1.998(In)

Specified peak 6-hour rainfall = 2.500(In)

Specified peak 24-hour rainfall = 5.000(In)

Rainfall depth area reduction factors:

Using a total area of 20.00(Ac.) (Ref: fig. E-4)

5-minute factor = 0.999 Adjusted rainfall = 0.664(In)

30-minute factor = 0.999 Adjusted rainfall = 1.136(In)

1-hour factor = 0.999 Adjusted rainfall = 1.399(In)

3-hour factor = 1.000 Adjusted rainfall = 1.997(In)

6-hour factor = 1.000 Adjusted rainfall = 2.500(In)

24-hour factor = 1.000 Adjusted rainfall = 5.000(In)

U n i t H y d r o g r a p h

Interval Number	'S' Graph Mean values	Unit Hydrograph ((CFS))
-----------------	-----------------------	-------------------------

(K = 241.88 (CFS))

1	8.231	19.908
2	51.673	105.077
3	74.307	54.745

4	84.207	23.946
5	89.961	13.917
6	93.549	8.678
7	95.969	5.855
8	97.532	3.780
9	98.410	2.122
10	99.248	2.028
11	100.000	1.819

Peak Unit Number	Adjusted mass rainfall (In)	Unit rainfall (In)
1	0.6637	0.6637
2	0.8171	0.1534
3	0.9228	0.1057
4	1.0060	0.0832
5	1.0756	0.0696
6	1.1361	0.0605
7	1.1899	0.0538
8	1.2385	0.0486
9	1.2830	0.0445
10	1.3242	0.0412
11	1.3626	0.0384
12	1.3987	0.0360
13	1.4355	0.0368
14	1.4704	0.0349
15	1.5037	0.0333
16	1.5355	0.0318
17	1.5660	0.0305
18	1.5953	0.0293
19	1.6235	0.0282
20	1.6507	0.0272
21	1.6771	0.0263
22	1.7026	0.0255
23	1.7273	0.0247
24	1.7513	0.0240
25	1.7746	0.0233
26	1.7974	0.0227
27	1.8195	0.0221
28	1.8411	0.0216
29	1.8622	0.0211
30	1.8827	0.0206
31	1.9029	0.0201
32	1.9226	0.0197
33	1.9419	0.0193
34	1.9608	0.0189
35	1.9793	0.0185
36	1.9974	0.0182

Unit Period (number)	Unit Rainfall (In)	Unit Soil-Loss (In)	Effective Rainfall (In)
1	0.0182	0.0045	0.0137
2	0.0185	0.0045	0.0140
3	0.0193	0.0047	0.0145
4	0.0197	0.0048	0.0149
5	0.0206	0.0051	0.0155
6	0.0211	0.0052	0.0159
7	0.0221	0.0054	0.0167
8	0.0227	0.0056	0.0171
9	0.0240	0.0059	0.0181

10	0.0247	0.0061	0.0187
11	0.0263	0.0065	0.0199
12	0.0272	0.0067	0.0205
13	0.0293	0.0072	0.0221
14	0.0305	0.0075	0.0230
15	0.0333	0.0082	0.0251
16	0.0349	0.0086	0.0263
17	0.0360	0.0089	0.0272
18	0.0384	0.0094	0.0290
19	0.0445	0.0109	0.0336
20	0.0486	0.0119	0.0367
21	0.0605	0.0149	0.0456
22	0.0696	0.0165	0.0531
23	0.1057	0.0165	0.0892
24	0.1534	0.0165	0.1369
25	0.6637	0.0165	0.6472
26	0.0832	0.0165	0.0667
27	0.0538	0.0132	0.0406
28	0.0412	0.0101	0.0311
29	0.0368	0.0090	0.0278
30	0.0318	0.0078	0.0240
31	0.0282	0.0069	0.0213
32	0.0255	0.0063	0.0192
33	0.0233	0.0057	0.0176
34	0.0216	0.0053	0.0163
35	0.0201	0.0049	0.0152
36	0.0189	0.0046	0.0143

Total soil rain loss = 0.31(In)
Total effective rainfall = 1.69(In)
Peak flow rate in flood hydrograph = 80.60(CFS) ✓

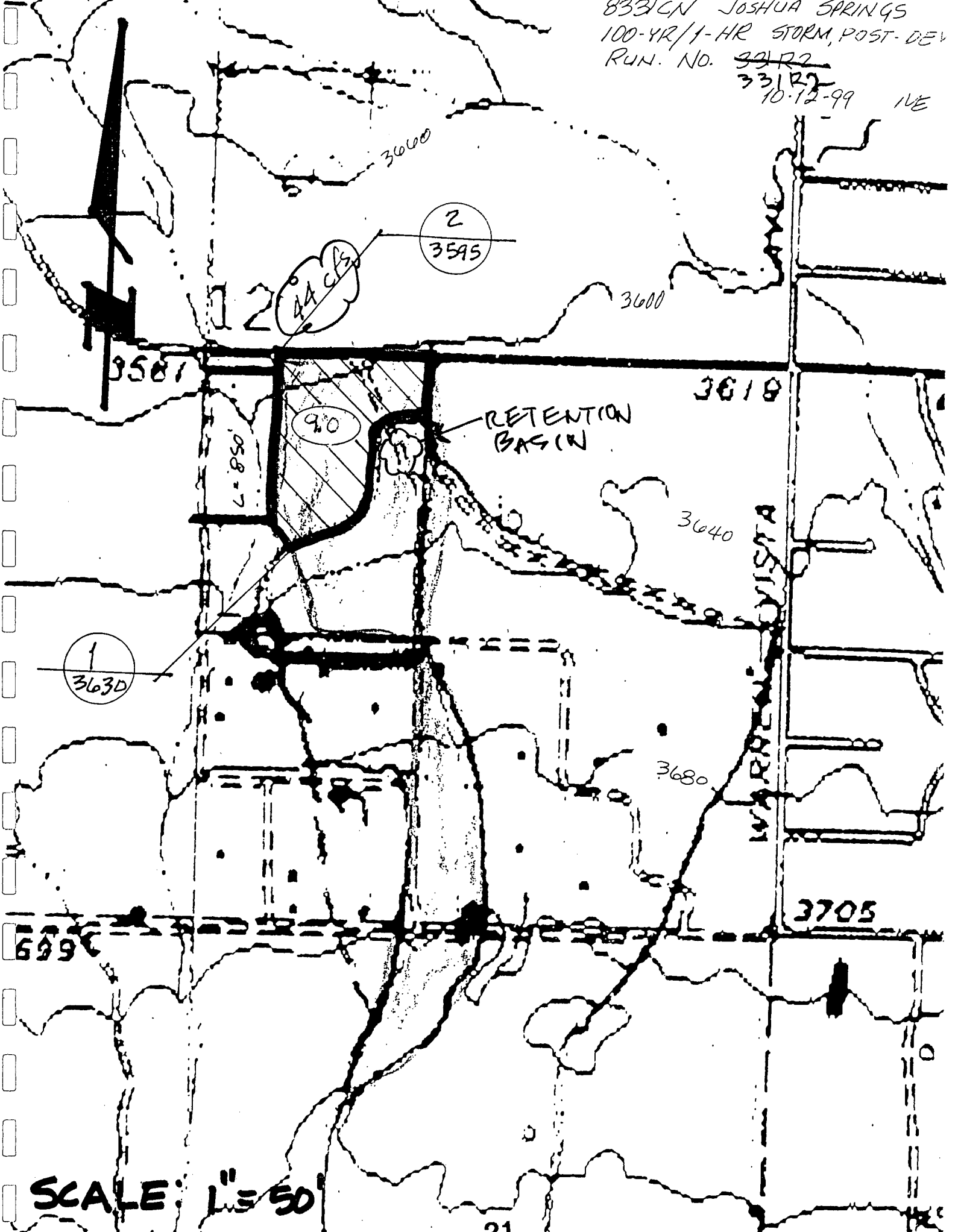
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3 - H O U R S T O R M
R u n o f f H y d r o g r a p h

Hydrograph in 5 Minute intervals ((CFS))

Time(h+m)	Volume Ac.Ft	Q(CFS)	0	22.5	45.0	67.5	90.0
0+ 5	0.0019	0.27	Q				
0+10	0.0137	1.72	Q				
0+15	0.0310	2.51	VQ				
0+20	0.0511	2.92	VQ				
0+25	0.0731	3.19	Q				
0+30	0.0966	3.42	Q				
0+35	0.1215	3.61	Q				
0+40	0.1477	3.80	QV				
0+45	0.1751	3.97	QV				
0+50	0.2038	4.17	QV				
0+55	0.2338	4.36	Q V				
1+ 0	0.2653	4.57	QV				
1+ 5	0.2982	4.78	Q V				
1+10	0.3330	5.05	Q V				
1+15	0.3697	5.32	Q V				
1+20	0.4089	5.69	Q V				
1+25	0.4502	6.01	Q V				
1+30	0.4936	6.29	Q V				
1+35	0.5397	6.70	Q V				

1+40	0.5908	7.42	Q	V					
1+45	0.6477	8.26	Q	V					
1+50	0.7144	9.68	Q	V					
1+55	0.7961	11.85	Q	V					
2+ 0	0.9153	17.32	Q	V					
2+ 5	1.1553	34.84			QV				
2+10	1.7104	80.60				V		Q	
2+15	2.0465	48.81				Q		V	
2+20	2.2351	27.39			Q		V		
2+25	2.3645	18.79			Q		V		
2+30	2.4611	14.02			Q		V		
2+35	2.5371	11.04	Q				V		
2+40	2.5976	8.79	Q				V		
2+45	2.6463	7.07	Q				V		
2+50	2.6901	6.35	Q				V		
2+55	2.7288	5.62	Q				V		
3+ 0	2.7574	4.16	Q				V		
3+ 5	2.7818	3.54	Q				V		
3+10	2.7948	1.88	Q				V		
3+15	2.8018	1.01	Q				V		
3+20	2.8060	0.62	Q				V		
3+25	2.8087	0.39	Q				V		
3+30	2.8104	0.25	Q				V		
3+35	2.8114	0.15	Q				V		
3+40	2.8121	0.09	Q				V		
3+45	2.8125	0.06	Q				V		
3+50	2.8126	0.03	Q				V		

8331CN JOSHUA SPRINGS
100-YR/1-HR STORM, POST-DEV
RUN. NO. ~~99122~~
33122
10-12-99 1VE



SCALE: 1" = 50'

San Bernardino County Rational Hydrology Program

(Hydrology Manual Date - August 1986)

CIVILCADD/CIVILDESIGN Engineering Software, (c) 1989-1998 Version 5.3
Rational Hydrology Study Date: 10/12/99

JOSHUA SPRINGS CHURCH, YUCCA VALLEY, CA W08331CN
100-YR, 1-HR STORM, POST-DEVELOPMENT
RUN NO. 331R1, 10-12-99, ME

Warner Engineering, Yucca Valley, California - S/N 598

***** Hydrology Study Control Information *****

Rational hydrology study storm event year is 100.0
Computed rainfall intensity:
Storm year = 100.00 1 hour rainfall = 1.400 (In.)
Slope used for rainfall intensity curve b = 0.7000
Soil antecedent moisture condition (AMC) = 3

++++
Process from Point/Station 1.000 to Point/Station 2.000
**** INITIAL AREA EVALUATION ****

COMMERCIAL subarea type

Decimal fraction soil group A = 0.000
Decimal fraction soil group B = 1.000
Decimal fraction soil group C = 0.000
Decimal fraction soil group D = 0.000
SCS curve number for soil (AMC 2) = 56.00
Adjusted SCS curve number for AMC 3 = 75.80
Pervious ratio (Ap) = 0.1000 Max loss rate (Fm) = 0.044 (In/Hr)
Initial subarea data:
Initial area flow distance = 850.000 (Ft.)
Top (of initial area) elevation = 3630.000 (Ft.)
Bottom (of initial area) elevation = 3595.000 (Ft.)
Difference in elevation = 35.000 (Ft.)
Slope = 0.04118 s (%) = 4.12
TC = $k(0.304) * [(length^3) / (elevation\ change)]^{0.2}$
Initial area time of concentration = 8.545 min.
Rainfall intensity = 5.478 (In/Hr) for a 100.0 year storm
Effective runoff coefficient used for area (Q=KCIA) is C = 0.893
Subarea runoff = 44.017 (CFS)
Total initial stream area = 9.000 (Ac.)
Pervious area fraction = 0.100
Initial area Fm value = 0.044 (In/Hr)
End of computations, Total Study Area = 9.00 (Ac.)

The following figures may
be used for a unit hydrograph study of the same area.
Note: These figures do not consider reduced effective area
effects caused by confluences in the rational equation.

Area averaged pervious area fraction (Ap) = 0.100
Area averaged SCS curve number = 56.0