FLOOD CONTROL DISTRICT OF MARICOPA COUNTY

HYDROLOGY REPORT

for
Floodplain Delineation Study
of
Upper Centennial Wash, Grass Wash and Aguila Farm Channel

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FLOOD CONTROL DISTRICT OF MARICOPA COUNTY

Hydrology Report

for

Floodplain Delineation Study

of

Upper Centennial Wash, Grass Wash and Aguila Farm Channel

Contract No. FCD 88-54

April 1990

Prepared by:

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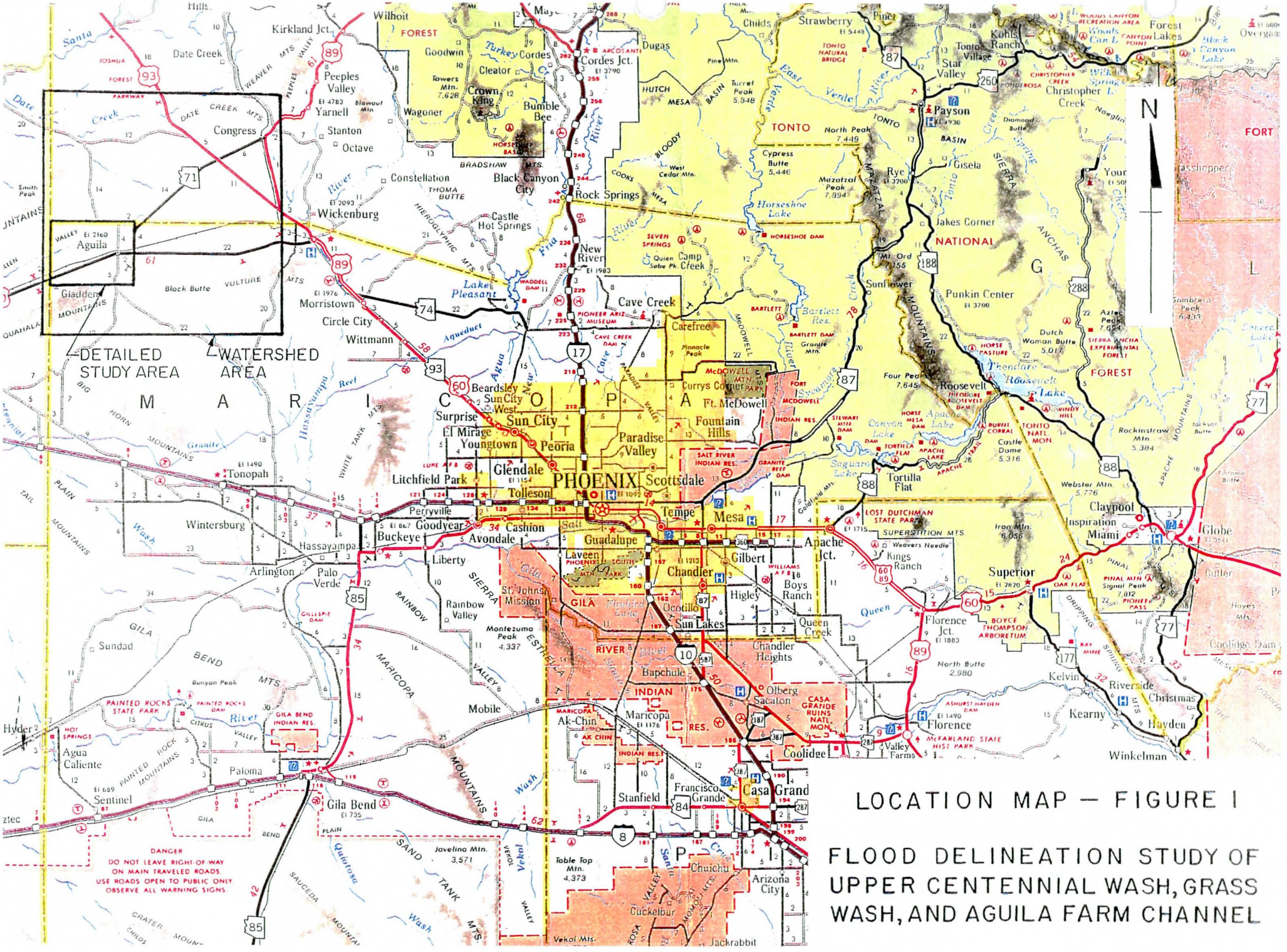
I. INTRODUCTION

URS Consultants was contracted by the Flood Control District of Maricopa County (the District) to perform detailed hydrologic and hydraulic analyses and floodplain mapping for the Upper Centennial Wash, Grass Wash and Aguila Farm Channel. The study was conducted in accordance with the Federal Emergency Management Agency's (FEMA), "Flood Insurance Study Guidelines and Specifications for Study Contractors, September 1985" (Reference 7). The study area is located surrounding the unincorporated community of Aguila, Arizona in the extreme northwest corner of Maricopa County (Figures 1 and 2). Aguila, Arizona is located approximately 25 miles west of Wickenburg, Arizona along U.S. Highway 60/70 and is centered within Township 7 North, Range 9 West, Gila and Salt River Base and Meridian.

The purpose of this report is to estimate 10-, 50-, and 100-year return frequency peak discharges at appropriate locations along the study reaches identified above. A detailed study previously had been performed (1978) by FEMA along portions of the Aguila Farm Channel and Grass Wash which estimated 10-, 50, and 100-year return frequency peak discharges (References 5 and 6). Similar peak discharges have not been estimated for the portion of Upper Centennial Wash encompassed by this study. Upper Centennial Wash was previously mapped using approximate methods. Therefore, the Aguila Farm Channel and Grass Wash study reaches are re-study areas, while the Upper Centennial Wash is a new detailed study reach.

The peak discharges estimated by this study will be used in determining water surface elevations and associated profiles, floodplain and floodway boundaries, and flood hazard zones within the study area. Floodplain and floodway boundaries and flood hazard zones will be determined using the appropriate 100-year peak discharge.



LOCATION MAP — FIGURE 1

FLOOD DELINEATION STUDY OF UPPER CENTENNIAL WASH, GRASS WASH, AND AGUILA FARM CHANNEL

II. WATERSHED DESCRIPTION

The watershed and associated subbasins are located within the extreme northwest corner of Maricopa County, Arizona. The northern boundary of the watershed consists of the Harcuvar and Date Creek Mountains. The eastern boundary is defined by a natural topographic watershed division between the Sols Wash and Upper Centennial Wash watersheds. The southern boundary of the watershed is formed by the Vulture and Harquahala Mountains. Runoff from the Aguila Farm Channel and Grass Wash join with the Upper Centennial Wash drainage system at the unincorporated town of Aguila. Runoff within the Upper Centennial Wash drains in a southwesterly direction where it exits Maricopa County and enters La Paz County. Runoff within the Centennial Wash drainage system eventually turns southeasterly and re-enters Maricopa County where it is referred to as Lower Centennial Wash (previously studied, see Reference 3).

The slope of the natural terrain varies widely. The steeper foothills and mountain slopes range from approximately 5 to 60 percent. Less steep areas within the study range from 0.2 to 5 percent. It should be noted that the slope of the three major drainage channels being studied range from 0.2 to 0.3 percent (Appendix F).

Four major soil texture classes were identified from the numerous soil types present within the watershed. The four are: Sandy Loam, Sandy Clay Loam, Clay Loam, and Clay. The most common is Sandy Loam. The least common is Clay (Appendix G and References 16 and 17).

The watershed has several man-made physical features which should be noted.

U.S. Highways 60/70 and 93 and State Route 71 traverse the watershed. Field reconnaissance observed that these highways are primarily constructed at-grade (or minimal fill) with low-flow culverts located at drainage concentration points. A major highway bridge crossing is located at Grass Wash and will be hydraulically modeled using HEC-2. This study assumed that the roadways do not significantly impede or alter the natural direction of flow.

The Atchinson Topeka and Santa Fe Railroad (AT & SF) transects the study area in a southwesterly direction. The rail bed is elevated fill approximately 4 to 6 feet above natural grade and acts as a barrier to runoff draining in a northerly direction. There are 33 drainage structures within the study area which allow runoff to pass through the railroad bed (Figure 2). The largest of these structures is a 300 foot long trestle crossing Grass Wash which will be hydraulically modeled using HEC-2. The remaining 32 structures were individually rated for their conveyence capacity using the procedure described in HDS-5 (Appendix I and Reference 19). Several assumptions were made in order to estimate culvert capacity. They were:

1. Each culvert has the ability to flow full so that HW/D = 1.
2. Each culvert is under inlet control.
3. Sedimentation which may be present at culverts will flush during significant flow events or will be removed by ongoing AT & SF maintenance activities.

It was determined that where one or multiple culverts are present within a subbasin, their combined capacity exceeds the estimated 100-year peak discharge for the subbasin (Appendix I). Therefore, the railroad drainage structures are adequately sized to allow runoff to pass through the rail bed. Where there are no drainage structures, runoff flows parallel to the rail bed in a southwesterly direction.

There are numerous man-made structures consisting of training dikes, spreader dikes, stock tanks, etc., located throughout the watershed. These structures do not meet the FEMA criteria as identified in Chapter 2-7.e. of Reference 7 and, therefore, were not considered in this study. These structures generally consist of unprotected fill, some compacted and some not, are poorly maintained, and have no erosion protection. Historically, these structures have failed during significant flow events (Reference 1). The Sols Wash Tank, located at the terminus of Subbasin 100, was assumed to fail and 50 percent of the flow would drain in Sols Wash and 50 percent of the flow would drain into the study area. This assumption was based on review of the topographic base map and aerial observation of the drainage patterns downstream of the structure, both indicate that flow splits to the east and west downstream of the structure in numerous channels. It was determined by further analyses (0% to 100% diversion) that flows from Subbasin 100 do not significantly affect downstream peak discharges within the detailed study area.

III. METHODOLOGY

URS Consultants estimated the flood hydrology and peak discharges for Upper Centennial Wash, Grass Wash and Aguila Farm Channel. A memo from the District specifying modeling methodology is included for review in Appendix D. A summary of the methodology and assumptions are presented below.

Computer Modeling

The Army Corps of Engineer's hydrologic computer model, "HEC-1 - Flood Hydrograph Package", was used to estimate peak discharges at several critical runoff concentration points within the study area (Reference 13). This program develops a runoff hydrograph for individual subbasins through the input of numerical representations of the basin's physical/hydrologic characteristics. The individual hydrographs are then routed and/or combined in a sequence similar to the way runoff occurs within the physical watershed. Hydrographs and peak discharges can be requested for output at specified runoff concentration points. A schematic representation of the modeling logic is illustrated in Figure 3.

Field Reconnaissance

URS Consultants has performed three field reconnaissance trips to the study area. The first trip was a general reconnaissance trip with District staff. This trip included aerial reconnaissance of the entire watershed combined with ground reconnaissance to observe the watershed's physical and hydrologic characteristics first hand. Two more detailed reconnaissance trips were made by URS staff to measure, record, and photograph the watershed's physical and hydrologic characteristics applied in the HEC-1 modeling.

Watershed Areas

United States Geological Survey topographic quadrangle maps were used to develop a mylar base map having a scale of 1:62,500 (Figure 2 and Reference 20). Individual watershed subbasins were delineated on this base map for area determination. The subbasin boundaries were defined using: 1) the topography as shown on the USGS base map; 2) aerial photos contained in the SCS soil survey documents (References 16 and 17); and, 3) through field reconnaissance.

Rainfall Depth

The depth of rainfall has been obtained from the information and procedures in the National Oceanic and Atmospheric Administration (NOAA) Atlas 2, "Precipitation-Frequency Atlas of the Western United States, Volume VIII - Arizona, " (Reference 18). The 24-hour, 10-, 50-, and 100-year frequency rainfall depths for the project area are 2.50, 3.55 and 4.05 inches, respectively (Appendix E).

Rain Distribution

The temporal rainfall distribution being used is the Type II, 24-hour duration storm developed by the Soil Conservation Service. The cumulative distribution table being used is included in Appendix E.

Area Reduction of Rainfall Depth

The spatial distribution pattern of rainfall in Arizona is not always uniform. Rainfall depths given in NOAA Atlas 2 are point values. It is necessary to adjust these point rainfall depths by a given ratio based on the watershed area being considered. Depth/area ratios were developed by District staff using NWS HYDRO 40 and supplied to URS. A copy of the depth/area values being used in this study are included in Appendix E.

Unit Hydrograph

The SCS Dimensionless Unit Hydrograph procedure was used in this study. This synthetic hydrograph represents the runoff hydrograph due to 1 inch (a unit) of rainfall excess applied uniformly over a watershed. The unit hydrograph ordinates are then adjusted based on the amount of rainfall excess. HEC-1 input from this method requires the estimation of the watershed's lag time in hours which is derived from the time of concentration.

Time of Concentration and Lag Time

Time of concentration (T_c) is the time it takes a molecule of water to travel from the hydraulically most distant point in a watershed to the outlet or
concentration point. The Kirpich Equation was used to estimate subbasin T_c values. T_c was estimated by the equation below:

$$T_c = L^{1.15}/7700\ H^{0.38}$$

where:

T_c = Time of concentration (hours)

L = Hydraulic length (feet)

H = Elevation difference (feet)

Lag time (L) is time between the center of mass of rainfall excess and the peak of the runoff hydrograph. Lag time is often empirically related to the Time of Concentration (T_c) of a watershed as shown below:

$$L = 0.6\ T_c$$

where:

L = Lag time (hours)

T_c = Time of Concentration (hours)

This relationship was developed by the SCS (References 13 and 15) and was used to compute lag time in this study. Computation sheets for T_c and L are included in Appendix F.

Watershed Losses

Rainfall excess is the equivalent uniform depth of runoff that occurs during a storm event. Rainfall excess equals the total rainfall depth minus losses due to interception, infiltration, surface depression storage, etc. Watershed losses for this study were modeled using the Green and Ampt procedure described in Reference 8. The Green and Ampt procedure in HEC-1 uses five parameters (surface retention loss, hydraulic conductivity, wetting front capillary suction, soil moisture deficit, and percent impervious area) which are based on soil texture classification and land-use to compute the expected losses. Loss parameters for the Green and Ampt procedure were determined using detailed SCS soil maps to identify the soil types present within the watershed (References 16 and 17). Soil types were then grouped by their respective texture classifications. Weighted Green and Ampt parameters were computed for each subbasin based on the percent of individual soil textures present. Figure 5 illustrates the major soil texture groups within the study area. Four land-uses, Commercial/Residential, Mountain, Range, and Agriculture, were quantified within each subbasin for use in the Green and Ampt procedure. Computation sheets for the Green and Ampt parameters are included in Appendix G.

Channel Losses

Channel losses via bed infiltration can contribute to the attenuation of peak discharge as flood waters travel downstream. Some infiltration occurs in most natural channels, however, alluvial (sandy or gravelly) bed channels are known to be areas of significant groundwater recharge because of their relatively high infiltration rates.

Channel losses were not estimated in this study for the following reasons:

1. Reliable infiltration data is very site specific and not available for this area.
2. Non-uniformity of the soil types/textures throughout the floodplain.
3. Broad, sheet flow type floodplain with low flow channels instead of a uniform prismatic channel section with clearly definable bed. A channel is not present in many areas.

Flood Routing

Channel routing of flood flows was accomplished using the Muskingum Method (Reference 13). Flood routing is an important consideration in large, undeveloped watersheds where overbank storage, distributary flow, and lengthy travel time can attenuate flood peaks. As previously mentioned, many of the flow paths are broad sheet flow areas with several braided low flow channels throughout. Flood Control District staff related that observed flow velocities in this terrain typically range from 3 to 5 feet per second within Maricopa County. URS staff estimated that flow velocities could range from 2 to 8 feet per second using Manning's Equation for normal depth. U.S.G.S. topographic maps were used to estimate slope and approximate cross section geometry for the flow plains. In addition, a study conducted in a watershed having similiar hydrologic and topographic characteristics concluded that flow velocities generally range from 3 to 7 feet per second (Reference 21).

Based on the information above and engineering judgement, URS selected 4 feet per second as an average routing velocity to be used in the Muskingum method. The routing travel time was estimated using an average flow velocity of 4 feet per second for the distance traveled between concentration points. The number of time steps for each routing reach was estimated using a 10 minute computation interval. A weighing factor (X) of 0.2 was used in each routing procedure (Reference 9). Tabulation of routing data can be found in Appendix H.

IV. RESULTS

A summary of the resultant peak discharges estimated by this study which are proposed for FEMA adoption are presented in Table 1. Complete HEC-1 summary outputs for the 10-, 50-, and 100-year return frequency storm events are provided for review in Appendicies A, B, and C, respectively. Table 1 compares URS estimates with the previously estimated values adopted by FEMA (Appendix J and Reference 6).

URS acquired a graphical relationship of peak discharge per square mile verses drainage area in square miles plotted by the Arizona Department of Water Resources from previously adopted FEMA studies which determined 100-year peak discharges in Maricopa County, Arizona (Reference 1). URS peak discharge per square mile were derived from the 100-year return frequency model (Appendix C) were plotted against the existing FEMA data as illustrated in Figure 4. Table 2 provides a summary of the URS data plotted on Figure 4. Figure 4 indicates that the 100-year peak discharges estimated by URS are within the range of peak discharge values previously adopted by FEMA.

Calibration of the HEC-1 model's peak discharge/return frequency relationship to known gauged discharges was not possible due to the fact that no discharge gauges are present within the three major tributaries being studied.

FEMA has recently adopted a hydrologic analysis conducted for a floodplain delineation study performed on the lower portion of Centennial Wash prepared by Cella Barr Associates (Reference 3). This study estimated the 100-year peak discharge for Upper Centennial Wash at the Maricopa/La Paz County line to be 19,500 cfs (384 square miles) compared with the URS estimate of 21,700 cfs (452 square miles). The difference in watershed area is primarily due to URS determining that a portion of a 58 square mile area, Subbasin 100, has the potential to drain into the study area. Even though the URS study went into much greater detail subdividing the watershed, the 100-year peak discharges derived in both studies are very similar.

There is some difference in the existing FEMA peak discharges and the discharges estimated by this study, especially for the Grass Wash watershed. URS was not able to obtain a copy of the original hydrology which established the adopted FEMA values. The current FEMA Flood Insurance Study (Reference 6) states that the original hydrology was performed using the SCS TR-20 flood hydrology program and was conducted in 1978. The differences between the two studies are likely due to the following obvious dissimilarities:

1. The URS study is by COE HEC-1 while the previous study used SCS TR-20.
2. The URS study is using the Green and Ampt method for estimating watershed losses while the previous study probably used the SCS curve number method.
3. The Grass Wash watershed is estimated at 70.6 square miles by URS while the previous study estimated the watershed at 83.0 square miles. (The Grass Wash peak discharges have the most significant differences).

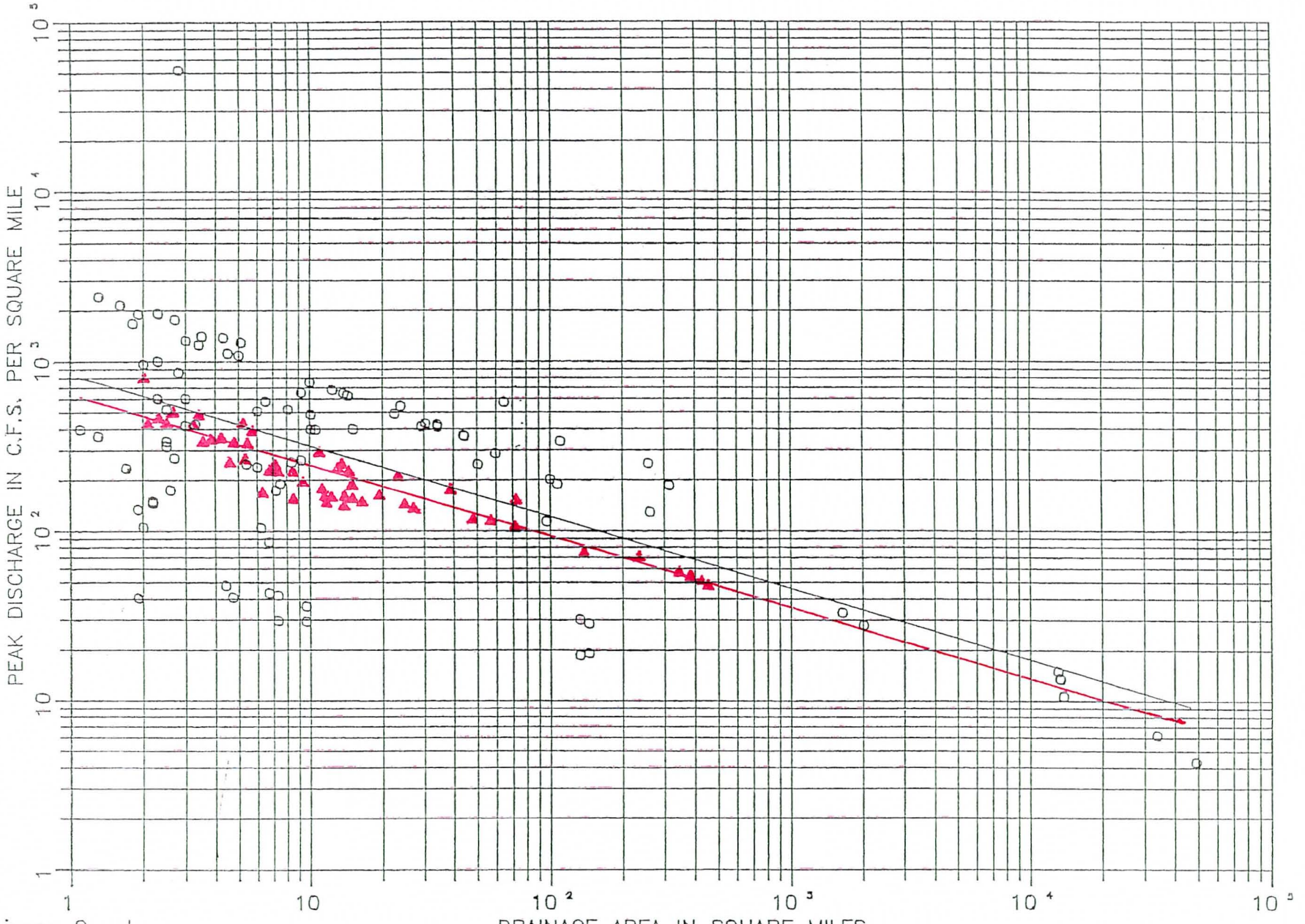
In conclusion, this study is presented to supercede the previous study's peak discharge data (where applicable) and to establish new estimated peak discharge values at the locations identified in Table 1.

Table 1

Summary of Discharges

Flooding Source and Location	Drainage Area (Sq.Mi.)	Peak Discharge (Cubic Feet per Second) 10-yr	50-yr	100-yr
Grass Wash				
At U.S. Highways 60/70	**70.6** (83.0)	**3,340** (6,380)	**8,660** (11,400)	**11,100** (14,400)
At N.W. corner of Sec. 25, T7N, R9W	**39.9** N/A	**2,430** N/A	**5,950** N/A	**7,500** N/A
At S.E. corner of Sec.25, T7N, R9W	**23.9** N/A	**1,720** N/A	**3,900** N/A	**4,870** N/A
Aguila Farm Channel				
At Eagle Eye Ave	**239.6** (216.0)	**3,620** (5,450)	**12,700** (12,000)	**16,900** (16,000)
Below Grass Wash	**314.4** N/A	**4,130** N/A	**14,500** N/A	**19,300** N/A
Upper Centennial Wash				
At Maricopa/La Paz County Boundary	**451.5** N/A	**4,880** N/A	**16,400** N/A	**21,700** N/A
At S.W. corner of Sec.4, T7N, R9W	**41.1** N/A	**1,900** N/A	**5,410** N/A	**6,960** N/A

Bold - URS Study
(Regular) - Previous FEMA Study
N/A - Not estimated in Previous Study



Maricopa County
JRM 01/11/89
Power Function PK/SQM = 828.9 DA ** -0.42
URS Data PK/SQM = 609.7 DA** -0.41
R2 = 0.89

FIGURE 4
Comparison of 100-yr Discharges
Source: Arizona Department of Water Resources

Table 2

100-year Peak Discharge per Square Mile
Summary Table

Subbasin I.D.	100-year Peak Discharge (cfs)	Area Sq.Mi	100-year Peak Discharge per Square Mile
1	1701	3.48	489
2A	2267	5.21	435
2B	1645	6.98	236
3	1205	3.63	332
4	1180	4.59	257
5A	1591	2.01	792
5B	1681	5.44	309
6	1454	8.57	170
7A	1231	2.25	547
7B	1649	4.95	333
8	923	2.13	433
9	1449	5.34	271
10	1168	6.34	184
11	1352	3.12	433
12	1046	2.59	404
13	1349	3.92	344
100	6549	58.27	112
101	1868	9.37	199
102	1544	5.25	294
103	2322	13.66	170
104	3993	28.20	142
105	3525	19.80	178
106	2247	5.75	391
107	3206	10.92	294

Table 2 (continued)

100-year Peak Discharge per Square Mile Summary Table

Subbansin I.D.	100-year Peak Discharge (cfs)	Area Sq.Mi	100-year Peak Discharge per Square Mile
108	1331	2.68	497
109	5682	49.05	116
110	2979	18.84	158
111	1073	2.41	445
112	2674	15.40	174
200	1486	4.24	350
201	3505	14.68	239
202	2288	14.98	153
203	2026	11.41	178
204	2158	12.76	169
205	3825	25.65	149
206	1966	8.83	223
207	1592	7.49	213
208	2143	12.62	170
209	1871	11.82	158
210	2701	16.93	160
A	3547	15.67	226
B	4873	23.88	204
C	7495	39.90	188
D	1668	7.19	232
E	3616	14.67	246
F	11060	70.55	157

Table 2 (continued)

100-year Peak Discharge per Square Mile
Summary Table

Subbasin I.D.	100-year Peak Discharge (cfs)	Area Sq.Mi.	100-year Peak Discharge per Square Mile
H	3202	16.66	192
I	11061	151.20	73
J	7221	70.29	103
K	16866	239.57	70
L	20345	355.43	57
M	21136	393.84	54
N	21364	422.77	51
O	21730	451.53	48

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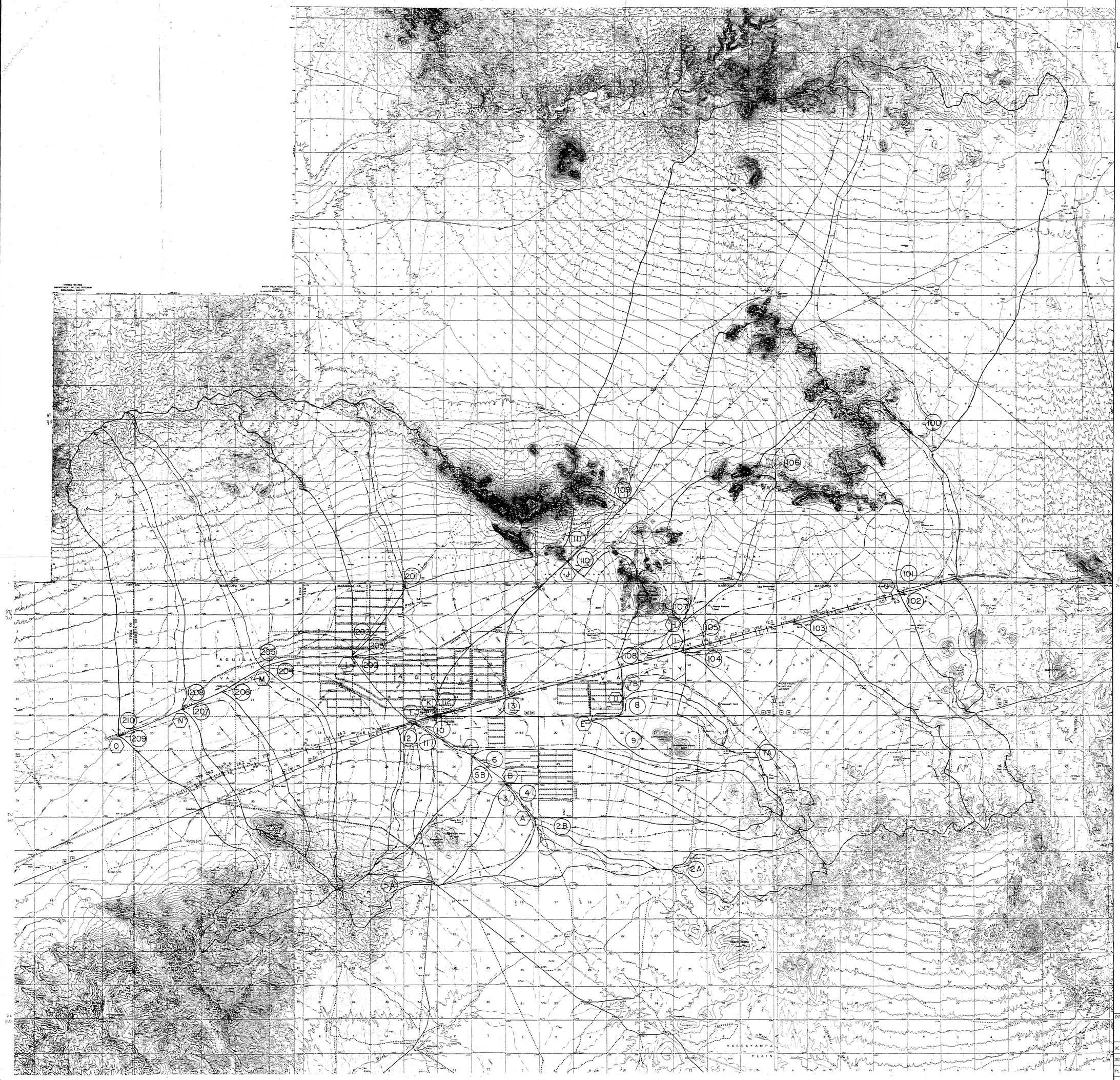
OF MARICOPA COUNT

FLOOD DELINEATION STUDY
UPPER CENTENNIAL WASH, GRASS
AND AGUILA FARM CHANNE



LEGEND

- SUBBASIN BOUNDARY
- (100) SUBBASIN IDENTIFICATION
- (G) HYDROGRAPH COMBINATION
- FLOW DIRECTION
- 11.3 AT & SF RR DRAINAGE STRUC
- Tc FLOW PATH

DISCHARGE SUMMARY

Subbasin I.D.	Area Sq. Mi.	Estimated Peak Discharge (cfs) 10-year	50-year	100-year
1	3.48	675	1373	1701
2A	5.21	782	1805	2267
2B	6.98	621	1326	1645
A	15.67	1227	2829	3547
3	3.63	479	969	1205
4	4.59	437	946	1180
B	23.81	1716	3901	4873
5A	2.01	561	1269	1591
5B	5.44	585	1342	1681
6	8.57	521	1165	1454
C	39.90	2428	5948	7493
7A	2.25	450	989	1231
7B	4.95	491	1293	1649
8	2.13	300	731	923
9	5.34	481	1150	1449
E	14.67	1080	2836	3616
10	6.34	481	934	1168
11	3.12	495	1087	1332
12	2.59	365	835	1046
13	3.92	586	1106	1349
F	70.55	3337	8660	11060
100	58.27	1585	5014	6549
101	9.37	651	1491	1868
102	5.25	545	1234	1544
G	72.89	871	2768	3618
103	13.66	772	1845	2322
104	28.20	1199	3141	3993
105	19.80	1192	2814	3525
106	5.75	714	1769	2247
107	10.92	992	2520	3206
H	16.66	943	2508	3202
I	151.20	2751	8509	11061
108	2.68	457	1061	1331
109	49.05	1402	4362	5682
110	18.84	838	2323	2979
111	2.41	354	850	1073
J	70.79	1676	5500	7221
112	15.40	929	2141	2674
K	239.57	3615	12731	16866
200	4.24	561	1179	1486
201	14.68	1049	2749	3505
202	14.98	663	1788	2284
203	11.41	725	1624	2026
L	355.43	4398	15332	20345
204	12.76	695	1709	2158
205	25.65	1068	2983	3825
M	393.84	4718	15945	21136
206	8.83	624	1551	1966
207	7.49	473	1246	1592
208	12.62	629	1676	2143
N	422.77	4799	16133	21364
209	11.82	571	1468	1871
210	16.93	775	2110	2701
O	451.53	4881	16438	21730

WATERSHED SUBBASIN BOUNDARY MAP

N

SCALE 1: 62,500

FIGURE 2

PREPARED BY: URS CONSULTANTS, IN
432 North 44th Street, Suite 163
Phoenix, Arizona 85008

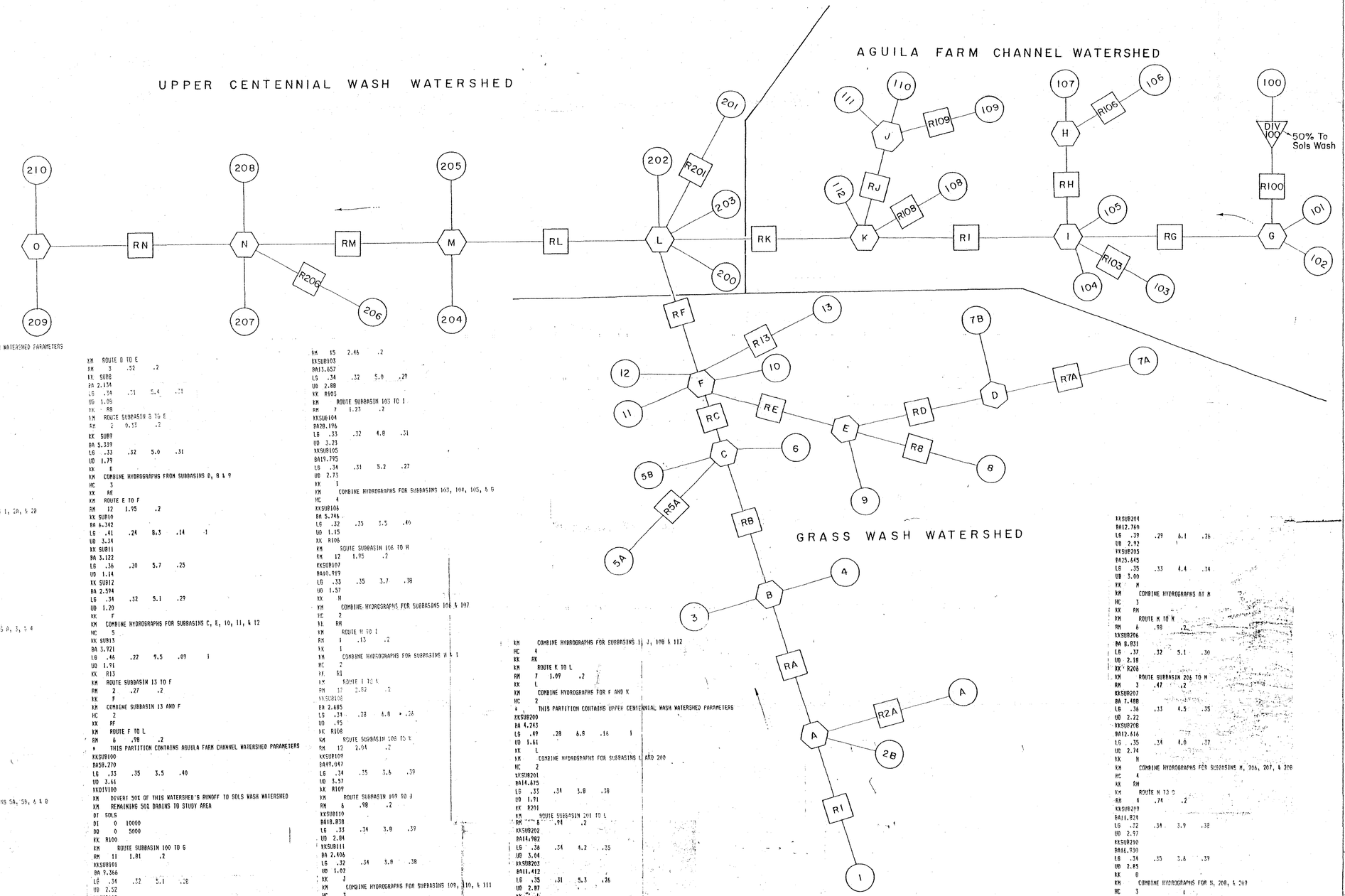
	BY	DATE	SUBMITTED BY:	DATE
DESIGN	S.S.S.	11/8/89		3/27/90
DESIGN CHK.	G.V.S.	11/15/89	RECOMMENDED BY:	DATE
PLANS	S.S.S.	11/8/89	APPROVED BY:	DATE
PLANS CHK.	G.V.S.	11/15/89	CHIEF ENGINEER AND GENERAL MANAGER	

FLOOD CONTROL DISTRICT OF MARICOPA COUNTY

FLOOD DELINEATION STUDY OF UPPER CENTENNIAL WASH, GRASS WASH AND AGUILA FARM CHANNEL

LEGEND

- (100) SUBBASIN HYDROGRAPH
- (H) COMBINE HYDROGRAPHS
- [R2] ROUTE HYDROGRAPH
- (DIV 100) DIVERT HYDROGRAPH
- ← FLOW DIRECTION




```
*    THIS PARTITION CONTAINS GRASS WASH WATERSHED PARAMETERS
KK  SUB1
BA 3.476
LS  .14     .27     7.2     .20
UD  1.05
KK   R1
KM   ROUTE SUBBASIN 1 TO A
RM    1     .07     .2
KK SUB2A
BA 5.211
LS  .28     .33     4.8     .32
UD  1.07
KK   R2A
KM   ROUTE SUBBASIN 2A TO A
RM   10    1.63     .2
KK SUB2B
BA 6.983
LS  .31     .30     6.1     .24
UD  2.29
KK    A
KM   COMBINE HYDROGRAPHS FOR SUBBASINS 1, 2A, & 2B
HC    3
KK   5A
KM   ROUTE A TO B
RM    2     .49     .2
KK SUB3
BA 7.027
LS  .35     .29     6.4     .22
UD  1.57
KK SUB4
BA 4.585
LS  .30     .29     6.4     .21
UD  2.00
KK    B
KM   COMBINE HYDROGRAPHS FOR SUBBASINS A, 3, & 4
HC    3
KK   RB
KM   ROUTE B TO C
RM    3     0.47    .2
KK SUB5A
BA 2.013
LS  .28     .35     3.5     .40
UD  .49
KK   5A
KM   ROUTE SUBBASIN 5A TO C
RM    9     1.52    .2
KK SUB5B
BA 5.457
LS  .31     .32     5.2     .28
UD  1.60
KK SUB6
BA 8.572
LS  .38     .27     7.2     .22
UD  3.08
KK    C
KM   COMBINE HYDROGRAPHS FOR SUBBASINS 5A, 5B, 6 & B
HC    4
KK   RC
KM   ROUTE C TO F
RM    4     0.72    .2
KK SUB7A
BA 2.247
LS  .30     .32     5.1     .29
UD  .85
KK   R7A
KM   ROUTE SUBBASIN 7A TO D
RM   12     1.97    .2
KK SUB7B
BA 4.947
LS  .35     .32     5.1     .33
UD  1.39
KK    D
KM   COMBINE HYDROGRAPHS FOR SUBBASINS 7A & 7B
HC    2
KK   RD
KM   ROUTE D TO E
RM    3     .52     .2
KK SUB8
BA 2.134
LS  .34     .31     5.4     .31
UD  1.06
KK   R8
KM   ROUTE SUBBASIN 8 TO E
RM    2     0.35    .2
KK SUB9
BA 5.339
LS  .33     .32     5.0     .31
UD  1.79
KK    E
KM   COMBINE HYDROGRAPHS FROM SUBBASINS D, 8 & 9
HC    3
KK   RE
KM   ROUTE E TO F
RM   12     1.95    .2
KK SUB10
BA 6.342
LS  .41     .24     8.3     .14     1
UD  3.34
KK SUB11
BA 3.122
LS  .36     .30     5.7     .25
UD  1.14
KK SUB12
BA 2.594
LS  .34     .32     5.1     .29
UD  1.20
KK    F
KM   COMBINE HYDROGRAPHS FOR SUBBASINS C, E, 10, 11, & 12
HC    5
KK SUB13
BA 3.921
LS  .46     .22     9.5     .09     1
UD  1.91
KK   R13
KM   ROUTE SUBBASIN 13 TO F
RM    2     .27     .2
KK    F
KM   COMBINE SUBBASIN 13 AND F
HC    2
KK   RF
KM   ROUTE F TO L
RM    6     .98     .2
*    THIS PARTITION CONTAINS AGUILA FARM CHANNEL WATERSHED PARAMETERS
KKSUB100
BA58.270
LS  .33     .35     3.5     .40
UD  3.44
KKDIV100
KM   DIVERT 50% OF THIS WATERSHED'S RUNOFF TO SOLS WASH WATERSHED
KM   REMAINING 50% DRAINS TO STUDY AREA
DT  SOL5
DI    0    10000
DQ    0     5000
KK  R100
KM   ROUTE SUBBASIN 100 TO G
RM   11     1.81    .2
KKSUB101
BA 7.366
LS  .34     .32     5.1     .28
UD  2.52
KKSUB102
BA 5.249
LS  .34     .32     5.1     .29
UD  1.69
KK    G
KM COMBINE HYDROGRAPHS FOR SUBBASINS 100, 101, & 102
HC    3
KK   RG
KM   ROUTE G TO I
RM   15     2.46    .2
KKSUB103
BA13.857
LS  .34     .32     5.0     .29
UD  2.88
KK  R103
KM   ROUTE SUBBASIN 103 TO I
RM    7     1.23    .2
KKSUB104
BA28.196
LS  .33     .32     4.8     .31
UD  3.23
KKSUB105
BA19.795
LS  .34     .31     5.2     .27
UD  2.73
KK    I
KM   COMBINE HYDROGRAPHS FOR SUBBASINS 103, 104, 105, & G
HC    4
KKSUB106
BA 5.746
LS  .32     .35     3.5     .40
UD  1.15
KK  R106
KM   ROUTE SUBBASIN 106 TO H
RM   12     1.95    .2
KKSUB107
BA10.919
LS  .33     .35     3.7     .38
UD  1.57
KK    H
KM   COMBINE HYDROGRAPHS FOR SUBBASINS 106 & 107
HC    2
KK   RH
KM   ROUTE H TO I
RM    1     .13     .2
KK    I
KM   COMBINE HYDROGRAPHS FOR SUBBASINS H & I
HC    2
KK   RI
KM   ROUTE I TO K
RM   17     2.82    .2
KKSUB108
BA 2.685
LS  .31     .28     6.8     .28
UD  .95
KK  R108
KM   ROUTE SUBBASIN 108 TO K
RM   12     2.04    .2
KKSUB109
BA17.047
LS  .34     .35     3.6     .39
UD  5.57
KK  R109
KM   ROUTE SUBBASIN 109 TO J
RM    6     .98     .2
KKSUB110
BA18.838
LS  .33     .34     3.8     .39
UD  2.84
KKSUB111
BA 2.406
LS  .32     .34     3.8     .38
UD  1.02
KK    J
KM   COMBINE HYDROGRAPHS FOR SUBBASINS 109, 110, & 111
HC    3
KK   RJ
KM   ROUTE J TO K
RM   13     2.13    .2
KKSUB112
BA15.399
LS  .37     .28     6.6     .23
UD  2.90
KK    K
KM   COMBINE HYDROGRAPHS FOR SUBBASINS I, J, 108 & 112
HC    4
KK   RK
KM   ROUTE K TO L
RM    7     1.09    .2
KK    L
KM   COMBINE HYDROGRAPHS FOR F AND K
HC    2
*    THIS PARTITION CONTAINS UPPER CENTENNIAL WASH WATERSHED PARAMETERS
KKSUB200
BA 4.243
LS  .49     .28     6.8     .16     1
UD  1.41
KK    L
KM   COMBINE HYDROGRAPHS FOR SUBBASINS L AND 200
HC    2
KKSUB201
BA14.675
LS  .33     .34     3.8     .38
UD  1.91
KK  R201
KM   ROUTE SUBBASIN 201 TO L
RM    6     .94     .2
KKSUB202
BA14.982
LS  .36     .34     4.2     .35
UD  3.04
KKSUB203
BA11.412
LS  .35     .31     5.3     .26
UD  2.87
KK    L
KM   COMBINE HYDROGRAPHS FOR SUBBASINS 201, 202 & 203
HC    3
KK    L
KM   COMBINE HYDROGRAPHS FOR ALL SUBBASINS AT L
HC    2
KK   RL
KM   ROUTE L TO M
RM    6     .39     .2
KKSUB204
BA12.760
LS  .39     .29     6.1     .26
UD  2.92
KKSUB205
BA25.645
LS  .35     .33     4.4     .34
UD  3.00
KK    M
KM   COMBINE HYDROGRAPHS AT M
HC    3
KK   RM
KM   ROUTE M TO N
RM    6     .98     .2
KKSUB206
BA 8.831
LS  .37     .32     5.1     .30
UD  2.18
KK  R206
KM   ROUTE SUBBASIN 206 TO N
RM    3     .47     .2
KKSUB207
BA 7.488
LS  .36     .33     4.5     .35
UD  2.22
KKSUB208
BA12.616
LS  .35     .34     4.0     .37
UD  2.74
KK    N
KM   COMBINE HYDROGRAPHS FOR SUBBASINS M, 206, 207, & 208
HC    4
KK   RN
KM   ROUTE N TO O
RM    4     .74     .2
KKSUB209
BA11.824
LS  .32     .34     3.9     .38
UD  2.97
KKSUB210
BA16.930
LS  .34     .35     3.6     .39
UD  2.85
KK    O
KM   COMBINE HYDROGRAPHS FOR N, 208, & 209
HC    3
ZZ
```

HEC-I COMPUTER MODELING SCHEMATIC

FIGURE 3

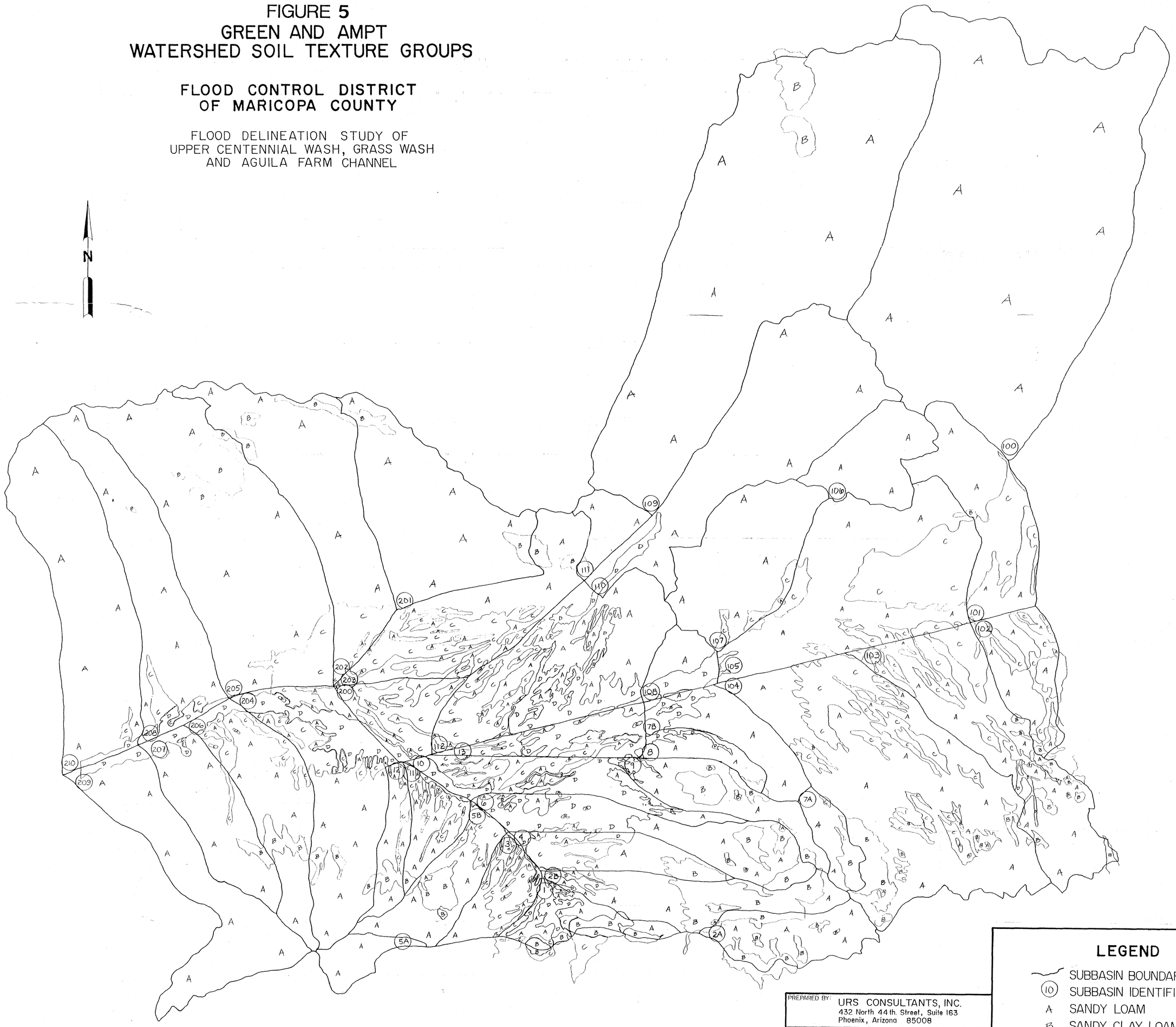
PREPARED BY: URS CONSULTANTS, INC.
432 North 44th Street, Suite 163
Phoenix, Arizona 85008

	BY	DATE	SUBMITTED BY:	DATE
DESIGN	S.S.S.	11/8/89		3/21/90
DESIGN CHK.	G.V.S.	11/15/89	RECOMMENDED BY:	DATE
PLANS	R.W.H.	11/8/89	APPROVED BY:	DATE
PLANS CHK.	S.S.S.	11/9/89	CHIEF ENGINEER AND GENERAL MANAGER	

FIGURE 5
GREEN AND AMPT
WATERSHED SOIL TEXTURE GROUPS

FLOOD CONTROL DISTRICT OF MARICOPA COUNTY

FLOOD DELINEATION STUDY OF
UPPER CENTENNIAL WASH, GRASS WASH
AND AGUILA FARM CHANNEL



PREPARED BY:	URS CONSULTANTS, INC. 432 North 44th. Street, Suite 163 Phoenix, Arizona 85008		
	BY	DATE	SUBMITTED BY: Scot Schlund, P.E. DATE 4/17/90
DESIGN	K.P.C.	3/90	
DESIGN CHK	S.S.S.	4/90	RECOMMENDED BY: DATE
PLANS			APPROVED BY: DATE
PLANS CHK			CHIEF ENGINEER AND GENERAL MANAGER

LEGEND

- SUBBASIN BOUNDARY
- (10) SUBBASIN IDENTIFICATION
- A SANDY LOAM
- B SANDY CLAY LOAM
- C CLAY LOAM
- D CLAY

APPENDICES

APPENDIX A

10 Year Peak Discharges

```
LINE          ID.......1.......2.......3.......4.......5.......6.......7.......8.......9......10

  1           ID     GRASS WASH/UPPER CENTENNIAL WASH FLOOD STUDY
  2           ID     FOR THE FLOOD CONTROL DISTRICT OF MARICOPA COUNTY
  3           ID     10 YEAR, 24 HOUR TYPE II STORM
  4           ID     GREEN AND AMPT LOSSES WITH SCS DIMENSIONLESS UNIT HYDROGRAPH
  5           ID
  6           ID     URS CONSULTANTS FILE: FCD.10    MARCH 1990
  7           ID
  8           IT      10 02AUG89    1200     145
  9           IO       5       0
 10           IN      30 02AUG89    1200
 11           JD    2.50      .1
 12           PC       0    .005    .011    .016    .022    .028    .035    .041    .048    .056
 13           PC    .063    .071    .080    .089    .098    .108    .120    .133    .147    .163
 14           PC    .181    .204    .235    .283    .663    .735    .772    .799    .820    .838
 15           PC    .854    .868    .880    .891    .902    .912    .921    .929    .937    .945
 16           PC    .952    .959    .965    .972    .978    .984    .989    .995   1.000
 17           JD    2.38      10
 18           JD    2.30      20
 19           JD    2.25      30
 20           JD    2.15      70
 21           JD    2.13     100
 22           JD    2.08     150
 23           JD    2.00     300
 24           JD    2.00     400
              *    THIS PARTITION CONTAINS GRASS WASH WATERSHED PARAMETERS

 25           KK    SUB1
 26           BA   3.476
 27           LG     .34     .27     7.2     .20
 28           UD    1.05

 29           KK      R1
 30           KM     ROUTE SUBBASIN 1 TO A
 31           RM       1     .07      .2

 32           KK   SUB2A
 33           BA   5.211
 34           LG     .28     .33     4.8     .32
 35           UD    1.07

 36           KK     R2A
 37           KM     ROUTE SUBBASIN 2A TO A
 38           RM      10    1.63      .2

 39           KK   SUB2B
 40           BA   6.983
 41           LG     .31     .30     6.1     .24
 42           UD    2.20

 43           KK       A
 44           KM     COMBINE HYDROGRAPHS FOR SUBBASINS 1, 2A, & 2B
 45           HC       3
```

```
LINE          ID.......1.......2.......3.......4.......5.......6.......7.......8.......9......10

  46          KK      RA
  47          KM     ROUTE A TO B
  48          RM       3     .49      .2

  49          KK    SUB3
  50          BA   3.627
  51          LG     .35     .29     6.4     .20
  52          UD    1.63

  53          KK    SUB4
  54          BA   4.585
  55          LG     .40     .29     6.4     .21
  56          UD    2.07

  57          KK       B
  58          KM     COMBINE HYDROGRAPHS FOR SUBBASINS A, 3, & 4
  59          HC       3

  60          KK      RB
  61          KM     ROUTE B TO C
  62          RM       3    0.47      .2

  63          KK   SUB5A
  64          BA   2.013
  65          LG     .26     .35     3.5     .40
  66          UD     .49

  67          KK     R5A
  68          KM     ROUTE SUBBASIN 5A TO C
  69          RM       9    1.52      .2

  70          KK   SUB5B
  71          BA   5.437
  72          LG     .34     .32     5.2     .28
  73          UD    1.60

  74          KK    SUB6
  75          BA   8.572
  76          LG     .38     .27     7.2     .22
  77          UD    3.08

  78          KK       C
  79          KM     COMBINE HYDROGRAPHS FOR SUBBASINS 5A, 5B, 6 & B
  80          HC       4

  81          KK      RC
  82          KM     ROUTE C TO F
  83          RM       4    0.72      .2
```

```
LINE          ID.......1.......2.......3.......4.......5.......6.......7.......8.......9......10

 84           KK   SUB7A
 85           BA   2.247
 86           LG     .30     .32     5.1     .29
 87           UD     .85

 88           KK     R7A
 89           KM     ROUTE SUBBBASIN 7A TO D
 90           RM      12    1.97      .2

 91           KK   SUB7B
 92           BA   4.947
 93           LG     .35     .32     5.1     .33
 94           UD    1.39

 95           KK      D
 96           KM     COMBINE HYDROGRAPHS FOR SUBBASINS 7A & 7B
 97           HC      2

 98           KK     RD
 99           KM     ROUTE D TO E
100           RM      3     .52      .2

101           KK    SUB8
102           BA   2.134
103           LG     .34     .31     5.4     .31
104           UD    1.08

105           KK     R8
106           KM     ROUTE SUBBASIN 8 TO E
107           RM      2    0.33      .2

108           KK    SUB9
109           BA   5.339
110           LG     .33     .32     5.0     .31
111           UD    1.79

112           KK      E
113           KM     COMBINE HYDROGRAPHS FROM SUBBASINS D, 8 & 9
114           HC      3

115           KK     RE
116           KM     ROUTE E TO F
117           RM     12    1.95      .2

118           KK   SUB10
119           BA   6.342
120           LG     .41     .24     8.3     .14       1
121           UD    3.34
```

```
LINE        ID.......1.......2.......3.......4.......5.......6.......7.......8.......9......10

122         KK   SUB11
123         BA   3.122
124         LG     .36     .30     5.7     .25
125         UD    1.14

126         KK   SUB12
127         BA   2.594
128         LG     .34     .32     5.1     .29
129         UD    1.20

130         KK      F
131         KM     COMBINE HYDROGRAPHS FOR SUBBASINS C, E, 10, 11, & 12
132         HC      5

133         KK   SUB13
134         BA   3.921
135         LG     .46     .22     9.5     .09       1
136         UD    1.91

137         KK     R13
138         KM     ROUTE SUBBASIN 13 TO F
139         RM      2     .27      .2

140         KK      F
141         KM     COMBINE SUBBASIN 13 AND F
142         HC      2

143         KK      RF
144         KM      ROUTE F TO L
145         RM      6     .98      .2
            *     THIS PARTITION CONTAINS AGUILA FARM CHANNEL WATERSHED PARAMETERS

146         KK  SUB100
147         BA  58.270
148         LG    .33     .35     3.5     .40
149         UD   3.61

150         KK  DIV100
151         KM      DIVERT 50% OF THIS WATERSHED'S RUNOFF TO SOLS WASH WATERSHED
152         KM      REMAINING 50% DRAINS TO STUDY AREA
153         DT    SOLS
154         DI      0   10000
155         DQ      0    5000

156         KK    R100
157         KM        ROUTE SUBBASIN 100 TO G
158         RM     11    1.81      .2

159         KK  SUB101
160         BA   9.366
161         LG     .34     .32     5.1     .28
162         UD    2.52
```

```
LINE          ID.......1.......2.......3.......4.......5.......6.......7.......8.......9......10

 163          KK  SUB102
 164          BA   5.249
 165          LG     .34     .32     5.1     .28
 166          UD    1.69

 167          KK       G
 168          KM   COMBINE HYDROGRAPHS FOR SUBBASINS 100, 101, & 102
 169          HC       3

 170          KK      RG
 171          KM        ROUTE G TO I
 172          RM      15    2.46      .2

 173          KK  SUB103
 174          BA  13.657
 175          LG     .34     .32     5.0     .29
 176          UD    2.88

 177          KK    R103
 178          KM        ROUTE SUBBASIN 103 TO I
 179          RM       7    1.23      .2

 180          KK  SUB104
 181          BA  28.196
 182          LG     .33     .32     4.8     .31
 183          UD    3.23

 184          KK  SUB105
 185          BA  19.795
 186          LG     .34     .31     5.2     .27
 187          UD    2.73

 188          KK       I
 189          KM        COMBINE HYDROGRAPHS FOR SUBBASINS 103, 104, 105, & G
 190          HC       4

 191          KK  SUB106
 192          BA   5.746
 193          LG     .32     .35     3.5     .40
 194          UD    1.15

 195          KK    R106
 196          KM        ROUTE SUBBASIN 106 TO H
 197          RM      12    1.95      .2

 198          KK  SUB107
 199          BA  10.919
 200          LG     .33     .35     3.7     .38
 201          UD    1.57
```

```
LINE          ID.......1.......2.......3.......4.......5.......6.......7.......8.......9......10

 202          KK       H
 203          KM        COMBINE HYDROGRAPHS FOR SUBBASINS 106 & 107
 204          HC       2

 205          KK      RH
 206          KM        ROUTE H TO I
 207          RM       1     .13      .2

 208          KK       I
 209          KM        COMBINE HYDROGRAPHS FOR SUBBASINS H & I
 210          HC       2

 211          KK      RI
 212          KM        ROUTE I TO K
 213          RM      17    2.82      .2

 214          KK  SUB108
 215          BA   2.685
 216          LG    .34     .28     6.8     .26
 217          UD    .95

 218          KK    R108
 219          KM        ROUTE SUBBASIN 108 TO K
 220          RM      12    2.04      .2

 221          KK  SUB109
 222          BA  49.047
 223          LG    .34     .35     3.6     .39
 224          UD   3.57

 225          KK    R109
 226          KM        ROUTE SUBBASIN 109 TO J
 227          RM       6     .98      .2

 228          KK  SUB110
 229          BA  18.838
 230          LG    .33     .34     3.8     .39
 231          UD   2.84

 232          KK  SUB111
 233          BA   2.406
 234          LG    .32     .34     3.8     .38
 235          UD   1.02

 236          KK       J
 237          KM        COMBINE HYDROGRAPHS FOR SUBBASINS 109, 110, & 111
 238          HC       3

 239          KK      RJ
 240          KM        ROUTE J TO K
 241          RM      13    2.13      .2
```

```
LINE        ID.......1.......2.......3.......4.......5.......6.......7.......8.......9......10

242         KK  SUB112
243         BA  15.399
244         LG    .37     .28     6.6     .23
245         UD   2.90

246         KK      K
247         KM       COMBINE HYDROGRAPHS FOR SUBBASINS I, J, 108 & 112
248         HC      4

249         KK     RK
250         KM       ROUTE K TO L
251         RM      7    1.09      .2

252         KK      L
253         KM       COMBINE HYDROGRAPHS FOR F AND K
254         HC      2
            *      THIS PARTITION CONTAINS UPPER CENTENNIAL WASH WATERSHED PARAMETERS

255         KK  SUB200
256         BA   4.243
257         LG    .49     .28     6.8     .16       1
258         UD   1.61

259         KK      L
260         KM       COMBINE HYDROGRAPHS FOR SUBBASINS L AND 200
261         HC      2

262         KK  SUB201
263         BA  14.675
264         LG    .33     .34     3.8     .38
265         UD   1.91

266         KK   R201
267         KM       ROUTE SUBBASIN 201 TO L
268         RM      6     .94      .2

269         KK  SUB202
270         BA  14.982
271         LG    .36     .34     4.2     .35
272         UD   3.04

273         KK  SUB203
274         BA  11.412
275         LG    .35     .31     5.3     .26
276         UD   2.87

277         KK      L
278         KM       COMBINE HYDROGRAPHS FOR SUBBASINS 201, 202 & 203
279         HC      3
```

```
LINE          ID.......1.......2.......3.......4.......5.......6.......7.......8.......9......10

 280          KK      L
 281          KM       COMBINE HYDROGRAPHS FOR ALL SUBBASINS AT L
 282          HC      2

 283          KK     RL
 284          KM       ROUTE L TO M
 285          RM      6     .99      .2

 286          KK  SUB204
 287          BA  12.760
 288          LG     .39     .29     6.1     .26
 289          UD    2.92

 290          KK  SUB205
 291          BA  25.645
 292          LG     .35     .33     4.4     .34
 293          UD    3.00

 294          KK      M
 295          KM       COMBINE HYDROGRAPHS AT M
 296          HC      3

 297          KK     RM
 298          KM       ROUTE M TO N
 299          RM      6     .98      .2

 300          KK  SUB206
 301          BA   8.831
 302          LG     .37     .32     5.1     .30
 303          UD    2.18

 304          KK    R206
 305          KM       ROUTE SUBBASIN 206 TO N
 306          RM      3     .47      .2

 307          KK  SUB207
 308          BA   7.488
 309          LG     .36     .33     4.5     .35
 310          UD    2.22

 311          KK  SUB208
 312          BA  12.616
 313          LG     .35     .34     4.0     .37
 314          UD    2.74

 315          KK      N
 316          KM       COMBINE HYDROGRAPHS FOR SUBBASINS M, 206, 207, & 208
 317          HC      4
```

```
LINE          ID.......1.......2.......3.......4.......5.......6.......7.......8.......9......10

 318          KK      RN
 319          KM        ROUTE N TO O
 320          RM       4     .74      .2

 321          KK  SUB209
 322          BA  11.824
 323          LG     .32     .34     3.9     .38
 324          UD    2.97

 325          KK  SUB210
 326          BA  16.930
 327          LG     .34     .35     3.6     .39
 328          UD    2.85

 329          KK       O
 330          KM        COMBINE HYDROGRAPHS FOR N, 208, & 209
 331          HC       3
 332          ZZ
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*************************************
*                                   *
*   FLOOD HYDROGRAPH PACKAGE  (HEC-1)  *
*      BY THE COE IN FEBRUARY 1981  *
*          REVISED 02 AUG 88        *
*                                   *
*  RUN DATE  04/16/1990  TIME  14:17:22 *
*                                   *
*************************************
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*************************************
*                                   *
*    DODSON AND ASSOCIATES, INC.    *
*  HYDROLOGIST AND CIVIL ENGINEERS  *
*     7015 W TIDWELL SUITE 107      *
*       HOUSTON, TEXAS  77092       *
*          (713) 895-8322           *
*                                   *
*************************************
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GRASS WASH/UPPER CENTENNIAL WASH FLOOD STUDY
FOR THE FLOOD CONTROL DISTRICT OF MARICOPA COUNTY
10 YEAR, 24 HOUR TYPE II STORM
GREEN AND AMPT LOSSES WITH SCS DIMENSIONLESS UNIT HYDROGRAPH

URS CONSULTANTS FILE: FCD.10 MARCH 1990

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 9 IO        OUTPUT CONTROL VARIABLES
                  IPRNT          5  PRINT CONTROL
                  IPLOT          0  PLOT CONTROL
                  QSCAL         0.  HYDROGRAPH PLOT SCALE

  IT         HYDROGRAPH TIME DATA
                   NMIN         10  MINUTES IN COMPUTATION INTERVAL
                  IDATE     2AUG89  STARTING DATE
                  ITIME       1200  STARTING TIME
                     NQ        145  NUMBER OF HYDROGRAPH ORDINATES
                 NDDATE     3AUG89  ENDING DATE
                 NDTIME       1200  ENDING TIME
                  ICENT         19  CENTURY MARK

            COMPUTATION INTERVAL     .17 HOURS
                 TOTAL TIME BASE   24.00 HOURS

      ENGLISH UNITS
          DRAINAGE AREA        SQUARE MILES
          PRECIPITATION DEPTH  INCHES
          LENGTH, ELEVATION    FEET
          FLOW                 CUBIC FEET PER SECOND
          STORAGE VOLUME       ACRE-FEET
          SURFACE AREA         ACRES
          TEMPERATURE          DEGREES FAHRENHEIT

11 JD        INDEX STORM NO. 1
                  STRM       2.50  PRECIPITATION DEPTH
                  TRDA        .10  TRANSPOSITION DRAINAGE AREA

12 PI          PRECIPITATION PATTERN
                 .00      .00      .00      .00      .00      .00      .00      .00      .00      .00
                 .00      .00      .00      .00      .00      .00      .00      .00      .00      .00
                 .00      .00      .00      .00      .00      .00      .00      .00      .00      .00
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                 .00      .00      .00      .00      .00      .00      .00      .00      .00      .00
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17 JD INDEX STORM NO. 2

STRM 2.38 PRECIPITATION DEPTH

TRDA 10.00 TRANSPOSITION DRAINAGE AREA

0 PI PRECIPITATION PATTERN

.00	.00	.00	.00	.00	.00	.00	.00	.00	.00
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.13	.13	.02	.02	.02	.01	.01	.01	.01	.01
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.00	.00	.00	.00						

18 JD INDEX STORM NO. 3

STRM 2.30 PRECIPITATION DEPTH

TRDA 20.00 TRANSPOSITION DRAINAGE AREA

0 PI PRECIPITATION PATTERN

.00	.00	.00	.00	.00	.00	.00	.00	.00	.00
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.01	.01	.01	.01	.01	.01	.02	.02	.02	.13
.13	.13	.02	.02	.02	.01	.01	.01	.01	.01
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.00	.00	.00	.00						

19 JD INDEX STORM NO. 4

STRM 2.25 PRECIPITATION DEPTH

TRDA 30.00 TRANSPOSITION DRAINAGE AREA

0 PI PRECIPITATION PATTERN

.00	.00	.00	.00	.00	.00	.00	.00	.00	.00
.00	.00	.00	.00	.00	.00	.00	.00	.00	.00
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.01	.01	.01	.01	.01	.01	.02	.02	.02	.13
.13	.13	.02	.02	.02	.01	.01	.01	.01	.01
.01	.01	.01	.01	.01	.01	.01	.01	.01	.01
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0 JD INDEX STORM NO. 5

STRM 2.15 PRECIPITATION DEPTH

TRDA 70.00 TRANSPOSITION DRAINAGE AREA

0 PI PRECIPITATION PATTERN

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.01	.01	.01	.01	.01	.01	.02	.02	.02	.13
.13	.13	.02	.02	.02	.01	.01	.01	.01	.01
.01	.01	.01	.01	.01	.01	.01	.01	.01	.01
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21 JD INDEX STORM NO. 6

STRM 2.13 PRECIPITATION DEPTH

TRDA 100.00 TRANSPOSITION DRAINAGE AREA

0 PI PRECIPITATION PATTERN

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.00	.00	.00	.00	.00	.00	.00	.00	.00	.00
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.00	.00	.00	.00	.01	.01	.01	.01	.01	.01
.01	.01	.01	.01	.01	.01	.02	.02	.02	.13
.13	.13	.02	.02	.02	.01	.01	.01	.01	.01
.01	.01	.01	.01	.01	.01	.01	.01	.01	.01
.00	.00	.00	.00	.00	.00	.00	.00	.00	.00
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22 JD INDEX STORM NO. 7

STRM 2.08 PRECIPITATION DEPTH

TRDA 150.00 TRANSPOSITION DRAINAGE AREA

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.01     .01     .01     .01     .01     .01     .02     .02     .02     .13
.13     .13     .02     .02     .02     .01     .01     .01     .01     .01
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23 JD      INDEX STORM NO. 8
             STRM        2.00  PRECIPITATION DEPTH
             TRDA      300.00  TRANSPOSITION DRAINAGE AREA

 0 PI        PRECIPITATION PATTERN
.00     .00     .00     .00     .00     .00     .00     .00     .00     .00
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.00     .00     .00     .00     .01     .01     .01     .01     .01     .01
.01     .01     .01     .01     .01     .01     .02     .02     .02     .13
.13     .13     .02     .02     .02     .01     .01     .01     .01     .01
.01     .01     .01     .01     .01     .01     .01     .01     .01     .01
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24 JD      INDEX STORM NO. 9
             STRM        2.00  PRECIPITATION DEPTH
             TRDA      400.00  TRANSPOSITION DRAINAGE AREA

 0 PI        PRECIPITATION PATTERN
.00     .00     .00     .00     .00     .00     .00     .00     .00     .00
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.01     .01     .01     .01     .01     .01     .02     .02     .02     .13
.13     .13     .02     .02     .02     .01     .01     .01     .01     .01
.01     .01     .01     .01     .01     .01     .01     .01     .01     .01
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RUNOFF SUMMARY
FLOW IN CUBIC FEET PER SECOND
TIME IN HOURS, AREA IN SQUARE MILES

OPERATION	STATION	PEAK FLOW	TIME OF PEAK	AVERAGE FLOW FOR MAXIMUM PERIOD 6-HOUR	24-HOUR	72-HOUR	BASIN AREA	MAXIMUM STAGE	TIME OF MAX STAGE
HYDROGRAPH AT	SUB1	675.	12.83	175.	44.	44.	3.48		
ROUTED TO	R1	668.	12.83	175.	44.	44.	3.48		
HYDROGRAPH AT	SUB2A	782.	12.83	205.	51.	51.	5.21		
ROUTED TO	R2A	645.	14.50	205.	51.	51.	5.21		
HYDROGRAPH AT	SUB2B	621.	14.00	305.	79.	79.	6.98		
3 COMBINED AT	A	1227.	14.33	624.	160.	160.	15.67		
ROUTED TO	RA	1200.	14.83	623.	160.	160.	15.67		
HYDROGRAPH AT	SUB3	479.	13.33	183.	46.	46.	3.63		
HYDROGRAPH AT	SUB4	437.	13.83	204.	53.	53.	4.59		
3 COMBINED AT	B	1716.	13.83	907.	233.	233.	23.88		
ROUTED TO	RB	1696.	14.33	905.	233.	233.	23.88		
HYDROGRAPH AT	SUB5A	561.	12.33	79.	20.	20.	2.01		
ROUTED TO	R5A	357.	13.83	79.	20.	20.	2.01		
HYDROGRAPH AT	SUB5B	585.	13.33	219.	55.	55.	5.44		
HYDROGRAPH AT	SUB6	521.	14.83	327.	92.	92.	8.57		
4 COMBINED AT	C	2428.	14.17	1291.	339.	339.	39.90		
ROUTED TO	RC	2350.	14.83	1286.	338.	338.	39.90		
HYDROGRAPH AT	SUB7A	450.	12.67	97.	24.	24.	2.25		
ROUTED TO	R7A	332.	14.67	97.	24.	24.	2.25		
HYDROGRAPH AT	SUB7B	498.	13.17	164.	41.	41.	4.95		
2 COMBINED AT	D	503.	13.33	254.	64.	64.	7.19		
ROUTED TO	RD	494.	14.00	254.	64.	64.	7.19		
HYDROGRAPH AT	SUB8	300.	12.83	79.	20.	20.	2.13		
ROUTED TO	R8	286.	13.17	79.	20.	20.	2.13		
HYDROGRAPH AT	SUB9	481.	13.50	199.	51.	51.	5.34		
3 COMBINED AT	E	1080.	13.50	484.	122.	122.	14.67		

ROUTED TO	RE	978.	15.67	481.	122.	122.	14.67
HYDROGRAPH AT	SUB10	481.	15.17	319.	93.	93.	6.34
HYDROGRAPH AT	SUB11	495.	13.00	138.	35.	35.	3.12
HYDROGRAPH AT	SUB12	365.	13.00	106.	26.	26.	2.59
5 COMBINED AT	F	3090.	15.17	1856.	502.	502.	66.63
HYDROGRAPH AT	SUB13	586.	13.67	257.	66.	66.	3.92
ROUTED TO	R13	579.	14.00	257.	66.	66.	3.92
2 COMBINED AT	F	3337.	15.00	2032.	548.	548.	70.55
ROUTED TO	RF	3259.	16.00	2020.	547.	547.	70.55
HYDROGRAPH AT	SUB100	1585.	15.50	1096.	322.	322.	58.27
DIVERSION TO	SOLS	793.	15.50	548.	161.	161.	58.27
HYDROGRAPH AT	DIV100	793.	15.50	548.	161.	161.	58.27
ROUTED TO	R100	775.	17.33	543.	158.	158.	58.27
HYDROGRAPH AT	SUB101	651.	14.33	355.	95.	95.	9.37
HYDROGRAPH AT	SUB102	545.	13.50	214.	54.	54.	5.25
3 COMBINED AT	G	871.	16.67	773.	249.	249.	72.89
ROUTED TO	RG	857.	19.17	759.	238.	238.	72.89
HYDROGRAPH AT	SUB103	772.	14.67	463.	127.	127.	13.66
ROUTED TO	R103	751.	16.00	460.	127.	127.	13.66
HYDROGRAPH AT	SUB104	1199.	15.00	775.	220.	220.	28.20
HYDROGRAPH AT	SUB105	1192.	14.50	689.	187.	187.	19.80
4 COMBINED AT	I	2429.	15.67	1774.	579.	579.	134.53
HYDROGRAPH AT	SUB106	714.	13.00	200.	50.	50.	5.75
ROUTED TO	R106	585.	15.00	200.	50.	50.	5.75
HYDROGRAPH AT	SUB107	992.	13.33	365.	92.	92.	10.92
2 COMBINED AT	H	943.	13.50	510.	129.	129.	16.66
ROUTED TO	RH	941.	13.67	510.	129.	129.	16.66
2 COMBINED AT	I	2751.	15.33	1970.	636.	636.	151.20
ROUTED TO	RI	2633.	18.17	1937.	591.	591.	151.20
HYDROGRAPH AT	SUB108	457.	12.67	109.	27.	27.	2.68

ROUTED TO	R108	348.	14.83	109.	27.	27.	2.68
HYDROGRAPH AT	SUB109	1402.	15.33	963.	282.	282.	49.05
ROUTED TO	R109	1386.	16.33	958.	280.	280.	49.05
HYDROGRAPH AT	SUB110	838.	14.67	498.	137.	137.	18.84
HYDROGRAPH AT	SUB111	354.	12.83	89.	22.	22.	2.41
3 COMBINED AT	J	1676.	15.83	1204.	365.	365.	70.29
ROUTED TO	RJ	1624.	18.00	1192.	355.	355.	70.29
HYDROGRAPH AT	SUB112	929.	14.67	560.	154.	154.	15.40
4 COMBINED AT	K	3615.	18.00	2715.	877.	877.	239.57
ROUTED TO	RK	3569.	19.17	2704.	838.	838.	239.57
2 COMBINED AT	L	4118.	18.00	3586.	1185.	1185.	310.12
HYDROGRAPH AT	SUB200	561.	13.33	213.	55.	55.	4.24
2 COMBINED AT	L	4125.	18.00	3604.	1215.	1215.	314.37
HYDROGRAPH AT	SUB201	1049.	13.67	457.	117.	117.	14.68
ROUTED TO	R201	1006.	14.67	455.	117.	117.	14.68
HYDROGRAPH AT	SUB202	663.	14.83	412.	115.	115.	14.98
HYDROGRAPH AT	SUB203	725.	14.67	434.	119.	119.	11.41
3 COMBINED AT	L	1898.	14.67	1032.	279.	279.	41.07
2 COMBINED AT	L	4398.	17.33	4008.	1383.	1383.	355.43
ROUTED TO	RL	4392.	18.17	3990.	1336.	1336.	355.43
HYDROGRAPH AT	SUB204	695.	14.67	421.	116.	116.	12.76
HYDROGRAPH AT	SUB205	1068.	14.83	659.	183.	183.	25.65
3 COMBINED AT	M	4718.	17.00	4285.	1489.	1489.	393.84
ROUTED TO	RM	4697.	18.17	4268.	1425.	1425.	393.84
HYDROGRAPH AT	SUB206	624.	14.00	304.	79.	79.	8.83
ROUTED TO	R206	614.	14.50	303.	79.	79.	8.83
HYDROGRAPH AT	SUB207	473.	14.00	234.	61.	61.	7.49
HYDROGRAPH AT	SUB208	629.	14.50	364.	99.	99.	12.62
4 COMBINED AT	N	4799.	18.00	4362.	1528.	1528.	422.77
ROUTED TO	RN	4779.	18.83	4348.	1463.	1463.	422.77

HYDROGRAPH AT	SUB209	571.	14.83	350.	97.	97.	11.82
HYDROGRAPH AT	SUB210	775.	14.67	462.	127.	127.	16.93
3 COMBINED AT	0	4881.	18.67	4443.	1565.	1565.	451.53

*** NORMAL END OF HEC-1 ***

APPENDIX B

50 Year Peak Discharges

```
LINE        ID.......1.......2.......3.......4.......5.......6.......7.......8.......9......10

  1         ID     GRASS WASH/UPPER CENTENNIAL WASH FLOOD STUDY
  2         ID     FOR THE FLOOD CONTROL DISTRICT OF MARICOPA COUNTY
  3         ID     50 YEAR, 24 HOUR TYPE II STORM
  4         ID     GREEN AND AMPT LOSSES WITH SCS DIMENSIONLESS UNIT HYDROGRAPH
  5         ID
  6         ID     URS CONSULTANTS FILE: FCD.50     NOVEMBER 1989
  7         ID
  8         IT      10 02AUG89    1200     145
  9         ID       5       0
 10         IN      30 02AUG89    1200
 11         JD    3.55      .1
 12         PC       0    .005    .011    .016    .022    .028    .035    .041    .048    .056
 13         PC    .063    .071    .080    .089    .098    .108    .120    .133    .147    .163
 14         PC    .181    .204    .235    .283    .663    .735    .772    .799    .820    .838
 15         PC    .854    .868    .880    .891    .902    .912    .921    .929    .937    .945
 16         PC    .952    .959    .965    .972    .978    .984    .989    .995   1.000
 17         JD    3.37      10
 18         JD    3.27      20
 19         JD    3.20      30
 20         JD    3.05      70
 21         JD    3.02     100
 22         JD    2.95     150
 23         JD    2.84     300
 24         JD    2.84     400
            *    THIS PARTITION CONTAINS GRASS WASH WATERSHED PARAMETERS

 25         KK    SUB1
 26         BA   3.476
 27         LG     .34     .27     7.2     .20
 28         UD    1.05

 29         KK      R1
 30         KM    ROUTE SUBBASIN 1 TO A
 31         RM       1     .07      .2

 32         KK   SUB2A
 33         BA   5.211
 34         LG     .28     .33     4.8     .32
 35         UD    1.07

 36         KK     R2A
 37         KM    ROUTE SUBBASIN 2A TO A
 38         RM      10    1.63      .2

 39         KK   SUB2B
 40         BA   6.983
 41         LG     .31     .30     6.1     .24
 42         UD    2.20

 43         KK       A
 44         KM    COMBINE HYDROGRAPHS FOR SUBBASINS 1, 2A, & 2B
 45         HC       3
```

```
LINE          ID.......1.......2.......3.......4.......5.......6.......7.......8.......9......10

  46          KK      RA
  47          KM     ROUTE A TO B
  48          RM       3     .49      .2

  49          KK    SUB3
  50          BA   3.627
  51          LG     .35     .29     6.4     .20
  52          UD    1.63

  53          KK    SUB4
  54          BA   4.585
  55          LG     .40     .29     6.4     .21
  56          UD    2.07

  57          KK       B
  58          KM     COMBINE HYDROGRAPHS FOR SUBBASINS A, 3, & 4
  59          HC       3

  60          KK      RB
  61          KM     ROUTE B TO C
  62          RM       3    0.47      .2

  63          KK   SUB5A
  64          BA   2.013
  65          LG     .26     .35     3.5     .40
  66          UD     .49

  67          KK     R5A
  68          KM     ROUTE SUBBASIN 5A TO C
  69          RM       9    1.52      .2

  70          KK   SUB5B
  71          BA   5.437
  72          LG     .34     .32     5.2     .28
  73          UD    1.60

  74          KK    SUB6
  75          BA   8.572
  76          LG     .38     .27     7.2     .22
  77          UD    3.08

  78          KK       C
  79          KM     COMBINE HYDROGRAPHS FOR SUBBASINS 5A, 5B, 6 & B
  80          HC       4

  81          KK      RC
  82          KM     ROUTE C TO F
  83          RM       4    0.72      .2
```

```
LINE          ID.......1.......2.......3.......4.......5.......6.......7.......8.......9......10

 84           KK   SUB7A
 85           BA   2.247
 86           LG     .30     .32     5.1     .29
 87           UD     .85

 88           KK     R7A
 89           KM     ROUTE SUBBBASIN 7A TO D
 90           RM      12    1.97      .2

 91           KK   SUB7B
 92           BA   4.947
 93           LG     .35     .32     5.1     .33
 94           UD    1.39

 95           KK       D
 96           KM     COMBINE HYDROGRAPHS FOR SUBBASINS 7A & 7B
 97           HC       2

 98           KK      RD
 99           KM     ROUTE D TO E
100           RM       3     .52      .2

101           KK    SUB8
102           BA   2.134
103           LG     .34     .31     5.4     .31
104           UD    1.08

105           KK      R8
106           KM     ROUTE SUBBASIN 8 TO E
107           RM       2    0.33      .2

108           KK    SUB9
109           BA   5.339
110           LG     .33     .32     5.0     .31
111           UD    1.79

112           KK       E
113           KM     COMBINE HYDROGRAPHS FROM SUBBASINS D, 8 & 9
114           HC       3

115           KK      RE
116           KM     ROUTE E TO F
117           RM      12    1.95      .2

118           KK   SUB10
119           BA   6.342
120           LG     .41     .24     8.3     .14       1
121           UD    3.34
```

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LINE          ID.......1.......2.......3.......4.......5.......6.......7.......8.......9......10

 122          KK   SUB11
 123          BA   3.122
 124          LG     .36     .30     5.7     .25
 125          UD    1.14

 126          KK   SUB12
 127          BA   2.594
 128          LG     .34     .32     5.1     .29
 129          UD    1.20

 130          KK      F
 131          KM    COMBINE HYDROGRAPHS FOR SUBBASINS C, E, 10, 11, & 12
 132          HC      5

 133          KK   SUB13
 134          BA   3.921
 135          LG     .46     .22     9.5     .09       1
 136          UD    1.91

 137          KK    R13
 138          KM    ROUTE SUBBASIN 13 TO F
 139          RM      2     .27      .2

 140          KK      F
 141          KM    COMBINE SUBBASIN 13 AND F
 142          HC      2

 143          KK     RF
 144          KM     ROUTE F TO L
 145          RM      6     .98      .2
              *    THIS PARTITION CONTAINS AGUILA FARM CHANNEL WATERSHED PARAMETERS

 146          KK  SUB100
 147          BA  58.270
 148          LG     .33     .35     3.5     .40
 149          UD    3.61

 150          KK  DIV100
 151          KM     DIVERT 50% OF THIS WATERSHED'S RUNOFF TO SOLS WASH WATERSHED
 152          KM     REMAINING 50% DRAINS TO STUDY AREA
 153          DT    SOLS
 154          DI      0   10000
 155          DQ      0    5000

 156          KK    R100
 157          KM       ROUTE SUBBASIN 100 TO G
 158          RM     11    1.81      .2

 159          KK  SUB101
 160          BA   9.366
 161          LG     .34     .32     5.1     .28
 162          UD    2.52
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LINE          ID.......1.......2.......3.......4.......5.......6.......7.......8.......9......10

 163          KK  SUB102
 164          BA   5.249
 165          LG     .34     .32     5.1     .28
 166          UD    1.69

 167          KK       G
 168          KM   COMBINE HYDROGRAPHS FOR SUBBASINS 100, 101, & 102
 169          HC       3

 170          KK      RG
 171          KM        ROUTE G TO I
 172          RM      15    2.46      .2

 173          KK  SUB103
 174          BA  13.657
 175          LG     .34     .32     5.0     .29
 176          UD    2.88

 177          KK    R103
 178          KM        ROUTE SUBBASIN 103 TO I
 179          RM       7    1.23      .2

 180          KK  SUB104
 181          BA  28.196
 182          LG     .33     .32     4.8     .31
 183          UD    3.23

 184          KK  SUB105
 185          BA  19.795
 186          LG     .34     .31     5.2     .27
 187          UD    2.73

 188          KK       I
 189          KM        COMBINE HYDROGRAPHS FOR SUBBASINS 103, 104, 105, & G
 190          HC       4

 191          KK  SUB106
 192          BA   5.746
 193          LG     .32     .35     3.5     .40
 194          UD    1.15

 195          KK    R106
 196          KM        ROUTE SUBBASIN 106 TO H
 197          RM      12    1.95      .2

 198          KK  SUB107
 199          BA  10.919
 200          LG     .33     .35     3.7     .38
 201          UD    1.57
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LINE          ID.......1.......2.......3.......4.......5.......6.......7.......8.......9......10

 202          KK       H
 203          KM        COMBINE HYDROGRAPHS FOR SUBBASINS 106 & 107
 204          HC       2

 205          KK      RH
 206          KM        ROUTE H TO I
 207          RM       1     .13      .2

 208          KK       I
 209          KM        COMBINE HYDROGRAPHS FOR SUBBASINS H & I
 210          HC       2

 211          KK      RI
 212          KM        ROUTE I TO K
 213          RM      17    2.82      .2

 214          KK  SUB108
 215          BA   2.685
 216          LG     .34     .28     6.8     .26
 217          UD     .95

 218          KK    R108
 219          KM        ROUTE SUBBASIN 108 TO K
 220          RM      12    2.04      .2

 221          KK  SUB109
 222          BA  49.047
 223          LG     .34     .35     3.6     .39
 224          UD    3.57

 225          KK    R109
 226          KM        ROUTE SUBBASIN 109 TO J
 227          RM       6     .98      .2

 228          KK  SUB110
 229          BA  18.838
 230          LG     .33     .34     3.8     .39
 231          UD    2.84

 232          KK  SUB111
 233          BA   2.406
 234          LG     .32     .34     3.8     .38
 235          UD    1.02

 236          KK       J
 237          KM        COMBINE HYDROGRAPHS FOR SUBBASINS 109, 110, & 111
 238          HC       3

 239          KK      RJ
 240          KM        ROUTE J TO K
 241          RM      13    2.13      .2
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LINE        ID.......1.......2.......3.......4.......5.......6.......7.......8.......9......10

242         KK  SUB112
243         BA  15.399
244         LG    .37     .28     6.6     .23
245         UD   2.90

246         KK      K
247         KM       COMBINE HYDROGRAPHS FOR SUBBASINS I, J, 108 & 112
248         HC      4

249         KK     RK
250         KM       ROUTE K TO L
251         RM      7    1.09      .2

252         KK      L
253         KM       COMBINE HYDROGRAPHS FOR F AND K
254         HC      2
            *      THIS PARTITION CONTAINS UPPER CENTENNIAL WASH WATERSHED PARAMETERS

255         KK  SUB200
256         BA   4.243
257         LG    .49     .28     6.8     .16       1
258         UD   1.61

259         KK      L
260         KM       COMBINE HYDROGRAPHS FOR SUBBASINS L AND 200
261         HC      2

262         KK  SUB201
263         BA  14.675
264         LG    .33     .34     3.8     .38
265         UD   1.91

266         KK   R201
267         KM       ROUTE SUBBASIN 201 TO L
268         RM      6     .94      .2

269         KK  SUB202
270         BA  14.982
271         LG    .36     .34     4.2     .35
272         UD   3.04

273         KK  SUB203
274         BA  11.412
275         LG    .35     .31     5.3     .26
276         UD   2.87

277         KK      L
278         KM       COMBINE HYDROGRAPHS FOR SUBBASINS 201, 202 & 203
279         HC      3
```

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LINE        ID.......1.......2.......3.......4.......5.......6.......7.......8.......9......10

 280        KK       L
 281        KM        COMBINE HYDROGRAPHS FOR ALL SUBBASINS AT L
 282        HC       2

 283        KK      RL
 284        KM        ROUTE L TO M
 285        RM       6     .99      .2

 286        KK  SUB204
 287        BA  12.760
 288        LG     .39     .29     6.1     .26
 289        UD    2.92

 290        KK  SUB205
 291        BA  25.645
 292        LG     .35     .33     4.4     .34
 293        UD    3.00

 294        KK       M
 295        KM        COMBINE HYDROGRAPHS AT M
 296        HC       3

 297        KK      RM
 298        KM        ROUTE M TO N
 299        RM       6     .98      .2

 300        KK  SUB206
 301        BA   8.831
 302        LG     .37     .32     5.1     .30
 303        UD    2.18

 304        KK    R206
 305        KM        ROUTE SUBBASIN 206 TO N
 306        RM       3     .47      .2

 307        KK  SUB207
 308        BA   7.488
 309        LG     .36     .33     4.5     .35
 310        UD    2.22

 311        KK  SUB208
 312        BA  12.616
 313        LG     .35     .34     4.0     .37
 314        UD    2.74

 315        KK       N
 316        KM        COMBINE HYDROGRAPHS FOR SUBBASINS M, 206, 207, & 208
 317        HC       4
```

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LINE        ID.......1.......2.......3.......4.......5.......6.......7.......8.......9......10

 318        KK      RN
 319        KM        ROUTE N TO O
 320        RM       4     .74      .2

 321        KK  SUB209
 322        BA  11.824
 323        LG     .32     .34     3.9     .38
 324        UD    2.97

 325        KK  SUB210
 326        BA  16.930
 327        LG     .34     .35     3.6     .39
 328        UD    2.85

 329        KK       O
 330        KM        COMBINE HYDROGRAPHS FOR N, 208, & 209
 331        HC       3
 332        ZZ
```

```
****************************************
*                                      *
*  FLOOD HYDROGRAPH PACKAGE  (HEC-1)   *
*     BY THE COE IN FEBRUARY 1981      *
*          REVISED 02 AUG 88           *
*                                      *
* RUN DATE  04/16/1990  TIME  14:01:23 *
*                                      *
****************************************
```

```
****************************************
*                                      *
*     DODSON AND ASSOCIATES, INC.      *
*  HYDROLOGIST AND CIVIL ENGINEERS     *
*      7015 W TIDWELL SUITE 107        *
*        HOUSTON, TEXAS  77092         *
*           (713) 895-8322             *
*                                      *
****************************************
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GRASS WASH/UPPER CENTENNIAL WASH FLOOD STUDY
FOR THE FLOOD CONTROL DISTRICT OF MARICOPA COUNTY
50 YEAR, 24 HOUR TYPE II STORM
GREEN AND AMPT LOSSES WITH SCS DIMENSIONLESS UNIT HYDROGRAPH

URS CONSULTANTS FILE: FCD.50 NOVEMBER 1989

```
 9 IO        OUTPUT CONTROL VARIABLES
                  IPRNT          5  PRINT CONTROL
                  IPLOT          0  PLOT CONTROL
                  QSCAL         0.  HYDROGRAPH PLOT SCALE

   IT        HYDROGRAPH TIME DATA
                   NMIN         10  MINUTES IN COMPUTATION INTERVAL
                  IDATE     2AUG89  STARTING DATE
                  ITIME       1200  STARTING TIME
                     NQ        145  NUMBER OF HYDROGRAPH ORDINATES
                 NDDATE     3AUG89  ENDING DATE
                 NDTIME       1200  ENDING TIME
                  ICENT         19  CENTURY MARK

            COMPUTATION INTERVAL     .17 HOURS
                 TOTAL TIME BASE   24.00 HOURS

       ENGLISH UNITS
           DRAINAGE AREA         SQUARE MILES
           PRECIPITATION DEPTH   INCHES
           LENGTH, ELEVATION     FEET
           FLOW                  CUBIC FEET PER SECOND
           STORAGE VOLUME        ACRE-FEET
           SURFACE AREA          ACRES
           TEMPERATURE           DEGREES FAHRENHEIT

11 JD        INDEX STORM NO. 1
                  STRM       3.55  PRECIPITATION DEPTH
                  TRDA        .10  TRANSPOSITION DRAINAGE AREA

12 PI          PRECIPITATION PATTERN
                 .00      .00      .00      .00      .00      .00      .00      .00      .00      .00
                 .00      .00      .00      .00      .00      .00      .00      .00      .00      .00
                 .00      .00      .00      .00      .00      .00      .00      .00      .00      .00
                 .00      .00      .00      .00      .00      .00      .00      .00      .00      .00
                 .00      .00      .00      .00      .00      .00      .00      .00      .00      .00
                 .00      .00      .00      .00      .01      .01      .01      .01      .01      .01
                 .01      .01      .01      .01      .01      .01      .02      .02      .02      .13
```

.13	.13	.02	.02	.02	.01	.01	.01	.01	.01
.01	.01	.01	.01	.01	.01	.01	.01	.01	.01
.00	.00	.00	.00	.00	.00	.00	.00	.00	.00
.00	.00	.00	.00	.00	.00	.00	.00	.00	.00
.00	.00	.00	.00	.00	.00	.00	.00	.00	.00
.00	.00	.00	.00	.00	.00	.00	.00	.00	.00
.00	.00	.00	.00	.00	.00	.00	.00	.00	.00
.00	.00	.00	.00						

17 JD INDEX STORM NO. 2

STRM 3.37 PRECIPITATION DEPTH

TRDA 10.00 TRANSPOSITION DRAINAGE AREA

0 PI PRECIPITATION PATTERN

.00	.00	.00	.00	.00	.00	.00	.00	.00	.00
.00	.00	.00	.00	.00	.00	.00	.00	.00	.00
.00	.00	.00	.00	.00	.00	.00	.00	.00	.00
.00	.00	.00	.00	.00	.00	.00	.00	.00	.00
.00	.00	.00	.00	.00	.00	.00	.00	.00	.00
.00	.00	.00	.00	.01	.01	.01	.01	.01	.01
.01	.01	.01	.01	.01	.01	.02	.02	.02	.13
.13	.13	.02	.02	.02	.01	.01	.01	.01	.01
.01	.01	.01	.01	.01	.01	.01	.01	.01	.01
.00	.00	.00	.00	.00	.00	.00	.00	.00	.00
.00	.00	.00	.00	.00	.00	.00	.00	.00	.00
.00	.00	.00	.00	.00	.00	.00	.00	.00	.00
.00	.00	.00	.00	.00	.00	.00	.00	.00	.00
.00	.00	.00	.00	.00	.00	.00	.00	.00	.00
.00	.00	.00	.00						

18 JD INDEX STORM NO. 3

STRM 3.27 PRECIPITATION DEPTH

TRDA 20.00 TRANSPOSITION DRAINAGE AREA

0 PI PRECIPITATION PATTERN

.00	.00	.00	.00	.00	.00	.00	.00	.00	.00
.00	.00	.00	.00	.00	.00	.00	.00	.00	.00
.00	.00	.00	.00	.00	.00	.00	.00	.00	.00
.00	.00	.00	.00	.00	.00	.00	.00	.00	.00
.00	.00	.00	.00	.00	.00	.00	.00	.00	.00
.00	.00	.00	.00	.01	.01	.01	.01	.01	.01
.01	.01	.01	.01	.01	.01	.02	.02	.02	.13
.13	.13	.02	.02	.02	.01	.01	.01	.01	.01
.01	.01	.01	.01	.01	.01	.01	.01	.01	.01
.00	.00	.00	.00	.00	.00	.00	.00	.00	.00
.00	.00	.00	.00	.00	.00	.00	.00	.00	.00
.00	.00	.00	.00	.00	.00	.00	.00	.00	.00
.00	.00	.00	.00	.00	.00	.00	.00	.00	.00
.00	.00	.00	.00	.00	.00	.00	.00	.00	.00
.00	.00	.00	.00						

19 JD INDEX STORM NO. 4

STRM 3.20 PRECIPITATION DEPTH

TRDA 30.00 TRANSPOSITION DRAINAGE AREA

0 PI PRECIPITATION PATTERN

.00	.00	.00	.00	.00	.00	.00	.00	.00	.00
.00	.00	.00	.00	.00	.00	.00	.00	.00	.00
.00	.00	.00	.00	.00	.00	.00	.00	.00	.00
.00	.00	.00	.00	.00	.00	.00	.00	.00	.00

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          .00       .00       .00       .00       .00       .00       .00       .00       .00       .00
          .00       .00       .00       .00       .01       .01       .01       .01       .01       .01
          .01       .01       .01       .01       .01       .01       .02       .02       .02       .13
          .13       .13       .02       .02       .02       .01       .01       .01       .01       .01
          .01       .01       .01       .01       .01       .01       .01       .01       .01       .01
          .00       .00       .00       .00       .00       .00       .00       .00       .00       .00
          .00       .00       .00       .00       .00       .00       .00       .00       .00       .00
          .00       .00       .00       .00       .00       .00       .00       .00       .00       .00
          .00       .00       .00       .00       .00       .00       .00       .00       .00       .00
          .00       .00       .00       .00       .00       .00       .00       .00       .00       .00
          .00       .00       .00       .00

20 JD     INDEX STORM NO. 5
            STRM        3.05  PRECIPITATION DEPTH
            TRDA       70.00  TRANSPOSITION DRAINAGE AREA

 0 PI      PRECIPITATION PATTERN
          .00       .00       .00       .00       .00       .00       .00       .00       .00       .00
          .00       .00       .00       .00       .00       .00       .00       .00       .00       .00
          .00       .00       .00       .00       .00       .00       .00       .00       .00       .00
          .00       .00       .00       .00       .00       .00       .00       .00       .00       .00
          .00       .00       .00       .00       .00       .00       .00       .00       .00       .00
          .00       .00       .00       .00       .01       .01       .01       .01       .01       .01
          .01       .01       .01       .01       .01       .01       .02       .02       .02       .13
          .13       .13       .02       .02       .02       .01       .01       .01       .01       .01
          .01       .01       .01       .01       .01       .01       .01       .01       .01       .01
          .00       .00       .00       .00       .00       .00       .00       .00       .00       .00
          .00       .00       .00       .00       .00       .00       .00       .00       .00       .00
          .00       .00       .00       .00       .00       .00       .00       .00       .00       .00
          .00       .00       .00       .00       .00       .00       .00       .00       .00       .00
          .00       .00       .00       .00       .00       .00       .00       .00       .00       .00
          .00       .00       .00       .00

21 JD     INDEX STORM NO. 6
            STRM        3.02  PRECIPITATION DEPTH
            TRDA      100.00  TRANSPOSITION DRAINAGE AREA

 0 PI      PRECIPITATION PATTERN
          .00       .00       .00       .00       .00       .00       .00       .00       .00       .00
          .00       .00       .00       .00       .00       .00       .00       .00       .00       .00
          .00       .00       .00       .00       .00       .00       .00       .00       .00       .00
          .00       .00       .00       .00       .00       .00       .00       .00       .00       .00
          .00       .00       .00       .00       .00       .00       .00       .00       .00       .00
          .00       .00       .00       .00       .01       .01       .01       .01       .01       .01
          .01       .01       .01       .01       .01       .01       .02       .02       .02       .13
          .13       .13       .02       .02       .02       .01       .01       .01       .01       .01
          .01       .01       .01       .01       .01       .01       .01       .01       .01       .01
          .00       .00       .00       .00       .00       .00       .00       .00       .00       .00
          .00       .00       .00       .00       .00       .00       .00       .00       .00       .00
          .00       .00       .00       .00       .00       .00       .00       .00       .00       .00
          .00       .00       .00       .00       .00       .00       .00       .00       .00       .00
          .00       .00       .00       .00       .00       .00       .00       .00       .00       .00
          .00       .00       .00       .00

22 JD     INDEX STORM NO. 7
            STRM        2.95  PRECIPITATION DEPTH
            TRDA      150.00  TRANSPOSITION DRAINAGE AREA
```

.00	.00	.00	.00	.00	.00	.00	.00	.00	.00
.00	.00	.00	.00	.00	.00	.00	.00	.00	.00
.00	.00	.00	.00	.00	.00	.00	.00	.00	.00
.00	.00	.00	.00	.00	.00	.00	.00	.00	.00
.00	.00	.00	.00	.01	.01	.01	.01	.01	.01
.01	.01	.01	.01	.01	.01	.02	.02	.02	.13
.13	.13	.02	.02	.02	.01	.01	.01	.01	.01
.01	.01	.01	.01	.01	.01	.01	.01	.01	.01
.00	.00	.00	.00	.00	.00	.00	.00	.00	.00
.00	.00	.00	.00	.00	.00	.00	.00	.00	.00
.00	.00	.00	.00	.00	.00	.00	.00	.00	.00
.00	.00	.00	.00	.00	.00	.00	.00	.00	.00
.00	.00	.00	.00	.00	.00	.00	.00	.00	.00
.00	.00	.00	.00						

23 JD INDEX STORM NO. 8

STRM 2.84 PRECIPITATION DEPTH

TRDA 300.00 TRANSPOSITION DRAINAGE AREA

0 PI PRECIPITATION PATTERN

.00	.00	.00	.00	.00	.00	.00	.00	.00	.00
.00	.00	.00	.00	.00	.00	.00	.00	.00	.00
.00	.00	.00	.00	.00	.00	.00	.00	.00	.00
.00	.00	.00	.00	.00	.00	.00	.00	.00	.00
.00	.00	.00	.00	.00	.00	.00	.00	.00	.00
.00	.00	.00	.00	.01	.01	.01	.01	.01	.01
.01	.01	.01	.01	.01	.01	.02	.02	.02	.13
.13	.13	.02	.02	.02	.01	.01	.01	.01	.01
.01	.01	.01	.01	.01	.01	.01	.01	.01	.01
.00	.00	.00	.00	.00	.00	.00	.00	.00	.00
.00	.00	.00	.00	.00	.00	.00	.00	.00	.00
.00	.00	.00	.00	.00	.00	.00	.00	.00	.00
.00	.00	.00	.00	.00	.00	.00	.00	.00	.00
.00	.00	.00	.00	.00	.00	.00	.00	.00	.00
.00	.00	.00	.00						

24 JD INDEX STORM NO. 9

STRM 2.84 PRECIPITATION DEPTH

TRDA 400.00 TRANSPOSITION DRAINAGE AREA

0 PI PRECIPITATION PATTERN

.00	.00	.00	.00	.00	.00	.00	.00	.00	.00
.00	.00	.00	.00	.00	.00	.00	.00	.00	.00
.00	.00	.00	.00	.00	.00	.00	.00	.00	.00
.00	.00	.00	.00	.00	.00	.00	.00	.00	.00
.00	.00	.00	.00	.00	.00	.00	.00	.00	.00
.00	.00	.00	.00	.01	.01	.01	.01	.01	.01
.01	.01	.01	.01	.01	.01	.02	.02	.02	.13
.13	.13	.02	.02	.02	.01	.01	.01	.01	.01
.01	.01	.01	.01	.01	.01	.01	.01	.01	.01
.00	.00	.00	.00	.00	.00	.00	.00	.00	.00
.00	.00	.00	.00	.00	.00	.00	.00	.00	.00
.00	.00	.00	.00	.00	.00	.00	.00	.00	.00
.00	.00	.00	.00	.00	.00	.00	.00	.00	.00
.00	.00	.00	.00	.00	.00	.00	.00	.00	.00
.00	.00	.00	.00						

RUNOFF SUMMARY
FLOW IN CUBIC FEET PER SECOND
TIME IN HOURS, AREA IN SQUARE MILES

OPERATION	STATION	PEAK FLOW	TIME OF PEAK	AVERAGE FLOW FOR MAXIMUM PERIOD 6-HOUR	24-HOUR	72-HOUR	BASIN AREA	MAXIMUM STAGE	TIME OF MAX STAGE
HYDROGRAPH AT	SUB1	1373.	12.83	356.	89.	89.	3.48		
ROUTED TO	R1	1364.	12.83	356.	89.	89.	3.48		
HYDROGRAPH AT	SUB2A	1805.	12.83	475.	119.	119.	5.21		
ROUTED TO	R2A	1490.	14.50	474.	119.	119.	5.21		
HYDROGRAPH AT	SUB2B	1326.	14.00	651.	170.	170.	6.98		
3 COMBINED AT	A	2829.	14.33	1409.	360.	360.	15.67		
ROUTED TO	RA	2763.	14.83	1405.	360.	360.	15.67		
HYDROGRAPH AT	SUB3	969.	13.33	370.	93.	93.	3.63		
HYDROGRAPH AT	SUB4	946.	13.83	441.	114.	114.	4.59		
3 COMBINED AT	B	3901.	14.00	2094.	538.	538.	23.88		
ROUTED TO	RB	3877.	14.50	2090.	538.	538.	23.88		
HYDROGRAPH AT	SUB5A	1269.	12.33	182.	46.	46.	2.01		
ROUTED TO	R5A	820.	13.83	182.	46.	46.	2.01		
HYDROGRAPH AT	SUB5B	1342.	13.33	502.	127.	127.	5.44		
HYDROGRAPH AT	SUB6	1165.	14.83	731.	205.	205.	8.57		
4 COMBINED AT	C	5948.	14.00	3199.	839.	839.	39.90		
ROUTED TO	RC	5756.	14.83	3186.	839.	839.	39.90		
HYDROGRAPH AT	SUB7A	989.	12.67	214.	54.	54.	2.25		
ROUTED TO	R7A	732.	14.67	214.	54.	54.	2.25		
HYDROGRAPH AT	SUB7B	1293.	13.17	428.	107.	107.	4.95		
2 COMBINED AT	D	1306.	13.17	633.	159.	159.	7.19		
ROUTED TO	RD	1273.	13.83	632.	159.	159.	7.19		
HYDROGRAPH AT	SUB8	731.	12.83	194.	48.	48.	2.13		
ROUTED TO	R8	698.	13.17	194.	48.	48.	2.13		
HYDROGRAPH AT	SUB9	1150.	13.50	476.	121.	121.	5.34		
					[illegible]	[illegible]	14.67		

ROUTED TO	RE	2548.	15.67	1234.	314.	314.	14.67
HYDROGRAPH AT	SUB10	934.	15.17	619.	179.	179.	6.34
HYDROGRAPH AT	SUB11	1087.	12.83	304.	76.	76.	3.12
HYDROGRAPH AT	SUB12	835.	13.00	243.	61.	61.	2.59
5 COMBINED AT	F	8155.	15.17	4884.	1318.	1318.	66.63
HYDROGRAPH AT	SUB13	1106.	13.67	489.	126.	126.	3.92
ROUTED TO	R13	1094.	14.00	488.	126.	126.	3.92
2 COMBINED AT	F	8660.	15.00	5256.	1415.	1415.	70.55
ROUTED TO	RF	8466.	16.00	5225.	1413.	1413.	70.55
HYDROGRAPH AT	SUB100	5014.	15.33	3468.	1020.	1020.	58.27
DIVERSION TO	SOLS	2507.	15.33	1734.	510.	510.	58.27
HYDROGRAPH AT	DIV100	2507.	15.33	1734.	510.	510.	58.27
ROUTED TO	R100	2451.	17.17	1717.	500.	500.	58.27
HYDROGRAPH AT	SUB101	1491.	14.33	813.	217.	217.	9.37
HYDROGRAPH AT	SUB102	1234.	13.50	486.	123.	123.	5.25
3 COMBINED AT	G	2768.	16.83	2362.	766.	766.	72.89
ROUTED TO	RG	2712.	19.17	2324.	730.	730.	72.89
HYDROGRAPH AT	SUB103	1845.	14.67	1107.	305.	305.	13.66
ROUTED TO	R103	1796.	15.83	1099.	304.	304.	13.66
HYDROGRAPH AT	SUB104	3141.	15.00	2032.	577.	577.	28.20
HYDROGRAPH AT	SUB105	2814.	14.50	1626.	442.	442.	19.80
4 COMBINED AT	I	7222.	15.50	5376.	1787.	1787.	134.53
HYDROGRAPH AT	SUB106	1769.	12.83	499.	125.	125.	5.75
ROUTED TO	R106	1451.	15.00	498.	125.	125.	5.75
HYDROGRAPH AT	SUB107	2520.	13.33	927.	234.	234.	10.92
2 COMBINED AT	H	2508.	13.50	1359.	344.	344.	16.66
ROUTED TO	RH	2502.	13.67	1358.	344.	344.	16.66
2 COMBINED AT	I	8509.	15.33	6167.	2031.	2031.	151.20
ROUTED TO	RI	8153.	18.00	6068.	1879.	1879.	151.20
HYDROGRAPH AT	SUB108	1061.	12.67	252.	63.	63.	2.68

ROUTED TO	R108	805.	14.83	252.	63.	63.	2.68
HYDROGRAPH AT	SUB109	4362.	15.33	2997.	878.	878.	49.05
ROUTED TO	R109	4313.	16.33	2981.	871.	871.	49.05
HYDROGRAPH AT	SUB110	2323.	14.67	1381.	379.	379.	18.84
HYDROGRAPH AT	SUB111	850.	12.83	215.	54.	54.	2.41
3 COMBINED AT	J	5500.	15.83	3954.	1199.	1199.	70.29
ROUTED TO	RJ	5329.	18.00	3913.	1165.	1165.	70.29
HYDROGRAPH AT	SUB112	2141.	14.67	1290.	356.	356.	15.40
4 COMBINED AT	K	12731.	18.00	9581.	3102.	3102.	239.57
ROUTED TO	RK	12565.	19.00	9541.	2958.	2958.	239.57
2 COMBINED AT	L	14530.	18.17	12365.	4089.	4089.	310.12
HYDROGRAPH AT	SUB200	1179.	13.33	448.	114.	114.	4.24
2 COMBINED AT	L	14545.	18.17	12405.	4171.	4171.	314.37
HYDROGRAPH AT	SUB201	2749.	13.67	1199.	307.	307.	14.68
ROUTED TO	R201	2633.	14.67	1194.	307.	307.	14.68
HYDROGRAPH AT	SUB202	1788.	14.83	1113.	311.	311.	14.98
HYDROGRAPH AT	SUB203	1624.	14.67	973.	267.	267.	11.41
3 COMBINED AT	L	5410.	14.67	2933.	792.	792.	41.07
2 COMBINED AT	L	15332.	17.83	13776.	4801.	4801.	355.43
ROUTED TO	RL	15286.	18.83	13716.	4624.	4624.	355.43
HYDROGRAPH AT	SUB204	1709.	14.67	1035.	286.	286.	12.76
HYDROGRAPH AT	SUB205	2983.	14.83	1841.	512.	512.	25.65
3 COMBINED AT	M	15945.	18.33	14770.	5210.	5210.	393.84
ROUTED TO	RM	15919.	19.17	14714.	4976.	4976.	393.84
HYDROGRAPH AT	SUB206	1551.	14.00	756.	197.	197.	8.83
ROUTED TO	R206	1525.	14.50	755.	197.	197.	8.83
HYDROGRAPH AT	SUB207	1246.	14.00	616.	161.	161.	7.49
HYDROGRAPH AT	SUB208	1676.	14.50	971.	264.	264.	12.62
4 COMBINED AT	N	16133.	18.83	15080.	5402.	5402.	422.77

HYDROGRAPH AT	SUB209	1468.	14.67	900.	250.	250.	11.82
HYDROGRAPH AT	SUB210	2110.	14.67	1257.	345.	345.	16.93
3 COMBINED AT	0	16438.	19.00	15413.	5588.	5588.	451.53

*** NORMAL END OF HEC-1 ***

APPENDIX C

100 Year Peak Discharges

```
LINE          ID.......1.......2.......3.......4.......5.......6.......7.......8.......9......10

  1           ID     GRASS WASH/UPPER CENTENNIAL WASH FLOOD STUDY
  2           ID     FOR THE FLOOD CONTROL DISTRICT OF MARICOPA COUNTY
  3           ID     100 YEAR, 24 HOUR TYPE II STORM
  4           ID     GREEN AND AMPT LOSSES WITH SCS DIMENSIONLESS UNIT HYDROGRAPH
  5           ID
  6           ID     URS CONSULTANTS FILE: FCD.100    NOVEMBER 1989
  7           ID
  8           IT      10 02AUG89    1200     145
  9           IO       5       0
 10           IN      30 02AUG89    1200
 11           JD    4.05      .1
 12           PC       0    .005    .011    .016    .022    .028    .035    .041    .048    .056
 13           PC    .063    .071    .080    .089    .098    .108    .120    .133    .147    .163
 14           PC    .181    .204    .235    .283    .663    .735    .772    .799    .820    .838
 15           PC    .854    .868    .880    .891    .902    .912    .921    .929    .937    .945
 16           PC    .952    .959    .965    .972    .978    .984    .989    .995   1.000
 17           JD    3.85      10
 18           JD    3.73      20
 19           JD    3.65      30
 20           JD    3.48      70
 21           JD    3.44     100
 22           JD    3.36     150
 23           JD    3.24     300
 24           JD    3.24     400
              *    THIS PARTITION CONTAINS GRASS WASH WATERSHED PARAMETERS

 25           KK    SUB1
 26           BA   3.476
 27           LG     .34     .27     7.2     .20
 28           UD    1.05

 29           KK      R1
 30           KM     ROUTE SUBBASIN 1 TO A
 31           RM       1     .07      .2

 32           KK   SUB2A
 33           BA   5.211
 34           LG     .28     .33     4.8     .32
 35           UD    1.07

 36           KK     R2A
 37           KM     ROUTE SUBBASIN 2A TO A
 38           RM      10    1.63      .2

 39           KK   SUB2B
 40           BA   6.983
 41           LG     .31     .30     6.1     .24
 42           UD    2.20

 43           KK      A
 44           KM     COMBINE HYDROGRAPHS FOR SUBBASINS 1, 2A, & 2B
 45           HC      3
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LINE          ID.......1.......2.......3.......4.......5.......6.......7.......8.......9......10

  46          KK      RA
  47          KM     ROUTE A TO B
  48          RM       3     .49      .2

  49          KK    SUB3
  50          BA   3.627
  51          LG     .35     .29     6.4     .20
  52          UD    1.63

  53          KK    SUB4
  54          BA   4.585
  55          LG     .40     .29     6.4     .21
  56          UD    2.07

  57          KK       B
  58          KM     COMBINE HYDROGRAPHS FOR SUBBASINS A, 3, & 4
  59          HC       3

  60          KK      RB
  61          KM     ROUTE B TO C
  62          RM       3    0.47      .2

  63          KK   SUB5A
  64          BA   2.013
  65          LG     .26     .35     3.5     .40
  66          UD     .49

  67          KK     R5A
  68          KM     ROUTE SUBBASIN 5A TO C
  69          RM       9    1.52      .2

  70          KK   SUB5B
  71          BA   5.437
  72          LG     .34     .32     5.2     .28
  73          UD    1.60

  74          KK    SUB6
  75          BA   8.572
  76          LG     .38     .27     7.2     .22
  77          UD    3.08

  78          KK       C
  79          KM     COMBINE HYDROGRAPHS FOR SUBBASINS 5A, 5B, 6 & B
  80          HC       4

  81          KK      RC
  82          KM     ROUTE C TO F
  83          RM       4    0.72      .2
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LINE          ID.......1.......2.......3.......4.......5.......6.......7.......8.......9......10

  84          KK   SUB7A
  85          BA   2.247
  86          LG     .30     .32     5.1     .29
  87          UD     .85

  88          KK     R7A
  89          KM     ROUTE SUBBBASIN 7A TO D
  90          RM      12    1.97      .2

  91          KK   SUB7B
  92          BA   4.947
  93          LG     .35     .32     5.1     .33
  94          UD    1.39

  95          KK       D
  96          KM     COMBINE HYDROGRAPHS FOR SUBBASINS 7A & 7B
  97          HC       2

  98          KK      RD
  99          KM     ROUTE D TO E
 100          RM       3     .52      .2

 101          KK    SUB8
 102          BA   2.134
 103          LG     .34     .31     5.4     .31
 104          UD    1.08

 105          KK      R8
 106          KM     ROUTE SUBBASIN 8 TO E
 107          RM       2    0.33      .2

 108          KK    SUB9
 109          BA   5.339
 110          LG     .33     .32     5.0     .31
 111          UD    1.79

 112          KK       E
 113          KM     COMBINE HYDROGRAPHS FROM SUBBASINS D, 8 & 9
 114          HC       3

 115          KK      RE
 116          KM     ROUTE E TO F
 117          RM      12    1.95      .2

 118          KK   SUB10
 119          BA   6.342
 120          LG     .41     .24     8.3     .14       1
 121          UD    3.34
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LINE          ID.......1.......2.......3.......4.......5.......6.......7.......8.......9......10

 122          KK   SUB11
 123          BA   3.122
 124          LG     .36     .30     5.7     .25
 125          UD    1.14

 126          KK   SUB12
 127          BA   2.594
 128          LG     .34     .32     5.1     .29
 129          UD    1.20

 130          KK      F
 131          KM    COMBINE HYDROGRAPHS FOR SUBBASINS C, E, 10, 11, & 12
 132          HC      5

 133          KK   SUB13
 134          BA   3.921
 135          LG     .46     .22     9.5     .09       1
 136          UD    1.91

 137          KK    R13
 138          KM    ROUTE SUBBASIN 13 TO F
 139          RM      2     .27      .2

 140          KK      F
 141          KM    COMBINE SUBBASIN 13 AND F
 142          HC      2

 143          KK     RF
 144          KM     ROUTE F TO L
 145          RM      6     .98      .2
              *    THIS PARTITION CONTAINS AGUILA FARM CHANNEL WATERSHED PARAMETERS

 146          KK  SUB100
 147          BA  58.270
 148          LG     .33     .35     3.5     .40
 149          UD    3.61

 150          KK  DIV100
 151          KM     DIVERT 50% OF THIS WATERSHED'S RUNOFF TO SOLS WASH WATERSHED
 152          KM     REMAINING 50% DRAINS TO STUDY AREA
 153          DT    SOLS
 154          DI      0   10000
 155          DQ      0    5000

 156          KK    R100
 157          KM       ROUTE SUBBASIN 100 TO G
 158          RM     11    1.81      .2

 159          KK  SUB101
 160          BA   9.366
 161          LG     .34     .32     5.1     .28
 162          UD    2.52
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LINE          ID.......1.......2.......3.......4.......5.......6.......7.......8.......9......10

 163          KK  SUB102
 164          BA   5.249
 165          LG     .34     .32     5.1     .28
 166          UD    1.69

 167          KK       G
 168          KM   COMBINE HYDROGRAPHS FOR SUBBASINS 100, 101, & 102
 169          HC       3

 170          KK      RG
 171          KM        ROUTE G TO I
 172          RM      15    2.46      .2

 173          KK  SUB103
 174          BA  13.657
 175          LG     .34     .32     5.0     .29
 176          UD    2.88

 177          KK    R103
 178          KM        ROUTE SUBBASIN 103 TO I
 179          RM       7    1.23      .2

 180          KK  SUB104
 181          BA  28.196
 182          LG     .33     .32     4.8     .31
 183          UD    3.23

 184          KK  SUB105
 185          BA  19.795
 186          LG     .34     .31     5.2     .27
 187          UD    2.73

 188          KK       I
 189          KM        COMBINE HYDROGRAPHS FOR SUBBASINS 103, 104, 105, & G
 190          HC       4

 191          KK  SUB106
 192          BA   5.746
 193          LG     .32     .35     3.5     .40
 194          UD    1.15

 195          KK    R106
 196          KM        ROUTE SUBBASIN 106 TO H
 197          RM      12    1.95      .2

 198          KK  SUB107
 199          BA  10.919
 200          LG     .33     .35     3.7     .38
 201          UD    1.57
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LINE          ID.......1.......2.......3.......4.......5.......6.......7.......8.......9......10

 202          KK       H
 203          KM        COMBINE HYDROGRAPHS FOR SUBBASINS 106 & 107
 204          HC       2

 205          KK      RH
 206          KM        ROUTE H TO I
 207          RM       1     .13      .2

 208          KK       I
 209          KM        COMBINE HYDROGRAPHS FOR SUBBASINS H & I
 210          HC       2

 211          KK      RI
 212          KM        ROUTE I TO K
 213          RM      17    2.82      .2

 214          KK  SUB108
 215          BA   2.685
 216          LG     .34     .28     6.8     .26
 217          UD     .95

 218          KK    R108
 219          KM        ROUTE SUBBASIN 108 TO K
 220          RM      12    2.04      .2

 221          KK  SUB109
 222          BA  49.047
 223          LG     .34     .35     3.6     .39
 224          UD    3.57

 225          KK    R109
 226          KM        ROUTE SUBBASIN 109 TO J
 227          RM       6     .98      .2

 228          KK  SUB110
 229          BA  18.838
 230          LG     .33     .34     3.8     .39
 231          UD    2.84

 232          KK  SUB111
 233          BA   2.406
 234          LG     .32     .34     3.8     .38
 235          UD    1.02

 236          KK       J
 237          KM        COMBINE HYDROGRAPHS FOR SUBBASINS 109, 110, & 111
 238          HC       3

 239          KK      RJ
 240          KM        ROUTE J TO K
 241          RM      13    2.13      .2
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LINE          ID.......1.......2.......3.......4.......5.......6.......7.......8.......9......10

 242          KK  SUB112
 243          BA  15.399
 244          LG    .37     .28     6.6     .23
 245          UD   2.90

 246          KK      K
 247          KM       COMBINE HYDROGRAPHS FOR SUBBASINS I, J, 108 & 112
 248          HC      4

 249          KK     RK
 250          KM       ROUTE K TO L
 251          RM      7    1.09      .2

 252          KK      L
 253          KM       COMBINE HYDROGRAPHS FOR F AND K
 254          HC      2
              *      THIS PARTITION CONTAINS UPPER CENTENNIAL WASH WATERSHED PARAMETERS

 255          KK  SUB200
 256          BA   4.243
 257          LG    .49     .28     6.8     .16       1
 258          UD   1.61

 259          KK      L
 260          KM       COMBINE HYDROGRAPHS FOR SUBBASINS L AND 200
 261          HC      2

 262          KK  SUB201
 263          BA  14.675
 264          LG    .33     .34     3.8     .38
 265          UD   1.91

 266          KK   R201
 267          KM       ROUTE SUBBASIN 201 TO L
 268          RM      6     .94      .2

 269          KK  SUB202
 270          BA  14.982
 271          LG    .36     .34     4.2     .35
 272          UD   3.04

 273          KK  SUB203
 274          BA  11.412
 275          LG    .35     .31     5.3     .26
 276          UD   2.87

 277          KK      L
 278          KM       COMBINE HYDROGRAPHS FOR SUBBASINS 201, 202 & 203
 279          HC      3
```

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LINE          ID.......1.......2.......3.......4.......5.......6.......7.......8.......9......10

 280          KK      L
 281          KM       COMBINE HYDROGRAPHS FOR ALL SUBBASINS AT L
 282          HC      2

 283          KK     RL
 284          KM       ROUTE L TO M
 285          RM      6     .99      .2

 286          KK  SUB204
 287          BA  12.760
 288          LG    .39     .29     6.1     .26
 289          UD   2.92

 290          KK  SUB205
 291          BA  25.645
 292          LG    .35     .33     4.4     .34
 293          UD   3.00

 294          KK      M
 295          KM       COMBINE HYDROGRAPHS AT M
 296          HC      3

 297          KK     RM
 298          KM       ROUTE M TO N
 299          RM      6     .98      .2

 300          KK  SUB206
 301          BA   8.831
 302          LG    .37     .32     5.1     .30
 303          UD   2.18

 304          KK   R206
 305          KM       ROUTE SUBBASIN 206 TO N
 306          RM      3     .47      .2

 307          KK  SUB207
 308          BA   7.488
 309          LG    .36     .33     4.5     .35
 310          UD   2.22

 311          KK  SUB208
 312          BA  12.616
 313          LG    .35     .34     4.0     .37
 314          UD   2.74

 315          KK      N
 316          KM       COMBINE HYDROGRAPHS FOR SUBBASINS M, 206, 207, & 208
 317          HC      4
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LINE          ID.......1.......2.......3.......4.......5.......6.......7.......8.......9......10

 318          KK      RN
 319          KM        ROUTE N TO O
 320          RM       4     .74      .2

 321          KK  SUB209
 322          BA  11.824
 323          LG     .32     .34     3.9     .38
 324          UD    2.97

 325          KK  SUB210
 326          BA  16.930
 327          LG     .34     .35     3.6     .39
 328          UD    2.85

 329          KK       O
 330          KM        COMBINE HYDROGRAPHS FOR N, 208, & 209
 331          HC       3
 332          ZZ
```

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*************************************
*                                   *
*  FLOOD HYDROGRAPH PACKAGE  (HEC-1)*
*     BY THE COE IN FEBRUARY 1981   *
*         REVISED 02 AUG 88         *
*                                   *
* RUN DATE  04/16/1990  TIME  13:46:38 *
*                                   *
*************************************
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*************************************
*                                   *
*    DODSON AND ASSOCIATES, INC.    *
*  HYDROLOGIST AND CIVIL ENGINEERS  *
*     7015 W TIDWELL SUITE 107      *
*       HOUSTON, TEXAS  77092       *
*          (713) 895-8322           *
*                                   *
*************************************
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GRASS WASH/UPPER CENTENNIAL WASH FLOOD STUDY
FOR THE FLOOD CONTROL DISTRICT OF MARICOPA COUNTY
100 YEAR, 24 HOUR TYPE II STORM
GREEN AND AMPT LOSSES WITH SCS DIMENSIONLESS UNIT HYDROGRAPH

URS CONSULTANTS FILE: FCD.100 NOVEMBER 1989

```
 9 IO        OUTPUT CONTROL VARIABLES
                  IPRNT          5  PRINT CONTROL
                  IPLOT          0  PLOT CONTROL
                  QSCAL         0.  HYDROGRAPH PLOT SCALE

   IT        HYDROGRAPH TIME DATA
                   NMIN         10  MINUTES IN COMPUTATION INTERVAL
                  IDATE     2AUG89  STARTING DATE
                  ITIME       1200  STARTING TIME
                     NQ        145  NUMBER OF HYDROGRAPH ORDINATES
                 NDDATE     3AUG89  ENDING DATE
                 NDTIME       1200  ENDING TIME
                  ICENT         19  CENTURY MARK

            COMPUTATION INTERVAL     .17 HOURS
                 TOTAL TIME BASE   24.00 HOURS

      ENGLISH UNITS
          DRAINAGE AREA         SQUARE MILES
          PRECIPITATION DEPTH   INCHES
          LENGTH, ELEVATION     FEET
          FLOW                  CUBIC FEET PER SECOND
          STORAGE VOLUME        ACRE-FEET
          SURFACE AREA          ACRES
          TEMPERATURE           DEGREES FAHRENHEIT

 11 JD       INDEX STORM NO. 1
                  STRM       4.05  PRECIPITATION DEPTH
                  TRDA        .10  TRANSPOSITION DRAINAGE AREA

 12 PI        PRECIPITATION PATTERN
                 .00      .00      .00      .00      .00      .00      .00      .00      .00      .00
                 .00      .00      .00      .00      .00      .00      .00      .00      .00      .00
                 .00      .00      .00      .00      .00      .00      .00      .00      .00      .00
                 .00      .00      .00      .00      .00      .00      .00      .00      .00      .00
                 .00      .00      .00      .00      .00      .00      .00      .00      .00      .00
                 .00      .00      .00      .00      .01      .01      .01      .01      .01      .01
                 .01      .01      .01      .01      .01      .01      .02      .02      .02      .13
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            .13      .13      .02      .02      .02      .01      .01      .01      .01      .01
            .01      .01      .01      .01      .01      .01      .01      .01      .01      .01
            .00      .00      .00      .00      .00      .00      .00      .00      .00      .00
            .00      .00      .00      .00      .00      .00      .00      .00      .00      .00
            .00      .00      .00      .00      .00      .00      .00      .00      .00      .00
            .00      .00      .00      .00      .00      .00      .00      .00      .00      .00
            .00      .00      .00      .00      .00      .00      .00      .00      .00      .00
            .00      .00      .00      .00

17 JD     INDEX STORM NO. 2
            STRM        3.85  PRECIPITATION DEPTH
            TRDA       10.00  TRANSPOSITION DRAINAGE AREA

 0 PI       PRECIPITATION PATTERN
            .00      .00      .00      .00      .00      .00      .00      .00      .00      .00
            .00      .00      .00      .00      .00      .00      .00      .00      .00      .00
            .00      .00      .00      .00      .00      .00      .00      .00      .00      .00
            .00      .00      .00      .00      .00      .00      .00      .00      .00      .00
            .00      .00      .00      .00      .00      .00      .00      .00      .00      .00
            .00      .00      .00      .00      .01      .01      .01      .01      .01      .01
            .01      .01      .01      .01      .01      .01      .02      .02      .02      .13
            .13      .13      .02      .02      .02      .01      .01      .01      .01      .01
            .01      .01      .01      .01      .01      .01      .01      .01      .01      .01
            .00      .00      .00      .00      .00      .00      .00      .00      .00      .00
            .00      .00      .00      .00      .00      .00      .00      .00      .00      .00
            .00      .00      .00      .00      .00      .00      .00      .00      .00      .00
            .00      .00      .00      .00      .00      .00      .00      .00      .00      .00
            .00      .00      .00      .00      .00      .00      .00      .00      .00      .00
            .00      .00      .00      .00

18 JD     INDEX STORM NO. 3
            STRM        3.73  PRECIPITATION DEPTH
            TRDA       20.00  TRANSPOSITION DRAINAGE AREA

 0 PI       PRECIPITATION PATTERN
            .00      .00      .00      .00      .00      .00      .00      .00      .00      .00
            .00      .00      .00      .00      .00      .00      .00      .00      .00      .00
            .00      .00      .00      .00      .00      .00      .00      .00      .00      .00
            .00      .00      .00      .00      .00      .00      .00      .00      .00      .00
            .00      .00      .00      .00      .00      .00      .00      .00      .00      .00
            .00      .00      .00      .00      .01      .01      .01      .01      .01      .01
            .01      .01      .01      .01      .01      .01      .02      .02      .02      .13
            .13      .13      .02      .02      .02      .01      .01      .01      .01      .01
            .01      .01      .01      .01      .01      .01      .01      .01      .01      .01
            .00      .00      .00      .00      .00      .00      .00      .00      .00      .00
            .00      .00      .00      .00      .00      .00      .00      .00      .00      .00
            .00      .00      .00      .00      .00      .00      .00      .00      .00      .00
            .00      .00      .00      .00      .00      .00      .00      .00      .00      .00
            .00      .00      .00      .00      .00      .00      .00      .00      .00      .00
            .00      .00      .00      .00

19 JD     INDEX STORM NO. 4
            STRM        3.65  PRECIPITATION DEPTH
            TRDA       30.00  TRANSPOSITION DRAINAGE AREA

 0 PI       PRECIPITATION PATTERN
            .00      .00      .00      .00      .00      .00      .00      .00      .00      .00
            .00      .00      .00      .00      .00      .00      .00      .00      .00      .00
            .00      .00      .00      .00      .00      .00      .00      .00      .00      .00
            .00      .00      .00      .00      .00      .00      .00      .00      .00      .00
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.01     .01     .01     .01     .01     .01     .02     .02     .02     .13
.13     .13     .02     .02     .02     .01     .01     .01     .01     .01
.01     .01     .01     .01     .01     .01     .01     .01     .01     .01
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.00     .00     .00     .00

20 JD      INDEX STORM NO. 5
             STRM        3.48  PRECIPITATION DEPTH
             TRDA       70.00  TRANSPOSITION DRAINAGE AREA

 0 PI        PRECIPITATION PATTERN
.00     .00     .00     .00     .00     .00     .00     .00     .00     .00
.00     .00     .00     .00     .00     .00     .00     .00     .00     .00
.00     .00     .00     .00     .00     .00     .00     .00     .00     .00
.00     .00     .00     .00     .00     .00     .00     .00     .00     .00
.00     .00     .00     .00     .00     .00     .00     .00     .00     .00
.00     .00     .00     .00     .01     .01     .01     .01     .01     .01
.01     .01     .01     .01     .01     .01     .02     .02     .02     .13
.13     .13     .02     .02     .02     .01     .01     .01     .01     .01
.01     .01     .01     .01     .01     .01     .01     .01     .01     .01
.00     .00     .00     .00     .00     .00     .00     .00     .00     .00
.00     .00     .00     .00     .00     .00     .00     .00     .00     .00
.00     .00     .00     .00     .00     .00     .00     .00     .00     .00
.00     .00     .00     .00     .00     .00     .00     .00     .00     .00
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.00     .00     .00     .00

21 JD      INDEX STORM NO. 6
             STRM        3.44  PRECIPITATION DEPTH
             TRDA      100.00  TRANSPOSITION DRAINAGE AREA

 0 PI        PRECIPITATION PATTERN
.00     .00     .00     .00     .00     .00     .00     .00     .00     .00
.00     .00     .00     .00     .00     .00     .00     .00     .00     .00
.00     .00     .00     .00     .00     .00     .00     .00     .00     .00
.00     .00     .00     .00     .00     .00     .00     .00     .00     .00
.00     .00     .00     .00     .00     .00     .00     .00     .00     .00
.00     .00     .00     .00     .01     .01     .01     .01     .01     .01
.01     .01     .01     .01     .01     .01     .02     .02     .02     .13
.13     .13     .02     .02     .02     .01     .01     .01     .01     .01
.01     .01     .01     .01     .01     .01     .01     .01     .01     .01
.00     .00     .00     .00     .00     .00     .00     .00     .00     .00
.00     .00     .00     .00     .00     .00     .00     .00     .00     .00
.00     .00     .00     .00     .00     .00     .00     .00     .00     .00
.00     .00     .00     .00     .00     .00     .00     .00     .00     .00
.00     .00     .00     .00     .00     .00     .00     .00     .00     .00
.00     .00     .00     .00

22 JD      INDEX STORM NO. 7
             STRM        3.36  PRECIPITATION DEPTH
             TRDA      150.00  TRANSPOSITION DRAINAGE AREA

 0 PI        PRECIPITATION PATTERN
.00     .00     .00     .00     .00     .00     .00     .00     .00     .00
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.00	.00	.00	.00	.00	.00	.00	.00	.00	.00
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.00	.00	.00	.00	.00	.00	.00	.00	.00	.00
.00	.00	.00	.00	.00	.00	.00	.00	.00	.00
.00	.00	.00	.00	.01	.01	.01	.01	.01	.01
.01	.01	.01	.01	.01	.01	.02	.02	.02	.13
.13	.13	.02	.02	.02	.01	.01	.01	.01	.01
.01	.01	.01	.01	.01	.01	.01	.01	.01	.01
.00	.00	.00	.00	.00	.00	.00	.00	.00	.00
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.00	.00	.00	.00	.00	.00	.00	.00	.00	.00
.00	.00	.00	.00	.00	.00	.00	.00	.00	.00
.00	.00	.00	.00						

23 JD INDEX STORM NO. 8

STRM 3.24 PRECIPITATION DEPTH

TRDA 300.00 TRANSPOSITION DRAINAGE AREA

0 PI PRECIPITATION PATTERN

.00	.00	.00	.00	.00	.00	.00	.00	.00	.00
.00	.00	.00	.00	.00	.00	.00	.00	.00	.00
.00	.00	.00	.00	.00	.00	.00	.00	.00	.00
.00	.00	.00	.00	.00	.00	.00	.00	.00	.00
.00	.00	.00	.00	.00	.00	.00	.00	.00	.00
.00	.00	.00	.00	.01	.01	.01	.01	.01	.01
.01	.01	.01	.01	.01	.01	.02	.02	.02	.13
.13	.13	.02	.02	.02	.01	.01	.01	.01	.01
.01	.01	.01	.01	.01	.01	.01	.01	.01	.01
.00	.00	.00	.00	.00	.00	.00	.00	.00	.00
.00	.00	.00	.00	.00	.00	.00	.00	.00	.00
.00	.00	.00	.00	.00	.00	.00	.00	.00	.00
.00	.00	.00	.00	.00	.00	.00	.00	.00	.00
.00	.00	.00	.00						

24 JD INDEX STORM NO. 9

STRM 3.24 PRECIPITATION DEPTH

TRDA 400.00 TRANSPOSITION DRAINAGE AREA

0 PI PRECIPITATION PATTERN

.00	.00	.00	.00	.00	.00	.00	.00	.00	.00
.00	.00	.00	.00	.00	.00	.00	.00	.00	.00
.00	.00	.00	.00	.00	.00	.00	.00	.00	.00
.00	.00	.00	.00	.00	.00	.00	.00	.00	.00
.00	.00	.00	.00	.00	.00	.00	.00	.00	.00
.00	.00	.00	.00	.01	.01	.01	.01	.01	.01
.01	.01	.01	.01	.01	.01	.02	.02	.02	.13
.13	.13	.02	.02	.02	.01	.01	.01	.01	.01
.01	.01	.01	.01	.01	.01	.01	.01	.01	.01
.00	.00	.00	.00	.00	.00	.00	.00	.00	.00
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.00	.00	.00	.00	.00	.00	.00	.00	.00	.00
.00	.00	.00	.00						

RUNOFF SUMMARY
FLOW IN CUBIC FEET PER SECOND
TIME IN HOURS, AREA IN SQUARE MILES

OPERATION	STATION	PEAK FLOW	TIME OF PEAK	AVERAGE FLOW FOR MAXIMUM PERIOD 6-HOUR	24-HOUR	72-HOUR	BASIN AREA	MAXIMUM STAGE	TIME OF MAX STAGE
HYDROGRAPH AT	SUB1	1701.	12.83	444.	111.	111.	3.48		
ROUTED TO	R1	1687.	12.83	444.	111.	111.	3.48		
HYDROGRAPH AT	SUB2A	2267.	12.83	597.	149.	149.	5.21		
ROUTED TO	R2A	1872.	14.50	596.	149.	149.	5.21		
HYDROGRAPH AT	SUB2B	1645.	14.00	807.	210.	210.	6.98		
3 COMBINED AT	A	3547.	14.33	1760.	450.	450.	15.67		
ROUTED TO	RA	3464.	14.83	1756.	450.	450.	15.67		
HYDROGRAPH AT	SUB3	1205.	13.33	462.	117.	117.	3.63		
HYDROGRAPH AT	SUB4	1180.	13.83	551.	142.	142.	4.59		
3 COMBINED AT	B	4873.	14.00	2618.	672.	672.	23.88		
ROUTED TO	RB	4844.	14.50	2614.	672.	672.	23.88		
HYDROGRAPH AT	SUB5A	1591.	12.33	229.	57.	57.	2.01		
ROUTED TO	R5A	1030.	13.83	229.	57.	57.	2.01		
HYDROGRAPH AT	SUB5B	1681.	13.33	629.	159.	159.	5.44		
HYDROGRAPH AT	SUB6	1454.	14.83	912.	256.	256.	8.57		
4 COMBINED AT	C	7495.	14.00	4037.	1059.	1059.	39.90		
ROUTED TO	RC	7252.	14.83	4021.	1059.	1059.	39.90		
HYDROGRAPH AT	SUB7A	1231.	12.67	267.	67.	67.	2.25		
ROUTED TO	R7A	912.	14.67	267.	67.	67.	2.25		
HYDROGRAPH AT	SUB7B	1649.	13.17	546.	137.	137.	4.95		
2 COMBINED AT	D	1668.	13.17	803.	201.	201.	7.19		
ROUTED TO	RD	1624.	13.83	802.	201.	201.	7.19		
HYDROGRAPH AT	SUB8	923.	12.83	245.	61.	61.	2.13		
ROUTED TO	R8	882.	13.17	245.	61.	61.	2.13		
HYDROGRAPH AT	SUB9	1449.	13.50	600.	152.	152.	5.34		
3 COMBINED AT	E	3616.	13.50	1579.	399.	399.	14.67		

ROUTED TO	RE	3246.	15.67	1569.	399.	399.	14.67
HYDROGRAPH AT	SUB10	1168.	15.17	774.	224.	224.	6.34
HYDROGRAPH AT	SUB11	1352.	12.83	378.	94.	94.	3.12
HYDROGRAPH AT	SUB12	1046.	13.00	305.	76.	76.	2.59
5 COMBINED AT	F	10427.	15.17	6241.	1685.	1685.	66.63
HYDROGRAPH AT	SUB13	1349.	13.67	599.	154.	154.	3.92
ROUTED TO	R13	1336.	14.00	598.	154.	154.	3.92
2 COMBINED AT	F	11060.	15.00	6708.	1806.	1806.	70.55
ROUTED TO	RF	10812.	16.00	6668.	1803.	1803.	70.55
HYDROGRAPH AT	SUB100	6549.	15.33	4530.	1332.	1332.	58.27
DIVERSION TO	SOLS	3275.	15.33	2265.	666.	666.	58.27
HYDROGRAPH AT	DIV100	3275.	15.33	2265.	666.	666.	58.27
ROUTED TO	R100	3202.	17.17	2243.	653.	653.	58.27
HYDROGRAPH AT	SUB101	1868.	14.33	1019.	272.	272.	9.37
HYDROGRAPH AT	SUB102	1544.	13.50	608.	154.	154.	5.25
3 COMBINED AT	G	3618.	16.83	3072.	997.	997.	72.89
ROUTED TO	RG	3543.	19.17	3023.	950.	950.	72.89
HYDROGRAPH AT	SUB103	2322.	14.67	1393.	383.	383.	13.66
ROUTED TO	R103	2261.	15.83	1383.	382.	382.	13.66
HYDROGRAPH AT	SUB104	3993.	15.00	2583.	734.	734.	28.20
HYDROGRAPH AT	SUB105	3525.	14.50	2037.	553.	553.	19.80
4 COMBINED AT	I	9334.	15.50	6966.	2322.	2322.	134.53
HYDROGRAPH AT	SUB106	2247.	12.83	633.	158.	158.	5.75
ROUTED TO	R106	1841.	15.00	632.	158.	158.	5.75
HYDROGRAPH AT	SUB107	3206.	13.33	1180.	298.	298.	10.92
2 COMBINED AT	H	3202.	13.50	1735.	439.	439.	16.66
ROUTED TO	RH	3194.	13.67	1734.	439.	439.	16.66
2 COMBINED AT	I	11061.	15.17	8026.	2649.	2649.	151.20
ROUTED TO	RI	10597.	18.00	7897.	2450.	2450.	151.20
HYDROGRAPH AT	SUB108	1331.	12.67	316.	79.	79.	2.68

ROUTED TO	R108	1009.	14.83	316.	79.	79.	2.68
HYDROGRAPH AT	SUB109	5682.	15.33	3905.	1144.	1144.	49.05
ROUTED TO	R109	5618.	16.33	3884.	1135.	1135.	49.05
HYDROGRAPH AT	SUB110	2979.	14.67	1771.	486.	486.	18.84
HYDROGRAPH AT	SUB111	1073.	12.83	272.	68.	68.	2.41
3 COMBINED AT	J	7221.	15.83	5192.	1574.	1574.	70.29
ROUTED TO	RJ	6997.	18.00	5138.	1530.	1530.	70.29
HYDROGRAPH AT	SUB112	2674.	14.67	1612.	444.	444.	15.40
4 COMBINED AT	K	16866.	18.00	12697.	4111.	4111.	239.57
ROUTED TO	RK	16649.	19.00	12643.	3919.	3919.	239.57
2 COMBINED AT	L	19295.	18.17	16376.	5415.	5415.	310.12
HYDROGRAPH AT	SUB200	1486.	13.33	568.	145.	145.	4.24
2 COMBINED AT	L	19313.	18.17	16428.	5520.	5520.	314.37
HYDROGRAPH AT	SUB201	3505.	13.67	1529.	391.	391.	14.68
ROUTED TO	R201	3357.	14.67	1522.	391.	391.	14.68
HYDROGRAPH AT	SUB202	2288.	14.83	1424.	398.	398.	14.98
HYDROGRAPH AT	SUB203	2026.	14.67	1213.	334.	334.	11.41
3 COMBINED AT	L	6963.	14.67	3774.	1019.	1019.	41.07
2 COMBINED AT	L	20345.	17.83	18239.	6362.	6362.	355.43
ROUTED TO	RL	20283.	18.83	18161.	6125.	6125.	355.43
HYDROGRAPH AT	SUB204	2158.	14.67	1307.	361.	361.	12.76
HYDROGRAPH AT	SUB205	3825.	14.83	2360.	657.	657.	25.65
3 COMBINED AT	M	21136.	18.33	19561.	6912.	6912.	393.84
ROUTED TO	RM	21101.	19.33	19487.	6599.	6599.	393.84
HYDROGRAPH AT	SUB206	1966.	14.00	959.	249.	249.	8.83
ROUTED TO	R206	1932.	14.33	956.	249.	249.	8.83
HYDROGRAPH AT	SUB207	1592.	14.00	787.	205.	205.	7.49
HYDROGRAPH AT	SUB208	2143.	14.50	1242.	338.	338.	12.62
4 COMBINED AT	N	21364.	19.00	19980.	7176.	7176.	422.77
ROUTED TO	RN	21350.	19.67	19923.	6865.	6865.	422.77

HYDROGRAPH AT	SUB209	1871.	14.67	1146.	318.	318.	11.82
HYDROGRAPH AT	SUB210	2701.	14.67	1610.	442.	442.	16.93
3 COMBINED AT	0	21730.	19.00	20430.	7433.	7433.	451.53

*** NORMAL END OF HEC-1 ***

APPENDIX D

District Memo

Centennial Wash Flood Insurance Study - Hydrology

Preferred Hydrologic Methods for the Centennial Wash hydrology:

Rainfall :	100 year, 24 hour storm. SCS type II distribution.
Areal Reduction :	NOAA HYDRO-40 (FCD will provide a copy of the report).
Loss Rate :	Green and Ampt as described in the Hydrology Manual (Tables of parameters to be provided) if the version of HEC-1 dated Dec. 5, 1988 is used.
	or Initial and uniform loss rate (tables of parameters to be provided).
Unit Hydrograph :	SCS dimensionless.
Channel Routing :	Normal depth routing where good channel data is available.
	Muskingum for all other routing.

Submittals for review by the Watershed Management Branch of the Hydrology Division will include the following upon completion:

1. Preliminary plans and maps.

2. Sample calculations to determine basin parameters for approval prior to the parameter determination for all the subbasins.

3. All calculations to determine basin parameters.

4. HEC-1 model along with the parameters used to prepare the HEC-1 coding. A running model on floppy disk and a schematic drawing of the basins shall accompany the HEC-1 model. The following symbols shall be used to prepare the schematic drawing along with the terminology to be used in the model:

LEGEND

○	Subarea calculation (SUB)
⬡	Combined hydrograph (CO)
□	Route hydrograph (R, or RO)
▽	Divert hydrograph (D, or DIV)

5. Preliminary and final report and product.

Note: The FCD requests prior notice to when the products will be submitted for review to allow scheduling by reviewer. All efforts will be made to return comments within one week after submittal.

APPENDIX E

Precipitation Data

49520.32

ADDENDUM to "HYDROLOGIC DESIGN FOR HIGHWAY DRAINAGE IN ARIZONA" April 1975

Steps to be used to determine precipitation values for various durations and return periods.

STEP 1. From the precipitation maps in the manual "Hydrologic Design for Highway Drainage in Arizona", determine the precipitation values for the 6 and 24 hour duration storms for return periods of 2, 5, 10, 25, 50 and 100 years. Tabulate these values in Table 1 in the column headed 'Map Values'

TABLE 1

Return Period (Years)	Precipitation Values (inches)			
	6 hour duration		24 hour duration	
	Map Value	Corrected Value	Map Value	Corrected Value
2	1.3	1.30	1.5	1.50
5	1.8	1.80	2.1	2.10
10	2.1	2.15	2.5	2.50
25	2.6	2.55	3.2	3.10
50	3.0	3.00	3.6	3.55
100	3.3	3.35	4.0	4.05

NOTE: There is a possibility of making an error while reading the maps because, (1) a site is not easy to locate precisely on a series of 12 maps, (2) there may be some slight registration differences in printing, and (3) precise interpolation between isolines is difficult. In order to minimize any errors in reading the maps, these values should be plotted on the diagram "Precipitation Depth versus Return Period" Fig. 1.

Project No. 49520.32 Station _____

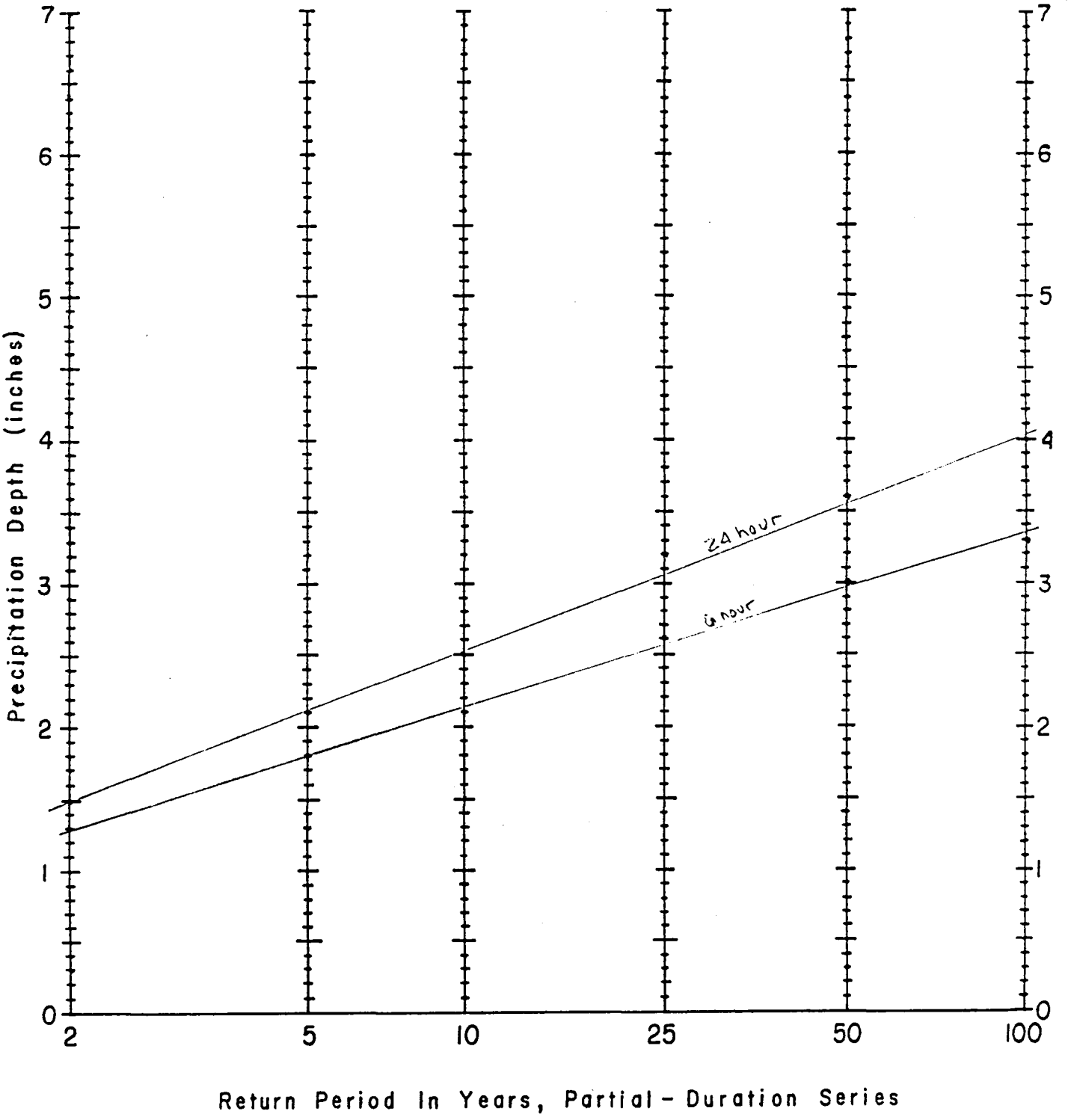


Figure 1 Precipitation Depth Versus Return Period for Partial-Duration Series

FLOOD CONTROL DISTRICT of Maricopa County

Interoffice Memorandum

CMT. NO

SUBJECT AREAL REDUCTION

☒ FILE
☐ DESTROY

TO: DJP

FROM: VAR JRL

DATE: 4/11/89

A question had come up regarding which areal reduction curve should be used. NOAA in their Technical Memorandum NWS HYDRO-40 entitled "Depth-Area Ratios in the Semi-Arid Southwest United States" has utilized the data from the Walnut Gulch Experimental watershed to develop the curves to be used for the Southwest region of the United States. The memo does not provide a regression equation for the curves, but only a graph. Because of the shape and the scale for the curves, it is difficult to achieve accurate values for the smaller watersheds. Therefore, Tom Hieb and I conducted independent determinations of the values for less than 100 square miles for a uniform set of ratios for a storm with a duration of 24 hours.

The ratios should be used for any watershed greater than 10 square miles. The following are the values to be used for a storm with a duration of 24 hours.

Square Mile	Ratio	Sq mi	Ratio
10	.95		
20	.92		
30	.90	150	.83
40	.89	200	.82
50	.88	250	.81
60	.87	300	.80
70	.86	350	.80
80	.86	400	.80
90	.85	450	.79
100	.85	500	.78

I have not looked at values for other durations, it there is a need to have these values, then we should determine a set of uniform ratios for that specific duration that can be used.

Aerially Reduced Rainfall Values

Area in Square Miles	Reduction Ratio	Precipitation Depth in Inches 10-yr	50-yr	100-yr
Point Rainfall	1.00	2.50	3.55	4.05
10	0.95	2.38	3.37	3.85
20	0.92	2.30	3.27	3.73
30	0.90	2.25	3.20	3.65
70	0.86	2.15	3.05	3.48
100	0.85	2.13	3.02	3.44
150	0.83	2.08	2.95	3.36
300	0.80	2.00	2.84	3.24
400	0.80	2.00	2.84	3.24

TABLE P-5

Coordinates of the SCS Type II Rainfall Distribution
(General Storm)

Time hrs	Ratio of Rainfall to Total Rainfall	Time hrs	Ratio of Rainfall to Total Rainfall
0	0.0	12.0	.663
.5	.005	12.5	.735
1.0	.011	13.0	.772
1.5	.016	13.5	.799
2.0	.022	14.0	.820
2.5	.028	14.5	.838
3.0	.035	15.0	.854
3.5	.041	15.5	.868
4.0	.048	16.0	.880
4.5	.056	16.5	.891
5.0	.063	17.0	.902
5.5	.071	17.5	.912
6.0	.080	18.0	.921
6.5	.089	18.5	.929
7.0	.098	19.0	.937
7.5	.108	19.5	.945
8.0	.120	20.0	.952
8.5	.133	20.5	.959
9.0	.147	21.0	.965
9.5	.163	21.5	.972
10.0	.181	22.0	.978
10.5	.204	22.5	.984
11.0	.235	23.0	.989
11.5	.283	23.5	.995
		24.0	1.000

APPENDIX F

Tc and L Data

WATERSHED Tc and L

KIRPICH EQUATION

Watershed I.D. No.	Highest Elev. Ft.	Lowest Elev. Ft.	Elev. Change Ft.	Length Ft.	Slope FT/FT	Velocity FPS	Tc* Hrs.	L** Hrs.
1	2400	2200	200	22395	.0089	3.6	1.74	1.05
				22395		3.6	1.74	

*Tc = $L^{1.15}/7700\ H^{0.38}$

**L = 0.6 Tc

WATERSHED Tc and L

KIRPICH EQUATION

Watershed I.D. No.	Highest Elev. Ft.	Lowest Elev. Ft.	Elev. Change Ft.	Length Ft.	Slope FT/FT	Velocity FPS	Tc* Hrs.	L** Hrs.
2A	2835	2600	235	4427	.053		.25	
	2600	2360	240	21353	.011		1.54	
				25780		4.0	1.79	1.07

$*Tc = L^{1.15} / 7700\ H^{0.38}$

$**L = 0.6\ Tc$

WATERSHED Tc and L

KIRPICH EQUATION

Watershed I.D. No.	Highest Elev. Ft.	Lowest Elev. Ft.	Elev. Change Ft.	Length Ft.	Slope FT/FT	Velocity FPS	Tc* Hrs.	L** Hrs.	
2B	2930	2640	290	721.17	.378		0.03	0.01	
	2640	2600	40	312.50	.128		0.02	0.01	
	2600	2560	40	16666.67	.024		0.16	0.10	
	2560	2480	80	5338.54	.015		0.48	0.29	
	2480	2200	280	39895.81	.007		2.98	1.79	KPC
				47942.69		3.6	3.67	2.20	KPC

*Tc = $L^{1.15}$ /7700 $H^{0.38}$

**L = 0.6 Tc

WATERSHED Tc and L

KIRPICH EQUATION

Watershed I.D. No.	Highest Elev. Ft.	Lowest Elev. Ft.	Elev. Change Ft.	Length Ft.	Slope FT/FT	Velocity FPS	Tc* Hrs.	L** Hrs.
3	2360	2220	140	14583	.0096		1.22	
	2220	2186	34	10937	.0031		1.50	
				25520		2.6	2.72	1.63

$*Tc = L^{1.15} / 7700\ H^{0.38}$

$**L = 0.6\ Tc$

WATERSHED Tc and L

KIRPICH EQUATION

Watershed I.D. No.	Highest Elev. Ft.	Lowest Elev. Ft.	Elev. Change Ft.	Length Ft.	Slope FT/FT	Velocity FPS	Tc* Hrs.	L** Hrs.
4	2480	2400	80	625.00	.128		0.04	0.02
	2400	2320	80	6875.00	.012		0.64	0.38
	2320	2240	80	10677.08	.008		1.05	0.63
	2240	2190	50	13958.32	.004		1.72	1.03
				32135		2.6	3.45	2.07

$*Tc = L^{1.15} / 7700\ H^{0.38}$

$**L = 0.6\ Tc$

WATERSHED Tc and L

KIRPICH EQUATION

Watershed I.D. No.	Highest Elev. Ft.	Lowest Elev. Ft.	Elev. Change Ft.	Length Ft.	Slope FT/FT	Velocity FPS	Tc* Hrs.	L** Hrs.
5A	4489	2600	1889	10417	.18		.31	
	2600	2390	210	7812	.027		.51	
				18229		6.2	.82	.49

*$Tc = L^{1.15} / 7700\ H^{0.38}$

**$L = 0.6\ Tc$

WATERSHED Tc and L

KIRPICH EQUATION

Watershed I.D. No.	Highest Elev. Ft.	Lowest Elev. Ft.	Elev. Change Ft.	Length Ft.	Slope FT/FT	Velocity FPS	Tc* Hrs.	L** Hrs.
5B	3200	2600	600	3906	.15		.15	
	2600	2280	320	11979	.027		.71	
	2280	2200	80	7812	.010		.74	
	2200	2175	25	7292	.003		1.06	
				30989		3.2	2.66	1.60

$*Tc = L^{1.15} / 7700\ H^{0.38}$

$**L = 0.6\ Tc$

WATERSHED Tc and L

KIRPICH EQUATION

Watershed I.D. No.	Highest Elev. Ft.	Lowest Elev. Ft.	Elev. Change Ft.	Length Ft.	Slope FT/FT	Velocity FPS	Tc* Hrs.	L** Hrs.
6	2912	2600	312	833.33	.374		0.03	0.02
	2600	2480	120	3385.41	.035		0.24	0.14
	2480	2320	160	13854.16	.012		1.09	0.66
	2320	2240	80	12031.24	.007		1.21	0.73
	2240	2200	40	8020.83	.005		0.99	0.59
	2200	2174	26	10937.50	.002		1.66	1.00
				49062		2.7	5.13	3.08

*$Tc = L^{1.15} / 7700\ H^{0.38}$

**$L = 0.6\ Tc$

WATERSHED Tc and L

KIRPICH EQUATION

Watershed I.D. No.	Highest Elev. Ft.	Lowest Elev. Ft.	Elev. Change Ft.	Length Ft.	Slope FT/FT	Velocity FPS	Tc* Hrs.	L** Hrs.
7A	2930	2600	330	1562	.21		.07	
	2600	2480	120	9635	.012		.80	
	2480	2435	45	4948	.0091		.54	
				16145		3.2	1.41	.85

$*Tc = L^{1.15} / 7700\ H^{0.38}$

$**L = 0.6\ Tc$

WATERSHED Tc and L

KIRPICH EQUATION

Watershed I.D. No.	Highest Elev. Ft.	Lowest Elev. Ft.	Elev. Change Ft.	Length Ft.	Slope FT/FT	Velocity FPS	Tc* Hrs.	L** Hrs.
7B	2435	2255	180	27604	.0065	3.3	2.31	1.39

$*Tc = L^{1.15} / 7700\ H^{0.38}$

$**L = 0.6\ Tc$

WATERSHED Tc and L

KIRPICH EQUATION

Watershed I.D. No.	Highest Elev. Ft.	Lowest Elev. Ft.	Elev. Change Ft.	Length Ft.	Slope FT/FT	Velocity FPS	Tc* Hrs.	L** Hrs.
8	2450	2400	50	781	.064		.06	
	2400	2250	150	20312	.0074		1.74	
				21093		3.3	1.80	1.08

$*Tc = L^{1.15} / 7700\ H^{0.38}$

$**L = 0.6\ Tc$

WATERSHED Tc and L

KIRPICH EQUATION

Watershed I.D. No.	Highest Elev. Ft.	Lowest Elev. Ft.	Elev. Change Ft.	Length Ft.	Slope FT/FT	Velocity FPS	Tc* Hrs.	L** Hrs.
9	2620	2600	20	781	.026		.09	
	2600	2400	200	13020	.015		.94	
	2400	2235	165	23177	.0071		1.95	
				36978		3.4	2.98	1.79

$*Tc = L^{1.15} / 7700\ H^{0.38}$

$**L = 0.6\ Tc$

WATERSHED Tc and L

KIRPICH EQUATION

Watershed I.D. No.	Highest Elev. Ft.	Lowest Elev. Ft.	Elev. Change Ft.	Length Ft.	Slope FT/FT	Velocity FPS	Tc* Hrs.	L** Hrs.
10	2380	2240	140	18750	.0075		1.63	
	2240	2180	60	16667	.0036		1.96	
	2180	2155	25	12500	.0020		1.97	
				47917		2.4	5.56	3.34

$*Tc = L^{1.15} / 7700\ H^{0.38}$

$**L = 0.6\ Tc$

WATERSHED Tc and L

KIRPICH EQUATION

Watershed I.D. No.	Highest Elev. Ft.	Lowest Elev. Ft.	Elev. Change Ft.	Length Ft.	Slope FT/FT	Velocity FPS	Tc* Hrs.	L** Hrs.
11	2360	2200	160	11458	.014		.88	
	2200	2155	45	8594	.0052		1.02	
				20052		2.9	1.90	1.14

$*Tc = L^{1.15} / 7700\ H^{0.38}$

$**L = 0.6\ Tc$

WATERSHED Tc and L

KIRPICH EQUATION

Watershed I.D. No.	Highest Elev. Ft.	Lowest Elev. Ft.	Elev. Change Ft.	Length Ft.	Slope FT/FT	Velocity FPS	Tc* Hrs.	L** Hrs.
12	3000	2400	600	4427	.14		.18	
	2400	2240	160	9375	.017		.70	
	2240	2155	85	11458	.0074		1.12	
				25260		3.5	2.00	1.20

$*Tc = L^{1.15} / 7700\ H^{0.38}$

$**L = 0.6\ Tc$

WATERSHED Tc and L

KIRPICH EQUATION

Watershed I.D. No.	Highest Elev. Ft.	Lowest Elev. Ft.	Elev. Change Ft.	Length Ft.	Slope FT/FT	Velocity FPS	Tc* Hrs.	L** Hrs.
13	2260	2163	97	29687	.0033	2.6	3.18	1.91

$*Tc = L^{1.15} / 7700\ H^{0.38}$

$**L = 0.6\ Tc$

WATERSHED Tc and L

KIRPICH EQUATION

Watershed I.D. No.	Highest Elev. Ft.	Lowest Elev. Ft.	Elev. Change Ft.	Length Ft.	Slope FT/FT	Velocity FPS	Tc* Hrs.	L** Hrs.
100	4214	3800	414	1,146.	.361		.04	
	3800	3720	80	2,396.	.033		.19	
	3720	3680	40	1,250.	.032		.12	
	3680	3520	160	2,891.	.055		.18	
	3520	3240	280	9505.	.030		.57	
	3240	2800	440	24,948.	.018		1.46	
	2800	2720	80	8,542.	.009		.82	
	2720	2580	140	28,542.	.005		2.64	
				79,220		3.66	6.02	3.61

*Tc = $L^{1.15}$ /7700 $H^{0.38}$

**L = 0.6 Tc

16.416

WATERSHED Tc and L

KIRPICH EQUATION

Watershed I.D. No.	Highest Elev. Ft.	Lowest Elev. Ft.	Elev. Change Ft.	Length Ft.	Slope FT/FT	Velocity FPS	Tc* Hrs.	L** Hrs.
101	3420	3100	320	.11 599	.534		.023	
	3100	3000	100	.09 439	.213		.027	
	3000	2900	100	.21 1094.	.091		.070	
	2900	2800	100	.375 1953.	.051		.137	
	2800	2600	200	1.7 8,854	.023		.600	
	2600	2520	80	2.1 10885.	.007		1.078	KPC
	2520	2460	60	2.275 11,849.	.005		1.326	
	2460	2440	20	1.17 6,146.	.003		.946	
				41849.		2.8	4.207	2.524 KPC

*Tc = $L^{1.15}$ / 7700 $H^{0.38}$

*L = 0.6 Tc

WATERSHED Tc and L

KIRPICH EQUATION

Watershed I.D. No.	Highest Elev. Ft.	Lowest Elev. Ft.	Elev. Change Ft.	Length Ft.	Slope FT/FT	Velocity FPS	Tc* Hrs.	L** Hrs.
102	2930	2640	290	1,354	.214		.060	
	2640	2600	40	729	.055		.062	
	2600	2480	120	15,755	.008		1.414	
	2480	2440	40	10,000	.004		1.273	
				27838		2.8	2.809	1.685

*$Tc = L^{1.15} / 7700\ H^{0.38}$

*$L = 0.6\ Tc$

WATERSHED Tc and L

KIRPICH EQUATION

Watershed I.D. No.	Highest Elev. Ft.	Lowest Elev. Ft.	Elev. Change Ft.	Length Ft.	Slope FT/FT	Velocity FPS	Tc* Hrs.	L** Hrs.
103	2840	2800	40	.26 1,354.	.030		.128	
	2800	2680	120	1.705 8984.	.013		.741	
	2680	2440	240	5.7 30,729.	.008		2.343	
	2440	2385	55	2.54 13,437	.004		1.584	
				54504		3.2	4.796	2.878

$*Tc = L^{1.15} / 7700\ H^{0.38}$

$**L = 0.6\ Tc$

WATERSHED Tc and L

KIRPICH EQUATION

Watershed I.D. No.	Highest Elev. Ft.	Lowest Elev. Ft.	Elev. Change Ft.	Length Ft.	Slope FT/FT	Velocity FPS	Tc* Hrs.	L** Hrs.
104	3054	2840	214	.15 781	.274		.036	
	2840	2800	40	.12 625	.064		.052	
	2800	2600	200	3.5 18,750	.011		1.423	
	2600	2400	200	4.66 24,609	.008		1.945	
	2400	2300	100	3.68 19,427	.005		1.928	
				64192		3.3	5.384	3.23

*Tc = $L^{1.15}$ /7700 $H^{0.38}$

**L = 0.6 Tc

WATERSHED Tc and L

KIRPICH EQUATION

Watershed I.D. No.	Highest Elev. Ft.	Lowest Elev. Ft.	Elev. Change Ft.	Length Ft.	Slope FT/FT	Velocity FPS	Tc* Hrs.	L** Hrs.
105	3181	2800	381	990	.385		.038	
	2800	2700	100	4169	.213		.027	KPC
	2700	2600	100	1,979	.051		.139	
	2600	2540	60	6,615	.009		.678	
	2540	2400	140	14,375	.010		1.200	
	2400	2295	105	24,479	.004		2.469	
				48907		3.0	4.551	2.731 KPC

$*Tc = L^{1.15} / 7700\ H^{0.38}$

$**L = 0.6\ Tc$

WATERSHED Tc and L

KIRPICH EQUATION

Watershed I.D. No.	Highest Elev. Ft.	Lowest Elev. Ft.	Elev. Change Ft.	Length Ft.	Slope FT/FT	Velocity FPS	Tc* Hrs.	L** Hrs.
106	3320	3000	320	.16 833	.384		.033	
	3000	2900	100	.14 729	.137		.044	
	2900	2800	100	.075 391	.256		.022	
	2800	2700	100	.53 2,760	.036		.204	
	2700	2560	140	1.4 7,292	.019		.550	
	2560	2540	20	.42 2,187	.009		.288	
	2540	2535	5	.63 3,281	.002		.779	
				17473		2.5	1.92	1.152

*$Tc = L^{1.15} / 7700\ H^{0.38}$

**$L = 0.6\ Tc$

WATERSHED Tc and L

KIRPICH EQUATION

Watershed I.D. No.	Highest Elev. Ft.	Lowest Elev. Ft.	Elev. Change Ft.	Length Ft.	Slope FT/FT	Velocity FPS	Tc* Hrs.	L** Hrs.
107	3165	2600	565	1302	.434		.045	
	2600	2540	60	651	.092		.047	
	2540	2480	60	2,734	.022		.246	
	2480	2420	60	3,333	.018		.308	
	2420	2305	115	20,703	.006		1.967	
				28723		3.1	2.613	1.568

*$Tc = L^{1.15} / 7700\ H^{0.38}$

**$L = 0.6\ Tc$

WATERSHED Tc and L

KIRPICH EQUATION

Watershed I.D. No.	Highest Elev. Ft.	Lowest Elev. Ft.	Elev. Change Ft.	Length Ft.	Slope FT/FT	Velocity FPS	Tc* Hrs.	L** Hrs.
108	2500	2400	160	.11 573	.279		.028	
	2400	2360	40	.13 677	.060		.058	
	2360	2300	60	.7 3,646	.017		.342	
	2300	2260	40	1.76 9,167	.004		1.152	
				14063		2.5	1.58	0.948

$*Tc = L^{1.15} / 7700\ H^{0.38}$

$**L = 0.6\ Tc$

WATERSHED Tc and L

KIRPICH EQUATION

Watershed I.D. No.	Highest Elev. Ft.	Lowest Elev. Ft.	Elev. Change Ft.	Length Ft.	Slope FT/FT	Velocity FPS	Tc* Hrs.	L** Hrs.
109	4240	3800	440	.17 885	.497		.031	
	3800	3600	200	.155 807	.248		.038	
	3600	3480	120	.18 937	.128		.055	
	3480	3240	240	.79 4,115	.058		.232	
	3240	3000	240	1.84 9,583	.025		.613	
	3000	2840	160	1.75 9,245	.017		.687	
	2840	2740	100	1.45 7,552	.013		.651	
	2740	2420	320	7.8 41,016	.009		2.927	
	2420	2390	30	1.05 5,469	.006		.709	
				79609		3.7	5.943	3.566

*Tc = $L^{1.15}$ /7700 $H^{0.38}$

**L = 0.6 Tc

WATERSHED Tc and L

KIRPICH EQUATION

Watershed I.D. No.	Highest Elev. Ft.	Lowest Elev. Ft.	Elev. Change Ft.	Length Ft.	Slope FT/FT	Velocity FPS	Tc* Hrs.	L** Hrs.
110								
	3300	3000	300	.115 599	.501		.023	KPC
	3000	2900	100	.1 521	.192		.030	KPC
	2900	2780	120	.3 1,562	.077		.099	
	2780	2580	200	.165 7,552	.027		.500	
	2580	2480	100	2.06 10,729	.009		.974	
	2480	2380	100	3.165 16,434	.006		1.596	
	2380	2320	60	2.55 13,281	.005		1.512	
				50728		3.0	4.734	2.840

*$Tc = L^{1.15} / 7700\ H^{0.38}$

*L = 0.6 Tc

WATERSHED Tc and L

KIRPICH EQUATION

Watershed I.D. No.	Highest Elev. Ft.	Lowest Elev. Ft.	Elev. Change Ft.	Length Ft.	Slope FT/FT	Velocity FPS	Tc* Hrs.	L** Hrs.
111								
	3092	2700	392	937	.418		.035	
	2700	2600	100	911	.110		.057	
	2600	2500	100	2,135	.047		.152	
	2500	2380	120	5,833	.021		.451	
	2380	2320	60	9,245	.007		.997	
				19061		3.1	1.692	1.015

*$Tc = L^{1.15}/7700\ H^{0.38}$

**$L = 0.6\ Tc$

WATERSHED Tc and L

KIRPICH EQUATION

Watershed I.D. No.	Highest Elev. Ft.	Lowest Elev. Ft.	Elev. Change Ft.	Length Ft.	Slope FT/FT	Velocity FPS	Tc* Hrs.	L** Hrs.
112	2725	2600	125	260.42	.480		0.01	0.01
	2600	2500	100	364.58	.274		0.02	0.01
	2500	2420	80	1250.01	.064		0.09	0.05
	2420	2330	90	6041.66	.015		0.52	0.31
	2330	2240	90	15781.24	.006		1.58	0.95
	2240	2160	80	23541.65	.003		2.62	1.57
				47240		2.7	4.84	2.90

*$Tc = L^{1.15} / 7700\ H^{0.38}$

*$L = 0.6\ Tc$

WATERSHED Tc and L

KIRPICH EQUATION

Watershed I.D. No.	Highest Elev. Ft.	Lowest Elev. Ft.	Elev. Change Ft.	Length Ft.	Slope FT/FT	Velocity FPS	Tc* Hrs.	L** Hrs.
200	2200	2180	20	3333.33	.006		0.47	0.28
	2180	2140	40	8749.99	.005		1.09	0.65
	2140	2120	20	7161.45	.003		1.13	0.68
				19245		2.0	2.69	1.61

*$Tc = L^{1.15} / 7700\ H^{0.38}$

**$L = 0.6\ Tc$

WATERSHED Tc and L

KIRPICH EQUATION

Watershed I.D. No.	Highest Elev. Ft.	Lowest Elev. Ft.	Elev. Change Ft.	Length Ft.	Slope FT/FT	Velocity FPS	Tc* Hrs.	L** Hrs.
201	2721	2500	221	1458.33	.152		0.07	0.04
	2500	2400	100	4322.91	.023		0.34	0.21
	—	—						
	2400	2300	100	7395.83	.014		0.64	0.38
	2300	2220	80	8177.08	.010		0.78	0.47
	2220	2180	40	5781.25	.007		0.68	0.41
	2180	2160	20	4635.41	.004		0.68	0.41
				31771		2.8	3.19	1.91

*$Tc = L^{1.15} / 7700\ H^{0.38}$

**$L = 0.6\ Tc$

WATERSHED Tc and L

KIRPICH EQUATION

Watershed I.D. No.	Highest Elev. Ft.	Lowest Elev. Ft.	Elev. Change Ft.	Length Ft.	Slope FT/FT	Velocity FPS	Tc* Hrs.	L** Hrs.	
202	3320	3280	40	468.75	.085		0.04	0.02	
	3280	3000	280	572.92	.489		0.02	0.01	
	3000	2800	200	989.58	.202		0.05	0.03	
	2800	2640	160	1770.83	.090		0.10	0.06	
	2640	2500	140	3697.91	.038		0.25	0.15	
	2500	2400	100	5364.58	.019		0.44	0.26	
	2400	2200	200	20260.40	.010		1.56	0.93	KPC
	2200	2160	40	7057.29	.006		0.85	0.51	
	2160	2120	40	13177.07	.003		1.75	1.05	
				53359.33		2.9	5.06	3.04	KPC

*Tc = L $^{1.15}$ /7700 H$^{0.38}$

**L = 0.6 Tc

WATERSHED Tc and L

KIRPICH EQUATION

Watershed I.D. No.	Highest Elev. Ft.	Lowest Elev. Ft.	Elev. Change Ft.	Length Ft.	Slope FT/FT	Velocity FPS	Tc* Hrs.	L** Hrs.
203	3083	2800	283	468.75	.604		0.02	0.01
	2800	2700	100	260.42	.384		0.01	0.01
	2700	2600	100	390.62	.256		0.02	0.01
	2600	2500	100	651.04	.154		0.04	0.02
	2500	2380	120	2916.66	.041		0.20	0.12
	2380	2320	60	4479.16	.013		0.43	0.26
	2320	2240	80	11249.99	.007		1.12	0.67
	2240	2140	100	18749.99	.005		1.85	1.11
	2140	2120	20	6927.08	.003		1.09	0.65
				46094		2.7	4.78	2.87

*$Tc = L^{1.15} / 7700\ H^{0.38}$

**$L = 0.6\ Tc$

WATERSHED Tc and L

KIRPICH EQUATION

Watershed I.D. No.	Highest Elev. Ft.	Lowest Elev. Ft.	Elev. Change Ft.	Length Ft.	Slope FT/FT	Velocity FPS	Tc* Hrs.	L** Hrs.
204	4489	3000	1489	3854.16	.386		0.11	0.06
	3000	2800	200	1041.67	.192		0.05	0.03
	2800	2600	200	1510.42	.137		0.08	0.05
	2600	2400	200	2968.75	.067		0.17	0.10
	2400	2280	120	6093.75	.020		0.47	0.28
	2280	2200	80	6458.33	.012		0.59	0.35
	2200	2140	60	8645.83	.007		0.92	0.55
	2140	2090	50	19218.74	.003		2.48	1.49
				49792		2.8	4.87	2.92

17532

*$Tc = L^{1.15} / 7700\ H^{0.38}$

**$L = 0.6\ Tc$

WATERSHED Tc and L

KIRPICH EQUATION

Watershed I.D. No.	Highest Elev. Ft.	Lowest Elev. Ft.	Elev. Change Ft.	Length Ft.	Slope FT/FT	Velocity FPS	Tc* Hrs.	L** Hrs.
205	3825	3680	145	677.08	.214		0.04	0.02
	3680	3000	680	2343.75	.290		0.08	0.05
	3000	2800	200	1406.25	.142		0.07	0.04
	2800	2600	200	4218.75	.047		0.26	0.15
	2600	2400	200	7656.25	.026		0.51	0.30
	2400	2300	100	6458.33	.016		0.54	0.33
	2300	2180	120	9847.74	.012		0.82	0.53
	2180	2120	60	10052.08	.006		1.10	0.66
	2120	2090	30	10989.58	.003		1.58	0.95
				53650		3.0	5.00	3.00

*$Tc = L^{1.15} / 7700\ H^{0.38}$

*$L = 0.6\ Tc$

WATERSHED Tc and L

KIRPICH EQUATION

Watershed I.D. No.	Highest Elev. Ft.	Lowest Elev. Ft.	Elev. Change Ft.	Length Ft.	Slope FT/FT	Velocity FPS	Tc* Hrs.	L** Hrs.
206	4489	3200	1289	2318	.56		.06	
	3200	2600	600	3932	.15		.16	
	2600	2400	200	3437	.06		.20	
	2400	2200	200	10130	.02		(.009) .70	
	2200	2076	124	26302	(.0047)		2.52	
				46119		3.5	3.64	2.18

*Tc = $L^{1.15}$ /7700 $H^{0.38}$

*L = 0.6 Tc

WATERSHED Tc and L

KIRPICH EQUATION

Watershed I.D. No.	Highest Elev. Ft.	Lowest Elev. Ft.	Elev. Change Ft.	Length Ft.	Slope FT/FT	Velocity FPS	Tc* Hrs.	L** Hrs.
207	3652	3000	652	1120	.58		.04	
	3000	2600	400	1406	.28		.06	
	2600	2360	240	2240	.11		.12	
	2360	2200	160	8333	.02		.61	
	2200	2080	120	15885	(.071) .01		1.43	
	2080	2065	15	8073	(.001)		1.44	
				37057		2.8	3.70	2.22

*Tc = $L^{1.15}$ /7700 $H^{0.38}$

*L = 0.6 Tc

15320

WATERSHED Tc and L

KIRPICH EQUATION

Watershed I.D. No.	Highest Elev. Ft.	Lowest Elev. Ft.	Elev. Change Ft.	Length Ft.	Slope FT/FT	Velocity FPS	Tc* Hrs.	L** Hrs.
208	4922	4000	922	1979	.47		.06	
	4000	3000	1000	6510	.15		.23	
	3000	2400	600	11979	.05		.56	
	2400	2200	200	13958	.01		1.01	
	2200	2100	100	10729	(.009) .01		.97	
	2100	2065	35	12500	(.003)		1.73	
				57655		3.5	4.56	2.74

16416

$*Tc = L^{1.15} / 7700\ H^{0.38}$

$*L = 0.6\ Tc$

WATERSHED Tc and L

KIRPICH EQUATION

Watershed I.D. No.	Highest Elev. Ft.	Lowest Elev. Ft.	Elev. Change Ft.	Length Ft.	Slope FT/FT	Velocity FPS	Tc* Hrs.	L** Hrs.
209	4919	4200	719	3255	.22		.12	
	4200	3000	1200	5208	.23		.17	
	3000	2800	200	911	.22		.04	
	2800	2400	400	9323	.04		.49	
	2400	2200	200	13021	.02		.94	
	2200	2060	140	14844	(.009) .01		1.25	
	2060	2040	20	11458	(.002)		1.94	
				58020		3.3	4.95	2.97

*$Tc = L^{1.15} / 7700\ H^{0.38}$

*$L = 0.6\ Tc$

WATERSHED Tc and L

KIRPICH EQUATION

Watershed I.D. No.	Highest Elev. Ft.	Lowest Elev. Ft.	Elev. Change Ft.	Length Ft.	Slope FT/FT	Velocity FPS	Tc* Hrs.	L** Hrs.
210	5242	3200	2042	5755	.35		.15	
	3200	2600	600	6458	.09		.28	
	2600	2400	200	5000	.04		.31	
	2400	2200	200	14427	.01		1.05	
	2200	2060	140	16667	(.008) .01		1.42	
	2060	2040	20	9375	(.002)		1.54	
				57682		3.4	4.75	2.85

*$Tc = L^{1.15} / 7700\ H^{0.38}$

**$L = 0.6\ Tc$

APPENDIX G

Green and Ampt Data

Soil Type/Texture Summary

Sandy Loam - SL

5,8,7,16,17,33,35,36,38,42,43,54,62,63,64,65,66,82,83,84,85,86,87,88,89,91,94,95,105,110,120,121,122,AoC,Sa,ArA,WgC,WhC,Mt,TwC,CgC,CvB,CuC,HmE,ClD,CnC,Go,CoD,CrF,CsC,ApB,AmC,CmD,Vm,Ba,Rr,CwD,BmF,BoF,WhC,Lc,La,LkD

Sandy Clay Loam - SCL

73,97,28,GsE,Le,GrB,Lh,Rs,LnC,Rm

Clay Loam - CL

24,25,26,27,LZ

Loam - L

None

Clay - C

67

TABLE 1

Surface retention loss for various land surfaces in Maricopa County

Land-use and/or Surface Cover	Surface Retention Loss IA inches
(1)	(2)
Natural	
Desert and rangeland, flat slope	.35
Hillslopes, Sonoran desert	.15
Mountain, with vegetated surface	.25
Developed (Residential and Commercial)	
Lawn and turf	.20
Desert landscape	.10
Pavement	.05
Agricultural	
Tilled fields and irrigated pasture	.50

Table 4.2
Green and Ampt Loss Rate Parameter Values for Bare Ground

Soil Texture Classification (1)	XKSAT inches/hour (2)	PSIF inches (3)	DTHETA[1]		
			Dry (4)	Normal (5)	Saturated (6)
sand	4.6	1.9	0.35	0.30	0
loamy sand	1.2	2.4	0.35	0.30	0
sandy loam	0.40	3.5	0.35	0.25	0
loam	0.25	4.3	0.35	0.25	0
silty loam	0.15	6.6	0.40	0.25	0
silt	0.10	7.5	0.35	0.15	0
sandy clay loam	0.06	8.6	0.25	0.15	0
clay loam	0.04	8.2	0.25	0.15	0
silty clay loam	0.04	10.8	0.30	0.15	0
sandy clay	0.02	9.4	0.20	0.10	0
silty clay	0.02	11.5	0.20	0.10	0
clay	0.01	12.4	0.15	0.05	0

[1] Selection of DTHETA:

Dry = Nonirrigated lands, such as desert and rangeland;
Normal = Irrigated lawn, turf, and permanent pasture;
Saturated = Irrigated agricultural land.

WATERSHED LOSS RATES
Green Ampt Parameters

Watershed I.D. NO.	Area Sq.Mi.	TC Hrs.	Soil Text.	% of Area	IA	DTHETA	PSIF	XKSAT	RTIMP
1	3.476		SL	44%		.35	3.5	.40	0
			SCL	24%		.25	8.6	.06	0
			CL	09%		.25	8.2	.04	0
			L						
			C	23%		.15	12.4	.01	0
	0.363		Mountain	10%	.25				
			Range	90%	.35				
			Ag.						
					.34	.27	7.2	.20	0

WATERSHED LOSS RATES
Green Ampt Parameters

Watershed I.D. NO.	Area Sq.Mi.	TC Hrs.	Soil Text.	% of Area	IA	DTHETA	PSIF	XKSAT	RTIMP
2A	5.211		SL	75%		.35	3.5	.40	0
			SCL	25%		.25	8.6	.06	0
			CL						
			L						
			C						
	3.711		mountain	71.7%	.25				
			range	29.7%	.35				
			Ag.	0%					
					.28	.33	4.8	.32	0

WATERSHED LOSS RATES
Green Ampt Parameters

Watershed I.D. NO.	Area Sq.Mi.	TC Hrs.	Soil Text.	% of Area	IA	DTHETA	PSIF	XKSAT	RTIMP
2B	6.983		SL	54 %		.35	3.5	.40	
			SCL	39 %		.25	8.6	.06	
			CL	01 %		.25	8.2	.04	
			L						
			C	06%		.15	12.4	.01	
	520.89		Mountain	12%	.25				
			Range	88%	.35				
			Ag						
					.31	.30	6.1	.24	

WATERSHED LOSS RATES
Green Ampt Parameters

Watershed I.D. NO.	Area Sq.Mi.	TC Hrs.	Soil Text.	% of Area	IA	DTHETA	PSIF	XKSAT	RTIMP
3	3.627		SL	45%		.35	3.5	.40	0
			SCL						
			CL	48%		.25	8.7	.04	0
			L						
			C	07%		.15	12.4	.01	0
			Range	100%	.35				
			Ag.	0 %					
					.35	.29	6.4	.20	0

WATERSHED LOSS RATES
Green Ampt Parameters

Watershed I.D. NO.	Area Sq.Mi.	TC Hrs.	Soil Text.	% of Area	IA	DTHETA	PSIF	XKSAT	RTIMP
4	4.585		SL	46%		.35	3.5	.40	
			SCL	14%		.25	8.6	.06	
			CL	33%		.25	8.7	.04	
			L						
			C	07%		.15	12.4	.01	
			Mountain	0%					
			Range	64%	.35				
			Ag	36%	.50				
					.40	.29	6.4	.21	

WATERSHED LOSS RATES

Green Ampt Parameters

Watershed I.D. NO.	Area Sq.Mi.	TC Hrs.	Soil Text.	% of Area	IA	DTHETA	PSIF	XKSAT	RTIMP
5A	2.013		SL	100%		.35	3.5	.40	0
			SCL						
			CL						
			L						
			C						
	.24		Range	12%	.35				
			Mountain	88%	.25				
			Ag.	0%					
					.26	.35	3.5	.40	0

WATERSHED LOSS RATES
Green Ampt Parameters

Watershed I.D. NO.	Area Sq.Mi.	TC Hrs.	Soil Text.	% of Area	IA	DTHETA	PSIF	XKSAT	RTIMP
5B	5.437		SL	66%		.35	3.5	.40	0
			SCL	17%		.25	8.6	.06	0
			CL	16%		.25	8.2	.04	0
			L						
			C	01%		.15	12.4	.01	0
			Range	67%	.35				
		1.297	Mountain	24%	.25				
			Ag.	9%	.50				
					.34	.37	5.2	.28	0

WATERSHED LOSS RATES
Green Ampt Parameters

Watershed I.D. NO.	Area Sq.Mi.	TC Hrs.	Soil Text.	% of Area	IA	DTHETA	PSIF	XKSAT	RTIMP
6	8.572		SL	51%		.35	3.5	.40	
			SCL	15%		.25	8.6	.06	
			CL	02%		.25	8.2	.04	
			L						
			C	32%		.15	12.4	.01	
	492.28		Mountain	9%	.25				
			Range	62%	.35				
			Ag	29%	.50				
					.38	.27	7.2	.22	

WATERSHED LOSS RATES
Green Ampt Parameters

Watershed I.D. NO.	Area Sq.Mi.	TC Hrs.	Soil Text.	% of Area	IA	DTHETA	PSIF	XKSAT	RTIMP
7A	2.247		SL	68%		.35	3.5	.40	0
			SCL	31%		.25	8.6	.06	0
			CL	01%		.25	8.2	.04	0
			L						
			C						
			range	46%	.35				
	1.222		mountain	54%	.25				
			Ag.	0%					
					.30	.32	5.1	.29	0

WATERSHED LOSS RATES
Green Ampt Parameters

Watershed I.D. NO.	Area Sq.Mi.	TC Hrs.	Soil Text.	% of Area	IA	DTHETA	PSIF	XKSAT	RTIMP
7B	4.947		SL	82%		.35	3.5	.40	0
			SCL	01%		.25	8.6	.06	0
			CL						
			L						
			C	17%		.15	12.4	.01	0
			range	100%	.35				
			Ag.	0%					
					.35	.32	5.1	.33	0

WATERSHED LOSS RATES
Green Ampt Parameters

Watershed I.D. NO.	Area Sq.Mi.	TC Hrs.	Soil Text.	% of Area	IA	DTHETA	PSIF	XKSAT	RTIMP
8	2.134		SL	76%		.35	3.5	.40	0
			SCL	06%		.25	8.6	.06	0
			CL						
			L						
			C	18%		.15	12.4	.01	0
	.120		mountain	6%	.25				
			range	94%	.35				
			Ag.	0%					
					.34	.31	5.4	.31	0

WATERSHED LOSS RATES
Green Ampt Parameters

Watershed I.D. NO.	Area Sq.Mi.	TC Hrs.	Soil Text.	% of Area	IA	DTHETA	PSIF	XKSAT	RTIMP
9	5.339		SL	74%		.35	3.5	.40	0
			SCL	21%		.25	8.6	.06	0
			CL						
			L						
			C	05%		.15	12.4	.01	0
	1.084		mountain	20%	.25				
			Range	80%	.35				
					.33	.37	5.0	.31	0

WATERSHED LOSS RATES
Green Ampt Parameters

Watershed I.D. NO.	Area Sq.Mi.	TC Hrs.	Soil Text.	% of Area	IA	DTHETA	PSIF	XKSAT	RTIMP
10	6.342		SL	31%		.35	3.5	.40	0
			SCL						
			CL	32%		.25	8.2	.04	0
			L						
			C	37%		.15	12.4	.01	0
	.120		Res/comm	1%	.10				
			Range	56%	.35				
			Ag.	43%	.50				
					.41	.24	8.3	.14	1%

WATERSHED LOSS RATES
Green Ampt Parameters

Watershed I.D. NO.	Area Sq.Mi.	TC Hrs.	Soil Text.	% of Area	IA	DTHETA	PSIF	XKSAT	RTIMP
11	3.122		SL	59%		.35	3.5	.40	0
			SCL	2%		.25	8.6	.06	0
			CL	33%		.25	8.2	.04	0
			L						
			C	6%		.15	12.4	.01	0
			Range	93%	.35				
			Ag.	7%	.50				
					.36	.30	5.7	.25	0

WATERSHED LOSS RATES
Green Ampt Parameters

Watershed I.D. NO.	Area Sq.Mi.	TC Hrs.	Soil Text.	% of Area	IA	DTHETA	PSIF	XKSAT	RTIMP
12	2.594		SL	69%		.35	3.5	.40	0
			SCL	14%		.25	8.6	.06	0
			CL	16%		.25	8.2	.04	0
			L						
			C	01%		.15	12.4	.01	0
			Range	90%	.35				
	.256		Mountain	10%	.25				
			Ag.	0%					
					.34	.32	5.1	.29	0

WATERSHED LOSS RATES
Green Ampt Parameters

Watershed I.D. NO.	Area Sq.Mi.	TC Hrs.	Soil Text.	% of Area	IA	DTHETA	PSIF	XKSAT	RTIMP
13	3.921		SL	19%		.35	3.5	.40	0
			SCL						
			CL	29%		.25	8.2	.04	0
			L						
			C	52%		.15	12.4	.01	0
	.091		Res/comm	1%	.10				
			Range	21%	.35				
	3.061		Ag	78%	.50				
					.46	.22	9.5	.09	1%

WATERSHED LOSS RATES
Green Ampt Parameters

Watershed I.D. NO.	Area Sq.Mi.	TC Hrs.	Soil Text.	% of Area	IA	DTHETA	PSIF	XKSAT	RTIMP
100	58.270		SL	100%		.35	3.5	.40	
			SCL						
			CL						
			L						
			C						
	9.592		Mountain	17%	.25				
			Range	83%	.35				
			Ag.	0%					
					.33	.35	3.5	.40	

WATERSHED LOSS RATES
Green Ampt Parameters

Watershed I.D. NO.	Area Sq.Mi.	TC Hrs.	Soil Text.	% of Area	IA	DTHETA	PSIF	XKSAT	RTIMP
101	9.366		SL	66%		.35	3.5	.40	
			SCL	01%		.25	8.6	.06	
			CL	33%		.25	8.2	.04	
			L						
			C						
	1.342		Mountain	14%	.25				
			Range	86%	.35				
			Ag.	0%					
					.34	.32	5.1	.28	

WATERSHED LOSS RATES
Green Ampt Parameters

Watershed I.D. NO.	Area Sq.Mi.	TC Hrs.	Soil Text.	% of Area	IA	DTHETA	PSIF	XKSAT	RTIMP
102	5.249		SL	66%		.35	3.5	.40	
			SCL	04%		.25	8.6	.06	
			CL	30%		.25	8.2	.04	
			L						
			C						
	.528		Mountain	10%	.25				
			Range	90%	.35				
			Ag.	0%					
					.34	.32	5.1	.28	

WATERSHED LOSS RATES
Green Ampt Parameters

Watershed I.D. NO.	Area Sq.Mi.	TC Hrs.	Soil Text.	% of Area	IA	DTHETA	PSIF	XKSAT	RTIMP
103	13.657		SL	70%		.35	3.5	.40	
			SCL	06%		.25	8.6	.06	
			CL	22%		.25	8.2	.04	
			L						
			C	2%		.15	12.4	.01	
	1.764		Mountain	13%	.25				
			Range	87%	.35				
			Ag.	0%					
					.34	.32	5.0	.29	

WATERSHED LOSS RATES
Green Ampt Parameters

Watershed I.D. NO.	Area Sq.Mi.	TC Hrs.	Soil Text.	% of Area	IA	DTHETA	PSIF	XKSAT	RTIMP
104	28.196		SL	74%		.35	3.5	.40	
			SCL	09%		.25	8.6	.06	
			CL	17%		.25	8.2	.04	
			L						
			C						
	6.048		Mountain	21%	.25				
			Range	79%	.35				
			Ag.	0%					
					.33	.32	4.8	.31	

WATERSHED LOSS RATES
Green Ampt Parameters

Watershed I.D. NO.	Area Sq.Mi.	TC Hrs.	Soil Text.	% of Area	IA	DTHETA	PSIF	XKSAT	RTIMP
105	19.795		SL	65%		.35	3.5	.40	
			SCL	.01%		.25	8.6	.06	
			CL	33%		.25	8.7	.04	
			L						
			C	.01%		.15	12.4	.01	
	1.403		Mountain	7%	.25				
			Range	93%	.35				
			Ag.	0%					
					.34	.31	5.2	.27	

WATERSHED LOSS RATES
Green Ampt Parameters

Watershed I.D. NO.	Area Sq.Mi.	TC Hrs.	Soil Text.	% of Area	IA	DTHETA	PSIF	XKSAT	RTIMP
106	5.746		SL	100%		.35	3.5	.40	
			SCL						
			CL						
			L						
			C						
	1.870		mountain	33%	.25				
			range	67%	.35				
			Ag	0%					
					.32	.35	3.5	.40	

WATERSHED LOSS RATES
Green Ampt Parameters

Watershed I.D. NO.	Area Sq.Mi.	TC Hrs.	Soil Text.	% of Area	IA	DTHETA	PSIF	XKSAT	RTIMP
107	10.919		SL	95%		.35	3.5	.40	
			SCL						
			CL	05%		.25	8.7	.04	
			L						
			C						
	1.705		Mountain	16%	.25				
			Range	84%	.35				
			Ag.	0%					
					.33	.35	3.7	.38	

WATERSHED LOSS RATES
Green Ampt Parameters

Watershed I.D. NO.	Area Sq.Mi.	TC Hrs.	Soil Text.	% of Area	IA	DTHETA	PSIF	XKSAT	RTIMP
108	2.685		SL	63%		.35	3.5	.40	
			SCL						
			CL						
			L						
			C	37%		.15	12.4	.01	
	0.362		mountain	14%	.25				
			Range	86%	.35				
			Ag.	0%					
					.34	.28	6.8	.26	

WATERSHED LOSS RATES
Green Ampt Parameters

Watershed I.D. NO.	Area Sq.Mi.	TC Hrs.	Soil Text.	% of Area	IA	DTHETA	PSIF	XKSAT	RTIMP
'09	49.047		SL	98%		.35	3.5	.40	
			SCL	2%		.25	8.6	.06	
			CL						
			L						
			C						
	4.178		Mountain	9%	.25				
			Range	91%	.35				
			Ag.	0%					
					.34	.35	3.6	.39	

WATERSHED LOSS RATES
Green Ampt Parameters

Watershed I.D. NO.	Area Sq.Mi.	TC Hrs.	Soil Text.	% of Area	IA	DTHETA	PSIF	XKSAT	RTIMP
110	18.838		SL	97%		.35	3.5	.40	
			SCL						
			CL						
			L						
			C	03%		.15	12.4	.01	
	2.986		Mountain	16%	.25				
			Range	84%	.35				
			Ag	0%					
					.33	.34	3.8	.39	

WATERSHED LOSS RATES
Green Ampt Parameters

Watershed I.D. NO.	Area Sq.Mi.	TC Hrs.	Soil Text.	% of Area	IA	DTHETA	PSIF	XKSAT	RTIMP
111	2.406		SL	94 %		.35	3.5	.40	
			SCL	06 %		.25	8.6	.06	
			CL						
			L						
			C						
	.769		Mountain	32%	.25				
			Range	68%	.35				
			Ag.	0%					
					.32	.34	3.8	.38	

WATERSHED LOSS RATES
Green Ampt Parameters

Watershed I.D. NO.	Area Sq.Mi.	TC Hrs.	Soil Text.	% of Area	IA	DTHETA	PSIF	XKSAT	RTIMP
112	15.399		SL	54%		.35	3.5	.40	
			SCL						
			CL	24%		.25	8.2	.04	
			L						
			C	22%		.15	12.4	.01	
	559.85		Mountain	6%	.25				
			Range	76%	.35				
			Ag	18%	.50				
					.37	.28	6.6	.23	

WATERSHED LOSS RATES
Green Ampt Parameters

Watershed I.D. NO.	Area Sq.Mi.	TC Hrs.	Soil Text.	% of Area	IA	DTHETA	PSIF	XKSAT	RTIMP
200	4.243		SL	34 %		.35	3.5	.40	
			SCL						
			CL	61%		.25	8.2	.04	
			L						
			C	05%		.15	12.4	.01	
			Res/Comm	1%	.10				
			Range	4%	.35				
			Ag.	95%	.50				
					.49	.28	6.8	.16	1

WATERSHED LOSS RATES
Green Ampt Parameters

Watershed I.D. NO.	Area Sq.Mi.	TC Hrs.	Soil Text.	% of Area	IA	DTHETA	PSIF	XKSAT	RTIMP
201	14.675		SL	94 %		.35	3.5	.40	
			SCL	06 %		.25	8.6	.06	
			CL						
			L						
			C						
	2258.70		Mountain	24%	.25				
			Range	76%	.35				
			Ag						
					.33	.34	3.8	.38	

WATERSHED LOSS RATES
Green Ampt Parameters

Watershed I.D. NO.	Area Sq.Mi.	TC Hrs.	Soil Text.	% of Area	IA	DTHETA	PSIF	XKSAT	RTIMP
202	14.982		SL	85%		.35	3.5	.40	
			SCL	04%		.25	8.6	.06	
			CL	11%		.25	8.2	.04	
			L						
			C						
	453.67		Mountain	5%	.25				
			Range	82%	.35				
			Ag	13%	.50				
					.36	.34	4.2	.35	

WATERSHED LOSS RATES
Green Ampt Parameters

Watershed I.D. NO.	Area Sq.Mi.	TC Hrs.	Soil Text.	% of Area	IA	DTHETA	PSIF	XKSAT	RTIMP
203	11.412		SL	61%		.35	3.5	.40	
			SCL	02%		.25	8.6	.06	
			CL	37%		.25	8.2	.04	
			L						
			C						
	820.47		Mountain	11%	.25				
			Range	82%	.35				
			Ag	7%	.50				
					.35	.31	5.3	.26	

WATERSHED LOSS RATES
Green Ampt Parameters

Watershed I.D. NO.	Area Sq.Mi.	TC Hrs.	Soil Text.	% of Area	IA	DTHETA	PSIF	XKSAT	RTIMP
204	12.760		SL	63%		.35	3.5	.40	
			SCL	03%		.25	8.6	.06	
			CL	14%		.25	8.2	.04	
			L						
			C	20%		.15	12.4	.01	
	1206.56		Mountain	15%	.25				
			Range	49%	.35				
			Ag	36%	.50				
					.39	.29	6.1	.26	

WATERSHED LOSS RATES
Green Ampt Parameters

Watershed I.D. NO.	Area Sq.Mi.	TC Hrs.	Soil Text.	% of Area	IA	DTHETA	PSIF	XKSAT	RTIMP
205	25.645		SL	82 %		.35	3.5	.40	
			SCL	09 %		.25	8.6	.06	
			CL	09 %		.25	8.2	.04	
			L						
			C						
	2596.54		Mountain	16%	.25				
			Range	71%	.35				
			Ag	13 %	.50				
					.35	.33	4.4	.34	

WATERSHED LOSS RATES
Green Ampt Parameters

Watershed I.D. NO.	Area Sq.Mi.	TC Hrs.	Soil Text.	% of Area	IA	DTHETA	PSIF	XKSAT	RTIMP
206	8.831		SL	72 %		.35	3.5	.40	
			SCL	06 %		.75	8.6	.06	
			CL	16 %		.75	8.2	.04	
			L						
			C	06 %		.15	12.4	.01	
	1.388		Mountain	16%	.25				
			Range	57%	.35				
			Ag.	27%	.50				
					.37	.32	5.1	.30	

WATERSHED LOSS RATES
Green Ampt Parameters

Watershed I.D. NO.	Area Sq.Mi.	TC Hrs.	Soil Text.	% of Area	IA	DTHETA	PSIF	XKSAT	RTIMP
207	7.488		SL	86%		.35	3.5	.40	
			SCL	4%		.25	8.6	.06	
			CL	02%		.25	8.2	.04	
			L						
			C	08%		.15	12.4	.01	
	1.147		Mountain	15%	.25				
			Range	70%	.35				
			Ag.	15%	.50				
					.36	.33	4.5	.35	

WATERSHED LOSS RATES
Green Ampt Parameters

Watershed I.D. NO.	Area Sq.Mi.	TC Hrs.	Soil Text.	% of Area	IA	DTHETA	PSIF	XKSAT	RTIMP
208	12.616		SL	92%		.35	3.5	.40	
			SCL	<1%					
			CL	05%		.25	8.2	.04	
			L						
			C	03%		.15	12.4	.01	
	1.659		mountain	13	.25				
			Range	79%	.35				
			Ag.	08%	.50				
					.35	.34	4.0	.37	

WATERSHED LOSS RATES
Green Ampt Parameters

Watershed I.D. NO.	Area Sq.Mi.	TC Hrs.	Soil Text.	% of Area	IA	DTHETA	PSIF	XKSAT	RTIMP
209	11.824		SL	96%		.35	3.5	.40	
			SCL						
			CL						
			L						
			C	04%		.15	12.4	.01	
	5.641		mountain	48%	.25				
			Range	42%	.35				
			Ag	10%	.50				
					.32	.34	3.9	.38	

WATERSHED LOSS RATES
Green Ampt Parameters

Watershed I.D. NO.	Area Sq.Mi.	TC Hrs.	Soil Text.	% of Area	IA	DTHETA	PSIF	XKSAT	RTIMP
210	16.930		SL	98%		.35	3.5	.40	
			SCL						
			CL	01 %		.25	8.2	.04	
			L						
			C	01 %		.15	12.4	.01	
	2.670		Mountain	16%	.25				
			Range	81%	.35				
			Cy	03 %	.50				
					.34	.35	3.6	.39	

APPENDIX H

Muskingum Routing Data

Muskingum Routing Summary Table

1) Assume Ave. Travel Velocity = 4.0 FPS

2) Muskingum K = $\frac{\text{Length (ft)}}{\text{4 fps x 3600 s/h}}$ = AMSKK

3) Time Steps = 10 min.

4) Steps = $\frac{\text{K (hr.) x 60 min/hr.}}{\text{10 min}}$ = integer NSTPS

5) X = .2 (constant)

ID	Length (ft)	NSTPS	AMSKK	X
R1	1042	1	.07	.2
R2A	23438	10	1.63	.2
RA	7031	3	.49	.2
RB	6771	3	.47	.2
R5A	21875	9	1.52	.2
RC	10417	4	.72	.2
R7A	28385	12	1.97	.2
RD	7552	3	.52	.2
R8	4687	2	.33	.2
RE	28125	12	1.95	.2
R13	3906	2	.27	.2
RF	14063	6	.98	.2
R100	26042	11	1.81	.2
RG	35417	15	2.46	.2
R103	17708	7	1.23	.2
R106	28125	12	1.95	.2

Muskingum Routing Summary Table (Continued)

ID	Length (ft)	NSTPS	AMSKK	X
RH	1823	1	.13	.2
RI	40625	17	2.82	.2
R108	29427	12	2.04	.2
R109	14062	6	.98	.2
RJ	30729	13	2.13	.2
RK	15625	7	1.09	.2
R201	13542	6	.94	.2
RL	14323	6	.99	.2
RM	14063	6	.98	.2
R206	6771	3	.47	.2
RN	10677	4	.74	.2

APPENDIX I

AT & SF Railroad Drainage Structures

1-5-87
~~8/31/89~~

Page No.	Photo No.	I.D. No.	Qcap (cfs)
1	36	6.8	51
	35	7.9	511
2	34	8.3	861
	33	8.5	2,057
3	32	9.6	2,193
	31	10.3	1,126
4	30	10.8	557
	29	11.3	1,858
5	28	11.7	781
	27	12.2	1,421
6	26	12.5	1,080
	25	12.9	1,295
7	24	13.2	102
	23	13.6	1,509
8	22	14.1	1,607
	21	14.7	715
9	19	24.0	1,443
	18	24.4	1,330
10	17	24.8	1,272
	16	25.2	1,148
11	15	25.6	1,530
	14	25.9	1,125
12	13	26.3	2,544
	12	26.8	1,602
13	11	27.5	3,180
	10	27.9	608
14	9	28.2	2,584
	8	28.6	1,375
15	7	28.8	104
	6	29.2	717
16	5	29.6	2,600
	4	29.7	250

Railroad culvert capacity vs. subbasin discharge check

Basin No. 102	Q cap.	Q basin	Q deficit
Clv. 6.8	51		
Clv. 7.9	511		
Total	562	1,544	982

Basin No. 103	Q cap.	Q basin	
Clv. 8.3	861		
Clv. 8.5	2,057		
Clv. 9.6	2,193		
Clv. 10.3	1,426		
Clv. 10.8	557		
Clv. 11.3	1,858		
Total	8,952	2,322	+ 982 = 3,304

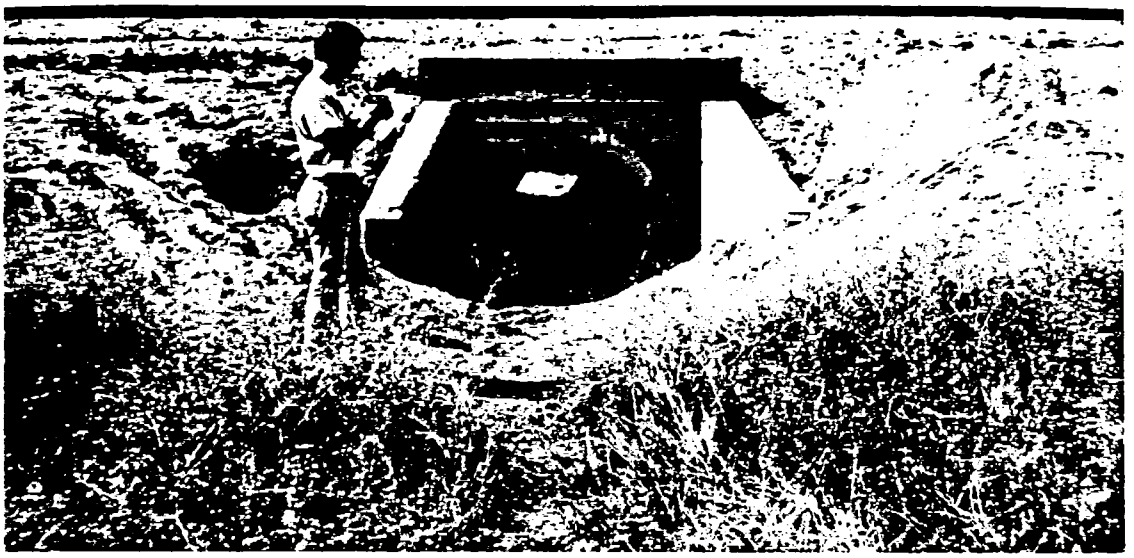
Basin No. 104	Q cap.	Q basin
Clv. 11.7	781	
Clv. 12.2	1,421	
Clv. 12.5	1,080	
Clv. 12.9	1,295	
Clv. 13.2	102	
Clv. 13.6	1,509	
Clv. 14.1	1,607	
Clv. 14.7	715	
Total	8,510	3,993

Basin No. 204	Q cap.	Q basin
Clv. 24.0	1,443	
Clv. 24.4	1,330	
Clv 24.8	1,272	
Clv. 25.2	1,148	
Total	5,193	2,158

Basin No. 206	Q cap.	Q basin
Clv. 25.6	1,530	
Clv. 25.9	1,125	
Clv. 26.3	2,544	
Clv. 26.8	1,602	
Total	6,801	1,966

Basin No. 207	Q cap.	Q basin
Clv. 27.5	3,180	
Clv. 27.9	608	
Clv. 28.2	2,584	
Clv. 28.6	1,375	
Clv. 28.8	104	
Total	7,851	1,592

Basin No. 209	Q cap.	Q basin
Clv. 29.2	717	
Clv. 29.6	2,600	
Clv. 29.7	250	
Total	3,567	1,871



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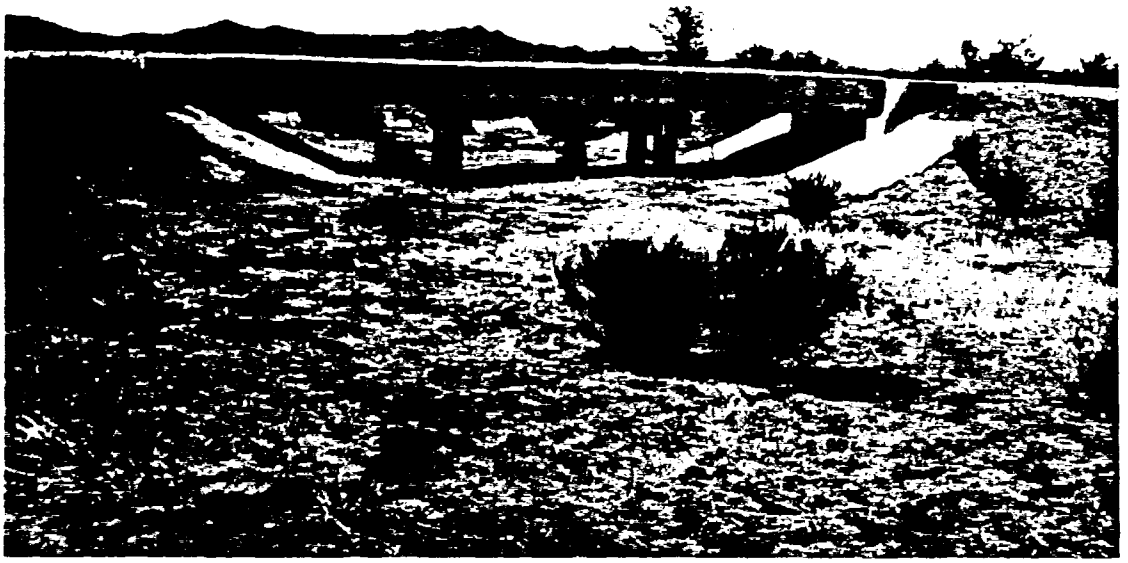
I.D. # 7.9



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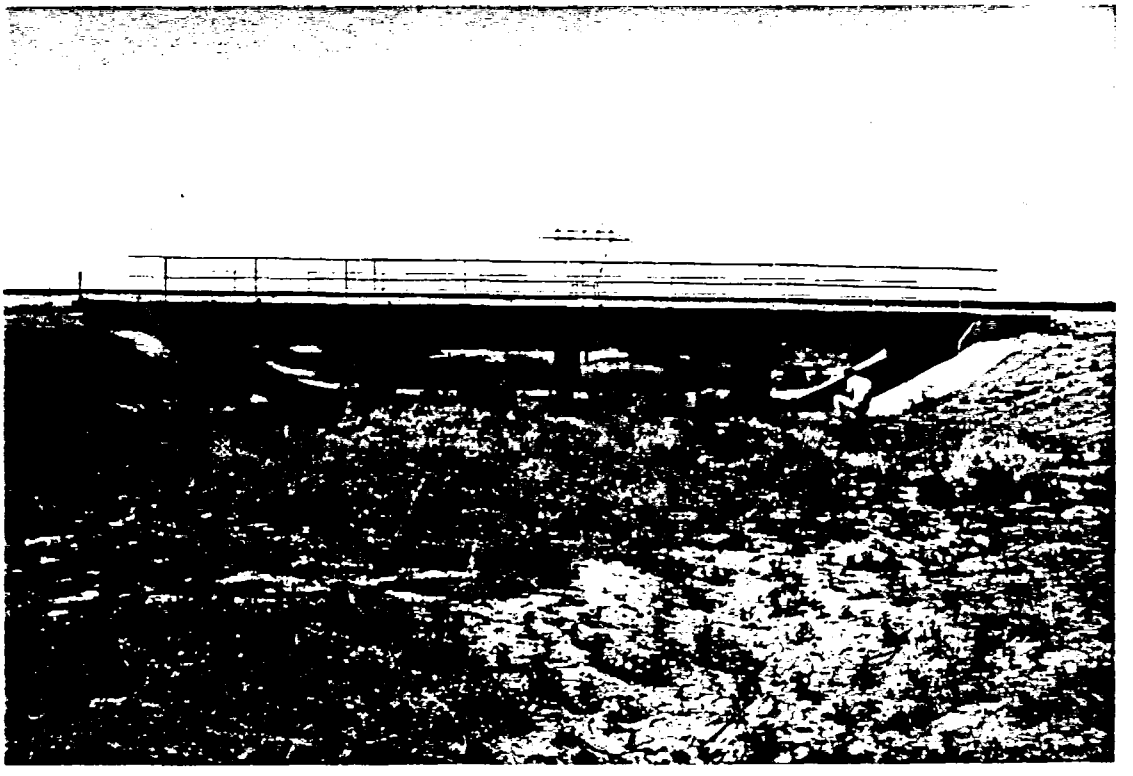
I.D # 8.5

10.F 9.6



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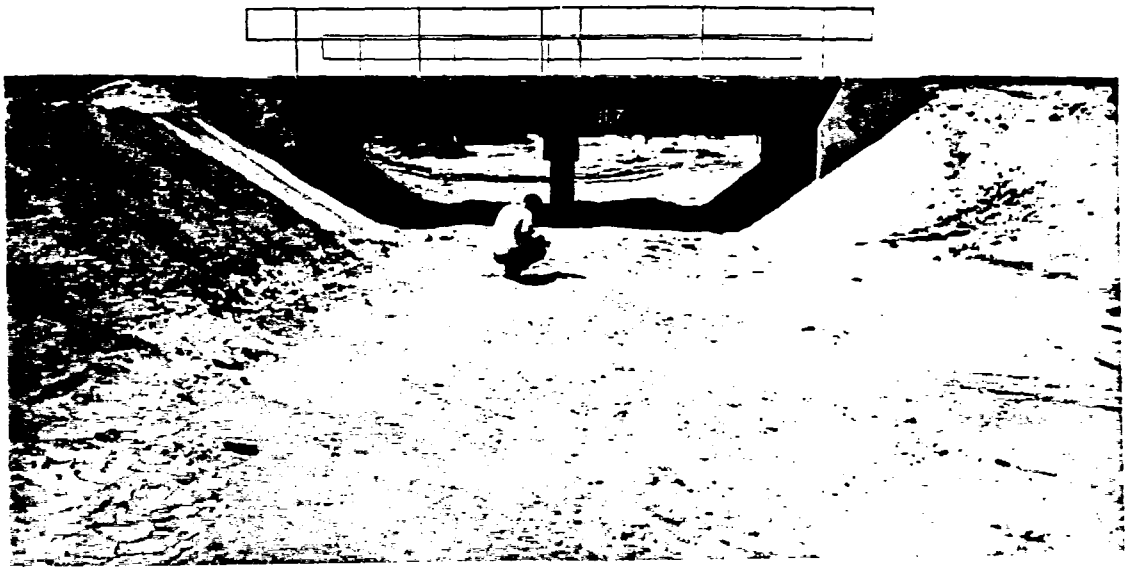
10.8

11.8



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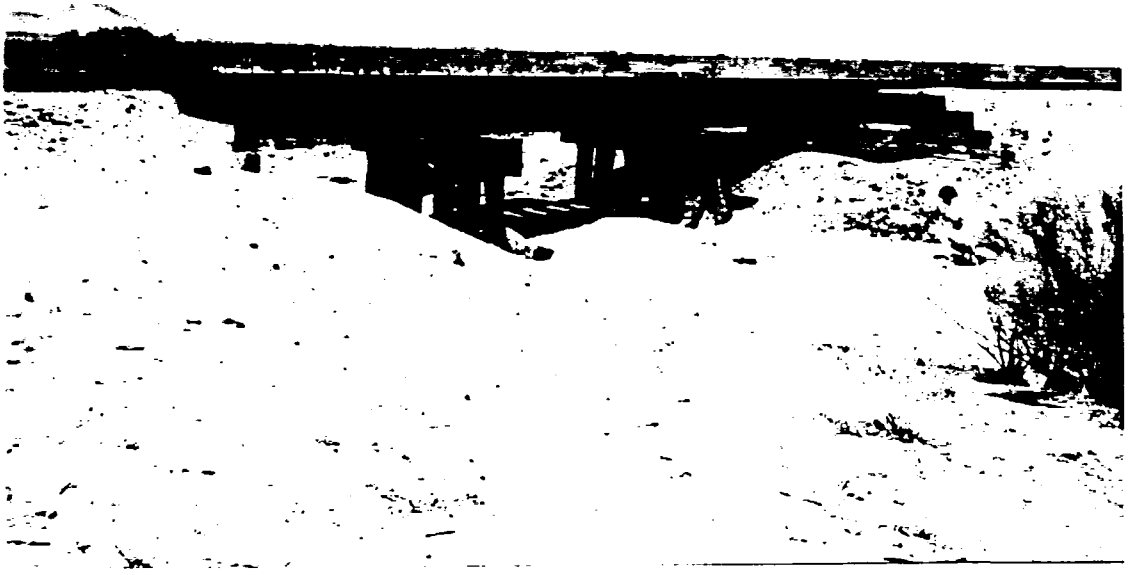
I.D.# 10.2

I.D. # 12.5



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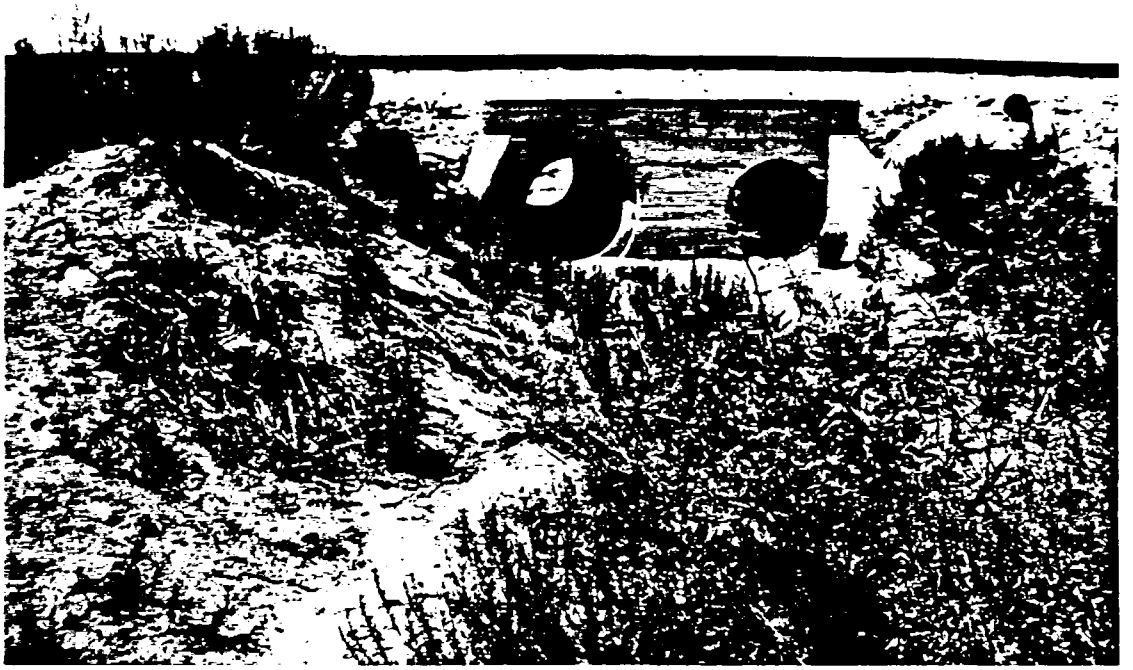

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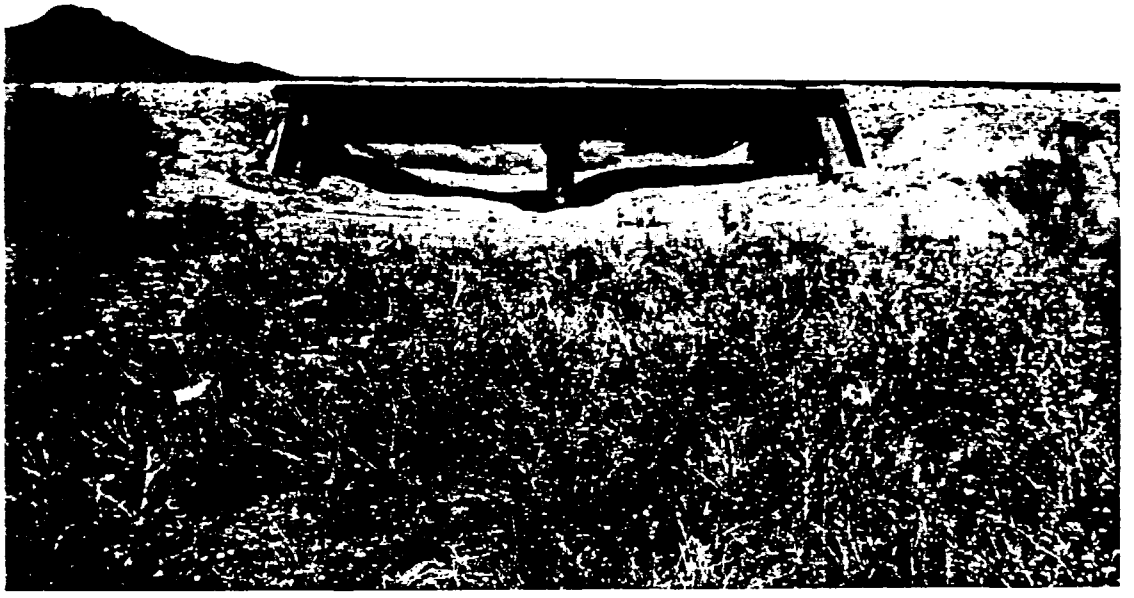

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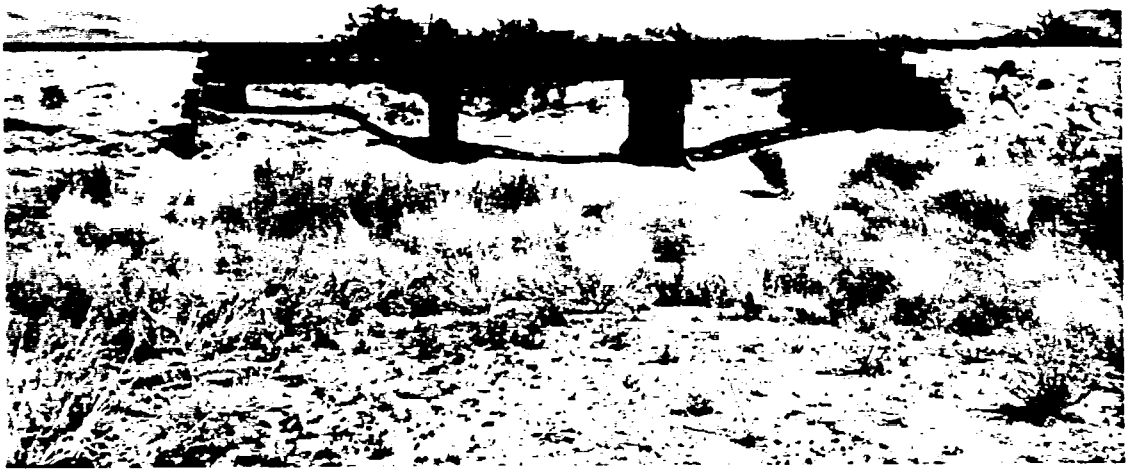

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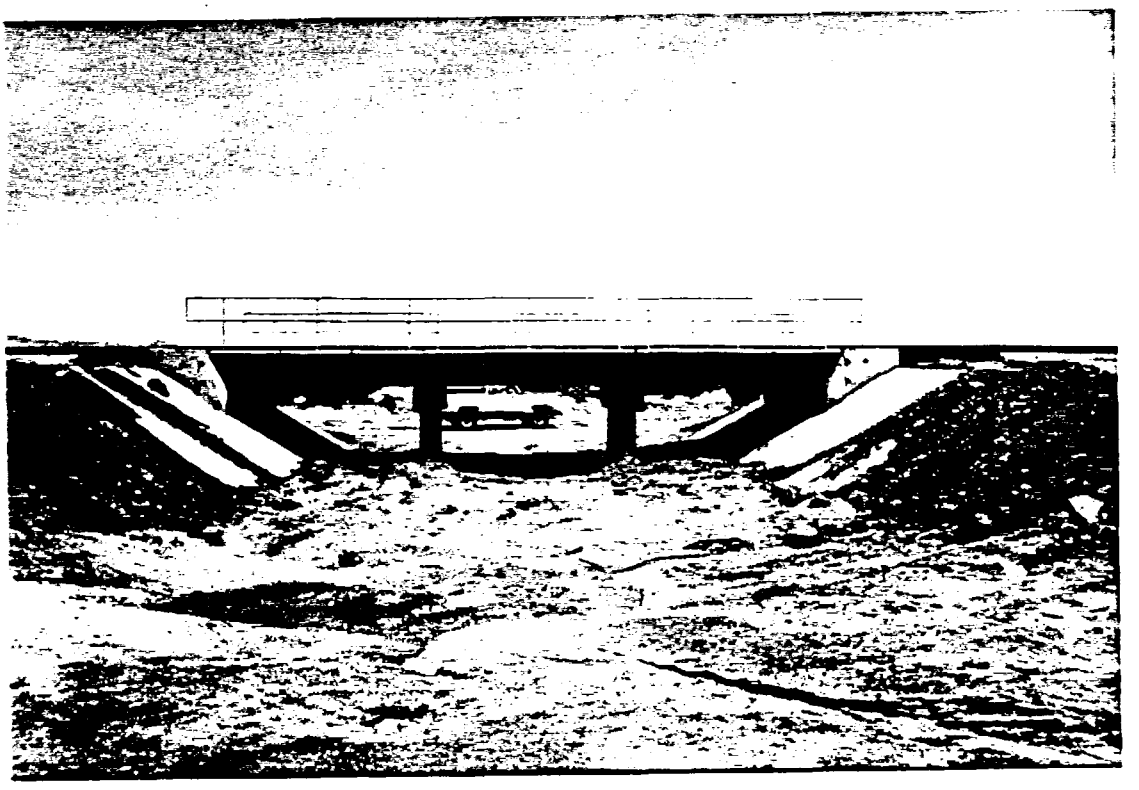

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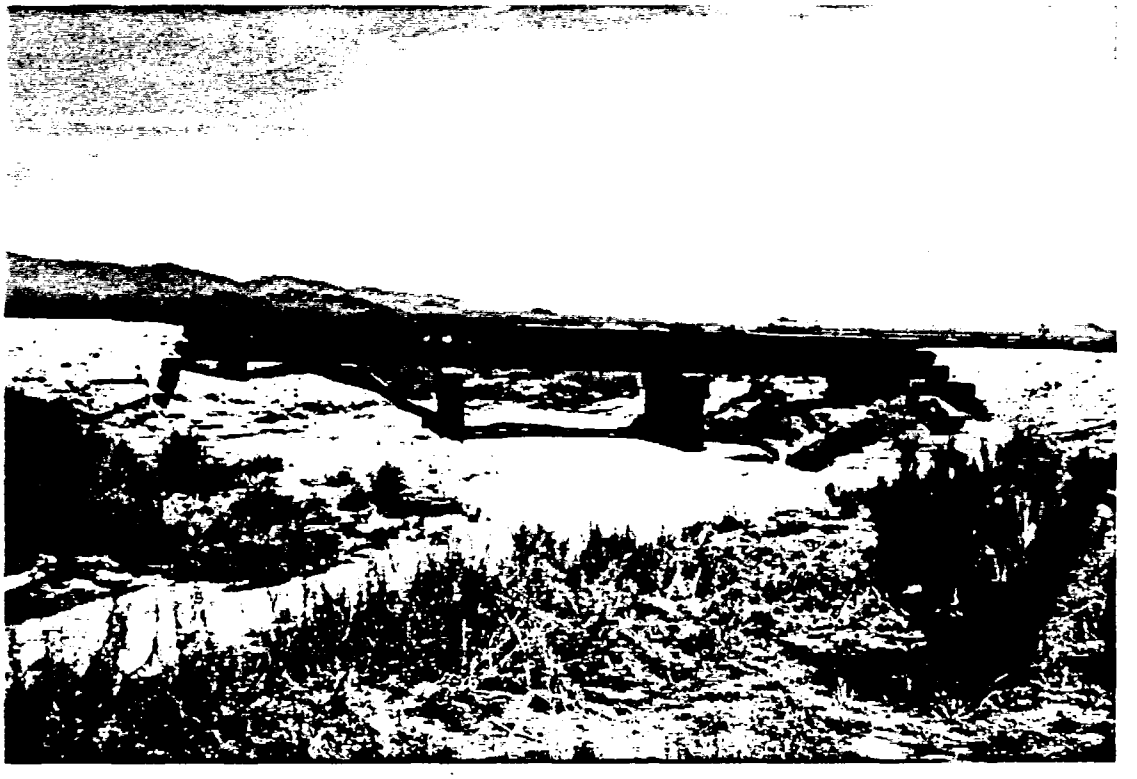

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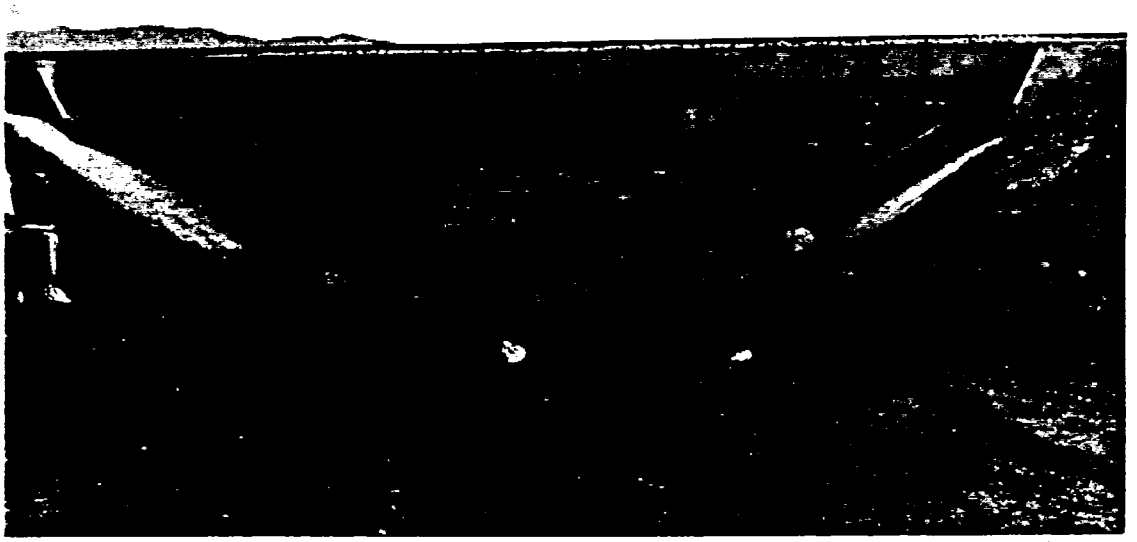

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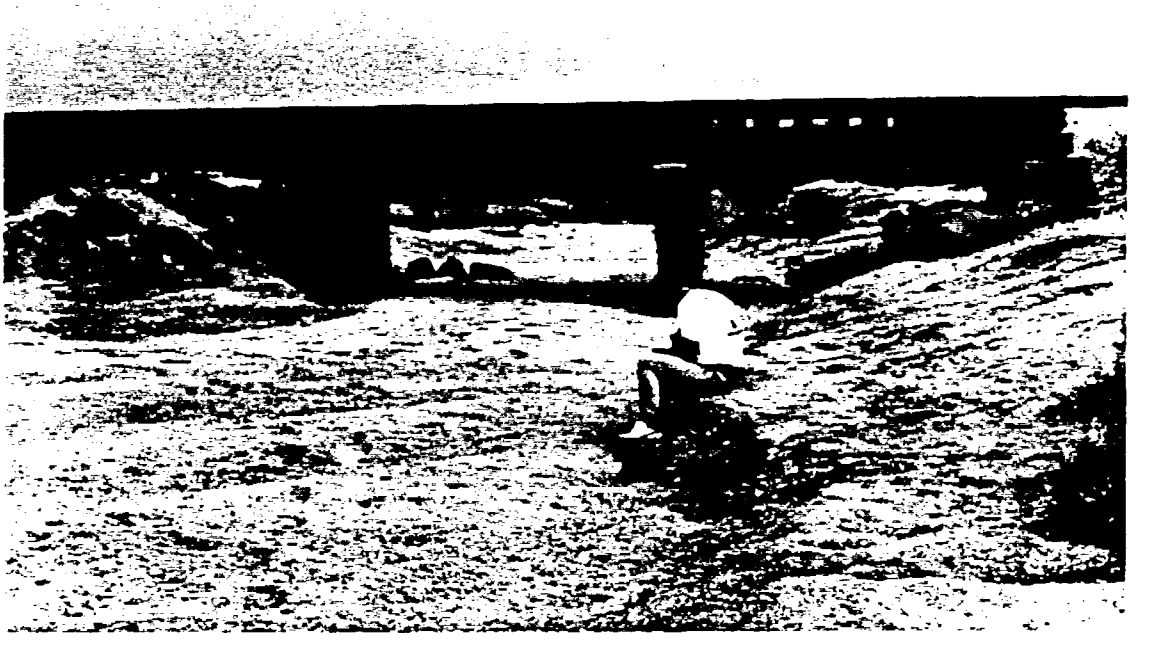

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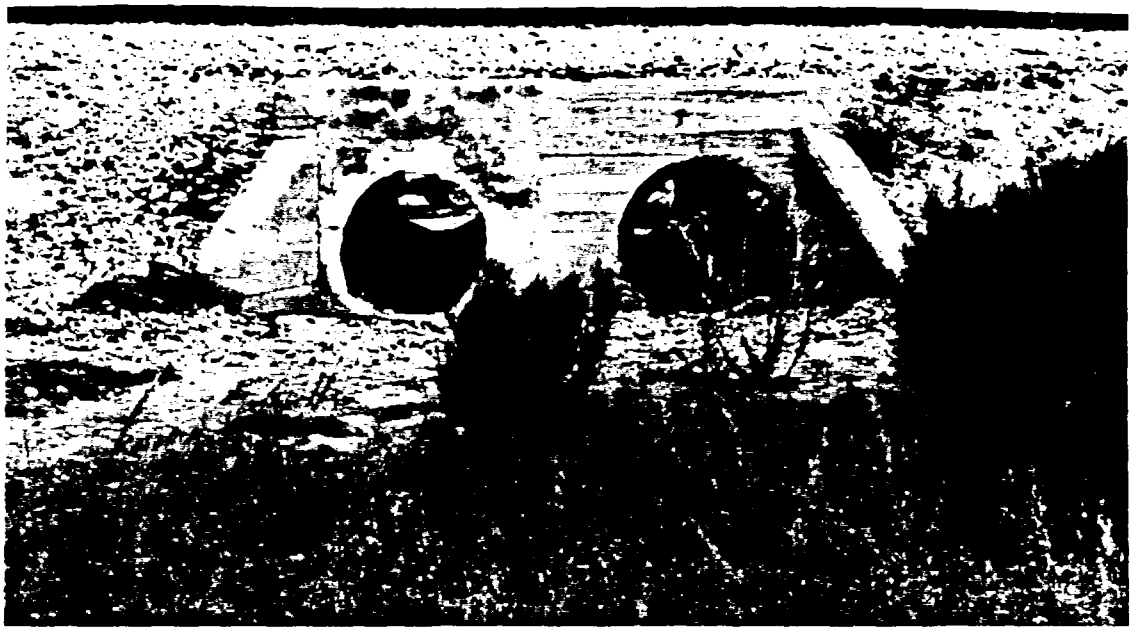

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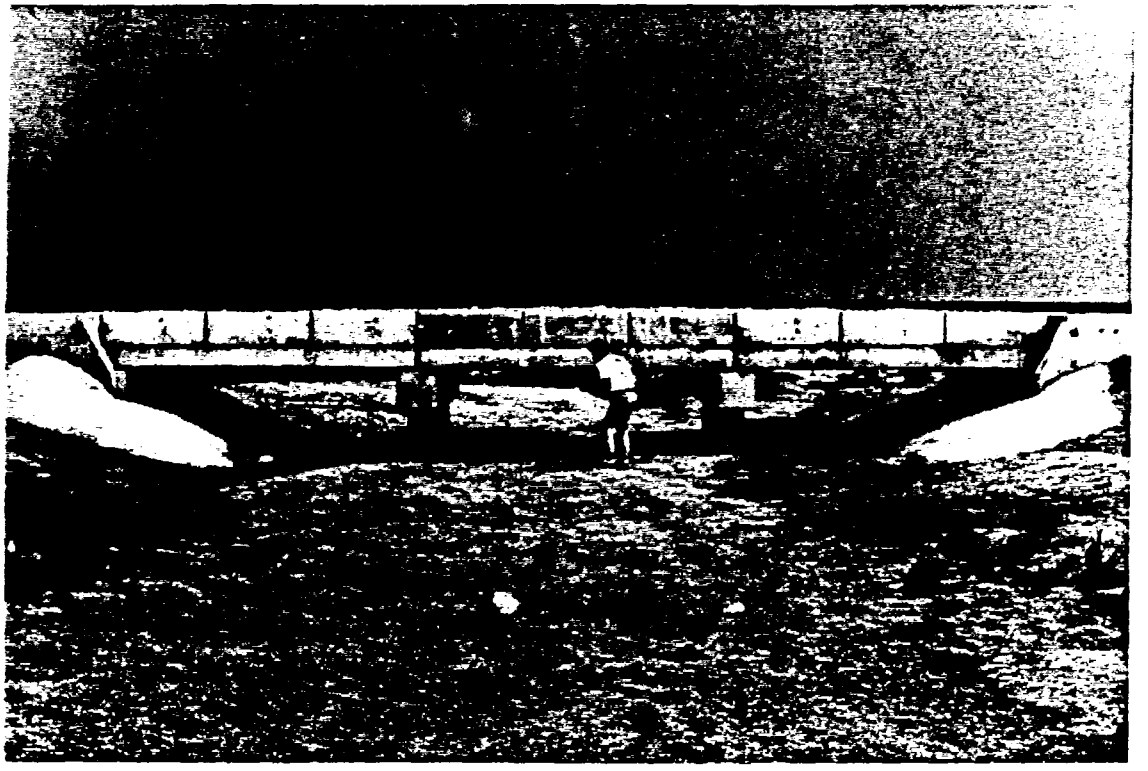

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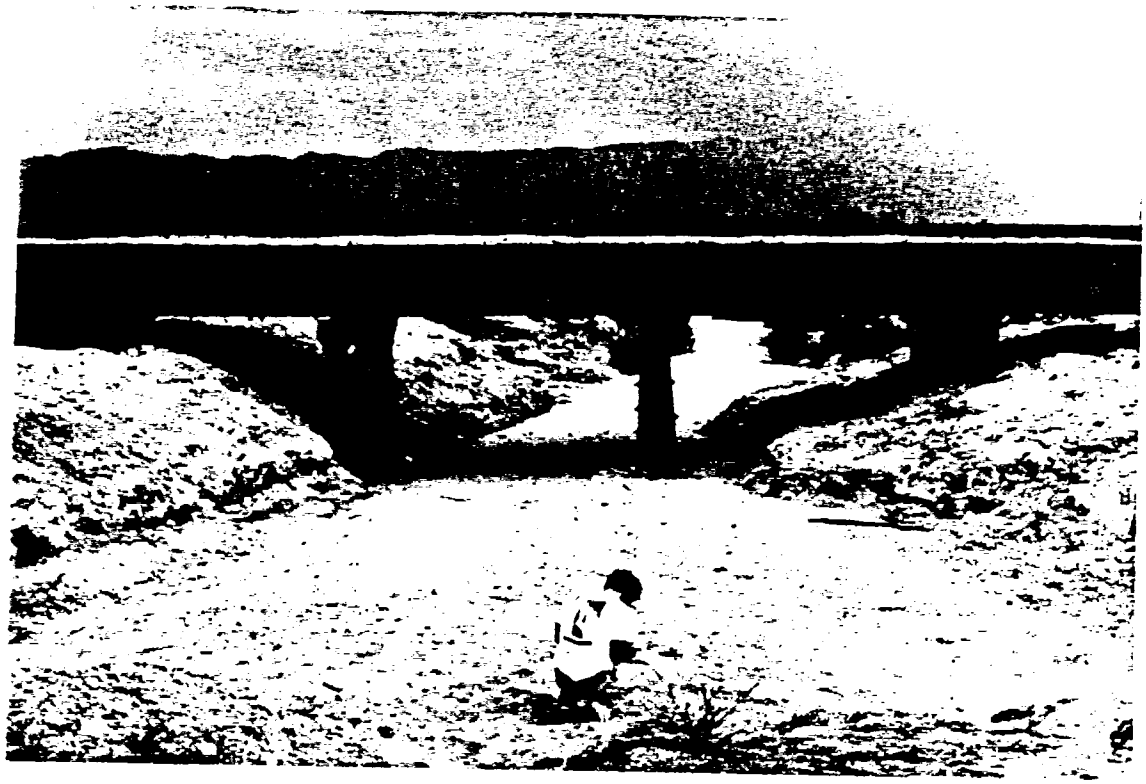

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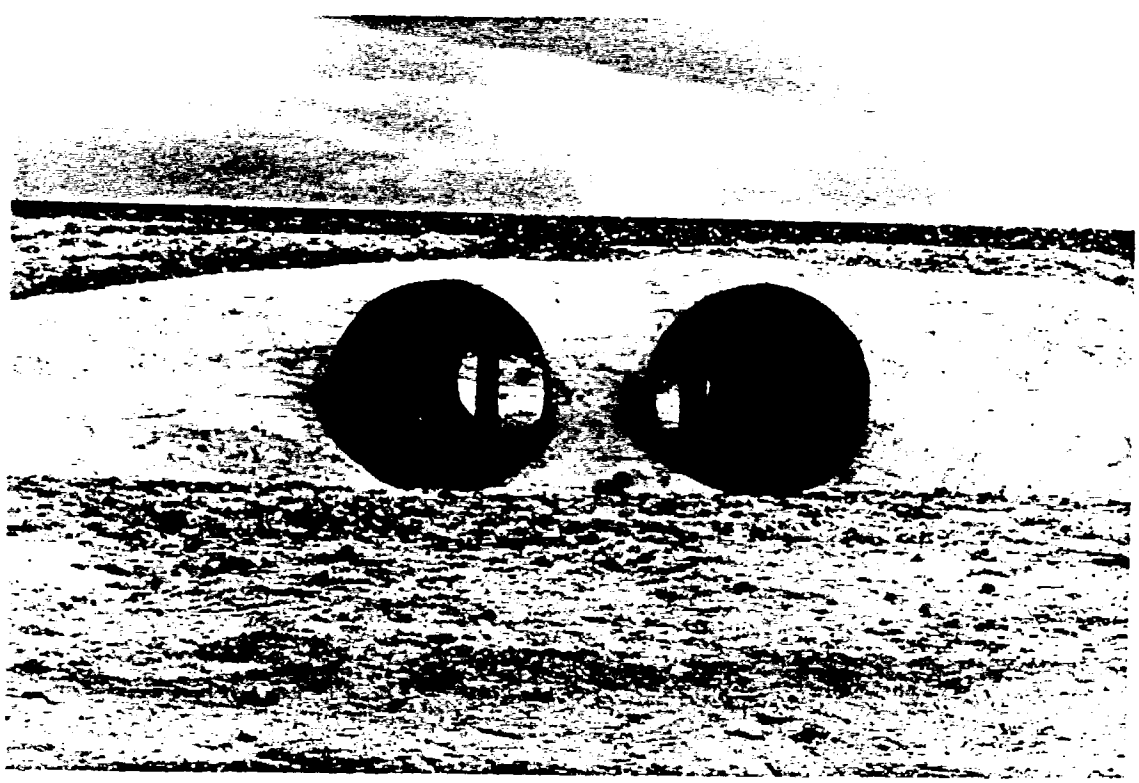

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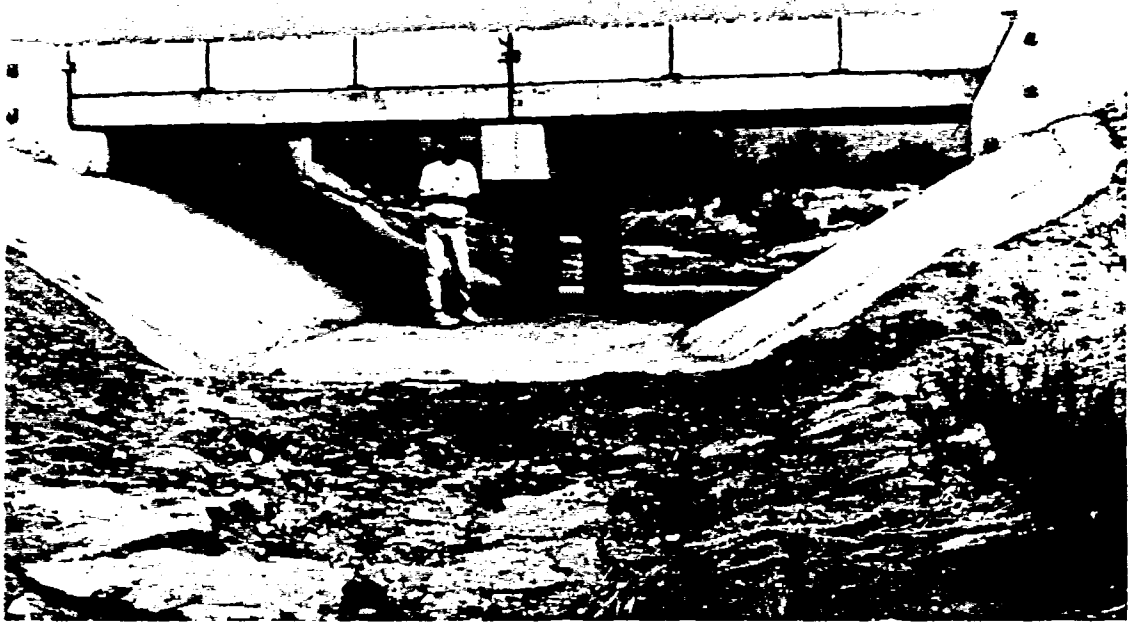

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BRIDGES OVER GRASS WASH

I.D. # 230 AT&SF 300 ft. LONG TRESTLE OVER GRASS WASH. VIEW LOOKING DOWN-STREAM FROM U.S. HIGHWAY 60/70 BRIDGE (BELOW).

U.S. HIGHWAY 60/70 232 ft. LONG BRIDGE OVER GRASS WASH. VIEW LOOKING UPSTREAM FROM AT&SF TRESTLE (ABOVE).

APPENDIX J

FEMA Peak Discharges

Table 3. Summary of Discharges (Cont'd)

Flooding Source and Location	Drainage Area (Square Miles)	Peak Discharges (Cubic Feet per Second) 10-Year	50-Year	100-Year	500-Year
Mockingbird Wash					
At U.S. Highways 60, 70, and 89	6.9	2,750	4,040	5,060	7,400
Little San Domingo Wash					
At U.S. Highways 60, 70, and 89	6.2	1,690	2,620	3,090	4,250
Wittmann Drainage					
At Atchison, Topeka & Santa Fe Railway	8.6	1,760	2,770	3,060	4,350
Aguila Farm Channel					
At Eagle Eye Avenue	216.0	5,450	12,000	16,000	--[1]
Grass Wash					
At U.S. Highways 60 and 70	83.0	6,380	11,600	14,400	--[1]
Lower El Mirage Wash					
At Cactus Road	1.9	90	200	250	--[1]
Lower El Mirage Wash Tributary					
At Mouth	1.3	53	110	150	--[1]
Sand Tank and Bender Washes					
At Gila Bend (Gillespie Canal)	261	28,200	33,000[2]	33,500[2]	34,500[2]
At Interstate Highway 8	257[3]	28,000	51,000	64,000	87,000

[1]Not Computed
[2]Decrease Due to Diversion at Interstate Highway 8
[3]An Equivalent of 128 Square Miles of Drainage Area Is Diverted to West at Interstate Highway 8

HYDROLOGIC ANALYSIS
OF THE CENTENNIAL WASH
IN MARICOPA COUNTY, ARIZONA

FOR

FEDERAL EMERGENCY MANAGEMENT AGENCY

September 22, 1988
Revised January 6, 1989
CBA File No. 04856-03-74
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I. INTRODUCTION

Cella Barr Associates (CBA) has been contracted by the Federal Emergency Management Agency (FEMA) to perform a detailed Flood Insurance Re-Study of the Centennial Wash in Maricopa County, Arizona. The study reach for the Centennial Wash commences at the La Paz County line at the upstream limit and extends downstream, a distance of approximately 39.8 miles, to the confluence with the Gila River near Gillespie Dam. The confluence of the Gila River and the Centennial Wash lies approximately 42 miles southwest of Phoenix, Arizona as indicated on the Vicinity Map, Figure 1.

The purpose of this investigation is to estimate 100-year peak discharges at specific locations along the study reach of the Centennial Wash. These discharges are proposed for use in the completion of the Centennial Wash Flood Insurance Re-Study and are to be employed in determining water surface elevations, floodway boundaries and flood zones within the limits of the detailed study reach. For this particular Flood Insurance Re-Study, subsequent floodplain and floodway delineations will be based on the 100-year flood discharges only.

II. WATERSHED DESCRIPTION

General

The Centennial Wash headwaters are located in the Date Creek Mountains near Wickenburg, Arizona, approximately 50 miles northwest of Phoenix. Runoff generated within the 1,870-square mile Centennial Drainage Basin, at the Gila River, tends to flow in a southerly direction (southwesterly within the upper portions and southeasterly in the lower portions) and passes through Yavapai, Maricopa and La Paz Counties. Towns which lie within the subject watershed include Aguila, Wenden and Salome.

The Centennial Wash Drainage Basin is generally elongated in shape, with a total basin length of approximately 110 miles and widths ranging from 15 to 35 miles.

This watershed is characterized by mountain ranges of moderate elevation along the entire perimeter of the basin. The channels of the Centennial Wash drainage basin are characterized by numerous poorly defined, highly dynamic, braided washes that create a poorly defined dominant channel over the majority of the watershed. In most locations, the Centennial Wash channel is wide and shallow and only recognizable by dense stands of native vegetation. In several other locations, the channel loses its definition and becomes part of the irrigated farmland that is prominent in several areas. The channel does not have the capacity to convey major flows and large areas of the watershed are susceptible to shallow flooding due to the flatness of the valley floor. The runoff rate derived from the watershed is attenuated significantly as sheet flow passes downstream across the watershed due to the effects of overbank storage. Channel slopes range from about 0.34 percent to 2.65 percent. Moderate to heavy growth of native vegetation covers most reaches of the channels and associated overbank areas.

The Centennial Wash headwaters at an elevation of 4,506 feet in the Date Creek Mountains and elevations become variably lower, reaching an elevation of about 787 feet at the confluence with the Gila River. This results in a mean slope of 0.64 percent for the overall Centennial Drainage Basin.

Within the Centennial Wash drainage basin, there are five major soils association types: Cherioni-Rock outcrop, Antho-Valencia, Muhall-Leveen, Gilman-Estrella-Avondale and Laveen-Coolidge. Four of the soil associations are of hydrologic Soils Group B and one is of hydrologic Soil Group D, as defined below:

> Cherioni-Rock outcrop, of hydrologic Soil Group D, has a high runoff potential and a very slow rate of water transmission. These very shallow soils, over nearly impervious material, are found in the mountainous portion of the Centennial Wash drainage basin. Approximately 10 to 20 percent of the study areas are comprised of this Soil Group D.
>
> The other four soil associations, comprising about 80 to 90 percent of the study area, are found in the braided channel regions and valley plains. These soils, of Soil Group B, have moderate infiltration rates when wetted and a moderate rate of water transmission. The soils are moderately deep to deep, moderately well to well drained with moderately fine to moderately coarse textures.

The natural vegetation cover in the study area is desert brush. Desert brush includes such plants as mesquite, palo verde, brittle brush, creosote bush, catclaw, ironwood, salt bush, saguaro and mixed cactus, etc. This hydrologic cover type is typical of lower elevations with low annual precipitation. Some irrigated farmlands are located in the study area along the Centennial Wash.

The study area is situated in a semi-arid climatic zone characterized by hot summers lasting from May to September with maximum daily

temperatures averaging more than 90°F (33°C), and mild winters with early morning temperatures usually above the freezing point and afternoon temperatures generally between 65°F (18°C) and 70°F (22°C).

Average annual precipitation varies from 11 inches at Wickenburg to 7 inches at the lower limit of the watershed. The study watershed is subject to three major wet seasons. The first season, during the winter months, is invoked by pacific storms producing gentle, widespread showers. The second season, during the summer months, is characterized by thunderstorms produced by moist air from the Gulf of Mexico. During the third season, from late summer to fall, rain is also delivered through tropical thunderstorms arising in the Pacific.

Physical Characteristics

For the purpose of this study, the Centennial Wash Drainage Basin has been divided into an upper and lower region. As shown on Figure 2, the upper watershed has been designated as that portion of the contributing drainage basin which lies above the Narrows Dam (southeast of Salome) and is represented by Sub-basins 1 through 18. The lower watershed extends from the dam, downstream to the Gila River and is comprised of Sub-basins 19 to 37. General basin characteristics for the two regions are presented in the following text.

Upper Centennial Basin

The Upper Centennial Basin is bounded on the north by the Harcuvar and Date Creek Mountains and on the south by the Harquahala and Vulture Mountains. The Centennial Wash in this vicinity flows in a southwesterly direction through the McMullen Valley before making an abrupt turn near Salome and continuing in a southeasterly direction to the Narrows Dam. The general slope for this reach of the Centennial Wash is 0.96 percent.

A majority of the Upper Centennial Basin remains in a natural state and is currently only impacted by minor flood control measures, highways, railroads and low intensity, irrigated cropland.

A vegetative cover density of about 20 percent Desert Brush extends throughout the undisturbed valley region of this basin, with densities in the mountain regions decreasing due to rocky outcrops.

Lower Centennial Basin

The Lower Centennial Basin is bounded on the north by the Harquahala, Big Horn and Belmont Mountains and on the south by the Little Harquahala, Eagletail and Gila Bend Mountains.

The Centennial Wash in this vicinity flows in a southeasterly direction through the Harquahala Plain before converging on the Gila River. The general slope for this reach is 0.31 percent.

Over the years, the natural condition for the Lower Centennial Basin has been considerably impacted by various land uses and improvements. A large portion of this area has been converted to irrigated cropland. Numerous regional flood control measures have also been instituted within the Lower Centennial Basin. A major segment of the Central Arizona Project, the Granite Reef Aqueduct, crosses the entire basin and passes under the Centennial Wash near Lone Mountain. In addition, major highway and railroad construction has taken place.

A natural, vegetative cover density of about 10 percent Desert Brush exists in the undisturbed valley regions with cover densities decreasing in the mountain regions.

The channel for the Centennial Wash in the Lower Centennial Basin is wide and shallow and sometimes only recognizable by the dense stands of Salt Cedar lining this reach of the watercourse. Runoff from large portions of the Lower Centennial Basin has been stored and/or diverted by flood control structures and is delivered at various locations along the main drainage course. Major tributaries in this region are Tiger Wash and Old Camp/Winters Wash.

Structural Features

Structural features within the watershed include major roadways, railroads, flood control structures and water distribution systems. The installation of these improvements has involved the participation of many Federal, State and Local agencies and represent a considerable investment.

The following text contains more specific information regarding the more prominent facilities.

Upper Centennial Basin

In the Upper Centennial Basin, major roadways include U.S. Highway 60/70 and State Highway 71. These roads traverse the basin from northeast to southwest through the central portion of the subject watershed. At the two locations where these highways cross the Centennial channel, concrete box culverts have been installed to convey runoff beneath the roadway. For the purpose of this study, it has been assumed that these structures will have no affect on the determination of the 100-year peak discharge at the confluence with the Gila River.

The Atchison-Topeka and Santa Fe Railroad traverses the Upper Centennial Watershed adjacent to the previously cited highways. The primary drainage channel crosses the railway near Wenden. Field investigation yielded that a new bridge crossing was under construction. It was the opinion of CBA that this new structure would be capable of passing the 100-year peak discharge and would provide no significant stormwater detention, therefore routings for this structure were not included in the hydrologic analysis.

Flood control structures within the Upper Centennial Basin range from minor features such as spreading dikes and local diversion systems to flood-retarding structures and levees. As determined through field investigation and reconnaissance, many of these structures were not designed to, or are not capable of, storing or diverting the 100-year storm runoff. It was assumed that these structures would have little consequence on the estimated 100-year peak discharge downstream and, therefore, minor features such as spreading dikes and irrigation systems were not modeled in the hydrologic analysis. The following is a discussion regarding the more significant flood control structures in the Upper Centennial Basin.

Ritter Dam is located in the northeastern portion of the upper watershed and was not incorporated into the hydrologic analysis due to its relatively small size and long distance from the downstream concentration points investigated along the study reach.

The Upper Centennial Flood Retarding Structures (FRS) are located along the primary channel between the Towns of Wenden and Aguila. These facilities were constructed in 1956 by the Bureau of Land Management and consist of seven detention structures. During field investigation, it was evident that the two upstream structures had been breeched at some time in the past. In light of the current condition of these facilities and the potential for future failures

of the system, CBA has elected not to incorporate the potential flood control effects of the Upper Centennial FRS in this investigation.

The Narrows Dam is located approximately eight miles southeast of Salome in the Little Harquahala Mountains. This facility is under the jurisdiction of the Bureau of Land Management and Maricopa County. As evidenced during field investigation, the dam is presently in good condition and functioning appropriately. However, we believe its capacity to control the 100-year discharge is marginal. Based on its significant size and storage area, however, we have incorporated the impact of this facility into the hydrologic analysis.

Lower Centennial Basin

In the Lower Centennial Basin, major roadways include the Salome-Buckeye Highway and Interstate 10. These roads traverse the basin from northwest to southeast through the central portion of the subject watershed. At locations where these highways cross the Centennial channel, concrete box culverts and dip sections have been installed to convey runoff beneath and/or across the roadway. For the purpose of this study, it has been assumed that these roadway crossings will have no affect on the determination of the 100-year peak discharges along the study reach.

The Southern Pacific Railroad traverses the Lower Centennial Watershed near the downstream study limits. The railroad crosses the primary drainage channel, and from field investigation, it appears that this facility will not function as a flood detention structure and, therefore, will have minimal affect on the downstream 100-year discharge.

Numerous flood control structures have been constructed within the Lower Centennial Basin. These facilities are depicted on Figure 3.

The Tiger Wash Detention Structure is located north of I-10, in the central region of the Centennial Drainage Basin. This facility detains peak runoff generated by the Tiger Wash Drainage Basin (Sub-Basin 21) and outlets into the Centennial Wash just upstream of I-10. For the purpose of this study, data relevant to the performance of this detention structure was obtained from the McArthur Report (Reference 8) and utilized in the hydrologic analysis.

The Harquahala Flood Retention Structure (FRS) is also located north of I-10 and lies to the east of the Tiger Wash Detention Structure. This facility detains peak runoff generated in the Big Horn Mountains (Sub-Basin 29). Outflow from this structure is conveyed to the Centennial Wash by means of the Saddleback Diversion System.

The Saddleback FRS lies south of I-10 and intercepts runoff from the Harquahala FRS and Sub-Basin 30. Stormwater from this structure is conveyed to the Centennial Wash by the Saddleback Diversion Channel as shown on Figure 3.

Adjacent to the primary drainage channel and south of I-10 is the Centennial Levee Reach I. This levee diverts runoff generated by the area just south of I-10 and upstream from the left overbank of the Centennial Wash.

Information relevant to the performance of the Harquahala FRS, the Saddleback FRS, the Saddleback Diversion and the Centennial Levee was obtained from the "Harquahala Valley Watershed - Supplemental Watershed Work Plan No. 1," March 1977 (Reference 9). These structures are included in the hydrologic analysis.

As illustrated on Figure 3, approximately 40 miles of the Central Arizona Project Canal (Granite Reef Aqueduct) passes through the Centennial watershed. The Granite Reef Aqueduct traverses the basin from west to east through the central portion of the subject basin and lies immediately south of the previously referenced Tiger Wash Detention Basin and Harquahala FRS. Structural data pertaining to this system was obtained from material provided by the U.S. Bureau of Reclamation.

In addition, a lateral branch of the Central Arizona Project (CAP) canal known as the Eagletail Reach passes in a southeasterly direction through Sub-Basins 26 and 27. Structural and performance data for this structure was obtained from the consulting firm Franzoy, Corey and Associates, and is incorporated in the HEC-1 analysis.

III. AVAILABLE INFORMATION

The Centennial Wash Drainage Basin has been the subject of considerable investigation in the past. For the preparation of this report, numerous federal, state and local government agencies and private parties were contacted and relevant material was requested and reviewed. A bibliographic listing of references and personal contacts utilized in the preparation of this report has been provided herein.

The primary reference source employed in this investigation was prepared by Mr. Robin McArthur of the U.S. Soil Conservation Service (Reference 8). This report is titled "Harquahala Valley Watershed, Hydrologic Studies for the Design of Reach 1 and Reach 2 of the Centennial Levee," January 1984. This study did not include the lower portion of Centennial Wash which is designated for Flood Insurance Re-Study as part of this report.

The U.S. Geological Survey has historically maintained several stream gauge recording stations at various locations along the Centennial Wash. For the purpose of this study, only the station that contributed sufficient data was considered relative to estimating a 100-year peak discharge. Of particular interest to this investigation is the water-stage recording station, U.S.G.S. No. 09517500, situated along the Centennial Wash near Arlington, Arizona. This station was located at the Centennial channel crossing of the former U.S. Highway 80, approximately three (3) miles upstream of Gillespie Dam and provides a continuous record of annual peak discharges for the period from January 1961 to September 1979. A Log-Pearson Type III Statistical Analysis was performed for the 19 years of recorded data using procedures outlined in Reference 4. The 100-year peak discharge value estimated by this procedure for the Centennial Wash, at a location approximately 3 miles upstream of Gillespie Dam (Gila River), was 39,200 cfs. This peak discharge is based on a contributing drainage basin area of 1,810 square miles, resulting in an average runoff generation rate of 21.7 cfs per square mile (0.3 cfs per acre) for the watershed.

It is the opinion of CBA, that the analysis of this particular stream gauge data resulted in a value which is too low to correctly represent the potential 100-year peak discharge for the Centennial Wash. This conclusion was reached after consideration of several primary factors:

- The statistical analysis was performed on only 19 years of recorded data.

- The location of the stream gauge recording station is approximately 130 miles from the headwaters of the Centennial Wash. This stream gauge data may not reflect contributions from all portions of the watershed.

- A 100-year storm runoff value of 21.7 cfs per square mile was low by comparison to the results of the McArthur Report (Reference 8).

It is, therefore, the intent of CBA not to utilize the results of the Flood Frequency Analysis presented herein for the current Centennial Wash Flood Insurance Study.

IV. HYDROLOGIC ANALYSIS

General

For the purpose of this study, the Army Corps of Engineers "HEC-1" computer program was utilized to estimate 100-year peak discharges along the study reach of the Centennial Wash. Use of this method was determined to be the preferred procedure during a meeting held on February 25, 1988 at CBA's Phoenix office which included representatives of CBA, the Flood Control District of Maricopa County, the Arizona Department of Water Resources, and several other agencies. The methodology employed for the selection of input parameters for the HEC-1 program is presented in the following text.

Drainage Basins

The Centennial Wash Drainage Basin was delineated using U.S. Geological Survey Quadrangle Maps, aerial photography and field investigation. The exterior watershed boundary and the interior sub-basin boundaries were delineated utilizing the USGS topographic map 7-1/2-minute series (1" = 24,000'). Drainage area sizes, elevations and length of watercourse were also determined using these maps. Due to the large size of these maps, they were not included in this report. The overall watershed was subdivided into sub-basins selected based upon topography and interpretation of characteristic unit flow contributions. The Centennial Wash Drainage Basin divisions and sub-basins are represented on Figure 2 of this report. Table 1 provides a summary of the estimated sub-basin areas.

In order to eliminate duplication of effort and to provide a means of comparison for the CBA results, concentration points for this study were selected to coincide with the concentration points of the McArthur Report within overlapping portions of the study reach.

Drainage Basin boundaries were then determined independently of the McArthur Report and basin areas were estimated with the use of a computer-assisted, digitizing table and manual planimeter. The entire Centennial Wash Watershed was divided into 40 sub-basins ranging in size from 8 to 185 square miles. A comparison was then made between the drainage basins determined by CBA and those estimated in the McArthur report. An acceptable correlation between the two computed basin areas exists. The difference in computed overall watershed area between this study and the McArthur Report, computed at the downstream concentration point for the McArthur Report (CBA Basins 1 through 22) is 0.6 square miles.

Curve Numbers

As determined through field investigation, a generally uniform vegetative cover of desert brush extends throughout the Centennial Wash watershed. Cover density within the valley portions of the study area varies from an estimated 20 percent in the upper regions of the watershed to about 10 percent for the lower regions. The surrounding mountain slopes have somewhat lower vegetative cover densities than the valley areas.

The determination of hydrologic soils groups was performed with the use of the Soil Conservation Service General Soil Maps for Maricopa and Yuma Counties (References 12 and 13). Sub-basins were differentiated and proportioned with respect to the appropriate soils groups.

Based on the above-referenced parameters, weighted curve numbers were then determined for each sub-basin according to the method presented in "Urban Hydrology for Small Watersheds, Soil Conservation Service Technical Release 55," 1986 (Reference 17). Curve numbers for each sub-basin are contained in Table 1 of this report.

Precipitation

Rainfall values were computed utilizing "NOAA Atlas 2, Precipitation - Frequency Atlas of the Western United States, volume VIII, Arizona" (Reference 18).

As mentioned earlier in this report, Mr. Robin McArthur of the U.S. Soil Conservation Service has prepared a detailed Hydrologic Study of the Centennial Wash for Centennial Levee Reaches I and II. After reviewing this report, CBA computed rainfall values for three sample basins using the same procedure as in the McArthur Study. CBA's results for sub-basins 8, 13 and 20 were then compared with the computed values in the McArthur Study, and the correlation was found to be acceptable.

To avoid duplication of effort, CBA utilized the precipitation values contained in the McArthur Report for sub-basins 1 through 25, 28, 30 and 31 (CBA's sub-basin sizes approximately match those presented in the McArthur Report). Precipitation values for the remaining drainage sub-basins, 26, 27, 29 and 32 through 37, which were not included in McArthur's Report, have been computed by CBA using the same method contained in said report. The procedure Mr. McArthur followed to compute the 100-year 24-hour rainfall values is attached as Appendix III in this report.

Lag Times

As described in the SCS "National Engineering Handbook, Section 4, Hydrology", Chapter 15 (Reference 19), the Time of Concentration for each sub-basin was computed using the Upland method and lag times for the subject basins were estimated in terms of T_c using the empirical relation of:

$$L = 0.6T_c$$

L = Lag Time (hours)
T_c = Time of Concentration (hours)

Table I presents the computed Lag Times used in the HEC-1 analysis.

Stream Channel Routings

Stream channel profiles are utilized by the HEC-1 program to route storm runoff through prescribed channel reaches. For the purpose of this study, channel routings were performed using the normal depth option of the HEC-1 program. Channel cross-sections for the lower portions of the Centennial Wash watershed were developed from topographic mapping (1 in. = 400 ft.; C.I. = 2 ft. and 4 ft., 1978 and 1988) and U.S.G.S. quadrangle sheets, 7.5 minute series topographic maps (1:24,000). Field cross-sections were developed for the upper portion of the watershed and the U.S.G.S. topographic maps (1:24,000) were utilized to determine approximate elevations of the cross-sections.

Flood Control Structures

Structural data, as well as any available hydrologic and hydraulic information, was obtained from local engineering firms and governmental agencies having jurisdiction over the existing structures. For the purpose of this investigation, 100-year composite hydrographs generated by the HEC-1 program were routed through the existing structures, based on data provided to CBA regarding previously performed analyses of the individual structures.

The following is a list of those structures which were modeled for the HEC-1 analysis: Lower Centennial Dam (Narrows Dam), Bureau of Land Management; Tiger Wash Detention Structure, Bureau of Reclamation; Harquahala Flood Retention Structure (FRS), Saddleback FRS, Maricopa County; Old Camp Wash Crossing of the Granite Reef Aqueduct, Central Arizona Water Conservation District; Eagletail Reach (CAP Lateral), Harquahala Valley Irrigation District.

Features which were not included in the HEC-1 analysis include local irrigation canals, levees and spreading dikes. These structures are presumed to effectively control runoff during low flow events, as those

that are produced by a 10- or 25-year storm; however, such structures would have little impact on the 100-year runoff.

Other structures not modeled for this analysis are the Upper Centennial Flood Retarding Structures, due to the structural failures evidenced during field reconnaissance and the Ritter Dam because of its location in the upper watershed and great distance from downstream concentration points.

V. RESULTS

The intent of this investigation is to determine 100-year peak discharges at designated locations along the Centennial Wash. These discharges are proposed for use in the completion of the Centennial Wash Flood Insurance Re-Study and are to be employed in determining water surface elevations, floodway boundaries and flood zones within the limits of the detailed study reach shown on Figures 1, 2, and 3.

The Flood Flow Frequency computer model provided by the U.S. Army Corps of Engineers was used to perform a Log-Pearson Type III Statistical Analysis on the 19 years of recorded gauge data (U.S.G.S. Gauge No. 09517500) located along the Centennial Wash, roughly 3 miles upstream of Gillespie Dam (Gila River). The results of this analysis yielded a 100-year peak discharge of 39,000 cfs. This value appears to be a low estimate, resulting from the relatively short period of record and the downstream location of the recording station with respect to a total basin length of 135 miles for the Centennial watershed. It is our opinion that 19 years of available stream flow data is not adequate to determine the 100-year peak discharge for the Centennial Wash at the Gila River.

Detailed hydrologic analysis of Centennial Wash at Centennial Levee Reaches I and II was performed by Mr. Robin McArthur (Reference 8). His study utilized the Soil Conservation Service TR-20 hydrologic model to determine 100-year discharges along portions of the Centennial Wash, but did not evaluate the lower reaches of the Centennial Wash designated for this Flood Insurance Re-Study.

The drainage areas at the Maricopa County/La Paz County line and at Centennial Levee Reaches I and II calculated by CBA correlate very closely with the drainage areas at the same locations in Mr. McArthur's Report. The 100-year peak discharge values at these locations computed by CBA (using the HEC-1 computer program) also correlate well, but are approximately five to seven percent (5 to 7%) lower when compared with the 100-year discharges presented in McArthur's Report (see Table 2).

Utilizing the HEC-1 computer program, a 100-year peak discharge of 67,300 cfs was estimated for the Centennial Wash at the confluence with the Gila River. Discharges determined at this location and other key locations along the study reach utilizing the HEC-1 computer model are depicted on Table 2. CBA proposes to use the peak discharges determined by the HEC-1 analysis to estimate the 100-year water surface elevations and floodway boundaries for the portions of the Centennial Wash designated for detailed study per this Flood Insurance Re-Study.

TABLE 1

CENTENNIAL WASH

PARAMETERS USED IN THE HEC-1 ANALYSIS

Drainage Sub-Basins	Drainage Area (square miles)	Lag Time (hours)	Curve Number	Precipitation (24 hrs. - 100-yr.) (in.)
1	67.0	5.80	78.0	3.88
2	185.0	15.70	81.0	3.88
3	43.0	4.81	80.0	3.88
4	21.6	3.27	81.0	3.88
4A	18.5	3.40	81.0	3.88
5	48.7	2.90	79.0	3.88
6	23.7	2.59	81.0	3.88
7	44.7	4.01	79.0	3.88
8	31.3	2.89	80.0	3.88
8A	16.2	2.33	80.0	3.88
9	52.2	3.02	80.0	3.88
10	17.0	2.50	79.0	3.88
11	20.2	3.04	78.0	3.88
12	10.6	1.98	79.0	3.88
12A	9.9	1.62	79.0	3.88
13	68.7	3.96	78.0	3.88
14	13.7	0.71	84.0	3.88
15	18.6	3.41	79.0	3.88
16	19.7	1.59	82.0	3.88
17	21.0	1.98	80.0	3.88
18	24.4	2.89	80.0	3.88

TABLE 1 (Cont.)

CENTENNIAL WASH

PARAMETERS USED IN THE HEC-1 ANALYSIS

Drainage Sub-Basins	Drainage Area (square miles)	Lag Time (hours)	Curve Number	Precipitation (24 hrs. - 100-yr.) (in.)
19	10.6	1.18	77.0	3.88
20	50.7	6.63	80.0	3.88
21	76.8	7.00	84.0	3.88
21A	84.4	7.20	84.0	3.88
22	25.1	2.51	79.0	3.88
23	7.9	2.00	77.0	3.88
24	11.2	2.51	77.0	3.88
25	24.9	4.21	77.0	3.88
26	42.4	3.19	79.0	4.12
27	62.1	4.35	77.0	4.12
28	84.4	15.06	75.0	4.12
29	101.3	4.85	83.0	3.93
30	28.6	4.75	78.0	3.93
31	12.0	0.96	86.0	4.12
32	52.4	5.05	79.0	3.93
33	47.0	4.00	80.0	3.93
34	64.3	4.64	81.0	3.93
35	99.6	4.73	87.0	3.93
36	163.1	12.25	79.0	3.93
37	45.8	4.43	83.0	3.93

TABLE 2

ESTIMATES OF 100-YEAR
PEAK DISCHARGES ALONG CENTENNIAL WASH
FROM HEC-1

	CBA's Study		Mr. McArthur's Study	
Location Along Centennial Wash	Drainage Area (square miles)	100-Year Discharge (cfs)	Drainage Area (square miles)	100-Year Discharge (cfs)
At Maricopa County/ La Paz County Line (Concentration Point 12 - Figure 2)	1,031.20	52,200	1,031.21	56,400
At Centennial Levee Reach 2 (Concentration Point 14 - Figure 2)	1,109.70	52,300	1,110.3	55,300
Near Base Line Road (Concentration Point 15, - Figure 2)	1,398.1	58,100	NO DATA	
At Railroad Bridge near Arlington (Concentration Point 17 - Figure 2)	1,824.53	67,300	NO DATA	
At Confluence with Gila River (Concentration Point 18 - Figure 2)	1,870.33	67,300	NO DATA	

VI. REFERENCES

1. "Centennial Wash Basin 100-Year Flood Study," May 1976.

2. "Central Arizona Project, Aqueduct System Location Map," Central Arizona Water Conservation District, June 1987.

3. "Eagletail Reach of Westside Canal - Harquahala Valley Irrigation District, Arizona - Central Arizona Project - Drawings," Franzoy-Corey Engineering Company, June 1984.

4. "Flood Flow Frequency Analysis - Computer Program 723-X6-L7550," U.S. Army Corps of Engineers-Hydrologic Engineering Center, February 1982.

5. "General Soil Map - Maricopa County, Arizona," Soil Conservation Service, March 1973.

6. "General Soil Map of Yuma County, Arizona," Soil Conservation Service, July 1974.

7. "Guidelines For Determining Flood Flow Frequency," United States Water Resources Council, Hydrology Committee Bulletin No. 17B, September 1981.

8. McArthur, R.P., "Harquahala Valley Watershed, Hydrology Studies for the Design of Reach 1 and Reach 2 of the Centennial Levee," Soil Conservation Service, January 1984.

9. "Harquahala Valley Watershed - Supplemental Watershed Work Plan No. 1," Maricopa County Flood Control District, March 1977.

10. "Hydrologic Design for Highway Drainage in Arizona," Arizona Highway Department - Bridge Division, December 1968.

11. "The Natural Vegetation of Arizona," Arizona Resources Information System, Cooperative Publication No. 2, 1973.

12. "Soil Survey of Maricopa County, Arizona," Soil Conservation Service, September 1977.

13. "Soil Survey of Yuma - Wellton Area," Soil Conservation Service, December 1980.

14. United States Department of the Interior, Geological Survey; 7.5 minute series topographic maps (1:24,000).
    Date Creek Ranch, Date Creek Ranch S. E., Date Creek Ranch S. W., O'Neal Pass, Congress S. W., Smith Peak and E. C. P. Peak.

15. United States Department of Interior, Geological Survey; 15 minute series topographic maps (1:62,500). Salome, Gladden, Aguila, Vulture Mountains, Hope, Lone Mountain, Big Horn Mountains, Belmont Mountains, Eagletail Mountains, Cortez Peak, Arlington, Woolsey Peak and Dendora Valley.

16. "Water Resources Data - Arizona," U. S. Geological Survey Water Data Report; Water Years, 1978 - 1984.

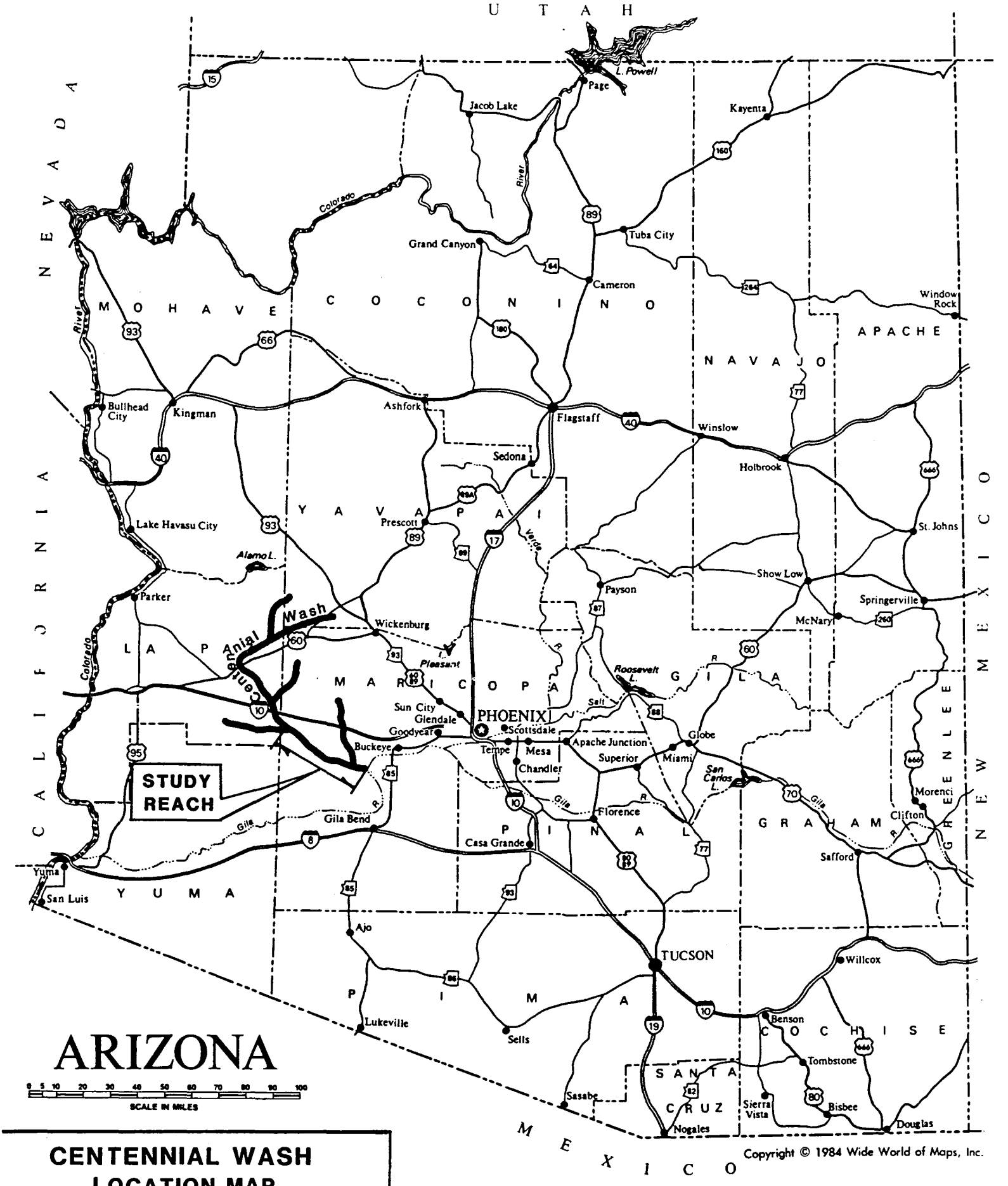
17. "Urban Hydrology for Small Watersheds," Soil Conservation Service Technical Release 55, June 1986.

18. "NOAA Atlas 2, Precipitation - Frequency Atlas of the Western United States, Volume VIII, Arizona," U.S. Department of Commerce.

19. "National Engineering Handbook, Section 4, Hydrology," Soil Conservation Service, Chapter 15.

VII. PERSONAL CONTACTS

1. HEATTON, L.
   Bureau of Reclamation, Phoenix, Arizona.
2. KOENEKAMP, T.
   Franzoy-Corey Engineering Company, Tempe, Arizona
3. McLAUGHLIN, D.
   Bureau of Land Management, Phoenix, Arizona
4. WALSH, R.
   Bureau of Reclamation, Phoenix, Arizona.
5. MCARTHUR, R.
   Soil Conservation Service, Phoenix, Arizona

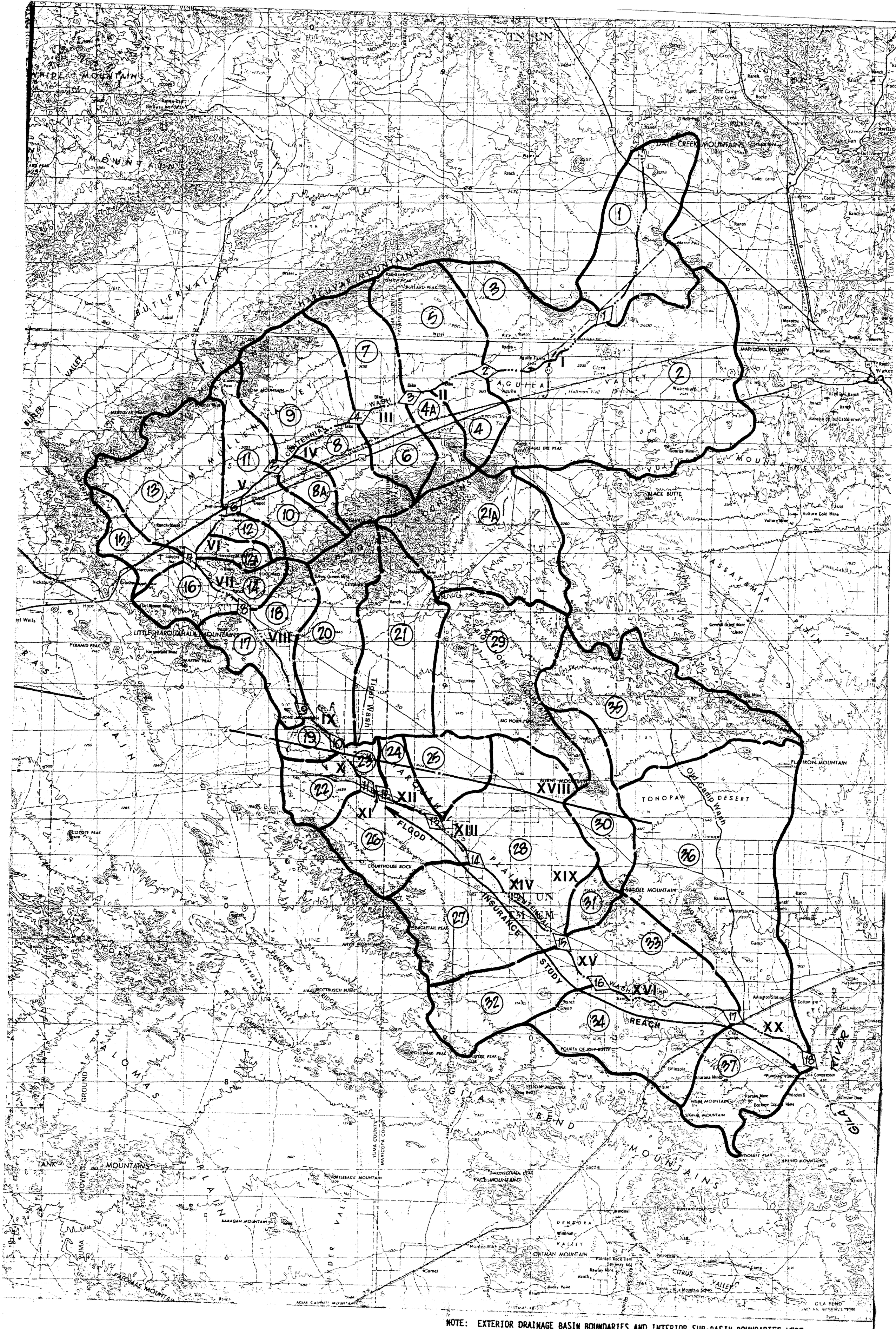


CENTENNIAL WASH
LOCATION MAP

CELLA BARR ASSOCIATES
2075 North Sixth Avenue
Tucson, Arizona 85705
(602) 624-7401

FILE NO. 04856-03-74
SEPTEMBER, 1988

FIGURE 1



NOTE: EXTERIOR DRAINAGE BASIN BOUNDARIES AND INTERIOR SUB-BASIN BOUNDARIES WERE DELINEATED ON U.S.G.S. TOPOGRAPHIC MAPS (7.5 MINUTE, 1:24000). THIS MAP IS AN EXHIBIT TO SHOW BASIN DIVISIONS AS INPUT IN THE HEC-1 ANALYSIS AND SHOULD NOT BE USED TO CHECK BASIN DELINEATION OR AREA.

KEY

◇2	CONCENTRATION POINTS
———	DRAINAGE BASIN BOUNDARY
— — —	SUBBASIN BOUNDARY
(12)	SUBBASIN NUMBER
XV	ROUTING REACH NUMBER

1" = 4 miles
Approximate Scale

FIGURE 2

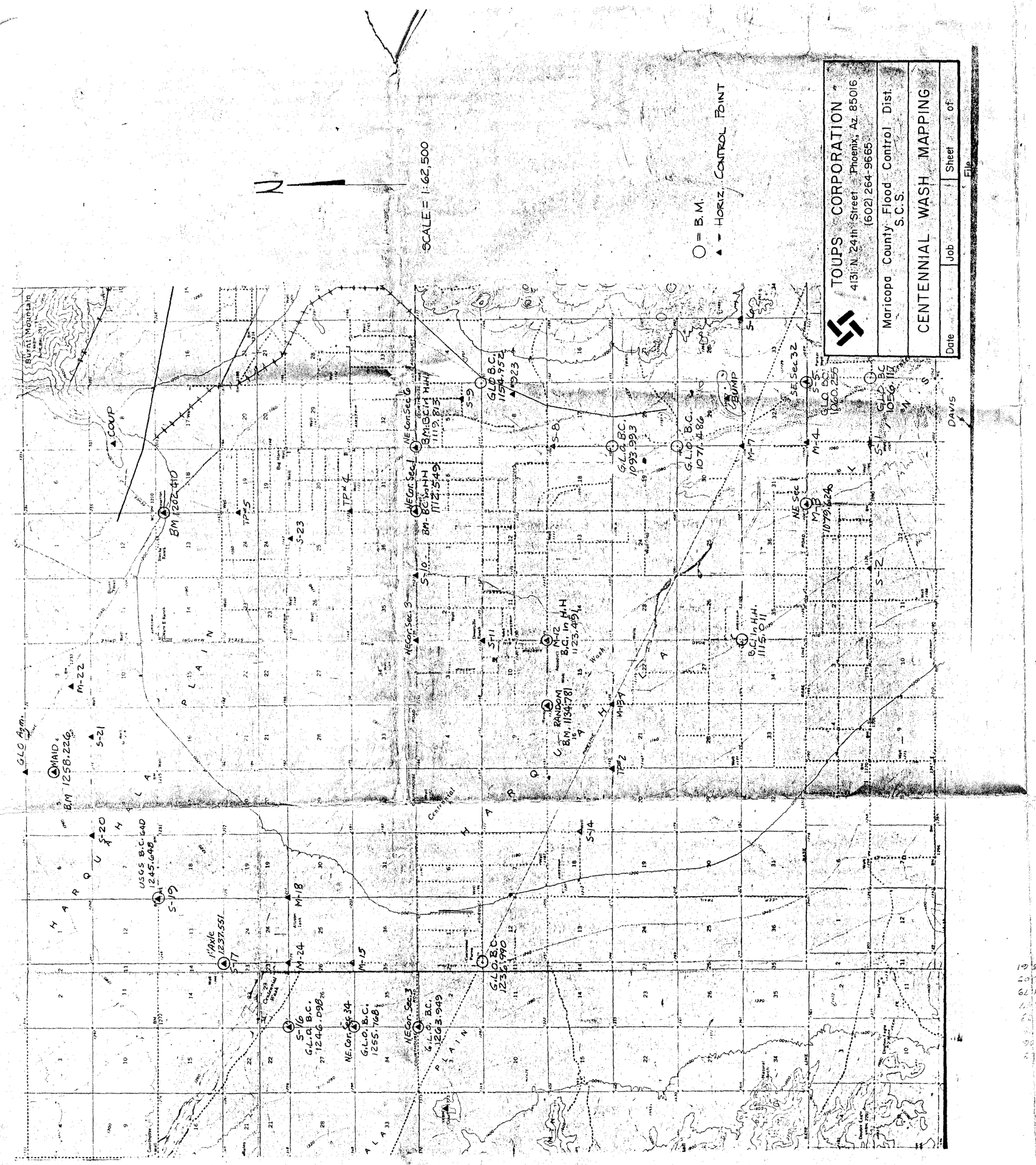
Centennial Wash
Flood Insurance Study
Maricopa County, Arizona

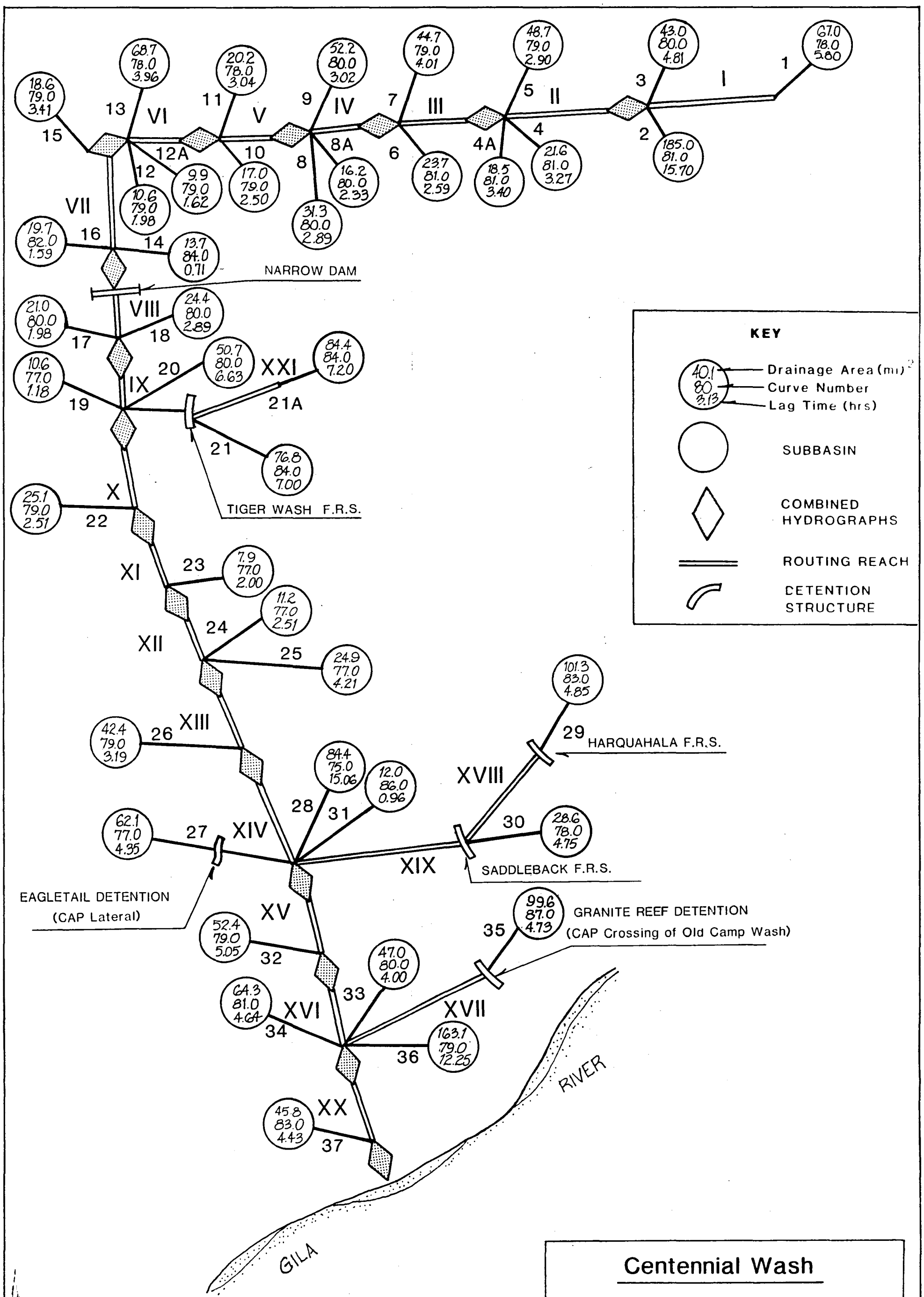
TOPOGRAPHIC MAP SHOWING CENTENNIAL WASH SUBBASINS

CELLA BARR ASSOCIATES
2075 North Sixth Avenue
Tucson, Arizona 85705
(602) 624-7401

JOB NO. 04856-04-74 SEPTEMBER 1988

REVISED DECEMBER, 1988


SCALE = 1:62,500
○ = B.M.
▲ = HORIZ. CONTROL POINT
TOUPS CORPORATION
413 N. 24th Street Phoenix, Az. 85016
(602) 264-9665
Maricopa County Flood Control Dist.
S.C.S.
CENTENNIAL WASH MAPPING
Date
Job
Sheet
of
File
COUP
DAVIS
MAID
COURT
PLEASANTON
RANDOM
WINEMAD
BUMP
AL. GLO
MOSHEN - N334,962.19 ~ E104,822.3
MAID - N316,500.24 ~ E116,223.06
PLEASANTON N319,200.10 ~ E131,268.
COUP - N322,322.36 ~ E133,222.
COURT - N890,978.67 ~ E82,155.
DAVIS - N844,929.40 ~ E125,551.79
RANDOM - N888,268.14 ~ E119,991.02
BUMP - N879,928.34 ~ E199,995.61
MAID TO COUP
MAID TO COURT
S 75°58'18.03"E - 25,713.035
S 14°17'59.17"W 62,131.271
PELLICATION TO COUP
N52°17'31.50"E - 0,133.865
RANDOM TO COUP
N 30°13'45.31.4"E ~ 39,034.715
RANDOM TO OASIS
S 55°11'14.66" E 61,811.033
RANDOM TO COURT
N 40°19'10.11"W ~ 78,910.615
RANDOM TO BUMP
S59°04'25.30"E ~ 29,069.390
BUMP TO DAVIS
S09°00'31.18"W ~ 27,740.817
DAVIS TO COURT
N 40°19'10.11"W ~ 78,910.615
DAVIS TO M.21 26,297.096
" TO M.4 10,965.647



Centennial Wash

SCHEMATIC OF THE BASIN LOGIC USED IN HEC-1

CELLA BARR ASSOCIATES
2075 North Sixth Avenue
Tucson, Arizona 85705
(602) 624-7401

JOB NO. 04856-03-74 JANUARY 1989

Modified summary for other hydrologic [illegible]

modified for HEC-1 version 4.1

RUNOFF SUMMARY
FLOW IN CUBIC FEET PER SECOND
TIME IN HOURS, AREA IN SQUARE MILES

	OPERATION	STATION	PEAK FLOW	TIME OF PEAK	AVERAGE FLOW FOR MAXIMUM PERIOD 6-HOUR	24-HOUR	72-HOUR	BASIN AREA	MAXIMUM STAGE	TIME OF MAX STAGE
+	HYDROGRAPH AT	SUB 1	7279.	18.50	6534.	3185.	1076.	67.00		
+	ROUTED TO	1	7110.	21.00	6359.	3128.	1076.	67.00		
+									2202.93	21.00
+	HYDROGRAPH AT	SUB 2	10486.	29.00	10267.	7910.	3346.	185.00		
+	HYDROGRAPH AT	SUB 3	5890.	17.00	5043.	2234.	749.	43.00		
+	3 COMBINED AT	1	16524.	22.50	16120.	12502.	5170.	295.00		
+	ROUTED TO	2	16448.	24.50	16074.	12464.	5162.	295.00		
+									2085.05	24.50
+	HYDROGRAPH AT	SUB 4	4125.	15.50	3101.	1172.	391.	21.60		
+	HYDROGRAPH AT	SUB4A	3440.	15.50	2626.	1004.	335.	18.50		
+	3 COMBINED AT	2	17869.	23.50	17398.	13460.	5881.	335.10		
+	HYDROGRAPH AT	SUB 5	9311.	15.00	6690.	2443.	815.	48.70		
+	2 COMBINED AT	3	19492.	22.50	18933.	15478.	6695.	383.80		
+	ROUTED TO	3	19500.	23.50	18915.	15434.	6688.	383.80		
+									2024.21	23.50
+	HYDROGRAPH AT	SUB 6	5325.	14.50	3647.	1287.	429.	23.70		
+	HYDROGRAPH AT	SUB 7	6689.	16.50	5465.	2238.	748.	44.70		
+	3 COMBINED AT	4	27317.	16.00	23263.	18446.	7857.	452.20		
+	ROUTED TO	4	26730.	18.00	22948.	18260.	7831.	452.20		
+									1944.79	18.00
+	HYDROGRAPH AT	SUB 8	6274.	15.00	4494.	1634.	545.	31.30		
+	HYDROGRAPH AT	SUB8A	3764.	14.50	2457.	846.	282.	16.20		
+	3 COMBINED AT	5	31129.	18.00	26075.	19518.	8640.	499.70		
+	HYDROGRAPH AT	SUB 9	10078.	15.00	7392.	2725.	909.	52.20		
+	2 COMBINED AT	6	36933.	17.50	30285.	21848.	9547.	551.90		
+	ROUTED TO	5	36672.	18.50	30200.	21783.	9544.	551.90		
+									1889.47	18.50
+	HYDROGRAPH AT	SUB10	3610.	14.50	2426.	853.	284.	17.00		
+	HYDROGRAPH AT	SUB11	3531.	15.00	2614.	973.	324.	20.20		
+	3 COMBINED AT	7	39628.	18.50	32636.	23237.	10149.	589.10		
+	ROUTED TO	6	38617.	19.50	32556.	23156.	10132.	589.10		
+									1825.04	19.50
+	HYDROGRAPH AT	SUB12	2648.	14.00	1582.	532.	177.	10.60		

+	HYDROGRAPH AT	SUB12A	2816.	13.50	1527.	497.	166.	9.90	
+	3 COMBINED AT	8	39507.	19.50	33372.	23595.	10459.	609.60	
+	HYDROGRAPH AT	SUB13	9907.	16.50	8076.	3303.	1103.	68.70	
+	2 COMBINED AT	9	45374.	19.50	39335.	26471.	11562.	678.30	
+	HYDROGRAPH AT	SUB15	3154.	15.50	2423.	932.	311.	18.60	
+	2 COMBINED AT	10	46817.	19.50	40947.	27296.	11873.	696.90	
+	ROUTED TO	7	44035.	22.00	40136.	27146.	11865.	696.90	
+									1771.32 22.00
+	HYDROGRAPH AT	SUB14	7985.	12.50	2675.	835.	278.	13.70	
+	HYDROGRAPH AT	SUB16	6509.	13.50	3441.	1113.	371.	19.70	
+	3 COMBINED AT	11	44994.	21.50	41166.	27682.	12491.	730.30	
+	ROUTED TO	1	44253.	22.50	40704.	27584.	12386.	730.30	
+									258.69 22.50
+	ROUTED TO	8	43686.	24.50	40447.	27523.	12373.	730.30	
+									1610.99 24.50
+	HYDROGRAPH AT	SUB17	5489.	14.00	3273.	1097.	366.	21.00	
+	HYDROGRAPH AT	SUB18	4891.	15.00	3503.	1274.	425.	24.40	
+	3 COMBINED AT	12	44911.	24.50	41594.	28176.	13127.	775.70	
+	ROUTED TO	12	44838.	25.00	41549.	28164.	13114.	775.70	
+									1444.86 25.00
+	HYDROGRAPH AT	SUB19	3328.	13.00	1534.	490.	163.	10.60	
+	HYDROGRAPH AT	SUB20	5433.	19.00	4992.	2588.	883.	50.70	
+	3 COMBINED AT	13	48175.	24.50	44900.	30404.	14142.	837.00	
+	HYDROGRAPH AT	SUB21A	9999.	20.00	9289.	4981.	1714.	84.40	
+	ROUTED TO	10	9161.	24.50	8443.	4948.	1714.	84.40	
+									1724.49 24.50
+	HYDROGRAPH AT	SUB21	9332.	19.50	8609.	4546.	1560.	76.80	
+	2 COMBINED AT	14	15639.	23.00	14636.	9426.	3274.	161.20	
+	ROUTED TO	2	7507.	31.50	7309.	5256.	2674.	161.20	
+									1408.11 31.50
+	2 COMBINED AT	15	51943.	25.00	48692.	35130.	16795.	998.20	
+	ROUTED TO	10	51880.	25.50	48701.	35125.	16780.	998.20	
+									1365.29 25.50
+	HYDROGRAPH AT	SUB22	5310.	14.50	3578.	1259.	420.	25.10	
+	2 COMBINED AT	16	52429.	25.50	49145.	35492.	17153.	1023.30	
+	ROUTED TO	11	52218.	26.00	49064.	35482.	17135.	1023.30	
+									1286.23 26.00

	HYDROGRAPH AT								
+		SUB23	1784.	14.00	1080.	365.	122.	7.90	
	2 COMBINED AT								
+		17	52330.	26.00	49159.	35570.	17230.	1031.20	
	ROUTED TO								
+		12	52160.	27.00	49093.	35558.	17213.	1031.20	
+									1270.48 27.00
	HYDROGRAPH AT								
+		SUB24	2154.	14.50	1459.	518.	173.	11.20	
	HYDROGRAPH AT								
+		SUB25	3294.	16.50	2718.	1148.	384.	24.90	
	3 COMBINED AT								
+		18	52897.	26.50	49840.	36227.	17705.	1067.30	
	ROUTED TO								
+		13	52662.	28.00	49623.	36195.	17677.	1067.30	
+									1183.35 28.00
	HYDROGRAPH AT								
+		SUB26	8348.	15.50	6240.	2348.	783.	42.40	
	2 COMBINED AT								
+		19	53200.	28.00	50235.	36817.	18339.	1109.70	
	ROUTED TO								
+		14	52166.	31.50	49472.	36665.	18319.	1109.70	
+									1097.23 31.50
	HYDROGRAPH AT								
+		SUB27	8912.	16.50	7451.	3172.	1061.	62.10	
	ROUTED TO								
+		3	952.	29.00	946.	888.	695.	62.10	
+									1260.18 29.00
	2 COMBINED AT								
+		20	53109.	31.50	50409.	37545.	19014.	1171.80	
	HYDROGRAPH AT								
+		SUB28	4285.	28.50	4195.	3190.	1328.	84.40	
	HYDROGRAPH AT								
+		SUB31	6754.	13.00	2721.	857.	286.	12.00	
	3 COMBINED AT								
+		21	57228.	31.50	54404.	40530.	20421.	1268.20	
	HYDROGRAPH AT								
+		SUB29	15962.	17.00	13675.	6022.	2021.	101.30	
	ROUTED TO								
+		4	340.	35.00	340.	339.	336.	101.30	
+									1408.67 35.00
	ROUTED TO								
+		15	340.	36.00	340.	339.	336.	101.30	
+									1201.80 35.50
	HYDROGRAPH AT								
+		SUB30	3710.	17.00	3166.	1401.	469.	28.60	
	ROUTED TO								
+		5	700.	28.00	698.	653.	431.	28.60	
+									1187.38 28.00
	ROUTED TO								
+		16	700.	30.00	698.	653.	428.	28.60	
+									1144.38 29.50
	3 COMBINED AT								
+		22	58265.	31.50	55438.	41515.	21145.	1398.10	
	ROUTED TO								
+		17	58086.	32.50	55305.	41497.	21130.	1398.10	
+									1052.10 32.50
	HYDROGRAPH AT								
+		SUB32	6774.	17.50	5882.	2668.	896.	52.40	
	2 COMBINED AT								
+		23	58488.	32.00	55764.	42051.	22007.	1450.50	
	ROUTED TO								
+		18	57431.	36.50	54967.	41908.	21980.	1450.50	
+									933.44 36.50
	HYDROGRAPH AT								
+		SUB33	7521.	16.50	6137.	2501.	836.	47.00	
	HYDROGRAPH AT								

```
+                    SUB34     9666.  17.00     8192.     3549.     1189.    64.30
        3 COMBINED AT
+                       24    57548.  36.50    55116.    42280.    23781.  1561.80
        HYDROGRAPH AT
+                    SUB35    18727.  17.00    15876.     6837.     2297.    99.60
        ROUTED TO
+                        6     6206.  23.50     6113.     4938.     2281.    99.60
+                                                                            68.29     23.50
        ROUTED TO
+                       19     6175.  29.00     6078.     4878.     2265.    99.60
+                                                                          1002.75     29.00
        HYDROGRAPH AT
+                    SUB36    10654.  25.50    10351.     7239.     2787.   163.10
        3 COMBINED AT
+                       25    67676.  36.00    65108.    51887.    28812.  1824.50
        ROUTED TO
+                       20    67263.  37.50    64808.    51845.    28778.  1824.50
+                                                                           850.26     37.50
        HYDROGRAPH AT
+                    SUB37     7718.  16.50     6451.     2728.      914.    45.80
        2 COMBINED AT
+                       26    67298.  37.50    64851.    52134.    29583.  1870.30

*** NORMAL END OF HEC-1 ***
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FLOOD HYDROGRAPH PACKAGE  (HEC-1)
          FEBRUARY 1981
         REVISED 30 OCT 81

RUN DATE WED, JAN 04 1989 TIME 14:07:22
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U.S. ARMY CORPS OF ENGINEERS
THE HYDROLOGIC ENGINEERING CENTER
609 SECOND STREET
DAVIS, CALIFORNIA 95616
(916) 440-3285 OR (FTS) 448-3285

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X     X  XXXXXXX   XXXXX          X
X     X  X        X     X        XX
X     X  X        X              X
XXXXXXX  XXXX     X        XXXXX  X
X     X  X        X              X
X     X  X        X     X        X
X     X  XXXXXXX   XXXXX         XXX
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THIS PROGRAM REPLACES ALL PREVIOUS VERSIONS OF HEC-1 KNOWN AS HEC1 (JAN 73), HEC1GS, HEC1DB, AND HEC1KW.

THE DEFINITIONS OF VARIABLES -RTIMP- AND -RTIOR- HAVE CHANGED FROM THOSE USED WITH THE 1973-STYLE INPUT STRUCTURE. THE DEFINITION OF -AMSKK- ON RM-CARD WAS CHANGED WITH REVISIONS DATED 28 SEP 81. SEE SEPTEMBER 1981 INPUT DESCRIPTION FOR NEW DEFINITIONS.

1 HEC-1 INPUT PAGE 1

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 LINE          ID.......1.......2.......3.......4.......5.......6.......7.......8.......9......10
    1          ID        MARICOPA CO. FLOOD INSURANCE STUDY
    2          ID        CENTENNIAL WASH  HEC-1 (FILE CWHEC1F)
    3          ID        CURVE NUMBERS DETERMINED BY UPLAND METHOD
    4          ID        CBA JOB NO. 04856-03-74   5 JANUARY 89
    5          IT      30 18APR88    1200     200
    6          IO       3       0
    7          IN      15 18APR88    1200

    8          KK   SUB 1
    9          KM   RUNOFF FROM SUBBASIN 1
   10          KM   SCS DIMENSIONLESS UNIT HYDROGRAPH
   11          KM   LAGTIME = HYDRAULIC LENGTH, AVG. WATERSHED SLOPE AND C.N.
   12          KM   RAINFALL DISTRIBUTION = SCS TYPE II
   13          BA    67.0
   14          PB    3.88
   15          PC       0   0.002   0.005   0.008   0.011   0.014   0.017   0.020   0.023   0.026
   16          PC   0.029   0.032   0.035   0.038   0.041   0.044   0.048   0.052   0.056   0.060
   17          PC   0.064   0.068   0.072   0.076   0.080   0.085   0.090   0.095   0.100   0.105
   18          PC   0.110   0.115   0.120   0.126   0.133   0.140   0.147   0.155   0.163   0.172
   19          PC   0.181   0.191   0.203   0.218   0.236   0.257   0.283   0.387   0.663   0.707
   20          PC   0.735   0.758   0.776   0.791   0.804   0.815   0.825   0.834   0.842   0.849
   21          PC   0.856   0.863   0.869   0.875   0.881   0.887   0.893   0.898   0.903   0.908
   22          PC   0.913   0.918   0.922   0.926   0.930   0.934   0.938   0.942   0.946   0.950
   23          PC   0.953   0.956   0.959   0.962   0.965   0.968   0.971   0.974   0.977   0.980
   24          PC   0.983   0.986   0.989   0.992   0.995   0.998   1.000
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 25         LS           78.0
 26         UD    5.80

 27         KK       1 ROUTE HYDROGRAPH 1 THROUGH REACH 1
 28         RL                    0.2
 29         RS      10    FLOW     -1
 30         RC   0.055   0.040   0.055   53500   0.005
 31         RX       0     400     700     900    1100    1400    1700    2100
 32         RY    2206    2204    2202    2200    2200    2202    2204    2206

 33         KK   SUB 2
 34         KM   RUNOFF FROM SUBBASIN 2
 35         BA     185
 36         LS           81.0
 37         UD   15.70

 38         KK   SUB 3
 39         KM   RUNOFF FROM SUBBASIN 3
 40         BA    43.0
 41         LS           80.0
 42         UD    4.81

 43         KK       1 COMBINE 1-3
 44         KM   ADD THREE HYDROGRAPHS
 45         HC       3
1                                    HEC-1 INPUT                                                    PAGE  2

LINE        ID.......1.......2.......3.......4.......5.......6.......7.......8.......9......10

 46         KK       2 ROUTE HYDROGRAPH 1-3 THROUGH REACH 2
 47         RL                    0.2
 48         RS       8    FLOW     -1
 49         RC   0.055   0.035   0.055   34375  0.0019
 50         RX       0     300     800    1200    1600    2000    2300    2460
 51         RY    2087    2087    2082    2080    2082    2085    2086    2087

 52         KK   SUB 4
 53         KM   RUNOFF FROM SUBBASIN 4
 54         BA    21.6
 55         LS           81.0
 56         UD    3.27

 57         KK   SUB4A
 58         KM   RUNOFF FROM SUBBASIN 4A
 59         BA    18.5
 60         LS           81.0
 61         UD    3.40

 62         KK       2 COMBINE 1-3 WITH 4 AND 4A
 63         KM   ADD THREE HYDROGRAPHS
 64         HC       3

 65         KK   SUB 5
 66         KM   RUNOFF FROM SUBBASIN 5
 67         BA    48.7
 68         LS           79.0
 69         UD    2.90
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 70          KK       3 COMBINE 1-4A WITH 5
 71          KM   ADD TWO HYDROGRAPHS
 72          HC       2

 73          KK       3 ROUTE HYDROGRAPH 1-5 THROUGH REACH 3
 74          RL                     0.2
 75          RS      10    FLOW      -1
 76          RC   0.055   0.040   0.055   18750  0.0022
 77          RX       0     300     400     800    1500    1800    2400    2700
 78          RY    2028    2026    2023    2020    2020    2023    2026    2028

 79          KK   SUB 6
 80          KM   RUNOFF FROM SUBBASIN 6
 81          BA    23.7
 82          LS            81.0
 83          UD    2.59

 84          KK   SUB 7
 85          KM   RUNOFF FROM SUBBASIN 7
 86          BA    44.7
 87          LS            79.0
 88          UD    4.01
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LINE         ID.......1.......2.......3.......4.......5.......6.......7.......8.......9......10

 89          KK       4 COMBINE 1-5 WITH 6 AND 7
 90          KM   ADD THREE HYDROGRAPHS
 91          HC       3

 92          KK       4 ROUTE HYDROGRAPH 1-7 THROUGH REACH 4
 93          RL                     0.2
 94          RS      10    FLOW      -1
 95          RC   0.050   0.040   0.055   38541  0.0023
 96          RX       0     200     500     800    1500    1700    1900    2100
 97          RY    1946    1944    1942    1940    1940    1942    1944    1946

 98          KK   SUB 8
 99          KM   RUNOFF FROM SUBBASIN 8
100          BA    31.3
101          LS              80
102          UD    2.89

103          KK   SUBBA
104          KM   RUNOFF FROM SUBBASIN 8A
105          BA    16.2
106          LS            80.0
107          UD    2.33

108          KK       5 COMBINE 1-7 WITH 8 AND 8A
109          KM   ADD THREE HYDROGRAPHS
110          HC       3

111          KK   SUB 9
112          KM   RUNOFF FROM SUBBASIN 9
113          BA    52.2
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 114           LS           80.0
 115           UD    3.02

 116           KK        6 COMBINE 1-8A WITH 9
 117           KM    ADD TWO HYDROGRAPHS
 118           HC        2

 119           KK        5 ROUTE HYDROGRAPH 1-9 THROUGH REACH 5
 120           RL                     0.2
 121           RS        6    FLOW      -1
 122           RC    0.055   0.040   0.055   18229  0.0033
 123           RX        0     500    1100    1150    1250    1260    1460    1480
 124           RY     1887    1885    1883    1880    1880    1884    1885    1888

 125           KK    SUB10
 126           KM    RUNOFF FROM SUBBASIN 10
 127           BA     17.0
 128           LS           79.0
 129           UD     2.50
1                                         HEC-1 INPUT                                             PAGE  4

      LINE     ID.......1.......2.......3.......4.......5.......6.......7.......8.......9......10

 130           KK    SUB11
 131           KM    RUNOFF FROM SUBBASIN 11
 132           BA     20.2
 133           LS           78.0
 134           UD     3.04

 135           KK        7 COMBINE 1-9 WITH 10 AND 11
 136           KM    ADD THREE HYDROGRAPHS
 137           HC        3

 138           KK        6 ROUTE HYDROGRAPH 1-11 THROUGH REACH 6
 139           RL                     0.2
 140           RS        6    FLOW      -1
 141           RC    0.050   0.035   0.050   26042  0.0029
 142           RX        0     300     700     900    1400    1700    2100    2600
 143           RY     1827    1823    1822    1820    1820    1821    1823    1824

 144           KK    SUB12
 145           KM    RUNOFF FROM SUBBASIN 12
 146           BA     10.6
 147           LS             79
 148           UD     1.98

 149           KK   SUB12A
 150           KM    RUNOFF FROM SUBBASIN 12A
 151           BA      9.9
 152           LS           79.0
 153           UD     1.62

 154           KK        8 COMBINE 1-11 WITH 12 AND 12A
 155           KM    ADD THREE HYDROGRAPHS
 156           HC        3

 157           KK    SUB13
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 158          KM   RUNOFF FROM SUBBASIN 13
 159          BA    68.7
 160          LS              78.0
 161          UD    3.96

 162          KK        9 COMBINE 1-12A WITH 13
 163          KM   ADD TWO HYDROGRAPHS
 164          HC        2

 165          KK   SUB15
 166          KM   RUNOFF FROM SUBBASIN 15
 167          BA    18.6
 168          LS                79
 169          UD    3.41
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LINE          ID.......1.......2.......3.......4.......5.......6.......7.......8.......9......10

 170          KK       10 COMBINE 1-13 WITH 15
 171          KM   ADD TWO HYDROGRAPHS
 172          HC        2

 173          KK        7 ROUTE HYDROGRAPH 1-15 THROUGH REACH 7
 174          RL                       0.2
 175          RS        6    FLOW       -1
 176          RC   0.055   0.040   0.055   26562   0.005
 177          RX        0     900     950    1110    1130    1140    1400    1700
 178          RY     1764    1763    1760    1760    1764    1762    1762    1764

 179          KK   SUB14
 180          KM   RUNOFF FROM SUBBASIN 14
 181          BA    13.7
 182          LS              84.0
 183          UD    0.71

 184          KK   SUB16
 185          KM   RUNOFF FROM SUBBASIN 16
 186          BA    19.7
 187          LS              82.0
 188          UD    1.59

 189          KK       11 COMBINE 1-15 WITH 14 AND 16
 190          KM   ADD THREE HYDROGRAPHS
 191          HC        3

 192          KK        1 ROUTE (LOWER CENTENNIAL - NARROWS DAM)
 193          KM   ROUTE TOTAL HYDROGRAPH THROUGH RESERVOIR
 194          RS        1    ELEV     224
 195          SV        0       0       0     500     850    1240    1700    2300    2620    2900
 196          SE      224     232  236.86  243.86  245.86  247.86  249.86  251.86  252.86  253.86
 197          SQ        0      20     160     547    1030    3150    7550   14000   18000   22500

 198          KK        8 ROUTE HYDROGRAPH 1-16 THROUGH REACH 8
 199          RL                       0.2
 200          RS       10    FLOW       -1
 201          RC   0.050   0.035   0.050   49479   0.004
 202          RX        0     500     550     640     650     800     820    1500
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 203         RY   1610    1609    1606    1604    1600    1600    1605    1608

 204         KK   SUB17
 205         KM   RUNOFF FROM SUBBASIN 17
 206         BA   21.0
 207         LS           80.0
 208         UD   1.98

 209         KK   SUB18
 210         KM   RUNOFF FROM SUBBASIN 18
 211         BA   24.4
 212         LS           80.0
 213         UD   2.89
1                                        HEC-1 INPUT                                        PAGE  6

LINE         ID.......1.......2.......3.......4.......5.......6.......7.......8.......9......10

 214         KK       12 COMBINE 1-16 WITH 17 AND 18
 215         KM   ADD THREE HYDROGRAPHS
 216         HC       3

 217         KK       12 ROUTE HYDROGRAPH 1-18 THROUGH REACH 9
 218         RL                   0.2
 219         RS       4    FLOW     -1
 220         RC   0.050   0.035   0.055   17708  0.0038
 221         RX       0     800    1000    2300    2600    3500    4000    4500
 222         RY    1450    1446    1442    1440    1442    1444    1446    1448

 223         KK   SUB19
 224         KM   RUNOFF FROM SUBBASIN 19
 225         BA   10.6
 226         LS           77.0
 227         UD   1.18

 228         KK   SUB20
 229         KM   RUNOFF FROM SUBBASIN 20
 230         BA   50.7
 231         LS           80.0
 232         UD   6.63

 233         KK       13 COMBINE 1-18 WITH 19 AND 20
 234         KM   ADD THREE HYDROGRAPHS
 235         HC       3

 236         KK  SUB21A
 237         KM   RUNOFF FROM SUBBASIN 21A
 238         BA   84.4
 239         LS           84.0
 240         UD    7.2

 241         KK       10 ROUTE HYDROGRAPH 21A THROUGH REACH 21
 242         RL                   0.2
 243         RS       6    FLOW     -1
 244         RC   0.055   0.040   0.060   63400  0.0088
 245         RX       0     100    1000    1010    1110    1120    2120    2220
 246         RY    1725    1724    1723    1720    1720    1723    1724    1725
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 247          KK   SUB21 (TIGER WASH)
 248          KM   RUNOFF FROM SUBBASIN 21
 249          BA    76.8
 250          LS            84.0
 251          UD     7.0

 252          KK       14 COMBINE 21 WITH 21A
 253          KM   ADD TWO HYDROGRAPHS
 254          HC        2
1                                     HEC-1 INPUT                                              PAGE  7

LINE          ID.......1.......2.......3.......4.......5.......6.......7.......8.......9......10

 255          KK        2 ROUTE (TIGER WASH DETENTION BASIN)
 256          KM   ROUTE HYDROGRAPH THROUGH TIGER WASH DETENTION BASIN
 257          RS        1    ELEV    1390
 258          SV        0       0       0    1716    6218    6973    7765    9460   11302   15428
 259          SE     1390    1393    1397    1401    1405  1405.5    1406    1407    1408    1410
 260          SQ        0     591     903    1132    1322    1637    2287    4307    7108   14651

 261          KK       15 COMBINE 1-20 WITH 21
 262          KM   ADD TWO HYDROGRAPHS
 263          HC        2

 264          KK       10 ROUTE HYDROGRAPH 1-21 THROUGH REACH 10
 265          RL                      0.2
 266          RS       10    FLOW      -1
 267          RC    0.055   0.035   0.060   19271  0.0033
 268          RX        0     800    1000    2300    2600    3500    4000    4500
 269          RY     1370    1366    1362    1360    1362    1364    1366    1368

 270          KK   SUB22
 271          KM   RUNOFF FROM SUBBASIN 22
 272          BA    25.1
 273          LS            79.0
 274          UD    2.51

 275          KK       16 COMBINE 1-21 WITH 22
 276          KM   ADD TWO HYDROGRAPHS
 277          HC        2

 278          KK       11 ROUTE HYDROGRAPH 1-22 THROUGH REACH 11
 279          RL                      0.2
 280          RS        2    FLOW      -1
 281          RC    0.055   0.035   0.055   10937  0.0015
 282          RX        0     800    1000    2300    2600    3500    4000    4500
 283          RY     1290    1286    1282    1280    1282    1284    1286    1288

 284          KK   SUB23
 285          KM   RUNOFF FROM SUBBASIN 23
 286          BA     7.9
 287          LS              77
 288          UD    2.00

 289          KK       17 COMBINE 1-22 WITH 23
 290          KM   ADD TWO HYDROGRAPHS
 291          HC        2
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 292          KK      12 ROUTE HYDROGRAPH 1-23 THROUGH REACH 12
 293          RL                     0.2
 294          RS       4    FLOW      -1
 295          RC   0.050   0.035   0.050   17708  0.0027
 296          RX       0     800    1000    2300    2600    3500    4000    4500
 297          RY    1274    1269    1267    1265    1267    1269    1271    1275
1                                       HEC-1 INPUT                                                   PAGE  8

LINE          ID.......1.......2.......3.......4.......5.......6.......7.......8.......9......10

 298          KK   SUB24
 299          KM   RUNOFF FROM SUBBASIN 24
 300          BA    11.2
 301          LS              77
 302          UD    2.51

 303          KK   SUB25
 304          KM   RUNOFF FROM SUBBASIN 25
 305          BA    24.9
 306          LS            .77.0
 307          UD    4.21

 308          KK      18 COMBINE 1-23 WITH 24 AND 25
 309          KM   ADD THREE HYDROGRAPHS
 310          HC       3

 311          KK      13 ROUTE HYDROGRAPH 1-25 THROUGH REACH 13
 312          RL                     0.2
 313          RS       6    FLOW      -1
 314          RC   0.050   0.035   0.050   21354  0.0027
 315          RX       0    2200    2900    4100    4300    5300    6250    7470
 316          RY    1184    1182    1180  1179.9    1180    1182    1180  1181.4

 317          KK   SUB26
 318          KM   RUNOFF FROM SUBBASIN 26
 319          BA    42.4
 320          PB    4.12
 321          PC       0   0.002   0.005   0.008   0.011   0.014   0.017   0.020   0.023   0.026
 322          PC   0.029   0.032   0.035   0.038   0.041   0.044   0.048   0.052   0.056   0.060
 323          PC   0.064   0.068   0.072   0.076   0.080   0.085   0.090   0.095   0.100   0.105
 324          PC   0.110   0.115   0.120   0.126   0.133   0.140   0.147   0.155   0.163   0.172
 325          PC   0.181   0.191   0.203   0.218   0.236   0.257   0.283   0.387   0.663   0.707
 326          PC   0.735   0.758   0.776   0.791   0.804   0.815   0.825   0.834   0.842   0.849
 327          PC   0.856   0.863   0.869   0.875   0.881   0.887   0.893   0.898   0.903   0.908
 328          PC   0.913   0.918   0.922   0.926   0.930   0.934   0.938   0.942   0.946   0.950
 329          PC   0.953   0.956   0.959   0.962   0.965   0.968   0.971   0.974   0.977   0.980
 330          PC   0.983   0.986   0.989   0.992   0.995   0.998   1.000
 331          LS              79
 332          UD    3.19

 333          KK      19 COMBINE 1-25 WITH 26
 334          KM   ADD TWO HYDROGRAPHS
 335          HC       2

 336          KK      14 ROUTE HYDROGRAPH 1-26 THROUGH REACH 14
 337          RL                     0.2
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 338          RS      14    FLOW      -1
 339          RC   0.065   0.045   0.065   46354  0.0027
 340          RX       0    2900    5300    5440    5630    5720    5730    8140
 341          RY    1100    1096    1092    1090    1088    1090    1092    1098
1                                        HEC-1 INPUT                                          PAGE  9

LINE          ID.......1.......2.......3.......4.......5.......6.......7.......8.......9......10

 342          KK   SUB27
 343          KM   RUNOFF FROM SUBBASIN 27
 344          BA    62.1
 345          LS            77.0
 346          UD    4.35

 347          KK       3 ROUTE (EAGLETAIL REACH)
 348          KM   ROUTE HYDROGRAPH THROUGH DETENTION STRUCTURE
 349          RS       1    ELEV  1252.5
 350          RV       5      50     155     310     525     790    1110    1485    1905    2355
 351          RE  1252.5  1253.0  1253.5  1254.0  1254.5  1255.0  1255.5  1256.0  1256.5  1257.0
 352          RQ       0      20      50      90     140     200     260     325     400     475

 353          KK      20 COMBINE 1-26 WITH 27
 354          KM   ADD TWO HYDROGRAPHS
 355          HC       2

 356          KK   SUB28
 357          KM   RUNNOFF FROM SUBBASIN 28
 358          BA    84.4
 359          LS            75.0
 360          UD   15.06

 361          KK   SUB31
 362          KM   RUNOFF FROM SUBBASIN 31
 363          BA    12.0
 364          LS            86.0
 365          UD     .96

 366          KK      21 COMBINE 1-27 WITH 28 AND 31
 367          KM   ADD THREE HYDROGRAPHS
 368          HC       3

 369          KK   SUB29
 370          KM   RUNOFF FROM SUBBASIN 29
 371          BA   101.3
 372          PB    3.93
 373          PC       0   0.002   0.005   0.008   0.011   0.014   0.017   0.020   0.023   0.026
 374          PC   0.029   0.032   0.035   0.038   0.041   0.044   0.048   0.052   0.056   0.060
 375          PC   0.064   0.068   0.072   0.076   0.080   0.085   0.090   0.095   0.100   0.105
 376          PC   0.110   0.115   0.120   0.126   0.133   0.140   0.147   0.155   0.163   0.172
 377          PC   0.181   0.191   0.203   0.218   0.236   0.257   0.283   0.387   0.663   0.707
 378          PC   0.735   0.758   0.776   0.791   0.804   0.815   0.825   0.834   0.842   0.849
 379          PC   0.856   0.863   0.869   0.875   0.881   0.887   0.893   0.898   0.903   0.908
 380          PC   0.913   0.918   0.922   0.926   0.930   0.934   0.938   0.942   0.946   0.950
 381          PC   0.953   0.956   0.959   0.962   0.965   0.968   0.971   0.974   0.977   0.980
 382          PC   0.983   0.986   0.989   0.992   0.995   0.998   1.000
 383          LS            83.0
 384          UD    4.85
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1                                        HEC-1 INPUT                                        PAGE 10

        LINE        ID.......1.......2.......3.......4.......5.......6.......7.......8.......9......10

         385        KK       4 ROUTE (HARQUAHALA F.R.S.)
         386        KM   ROUTE HYDROGRAPH 29 THROUGH DETENTION STRUCTURE
         387        RS       1    ELEV    1393
         388        RV       0    1000    1500    2300    3500    5000    7000    8500   12000   14200
         389        RE    1393    1395    1397    1399    1401    1403    1405    1407    1409    1411
         390        RQ       0     121     172     210     243     272     298     322     344    1214

         391        KK      15 ROUTE HYDROGRAPH 29 THROUGH REACH 18
         392        RL                     0.2
         393        RS       6    FLOW      -1
         394        RC   0.040   0.028   0.040   31771  0.0041
         395        RX       0      10      14      24      36      71      83     183
         396        RY  1205.5  1205.5  1203.5  1203.5    1200    1200  1203.5    1205

         397        KK   SUB30
         398        KM   RUNOFF FROM SUBBASIN 30
         399        BA    28.6
         400        LS            78.0
         401        UD    4.75

         402        KK       5 ROUTE (SADDLEBACK F.R.S.)
         403        KM   ROUTE HYDROGRAPH 30 THROUGH DETENTION STRUCTURE
         404        RS       1    ELEV    1179
         405        RV       0     200     400    1000    1750    3000    4500    6800    9300   10500
         406        RE    1179    1181    1183    1185    1187    1189    1191    1193    1195    1197
         407        RQ       0     100     240     440     670     830    1030    1200    1310    1450

         408        KK      16 ROUTE HYDROGRAPH 30 THROUGH REACH 19
         409        RL                     0.2
         410        RS      12    FLOW      -1
         411        RC   0.040   0.030   0.040   43229  0.0038
         412        RX       0      10      24      64      73     205     220     270
         413        RY  1149.5  1149.5    1146    1146    1143    1143    1146    1147

         414        KK      22 COMBINE 1-31 WITH 29 AND 30
         415        KM   ADD THREE HYDROGRAPHS
         416        HC       3

         417        KK      17 ROUTE HYDROGRAPH 1-31 THROUGH REACH 15
         418        RL                     0.2
         419        RS       4    FLOW      -1
         420        RC   0.055   0.035   0.055   20833  0.0030
         421        RX       0    1800    2100    2130    2700    2790    3280    4300
         422        RY    1056    1050    1046    1044    1044    1046    1056  1056.6

         423        KK   SUB32
         424        KM   RUNOFF FROM SUBBASIN 32
         425        BA    52.4
         426        LS            79.0
         427        UD    5.05
1                                        HEC-1 INPUT                                        PAGE 11

        LINE        ID.......1.......2.......3.......4.......5.......6.......7.......8.......9......10
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428     KK      23 COMBINE 1-31 WITH 32
429     KM   ADD TWO HYDROGRAPHS
430     HC       2

431     KK      18 ROUTE HYDROGRAPH 1-32 THROUGH REACH 16
432     RL                      0.2
433     RS      14    FLOW      -1
434     RC   0.065   0.040   0.055   58333  0.0024
435     RX       0     700    1300    1400    1550    1600    1800    2100
436     RY     930     928     924     920     920     924     928     930

437     KK   SUB33
438     KM   RUNOFF FROM SUBBASIN 33
439     BA    47.0
440     LS             80.0
441     UD    4.00

442     KK   SUB34
443     KM   RUNOFF FROM SUBBASIN 34
444     BA    64.3
445     LS             81.0
446     UD    4.64

447     KK      24 COMBINE 1-32 WITH 33 AND 34
448     KM   ADD THREE HYDROGRAPHS
449     HC       3

450     KK   SUB35
451     KM   RUNOFF FROM SUBBASIN 35
452     BA    99.6
453     LS             87.0
454     UD    4.73

455     KK       6 ROUTE (OLD CAMP DETENTION BASIN)
456     KM   ROUTE HYDROGRAPH 35 THROUGH OLD CAMP DETENTION (UPSTRM OF C.A.P.)
457     RS       1    ELEV       0
458     RV       0     163     326     489     652     816     978    1141    1222    1344
459     RE       0       2       4       6       8      10      12      14      15      16
460     RQ       0     156     315     585     825    1020    1200    1335    1410    1500

461     KK      19 ROUTE HYDROGRAPH 35 THROUGH REACH 17
462     RL                      0.2
463     RS      24    FLOW      -1
464     RC   0.060   0.035   0.060  105600  0.0049
465     RX       0     200     400     600     800    1000    1200    1400
466     RY    1004    1003    1002    1000    1000    1002    1003    1004

467     KK   SUB36
468     KM   RUNOFF FROM SUBBASIN 36
469     BA   163.1
470     LS             79.0
471     UD   12.25
1                                   HEC-1 INPUT                                        PAGE 12

LINE    ID.......1.......2.......3.......4.......5.......6.......7.......8.......9......10
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472          KK      25 COMBINE 1-34 WITH 35 AND 36
473          KM   ADD THREE HYDROGRAPHS
474          HC       3

475          KK      20 ROUTE HYDROGRAPH 1-36 THROUGH REACH 20
476          RL                    0.2
477          RS       6    FLOW     -1
478          RC   0.065   0.040   0.060   30729  0.0024
479          RX       0     400     800    1000    1100    1500    1800    2300
480          RY     848     846     842     840     840     842     846     848

481          KK   SUB37
482          KM   RUNOFF FROM SUBBASIN 37
483          BA    45.8
484          LS            83.0
485          UD    4.43

486          KK      26 COMBINE 1-36 WITH 37
487          KM   ADD TWO HYDROGRAPHS
488          HC       2
489          ZZ
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*****************************************
*                                       *
*   FLOOD HYDROGRAPH PACKAGE  (HEC-1)   *
*            FEBRUARY 1981              *
*          REVISED 30 OCT 81            *
*                                       *
*RUN DATE WED, JAN 04 1989 TIME 14:07:22*
*                                       *
*****************************************
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*************************************
*                                   *
*    U.S. ARMY CORPS OF ENGINEERS   *
*  THE HYDROLOGIC ENGINEERING CENTER *
*          609 SECOND STREET        *
*       DAVIS, CALIFORNIA 95616     *
*  (916) 440-3285 OR (FTS) 448-3285 *
*                                   *
*************************************
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                    MARICOPA CO. FLOOD INSURANCE STUDY
                    CENTENNIAL WASH  HEC-1 (FILE CWHEC1F)
                    CURVE NUMBERS DETERMINED BY UPLAND METHOD
                    CBA JOB NO. 04856-03-74   5 JANUARY 89

  6 IO        OUTPUT CONTROL VARIABLES
                 IPRNT          3  PRINT CONTROL
                 IPLOT          0  PLOT CONTROL
                 QSCAL         0.  HYDROGRAPH PLOT SCALE

   IT         HYDROGRAPH TIME DATA
                 NMIN          30  MINUTES IN COMPUTATION INTERVAL
                 IDATE     18APR88  STARTING DATE
                 ITIME        1200  STARTING TIME
                    NQ         200  NUMBER OF HYDROGRAPH ORDINATES
                NDDATE     22APR88  ENDING DATE
                NDTIME        1530  ENDING TIME

            COMPUTATION INTERVAL    0.50 HOURS
                 TOTAL TIME BASE   99.50 HOURS

       ENGLISH UNITS
           DRAINAGE AREA        SQUARE MILES
```

```
PRECIPITATION DEPTH   INCHES
LENGTH, ELEVATION     FEET
FLOW                  CUBIC FEET PER SECOND
STORAGE VOLUME        ACRE-FEET
SURFACE AREA          ACRES
TEMPERATURE           DEGREES FAHRENHEIT


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

        **************
        *            *
 8 KK   *   SUB 1    *
        *            *
        **************
                 RUNOFF FROM SUBBASIN 1
                 SCS DIMENSIONLESS UNIT HYDROGRAPH
                 LAGTIME = HYDRAULIC LENGTH, AVG. WATERSHED SLOPE AND C.N.
                 RAINFALL DISTRIBUTION = SCS TYPE II

 7 IN       TIME DATA FOR INPUT TIME SERIES
              JXMIN        15  TIME INTERVAL IN MINUTES
             JXDATE    18APR88  STARTING DATE
             JXTIME      1200  STARTING TIME

          SUBBASIN RUNOFF DATA

 13 BA      SUBBASIN CHARACTERISTICS
              TAREA     67.00  SUBBASIN AREA

            PRECIPITATION DATA

 14 PB        STORM      3.88  BASIN TOTAL PRECIPITATION

 15 PI        INCREMENTAL PRECIPITATION PATTERN
              0.00    0.01    0.01    0.01    0.01    0.01    0.01    0.01    0.01    0.01
              0.01    0.01    0.01    0.01    0.01    0.01    0.01    0.01    0.02    0.02
              0.02    0.03    0.05    0.38    0.07    0.04    0.03    0.02    0.02    0.01
              0.01    0.01    0.01    0.01    0.01    0.01    0.01    0.01    0.01    0.01
              0.01    0.01    0.01    0.01    0.01    0.01    0.01    0.01

 25 LS      SCS LOSS RATE
              STRTL      0.56  INITIAL ABSTRACTION
             CRVNBR     78.00  CURVE NUMBER
              RTIMP      0.00  PERCENT IMPERVIOUS AREA

 26 UD      SCS DIMENSIONLESS UNITGRAPH
              TLAG      5.80  LAG

                                  ***

                              UNIT HYDROGRAPH
                          60 END-OF-PERIOD ORDINATES
      133.    405.    766.   1213.   1772.   2479.   3313.   4055.   4645.   5061.
     5302.   5346.   5311.   5114.   4827.   4506.   4147.   3705.   3187.   2713.
     2328.   2028.   1763.   1542.   1369.   1208.   1057.    924.    792.    702.
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613.    537.    470.    406.    358.    309.    271.    238.    207.    183.
159.    140.    122.    107.     93.     80.     71.     62.     56.     50.
 45.     40.     34.     29.     24.     20.     15.     11.      7.      2.

   ***          ***          ***          ***          ***
                HYDROGRAPH AT STATION    SUB 1

    TOTAL RAINFALL =  3.88, TOTAL LOSS =  2.09, TOTAL EXCESS =  1.79

 PEAK FLOW    TIME                      MAXIMUM AVERAGE FLOW
                                   6-HR      24-HR      72-HR    99.50-HR
+  (CFS)      (HR)
                         (CFS)
+   7279.     18.50                6534.      3185.      1076.       779.
                       (INCHES)   0.907      1.768      1.792      1.792
                        (AC-FT)   3240.      6317.      6403.      6403.

                       CUMULATIVE AREA =   67.00 SQ MI


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

          ***************
          *             *
  27 KK   *         1   *     ROUTE HYDROGRAPH 1 THROUGH REACH 1
          *             *
          ***************

            HYDROGRAPH ROUTING DATA

  28 RL       ROUTING LOSSES
                   QLOSS       0.00  INITIAL LOSS
                   CLOSS       0.00  ADDITIONAL FRACTION LOST

  29 RS       STORAGE ROUTING
                   NSTPS         10  NUMBER OF SUBREACHES
                    ITYP       FLOW  TYPE OF INITIAL CONDITION
                  RSVRIC      -1.00  INITIAL CONDITION
                       X       0.00 WORKING R AND D COEFFICIENT

  30 RC       NORMAL DEPTH CHANNEL ROUTING
                     AML      0.055  LEFT OVERBANK N-VALUE
                    ANCH      0.040  MAIN CHANNEL N-VALUE
                     ANR      0.055  RIGHT OVERBANK N-VALUE
                   RLNTH      53500.  REACH LENGTH
                     SEL     0.0050  ENERGY SLOPE
                   ELMAX        0.0  MAX. ELEV. FOR STORAGE/OUTFLOW CALCULATION

                                   CROSS-SECTION DATA
                        --- LEFT OVERBANK --- + ------ MAIN CHANNEL ------- + --- RIGHT OVERBANK ---
  32 RY      ELEVATION  2206.00   2204.00   2202.00   2200.00   2200.00   2202.00   2204.00   2206.00
  31 RX      DISTANCE      0.00    400.00    700.00    900.00   1100.00   1400.00   1700.00   2100.00

                                          ***

                                   COMPUTED STORAGE-OUTFLOW-ELEVATION DATA
```

STORAGE	0.00	92.88	216.38	370.50	555.24	770.60	1016.57	1294.53	1608.90	1960.00
OUTFLOW	0.00	83.44	289.30	620.76	1090.55	1712.60	2500.86	3611.71	4998.36	6604.70
ELEVATION	2200.00	2200.32	2200.63	2200.95	2201.26	2201.58	2201.89	2202.21	2202.53	2202.84
STORAGE	2347.85	2772.45	3233.78	3732.54	4277.57	4871.60	5514.61	6206.62	6947.61	7737.60
OUTFLOW	8441.36	10518.13	12844.43	15416.82	18242.76	21365.62	24799.08	28556.64	32651.51	37096.64
ELEVATION	2203.16	2203.47	2203.79	2204.11	2204.42	2204.74	2205.05	2205.37	2205.68	2206.00

*** WARNING *** MODIFIED PULS ROUTING MAY BE NUMERICALLY UNSTABLE FOR OUTFLOWS BETWEEN 8441. TO 37097.
THE ROUTED HYDROGRAPH SHOULD BE EXAMINED FOR OSCILLATIONS OR OUTFLOWS GREATER THAN PEAK INFLOWS.
THIS CAN BE CORRECTED BY DECREASING THE TIME INTERVAL OR INCREASING STORAGE (USE A LONGER REACH.)

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

HYDROGRAPH AT STATION 1

PEAK FLOW	TIME		MAXIMUM AVERAGE FLOW			
			6-HR	24-HR	72-HR	99.50-HR
+ (CFS)	(HR)					
		(CFS)				
+ 7110.	21.00		6359.	3128.	1076.	779.
		(INCHES)	0.882	1.736	1.792	1.792
		(AC-FT)	3153.	6205.	6403.	6403.

PEAK STORAGE	TIME	MAXIMUM AVERAGE STORAGE			
		6-HR	24-HR	72-HR	99.50-HR
+ (AC-FT)	(HR)				
207.	21.00	191.	110.	40.	29.

PEAK STAGE	TIME	MAXIMUM AVERAGE STAGE			
		6-HR	24-HR	72-HR	99.50-HR
+ (FEET)	(HR)				
2202.93	21.00	2202.79	2201.89	2200.72	2200.52

CUMULATIVE AREA = 67.00 SQ MI

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          **************
          *            *
33 KK     *   SUB 2    *
          *            *
          **************
```

RUNOFF FROM SUBBASIN 2

SUBBASIN RUNOFF DATA

35 BA SUBBASIN CHARACTERISTICS

TAREA 185.00 SUBBASIN AREA

PRECIPITATION DATA

14 PB STORM 3.88 BASIN TOTAL PRECIPITATION

15 PI INCREMENTAL PRECIPITATION PATTERN

0.00	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01
0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.02	0.02

0.02	0.03	0.05	0.38	0.07	0.04	0.03	0.02	0.02	0.01
0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01
0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01		

36 LS SCS LOSS RATE

STRTL	0.47	INITIAL ABSTRACTION
CRVNBR	81.00	CURVE NUMBER
RTIMP	0.00	PERCENT IMPERVIOUS AREA

37 UD SCS DIMENSIONLESS UNITGRAPH

TLAG	15.70	LAG

***

UNIT HYDROGRAPH TRUNCATED FROM 159 TO 150 INTERVALS

UNIT HYDROGRAPH
150 END-OF-PERIOD ORDINATES
VOLUME = 1.00

53.	105.	158.	268.	391.	514.	659.	817.	975.	1156.
1366.	1577.	1805.	2086.	2367.	2651.	2985.	3319.	3652.	3941.
4222.	4503.	4725.	4919.	5112.	5263.	5368.	5474.	5554.	5571.
5589.	5603.	5585.	5568.	5550.	5453.	5347.	5242.	5124.	5001.
4878.	4745.	4605.	4464.	4312.	4136.	3960.	3780.	3569.	3358.
3147.	2970.	2794.	2619.	2483.	2360.	2237.	2125.	2019.	1914.
1815.	1727.	1640.	1556.	1492.	1428.	1364.	1300.	1236.	1172.
1117.	1064.	1012.	959.	906.	853.	808.	773.	738.	703.
668.	633.	598.	572.	545.	519.	493.	466.	440.	418.
399.	380.	360.	341.	322.	304.	291.	278.	265.	252.
238.	225.	215.	206.	196.	186.	177.	167.	159.	152.
145.	138.	131.	124.	117.	112.	106.	101.	96.	90.
85.	81.	78.	74.	71.	67.	64.	61.	59.	57.
54.	52.	50.	48.	46.	44.	42.	40.	38.	36.
33.	31.	29.	27.	25.	24.	22.	20.	18.	17.

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

HYDROGRAPH AT STATION SUB 2

TOTAL RAINFALL = 3.88, TOTAL LOSS = 1.86, TOTAL EXCESS = 2.02

PEAK FLOW	TIME		MAXIMUM AVERAGE FLOW			
			6-HR	24-HR	72-HR	99.50-HR
+ (CFS)	(HR)					
		(CFS)				
+ 10490.	29.00		10270.	7912.	3347.	2425.
		(INCHES)	0.516	1.591	2.018	2.021
		(AC-FT)	5092.	15693.	19916.	19941.

CUMULATIVE AREA = 185.00 SQ MI

*** ***

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* *

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38 KK     *     SUB 3  *
          *            *
          **************
                    RUNOFF FROM SUBBASIN 3

            SUBBASIN RUNOFF DATA

40 BA          SUBBASIN CHARACTERISTICS
                    TAREA       43.00  SUBBASIN AREA

               PRECIPITATION DATA

14 PB               STORM        3.88  BASIN TOTAL PRECIPITATION

15 PI            INCREMENTAL PRECIPITATION PATTERN
                   0.00      0.01      0.01      0.01      0.01      0.01      0.01      0.01      0.01      0.01
                   0.01      0.01      0.01      0.01      0.01      0.01      0.01      0.01      0.02      0.02
                   0.02      0.03      0.05      0.38      0.07      0.04      0.03      0.02      0.02      0.01
                   0.01      0.01      0.01      0.01      0.01      0.01      0.01      0.01      0.01      0.01
                   0.01      0.01      0.01      0.01      0.01      0.01      0.01      0.01

41 LS          SCS LOSS RATE
                    STRTL        0.50  INITIAL ABSTRACTION
                   CRVNBR       80.00  CURVE NUMBER
                    RTIMP        0.00  PERCENT IMPERVIOUS AREA

42 UD          SCS DIMENSIONLESS UNITGRAPH
                    TLAG        4.81  LAG

                                                  ***

                                              UNIT HYDROGRAPH
                                          50 END-OF-PERIOD ORDINATES
             122.      404.      767.     1249.     1891.     2654.     3312.     3775.     4038.     4101.
            4070.     3853.     3575.     3257.     2865.     2393.     1971.     1663.     1410.     1198.
            1037.      889.      760.      639.      546.      465.      397.      337.      286.      242.
             206.      176.      150.      128.      109.       93.       79.       67.       57.       49.
              43.       38.       33.       28.       23.       19.       15.       11.        6.        2.

     ***            ***            ***            ***            ***
                      HYDROGRAPH AT STATION    SUB 3

      TOTAL RAINFALL =  3.88, TOTAL LOSS =  1.94, TOTAL EXCESS =  1.94

  PEAK FLOW     TIME                        MAXIMUM AVERAGE FLOW
                                     6-HR       24-HR       72-HR     99.50-HR
+   (CFS)       (HR)
                          (CFS)
+    5890.      17.00                5043.       2234.        749.        542.
                         (INCHES)   1.090       1.932       1.943       1.943
                          (AC-FT)   2501.       4431.       4456.       4456.

                         CUMULATIVE AREA =   43.00 SQ MI

*** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** ***
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          ***************
          *             *
  43 KK   *         1   *      COMBINE 1-3
          *             *
          ***************
                        ADD THREE HYDROGRAPHS

  45 HC         HYDROGRAPH COMBINATION
                      ICOMP          3  NUMBER OF HYDROGRAPHS TO COMBINE

                                                                  ***

     ***            ***            ***            ***            ***
                        HYDROGRAPH AT STATION      1

 PEAK FLOW     TIME                          MAXIMUM AVERAGE FLOW
                                     6-HR       24-HR       72-HR     99.50-HR
+  (CFS)       (HR)
                          (CFS)
+  16527.     22.50                16122.      12504.       5171.       3745.
                       (INCHES)    0.508       1.576       1.956       1.958
                        (AC-FT)    7994.      24802.      30770.      30799.

                        CUMULATIVE AREA =  295.00 SQ MI


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

          ***************
          *             *
  46 KK   *         2   *      ROUTE HYDROGRAPH 1-3 THROUGH REACH 2
          *             *
          ***************

            HYDROGRAPH ROUTING DATA

  47 RL         ROUTING LOSSES
                     QLOSS        0.00  INITIAL LOSS
                     CLOSS        0.00  ADDITIONAL FRACTION LOST

  48 RS         STORAGE ROUTING
                     NSTPS           8  NUMBER OF SUBREACHES
                      ITYP        FLOW  TYPE OF INITIAL CONDITION
                    RSVRIC       -1.00  INITIAL CONDITION
                         X        0.00 WORKING R AND D COEFFICIENT

  49 RC         NORMAL DEPTH CHANNEL ROUTING
                       ANL       0.055  LEFT OVERBANK N-VALUE
                      ANCH       0.035  MAIN CHANNEL N-VALUE
                       ANR       0.055  RIGHT OVERBANK N-VALUE
                     RLNTH      34375.  REACH LENGTH
                       SEL      0.0019  ENERGY SLOPE
                     ELMAX         0.0  MAX. ELEV. FOR STORAGE/OUTFLOW CALCULATION

                                  CROSS-SECTION DATA
```

```
                          --- LEFT OVERBANK --- + ------ MAIN CHANNEL ------- + --- RIGHT OVERBANK ---
 51 RY      ELEVATION   2087.00   2087.00   2082.00   2080.00   2082.00   2085.00   2086.00   2087.00
 50 RX      DISTANCE       0.00    300.00    800.00   1200.00   1600.00   2000.00   2300.00   2460.00

                                                   ***

                                        COMPUTED STORAGE-OUTFLOW-ELEVATION DATA
        STORAGE       0.00     21.42     85.69    192.80    342.76    535.57    768.30   1027.67   1312.03   1621.38
        OUTFLOW       0.00     16.31    103.55    305.31    657.53   1192.17   2005.48   3086.29   4385.59   5908.43
      ELEVATION    2080.00   2080.37   2080.74   2081.11   2081.47   2081.84   2082.21   2082.58   2082.95   2083.32
        STORAGE    1955.73   2315.07   2699.40   3108.73   3544.69   4020.58   4539.31   5097.07   5683.28   6297.35
        OUTFLOW    7660.95   9649.97  11882.74  14366.81  17289.46  20738.81  24500.94  28598.67  33029.00  37790.61
      ELEVATION    2083.68   2084.05   2084.42   2084.79   2085.16   2085.53   2085.89   2086.26   2086.63   2087.00

*** WARNING *** MODIFIED PULS ROUTING MAY BE NUMERICALLY UNSTABLE FOR OUTFLOWS BETWEEN    11883. TO    37791.
              THE ROUTED HYDROGRAPH SHOULD BE EXAMINED FOR OSCILLATIONS OR OUTFLOWS GREATER THAN PEAK INFLOWS.
              THIS CAN BE CORRECTED BY DECREASING THE TIME INTERVAL OR INCREASING STORAGE (USE A LONGER REACH.)

     ***            ***            ***            ***            ***
                      HYDROGRAPH AT STATION       2

 PEAK FLOW     TIME                        MAXIMUM AVERAGE FLOW
                                   6-HR       24-HR       72-HR     99.50-HR
+  (CFS)       (HR)
                          (CFS)
+  16451.     24.50                16077.      12466.       5163.       3744.
                        (INCHES)    0.507       1.572       1.953       1.957
                         (AC-FT)    7972.      24726.      30724.      30785.

 PEAK STORAGE  TIME                       MAXIMUM AVERAGE STORAGE
                                   6-HR       24-HR       72-HR     99.50-HR
+  (AC-FT)     (HR)
     427.     24.50                 420.        347.        161.        118.

 PEAK STAGE    TIME                        MAXIMUM AVERAGE STAGE
                                   6-HR       24-HR       72-HR     99.50-HR
+  (FEET)      (HR)
  2085.05     24.50               2085.01     2084.47     2082.63     2081.98

                        CUMULATIVE AREA =  295.00 SQ MI


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

          **************
          *            *
 52 KK    *    SUB 4   *
          *            *
          **************
                        RUNOFF FROM SUBBASIN 4

            SUBBASIN RUNOFF DATA

 54 BA        SUBBASIN CHARACTERISTICS
                     TAREA       21.60  SUBBASIN AREA
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          PRECIPITATION DATA

 14 PB           STORM        3.88  BASIN TOTAL PRECIPITATION

 15 PI            INCREMENTAL PRECIPITATION PATTERN
                    0.00     0.01     0.01     0.01     0.01     0.01     0.01     0.01     0.01     0.01
                    0.01     0.01     0.01     0.01     0.01     0.01     0.01     0.01     0.02     0.02
                    0.02     0.03     0.05     0.38     0.07     0.04     0.03     0.02     0.02     0.01
                    0.01     0.01     0.01     0.01     0.01     0.01     0.01     0.01     0.01     0.01
                    0.01     0.01     0.01     0.01     0.01     0.01     0.01     0.01

 55 LS          SCS LOSS RATE
                 STRTL        0.47  INITIAL ABSTRACTION
                CRVNBR       81.00  CURVE NUMBER
                 RTIMP        0.00  PERCENT IMPERVIOUS AREA

 56 UD          SCS DIMENSIONLESS UNITGRAPH
                  TLAG        3.27  LAG

                                                 ***

                                           UNIT HYDROGRAPH
                                       35 END-OF-PERIOD ORDINATES
           176.      521.     1043.     1778.     2465.     2851.     2964.     2871.     2595.     2253.
          1794.     1355.     1074.      847.      689.      549.      427.      343.      273.      215.
           169.      135.      108.       85.       68.       54.       42.       34.       28.       23.
            18.       13.        9.        5.        1.

    ***            ***            ***            ***            ***
                     HYDROGRAPH AT STATION     SUB 4

    TOTAL RAINFALL =  3.88, TOTAL LOSS =  1.86, TOTAL EXCESS =  2.02

  PEAK FLOW     TIME                    MAXIMUM AVERAGE FLOW
                                 6-HR        24-HR       72-HR     99.50-HR
+   (CFS)       (HR)
                         (CFS)
+    4125.     15.50             3101.       1172.        391.         283.
                       (INCHES)  1.335       2.019       2.021        2.021
                        (AC-FT)  1538.       2325.       2328.        2328.

                     CUMULATIVE AREA =   21.60 SQ MI


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

          **************
          *            *
 57 KK    *    SUB4A   *
          *            *
          **************
                       RUNOFF FROM SUBBASIN 4A

          SUBBASIN RUNOFF DATA

 59 BA          SUBBASIN CHARACTERISTICS
```

```
                    TAREA       18.50  SUBBASIN AREA

               PRECIPITATION DATA

  14 PB             STORM        3.88  BASIN TOTAL PRECIPITATION

  15 PI          INCREMENTAL PRECIPITATION PATTERN
                   0.00    0.01    0.01    0.01    0.01    0.01    0.01    0.01    0.01    0.01
                   0.01    0.01    0.01    0.01    0.01    0.01    0.01    0.01    0.02    0.02
                   0.02    0.03    0.05    0.38    0.07    0.04    0.03    0.02    0.02    0.01
                   0.01    0.01    0.01    0.01    0.01    0.01    0.01    0.01    0.01    0.01
                   0.01    0.01    0.01    0.01    0.01    0.01    0.01    0.01

  60 LS        SCS LOSS RATE
                    STRTL        0.47  INITIAL ABSTRACTION
                   CRVNBR       81.00  CURVE NUMBER
                    RTIMP        0.00  PERCENT IMPERVIOUS AREA

  61 UD        SCS DIMENSIONLESS UNITGRAPH
                     TLAG        3.40  LAG

                                                    ***

                                                UNIT HYDROGRAPH
                                           36 END-OF-PERIOD ORDINATES
            137.     408.     802.    1373.    1948.    2308.    2437.    2424.    2220.    1968.
           1644.    1263.     987.     786.     636.     514.     412.     328.     261.     211.
            168.     132.     107.      86.      69.      55.      44.      35.      28.      24.
             20.      16.      12.       8.       5.       2.

     ***            ***            ***            ***            ***
                      HYDROGRAPH AT STATION    SUB4A

      TOTAL RAINFALL =  3.88, TOTAL LOSS =  1.86, TOTAL EXCESS =  2.02

  PEAK FLOW     TIME                        MAXIMUM AVERAGE FLOW
                                     6-HR       24-HR       72-HR     99.50-HR
+   (CFS)       (HR)
                          (CFS)
+    3440.     15.50                2626.       1004.        335.        242.
                        (INCHES)   1.320       2.018       2.021       2.021
                         (AC-FT)   1302.       1991.       1994.       1994.

                       CUMULATIVE AREA =   18.50 SQ MI


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

          **************
          *            *
  62 KK   *         2  *      COMBINE 1-3 WITH 4 AND 4A
          *            *
          **************
                         ADD THREE HYDROGRAPHS

  64 HC        HYDROGRAPH COMBINATION
```

```
                    ICOMP          3  NUMBER OF HYDROGRAPHS TO COMBINE

                                                                            ***

      ***              ***              ***              ***              ***
                          HYDROGRAPH AT STATION          2

  PEAK FLOW      TIME                              MAXIMUM AVERAGE FLOW
                                           6-HR         24-HR         72-HR       99.50-HR
+   (CFS)        (HR)
                              (CFS)
+   17871.       23.50                    17400.        13462.         5882.          4269.
                            (INCHES)      0.483         1.494         1.958          1.964
                            (AC-FT)       8628.         26701.        34998.         35107.

                           CUMULATIVE AREA =   335.10 SQ MI


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

            **************
            *            *
  65 KK     *    SUB 5   *
            *            *
            **************
                             RUNOFF FROM SUBBASIN 5

                 SUBBASIN RUNOFF DATA

  67 BA            SUBBASIN CHARACTERISTICS
                        TAREA        48.70  SUBBASIN AREA

                   PRECIPITATION DATA

  14 PB                 STORM          3.88  BASIN TOTAL PRECIPITATION

  15 PI              INCREMENTAL PRECIPITATION PATTERN
                          0.00      0.01      0.01      0.01      0.01      0.01      0.01      0.01      0.01      0.01
                          0.01      0.01      0.01      0.01      0.01      0.01      0.01      0.01      0.02      0.02
                          0.02      0.03      0.05      0.38      0.07      0.04      0.03      0.02      0.02      0.01
                          0.01      0.01      0.01      0.01      0.01      0.01      0.01      0.01      0.01      0.01
                          0.01      0.01      0.01      0.01      0.01      0.01      0.01      0.01

  68 LS            SCS LOSS RATE
                        STRTL          0.53  INITIAL ABSTRACTION
                        CRVNBR        79.00  CURVE NUMBER
                        RTIMP          0.00  PERCENT IMPERVIOUS AREA

  69 UD            SCS DIMENSIONLESS UNITGRAPH
                        TLAG           2.90  LAG

                                                                            ***

                                                                  UNIT HYDROGRAPH
                                                            31 END-OF-PERIOD ORDINATES
            531.     1576.     3226.     5347.     6894.     7433.     7344.     6581.     5612.     4296.
```

```
          3195.    2447.    1918.    1496.    1141.     889.     689.     528.     402.     313.
           244.     189.     145.     111.      87.      71.      57.      42.      30.      18.
             6.

     ***            ***            ***            ***            ***
                      HYDROGRAPH AT STATION    SUB 5

      TOTAL RAINFALL =  3.88, TOTAL LOSS =  2.01, TOTAL EXCESS =  1.87

  PEAK FLOW     TIME                        MAXIMUM AVERAGE FLOW
                                     6-HR       24-HR       72-HR     99.50-HR
+   (CFS)       (HR)
                         (CFS)
+    9311.     15.00                6690.       2443.        815.        590.
                       (INCHES)    1.277       1.866       1.867       1.867
                        (AC-FT)    3318.       4845.       4848.       4848.

                       CUMULATIVE AREA =   48.70 SQ MI


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

          ***************
          *             *
  70 KK   *         3   *     COMBINE 1-4A WITH 5
          *             *
          ***************
                         ADD TWO HYDROGRAPHS

  72 HC          HYDROGRAPH COMBINATION
                       ICOMP          2  NUMBER OF HYDROGRAPHS TO COMBINE

                                                                 ***

     ***            ***            ***            ***            ***
                      HYDROGRAPH AT STATION       3

  PEAK FLOW     TIME                        MAXIMUM AVERAGE FLOW
                                     6-HR       24-HR       72-HR     99.50-HR
+   (CFS)       (HR)
                         (CFS)
+   19493.     22.50                18935.      15480.       6696.       4859.
                       (INCHES)    0.459       1.500       1.946       1.952
                        (AC-FT)    9389.      30705.      39842.      39955.

                       CUMULATIVE AREA =  383.80 SQ MI


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

          ***************
          *             *
  73 KK   *         3   *     ROUTE HYDROGRAPH 1-5 THROUGH REACH 3
          *             *
          ***************
```

HYDROGRAPH ROUTING DATA

74 RL ROUTING LOSSES
- QLOSS 0.00 INITIAL LOSS
- CLOSS 0.00 ADDITIONAL FRACTION LOST

75 RS STORAGE ROUTING
- NSTPS 10 NUMBER OF SUBREACHES
- ITYP FLOW TYPE OF INITIAL CONDITION
- RSVRIC -1.00 INITIAL CONDITION
- X 0.00 WORKING R AND D COEFFICIENT

76 RC NORMAL DEPTH CHANNEL ROUTING
- ANL 0.055 LEFT OVERBANK N-VALUE
- ANCH 0.040 MAIN CHANNEL N-VALUE
- ANR 0.055 RIGHT OVERBANK N-VALUE
- RLNTH 18750. REACH LENGTH
- SEL 0.0022 ENERGY SLOPE
- ELMAX 0.0 MAX. ELEV. FOR STORAGE/OUTFLOW CALCULATION

CROSS-SECTION DATA

		--- LEFT OVERBANK --- +		------ MAIN CHANNEL ------- +			--- RIGHT OVERBANK ---	
78 RY	ELEVATION	2028.00	2026.00	2023.00	2020.00	2020.00	2023.00	2026.00	2028.00
77 RX	DISTANCE	0.00	300.00	400.00	800.00	1500.00	1800.00	2400.00	2700.00

***

COMPUTED STORAGE-OUTFLOW-ELEVATION DATA

STORAGE	0.00	135.77	289.35	460.73	649.91	856.91	1081.71	1324.31	1584.72	1862.94
OUTFLOW	0.00	296.75	969.34	1963.72	3272.12	4898.21	6850.42	9139.56	12173.77	15649.70
ELEVATION	2020.00	2020.42	2020.84	2021.26	2021.68	2022.11	2022.53	2022.95	2023.37	2023.79
STORAGE	2158.96	2472.79	2804.42	3153.86	3521.11	3907.59	4316.81	4748.92	5203.92	5681.82
OUTFLOW	19521.01	23794.42	28476.41	33573.50	39092.34	45021.45	51412.53	58273.07	65610.36	73434.74
ELEVATION	2024.21	2024.63	2025.05	2025.47	2025.89	2026.32	2026.74	2027.16	2027.58	2028.00

*** WARNING *** MODIFIED PULS ROUTING MAY BE NUMERICALLY UNSTABLE FOR OUTFLOWS BETWEEN 969. TO 73435.
THE ROUTED HYDROGRAPH SHOULD BE EXAMINED FOR OSCILLATIONS OR OUTFLOWS GREATER THAN PEAK INFLOWS.
THIS CAN BE CORRECTED BY DECREASING THE TIME INTERVAL OR INCREASING STORAGE (USE A LONGER REACH.)

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

HYDROGRAPH AT STATION 3

PEAK FLOW	TIME		MAXIMUM AVERAGE FLOW			
			6-HR	24-HR	72-HR	99.50-HR
+ (CFS)	(HR)					
		(CFS)				
+ 19501.	23.50		18917.	15436.	6689.	4857.
		(INCHES)	0.458	1.496	1.944	1.951
		(AC-FT)	9380.	30617.	39802.	39938.

PEAK STORAGE	TIME	MAXIMUM AVERAGE STORAGE			
		6-HR	24-HR	72-HR	99.50-HR
+ (AC-FT)	(HR)				
216.	23.50	211.	184.	92.	67.

PEAK STAGE TIME MAXIMUM AVERAGE STAGE

```
                                    6-HR       24-HR       72-HR     99.50-HR
+  (FEET)     (HR)
  2024.21     23.50              2024.14     2023.75     2022.04      2021.50

                        CUMULATIVE AREA =  383.80 SQ MI


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

            ***************
            *             *
  79 KK     *    SUB 6    *
            *             *
            ***************
                          RUNOFF FROM SUBBASIN 6

              SUBBASIN RUNOFF DATA

  81 BA         SUBBASIN CHARACTERISTICS
                     TAREA       23.70  SUBBASIN AREA

                PRECIPITATION DATA

  14 PB              STORM        3.88  BASIN TOTAL PRECIPITATION

  15 PI           INCREMENTAL PRECIPITATION PATTERN
                    0.00      0.01      0.01      0.01      0.01      0.01      0.01      0.01      0.01      0.01
                    0.01      0.01      0.01      0.01      0.01      0.01      0.01      0.01      0.02      0.02
                    0.02      0.03      0.05      0.38      0.07      0.04      0.03      0.02      0.02      0.01
                    0.01      0.01      0.01      0.01      0.01      0.01      0.01      0.01      0.01      0.01
                    0.01      0.01      0.01      0.01      0.01      0.01      0.01      0.01

  82 LS         SCS LOSS RATE
                     STRTL        0.47  INITIAL ABSTRACTION
                    CRVNBR       81.00  CURVE NUMBER
                     RTIMP        0.00  PERCENT IMPERVIOUS AREA

  83 UD         SCS DIMENSIONLESS UNITGRAPH
                      TLAG        2.59  LAG

                                                  ***

                                                UNIT HYDROGRAPH
                                            28 END-OF-PERIOD ORDINATES
             335.     1018.     2110.     3323.     3942.     4007.     3656.     3109.     2332.     1683.
            1256.      963.      727.      540.      406.      303.      225.      171.      129.       97.
              73.       55.       42.       33.       25.       17.       10.        3.

     ***            ***            ***            ***            ***
                       HYDROGRAPH AT STATION    SUB 6

      TOTAL RAINFALL =  3.88, TOTAL LOSS =  1.86, TOTAL EXCESS =  2.02

  PEAK FLOW     TIME                          MAXIMUM AVERAGE FLOW
                                    6-HR       24-HR       72-HR     99.50-HR
+  (CFS)       (HR)
```

```
                    (CFS)
+   5325.    14.50              3647.      1287.      429.       311.
                  (INCHES)      1.431      2.020      2.021      2.021
                   (AC-FT)      1809.      2554.      2555.      2555.

                   CUMULATIVE AREA =   23.70 SQ MI


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

          ***************
          *             *
 84 KK    *    SUB 7    *
          *             *
          ***************
                    RUNOFF FROM SUBBASIN 7

            SUBBASIN RUNOFF DATA

 86 BA        SUBBASIN CHARACTERISTICS
                  TAREA       44.70  SUBBASIN AREA

              PRECIPITATION DATA

 14 PB            STORM        3.88  BASIN TOTAL PRECIPITATION

 15 PI          INCREMENTAL PRECIPITATION PATTERN
                 0.00    0.01    0.01    0.01    0.01    0.01    0.01    0.01    0.01    0.01
                 0.01    0.01    0.01    0.01    0.01    0.01    0.01    0.01    0.02    0.02
                 0.02    0.03    0.05    0.38    0.07    0.04    0.03    0.02    0.02    0.01
                 0.01    0.01    0.01    0.01    0.01    0.01    0.01    0.01    0.01    0.01
                 0.01    0.01    0.01    0.01    0.01    0.01    0.01    0.01

 87 LS        SCS LOSS RATE
                  STRTL        0.53  INITIAL ABSTRACTION
                 CRVNBR       79.00  CURVE NUMBER
                  RTIMP        0.00  PERCENT IMPERVIOUS AREA

 88 UD        SCS DIMENSIONLESS UNITGRAPH
                  TLAG        4.01  LAG

                                          ***

                                     UNIT HYDROGRAPH
                                 42 END-OF-PERIOD ORDINATES
          214.     665.    1279.    2134.    3217.    4178.    4777.    5036.    5038.    4792.
         4389.    3909.    3288.    2618.    2116.    1739.    1431.    1210.    1003.     825.
          679.     560.     466.     381.     315.     259.     214.     179.     146.     122.
          101.      83.      69.      57.      49.      42.      35.      28.      21.      15.
           10.       4.

    ***          ***          ***          ***          ***
                   HYDROGRAPH AT STATION    SUB 7

     TOTAL RAINFALL =  3.88, TOTAL LOSS =  2.01, TOTAL EXCESS =  1.87
```

```
 PEAK FLOW     TIME                        MAXIMUM AVERAGE FLOW
                                    6-HR       24-HR       72-HR     99.50-HR
   (CFS)       (HR)
                          (CFS)
+   6689.     16.50                5465.       2238.        748.        541.
                        (INCHES)   1.137       1.862       1.867       1.867
                         (AC-FT)   2710.       4439.       4450.       4450.

                        CUMULATIVE AREA =   44.70 SQ MI


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

          ***************
          *             *
  89 KK   *         4   *      COMBINE 1-5 WITH 6 AND 7
          *             *
          ***************
                          ADD THREE HYDROGRAPHS

  91 HC         HYDROGRAPH COMBINATION
                      ICOMP          3  NUMBER OF HYDROGRAPHS TO COMBINE

                                                          ***

     ***            ***            ***            ***            ***
                        HYDROGRAPH AT STATION        4

 PEAK FLOW     TIME                        MAXIMUM AVERAGE FLOW
                                    6-HR       24-HR       72-HR     99.50-HR
+  (CFS)       (HR)
                          (CFS)
+  27317.     16.00                23264.      18448.       7858.       5709.
                        (INCHES)   0.478       1.517       1.939       1.946
                         (AC-FT)   11536.      36590.      46759.      46943.

                        CUMULATIVE AREA =  452.20 SQ MI


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

          ***************
          *             *
  92 KK   *         4   *      ROUTE HYDROGRAPH 1-7 THROUGH REACH 4
          *             *
          ***************

            HYDROGRAPH ROUTING DATA

  93 RL         ROUTING LOSSES
                      QLOSS        0.00  INITIAL LOSS
                      CLOSS        0.00  ADDITIONAL FRACTION LOST

  94 RS         STORAGE ROUTING
                      NSTPS          10  NUMBER OF SUBREACHES
```

ITYP FLOW TYPE OF INITIAL CONDITION
RSVRIC -1.00 INITIAL CONDITION
X 0.00 WORKING R AND D COEFFICIENT

95 RC NORMAL DEPTH CHANNEL ROUTING

ANL	0.050	LEFT OVERBANK N-VALUE
ANCH	0.040	MAIN CHANNEL N-VALUE
ANR	0.055	RIGHT OVERBANK N-VALUE
RLNTH	38541.	REACH LENGTH
SEL	0.0023	ENERGY SLOPE
ELMAX	0.0	MAX. ELEV. FOR STORAGE/OUTFLOW CALCULATION

CROSS-SECTION DATA

		--- LEFT OVERBANK --- +		------ MAIN CHANNEL			------- + --- RIGHT OVERBANK ---		
97 RY	ELEVATION	1946.00	1944.00	1942.00	1940.00	1940.00	1942.00	1944.00	1946.00
96 RX	DISTANCE	0.00	200.00	500.00	800.00	1500.00	1700.00	1900.00	2100.00

***

COMPUTED STORAGE-OUTFLOW-ELEVATION DATA

STORAGE	0.00	206.61	435.28	686.01	958.80	1253.64	1570.55	1909.51	2270.53	2653.60
OUTFLOW	0.00	186.86	606.63	1220.96	2021.18	3006.15	4178.09	5679.08	7458.64	9454.66
ELEVATION	1940.00	1940.32	1940.63	1940.95	1941.26	1941.58	1941.89	1942.21	1942.53	1942.84
STORAGE	3058.74	3485.93	3935.19	4406.25	4895.94	5403.28	5928.27	6470.90	7031.18	7609.10
OUTFLOW	11670.34	14108.74	16773.07	19671.49	22809.45	26177.34	29776.47	33608.45	37675.14	41978.54
ELEVATION	1943.16	1943.47	1943.79	1944.11	1944.42	1944.74	1945.05	1945.37	1945.68	1946.00

*** WARNING *** MODIFIED PULS ROUTING MAY BE NUMERICALLY UNSTABLE FOR OUTFLOWS BETWEEN 5679. TO 41979.
THE ROUTED HYDROGRAPH SHOULD BE EXAMINED FOR OSCILLATIONS OR OUTFLOWS GREATER THAN PEAK INFLOWS.
THIS CAN BE CORRECTED BY DECREASING THE TIME INTERVAL OR INCREASING STORAGE (USE A LONGER REACH.)

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

HYDROGRAPH AT STATION 4

PEAK FLOW	TIME		MAXIMUM AVERAGE FLOW			
			6-HR	24-HR	72-HR	99.50-HR
+ (CFS)	(HR)					
		(CFS)				
+ 26730.	18.00		22948.	18262.	7832.	5693.
		(INCHES)	0.472	1.502	1.932	1.941
		(AC-FT)	11379.	36221.	46601.	46814.

PEAK STORAGE	TIME		MAXIMUM AVERAGE STORAGE			
			6-HR	24-HR	72-HR	99.50-HR
+ (AC-FT)	(HR)					
548.	18.00		491.	416.	207.	152.

PEAK STAGE	TIME		MAXIMUM AVERAGE STAGE			
			6-HR	24-HR	72-HR	99.50-HR
+ (FEET)	(HR)					
1944.79	18.00		1944.43	1943.92	1942.15	1941.60

CUMULATIVE AREA = 452.20 SQ MI

*** ***

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            **************
            *            *
  98 KK     *    SUB 8   *
            *            *
            **************
                     RUNOFF FROM SUBBASIN 8

               SUBBASIN RUNOFF DATA

 100 BA         SUBBASIN CHARACTERISTICS
                      TAREA       31.30  SUBBASIN AREA

                PRECIPITATION DATA

  14 PB               STORM        3.88  BASIN TOTAL PRECIPITATION

  15 PI           INCREMENTAL PRECIPITATION PATTERN
                     0.00      0.01      0.01      0.01      0.01      0.01      0.01      0.01      0.01      0.01
                     0.01      0.01      0.01      0.01      0.01      0.01      0.01      0.01      0.02      0.02
                     0.02      0.03      0.05      0.38      0.07      0.04      0.03      0.02      0.02      0.01
                     0.01      0.01      0.01      0.01      0.01      0.01      0.01      0.01      0.01      0.01
                     0.01      0.01      0.01      0.01      0.01      0.01      0.01      0.01

 101 LS         SCS LOSS RATE
                      STRTL        0.50  INITIAL ABSTRACTION
                     CRVNBR       80.00  CURVE NUMBER
                      RTIMP        0.00  PERCENT IMPERVIOUS AREA

 102 UD         SCS DIMENSIONLESS UNITGRAPH
                       TLAG        2.89  LAG

                                                                           ***

                                                                    UNIT HYDROGRAPH
                                                               31 END-OF-PERIOD ORDINATES
                344.     1022.     2092.     3463.     4458.     4794.     4725.     4230.     3597.     2741.
               2041.     1563.     1225.      955.      724.      566.      438.      336.      256.      198.
                155.      120.       92.       70.       55.       45.       36.       26.       18.       11.
                  3.

       ***              ***               ***               ***               ***
                          HYDROGRAPH AT STATION    SUB 8

       TOTAL RAINFALL =  3.88, TOTAL LOSS =  1.94, TOTAL EXCESS =  1.94

  PEAK FLOW     TIME                            MAXIMUM AVERAGE FLOW
                                       6-HR         24-HR        72-HR     99.50-HR
+   (CFS)        (HR)
                           (CFS)
+    6274.      15.00                  4494.         1634.         545.         394.
                         (INCHES)      1.335         1.942        1.943        1.943
                          (AC-FT)      2228.         3241.        3243.        3243.

                         CUMULATIVE AREA =    31.30 SQ MI
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103 KK     SUBBA

                    RUNOFF FROM SUBBASIN BA

          SUBBASIN RUNOFF DATA

105 BA       SUBBASIN CHARACTERISTICS
                 TAREA       16.20  SUBBASIN AREA

             PRECIPITATION DATA

 14 PB           STORM        3.88  BASIN TOTAL PRECIPITATION

 15 PI         INCREMENTAL PRECIPITATION PATTERN
                0.00    0.01    0.01    0.01    0.01    0.01    0.01    0.01    0.01    0.01
                0.01    0.01    0.01    0.01    0.01    0.01    0.01    0.01    0.02    0.02
                0.02    0.03    0.05    0.38    0.07    0.04    0.03    0.02    0.02    0.01
                0.01    0.01    0.01    0.01    0.01    0.01    0.01    0.01    0.01    0.01
                0.01    0.01    0.01    0.01    0.01    0.01    0.01    0.01

106 LS       SCS LOSS RATE
                 STRTL        0.50  INITIAL ABSTRACTION
                CRVNBR       80.00  CURVE NUMBER
                 RTIMP        0.00  PERCENT IMPERVIOUS AREA

107 UD       SCS DIMENSIONLESS UNITGRAPH
                 TLAG        2.33  LAG

                                          UNIT HYDROGRAPH
                                     25 END-OF-PERIOD ORDINATES
          290.     896.    1896.    2740.    3025.    2890.    2473.    1880.    1302.     944.
          704.     514.     374.     273.     198.     144.     106.      77.      56.      41.
           31.      24.      17.      11.       5.

                    HYDROGRAPH AT STATION    SUBSA

     TOTAL RAINFALL =  3.88, TOTAL LOSS =  1.94, TOTAL EXCESS =  1.94

 PEAK FLOW     TIME                      MAXIMUM AVERAGE FLOW
                                  6-HR       24-HR       72-HR     99.50-HR
+  (CFS)       (HR)
                        (CFS)
+   3764.     14.50                2457.       846.       282.        204.
                       (INCHES)    1.410      1.943      1.943       1.943
                        (AC-FT)    1218.      1678.      1679.       1679.

                       CUMULATIVE AREA =   16.20 SQ MI
```

```
108 KK      5      COMBINE 1-7 WITH 6 AND 8A

                    ADD THREE HYDROGRAPHS

110 HC        HYDROGRAPH COMBINATION
                 ICOMP          3  NUMBER OF HYDROGRAPHS TO COMBINE

                                                    ***

     ***          ***          ***          ***          ***
                    HYDROGRAPH AT STATION       5

 PEAK FLOW    TIME                      MAXIMUM AVERAGE FLOW
                                 6-HR       24-HR       72-HR     99.50-HR
+  (CFS)      (HR)
                         (CFS)
+  31129.     18.00              26075.      19520.       8641.       6292.
                      (INCHES)    0.485       1.453       1.929       1.941
                       (AC-FT)   12930.      38717.      51417.      51736.

                      CUMULATIVE AREA =  499.70 SQ MI


111 KK     SUB 9

                    RUNOFF FROM SUBBASIN 9

           SUBBASIN RUNOFF DATA

113 BA       SUBBASIN CHARACTERISTICS
                 TAREA       52.20  SUBBASIN AREA

             PRECIPITATION DATA

 14 PB           STORM        3.88  BASIN TOTAL PRECIPITATION

 15 PI         INCREMENTAL PRECIPITATION PATTERN
                 0.00      0.01      0.01      0.01      0.01      0.01      0.01      0.01      0.01      0.01
                 0.01      0.01      0.01      0.01      0.01      0.01      0.01      0.01      0.02      0.02
                 0.02      0.03      0.05      0.38      0.07      0.04      0.03      0.02      0.02      0.01
                 0.01      0.01      0.01      0.01      0.01      0.01      0.01      0.01      0.01      0.01
                 0.01      0.01      0.01      0.01      0.01      0.01      0.01      0.01

114 LS       SCS LOSS RATE
```

```
                STRTL        0.50  INITIAL ABSTRACTION
               CRVNBR       80.00  CURVE NUMBER
                RTIMP        0.00  PERCENT IMPERVIOUS AREA

 115 UD        SCS DIMENSIONLESS UNITGRAPH
                 TLAG        3.02  LAG

                                                  ***

                                             UNIT HYDROGRAPH
                                        32 END-OF-PERIOD ORDINATES
            517.      1519.      3115.      5233.      6871.      7648.      7658.      7046.      6162.      4975.
           3687.      2846.      2206.      1763.      1380.      1062.       826.       649.       505.       391.
            304.       239.       188.       146.       112.        89.        73.        59.        45.        32.
             20.         8.

      ***            ***            ***            ***            ***
                 HYDROGRAPH AT STATION    SUB 9

      TOTAL RAINFALL =  3.88, TOTAL LOSS =  1.94, TOTAL EXCESS =  1.94

  PEAK FLOW     TIME                          MAXIMUM AVERAGE FLOW
                                      6-HR       24-HR       72-HR     99.50-HR
+   (CFS)       (HR)
                              (CFS)
+   10078.     15.00                  7392.       2725.        909.        658.
                            (INCHES)  1.317       1.942       1.943       1.943
                             (AC-FT)  3665.       5405.       5409.       5409.

                          CUMULATIVE AREA =   52.20 SQ MI


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

           **************
           *            *
 116 KK    *         6  *     COMBINE 1-8A WITH 9
           *            *
           **************
                  ADD TWO HYDROGRAPHS

 118 HC        HYDROGRAPH COMBINATION
                ICOMP          2  NUMBER OF HYDROGRAPHS TO COMBINE

                                                  ***

      ***            ***            ***            ***            ***
                 HYDROGRAPH AT STATION         6

  PEAK FLOW     TIME                          MAXIMUM AVERAGE FLOW
                                      6-HR       24-HR       72-HR     99.50-HR
+   (CFS)       (HR)
                              (CFS)
+   36933.     17.50                 30286.      21849.       9548.       6949.
                            (INCHES)  0.510       1.472       1.930       1.941
                             (AC-FT) 15018.      43337.      56815.      57145.
```

CUMULATIVE AREA = 551.90 SQ MI

```
119 KK    ***************
          *             *
          *         5   *     ROUTE HYDROGRAPH 1-9 THROUGH REACH 5
          *             *
          ***************

             HYDROGRAPH ROUTING DATA

120 RL         ROUTING LOSSES
                    QLOSS        0.00  INITIAL LOSS
                    CLOSS        0.00  ADDITIONAL FRACTION LOST

121 RS         STORAGE ROUTING
                    NSTPS           6  NUMBER OF SUBREACHES
                     ITYP        FLOW  TYPE OF INITIAL CONDITION
                   RSVRIC       -1.00  INITIAL CONDITION
                        X        0.00 WORKING R AND D COEFFICIENT

122 RC         NORMAL DEPTH CHANNEL ROUTING
                      ANL       0.055  LEFT OVERBANK N-VALUE
                     ANCH       0.040  MAIN CHANNEL N-VALUE
                      ANR       0.055  RIGHT OVERBANK N-VALUE
                    RLNTH      18229.  REACH LENGTH
                      SEL      0.0033  ENERGY SLOPE
                    ELMAX         0.0  MAX. ELEV. FOR STORAGE/OUTFLOW CALCULATION

                                   CROSS-SECTION DATA
                        --- LEFT OVERBANK --- + ------ MAIN CHANNEL ------- + --- RIGHT OVERBANK ---
124 RY       ELEVATION   1887.00   1885.00   1883.00   1880.00   1880.00   1884.00   1885.00   1888.00
123 RX       DISTANCE       0.00    500.00   1100.00   1150.00   1250.00   1260.00   1460.00   1480.00

                                                  ***

                                       COMPUTED STORAGE-OUTFLOW-ELEVATION DATA
          STORAGE       0.00     18.33     38.08     59.26     81.86    105.88    131.32    158.18    194.51    253.12
          OUTFLOW       0.00     51.31    165.34    330.19    542.25    800.10   1103.32   1452.02   1896.19   2449.66
        ELEVATION    1880.00   1880.42   1880.84   1881.26   1881.68   1882.11   1882.53   1882.95   1883.37   1883.79
          STORAGE     336.01    454.16    609.26    790.31    990.41   1209.55   1447.73   1703.65   1963.69   2224.22
          OUTFLOW    3153.58   4064.32   5240.03   6750.94   8562.14  10683.76  13127.99  16047.79  19538.98  23353.33
        ELEVATION    1884.21   1884.63   1885.05   1885.47   1885.89   1886.32   1886.74   1887.16   1887.58   1888.00

*** WARNING *** MODIFIED PULS ROUTING MAY BE NUMERICALLY UNSTABLE FOR OUTFLOWS BETWEEN      330. TO    23353.
              THE ROUTED HYDROGRAPH SHOULD BE EXAMINED FOR OSCILLATIONS OR OUTFLOWS GREATER THAN PEAK INFLOWS.
              THIS CAN BE CORRECTED BY DECREASING THE TIME INTERVAL OR INCREASING STORAGE (USE A LONGER REACH.)

     ***            ***            ***            ***            ***
                       HYDROGRAPH AT STATION       5

 PEAK FLOW     TIME                          MAXIMUM AVERAGE FLOW
                                   6-HR       24-HR       72-HR     99.50-HR
```

```
+   (CFS)       (HR)
                          (CFS)
+   36672.     18.50                30201.      21784.       9545.       6945.
                        (INCHES)    0.509       1.468       1.930       1.940
                         (AC-FT)   14975.      43208.      56797.      57106.

 PEAK STORAGE   TIME                        MAXIMUM AVERAGE STORAGE
                                     6-HR       24-HR       72-HR     99.50-HR
+  (AC-FT)      (HR)
     522.      18.50                  449.        350.        160.        117.

  PEAK STAGE    TIME                        MAXIMUM AVERAGE STAGE
                                     6-HR       24-HR       72-HR     99.50-HR
+   (FEET)      (HR)
   1889.47     18.50               1888.76     1887.80     1885.02     1883.79

                         CUMULATIVE AREA =  551.90 SQ MI


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

           ***************
           *             *
 125 KK    *    SUB10    *
           *             *
           ***************
                          RUNOFF FROM SUBBASIN 10

              SUBBASIN RUNOFF DATA

 127 BA          SUBBASIN CHARACTERISTICS
                      TAREA       17.00  SUBBASIN AREA

                 PRECIPITATION DATA

  14 PB               STORM        3.88  BASIN TOTAL PRECIPITATION

  15 PI            INCREMENTAL PRECIPITATION PATTERN
                     0.00      0.01      0.01      0.01      0.01      0.01      0.01      0.01      0.01      0.01
                     0.01      0.01      0.01      0.01      0.01      0.01      0.01      0.01      0.02      0.02
                     0.02      0.03      0.05      0.38      0.07      0.04      0.03      0.02      0.02      0.01
                     0.01      0.01      0.01      0.01      0.01      0.01      0.01      0.01      0.01      0.01
                     0.01      0.01      0.01      0.01      0.01      0.01      0.01      0.01

 128 LS          SCS LOSS RATE
                      STRTL        0.53  INITIAL ABSTRACTION
                     CRVNBR       79.00  CURVE NUMBER
                      RTIMP        0.00  PERCENT IMPERVIOUS AREA

 129 UD          SCS DIMENSIONLESS UNITGRAPH
                       TLAG        2.50  LAG

                                         ***

                                    UNIT HYDROGRAPH
                              27 END-OF-PERIOD ORDINATES
```

```
          260.     795.    1660.    2537.    2957.    2957.    2624.    2165.    1563.    1131.
          836.     638.     471.     352.     262.     194.     144.     107.      80.      59.
           44.      33.      26.      20.      14.       8.       3.

   ***          ***          ***          ***          ***
                  HYDROGRAPH AT STATION    SUB10

     TOTAL RAINFALL =  3.88, TOTAL LOSS =  2.01, TOTAL EXCESS =  1.87

 PEAK FLOW    TIME                        MAXIMUM AVERAGE FLOW
                                   6-HR       24-HR       72-HR     99.50-HR
+  (CFS)      (HR)
                        (CFS)
+   3610.    14.50                2426.        853.        284.        206.
                      (INCHES)    1.327       1.866       1.867       1.867
                       (AC-FT)    1203.       1692.       1692.       1692.

                      CUMULATIVE AREA =   17.00 SQ MI


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

          ***************
          *             *
 130 KK   *    SUB11    *
          *             *
          ***************
                     RUNOFF FROM SUBBASIN 11

            SUBBASIN RUNOFF DATA

 132 BA       SUBBASIN CHARACTERISTICS
                   TAREA       20.20  SUBBASIN AREA

              PRECIPITATION DATA

  14 PB            STORM        3.88  BASIN TOTAL PRECIPITATION

  15 PI          INCREMENTAL PRECIPITATION PATTERN
                  0.00     0.01     0.01     0.01     0.01     0.01     0.01     0.01     0.01     0.01
                  0.01     0.01     0.01     0.01     0.01     0.01     0.01     0.01     0.02     0.02
                  0.02     0.03     0.05     0.38     0.07     0.04     0.03     0.02     0.02     0.01
                  0.01     0.01     0.01     0.01     0.01     0.01     0.01     0.01     0.01     0.01
                  0.01     0.01     0.01     0.01     0.01     0.01     0.01     0.01

 133 LS       SCS LOSS RATE
                   STRTL        0.56  INITIAL ABSTRACTION
                  CRVNBR       78.00  CURVE NUMBER
                   RTIMP        0.00  PERCENT IMPERVIOUS AREA

 134 UD       SCS DIMENSIONLESS UNITGRAPH
                    TLAG        3.04  LAG

                                   ***

                              UNIT HYDROGRAPH
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```
                                        32 END-OF-PERIOD ORDINATES
      197.     578.    1185.    1995.    2627.    2939.    2947.    2725.    2390.    1946.
     1448.    1114.     866.     692.     543.     417.     327.     257.     200.     154.
      121.      95.      75.      58.      45.      36.      29.      24.      18.      13.
        9.       4.

   ***          ***          ***          ***          ***
                  HYDROGRAPH AT STATION    SUB11

    TOTAL RAINFALL =  3.88, TOTAL LOSS =  2.09, TOTAL EXCESS =  1.79

 PEAK FLOW    TIME                      MAXIMUM AVERAGE FLOW
                                 6-HR       24-HR       72-HR     99.50-HR
+  (CFS)      (HR)
                        (CFS)
+   3531.    15.00              2614.        973.        324.        235.
                      (INCHES)   1.203       1.791       1.792       1.792
                      (AC-FT)    1296.       1929.       1930.       1930.

                      CUMULATIVE AREA =   20.20 SQ MI


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

          ***************
          *             *
 135 KK   *         7   *      COMBINE 1-9 WITH 10 AND 11
          *             *
          ***************
                         ADD THREE HYDROGRAPHS

 137 HC         HYDROGRAPH COMBINATION
                     ICOMP          3  NUMBER OF HYDROGRAPHS TO COMBINE

                                                          ***

   ***          ***          ***          ***          ***
                  HYDROGRAPH AT STATION       7

 PEAK FLOW    TIME                      MAXIMUM AVERAGE FLOW
                                 6-HR       24-HR       72-HR     99.50-HR
+  (CFS)      (HR)
                        (CFS)
+  39628.    18.50             32637.      23239.      10150.       7385.
                      (INCHES)   0.515       1.467       1.922       1.933
                      (AC-FT)   16183.      46093.      60394.      60729.

                      CUMULATIVE AREA =  589.10 SQ MI


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

          ***************
          *             *
 138 KK   *         6   *      ROUTE HYDROGRAPH 1-11 THROUGH REACH 6
```

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

            HYDROGRAPH ROUTING DATA

 139 RL       ROUTING LOSSES
                   QLOSS        0.00  INITIAL LOSS
                   CLOSS        0.00  ADDITIONAL FRACTION LOST

 140 RS       STORAGE ROUTING
                   NSTPS           6  NUMBER OF SUBREACHES
                    ITYP        FLOW  TYPE OF INITIAL CONDITION
                  RSVRIC       -1.00  INITIAL CONDITION
                       X        0.00 WORKING R AND D COEFFICIENT

 141 RC       NORMAL DEPTH CHANNEL ROUTING
                     ANL       0.050  LEFT OVERBANK N-VALUE
                    ANCH       0.035  MAIN CHANNEL N-VALUE
                     ANR       0.050  RIGHT OVERBANK N-VALUE
                   RLNTH      26042.  REACH LENGTH
                     SEL      0.0029  ENERGY SLOPE
                   ELMAX         0.0  MAX. ELEV. FOR STORAGE/OUTFLOW CALCULATION

                                        CROSS-SECTION DATA
                          --- LEFT OVERBANK --- + ------ MAIN CHANNEL ------- + --- RIGHT OVERBANK ---
 143 RY       ELEVATION   1827.00   1823.00   1822.00   1820.00   1820.00   1821.00   1823.00   1824.00
 142 RX       DISTANCE       0.00    300.00    700.00    900.00   1400.00   1700.00   2100.00   2600.00

                                                          ***

                                        COMPUTED STORAGE-OUTFLOW-ELEVATION DATA
          STORAGE       0.00    126.36    285.18    476.12    693.48    935.18   1205.21   1521.68   1886.85   2299.95
          OUTFLOW       0.00    229.74    778.11   1666.20   2959.85   4584.49   6623.62   9108.09  12024.19  15361.07
        ELEVATION    1820.00   1820.37   1820.74   1821.11   1821.47   1821.84   1822.21   1822.58   1822.95   1823.32
          STORAGE    2759.74   3265.77   3792.80   4325.91   4865.11   5410.39   5961.76   6519.21   7082.75   7652.38
          OUTFLOW   19217.51  23645.77  28820.25  34495.46  40652.78  47277.80  54358.92  61886.63  69852.98  78251.25
        ELEVATION    1823.68   1824.05   1824.42   1824.79   1825.16   1825.53   1825.89   1826.26   1826.63   1827.00

*** WARNING *** MODIFIED PULS ROUTING MAY BE NUMERICALLY UNSTABLE FOR OUTFLOWS BETWEEN    12024. TO    78251.
               THE ROUTED HYDROGRAPH SHOULD BE EXAMINED FOR OSCILLATIONS OR OUTFLOWS GREATER THAN PEAK INFLOWS.
               THIS CAN BE CORRECTED BY DECREASING THE TIME INTERVAL OR INCREASING STORAGE (USE A LONGER REACH.)

     ***            ***            ***            ***            ***
                       HYDROGRAPH AT STATION       6

 PEAK FLOW     TIME                          MAXIMUM AVERAGE FLOW
                                        6-HR       24-HR       72-HR     99.50-HR
+   (CFS)      (HR)
                          (CFS)
+   38617.     19.50                  32557.      23158.      10133.       7372.
                       (INCHES)       0.514       1.462       1.919       1.929
                        (AC-FT)      16144.      45932.      60297.      60621.

 PEAK STORAGE  TIME                          MAXIMUM AVERAGE STORAGE
                                        6-HR       24-HR       72-HR     99.50-HR
+  (AC-FT)     (HR)
     781.     19.50                    689.        527.        257.        189.
```

```
PEAK STAGE    TIME                        MAXIMUM AVERAGE STAGE
                                   6-HR       24-HR      72-HR     99.50-HR
+  (FEET)     (HR)
  1825.04     19.50              1824.66    1823.95    1822.28    1821.70

                      CUMULATIVE AREA =  589.10 SQ MI


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

          ***************
          *             *
144 KK    *    SUB12    *
          *             *
          ***************
                    RUNOFF FROM SUBBASIN 12

            SUBBASIN RUNOFF DATA

146 BA        SUBBASIN CHARACTERISTICS
                   TAREA       10.60  SUBBASIN AREA

              PRECIPITATION DATA

 14 PB             STORM        3.88  BASIN TOTAL PRECIPITATION

 15 PI          INCREMENTAL PRECIPITATION PATTERN
                  0.00      0.01      0.01      0.01      0.01      0.01      0.01      0.01      0.01      0.01
                  0.01      0.01      0.01      0.01      0.01      0.01      0.01      0.01      0.02      0.02
                  0.02      0.03      0.05      0.38      0.07      0.04      0.03      0.02      0.02      0.01
                  0.01      0.01      0.01      0.01      0.01      0.01      0.01      0.01      0.01      0.01
                  0.01      0.01      0.01      0.01      0.01      0.01      0.01      0.01

147 LS        SCS LOSS RATE
                   STRTL        0.53  INITIAL ABSTRACTION
                  CRVNBR       79.00  CURVE NUMBER
                   RTIMP        0.00  PERCENT IMPERVIOUS AREA

148 UD        SCS DIMENSIONLESS UNITGRAPH
                    TLAG        1.98  LAG

                                                  ***

                                              UNIT HYDROGRAPH
                                         22 END-OF-PERIOD ORDINATES
            279.      889.     1781.     2267.     2242.     1890.     1369.      905.      627.      446.
            307.      214.      148.      102.       71.       49.       34.       24.       18.       12.
              7.        2.

     ***            ***            ***            ***            ***
                     HYDROGRAPH AT STATION    SUB12

      TOTAL RAINFALL =  3.88, TOTAL LOSS =  2.01, TOTAL EXCESS =  1.87

PEAK FLOW     TIME                        MAXIMUM AVERAGE FLOW
```

```
                SUBBASIN RUNOFF DATA

371 BA            SUBBASIN CHARACTERISTICS
                       TAREA      101.30  SUBBASIN AREA

                  PRECIPITATION DATA

372 PB                 STORM       3.93  BASIN TOTAL PRECIPITATION

373 PI              INCREMENTAL PRECIPITATION PATTERN
                      0.00      0.01      0.01      0.01      0.01      0.01      0.01      0.01      0.01      0.01
                      0.01      0.01      0.01      0.01      0.01      0.01      0.01      0.01      0.02      0.02
                      0.02      0.03      0.05      0.38      0.07      0.04      0.03      0.02      0.02      0.01
                      0.01      0.01      0.01      0.01      0.01      0.01      0.01      0.01      0.01      0.01
                      0.01      0.01      0.01      0.01      0.01      0.01      0.01      0.01

383 LS            SCS LOSS RATE
                       STRTL       0.41  INITIAL ABSTRACTION
                      CRVNBR      83.00  CURVE NUMBER
                       RTIMP       0.00  PERCENT IMPERVIOUS AREA

384 UD            SCS DIMENSIONLESS UNITGRAPH
                        TLAG       4.85  LAG

                                                    ***

                                                UNIT HYDROGRAPH
                                            50 END-OF-PERIOD ORDINATES
              282.      933.     1773.     2885.     4361.     6120.     7660.     8761.     9401.     9580.
             9523.     9062.     8426.     7698.     6809.     5736.     4735.     3981.     3382.     2876.
             2481.     2138.     1829.     1546.     1313.     1125.      959.      818.      694.      590.
              500.      429.      365.      314.      266.      229.      194.      165.      139.      121.
              103.       92.       81.       69.       58.       47.       38.       28.       19.        9.

      ***           ***           ***           ***           ***
                       HYDROGRAPH AT STATION    SUB29

      TOTAL RAINFALL =  3.93, TOTAL LOSS =  1.70, TOTAL EXCESS =  2.23

  PEAK FLOW     TIME                        MAXIMUM AVERAGE FLOW
                                     6-HR       24-HR       72-HR     99.50-HR
+   (CFS)       (HR)
                          (CFS)
+   15962.     17.00               13675.       6022.       2021.       1462.
                         (INCHES)   1.255       2.211       2.226       2.226
                          (AC-FT)   6781.      11945.      12024.      12024.

                         CUMULATIVE AREA =  101.30 SQ MI


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

            ***************
            *             *
385 KK      *         4   *      ROUTE (HARQUAHALA F.R.S.)
            *             *
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****
ROUTE HYDROGRAPH 29 THROUGH DETENTION STRUCTURE

HYDROGRAPH ROUTING DATA

```
337 RL      ROUTING LOSSES
                QLOSS        0.00  INITIAL LOSS
                CLOSS        0.00  ADDITIONAL FRACTION LOST

387 RS      STORAGE ROUTING
                NSTPS           1  NUMBER OF SUBREACHES
                 ITYP        ELEV  TYPE OF INITIAL CONDITION
               RSVRIC     1393.00  INITIAL CONDITION
                    X        0.00  WORKING R AND D COEFFICIENT
```

388 SV	STORAGE	0.0	1000.0	1500.0	2300.0	3500.0	5000.0	7000.0	8500.0	12000.0	14200.0
389 SE	ELEVATION	1393.00	1395.00	1397.00	1399.00	1401.00	1403.00	1405.00	1407.00	1409.00	1411.00
390 SQ	DISCHARGE	0.	121.	172.	210.	243.	272.	298.	322.	344.	1214.

***

*** *** *** *** ***
HYDROGRAPH AT STATION 4

PEAK FLOW	TIME		MAXIMUM AVERAGE FLOW			
			6-HR	24-HR	72-HR	99.50-HR
+ (CFS)	(HR)					
		(CFS)				
+ 340.	35.00		340.	339.	336.	281.
		(INCHES)	0.031	0.125	0.370	0.428
		(AC-FT)	169.	673.	1998.	2315.

PEAK STORAGE	TIME		MAXIMUM AVERAGE STORAGE			
			6-HR	24-HR	72-HR	99.50-HR
+ (AC-FT)	(HR)					
11424.	35.00		11409.	11259.	10689.	8646.

PEAK STAGE	TIME		MAXIMUM AVERAGE STAGE			
			6-HR	24-HR	72-HR	99.50-HR
+ (FEET)	(HR)					
1408.67	35.00		1408.66	1408.58	1408.25	1405.57

CUMULATIVE AREA = 101.30 SQ MI

*** ***

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          **************
          *            *
391 KK    *       15   *    ROUTE HYDROGRAPH 29 THROUGH REACH 18
          *            *
```

****

HYDROGRAPH ROUTING DATA

392 RL ROUTING LOSSES

QLOSS	0.00	INITIAL LOSS
CLOSS	0.00	ADDITIONAL FRACTION LOST

393 RS STORAGE ROUTING

NSTPS	6	NUMBER OF SUBREACHES
ITYP	FLOW	TYPE OF INITIAL CONDITION
RSVRIC	-1.00	INITIAL CONDITION
X	0.00	WORKING R AND D COEFFICIENT

394 RC NORMAL DEPTH CHANNEL ROUTING

ANL	0.040	LEFT OVERBANK N-VALUE
ANCH	0.028	MAIN CHANNEL N-VALUE
ANR	0.040	RIGHT OVERBANK N-VALUE
RLNTH	31771.	REACH LENGTH
SEL	0.0041	ENERGY SLOPE
ELMAX	0.0	MAX. ELEV. FOR STORAGE/OUTFLOW CALCULATION

CROSS-SECTION DATA

		--- LEFT OVERBANK ---		+ ------ MAIN CHANNEL		------- +		--- RIGHT OVERBANK ---	
396 RY	ELEVATION	1205.50	1205.50	1203.50	1203.50	1200.00	1200.00	1203.50	1205.00
395 RX	DISTANCE	0.00	10.00	14.00	24.00	36.00	71.00	83.00	183.00

***

COMPUTED STORAGE-OUTFLOW-ELEVATION DATA

STORAGE	0.00	7.60	15.62	24.05	32.91	42.19	51.88	61.99	72.53	83.48
OUTFLOW	0.00	15.26	48.95	97.21	158.66	232.57	318.50	416.19	525.49	646.33
ELEVATION	1200.00	1200.29	1200.58	1200.87	1201.16	1201.45	1201.74	1202.03	1202.32	1202.61
STORAGE	94.85	106.64	118.85	134.96	155.44	180.12	208.99	242.06	278.26	314.72
OUTFLOW	778.66	922.51	1077.91	1119.80	1328.10	1568.37	1841.09	2148.64	2515.77	2926.57
ELEVATION	1202.89	1203.18	1203.47	1203.76	1204.05	1204.34	1204.63	1204.92	1205.21	1205.50

*** WARNING *** MODIFIED PULS ROUTING MAY BE NUMERICALLY UNSTABLE FOR OUTFLOWS BETWEEN 233. TO 2927.
THE ROUTED HYDROGRAPH SHOULD BE EXAMINED FOR OSCILLATIONS OR OUTFLOWS GREATER THAN PEAK INFLOWS.
THIS CAN BE CORRECTED BY DECREASING THE TIME INTERVAL OR INCREASING STORAGE (USE A LONGER REACH.)

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

HYDROGRAPH AT STATION 15

PEAK FLOW	TIME		MAXIMUM AVERAGE FLOW			
			6-HR	24-HR	72-HR	99.50-HR
+ (CFS)	(HR)					
		(CFS)				
+ 340.	36.00		340.	339.	336.	275.
		(INCHES)	0.031	0.125	0.370	0.419
		(AC-FT)	169.	673.	1998.	2262.

PEAK STORAGE	TIME	MAXIMUM AVERAGE STORAGE			
		6-HR	24-HR	72-HR	99.50-HR
+ (AC-FT)	(HR)				
9.	35.50	9.	9.	9.	7.

PEAK STAGE (FEET)	TIME (HR)	MAXIMUM AVERAGE STAGE 6-HR	24-HR	72-HR	99.50-HR
1201.80	36.00	1201.80	1201.80	1201.79	1201.48

CUMULATIVE AREA = 101.30 SQ MI

397 KK

SUB30

RUNOFF FROM SUBBASIN 30

SUBBASIN RUNOFF DATA

399 BA SUBBASIN CHARACTERISTICS

TAREA 28.60 SUBBASIN AREA

PRECIPITATION DATA

372 PB STORM 3.93 BASIN TOTAL PRECIPITATION

373 PI INCREMENTAL PRECIPITATION PATTERN

0.00	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01
0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.02	0.02
0.02	0.03	0.05	0.38	0.07	0.04	0.03	0.02	0.02	0.01
0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01
0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01		

400 LS SCS LOSS RATE

STRTL 0.56 INITIAL ABSTRACTION

CRVNBR 78.00 CURVE NUMBER

RTIMP 0.00 PERCENT IMPERVIOUS AREA

401 UD SCS DIMENSIONLESS UNITGRAPH

TLAG 4.75 LAG

UNIT HYDROGRAPH

50 END-OF-PERIOD ORDINATES

83.	276.	525.	857.	1299.	1824.	2266.	2570.	2735.	2763.
2735.	2570.	2376.	2155.	1879.	1547.	1271.	1078.	912.	774.
673.	572.	489.	406.	351.	296.	254.	213.	182.	152.
131.	111.	95.	80.	69.	58.	50.	41.	36.	30.
27.	24.	20.	17.	14.	11.	8.	6.	3.	0.

HYDROGRAPH AT STATION SUB30

TOTAL RAINFALL = 3.93, TOTAL LOSS = 2.10, TOTAL EXCESS = 1.83

```
PEAK FLOW     TIME                          MAXIMUM AVERAGE FLOW
                                     6-HR       24-HR       72-HR     99.50-HR
  (CFS)       (HR)
                          (CFS)
+   3710.     17.00                  3166.       1401.        469.        340.
                        (INCHES)     1.029       1.822       1.831       1.831
                         (AC-FT)     1570.       2779.       2793.       2793.

                        CUMULATIVE AREA =   28.60 SQ MI
```

```
402 KK     ***************
           *             *
           *         5   *      ROUTE (SADDLEBACK F.R.S.)
           *             *
           ***************
                          ROUTE HYDROGRAPH 30 THROUGH DETENTION STRUCTURE

              HYDROGRAPH ROUTING DATA

392 RL          ROUTING LOSSES
                     QLOSS        0.00  INITIAL LOSS
                     CLOSS        0.00  ADDITIONAL FRACTION LOST

404 RS          STORAGE ROUTING
                     NSTPS           1  NUMBER OF SUBREACHES
                      ITYP        ELEV  TYPE OF INITIAL CONDITION
                     RSVRIC     1179.00  INITIAL CONDITION
                         X        0.00 WORKING R AND D COEFFICIENT

405 SV            STORAGE        0.0     200.0     400.0    1000.0    1750.0    3000.0    4500.0    6800.0    9300.0   10500.0

406 SE          ELEVATION     1179.00   1181.00   1183.00   1185.00   1187.00   1189.00   1191.00   1193.00   1195.00   1197.00

407 SQ          DISCHARGE         0.      100.      240.      440.      670.      830.     1030.     1200.     1310.     1450.

                                                                   ***

     ***            ***            ***            ***            ***
                       HYDROGRAPH AT STATION        5

PEAK FLOW     TIME                          MAXIMUM AVERAGE FLOW
                                     6-HR       24-HR       72-HR     99.50-HR
+  (CFS)      (HR)
                          (CFS)
+    700.     28.00                   698.        653.        431.        324.
                        (INCHES)     0.227       0.849       1.680       1.746
                         (AC-FT)      346.       1295.       2563.       2663.

PEAK STORAGE  TIME                          MAXIMUM AVERAGE STORAGE
                                     6-HR       24-HR       72-HR     99.50-HR
```

+ (AC-FT)	(HR)				
1987.	28.00	1968.	1743.	1030.	769.

PEAK STAGE	TIME	MAXIMUM AVERAGE STAGE			
		6-HR	24-HR	72-HR	99.50-HR
+ (FEET)	(HR)				
1187.38	28.00	1187.35	1186.89	1184.76	1183.41

CUMULATIVE AREA = 28.60 SQ MI

*** ***

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          **************
          *            *
408 KK    *        16  *    ROUTE HYDROGRAPH 30 THROUGH REACH 19
          *            *
          **************
```

HYDROGRAPH ROUTING DATA

409 RL ROUTING LOSSES

QLOSS	0.00	INITIAL LOSS
CLOSS	0.00	ADDITIONAL FRACTION LOST

410 RS STORAGE ROUTING

NSTPS	12	NUMBER OF SUBREACHES
ITYP	FLOW	TYPE OF INITIAL CONDITION
RSVRIC	-1.00	INITIAL CONDITION
X	0.00	WORKING R AND D COEFFICIENT

411 RC NORMAL DEPTH CHANNEL ROUTING

ANL	0.040	LEFT OVERBANK N-VALUE
ANCH	0.030	MAIN CHANNEL N-VALUE
ANR	0.040	RIGHT OVERBANK N-VALUE
RLNTH	43229.	REACH LENGTH
SEL	0.0038	ENERGY SLOPE
ELMAX	0.0	MAX. ELEV. FOR STORAGE/OUTFLOW CALCULATION

CROSS-SECTION DATA

		--- LEFT OVERBANK --- +		------ MAIN CHANNEL ------- +			--- RIGHT OVERBANK ---		
413 RY	ELEVATION	1149.50	1149.50	1146.00	1146.00	1143.00	1143.00	1146.00	1147.00
412 RX	DISTANCE	0.00	10.00	24.00	64.00	73.00	205.00	220.00	270.00

***

COMPUTED STORAGE-OUTFLOW-ELEVATION DATA

STORAGE	0.00	45.28	91.49	138.63	186.69	235.69	285.61	336.47	388.25	444.24
OUTFLOW	0.00	67.90	216.45	427.17	692.77	1008.94	1372.76	1782.10	2235.35	2346.87
ELEVATION	1143.00	1143.34	1143.68	1144.03	1144.37	1144.71	1145.05	1145.39	1145.74	1146.08
STORAGE	515.37	592.77	676.16	761.41	847.13	933.31	1019.95	1107.06	1194.64	1282.68
OUTFLOW	2938.74	3606.89	4354.90	5188.90	6088.56	7051.61	8076.16	9160.64	10303.70	11504.13
ELEVATION	1146.42	1146.76	1147.11	1147.45	1147.79	1148.13	1148.47	1148.82	1149.16	1149.50

*** WARNING *** MODIFIED PULS ROUTING MAY BE NUMERICALLY UNSTABLE FOR OUTFLOWS BETWEEN 216. TO 11504.
THE ROUTED HYDROGRAPH SHOULD BE EXAMINED FOR OSCILLATIONS OR OUTFLOWS GREATER THAN PEAK INFLOWS.

THIS CAN BE CORRECTED BY DECREASING THE TIME INTERVAL OR INCREASING STORAGE (USE A LONGER REACH.)

HYDROGRAPH AT STATION 16

PEAK FLOW	TIME		MAXIMUM AVERAGE FLOW			
			6-HR	24-HR	72-HR	99.50-HR
+ (CFS)	(HR)					
		(CFS)				
+ 700.	30.00		698.	653.	428.	318.
		(INCHES)	0.227	0.848	1.671	1.715
		(AC-FT)	346.	1294.	2549.	2617.

PEAK STORAGE	TIME	MAXIMUM AVERAGE STORAGE			
		6-HR	24-HR	72-HR	99.50-HR
+ (AC-FT)	(HR)				
16.	29.50	16.	15.	11.	9.

PEAK STAGE	TIME	MAXIMUM AVERAGE STAGE			
		6-HR	24-HR	72-HR	99.50-HR
+ (FEET)	(HR)				
1144.38	30.00	1144.37	1144.32	1143.99	1143.75

CUMULATIVE AREA = 28.60 SQ MI

414 KK 22 COMBINE 1-31 WITH 29 AND 30

ADD THREE HYDROGRAPHS

416 HC HYDROGRAPH COMBINATION
ICOMP 3 NUMBER OF HYDROGRAPHS TO COMBINE

HYDROGRAPH AT STATION 22

PEAK FLOW	TIME		MAXIMUM AVERAGE FLOW			
			6-HR	24-HR	72-HR	99.50-HR
+ (CFS)	(HR)					
		(CFS)				
+ 58266.	31.50		55439.	41517.	21152.	15832.
		(INCHES)	0.369	1.104	1.688	1.746
		(AC-FT)	27490.	82347.	125861.	130189.

CUMULATIVE AREA = 1398.10 SQ MI

```
                ***************
                *             *
417 KK          *        17   *      ROUTE HYDROGRAPH 1-31 THROUGH REACH 15
                *             *
                ***************

                  HYDROGRAPH ROUTING DATA

418 RL              ROUTING LOSSES
                          QLOSS        0.00  INITIAL LOSS
                          CLOSS        0.00  ADDITIONAL FRACTION LOST

419 RS              STORAGE ROUTING
                          NSTPS           4  NUMBER OF SUBREACHES
                          ITYP         FLOW  TYPE OF INITIAL CONDITION
                         RSVRIC       -1.00  INITIAL CONDITION
                              X        0.00 WORKING R AND D COEFFICIENT

420 RC              NORMAL DEPTH CHANNEL ROUTING
                            ANL       0.055  LEFT OVERBANK N-VALUE
                           ANCH       0.035  MAIN CHANNEL N-VALUE
                            ANR       0.055  RIGHT OVERBANK N-VALUE
                          RLNTH      20633.  REACH LENGTH
                            SEL      0.0030  ENERGY SLOPE
                          ELMAX         0.0  MAX. ELEV. FOR STORAGE/OUTFLOW CALCULATION

                                        CROSS-SECTION DATA
                          --- LEFT OVERBANK --- + ------ MAIN CHANNEL ------- + --- RIGHT OVERBANK ---
422 RY        ELEVATION   1056.00   1050.00   1046.00   1044.00   1044.00   1046.00   1056.00   1056.60
421 RX        DISTANCE       0.00   1800.00   2100.00   2130.00   2700.00   2790.00   3280.00   4300.00

                                                          ***

                                        COMPUTED STORAGE-OUTFLOW-ELEVATION DATA
            STORAGE       0.00    187.09    386.80    599.14    830.61   1088.15   1371.78   1681.49   2017.28   2379.16
            OUTFLOW       0.00    678.47   2182.44   4349.53   7322.15  10963.21  15277.24  20273.53  25963.71  32361.08
          ELEVATION    1044.00   1044.66   1045.33   1045.99   1046.65   1047.32   1047.98   1048.64   1049.31   1049.97
            STORAGE    2788.57   3271.34   3827.51   4457.08   5160.06   5936.44   6786.23   7709.42   8706.02   9892.33
            OUTFLOW   39210.54  47074.23  55987.37  66015.54  77233.25  89715.39 103535.23 118764.00 135470.90 150104.33
          ELEVATION    1050.63   1051.29   1051.96   1052.62   1053.28   1053.95   1054.61   1055.27   1055.94   1056.60

*** WARNING *** MODIFIED PULS ROUTING MAY BE NUMERICALLY UNSTABLE FOR OUTFLOWS BETWEEN     4350. TO   150104.
                THE ROUTED HYDROGRAPH SHOULD BE EXAMINED FOR OSCILLATIONS OR OUTFLOWS GREATER THAN PEAK INFLOWS.
                THIS CAN BE CORRECTED BY DECREASING THE TIME INTERVAL OR INCREASING STORAGE (USE A LONGER REACH.)

     ***            ***            ***            ***            ***
                       HYDROGRAPH AT STATION       17

 PEAK FLOW     TIME                          MAXIMUM AVERAGE FLOW
                                     6-HR       24-HR       72-HR     99.50-HR
+  (CFS)       (HR)
                          (CFS)
+  58088.     32.50                55304.      41499.      21137.       15777.
                        (INCHES)    0.368       1.104       1.687        1.740
                         (AC-FT)   27424.      82313.     125771.      129737.
```

PEAK STORAGE (AC-FT)	TIME (HR)	MAXIMUM AVERAGE STORAGE 6-HR	24-HR	72-HR	99.50-HR
990.	32.50	946.	735.	422.	323.

PEAK STAGE (FEET)	TIME (HR)	MAXIMUM AVERAGE STAGE 6-HR	24-HR	72-HR	99.50-HR
1052.10	32.50	1051.90	1050.76	1048.36	1047.40

CUMULATIVE AREA = 1398.10 SQ MI

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423 KK     ***************
           *             *
           *    SUB32    *
           *             *
           ***************
```

RUNOFF FROM SUBBASIN 32

SUBBASIN RUNOFF DATA

```
425 BA        SUBBASIN CHARACTERISTICS
                   TAREA       52.40  SUBBASIN AREA

              PRECIPITATION DATA

372 PB             STORM        3.93  BASIN TOTAL PRECIPITATION

373 PI          INCREMENTAL PRECIPITATION PATTERN
                  0.00    0.01    0.01    0.01    0.01    0.01    0.01    0.01    0.01    0.01
                  0.01    0.01    0.01    0.01    0.01    0.01    0.01    0.01    0.02    0.02
                  0.02    0.03    0.05    0.38    0.07    0.04    0.03    0.02    0.02    0.01
                  0.01    0.01    0.01    0.01    0.01    0.01    0.01    0.01    0.01    0.01
                  0.01    0.01    0.01    0.01    0.01    0.01    0.01    0.01

426 LS        SCS LOSS RATE
                   STRTL        0.53  INITIAL ABSTRACTION
                  CRVNBR       79.00  CURVE NUMBER
                   RTIMP        0.00  PERCENT IMPERVIOUS AREA

427 UD        SCS DIMENSIONLESS UNITGRAPH
                    TLAG        5.05  LAG
```

***

UNIT HYDROGRAPH
52 END-OF-PERIOD ORDINATES

135.	440.	835.	1352.	2031.	2847.	3617.	4208.	4587.	4754.
4763.	4641.	4358.	4032.	3657.	3197.	2659.	2208.	1890.	1616.
1384.	1207.	1042.	898.	762.	652.	562.	482.	414.	352.
303.	256.	222.	189.	164.	140.	121.	103.	89.	76.
65.	56.	49.	44.	39.	33.	28.	23.	18.	14.
9.	5.								

```
     ***            ***            ***            ***            ***
                      HYDROGRAPH AT STATION    SUB32

      TOTAL RAINFALL =  3.93, TOTAL LOSS =  2.02, TOTAL EXCESS =  1.91

  PEAK FLOW     TIME                        MAXIMUM AVERAGE FLOW
                                        6-HR       24-HR       72-HR     99.50-HR
+   (CFS)       (HR)
                          (CFS)
+    6774.     17.50                  5882.       2668.        896.        648.
                        (INCHES)     1.044       1.893       1.907       1.907
                         (AC-FT)     2917.       5291.       5329.       5329.

                        CUMULATIVE AREA =   52.40 SQ MI


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

            ***************
            *             *
 428 KK     *        23   *      COMBINE 1-31 WITH 32
            *             *
            ***************
                            ADD TWO HYDROGRAPHS

 430 HC          HYDROGRAPH COMBINATION
                       ICOMP          2  NUMBER OF HYDROGRAPHS TO COMBINE

                                                                  ***

     ***            ***            ***            ***            ***
                      HYDROGRAPH AT STATION       23

  PEAK FLOW     TIME                        MAXIMUM AVERAGE FLOW
                                        6-HR       24-HR       72-HR     99.50-HR
+   (CFS)       (HR)
                          (CFS)
+   58488.     32.00                 55763.      42054.      22013.      16425.
                        (INCHES)     0.357       1.078       1.693       1.746
                         (AC-FT)    27651.      83413.     130989.     135066.

                        CUMULATIVE AREA = 1450.50 SQ MI


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

            ***************
            *             *
 431 KK     *        18   *      ROUTE HYDROGRAPH 1-32 THROUGH REACH 16
            *             *
            ***************

               HYDROGRAPH ROUTING DATA
```

```
432 RL          ROUTING LOSSES
                     QLOSS        0.00  INITIAL LOSS
                     CLOSS        0.00  ADDITIONAL FRACTION LOST

433 RS          STORAGE ROUTING
                     NSTPS          14  NUMBER OF SUBREACHES
                      ITYP        FLOW  TYPE OF INITIAL CONDITION
                    RSVRIC       -1.00  INITIAL CONDITION
                         X        0.00 WORKING R AND D COEFFICIENT

434 RC          NORMAL DEPTH CHANNEL ROUTING
                       ANL       0.065  LEFT OVERBANK N-VALUE
                      ANCH       0.040  MAIN CHANNEL N-VALUE
                       ANR       0.055  RIGHT OVERBANK N-VALUE
                     RLNTH      58333.  REACH LENGTH
                       SEL      0.0024  ENERGY SLOPE
                     ELMAX         0.0  MAX. ELEV. FOR STORAGE/OUTFLOW CALCULATION

                                          CROSS-SECTION DATA
                           --- LEFT OVERBANK --- + ------ MAIN CHANNEL ------- + --- RIGHT OVERBANK ---
435 RX        ELEVATION    930.00    928.00    924.00    920.00    920.00    924.00    928.00    930.00
435 RX        DISTANCE       0.00    700.00   1300.00   1400.00   1550.00   1600.00   1800.00   2100.00

                                                          ***

                                          COMPUTED STORAGE-OUTFLOW-ELEVATION DATA
          STORAGE       0.00    112.68    239.26    379.76    534.17    702.49    884.72   1080.87   1295.74   1573.95
          OUTFLOW       0.00     96.16    313.47    633.66   1053.60   1573.89   2196.77   2925.26   3824.26   4956.51
        ELEVATION     920.00    920.53    921.05    921.58    922.11    922.63    923.16    923.68    924.21    924.74
          STORAGE    1926.36   2352.96   2853.74   3428.72   4077.89   4801.25   5634.41   6650.82   7852.71   9240.08
          OUTFLOW    6270.91   7795.27   9553.58  11567.64  13857.81  16443.37  19090.04  22172.76  25793.16  29990.18
        ELEVATION     925.26    925.79    926.32    926.84    927.37    927.89    928.42    928.95    929.47    930.00

*** WARNING *** MODIFIED PULS ROUTING MAY BE NUMERICALLY UNSTABLE FOR OUTFLOWS BETWEEN     2197. TO    16443.
                THE ROUTED HYDROGRAPH SHOULD BE EXAMINED FOR OSCILLATIONS OR OUTFLOWS GREATER THAN PEAK INFLOWS.
                THIS CAN BE CORRECTED BY DECREASING THE TIME INTERVAL OR INCREASING STORAGE (USE A LONGER REACH.)

     ***            ***            ***            ***            ***
                       HYDROGRAPH AT STATION      18

 PEAK FLOW     TIME                          MAXIMUM AVERAGE FLOW
                                     6-HR       24-HR       72-HR     99.50-HR
+  (CFS)       (HR)
                          (CFS)
+  57432.      36.50                54966.      41911.      21986.      16294.
                        (INCHES)    0.352       1.075       1.691       1.732
                         (AC-FT)   27256.      83130.     130826.     133987.

 PEAK STORAGE  TIME                          MAXIMUM AVERAGE STORAGE
                                     6-HR       24-HR       72-HR     99.50-HR
+  (AC-FT)     (HR)
    1308.      36.50                 1250.       941.        486.        361.

 PEAK STAGE    TIME                          MAXIMUM AVERAGE STAGE
                                     6-HR       24-HR       72-HR     99.50-HR
+  (FEET)      (HR)
   933.44      36.50                933.13      931.49      928.29      926.45
```

CUMULATIVE AREA = 1450.50 SQ MI

```
437 KK     SUB33
```

RUNOFF FROM SUBBASIN 33

SUBBASIN RUNOFF DATA

```
439 BA     SUBBASIN CHARACTERISTICS
                TAREA      47.00  SUBBASIN AREA

           PRECIPITATION DATA

372 PB          STORM       3.93  BASIN TOTAL PRECIPITATION

373 PI       INCREMENTAL PRECIPITATION PATTERN
                0.00      0.01      0.01      0.01      0.01      0.01      0.01      0.01      0.01      0.01
                0.01      0.01      0.01      0.01      0.01      0.01      0.01      0.01      0.02      0.02
                0.02      0.03      0.05      0.38      0.07      0.04      0.03      0.02      0.02      0.01
                0.01      0.01      0.01      0.01      0.01      0.01      0.01      0.01      0.01      0.01
                0.01      0.01      0.01      0.01      0.01      0.01      0.01      0.01

440 LS     SCS LOSS RATE
                STRTL       0.50  INITIAL ABSTRACTION
                CRVNBR     80.00  CURVE NUMBER
                RTIMP       0.00  PERCENT IMPERVIOUS AREA

441 UD     SCS DIMENSIONLESS UNITGRAPH
                TLAG        4.00  LAG
```

UNIT HYDROGRAPH
42 END-OF-PERIOD ORDINATES

226.	704.	1354.	2259.	3405.	4414.	5042.	5309.	5309.	5042.
4615.	4103.	3443.	2739.	2215.	1819.	1495.	1266.	1049.	860.
710.	584.	487.	397.	328.	270.	223.	186.	152.	127.
105.	86.	71.	59.	51.	44.	36.	29.	22.	16.
9.	3.								

HYDROGRAPH AT STATION SUB33

TOTAL RAINFALL = 3.93, TOTAL LOSS = 1.95, TOTAL EXCESS = 1.98

PEAK FLOW (CFS)	TIME (HR)	MAXIMUM AVERAGE FLOW 6-HR (CFS)	24-HR	72-HR	99.50-HR
+					

```
+   7521.    16.50                6137.      2501.      836.       605.
                        (INCHES)  1.214      1.979      1.984      1.984
                        (AC-FT)   3043.      4960.      4973.      4973.

                        CUMULATIVE AREA =   47.00 SQ MI


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

            ***************
            *             *
441 KK      *    SUB34    *
            *             *
            ***************
                        RUNOFF FROM SUBBASIN 34

              SUBBASIN RUNOFF DATA

444 BA          SUBBASIN CHARACTERISTICS
                     TAREA       64.30  SUBBASIN AREA

                PRECIPITATION DATA

372 PB               STORM        3.93  BASIN TOTAL PRECIPITATION

373 PI            INCREMENTAL PRECIPITATION PATTERN
                    0.00      0.01      0.01      0.01      0.01      0.01      0.01      0.01      0.01      0.01
                    0.01      0.01      0.01      0.01      0.01      0.01      0.01      0.01      0.02      0.02
                    0.02      0.03      0.05      0.38      0.07      0.04      0.03      0.02      0.02      0.01
                    0.01      0.01      0.01      0.01      0.01      0.01      0.01      0.01      0.01      0.01
                    0.01      0.01      0.01      0.01      0.01      0.01      0.01      0.01

445 LS          SCS LOSS RATE
                     STRTL        0.47  INITIAL ABSTRACTION
                    CRVNBR       81.00  CURVE NUMBER
                     RTIMP        0.00  PERCENT IMPERVIOUS AREA

446 UD          SCS DIMENSIONLESS UNITGRAPH
                      TLAG        4.64  LAG

                                                  ***

                                              UNIT HYDROGRAPH
                                          48 END-OF-PERIOD ORDINATES
            201.      661.     1259.     2062.     3123.     4332.     5321.     5979.     6304.     6341.
           6197.     5790.     5317.     4757.     4064.     3330.     2753.     2324.     1961.     1675.
           1438.     1221.     1026.      866.      736.      624.      527.      445.      374.      317.
            269.      229.      193.      165.      139.      118.       99.       84.       71.       63.
             55.       47.       40.       32.       25.       19.       12.        6.

     ***            ***            ***            ***            ***
                        HYDROGRAPH AT STATION    SUB34

      TOTAL RAINFALL =  3.93, TOTAL LOSS =  1.87, TOTAL EXCESS =  2.06

PEAK FLOW     TIME                          MAXIMUM AVERAGE FLOW
```

```
                                    6-HR       24-HR       72-HR     99.50-HR
   (CFS)       (HR)
                          (CFS)
+   9666.     17.00                8192.       3545.       1189.        860.
                       (INCHES)    1.185       2.053       2.063       2.063
                        (AC-FT)    4062.       7039.       7074.       7074.

                        CUMULATIVE AREA =   64.30 SQ MI


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

            ***************
            *             *
 447 KK     *        24   *      COMBINE 1-32 WITH 33 AND 34
            *             *
            ***************
                            ADD THREE HYDROGRAPHS

 449 HC          HYDROGRAPH COMBINATION
                      ICOMP          3  NUMBER OF HYDROGRAPHS TO COMBINE

                                                                  ***

     ***             ***             ***             ***             ***
                        HYDROGRAPH AT STATION       24

 PEAK FLOW     TIME                          MAXIMUM AVERAGE FLOW
                                    6-HR       24-HR       72-HR     99.50-HR
+   (CFS)      (HR)
                          (CFS)
+   57549.    36.50                55116.      42285.      23787.      17759.
                       (INCHES)    0.328       1.007       1.699       1.753
                        (AC-FT)   27330.      83872.     141541.     146034.

                        CUMULATIVE AREA = 1561.80 SQ MI


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

            ***************
            *             *
 450 KK     *     SUB35   *
            *             *
            ***************
                            RUNOFF FROM SUBBASIN 35

              SUBBASIN RUNOFF DATA

 452 BA          SUBBASIN CHARACTERISTICS
                      TAREA       99.60  SUBBASIN AREA

                 PRECIPITATION DATA

 372 PB               STORM        3.93  BASIN TOTAL PRECIPITATION
```

```
373 PI          INCREMENTAL PRECIPITATION PATTERN
                  0.00    0.01    0.01    0.01    0.01    0.01    0.01    0.01    0.01    0.01
                  0.01    0.01    0.01    0.01    0.01    0.01    0.01    0.01    0.02    0.02
                  0.02    0.03    0.05    0.38    0.07    0.04    0.03    0.02    0.02    0.01
                  0.01    0.01    0.01    0.01    0.01    0.01    0.01    0.01    0.01    0.01
                  0.01    0.01    0.01    0.01    0.01    0.01    0.01    0.01

453 LS        SCS LOSS RATE
                  STRTL       0.30  INITIAL ABSTRACTION
                  CRVNBR     87.00  CURVE NUMBER
                  RTIMP       0.00  PERCENT IMPERVIOUS AREA

454 UD        SCS DIMENSIONLESS UNITGRAPH
                  TLAG        4.73  LAG

                                                  ***

                                              UNIT HYDROGRAPH
                                          49 END-OF-PERIOD ORDINATES
          293.    973.   1850.   3020.   4578.   6414.   7952.   9004.   9568.   9657.
         9529.   8952.   8263.   7481.   6500.   5348.   4398.   3726.   3151.   2677.
         2323.   1974.   1683.   1402.   1208.   1019.    873.    732.    625.    523.
          450.    380.    326.    275.    236.    199.    170.    142.    123.    104.
           93.     81.     69.     58.     47.     37.     27.     17.      8.

    ***         ***         ***         ***         ***
                  HYDROGRAPH AT STATION    SUB35

     TOTAL RAINFALL =  3.93, TOTAL LOSS =  1.36, TOTAL EXCESS =  2.57

 PEAK FLOW    TIME                      MAXIMUM AVERAGE FLOW
                                  6-HR      24-HR      72-HR    99.50-HR
+  (CFS)      (HR)
                        (CFS)
+  18727.     17.00              15876.      6837.      2297.      1662.
                      (INCHES)    1.482      2.553      2.573      2.573
                      (AC-FT)     7872.     13561.     13665.     13665.

                      CUMULATIVE AREA =   99.60 SQ MI


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

          **************
          *            *
455 KK    *        6   *      ROUTE (OLD CAMP DETENTION BASIN)
          *            *
          **************
                      ROUTE HYDROGRAPH 35 THROUGH OLD CAMP DETENTION (UPSTRM OF C.A.P.)

            HYDROGRAPH ROUTING DATA

432 RL        ROUTING LOSSES
                  QLOSS       0.00  INITIAL LOSS
                  CLOSS       0.00  ADDITIONAL FRACTION LOST
```

```
457 RS          STORAGE ROUTING
                     NSTPS           1  NUMBER OF SUBREACHES
                     ITYP         ELEV  TYPE OF INITIAL CONDITION
                     RSVRIC       0.00  INITIAL CONDITION
                     X            0.00  WORKING R AND D COEFFICIENT

458 SV          STORAGE        0.0    163.0    326.0    489.0    652.0    816.0    978.0   1141.0   1222.0   1344.0

459 SE          ELEVATION      0.00     2.00     4.00     6.00     8.00    10.00    12.00    14.00    15.00    16.00

460 SQ          DISCHARGE        0.     156.     315.     585.     825.    1020.    1200.    1335.    1410.    1500.

                                                          ***

     ***          ***          ***          ***          ***
                      HYDROGRAPH AT STATION        6

  PEAK FLOW    TIME                           MAXIMUM AVERAGE FLOW
                                    6-HR        24-HR       72-HR     99.50-HR
+  (CFS)       (HR)
                        (CFS)
+    6206.    23.50                 6113.       4938.       2281.       1659.
                        (INCHES)    0.571       1.844       2.556       2.568
                        (AC-FT)     3031.       9795.      13576.      13641.

 PEAK STORAGE  TIME                          MAXIMUM AVERAGE STORAGE
                                    6-HR        24-HR       72-HR     99.50-HR
+ (AC-FT)      (HR)
     7724.    23.50                 7597.       6005.       2624.       1907.

  PEAK STAGE   TIME                           MAXIMUM AVERAGE STAGE
                                    6-HR        24-HR       72-HR     99.50-HR
+  (FEET)      (HR)
     68.29    23.50                 67.25       54.20       24.92       18.14

                       CUMULATIVE AREA =   99.60 SQ MI


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

            **************
            *            *
461 KK      *       19   *      ROUTE HYDROGRAPH 35 THROUGH REACH 17
            *            *
            **************

               HYDROGRAPH ROUTING DATA

462 RL          ROUTING LOSSES
                     QLOSS        0.00  INITIAL LOSS
                     CLOSS        0.00  ADDITIONAL FRACTION LOST
```

```
463 RS          STORAGE ROUTING
                     NSTPS          24  NUMBER OF SUBREACHES
                      ITYP        FLOW  TYPE OF INITIAL CONDITION
                    RSVRIC       -1.00  INITIAL CONDITION
                         X        0.00 WORKING R AND D COEFFICIENT

464 RC          NORMAL DEPTH CHANNEL ROUTING
                       ANL       0.060  LEFT OVERBANK N-VALUE
                      ANCH       0.035  MAIN CHANNEL N-VALUE
                       ANR       0.060  RIGHT OVERBANK N-VALUE
                     RLNTH     105600.  REACH LENGTH
                       SEL      0.0049  ENERGY SLOPE
                     ELMAX         0.0  MAX. ELEV. FOR STORAGE/OUTFLOW CALCULATION

                                     CROSS-SECTION DATA
                          --- LEFT OVERBANK --- + ------ MAIN CHANNEL ------- + --- RIGHT OVERBANK ---
466 RY        ELEVATION   1004.00   1003.00   1002.00   1000.00   1000.00   1002.00   1003.00   1004.00
465 RX        DISTANCE       0.00    200.00    400.00    600.00    800.00   1000.00   1200.00   1400.00

                                                          ***

                                          COMPUTED STORAGE-OUTFLOW-ELEVATION DATA
          STORAGE       0.00    112.82    247.12    402.92    580.21    778.98    999.24   1241.00   1504.24   1788.97
          OUTFLOW       0.00     46.19    153.35    315.88    534.96    813.27   1154.00   1560.57   2036.47   2565.19
        ELEVATION    1000.00   1000.21   1000.42   1000.63   1000.84   1001.05   1001.26   1001.47   1001.68   1001.89
          STORAGE    2097.88   2447.07   2839.25   3274.41   3752.54   4273.65   4837.74   5444.81   6094.85   6787.88
          OUTFLOW    3278.39   4125.85   5067.71   6109.25   7255.04   8509.32   9876.11  11359.29  12962.61  14689.76
        ELEVATION    1002.11   1002.32   1002.53   1002.74   1002.95   1003.16   1003.37   1003.58   1003.79   1004.00

*** WARNING *** MODIFIED PULS ROUTING MAY BE NUMERICALLY UNSTABLE FOR OUTFLOWS BETWEEN     2585. TO    14690.
               THE ROUTED HYDROGRAPH SHOULD BE EXAMINED FOR OSCILLATIONS OR OUTFLOWS GREATER THAN PEAK INFLOWS.
               THIS CAN BE CORRECTED BY DECREASING THE TIME INTERVAL OR INCREASING STORAGE (USE A LONGER REACH.)

      ***            ***            ***            ***            ***
                        HYDROGRAPH AT STATION       19

 PEAK FLOW     TIME                          MAXIMUM AVERAGE FLOW
                                     6-HR       24-HR       72-HR     99.50-HR
+   (CFS)      (HR)
                          (CFS)
+    6175.     29.00                6078.       4878.       2265.       1645.
                        (INCHES)    0.567       1.821       2.537       2.547
                         (AC-FT)    3014.       9675.      13476.      13528.

 PEAK STORAGE  TIME                          MAXIMUM AVERAGE STORAGE
                                     6-HR       24-HR       72-HR     99.50-HR
+  (AC-FT)     (HR)
     138.     29.00                 136.        115.         61.         45.

 PEAK STAGE    TIME                          MAXIMUM AVERAGE STAGE
                                     6-HR       24-HR       72-HR     99.50-HR
+   (FEET)     (HR)
   1002.75    29.00               1002.73     1002.47     1001.50     1001.11

                        CUMULATIVE AREA =   99.60 SQ MI
```

```
467 KK    SUB36

          RUNOFF FROM SUBBASIN 36

          SUBBASIN RUNOFF DATA

468 BA      SUBBASIN CHARACTERISTICS
                TAREA      163.10  SUBBASIN AREA

            PRECIPITATION DATA

372 PB          STORM        3.93  BASIN TOTAL PRECIPITATION

373 PI        INCREMENTAL PRECIPITATION PATTERN
                0.00    0.01    0.01    0.01    0.01    0.01    0.01    0.01    0.01    0.01
                0.01    0.01    0.01    0.01    0.01    0.01    0.01    0.01    0.02    0.02
                0.02    0.03    0.05    0.38    0.07    0.04    0.03    0.02    0.02    0.01
                0.01    0.01    0.01    0.01    0.01    0.01    0.01    0.01    0.01    0.01
                0.01    0.01    0.01    0.01    0.01    0.01    0.01    0.01

470 LS      SCS LOSS RATE
                STRTL        0.53  INITIAL ABSTRACTION
                CRVNBR      79.00  CURVE NUMBER
                RTIMP        0.00  PERCENT IMPERVIOUS AREA

471 UD      SCS DIMENSIONLESS UNITGRAPH
                TLAG        12.25  LAG

                                   UNIT HYDROGRAPH
                              125 END-OF-PERIOD ORDINATES
          76.     151.     277.     454.     630.     857.    1084.    1349.    1651.    1954.
        2357.    2761.    3202.    3681.    4160.    4564.    4967.    5307.    5585.    5862.
        6013.    6165.    6253.    6278.    6303.    6278.    6253.    6165.    6013.    5862.
        5686.    5509.    5320.    5118.    4917.    4664.    4412.    4135.    3832.    3530.
        3278.    3026.    2811.    2635.    2458.    2307.    2156.    2017.    1891.    1765.
        1673.    1581.    1489.    1397.    1305.    1229.    1153.    1078.    1002.     927.
         876.     826.     775.     725.     674.     637.     599.     561.     523.     485.
         458.     430.     402.     374.     347.     328.     309.     290.     271.     252.
         238.     224.     211.     197.     183.     173.     163.     153.     142.     132.
         125.     117.     110.     102.      95.      90.      84.      79.      74.      69.
          66.      63.      60.      57.      54.      51.      48.      45.      42.      39.
          36.      33.      30.      28.      25.      23.      20.      18.      15.      13.
          10.       8.       5.       3.       0.

          HYDROGRAPH AT STATION    SUB36

TOTAL RAINFALL =  3.93, TOTAL LOSS =  2.02, TOTAL EXCESS =  1.91
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```
PEAK FLOW     TIME                          MAXIMUM AVERAGE FLOW
                                     6-HR       24-HR       72-HR     99.50-HR
+  (CFS)      (HR)
                        (CFS)
+  10654.     25.50                10351.      7239.       2787.       2017.
                      (INCHES)     0.590      1.651       1.907       1.907
                       (AC-FT)     5133.     14359.      16587.      16587.

                       CUMULATIVE AREA =  163.10 SQ MI
```

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

          ***************
          *             *
472 KK    *        25   *      COMBINE 1-34 WITH 35 AND 36
          *             *
          ***************
                          ADD THREE HYDROGRAPHS

474 HC          HYDROGRAPH COMBINATION
                     ICOMP           3  NUMBER OF HYDROGRAPHS TO COMBINE

                                                                  ***

     ***            ***            ***            ***            ***
                       HYDROGRAPH AT STATION       25

PEAK FLOW     TIME                          MAXIMUM AVERAGE FLOW
                                     6-HR       24-HR       72-HR     99.50-HR
+  (CFS)      (HR)
                        (CFS)
+  67675.     36.00                65106.     51898.      28818.      21421.
                      (INCHES)     0.332      1.058       1.762       1.810
                       (AC-FT)    32284.    102939.     171481.     176149.

                       CUMULATIVE AREA = 1824.50 SQ MI
```

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

          ***************
          *             *
475 KK    *        20   *      ROUTE HYDROGRAPH 1-36 THROUGH REACH 20
          *             *
          ***************

            HYDROGRAPH ROUTING DATA

476 RL          ROUTING LOSSES
                     QLOSS        0.00  INITIAL LOSS
                     CLOSS        0.00  ADDITIONAL FRACTION LOST

477 RS          STORAGE ROUTING
                     NSTPS           6  NUMBER OF SUBREACHES
```

```
                    ITYP         FLOW  TYPE OF INITIAL CONDITION
                  RSVRIC        -1.00  INITIAL CONDITION
                       X         0.00  WORKING R AND D COEFFICIENT

 478 RC        NORMAL DEPTH CHANNEL ROUTING
                     ANL        0.065  LEFT OVERBANK N-VALUE
                    ANCH        0.040  MAIN CHANNEL N-VALUE
                     ANR        0.060  RIGHT OVERBANK N-VALUE
                   RLNTH       30729.  REACH LENGTH
                     SEL       0.0024  ENERGY SLOPE
                   ELMAX          0.0  MAX. ELEV. FOR STORAGE/OUTFLOW CALCULATION

                                         CROSS-SECTION DATA
                       --- LEFT OVERBANK --- + ------ MAIN CHANNEL ------- + --- RIGHT OVERBANK ---
 480 RY       ELEVATION    848.00    846.00    842.00    840.00    840.00    842.00    846.00    848.00
 479 RX       DISTANCE       0.00    400.00    800.00   1000.00   1100.00   1500.00   1800.00   2300.00

                                                       ***

                                         COMPUTED STORAGE-OUTFLOW-ELEVATION DATA
           STORAGE      0.00     48.46    134.44    257.95    418.97    617.02    841.35   1087.57   1355.68   1645.67
           OUTFLOW      0.00     56.62    230.75    557.37   1070.19   1848.37   3011.84   4420.45   6074.70   7976.42
         ELEVATION    840.00    840.42    840.84    841.26    841.68    842.11    842.53    842.95    843.37    843.79
           STORAGE   1957.55   2291.31   2646.97   3024.50   3423.93   3854.91   4341.10   4883.57   5482.31   6137.33
           OUTFLOW  10128.45  12534.34  15198.17  18124.32  21317.47  24602.22  28203.85  32194.92  36586.83  41396.46
         ELEVATION    844.21    844.63    845.05    845.47    845.89    846.32    846.74    847.16    847.58    848.00

     ***          ***         ***          ***          ***
                    HYDROGRAPH AT STATION       20

 PEAK FLOW     TIME                          MAXIMUM AVERAGE FLOW
                                   6-HR         24-HR         72-HR      99.50-HR
+   (CFS)      (HR)
                       (CFS)
+   67261.     37.50              64805.       51857.        28784.       21316.
                     (INCHES)      0.330        1.057         1.760        1.801
                      (AC-FT)     32135.      102856.       171276.      175288.

 PEAK STORAGE  TIME                          MAXIMUM AVERAGE STORAGE
                                   6-HR         24-HR         72-HR      99.50-HR
+  (AC-FT)     (HR)
     1610.     37.50               1554.        1260.          740.         557.

 PEAK STAGE    TIME                          MAXIMUM AVERAGE STAGE
                                   6-HR         24-HR         72-HR      99.50-HR
+   (FEET)     (HR)
    850.26     37.50              850.05       848.92        846.41       845.00

                   CUMULATIVE AREA = 1824.50 SQ MI


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

             **************
             *            *
 481 KK      *    SUB37   *
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*   *
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RUNOFF FROM SUBBASIN 37

SUBBASIN RUNOFF DATA

483 BA SUBBASIN CHARACTERISTICS
TAREA 45.80 SUBBASIN AREA

PRECIPITATION DATA

372 PB STORM 3.93 BASIN TOTAL PRECIPITATION

373 PI INCREMENTAL PRECIPITATION PATTERN

0.00	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01
0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.02	0.02
0.02	0.03	0.05	0.38	0.07	0.04	0.03	0.02	0.02	0.01
0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01
0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01		

484 LS SCS LOSS RATE
STRTL 0.41 INITIAL ABSTRACTION
CRVNBR 83.00 CURVE NUMBER
RTIMP 0.00 PERCENT IMPERVIOUS AREA

485 UD SCS DIMENSIONLESS UNITGRAPH
TLAG 4.43 LAG

***

UNIT HYDROGRAPH
46 END-OF-PERIOD ORDINATES

165.	531.	1016.	1674.	2532.	3434.	4130.	4557.	4714.	4700.
4472.	4129.	3733.	3238.	2638.	2146.	1800.	1507.	1273.	1089.
918.	766.	641.	540.	456.	380.	320.	265.	225.	188.
160.	134.	113.	95.	80.	67.	57.	49.	43.	37.
30.	24.	19.	14.	9.	4.				

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

HYDROGRAPH AT STATION SUB37

TOTAL RAINFALL = 3.93, TOTAL LOSS = 1.70, TOTAL EXCESS = 2.23

PEAK FLOW	TIME		MAXIMUM AVERAGE FLOW			
			6-HR	24-HR	72-HR	99.50-HR
+ (CFS)	(HR)					
		(CFS)				
+ 7718.	16.50		6451.	2728.	914.	661.
		(INCHES)	1.310	2.215	2.226	2.226
		(AC-FT)	3199.	5411.	5436.	5436.

CUMULATIVE AREA = 45.80 SQ MI

*** ***

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             **************
             *            *
   466 KK    *        26  *     COMBINE 1-36 WITH 37
             *            *
             **************
                              ADD TWO HYDROGRAPHS

   488 HC         HYDROGRAPH COMBINATION
                       1CCMP           2  NUMBER OF HYDROGRAPHS TO COMBINE

                                                                 ***

        ***            ***            ***            ***            ***
                            HYDROGRAPH AT STATION        26

   PEAK FLOW     TIME                       MAXIMUM AVERAGE FLOW
                                     6-HR        24-HR        72-HR     99.50-HR
 +   (CFS)       (HR)
                            (CFS)
 +   67296.      37.50               64849.      52146.       29589.      21976.
                            (INCHES)  0.322       1.037        1.765       1.812
                            (AC-FT)  32156.     103431.      176069.     180725.

                            CUMULATIVE AREA = 1870.30 SQ MI
1
```

RUNOFF SUMMARY
FLOW IN CUBIC FEET PER SECOND
TIME IN HOURS, AREA IN SQUARE MILES

	OPERATION	STATION	PEAK FLOW	TIME OF PEAK	AVERAGE FLOW FOR MAXIMUM PERIOD			BASIN AREA	MAXIMUM STAGE	TIME OF MAX STAGE
+					6-HOUR	24-HOUR	72-HOUR			
	HYDROGRAPH AT									
+		SUB 1	7279.	18.50	6534.	3185.	1076.	67.00		
	ROUTED TO									
+		1	7110.	21.00	6359.	3128.	1076.	67.00		
+									2202.93	21.00
	HYDROGRAPH AT									
+		SUB 2	10490.	29.00	10270.	7912.	3347.	185.00		
	HYDROGRAPH AT									
+		SUB 3	5890.	17.00	5043.	2234.	749.	43.00		
	3 COMBINED AT									
+		1	16527.	22.50	16122.	12504.	5171.	295.00		
	ROUTED TO									
+		2	16451.	24.50	16077.	12466.	5163.	295.00		
+									2085.05	24.50
	HYDROGRAPH AT									
+		SUB 4	4125.	15.50	3101.	1172.	391.	21.60		
	HYDROGRAPH AT									

+		SUB4A	3440.	15.50	2626.	1004.	335.	18.50		
	3 COMBINED AT									
+		2	17871.	23.50	17400.	13462.	5882.	335.10		
	HYDROGRAPH AT									
+		SUB 5	9311.	15.00	6690.	2443.	815.	48.70		
	2 COMBINED AT									
+		3	19493.	22.50	18935.	15480.	6696.	383.80		
	ROUTED TO									
+		3	19501.	23.50	18917.	15436.	6689.	383.80		
+									2024.21	23.50
	HYDROGRAPH AT									
+		SUB 6	5325.	14.50	3647.	1287.	429.	23.70		
	HYDROGRAPH AT									
+		SUB 7	6689.	16.50	5465.	2238.	748.	44.70		
	3 COMBINED AT									
+		4	27317.	16.00	23264.	18448.	7858.	452.20		
	ROUTED TO									
+		4	26730.	18.00	22948.	18262.	7832.	452.20		
+									1944.79	18.00
	HYDROGRAPH AT									
+		SUB 8	6274.	15.00	4494.	1634.	545.	31.30		
	HYDROGRAPH AT									
+		SUB8A	3764.	14.50	2457.	846.	282.	16.20		
	3 COMBINED AT									
+		5	31129.	18.00	26075.	19520.	8641.	499.70		
	HYDROGRAPH AT									
+		SUB 9	10078.	15.00	7392.	2725.	909.	52.20		
	2 COMBINED AT									
+		6	36933.	17.50	30286.	21849.	9548.	551.90		
	ROUTED TO									
+		5	36672.	18.50	30201.	21784.	9545.	551.90		
+									1889.47	18.50
	HYDROGRAPH AT									
+		SUB10	3610.	14.50	2426.	853.	284.	17.00		
	HYDROGRAPH AT									
+		SUB11	3531.	15.00	2614.	973.	324.	20.20		
	3 COMBINED AT									
+		7	39628.	18.50	32637.	23239.	10150.	589.10		
	ROUTED TO									

		6	38617.	19.50	32557.	23158.	10133.	589.10		
									1825.04	19.50
	HYDROGRAPH AT									
+		SUB12	2648.	14.00	1582.	532.	177.	10.60		
	HYDROGRAPH AT									
+		SUB12A	2816.	13.50	1527.	497.	166.	9.90		
	3 COMBINED AT									
+		8	39508.	19.50	33373.	23597.	10460.	609.60		
	HYDROGRAPH AT									
+		SUB13	9907.	16.50	8076.	3303.	1103.	68.70		
	2 COMBINED AT									
+		9	45375.	19.50	39335.	26472.	11563.	678.30		
	HYDROGRAPH AT									
+		SUB15	3154.	15.50	2423.	932.	311.	18.60		
	2 COMBINED AT									
+		10	46818.	19.50	40947.	27297.	11873.	696.90		
	ROUTED TO									
+		7	44034.	22.00	40136.	27147.	11866.	696.90		
									1771.33	22.00
	HYDROGRAPH AT									
+		SUB14	7985.	12.50	2675.	835.	278.	13.70		
	HYDROGRAPH AT									
+		SUB16	6509.	13.50	3441.	1113.	371.	19.70		
	3 COMBINED AT									
+		11	44991.	21.50	41164.	27682.	12492.	730.30		
	ROUTED TO									
+		1	44251.	22.50	40703.	27585.	12386.	730.30		
+									258.69	22.50
	ROUTED TO									
+		8	43685.	24.50	40446.	27524.	12374.	730.30		
+									1610.99	24.50
	HYDROGRAPH AT									
+		SUB17	5489.	14.00	3273.	1097.	366.	21.00		
	HYDROGRAPH AT									
+		SUB18	4891.	15.00	3503.	1274.	425.	24.40		
	3 COMBINED AT									
+		12	44910.	24.50	41593.	28177.	13128.	775.70		
	ROUTED TO									
+		12	44836.	25.00	41548.	28165.	13115.	775.70		
+									1444.86	25.00

	HYDROGRAPH AT								
+		SUB19	3328.	13.00	1534.	490.	163.	10.60		
	HYDROGRAPH AT								
+		SUB20	5433.	19.00	4992.	2588.	883.	50.70		
	3 COMBINED AT								
+		13	48171.	24.50	44897.	30403.	14144.	837.00		
	HYDROGRAPH AT								
+		SUB21A	9999.	20.00	9289.	4981.	1714.	84.40		
	ROUTED TO								
+		10	9161.	24.50	8443.	4948.	1714.	84.40		
+									1724.49	24.50
	HYDROGRAPH AT								
+		SUB21	9332.	19.50	8609.	4546.	1560.	76.80		
	2 COMBINED AT								
+		14	15639.	23.00	14636.	9426.	3274.	161.20		
	ROUTED TO								
+		2	7509.	31.50	7311.	5258.	2675.	161.20		
+									1408.11	31.50
	2 COMBINED AT								
+		15	51945.	25.00	48694.	35132.	16794.	998.20		
	ROUTED TO								
+		10	51882.	25.50	48703.	35127.	16780.	998.20		
+									1365.29	25.50
	HYDROGRAPH AT								
+		SUB22	5310.	14.50	3578.	1259.	420.	25.10		
	2 COMBINED AT								
+		16	52431.	25.50	49148.	35494.	17153.	1023.30		
	ROUTED TO								
+		11	52220.	26.00	49067.	35484.	17135.	1023.30		
+									1286.23	26.00
	HYDROGRAPH AT								
+		SUB23	1784.	14.00	1080.	365.	122.	7.90		
	2 COMBINED AT								
+		17	52331.	26.00	49161.	35571.	17231.	1031.20		
	ROUTED TO								
+		12	52163.	27.00	49095.	35560.	17215.	1031.20		
+									1270.48	27.00
	HYDROGRAPH AT								
+		SUB24	2154.	14.50	1459.	518.	173.	11.20		

	HYDROGRAPH AT									
		SUB25	3294.	16.50	2718.	1148.	384.	24.90		
	3 COMBINED AT									
+		18	52898.	26.50	49842.	36228.	17709.	1067.30		
	ROUTED TO									
+		13	52664.	28.00	49623.	36197.	17681.	1067.30		
+									1183.35	28.00
	HYDROGRAPH AT									
+		SUB26	8348.	15.50	6240.	2348.	783.	42.40		
	2 COMBINED AT									
+		19	53202.	28.00	50235.	36818.	18346.	1109.70		
	ROUTED TO									
+		14	52167.	31.50	49473.	36666.	18325.	1109.70		
+									1097.23	31.50
	HYDROGRAPH AT									
+		SUB27	8912.	16.50	7451.	3172.	1061.	62.10		
	ROUTED TO									
+		3	952.	29.00	946.	888.	695.	62.10		
+									1260.18	29.00
	2 COMBINED AT									
+		20	53110.	31.50	50410.	37547.	19020.	1171.80		
	HYDROGRAPH AT									
+		SUB28	4285.	28.50	4195.	3190.	1328.	84.40		
	HYDROGRAPH AT									
+		SUB31	6754.	13.00	2721.	857.	286.	12.00		
	3 COMBINED AT									
+		21	57229.	31.50	54405.	40531.	20427.	1268.20		
	HYDROGRAPH AT									
+		SUB29	15962.	17.00	13675.	6022.	2021.	101.30		
	ROUTED TO									
+		4	340.	35.00	340.	339.	336.	101.30		
+									1408.67	35.00
	ROUTED TO									
+		15	340.	36.00	340.	339.	336.	101.30		
+									1201.80	36.00
	HYDROGRAPH AT									
+		SUB30	3710.	17.00	3166.	1401.	469.	28.60		
	ROUTED TO									
+		5	700.	28.00	698.	653.	431.	28.60		
+									1187.38	28.00

	ROUTED TO									
		16	709.	30.00	698.	653.	428.	28.60		
									1144.32	30.00
	3 COMBINED AT									
+		22	58266.	31.50	55439.	41517.	21152.	1398.10		
	ROUTED TO									
+		17	58088.	32.50	55304.	41499.	21137.	1398.10		
+									1052.10	32.50
	HYDROGRAPH AT									
+		SUB32	6774.	17.50	5882.	2668.	896.	52.40		
	2 COMBINED AT									
+		23	58488.	32.00	55763.	42054.	22013.	1450.50		
	ROUTED TO									
+		18	57432.	36.50	54966.	41911.	21986.	1450.50		
+									933.44	36.50
	HYDROGRAPH AT									
+		SUB33	7521.	16.50	6137.	2501.	836.	47.00		
	HYDROGRAPH AT									
+		SUB34	9666.	17.00	8192.	3549.	1189.	64.30		
	3 COMBINED AT									
+		24	57549.	36.50	55116.	42285.	23787.	1561.80		
	HYDROGRAPH AT									
+		SUB35	18727.	17.00	15876.	6837.	2297.	99.60		
	ROUTED TO									
+		6	6206.	23.50	6113.	4938.	2281.	99.60		
+									68.29	23.50
	ROUTED TO									
+		19	6175.	29.00	6078.	4878.	2265.	99.60		
+									1002.75	29.00
	HYDROGRAPH AT									
+		SUB36	10654.	25.50	10351.	7239.	2787.	163.10		
	3 COMBINED AT									
+		25	67675.	36.00	65106.	51898.	28818.	1824.50		
	ROUTED TO									
+		20	67261.	37.50	64805.	51857.	28784.	1824.50		
+									850.26	37.50
	HYDROGRAPH AT									
+		SUB37	7718.	16.50	6451.	2728.	914.	45.80		
	2 COMBINED AT									
+		26	67296.	37.50	64849.	52146.	29589.	1870.30		

*** NORMAL END OF HEC-1 ***

1

STORM PRECIPITATION VOLUMES

R McArthur 1/84

PURPOSE: Precipitation volumes are required as input to the TR-20 rainfall-runoff model. The frequency of the precipitation amounts by duration are used as the basis of estimating the flood frequency.

PROCEDURE: The precipitation are taken from "NOAA Atlas 2, Precipitation-Frequency Atlas of the Western United States, Volume VIII, Arizona"; NWS, NOAA, USDC. Procedures outlined in this source were followed including using a grid to determine the average precipitation over the area of interest, conversion of partial duration to annual series, derivation of shorter duration precipitation volumes, and point-to-areal adjustments.

The recommendations of TSC TECHNICAL NOTE-HYDROLOGY-PO-6 (Rev.2) were also followed in using NOAA Atlas 2.

Due to the large size of the contributing area the area was divided into 5 subareas to determine if there was a significant difference in average point values by geographical location. The 5 subdivisions included:

"A" - the area above Aguila (the upper part of the D.A.)

"B" - the north side of McMullen Valley; bounded by Centennial Wash along the south side and the Harcuvar mountains on the north side.

"C" - the south side of McMullen Valley; bounded on the north by Centennial Wash and along the south by the Harquahala Mountains

"D" - the northwest part of Harquahala Valley including Tiger Wash; Centennial Wash as the southern boundary

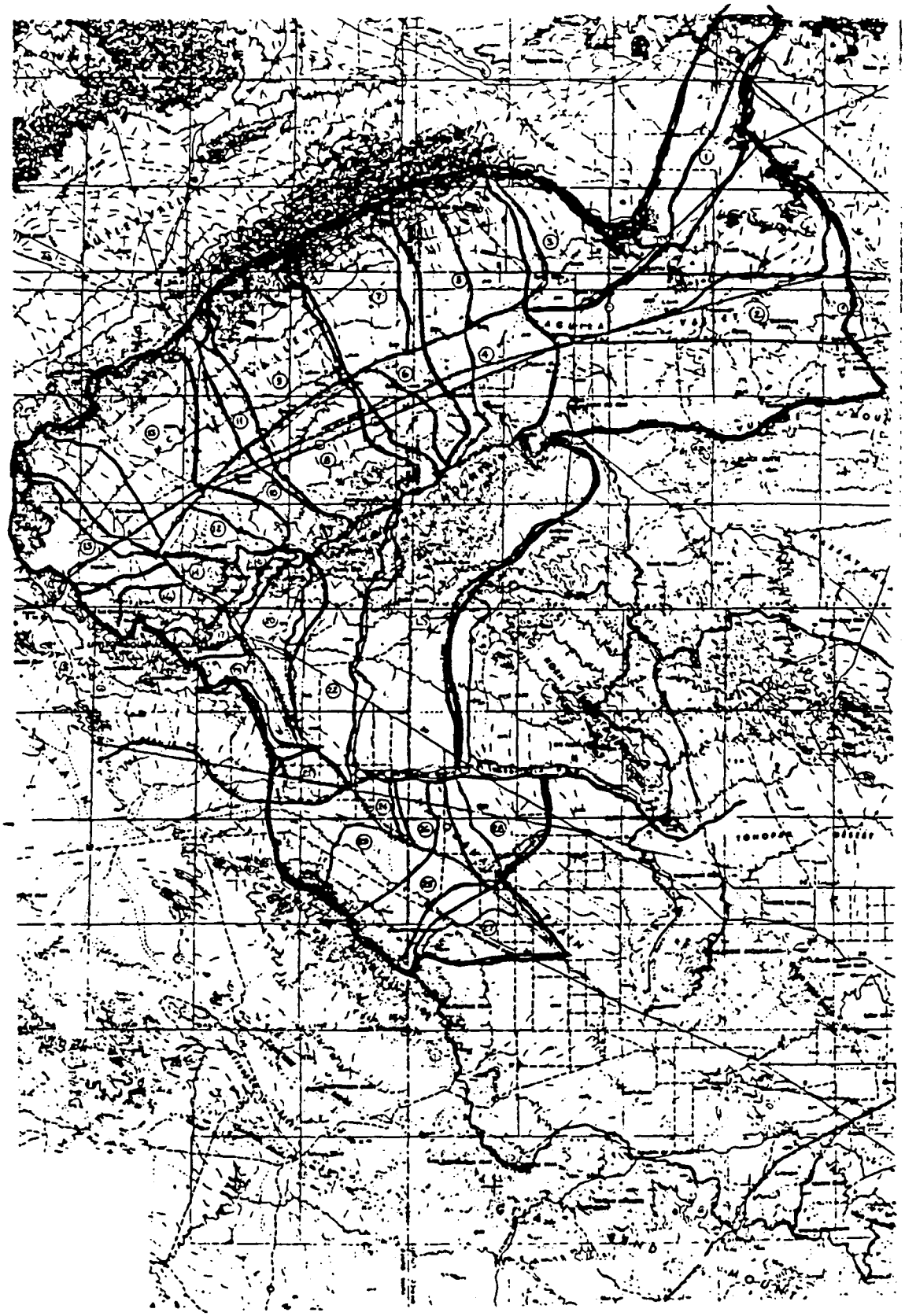
"E" the west part of Harquahala Valley bounded on the west by the low elevation extension of the Little Harquahala Mountains and the Eagletail Mountains and on the east by Centennial Wash

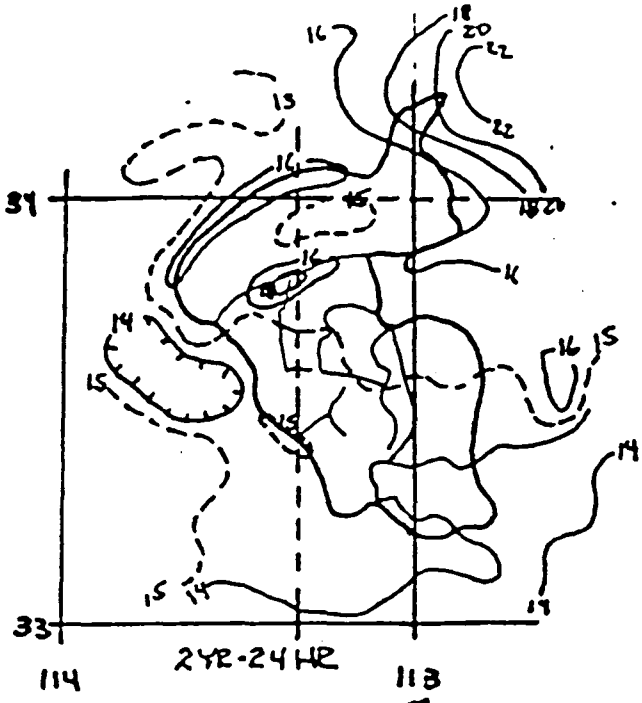
Fifty grid points were used to derive the average point precipitation volumes.

Point-to-area reduction was done by assume the center (maximum contribution) of the storm in the lower part of the watershed and decreasing amount in an upstream direction. The drainage areas were accumulated from the lowest point in the watershed to the highest point. Point-to-areal factors were altered to reflect major changes in the accumulated drainage area. Beyond 200 M^2 there is little change in the point-to-area curve for the 24-hour duration storms.

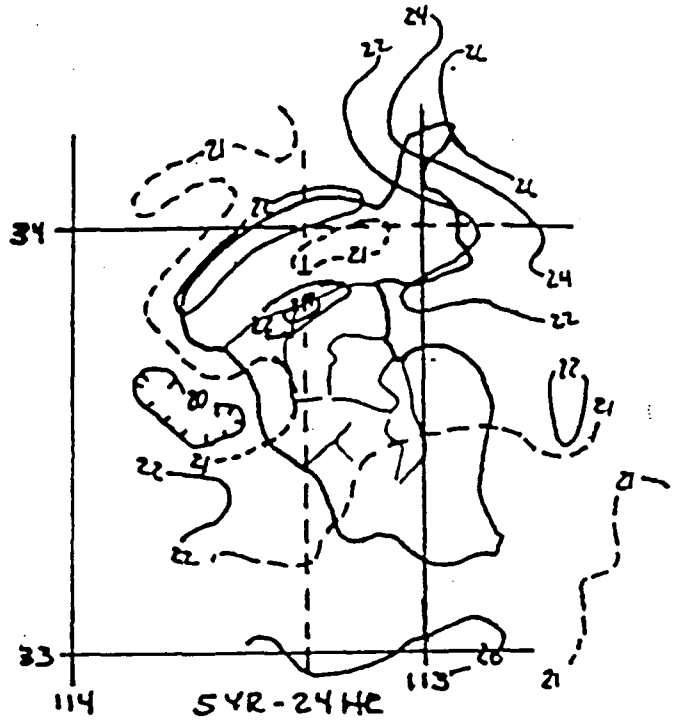
RESULTS & CONCLUSIONS: Derivation of average point precipitation for each of the 5 subdivisions concluded that there is not a significant difference with geographical location. There one average value was used for each frequency. The results are presented along with the areal reductions for the 24-hour and the 6-hour storm durations.

The 24-hour duration is best suited to fit the time of concentration for the entire area. The 6-hour duration

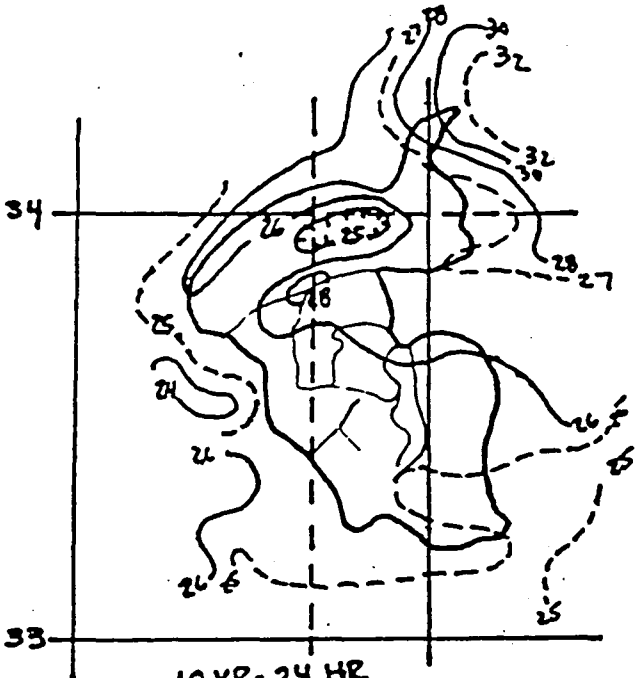




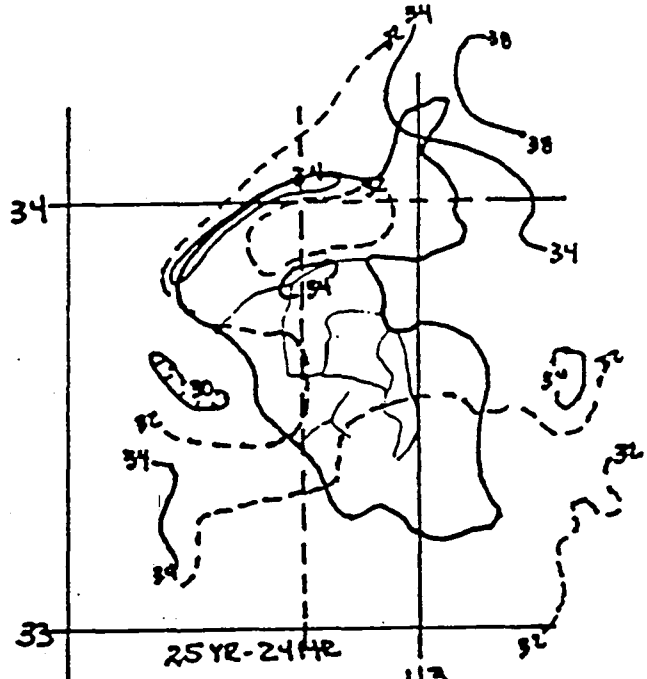
2YR-24 HR



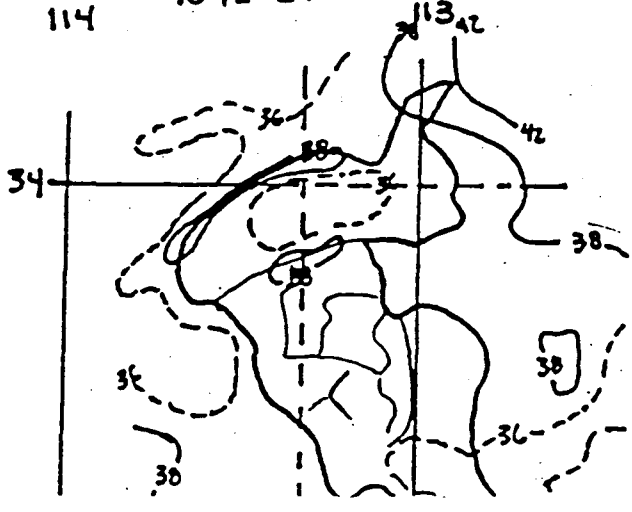
5YR-24 HR

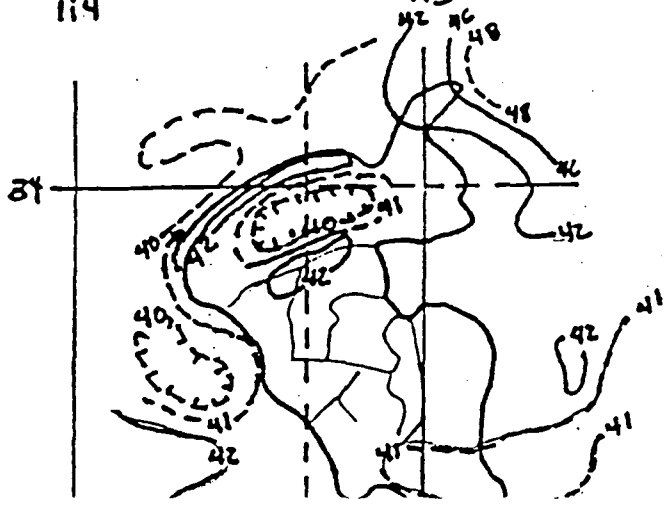


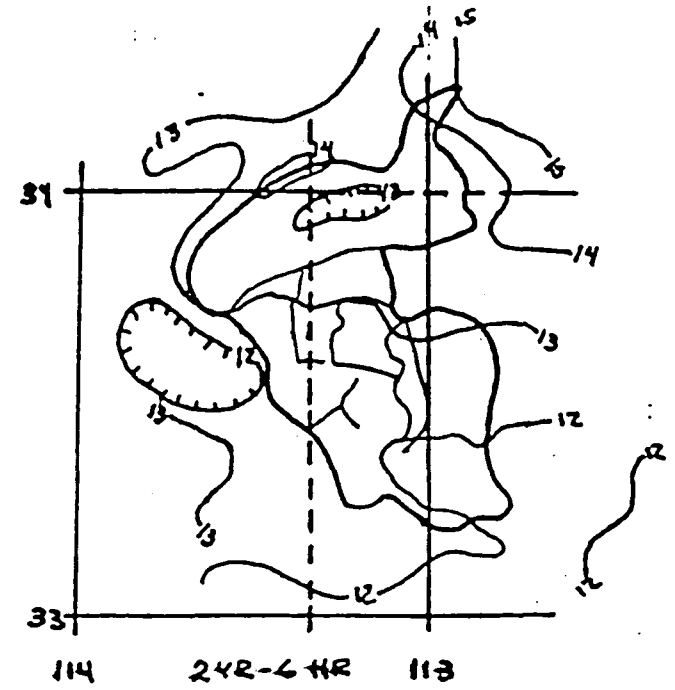
10YR-24 HR



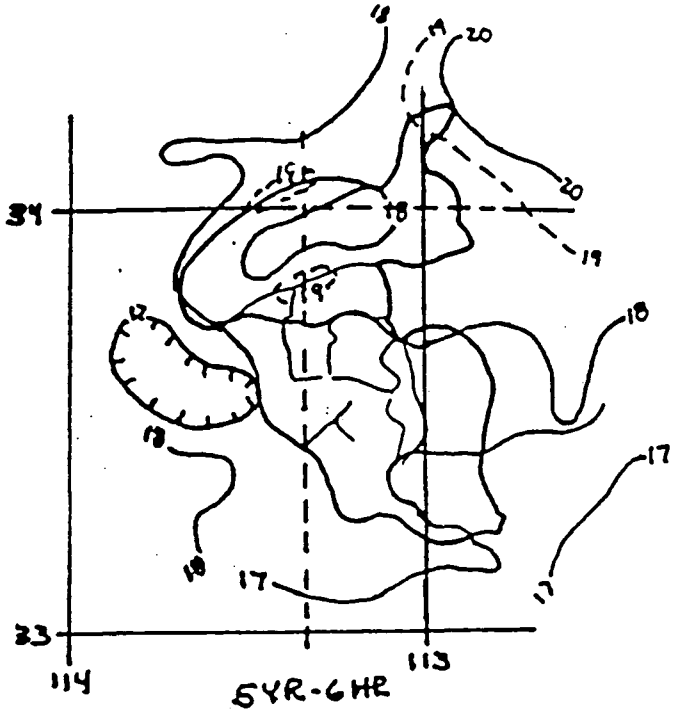
25YR-24 HR



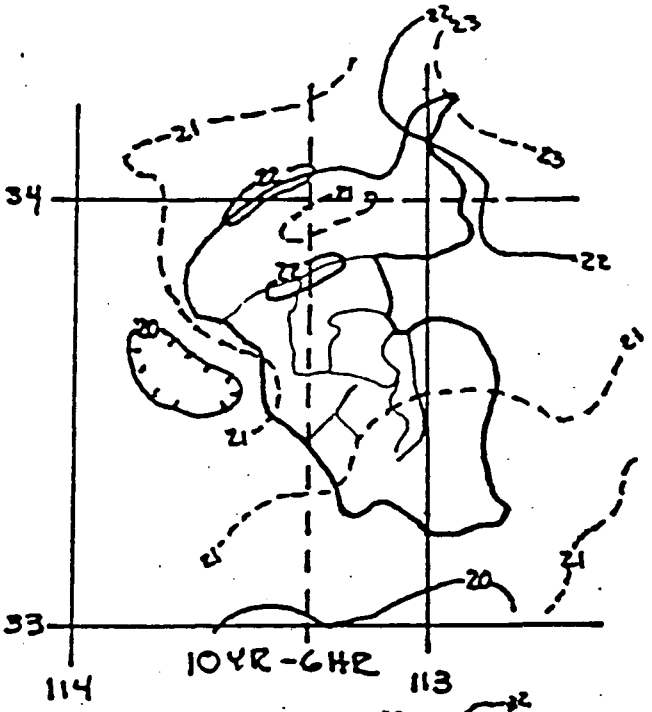




24YR-6HR



5YR-6HR



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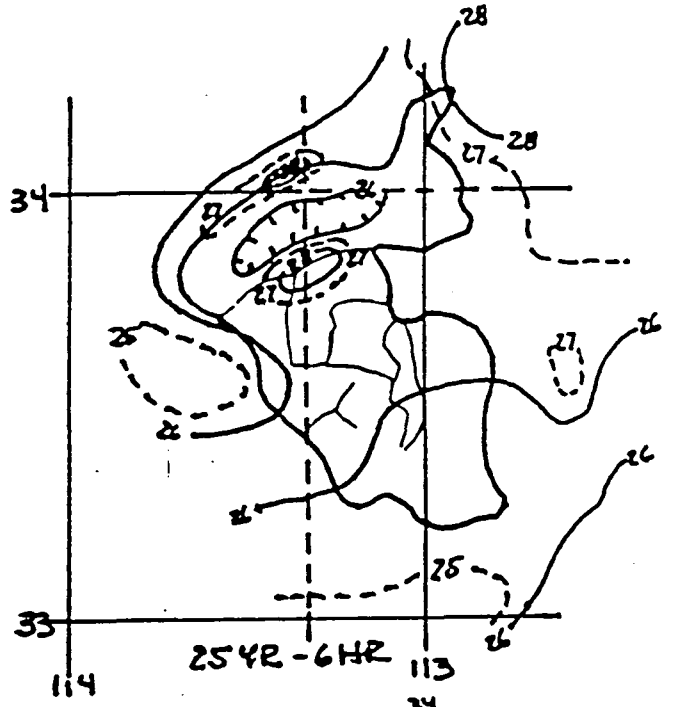

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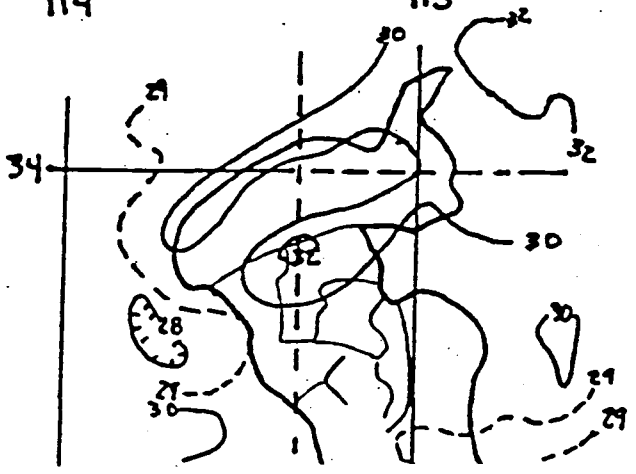
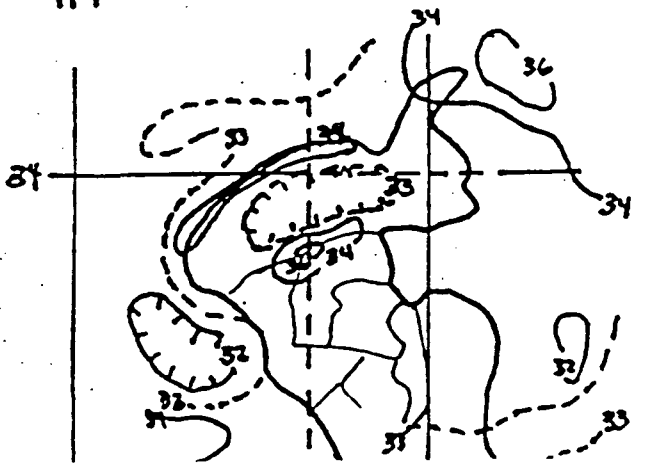
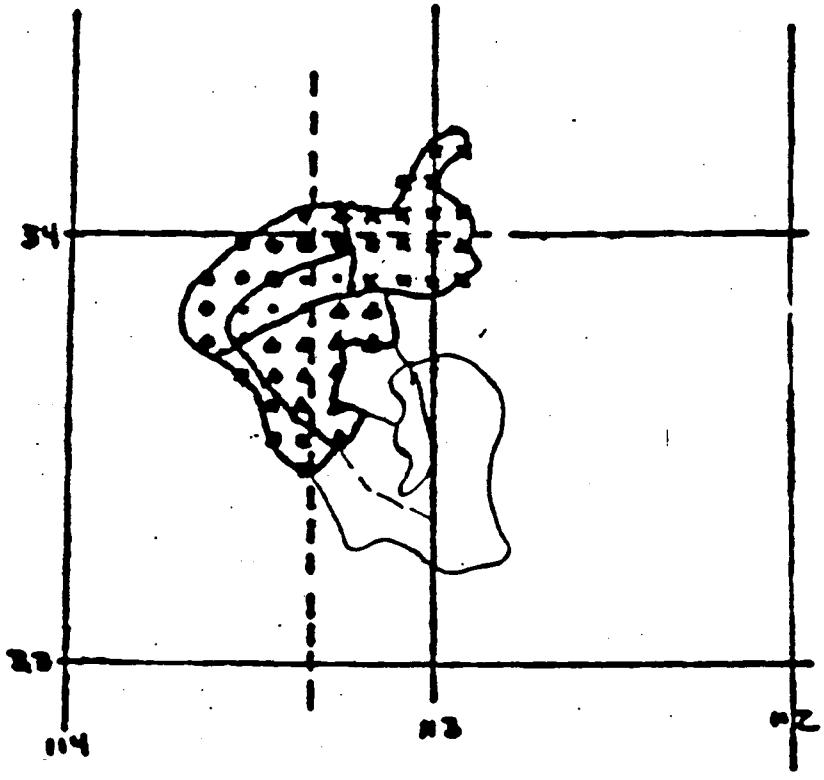






GRID FOR ESTIMATING
AVERAGE POINT PRECIPITATION

HARQUAHALA VALLEY WATERSHED

ARIZONA HARQUAHALA VALLEY WATERSHED

R. McArthur 9/20/83

DERIVATION OF AREAL PRECIPITATION VOLUMES
TO BE USED IN THE TR-20 ANALYSIS OF CENTENNIAL WASH

PART OF DRAINAGE AREA		AREAL REDUCTION FACTOR	6-HOUR PRECIPITATION VOLUMES FOR SELECTED RETURN PERIODS													
			500-YR		100-YR		50-YR		25-YR		10-YR		5-YR		2-YR	
FR	TO		POINT	AREAL	POINT	AREAL	POINT	AREAL	POINT	AREAL	POINT	AREAL	POINT	AREAL	POINT	AREAL
001	122	0.832 348.93	4.5	3.74	3.46	2.88	3.01	2.50	2.62	2.18	2.10	1.75	1.72	1.43	1.16	0.97
015	132	0.840 279.89		3.78		2.91		2.53		2.20		1.76		1.44		0.97
020	151	0.849 217.04		3.82		2.94		2.56		2.22		1.78		1.46		0.98
027	152	0.962 (19.89 mi²)		4.33		3.33		2.90		2.52		2.02		1.65		1.12

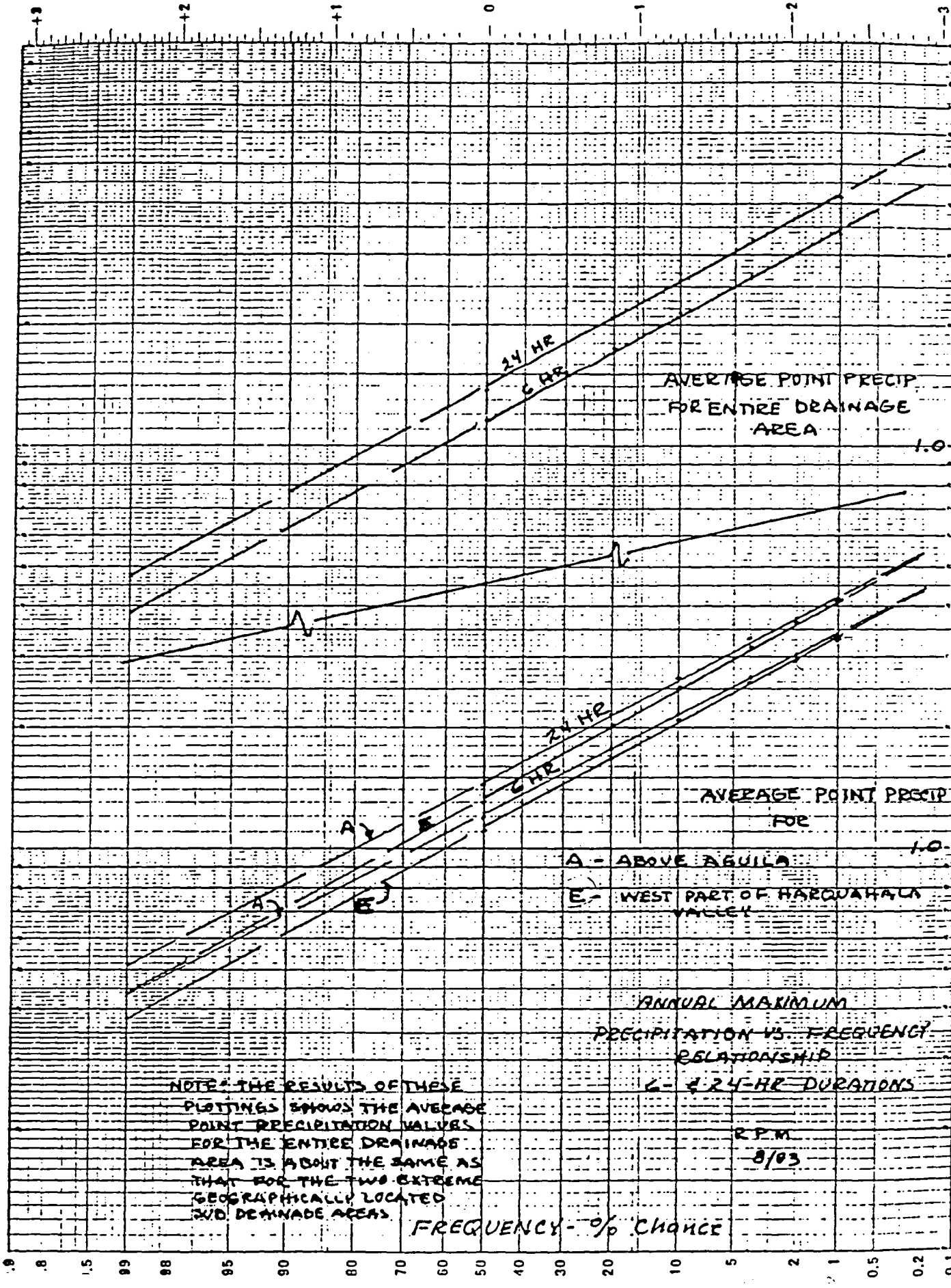
ARIZONA HARQUAHALA VALLEY WATERSHED

R. McArthur 9/8/83

DERIVATION OF AREAL PRECIPITATION VOLUMES
TO BE USED IN THE TR-20 ANALYSIS OF CENTENNIAL WASH

* PART OF DRAINAGE AREA		AREAL REDUCTION FACTOR	24 HOUR PRECIPITATION VOLUMES FOR SELECTED RETURN PERIOD													
			500-YR		100-YR		50-YR		25-YR		10-YR		5-YR		2-YR	
FR	TO		POINT	AREAL	POINT	AREAL	POINT	AREAL	POINT	AREAL	POINT	AREAL	POINT	AREAL	POINT	AREA
			5.5		4.25		3.71		3.20		2.58		2.10		1.40	
001	122	0.908		4.99		3.86		3.37		2.91		2.34		1.91		1.27
015	132	0.912		5.02		3.88		3.38		2.92		2.35		1.92		1.28
020	151	0.916		5.04		3.89		3.40		2.93		2.36		1.92		1.28
027	152	0.969		5.33		4.12		3.60		3.10		2.50		2.03		1.36

* REFER TO TR-20 FOR IDENTITY OF LOCATIONS


+3
+2
+1
0
-1
-2
-3
24 HR
6 HR
AVERAGE POINT PRECIP
FOR ENTIRE DRAINAGE
AREA
1.0
24 HR
6 HR
AVERAGE POINT PRECIP
FOR
1.0
A - ABOVE AGUILA
E - WEST PART OF HARQUAHALA VALLEY
A
E
A
E
ANNUAL MAXIMUM
PRECIPITATION VS. FREQUENCY
RELATIONSHIP
6- & 24-HR DURATIONS
RPM
8/03
NOTE: THE RESULTS OF THESE PLOTTINGS SHOWS THE AVERAGE POINT PRECIPITATION VALUES FOR THE ENTIRE DRAINAGE AREA IS ABOUT THE SAME AS THAT FOR THE TWO EXTREME GEOGRAPHICALLY LOCATED SUB DRAINAGE AREAS
FREQUENCY - % CHANCE
.9
.8
1.5
99
98
95
90
80
70
60
50
40
30
20
10
5
2
1
0.5
0.2
0.1

ARIZONA HARQUAHALA VALLEY WATERSHED

R. McArthur 8/26/83

COMPUTATION OF MAXIMUM ANNUAL PRECIPITATION 1 2
FREQUENCY VALUES FOR 6 HR & 24 HR DURATIONS ANNUAL SERIES

FOR ENTIRE DRAINAGE AREA ABOVE PROPOSED
CENTENNIAL WASH LEVEE

6 HOUR DURATION				
FREQUENCY (YRS)	MAP VALUE (INS.)	FACTOR	PLOTTED VALUE (IN.)	VALUE USED (IN.)
(500)				(4.5)
100	3.36	1.00	3.36	3.46
50	3.01	1.00	3.01	3.01
25	2.66	1.00	2.66	2.62
10	2.16	0.99	2.14	2.10
5	1.82	0.96	1.75	1.72
2	1.32	0.88	1.16	1.16

USE

24 HOUR DURATION				
(500)				(5.5)
100	4.15	1.00	4.15	4.25
50	3.71	1.00	3.71	3.71
25	3.28	1.00	3.28	3.20
10	2.62	0.99	2.59	2.58
5	2.19	0.96	2.10	2.10
2	1.57	0.88	1.38	1.40

ARIZONA HARQUAHALA VALLEY WATERSHED

R. McArthur 8/26/83

COMPUTATION OF MAXIMUM ANNUAL PRECIPITATION- 2 2

FREQUENCY VOLUMES FOR 6HR & 24 HR DURATIONS ANNUAL SERIES

6 HOUR DURATION

FREQUENCY (YRS)	FACTOR	A ABOVE AGUILA MAP VALUE (In)	A PLOTTED VALUE (In)	A VALUE USED (In.)	B NORTHSIDE OF McMULLEN VALLEY MAP VALUE (In)	B PLOTTED VALUE (In.)	B VALUE USED (In.)	C SOUTHSIDE OF McMULLEN VALLEY MAP VALUE (In.)	C PLOTTED VALUE (In.)	C VALUE USED (In.)	D NW PART OF HARQUAHALA VALLEY MAP VALUE (In.)	D PLOTTED VALUE (In)	D VALUE USED (In)	E W PART OF HARQUAHALA VALLEY MAP VALUE (In.)	E PLOTTED VALUE (In)	E VALUE USED (In)
(500)				(4.35)												(4.35)
100	1.00	3.36	3.36	3.42	3.35	3.35		3.36	3.36		3.37	3.37		3.31	3.31	3.35
50	1.00	3.03	3.03	3.03	3.00	3.00		3.02	3.02		3.03	3.03		2.93	2.93	2.95
25	1.00	2.66	2.66	2.66	2.67	2.67		2.66	2.66		2.68	2.68		2.60	2.60	2.58
10	0.99	2.18	2.16	2.16	2.16	2.14		2.16	2.14		2.16	2.14		2.11	2.09	2.05
5	0.96	1.84	1.77	1.77	1.83	1.76		1.83	1.76		1.80	1.73		1.74	1.67	1.68
2	0.88	1.36	1.20	1.22	1.34	1.18		1.33	1.17		1.28	1.13		1.25	1.10	1.13

24 HOUR DURATION

		A			B			C			D			E		
(500)				(5.4)												(5.4)
100	1.00	4.19	4.19	4.19	4.13	4.13		4.07	4.07		4.17	4.17		4.13	4.13	4.08
50	1.00	3.71	3.71	3.70	3.71	3.71		3.69	3.69		3.74	3.74		3.64	3.64	3.59
25	1.00	3.31	3.31	3.22	3.29	3.29		3.27	3.27		3.28	3.28		3.15	3.15	3.10
10	0.99	2.67	2.64	2.60	2.57	2.54		2.62	2.59		2.61	2.58		2.53	2.50	2.50
5	0.96	2.23	2.14	2.13	2.19	2.10		2.20	2.11		2.16	2.07		2.10	2.02	2.00
2	0.88	1.62	1.43	1.45	1.58	1.39		1.59	1.40		1.52	1.34		1.48	1.30	1.33

ARIZONA HARQUAHALA VALLEY WATERSHED

R McArthur 8/26/83

DETERMINATION OF AVERAGE POINT PRECIPITATION 1/2

CENTENNIAL WASH

SOURCE: NOAA ATLAS 2 Vol. VIII Arizona Precip-Frequency Atlas of the Western US

PART OF D.A.	GRID VALUES OF PRECIP & MEAN COMPUTATIONS											
	6 HR DURATION						24 HR DURATION					
	2 YR	5 YR	10 YR	25 YR	50 YR	100 YR	2 YR	5 YR	10 YR	25 YR	50 YR	100 YR
	1.5	1.96	2.3	2.8	3.14	3.5	2.1	2.6	3.1	3.6	4.0	4.65
A	1.38	1.86	2.19	2.68	3.08	3.36	1.59	2.25	2.68	3.32	3.72	4.16
ABOVE	1.38	1.85	2.18	2.67	3.08	3.35	1.58	2.18	2.65	3.3	3.7	4.16
AGUILA	1.38	1.85	2.18	2.66	3.12	3.34	1.6	2.23	2.7	3.32	3.72	4.17
	1.42	1.91	2.26	2.69	3.06	3.42	1.59	2.46	2.9	3.5	3.85	4.38
	1.38	1.87	2.2	2.68	3.01	3.38	1.54	2.3	2.7	3.38	3.78	4.19
	1.36	1.84	2.18	2.67	3.02	3.35	1.56	2.18	2.66	3.3	3.7	4.16
	1.34	1.83	2.17	2.65	2.92	3.33	1.63	2.15	2.62	3.28	3.68	4.13
	1.36	1.83	2.16	2.65	3.05	3.33	1.9	2.2	2.68	3.27	3.7	4.14
	1.36	1.85	2.18	2.66	2.99	3.36	1.6	2.22	2.68	3.33	3.62	4.18
	1.32	1.82	2.15	2.64	2.99	3.33	1.55	2.15	2.62	3.25	3.6	4.13
	1.3	1.8	2.12	2.62	3.05	3.3	1.52	2.1	2.55	3.2	3.75	4.11
	1.34	1.83	2.16	2.63	2.99	3.34	1.55	2.16	2.63	3.25	3.6	4.13
	1.32	1.8	2.13	2.62	2.98	3.36	1.52	2.2	2.62	3.25	3.55	4.16
	1.28	1.75	2.1	2.58	3.03	3.28	1.48	2.05	2.45	3.15	3.7	3.96
	1.33	1.81	2.18	2.65	3.00	3.4	1.59	2.15	2.61	3.22	3.6	4.12
17	1.38	1.86	2.16	2.68	3.0	3.4	1.62	2.25	2.62	3.4	3.8	4.22
	Σ=23.13	Σ31.32	37.00	45.23	51.51	57.19	27.52	37.83	45.47	56.32	63.07	71.15
M	1.36	1.84	2.18	2.66	3.03	3.36	1.62	2.23	2.67	3.31	3.71	4.19
B	1.28	1.75	2.08	2.6	2.98	3.28	1.48	2.1	2.45	3.18	3.55	3.95
NORTHSIDE	1.36	1.95	2.22	2.82	3.03	3.45	1.52	2.25	2.63	3.45	3.9	4.3
OF	1.25	1.82	2.12	2.6	2.98	3.28	1.65	2.18	2.53	3.18	3.58	4.05
MCMULLEN	1.42	1.85	2.18	2.66	3.0	3.34	1.6	2.22	2.6	3.2	3.58	4.1
VALLEY	1.32	1.78	2.12	2.55	2.97	3.25	1.53	2.16	2.54	3.18	3.58	3.95
	1.38	1.82	2.23	2.8	3.05	3.45	1.58	2.2	2.62	3.3	3.9	4.3
	1.32	1.86	2.18	2.68	3.0	3.33	1.65	2.2	2.59	3.3	3.68	4.1
	1.37	1.82	2.12	2.7	3.03	3.42	1.65	2.2	2.61	3.45	3.85	4.25
	1.35	1.83	2.14	2.62	3.0	3.39	1.58	2.22	2.6	3.38	3.78	4.18
	1.32	1.8	2.16	2.63	2.94	3.34	1.55	2.16	2.57	3.24	3.70	4.14
10	Σ13.37	18.28	21.55	26.70	29.98	33.53	15.79	21.89	25.74	32.86	37.10	41.32
M	1.34	1.83	2.16	2.67	3.00	3.35	1.58	2.19	2.57	3.29	3.71	4.13
C	1.32	1.82	2.15	2.65	3.0	3.3	1.52	2.16	2.6	3.2	3.6	4.0
SOUTH SIDE	1.32	1.8	2.1	2.6	2.99	3.28	1.50	2.1	2.55	3.15	3.56	3.95
OF	1.33	1.9	2.22	2.82	3.2	3.6	1.80	2.4	2.85	3.45	3.85	4.2
MCMULLEN	1.34	1.8	2.18	2.65	3.0	3.32	1.60	2.19	2.6	3.21	3.7	4.1

ARIZONA HARQUAHALA VALLEY WATERSHED

R McArthur 8/26/83

DETERMINATION OF AVERAGE POINT PRECIPITATION 2/2

CENTENNIAL WASH

SOURCE: NOAA ATLAS 2 Vol. VIII Arizona Precip-Frequency Atlas of the Western U.S.

PART OF D.A.	GRID VALUES OF PRECIP & MEAN COMPUTATIONS											
	6 HR DURATION						24 HR DURATION					
	2 YR	5 YR	10 YR	25 YR	50 YR	100 YR	2 YR	5 YR	10 YR	25 YR	50 YR	100 YR
D	1.33	1.86	2.19	2.69	3.1	3.39	1.58	2.19	2.7	3.35	3.78	4.18
N W PART OF	1.30	1.8	2.18	2.68	3.0	3.38	1.55	2.17	2.63	3.32	3.78	4.18
HARQUAHALA	1.34	1.9	2.2	2.8	3.18	3.5	1.6	2.4	2.75	3.4	3.8	4.25
VALLEY	1.31	1.82	2.18	2.69	3.1	3.38	1.54	2.15	2.63	3.35	3.78	4.19
INCLUDE	1.28	1.78	2.16	2.67	2.99	3.37	1.48	2.12	2.68	3.28	3.73	4.17
TIGER	1.25	1.75	2.14	2.64	2.92	3.35	1.47	2.11	2.57	3.25	3.7	4.14
WASH	1.23	1.73	2.12	2.63	2.94	3.33	1.46	2.12	2.55	3.21	3.68	4.15
	1.3	1.83	2.18	2.7	3.1	3.4	1.59	2.2	2.6	3.3	3.67	4.13
	1.26	1.78	2.14	2.65	2.99	3.35	1.49	2.11	2.57	3.19	3.78	4.19
	1.29	1.73	2.12	2.62	2.95	3.33	1.46	2.09	2.54	3.18	3.7	4.16
	1.23	1.81	2.19	2.7	3.05	3.38	1.6	2.2	2.62	3.29	3.68	4.13
	1.23	1.76	2.13	2.63	2.96	3.33	1.47	2.09	2.56	3.18	3.72	4.19
12 Σ	15.35	21.55	25.93	32.10	36.32	40.49	18.29	25.95	31.30	39.30	44.90	50.06
M	1.28	1.80	2.16	2.68	3.03	3.37	1.52	2.16	2.61	3.28	3.74	4.17
E	1.28	1.74	2.12	2.62	2.95	3.32	1.47	2.12	2.54	3.18	3.64	4.12
W PART	1.27	1.71	2.12	2.58	2.95	3.33	1.43	2.04	2.54	3.22	3.63	4.15
OF	1.23	1.72	2.1	2.64	2.91	3.3	1.48	2.09	2.52	3.1	3.62	4.13
HARQUAHALA	1.25	1.75	2.09	2.57	2.93	3.31	1.48	2.13	2.53	3.1	3.68	4.12
VALLEY	1.25	1.76	2.12	2.6	2.92	3.31	1.52	2.12	2.53	3.15	3.61	4.12
ABOVE LEVEE LOCATION												
5 Σ	6.23	8.68	10.55	13.01	14.66	16.57	7.38	10.50	12.66	15.75	18.18	20.64
M	1.25	1.74	2.11	2.60	2.93	3.31	1.48	2.10	2.53	3.15	3.64	4.13
ENTIRE AREA												
50 Σ	66.04	90.79	107.98	132.98	150.59	167.96	78.53	109.34	130.91	163.84	185.36	207.55
M	1.32	1.82	2.16	2.66	3.01	3.36	1.57	2.19	2.62	3.28	3.71	4.15

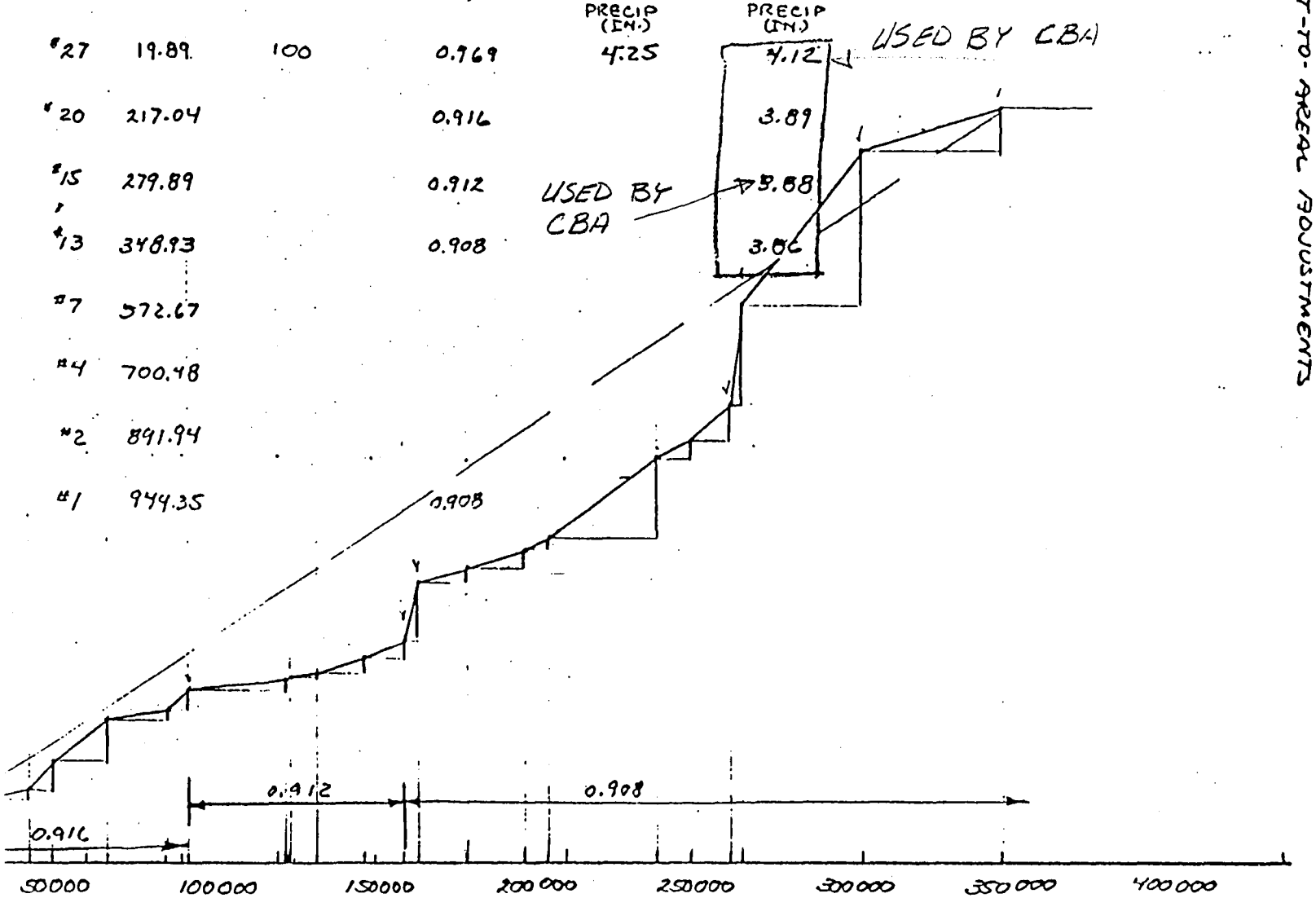
ARIZONA HARQUAHALA VALLEY WATERSHED

R. McARTHUR 8/29/82

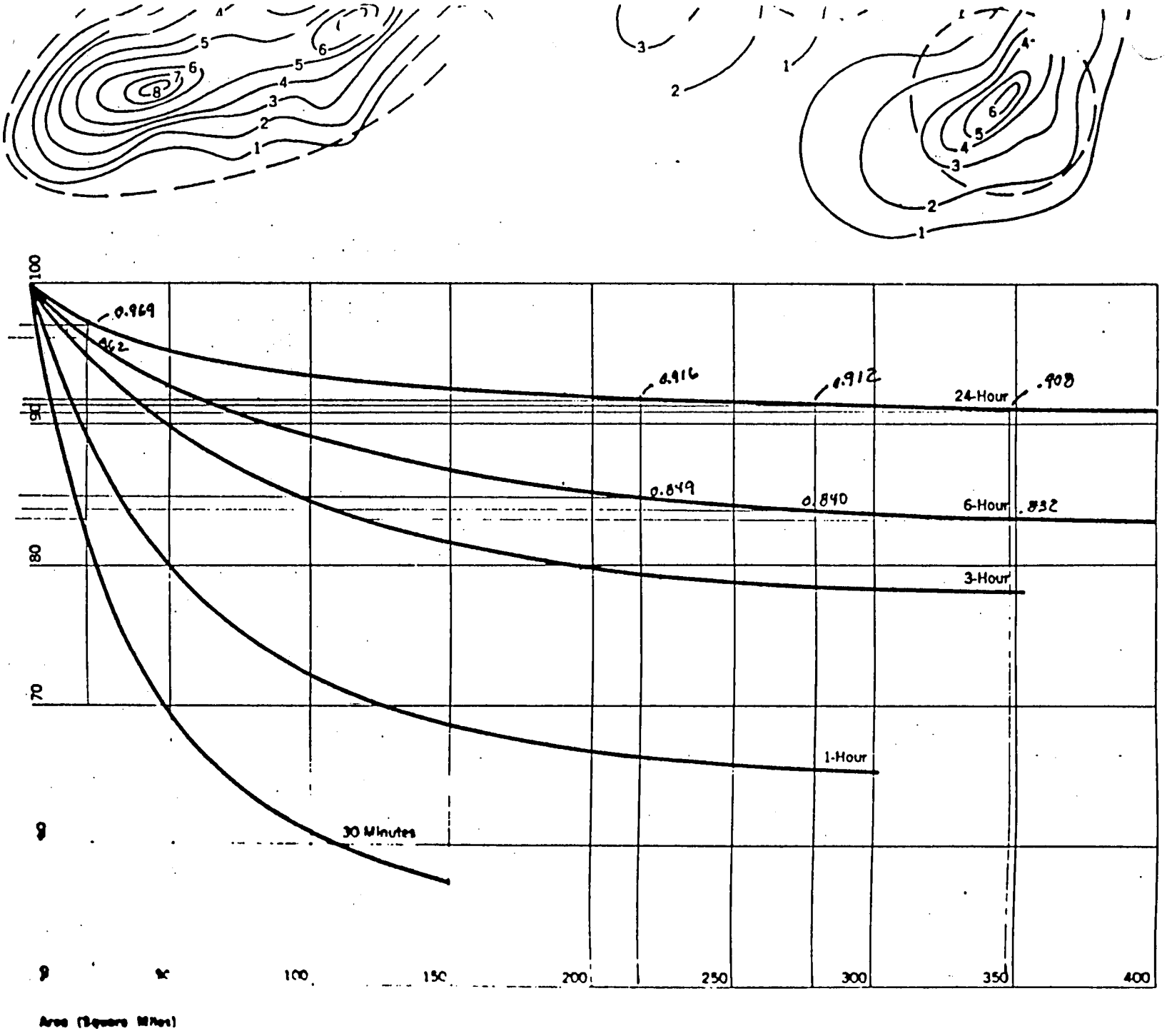
DERIVATION OF DRAINAGE AREAS TO USE FOR POINT-TO-AREAL ADJUSTMENTS

24 HOUR DURATION

	ACCUM. DRAINAGE AREA	FREQUENCY	POINT/AREA	POINT PRECIP (IN.)	AREAL PRECIP (IN.)
#27	19.89	100	0.969	4.25	4.12
#20	217.04		0.916		3.89
#15	279.89		0.912		3.88
#13	348.93		0.908		3.86
#7	572.67				
#4	700.48				
#2	891.94				
#1	944.35		0.908		



DISTANCE ALONG CENTENNIAL WASH FROM PROPOSED LEVEE LOCATION UPSTREAM


24-Hour
6-Hour
3-Hour
1-Hour
30 Minutes
0.969
0.962
0.916
0.912
0.908
0.849
0.840
0.832
100
90
80
70
100
150
200
250
300
350
400
Area (Square Miles)