CELLA BARR ASSOCIATES

HYDROLOGIC ANALYSIS OF THE WATERMAN WASH IN MARICOPA COUNTY, ARIZONA

FOR

MARICOPA COUNTY FLOOD INSURANCE STUDY
FEDERAL EMERGENCY MANAGEMENT AGENCY

Revised
September 1, 1988
CBA File No. 04856-04-74
SA-158
FEMA Contract No. EMW-88-R-2603

Prepared By: James C. Carroll
Shoja Amani
John S. Wise

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September 1, 1988

FLOOD CONTROL DISTRICT
RECEIVED
SEP 0 6 1988
DEL HYDRO
ADMIN LMGT
FINANCE FILE
AMH
PAC

Mr. Joe Tram
Floodplain Management Supervisor
Flood Control District of Maricopa County
3335 West Durango Street
Phoenix, Arizona 85009

Re: **Flood Insurance Study - Waterman Wash**
CBA File No. 04856-04-74

Dear Mr. Tram:

We have received comments from several agencies, including the Flood Control District of Maricopa County, Soil Conservation Service, U.S. Geological Survey, Arizona Department of Water Resources and U.S. Army Corps of Engineers responding to our hydrologic analysis for Waterman Wash submitted June 16, 1988. The submitted hydrologic analysis presented 100-year discharges proposed for use in the Flood Insurance Study for Waterman Wash in Maricopa County Arizona. Based on our evaluation of the overall input received, it was our opinion that certain modifications were warranted with respect to our HEC-1 analysis that formed the basis for establishing 100-year discharges. The major modifications performed are as follows:

1. The exterior boundary of the watershed and the interior boundaries of the sub-basins were revised.

2. Runoff curve numbers were recomputed using the Soil Conservation Service Technical Release, TR-55.

3. Sub-basins 1, 2 and 7 were further subdivided.

4. Sub-basins 2, 4, 7 and 12 were divided into two parts representing each side of the wash.

5. Channel cross-sections (used in channel routing) were modified to represent a more defined channel with steeper side slopes based on topographic information and field data.

6. Twenty-four hour Type II rainfall distributions were revised to include more detail (15-minute interval steps).

7. The total watershed area has been recomputed and changed in the HEC-1 analysis from 399.4 to 401.6 square miles.

8. Lag time computations were revised and computed according to the methods described in the SCS "National Engineering Handbook, Section 4, Hydrology," Chapter 15.

The net result of these modifications to the HEC-1 program was an increase in the 100-year discharges originally proposed in our June 16, 1988 submittal. The following, revised 100-year discharge values will be adopted for use in the Flood Insurance Study for Waterman Wash:

1.	At the confluence with the West Prong of Waterman Wash	22,400 cfs.
2.	9,000 feet upstream of Rainbow Valley Road	27,200 cfs.
3.	At the confluence with Gila River	31,800 cfs.

Under our contract with the Federal Emergency Management Agency (FEMA), the Study is scheduled to be completed in "draft" form in January or February of 1989. Your timely input with respect to this phase of our Flood Insurance Study for Waterman Wash has been greatly appreciated.

Sincerely,

CELLA BARR ASSOCIATES

James C Carroll for S.A.

Shoja Amani
Project Hydrologist

SA-159:lkb

Enclosure

c: James Nelson, CBA
John Wise, CBA

Talked to JMR, the new T_{Lags} appear O.k. to him too, so we will leave them as is. Called Shoja This A.M., told him not to change the T_{Lags}. (except for Sub-4)

Amir. 10/4/88

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INTRODUCTION

Cella Barr Associates (CBA) has been contracted by the Federal Emergency Management Agency (FEMA) to perform a detailed Flood Insurance Study of the Waterman Wash in Maricopa County, Arizona. As shown on Figure 1, the study reach to be investigated extends for approximately 15.6 miles from the confluence of Waterman Wash with its West Prong north of the Maricopa County Line to the confluence with the Gila River. The confluence of the Gila River and Waterman Wash lies approximately 25 miles southwest of Phoenix, Arizona near Buckeye.

The purpose of this investigation is to estimate 100-year peak discharges at specific locations within the Waterman Wash watershed. These discharges will be used in the Waterman Wash Flood Insurance Study and are to be employed in determining water surface elevations and floodway boundaries within the limits of the study reach. Based on criteria provided by FEMA, the hydraulic calculations for this study will be limited to the 100-year storm event.

WATERSHED DESCRIPTION

The Waterman Wash headwaters in the Maricopa Mountains east of Gila Bend, Arizona, approximately 45 miles southwest of Phoenix. As indicated on Figure 2, the subject basin is bounded on the southwest by the Maricopa Mountains and on the northeast by the Sierra Estrella and Palo Verde Mountains. The Waterman Wash in this vicinity flows in a northwesterly direction, through the Mobile and Rainbow Valleys.

Runoff generated within the estimated 401.6-square mile Waterman Drainage Basin tends to flow in a northwesterly direction and encompasses portions of both Maricopa and Pinal Counties. Mobile is the only community with some isolated, private residential properties which is located within the Waterman Wash watershed.

The Waterman Wash Drainage Basin is elliptical in shape, with a total basin length of approximately 37 miles and a maximum basin width of about 20 miles. The subject watershed is characterized by mountains of moderate elevation along the entire perimeter of the basin.

In the lower portion of the watershed, downstream of the confluence with West Prong, the natural channel is wide (approximately 100 to 150 feet) and well incised with a relatively clean, sandy bottom. Heavy growth of native vegetation, especially salt cedar, covers the primary channel banks and isolated sand bars within the channel. The channel slope in the lower portion is approximately 0.29 percent. Portions of the Waterman Wash channel have been altered from its natural condition by local farmers who have been excavating and widening the natural channel and building earthen dikes along the channel to protect their farms from flooding. Although this channel widening and construction of dikes may provide some protection during low flow events, they are not effective during major storm events such as the 100-year flood.

The physical characteristics of the channel differs for the upper reaches of the watershed where alluvial fans originate (upstream of the confluence with West Prong). The stream channels of the alluvial fan regions are generally poorly defined and highly braided. The channels of the upper Waterman Wash drainage basin are characterized by numerous poorly defined, highly dynamic, braided washes having no clearly defined dominant channel over the majority of the watershed. The channels do not have the capacity to convey the major flows, and large areas of the alluvial fans are susceptible to shallow sheet flooding with depths of flow of approximately one foot. The runoff rates derived from the watershed attenuate significantly as sheet flow passes downstream across the alluvial fan. Channel slopes range from about 0.77 percent to 2.6 percent. Moderate to heavy growth of native vegetation covers the overbanks. Channels are narrow (approximately ten to twenty feet wide) and are generally clean with sandy bottoms.

There are five major soil association types within the Waterman Wash drainage basin: Cherioni-Rock outcrop, Antho-Valencia, Muhall-Leveen, Gilman-Estrella-Avendale and Leveen-Coolidge. Four of the soil associations are of hydrologic soil group B and one is of hydrologic soil group D, as defined below:

> The 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 Waterman Wash drainage basin. Approximately ten (10) to twenty (20) percent of the study area is comprised of soil group D.
>
> The other four soil associations, comprising about eighty (80) to ninety (90) percent of the study area, are found in the alluvial fan and valley plains. These soils, of 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.

This hydrologic cover type is typical of lower elevations and low annual precipitation. Some irrigated farmlands are located in the lower portion of the study area along the wash. A 30 percent vegetation cover density was chosen to represent average conditions in the Waterman Wash drainage basin.

The study area is situated in a semi-arid climatic zone characterized by hot summers, lasting from May to September, during which maximum daily temperatures average more than 90°F (33°C). Winters are mild, 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 is between six (6) and nine (9) inches. 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. The third season, from late summer to fall, is characterized by rain delivered through tropical thunderstorms arising in the Pacific.

Developed portions of the watershed consist of some low intensity/irrigated farming, range land and local roadways. Structural features within the watershed include the Southern Pacific Railroad, El Paso natural gas pipeline, farmland flood dikes, stock tanks, spreading dikes and minor roadways. At the present time, there are no major flood control structures functioning in the Waterman Wash Drainage Basin.

AVAILABLE INFORMATION

Research for the preparation of this report yielded no previous Flood Insurance Studies for the study reach of Waterman Wash.

The U.S. Geological Survey has maintained 22 years of recorded data for a crest-stage gauging station (No. 95142) on the Waterman Wash from 1964 through 1985. The station is located 2.4 miles above the mouth of the wash, approximately 5.2 miles southeast of Buckeye. CBA utilized this information to estimate a 100-year peak discharge at the above-referenced location based on the U.S. Army Corps of Engineers "Flood Flow Frequency" analysis, the results of which are presented later in this report.

The U.S.G.S. has estimated peak discharges for Waterman Wash in the publication entitled "Methods for Estimating the Magnitude and Frequency of Floods in Arizona" prepared for the Arizona Department of Transportation (A.D.O.T.). A discussion of this data is contained in the results section of this report.

HYDROLOGIC ANALYSIS

For the purpose of this study, the U.S. Army Corps of Engineers "HEC-1" computer program (1981) was utilized to determine the estimated 100-year peak discharge along the study reach of the Waterman Wash.

The methodology employed for the selection of input parameters for the HEC-1 program is presented in the following text:

Drainage Basins

The Waterman Wash Drainage Basin was delineated using U.S. Geological Survey Quadrangle Maps, aerial photography and field investigation.

Drainage basin boundaries were determined and basin areas were estimated with the use of a manual planimeter. The Waterman Wash watershed has been divided into eighteen sub-basins ranging in size from 4.95 to 42.46 square miles. The exterior watershed boundary and interior sub-basin boundaries were delineated utilizing the U.S.G.S. topographic map 7-1/2-minute series (1 = 24,000). Sub-basin areas, elevations, watercourse lengths and other pertinent information were determined from these maps. Due to the relatively large composite size, the 7-1/2-minute composite series map was not included with this report. A large scale map (1 inch = 62,000 inches) is attached as Figure 2 to indicate the Waterman Wash drainage basin divisions as coded in the HEC-1 computer model. Table 1 provides a summary of the estimated basin areas.

Curve Numbers

As determined through field investigation, a generally uniform vegetative cover of Desert Brush extends throughout the Waterman Wash watershed with a cover density of approximately 30 percent.

The determination of hydrologic soil groups was performed with the use of the Soil Conservation Service General Soils Maps for Maricopa County.

Based on the soil type (10% D and 90% B), vegetation type (desert brush) and vegetation cover density of 30%, weighted curve numbers were then determined according to the method presented in the publication entitled "Urban Hydrology for Small Watersheds" (Reference 10). Table 1 presents the computed curve numbers as utilized for the HEC-1 analysis.

Precipitation

The 100-year, 24-hour rainfall value was computed using precipitation data from the "NOAA ATLAS 2, Precipitation - Frequency Atlas of the Western United States, Volume VIII, Arizona". This procedure resulted in an average precipitation value of 4.4 inches for the 100-year, 24-hour storm. Applying an aerial reduction factor of 0.905 (Reference 5), a precipitation value of 3.98 inches was determined. The results are presented in Table 1.

Lag Time

As described in the SCS "National Engineering Handbook, Section 4, Hydrology", Chapter 15, 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

The stream channel program option of the HEC-1 Model utilizes cross-sections and normal depth computations to route computed storm runoff hydrographs through prescribed reaches of Waterman Wash. Channel cross-sections were taken from topographic mapping of the study area developed for the future HEC-2 modeling task, (1 in. = 400 ft.; C.I. = 4 ft., McLain Harbers Co., Inc., 1988). Approximate field cross-sections, as developed by a CBA reconnaissance crew, were used in instances where detailed topographic information was not available.

RESULTS

The intent of this investigation is to determine 100-year peak discharge values at designated locations along Waterman Wash. These values are to be used for Flood Insurance Study evaluations. Research into the subject indicated that 100-year peak discharges for Waterman Wash have been estimated by the U. S. Geological Survey (USGS). CBA has utilized the U.S. Army Corps of Engineers "Flood Flow Frequency" and "HEC-1" computer models to estimate peak discharges. The following presents a comparison of the results.

The USGS has estimated peak discharges for Waterman Wash in the report "Methods for Estimating the Magnitude and Frequency of Floods in Arizona" prepared for the Arizona Department of Transportation (ADOT). For this report, 12 years of stream gauge record for Waterman Wash near Buckeye was utilized (Gauge No. 09514200) and two methods of analysis were performed. The first, based on a frequency distribution, resulted in a 100-year peak discharge of 11,800 cfs. The second method utilized weighted averages of values from frequency distributions and values from regression equations to estimate a 100-year peak discharge of 16,400 cfs. An additional method presented in the above-referenced report estimates flood magnitudes for ungauged sites based on regional data and regression equations. A 100-year peak discharge of 21,912 cfs for Waterman Wash at the Gila River was estimated by the procedure. Due to the limited gauge data utilized for this report, results are not directly applicable for use in defining 100-year peak discharges for the Waterman Wash. Further, ADOT has recently indicated that information provided in this report should only be used with extreme caution.

why 12 years here & 22 years next pg?

CBA also utilized the method presented in the publication "Urban Hydrology for Small Watersheds," Soil Conservation Service Technical Release 55 (TR 55), June 1986, to arrive at an estimated 100-year peak discharge of 4,975 cfs for Sub-basin 4 of the Waterman Watershed.

A comparison was then made between the TR-55 results and those produced by the HEC-1 analysis for the same sub-basin. A 100-year peak discharge of 4,040 was determined by the HEC-1 model.

The above analyses were performed only to compare the result of the HEC-1 analysis with other available procedures and methodologies for determining 100-year discharges in Arizona. The results of these analyses are not proposed to be used directly in this study.

The "Flood Flow Frequency" computer model, provided by the U.S. Army Corps of Engineers, was used by CBA to perform a Log-Pearson Type III Statistical Analysis on the twenty-two years of recorded data (USGS Gauge No. 95142). The results of this analysis yielded a 100-year peak discharge of 9,000 cfs. Due to the relatively large size of the drainage area of Waterman Wash (approximately 401.6 square miles), it is our opinion that twenty-two years of available stream flow data is not adequate to determine the 100-year peak discharge for Waterman Wash at the Gila River. Therefore, the results of this analysis are not proposed for use in the current study.

CBA, with direction from the Community and FEMA's Project Officer, has elected to model the Waterman Wash Drainage Basin utilizing the U.S. Army Corps of Engineers HEC-1 computer model. According to the HEC-1 procedure, a 100-year peak discharge of 31,800 cfs was estimated for Waterman Wash at the Gila River. It is the intent of CBA to use the peak discharges determined by the HEC-1 analysis to estimate the 100-year water surface elevations and floodway boundaries for the study reach of Waterman Wash designated for this Flood Insurance Study. Table 2 shows 100-year peak discharges to be utilized in the Flood Insurance Study for specific reaches of Waterman Wash.

There are two (2) major structural features in the Waterman Wash watershed which may effect the magnitude of the 100-year peak discharges along the Waterman Wash.

The first set of features are the flooding dikes, spreading dikes and levees along the lower portion of the Waterman Wash channel. These dikes and levees were constructed of native available material by local farmers in an effort to protect their farms from flooding. This dike system may cause ponding and impede flows conveyed to the main channel of the Waterman Wash, and attenuate the runoff rates derived from the watershed. However, they do not provide flood protection against the 100-year storm event.

Note!

The second group of features are a series of dikes on the south side of the Southern Pacific Railroad and the existence of drainage structures at railroad crossings in the upper watershed. From field observations it appears that some ponding of flows will occur along the south side of the railroad embankment and may cause attenuation of the runoff hydrographs reaching the downstream concentration points. The sub-basin areas which contribute runoff to the railroad embankment are small in nature, compared with the entire Waterman Wash Watershed. The ponding of runoff is primarily the result of the inability of the drainage structures to convey the peak flows under the railroad. Due to the lack of detailed topographic information of the area, stage-discharge and stage-storage relationships could not be established to perform routings of the incoming flows through the railroad drainage system. The HEC-1 hydrologic analysis indicates that the contribution to the downstream peaks from the upstream watershed is minimal.

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The results of the HEC-1 analysis presented in this report, and corresponding 100-year peak discharges in Table 2, are reasonable and acceptable to be used for the purpose of the Waterman Wash Flood Insurance Study in Maricopa County, Arizona.

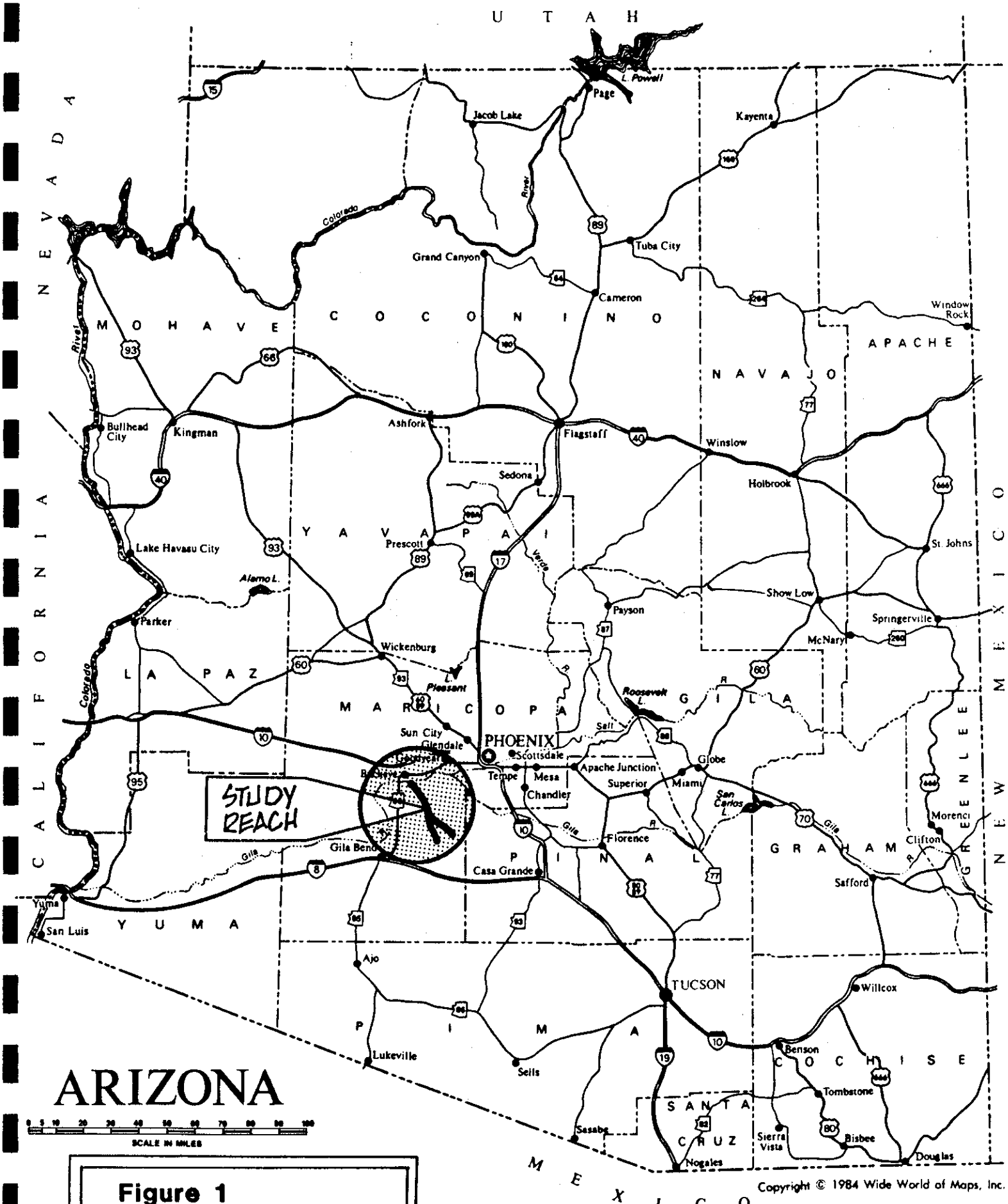

Figure 1

Location Map
WATERMAN WASH

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Tucson, Arizona 85705
(602) 624-7401

File No. 04856-04-74 June 1988

TABLE 1
WATERMAN WASH
HEC-1 PARAMETERS

Drainage Sub-basins	Drainage Area $(MI)^2$	Lag Time (Hrs)	Curve Number	Precipitation (24 hrs-100-yr.) in.
1	34.01	3.65 8.56	79	3.98
2	11.50	2.09 2.20	79	3.98
3	14.30	2.33 3.18	79.8	3.98
4	29.15	4.35 4.95	79.8	3.98
5	12.32	3.10 4.66	78.0	3.98
6	30.35	2.93 3.69	78.0	3.98
7	4.95	1.43 1.35	79.0	3.98
8	23.13	5.10 7.46	78.0	3.98
9	18.29	2.67 3.35	80.5	3.98
10	42.46	2.67 5.31	79.7	3.98
11	25.62	2.59 4.89	78.0	3.98
12	25.25	2.05 4.45	79.4	3.98
13	31.98	4.03 6.37	78	3.98
14	8.88	2.22 2.50	79.0	3.98
15	25.20	2.22 4.30	79.0	3.98
16	24.30	3.00 4.20	79.4	3.98
17	31.50	3.93 6.47	79.4	3.98
18	8.40	1.65 2.44	80.5	3.98

see new info enclosed

TABLE 2
WATERMAN WASH
ESTIMATES OF 100-YEAR
PEAK DISCHARGES

Location along Waterman Wash	D.A. (Sq. Mi.)	100-year Discharge (cfs)
At confluence with the West Prong Concentration Point 6, Figure 2	246.1	22,400
8,000 feet upstream of Rainbow Valley Road Concentration Point 8, Figure 2	337.4	27,200
At confluence with Gila River Concentration Point 10, Figure 2	401.6	31,800

REFERENCES

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

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

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

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

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

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

7. "Methods for Estimating the Magnitude and Frequency of Floods in Arizona," Arizona Department of Transportation, 1978.

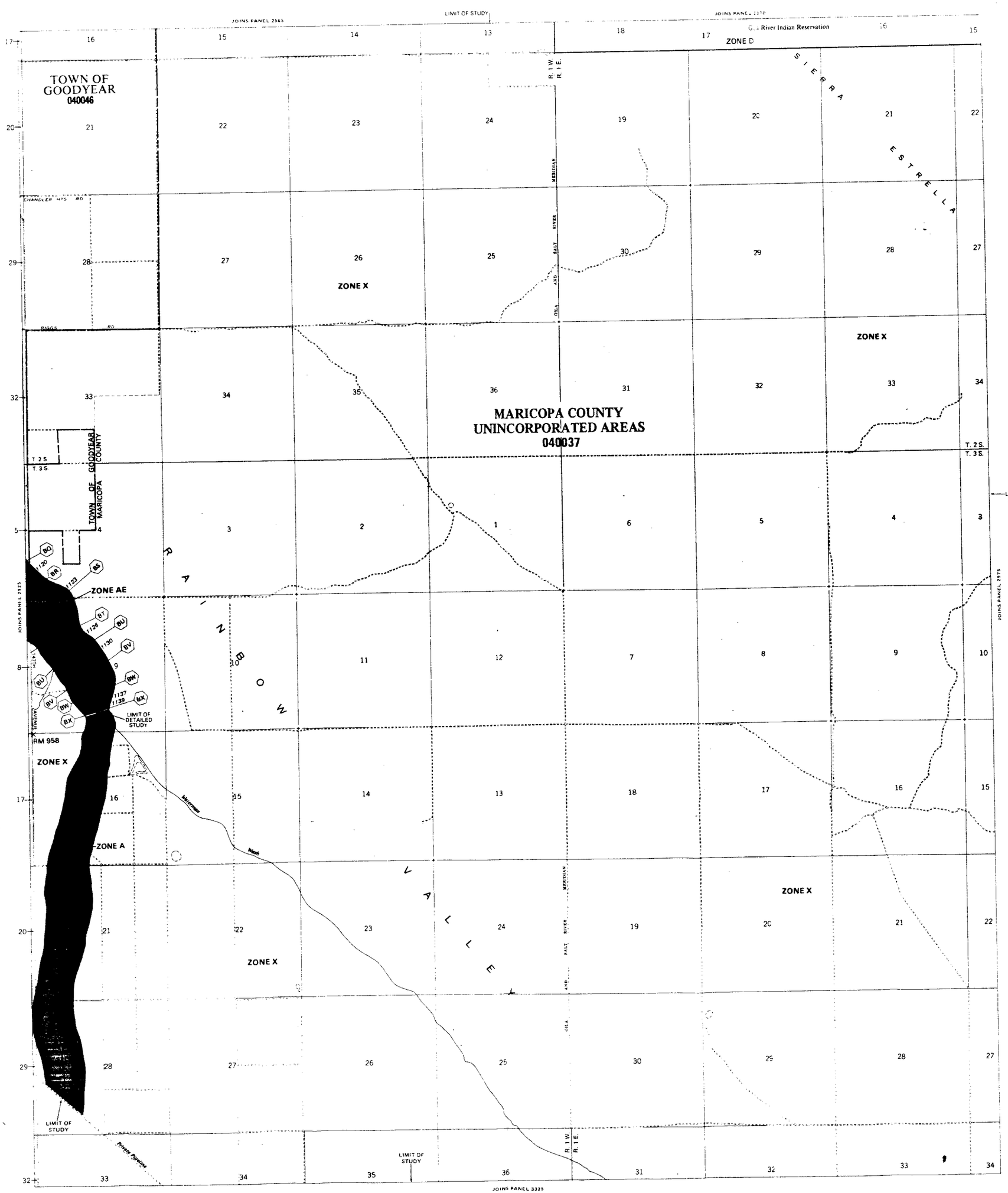
8. "Roughness Characteristics of Natural Channels," U. S. Geological Survey, 1967.

9. "Soil Survey of Maricopa County, Arizona, Central Part," Soil Conservation Service, September 1977.

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

11. "Water Resources Data - Arizona," U. S. Geological Survey Water Report; Water Years, 1964-1981.

12. United States Department of the Interior, Geological Survey; 15 minute series topographic maps (1:24000): Antelope Peak, Avondale, Buckeye, Cotton Center, Estrella Maricopa, Mobile



ELEVATION REFERENCE MARKS

BENCH MARK	ELEVATION (FT. NGVD)	DESCRIPTION AND LOCATION
RM958	[illegible]	[illegible]
RM959	[illegible]	[illegible]

LEGEND

SPECIAL FLOOD HAZARD AREAS INUNDATED BY 100-YEAR FLOOD

- **ZONE A** — No base flood elevations determined.
- **ZONE AE** — Base flood elevations determined.
- **ZONE AH** — Flood depths of 1 to 3 feet (usually areas of ponding); base flood elevations determined.
- **ZONE AO** — Flood depths of 1 to 3 feet (usually sheet flow on sloping terrain); average depths determined. For areas of alluvial fan flooding, velocities also determined.
- **ZONE A99** — To be protected from 100-year flood by Federal flood protection system under construction; no base elevations determined.
- **ZONE V** — Coastal flood with velocity hazard (wave action); no base flood elevations determined.
- **ZONE VE** — Coastal flood with velocity hazard (wave action); base flood elevations determined.

FLOODWAY AREAS IN ZONE AE

OTHER FLOOD AREAS

- **ZONE X** — Areas of 500-year flood; areas of 100-year flood with average depths of less than 1 foot or with drainage areas less than 1 square mile; and areas protected by levees from 100-year flood.

OTHER AREAS

- **ZONE X** — Areas determined to be outside 500-year flood plain.
- **ZONE D** — Areas in which flood hazards are undetermined.

Flood Boundary

Floodway Boundary

Zone D Boundary

Boundary Dividing Special Flood Hazard Zones, and Boundary Dividing Areas of Different Coastal Base Flood Elevations Within Special Flood Hazard Zones.

513 — Base Flood Elevation Line; Elevation in Feet*

D — D — Cross Section Line

(EL 987) — Base Flood Elevation in Feet Where Uniform Within Zone*

RM7X — Elevation Reference Mark

*Referenced to the National Geodetic Vertical Datum of 1929

NOTES

This map is for use in administering the National Flood Insurance Program. It does not necessarily identify all areas subject to flooding, particularly from local drainage sources of small size, or all planimetric features outside Special Flood Hazard Areas.

Areas of special flood hazard (100-year flood) include Zones A, A1-30, AE, AH, AO, A99, V, V1-30 AND VE.

Certain areas not in Special Flood Hazard Areas may be protected by flood control structures.

Boundaries of the floodways were computed at cross sections and interpolated between cross sections. The floodways were based on hydraulic considerations with regard to requirements of the Federal Emergency Management Agency.

Floodway widths in some areas may be too narrow to show to scale. Floodway widths are provided in the Flood Insurance Study Report.

Coastal base flood elevations apply only landward of the shoreline.

Corporate limits shown are current as of the date of this map. The user should contact appropriate community officials to determine if corporate limits have changed subsequent to the issuance of the map.

For community map revision history prior to countywide mapping, see Section 6.0 of the Flood Insurance Study Report.

For adjoining map panels see separately printed Map Index.

MAP REPOSITORY

Refer to Repository Listing on Index Map

EFFECTIVE DATE OF COUNTYWIDE FLOOD INSURANCE RATE MAP:

APRIL 15, 1988

EFFECTIVE DATE (S) OF REVISION (S) TO THIS PANEL

Map revised September 4, 1991 to update corporate limits, to change base flood elevations, to add base flood elevations, to add special flood hazard areas, to change special flood hazard areas, to change zone designations, to update map format, to add roads and road names and to incorporate previously issued letter of map revision.

To determine if flood insurance is available, contact an insurance agent or call the National Flood Insurance Program at (800) 638-6620.

N

APPROXIMATE SCALE IN FEET

2000 0 2000

NATIONAL FLOOD INSURANCE PROGRAM

FIRM
FLOOD INSURANCE RATE MAP

MARICOPA COUNTY, ARIZONA AND INCORPORATED AREAS

PANEL 2950 OF 4350

CONTAINS

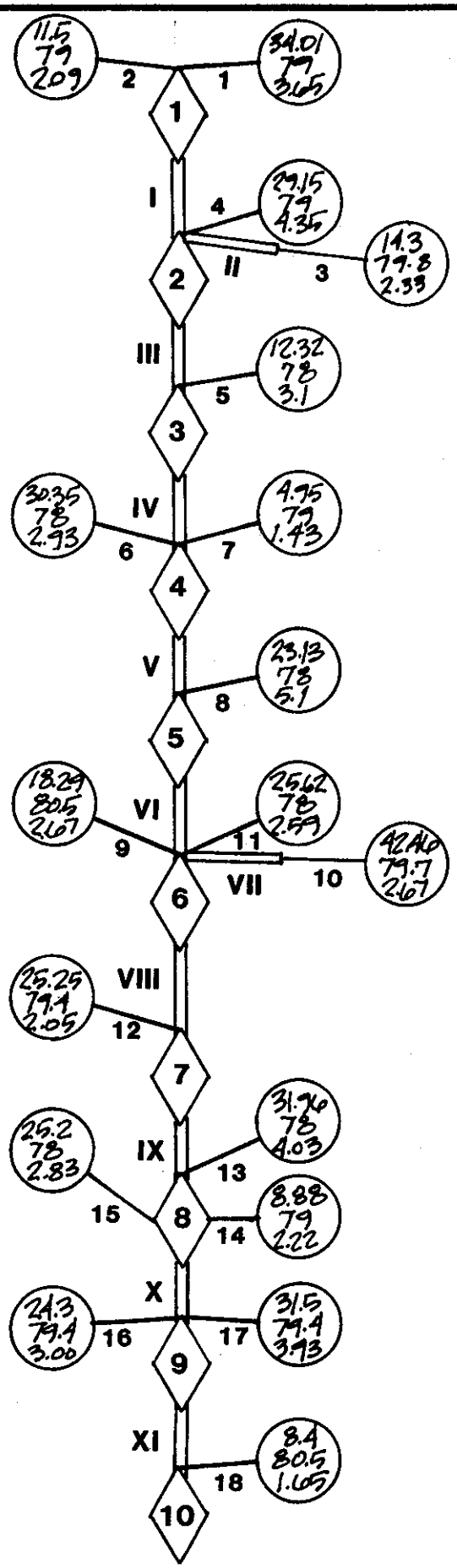
COMMUNITY	NUMBER	PANEL	SUFFIX
MARICOPA COUNTY, UNINCORPORATED AREAS	040037	2950	E
TOWN OF GOODYEAR	040046	2950	E

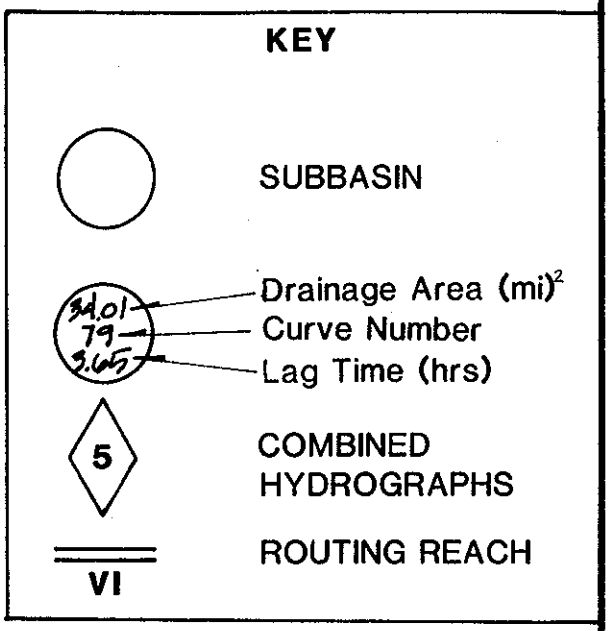
MAP NUMBER
04013C2950 E

MAP REVISED:
SEPTEMBER 4, 1991

Federal Emergency Management Agency

APPENDIX





Waterman Wash

SCHEMATIC OF THE BASIN LOGIC USED IN HEC-1

JOB NO. 04856-04-74 AUGUST 1988

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

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1****************************************
*                                      *
*   FLOOD HYDROGRAPH PACKAGE  (HEC-1)  *
*            FEBRUARY 1981             *
*          REVISED 30 OCT 81           *
*                                      *
*RUN DATE WED, AUG 31 1988 TIME 14:48:09*
*                                      *
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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  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       WATERMAN WASH HEC 1 ANALYSIS [FILE WWHEC1H]
   3          ID       MODIFIED RAINFALL AND 15 MIN. R.C.T.
   4          ID       WIDE, NATURAL REACH AND HEC2 CROSS-SECTIONS
   5          ID       HEC2 "N" VALUES
   6          ID       CBA JOB# 04856-04-74, AUGUST 25,1988
   7          IT     30 14JUN88    1200     150
   8          IO      3       0
   9          IN     15 14JUN88    1200

  10          KK   SUB 1
  11          KM   RUNOFF FROM SUBBASIN 1
  12          KM   SCS DIMENSIONLESS UNIT HYDROGRAPH
  13          KM   LAGT = HYDRAULIC LENGTH, AVE. WATERSHED SLOPE AND ROUGHNESS COEFFICIENT
  14          KM   RAINFALL DISTRIBUTION SCS TYPE II
  15          BA    34.01
  16          PB    3.98
  17          PC       0   0.002   0.005   0.008   0.011   0.014   0.017   0.020   0.023   0.026
  18          PC   0.029   0.032   0.035   0.038   0.041   0.044   0.048   0.052   0.056   0.060
  19          PC   0.064   0.068   0.072   0.076   0.080   0.085   0.090   0.095   0.100   0.105
  20          PC   0.110   0.115   0.120   0.126   0.133   0.140   0.147   0.155   0.163   0.172
  21          PC   0.181   0.191   0.203   0.218   0.236   0.257   0.283   0.387   0.663   0.707
  22          PC   0.735   0.758   0.776   0.791   0.804   0.815   0.825   0.834   0.842   0.849
  23          PC   0.856   0.863   0.869   0.875   0.881   0.887   0.893   0.898   0.903   0.908
```

make sure hyd. not truncated!

checked OK

```
24        PC   0.913   0.918   0.922   0.926   0.930   0.934   0.938   0.942   0.946   0.950
25        PC   0.953   0.956   0.959   0.962   0.965   0.968   0.971   0.974   0.977   0.980
26        PC   0.983   0.986   0.989   0.992   0.995   0.998   1.000
27        LS             79
28        UD    8.56
```

(2 ft/sec)

```
29        KK       1 ROUTE HYDROGRAPH ONE THROUGH REACH ONE
30        RS       1    FLOW      -1
31        RC   0.045   0.030   0.045   18500  0.0039
32        RX       0       5     105     113     124     132     232     237
33        RY    1267    1265    1264    1260    1260    1264    1265    1267

34        KK   SUB 2
35        KM   RUNOFF FROM SUBBASIN 2
36        BA    11.5
37        LS             79
38        UD    2.20
```

2.2 ft/sec

```
39        KK       1 COMBINE 1 AND 2
40        HC       2

41        KK   SUB 3
42        KM   RUNOFF FROM SUBBASIN 3
43        BA    14.3
44        LS           79.8
45        UD    3.18
```

2.3 ft/sec

why 3 & 4 have the same curve #'s?

```
1                                   HEC-1 INPUT                                    PAGE  2

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

46        KK       2 ROUTE HYDROGRAPH 3 THROUGH REACH 2
47        RS       1    FLOW      -1
48        RC   0.045   0.030   0.045   11600  0.0071
49        RX       0    1000    1600    1620    1650    1670    2200    2650
50        RY    1230    1229    1225    1220    1220    1225    1229    1230
```

why Reach 2, should go through 4, ~40,000 ft reach length!

```
51        KK   SUB 4
52        KM   RUNOFF FROM SUBBASIN 4
53        BA   29.15
54        LS           79.8
55        UD    4.95
```

(4 ft/sec)

```
56        KK       2 COMBINE THREE HYDROGRAPHS 1-2 WITH 3 AND 4
57        HC       3

58        KK       3 ROUTE HYDROGRAPHS 1-4 THROUGH REACH 3
59        RS       1    FLOW      -1
60        RC   0.050   0.035   0.045   44900  0.0017
61        RX    1300    1400    1600    1620    1650    1670    1820    1920
62        RY    1230    1229    1225    1220    1220    1225    1229    1230
```

This should have been up here

```
63        KK    SUB 5
64        KM   RUNOFF FROM SUBBASIN 5
65        BA   12.32
66        LS             78
67        UD    4.60
```

3 ft/sec

```
 68          KK      3 COMBINE TWO HYDROGRAPHS 1-4 WITH 5
 69          HC      2

 70          KK      4 ROUTE HYDROGRAPHS 1-5 THROUGH REACH 4 ✓
 71          RS      1    FLOW      -1
 72          RC  0.045   0.030   0.045    9500  0.0021
 73          RX      0    1000    1600    1620    1650    1670    2200    2650
 74          RY   1211    1210    1206    1200    1200    1206    1210    1211

 75          KK  SUB 6
 76          KM  RUNOFF FROM SUBBASIN 6
 77          BA  30.35
 78          LS          78   why the name as sub 5 ?
 79          UD   3.69  (4 ft/sec)

 80          KK  SUB 7
 81          KM  RUNOFF FROM SUBBASIN 7
 82          BA   4.95
 83          LS          79
 84          UD   1.35  (3 ft/sec)

 85          KK      4 COMBINE THREE HYDROGRAPHS 1-5 WITH 6 AND 7
 86          HC      3
```



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

 87          KK      5 ROUTE HYDROGRAPHS 1-7 THROUGH REACH 5 ✓
 88          RS      1    FLOW      -1
 89          RC  0.045   0.030   0.050   11600  0.0026
 90          RX      0    1000    1600    1620    1650    1670    2200    2650
 91          RY   1172    1171    1167    1160    1160    1167    1171    1172

 92          KK  SUB 8
 93          KM  RUNOFF FROM SUBBASIN 8
 94          BA  23.13
 95          LS          78
 96          UD   7.40  (3 ft/sec)

 97          KK      5 COMBINE TWO HYDROGRAPHS 1-7 WITH 8
 98          HC      2

 99          KK      6 ROUTE HYDROGRAPHS 1-8 THROUGH REACH 6 ✓
100          RS      1    FLOW      -1
101          RC  0.045   0.030   0.045    9500  0.0021
102          RX      0    1010    1590    1610    1640    1660    1890    2650
103          RY   1145    1144    1140    1133    1133    1140    1144    1145

104          KK  SUB 9
105          KM  RUNOFF FROM SUBBASIN 9
106          BA  18.29
107          LS          80.5
108          UD   3.35

109          KK      6 COMBINE TWO HYDROGRAPHS 1-8 WITH 9
110          HC      2
```

```
111        KK   SUB10
112        KM   RUNOFF FROM SUBBASIN 10
113        BA   42.46
114        LS           79.8
115        UD    5.31

116        KK       7 ROUTE HYDROGRAPH 10 THROUGH REACH # ||
117        RS       1    FLOW      -1
118        RC   0.045   0.030   0.045   39600  0.0051
119        RX       0      50      70     120     200     220     235     390
120        RY    1156    1152    1148    1146    1146    1148    1152    1156

121        KK   SUB11
122        KM   RUNOFF FROM SUBBASIN 11
123        BA   25.62
124        LS           79.8
125        UD    4.89

126        KK       6 COMBINE THREE HYDROGRAPHS 1-9 WITH 10 AND 11
127        HC       3
```



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

128        KK       8 ROUTE HYDROGRAPHS 1-11 THROUGH REACH 8
129        RS       1    FLOW  -1
130        RC   0.037   0.028   0.039    9500  0.0045
131        RX    2767    3206    4047    4063    4115    4137    4339    4747
132        RY    1115    1114    1114    1103    1103    1111    1112    1114

133        KK   SUB12
134        KM   RUNOFF FROM SUBBASIN 12
135        BA   25.25
136        LS           79.4
137        UD    4.45
```

3 Pine

```
138        KK       7 COMBINE 2 HYDROGRAPHS 1-11 WITH 14 AND 12
139        HC       2

140        KK       9 ROUTE HYDROGRAPHS 1-12 THROUGH REACH 9
141        RS       1    FLOW      -1
142        RC   0.037   0.028   0.037   22200  0.0027
143        RX    1772    3567    3599    3653    3681    3841    5268    5297
144        RY    1066    1065    1057    1057    1066    1065    1065    1067

145        KK   SUB13
146        KM   RUNOFF FROM SUBBASIN 13
147        BA   31.96
148        LS            78
149        UD    6.37

150        KK   SUB14
151        KM   RUNOFF FROM SUBBASIN 14
152        BA    8.88
153        LS            79
154        UD    2.50
```

```
155          KK      8 COMBINE THREE HYDROGRAPHS 1-12 WITH 13 AND 14
156          HC      3

157          KK   SUB15
158          KM   RUNOFF FROM SUBBASIN 15
159          BA    25.2
160          LS            78
161          UD    4.30

162          KK      9 COMBINE TWO HYDROGRAPHS 1-14 WITH 15
163          HC      2

164          KK     10 ROUTE HYDROGRAPHS 1-15 THROUGH REACH 10 ✓
165          RS      1    FLOW      -1
166          RC  0.036   0.032   0.035   29000  0.0028
167          RX   2069    2933    3070    3135    3163    3226    3834    4251
168          RY    995     994     987     988     994     993     993     995
1                                          HEC-1 INPUT                                    PAGE  5

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

169          KK   SUB16
170          KM   RUNOFF FROM SUBBASIN 16
171          BA    24.3
172          LS           79.4
173          UD    4.20

174          KK   SUB17
175          KM   RUNOFF FROM SUBBASIN 17
176          BA   31.5  wrong (missing at least 16 square miles)  22.4
177          LS           79.4
178          UD    6.47

179          KK     10 COMBINE THREE HYDROGRAPHS 1-15 WITH 16 AND 17
180          HC      3

181          KK     11 ROUTE HYDROGRAPHS 1-19 THROUGH REACH 11
182          RS      1    FLOW      -1
183          RC  0.045   0.028   0.040   15800  0.0018
184          RX   2075    2373    2406    2556    2566    2752    3423    3440
185          RY    888     884     879     878     881     883     883     888

186          KK   SUB18
187          KM   RUNOFF FROM SUBBASIN 18
188          BA     8.4
189          LS           80.5
190          UD    2.44

191          KK     11 COMBINE TWO HYDROGRAPHS 1-17 WITH 18
192          HC      2
193          ZZ
1*************************************                    *************************************
*                                   *                    *                                   *
*  FLOOD HYDROGRAPH PACKAGE  (HEC-1) *                    *  U.S. ARMY CORPS OF ENGINEERS     *
*          FEBRUARY 1981            *                    * THE HYDROLOGIC ENGINEERING CENTER *
*        REVISED 30 OCT 81          *                    *        609 SECOND STREET          *
*                                   *                    *      DAVIS, CALIFORNIA 95616      *
```

```
*RUN DATE WED, AUG 31 1988 TIME 14:48:09*                                  * (916) 440-3285 OR (FTS) 448-3285  *
*                                       *                                  *                                   *
*****************************************                                  *************************************
```

MARICOPA CO. FLOOD INSURANCE STUDY
WATERMAN WASH HEC 1 ANALYSIS [FILE WWHEC1H]
MODIFIED RAINFALL AND 15 MIN. R.C.T.
WIDE, NATURAL REACH AND HEC2 CROSS-SECTIONS
HEC2 "N" VALUES
CBA JOB# 04856-04-74, AUGUST 25,1988

```
  8 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     14JUN88  STARTING DATE
                     ITIME       1200  STARTING TIME
                        NQ        150  NUMBER OF HYDROGRAPH ORDINATES
                    NDDATE     17JUN88  ENDING DATE
                    NDTIME       1430  ENDING TIME

                 COMPUTATION INTERVAL    0.50 HOURS
                      TOTAL TIME BASE   74.50 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


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

          *************
          *           *
 10 KK    *    SUB 1  *
          *           *
          *************
                       RUNOFF FROM SUBBASIN 1
                       SCS DIMENSIONLESS UNIT HYDROGRAPH
                       LAGT = HYDRAULIC LENGTH, AVE. WATERSHED SLOPE AND ROUGHNESS COEFFICIENT
                       RAINFALL DISTRIBUTION SCS TYPE II

  9 IN         TIME DATA FOR INPUT TIME SERIES
                     JXMIN         15  TIME INTERVAL IN MINUTES
                    JXDATE     14JUN88  STARTING DATE
                    JXTIME       1200  STARTING TIME
```

SUBBASIN RUNOFF DATA

15 BA SUBBASIN CHARACTERISTICS

TAREA	34.00	SUBBASIN AREA
SNAP	1.00	NORMAL ANNUAL PRECIPITATION

PRECIPITATION DATA

16 PB

STORM	3.98	BASIN TOTAL PRECIPITATION

17 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		

27 LS SCS LOSS RATE

STRTL	0.53	INITIAL ABSTRACTION
CRVNBR	79.00	CURVE NUMBER
RTIMP	0.00	PERCENT IMPERVIOUS AREA

28 UD SCS DIMENSIONLESS UNITGRAPH

TLAG	8.56	LAG

***

UNIT HYDROGRAPH
88 END-OF-PERIOD ORDINATES

32.	74.	148.	232.	327.	445.	572.	739.	915.	1116.
1303.	1472.	1606.	1723.	1791.	1847.	1858.	1861.	1850.	1807.
1743.	1671.	1596.	1511.	1419.	1313.	1196.	1069.	959.	854.
780.	709.	646.	588.	535.	493.	454.	415.	378.	347.
315.	283.	259.	238.	217.	197.	181.	165.	149.	136.
124.	113.	101.	94.	86.	78.	71.	65.	59.	54.
49.	45.	41.	37.	34.	31.	28.	26.	24.	22.
20.	19.	17.	16.	15.	14.	12.	11.	10.	9.
8.	6.	5.	4.	3.	2.	1.	0.		

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

HYDROGRAPH AT STATION SUB 1

TOTAL RAINFALL = 3.98, TOTAL LOSS = 2.03, TOTAL EXCESS = 1.95

	PEAK FLOW (CFS)	TIME (HR)		MAXIMUM AVERAGE FLOW 6-HR	24-HR	72-HR	74.50-HR
+	2998.	21.50	(CFS)	2845.	1684.	593.	573.
			(INCHES)	0.778	1.842	1.947	1.947
			(AC-FT)	1411.	3339.	3531.	3531.

CUMULATIVE AREA = 34.00 SQ MI

*** ***

```
          **************
          *            *
 29 KK    *         1  *      ROUTE HYDROGRAPH ONE THROUGH REACH ONE
          *            *
          **************

             HYDROGRAPH ROUTING DATA

 30 RS         STORAGE ROUTING
                    NSTPS          1  NUMBER OF SUBREACHES
                     ITYP       FLOW  TYPE OF INITIAL CONDITION
                   RSVRIC      -1.00  INITIAL CONDITION
                        X       0.00 WORKING R AND D COEFFICIENT

 31 RC         NORMAL DEPTH CHANNEL ROUTING
                      ANL      0.045  LEFT OVERBANK N-VALUE
                     ANCH      0.030  MAIN CHANNEL N-VALUE
                      ANR      0.045  RIGHT OVERBANK N-VALUE
                    RLNTH      18500.  REACH LENGTH
                      SEL     0.0039  ENERGY SLOPE
                    ELMAX        0.0  MAX. ELEV. FOR STORAGE/OUTFLOW CALCULATION

                                      CROSS-SECTION DATA
                        --- LEFT OVERBANK --- + ------ MAIN CHANNEL ------- + --- RIGHT OVERBANK ---
 33 RY       ELEVATION   1267.00   1265.00   1264.00   1260.00   1260.00   1264.00   1265.00   1267.00
 32 RX       DISTANCE       0.00      5.00    105.00    113.00    124.00    132.00    232.00    237.00

                                                          ***

                                      COMPUTED STORAGE-OUTFLOW-ELEVATION DATA
          STORAGE      0.00      1.84      3.90      6.20      8.73     11.49     14.48     17.70     21.15     24.83
          OUTFLOW      0.00      6.56     21.24     42.71     70.72    105.30    146.57    194.73    249.99    312.60
        ELEVATION   1260.00   1260.37   1260.74   1261.11   1261.47   1261.84   1262.21   1262.58   1262.95   1263.32
          STORAGE     28.74     33.00     44.63     67.80    101.46    137.25    173.32    209.69    246.34    283.28
          OUTFLOW    382.81    463.37    579.70    747.64   1003.13   1355.04   1776.47   2261.37   2805.56   3405.92
        ELEVATION   1263.68   1264.05   1264.42   1264.79   1265.16   1265.53   1265.89   1266.26   1266.63   1267.00

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

  PEAK FLOW     TIME                        MAXIMUM AVERAGE FLOW
                                     6-HR       24-HR       72-HR     74.50-HR
+   (CFS)       (HR)
                          (CFS)
+    2960.     22.50                2805.       1679.        593.         573.
                        (INCHES)   0.767       1.837       1.947        1.947
                         (AC-FT)   1391.       3330.       3531.        3531.

 PEAK STORAGE   TIME                        MAXIMUM AVERAGE STORAGE
                                     6-HR       24-HR       72-HR     74.50-HR
+  (AC-FT)      (HR)
     256.      22.50                 246.        154.         55.          53.

  PEAK STAGE    TIME                        MAXIMUM AVERAGE STAGE
                                     6-HR       24-HR       72-HR     74.50-HR
```

```
+  (FEET)     (HR)
   1266.73    22.50              1266.63     1265.65     1262.42     1262.34

                      CUMULATIVE AREA =   34.00 SQ MI


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

           **************
           *            *
  34 KK    *    SUB 2   *
           *            *
           **************
                         RUNOFF FROM SUBBASIN 2

              SUBBASIN RUNOFF DATA

  36 BA         SUBBASIN CHARACTERISTICS
                     TAREA       11.50  SUBBASIN AREA

                PRECIPITATION DATA

  16 PB              STORM        3.98  BASIN TOTAL PRECIPITATION

  17 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

  37 LS         SCS LOSS RATE
                     STRTL        0.53  INITIAL ABSTRACTION
                    CRVNBR       79.00  CURVE NUMBER
                     RTIMP        0.00  PERCENT IMPERVIOUS AREA

  38 UD         SCS DIMENSIONLESS UNITGRAPH
                      TLAG        2.20  LAG

                                                  ***

                                                UNIT HYDROGRAPH
                                           24 END-OF-PERIOD ORDINATES
              235.      733.     1542.     2132.     2264.     2071.     1705.     1197.      835.      602.
              439.      311.      225.      160.      114.       83.       60.       43.       31.       23.
               17.       12.        7.        2.

     ***            ***            ***            ***            ***
                       HYDROGRAPH AT STATION    SUB 2

      TOTAL RAINFALL =  3.98, TOTAL LOSS =  2.03, TOTAL EXCESS =  1.95

  PEAK FLOW     TIME                        MAXIMUM AVERAGE FLOW
                                     6-HR       24-HR       72-HR     74.50-HR
+  (CFS)       (HR)
                         (CFS)
```

```
+    2749.     14.50                1766.       602.       201.        194.
                         (INCHES)   1.428      1.947      1.947       1.947
                          (AC-FT)    876.      1194.      1194.       1194.

                          CUMULATIVE AREA =   11.50 SQ MI


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

            **************
            *            *
  39 KK     *         1  *      COMBINE 1 AND 2
            *            *
            **************

  40 HC          HYDROGRAPH COMBINATION
                       ICOMP          2  NUMBER OF HYDROGRAPHS TO COMBINE

                                                                  ***

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

 PEAK FLOW     TIME                          MAXIMUM AVERAGE FLOW
                                    6-HR       24-HR      72-HR     74.50-HR
+  (CFS)       (HR)
                          (CFS)
+    3340.     22.00                3192.      2229.       794.        767.
                         (INCHES)   0.652      1.822      1.947       1.947
                          (AC-FT)   1583.      4422.      4725.       4725.

                          CUMULATIVE AREA =   45.50 SQ MI


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

            **************
            *            *
  41 KK     *     SUB 3  *
            *            *
            **************
                            RUNOFF FROM SUBBASIN 3

              SUBBASIN RUNOFF DATA

  43 BA          SUBBASIN CHARACTERISTICS
                       TAREA       14.30  SUBBASIN AREA

                 PRECIPITATION DATA

  16 PB                STORM        3.98  BASIN TOTAL PRECIPITATION

  17 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

 44 LS        SCS LOSS RATE
                STRTL       0.51  INITIAL ABSTRACTION
                CRVNBR     79.80  CURVE NUMBER
                 RTIMP      0.00  PERCENT IMPERVIOUS AREA

 45 UD        SCS DIMENSIONLESS UNITGRAPH
                 TLAG       3.18  LAG

                                                  ***

                                              UNIT HYDROGRAPH
                                         34 END-OF-PERIOD ORDINATES
            125.     368.     745.    1265.    1716.    1964.    2011.    1915.    1714.    1456.
           1121.     857.     671.     534.     427.     337.     265.     208.     164.     130.
            102.      80.      64.      50.      40.      31.      25.      20.      17.      13.
             10.       7.       4.       1.

    ***          ***          ***          ***          ***
                   HYDROGRAPH AT STATION    SUB 3

     TOTAL RAINFALL =  3.98, TOTAL LOSS =  1.97, TOTAL EXCESS =  2.01

  PEAK FLOW     TIME                        MAXIMUM AVERAGE FLOW
                                     6-HR       24-HR      72-HR     74.50-HR
+   (CFS)       (HR)
                            (CFS)
+    2752.     15.50                2056.       772.       258.        249.
                         (INCHES)   1.337      2.007      2.009       2.009
                          (AC-FT)   1019.      1531.      1533.       1533.

                          CUMULATIVE AREA =   14.30 SQ MI


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

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            *            *
 46 KK      *        2   *      ROUTE HYDROGRAPH 3 THROUGH REACH 2
            *            *
            **************

              HYDROGRAPH ROUTING DATA

 47 RS        STORAGE ROUTING
                NSTPS          1  NUMBER OF SUBREACHES
                 ITYP       FLOW  TYPE OF INITIAL CONDITION
                RSVRIC      -1.00  INITIAL CONDITION
                    X       0.00 WORKING R AND D COEFFICIENT

 48 RC        NORMAL DEPTH CHANNEL ROUTING
                 ANL       0.045  LEFT OVERBANK N-VALUE
                ANCH       0.030  MAIN CHANNEL N-VALUE
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                    ANR      0.045  RIGHT OVERBANK N-VALUE
                  RLNTH      11600.  REACH LENGTH
                    SEL      0.0071  ENERGY SLOPE
                  ELMAX        0.0  MAX. ELEV. FOR STORAGE/OUTFLOW CALCULATION

                                   CROSS-SECTION DATA
                      --- LEFT OVERBANK --- + ------ MAIN CHANNEL ------- + --- RIGHT OVERBANK ---
 50 RY      ELEVATION  1230.00  1229.00  1225.00  1220.00  1220.00  1225.00  1229.00  1230.00
 49 RX      DISTANCE      0.00  1000.00  1600.00  1620.00  1650.00  1670.00  2200.00  2650.00

                                                  ***

                                   COMPUTED STORAGE-OUTFLOW-ELEVATION DATA
          STORAGE      0.00     4.50     9.59    15.27    21.54    28.40    35.85    43.89    52.52    61.74
          OUTFLOW      0.00    44.08   143.69   290.64   483.66   723.25  1010.59  1347.24  1734.95  2175.55
        ELEVATION   1220.00  1220.53  1221.05  1221.58  1222.11  1222.63  1223.16  1223.68  1224.21  1224.74
          STORAGE     74.09   104.74   156.22   228.55   321.72   435.73   570.57   726.26   937.67  1255.60
          OUTFLOW   2727.31  3502.75  4591.59  6098.86  8115.50 10723.92 14000.60 18017.52 20842.93 26205.31
        ELEVATION   1225.26  1225.79  1226.32  1226.84  1227.37  1227.89  1228.42  1228.95  1229.47  1230.00

    ***          ***          ***          ***          ***
                   HYDROGRAPH AT STATION      2

  PEAK FLOW     TIME                    MAXIMUM AVERAGE FLOW
                                   6-HR      24-HR      72-HR    74.50-HR
+   (CFS)       (HR)
                          (CFS)
+    2728.      15.50              2050.       771.       258.       249.
                        (INCHES)   1.333      2.006      2.009      2.009
                         (AC-FT)   1017.      1530.      1533.      1533.

 PEAK STORAGE   TIME                    MAXIMUM AVERAGE STORAGE
                                   6-HR      24-HR      72-HR    74.50-HR
+  (AC-FT)      (HR)
      74.       15.50                59.        26.         9.         8.

  PEAK STAGE    TIME                    MAXIMUM AVERAGE STAGE
                                   6-HR      24-HR      72-HR    74.50-HR
+   (FEET)      (HR)
   1225.26      15.50            1224.53    1222.24    1220.75    1220.73

                        CUMULATIVE AREA =   14.30 SQ MI


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

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          *            *
 51 KK    *    SUB 4   *
          *            *
          **************
                        RUNOFF FROM SUBBASIN 4

            SUBBASIN RUNOFF DATA

 53 BA        SUBBASIN CHARACTERISTICS
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                    TAREA       29.15  SUBBASIN AREA

               PRECIPITATION DATA

 16 PB              STORM        3.98  BASIN TOTAL PRECIPITATION

 17 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

 54 LS          SCS LOSS RATE
                     STRTL        0.51  INITIAL ABSTRACTION
                    CRVNBR       79.80  CURVE NUMBER
                     RTIMP        0.00  PERCENT IMPERVIOUS AREA

 55 UD          SCS DIMENSIONLESS UNITGRAPH
                      TLAG        4.95  LAG

                                                    ***

                                                UNIT HYDROGRAPH
                                          51 END-OF-PERIOD ORDINATES
             78.      256.      487.      790.     1191.     1670.     2106.     2429.     2628.     2701.
           2695.     2596.     2426.     2231.     2000.     1718.     1424.     1189.     1013.      863.
            740.      645.      552.      474.      396.      344.      292.      253.      213.      184.
            155.      133.      114.       98.       84.       72.       62.       53.       45.       38.
             33.       29.       25.       22.       19.       16.       13.       10.        8.        5.
              3.

    ***          ***          ***          ***          ***
                      HYDROGRAPH AT STATION    SUB 4

      TOTAL RAINFALL =  3.98, TOTAL LOSS =  1.97, TOTAL EXCESS =  2.01

  PEAK FLOW     TIME                        MAXIMUM AVERAGE FLOW
                                     6-HR       24-HR       72-HR     74.50-HR
+   (CFS)       (HR)
                            (CFS)
+    4040.     17.50                3493.       1565.        525.        507.
                          (INCHES)  1.114       1.996       2.009       2.009
                           (AC-FT)  1732.       3104.       3124.       3124.

                      CUMULATIVE AREA =   29.15 SQ MI


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

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          *            *
 56 KK    *         2  *     COMBINE THREE HYDROGRAPHS 1-2 WITH 3 AND 4
          *            *
          **************
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 57 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     74.50-HR
+  (CFS)       (HR)
                         (CFS)
+    8756.     16.00                8122.       4563.       1577.        1524.
                       (INCHES)    0.849       1.908       1.978        1.978
                        (AC-FT)    4028.       9050.       9382.        9382.

                       CUMULATIVE AREA =   88.95 SQ MI


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

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           *            *
 58 KK     *        3   *      ROUTE HYDROGRAPHS 1-4 THROUGH REACH 3
           *            *
           **************

             HYDROGRAPH ROUTING DATA

 59 RS         STORAGE ROUTING
                     NSTPS          1  NUMBER OF SUBREACHES
                      ITYP       FLOW  TYPE OF INITIAL CONDITION
                    RSVRIC      -1.00  INITIAL CONDITION
                         X       0.00 WORKING R AND D COEFFICIENT

 60 RC         NORMAL DEPTH CHANNEL ROUTING
                       ANL      0.050  LEFT OVERBANK N-VALUE
                      ANCH      0.035  MAIN CHANNEL N-VALUE
                       ANR      0.045  RIGHT OVERBANK N-VALUE
                     RLNTH     44900.  REACH LENGTH
                       SEL     0.0017  ENERGY SLOPE
                     ELMAX        0.0  MAX. ELEV. FOR STORAGE/OUTFLOW CALCULATION

                                          CROSS-SECTION DATA
                          --- LEFT OVERBANK --- + ------ MAIN CHANNEL ------- + --- RIGHT OVERBANK ---
 62 RY       ELEVATION  1230.00   1229.00   1225.00   1220.00   1220.00   1225.00   1229.00   1230.00
 61 RX       DISTANCE   1300.00   1400.00   1600.00   1620.00   1650.00   1670.00   1820.00   1920.00

                                                          ***

                                          COMPUTED STORAGE-OUTFLOW-ELEVATION DATA
           STORAGE      0.00     17.42     37.12     59.10     83.37    109.93    138.77    169.89    203.30    238.99
           OUTFLOW      0.00     18.49     60.27    121.90    202.86    303.34    423.86    565.06    727.67    912.47
         ELEVATION   1220.00   1220.53   1221.05   1221.58   1222.11   1222.63   1223.16   1223.68   1224.21   1224.74
           STORAGE    279.80    342.76    430.70    543.63    681.54    844.44   1032.31   1245.18   1496.03   1803.83
           OUTFLOW   1141.93   1432.57   1783.08   2207.90   2719.54   3329.35   4047.86   4885.03   5735.27   6780.47
```

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        ELEVATION    1225.26   1225.79   1226.32   1226.84   1227.37   1227.89   1228.42   1228.95   1229.47   1230.00

     ***            ***            ***            ***            ***
                      HYDROGRAPH AT STATION        3

  PEAK FLOW     TIME                          MAXIMUM AVERAGE FLOW
                                     6-HR       24-HR      72-HR     74.50-HR
+   (CFS)       (HR)
                            (CFS)
+    6978.     20.50                6752.      4449.      1575.       1523.
                          (INCHES)  0.706      1.860      1.976       1.976
                           (AC-FT)  3348.      8824.      9375.       9375.

 PEAK STORAGE   TIME                          MAXIMUM AVERAGE STORAGE
                                     6-HR       24-HR      72-HR     74.50-HR
+  (AC-FT)      (HR)
    1862.      20.50                1795.      1154.       418.        404.

  PEAK STAGE    TIME                          MAXIMUM AVERAGE STAGE
                                     6-HR       24-HR      72-HR     74.50-HR
+   (FEET)      (HR)
   1230.10     20.50              1229.99     1228.43    1223.61     1223.49

                          CUMULATIVE AREA =   88.95 SQ MI


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

            **************
            *            *
  63 KK     *     SUB    *     5
            *            *
            **************
                          RUNOFF FROM SUBBASIN 5

              SUBBASIN RUNOFF DATA

  65 BA         SUBBASIN CHARACTERISTICS
                     TAREA       12.32  SUBBASIN AREA

                PRECIPITATION DATA

  16 PB              STORM        3.98  BASIN TOTAL PRECIPITATION

  17 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

  66 LS         SCS LOSS RATE
                     STRTL        0.56  INITIAL ABSTRACTION
                    CRVNBR       78.00  CURVE NUMBER
                     RTIMP        0.00  PERCENT IMPERVIOUS AREA
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 67 UD         SCS DIMENSIONLESS UNITGRAPH
                     TLAG        4.60  LAG

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                                                UNIT HYDROGRAPH
                                           48 END-OF-PERIOD ORDINATES
            40.     130.     247.     405.     613.     847.    1036.    1160.    1219.    1224.
          1191.    1110.    1017.     905.     767.     627.     520.     438.     369.     316.
           270.     229.     191.     162.     137.     117.      98.      83.      69.      59.
            50.      42.      36.      30.      25.      22.      18.      16.      13.      12.
            10.       9.       7.       6.       4.       3.       2.       1.

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

      TOTAL RAINFALL =  3.98, TOTAL LOSS =  2.11, TOTAL EXCESS =  1.87

  PEAK FLOW     TIME                          MAXIMUM AVERAGE FLOW
                                      6-HR       24-HR       72-HR     74.50-HR
+   (CFS)       (HR)
                          (CFS)
+    1671.     17.00                1417.        617.        207.        200.
                         (INCHES)   1.069       1.863       1.871       1.871
                          (AC-FT)    703.       1224.       1229.       1229.

                         CUMULATIVE AREA =   12.32 SQ MI


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

            **************
            *            *
  68 KK     *        3   *     COMBINE TWO HYDROGRAPHS 1-4 WITH 5
            *            *
            **************

  69 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     74.50-HR
+   (CFS)       (HR)
                          (CFS)
+    8163.     19.00                7855.       5052.       1782.       1722.
                         (INCHES)   0.721       1.855       1.963       1.963
                          (AC-FT)    3895.     10021.      10604.      10604.

                         CUMULATIVE AREA =  101.27 SQ MI
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          **************
          *            *
 70 KK    *        4   *      ROUTE HYDROGRAPHS 1-5 THROUGH REACH 4
          *            *
          **************

            HYDROGRAPH ROUTING DATA

 71 RS        STORAGE ROUTING
                   NSTPS          1  NUMBER OF SUBREACHES
                    ITYP       FLOW  TYPE OF INITIAL CONDITION
                  RSVRIC      -1.00  INITIAL CONDITION
                       X       0.00 WORKING R AND D COEFFICIENT

 72 RC        NORMAL DEPTH CHANNEL ROUTING
                     ANL      0.045  LEFT OVERBANK N-VALUE
                    ANCH      0.030  MAIN CHANNEL N-VALUE
                     ANR      0.045  RIGHT OVERBANK N-VALUE
                   RLNTH      9500.  REACH LENGTH
                     SEL     0.0021  ENERGY SLOPE
                   ELMAX        0.0  MAX. ELEV. FOR STORAGE/OUTFLOW CALCULATION

                                        CROSS-SECTION DATA
                          --- LEFT OVERBANK --- + ------ MAIN CHANNEL ------- + --- RIGHT OVERBANK ---
 74 RY       ELEVATION   1211.00   1210.00   1206.00   1200.00   1200.00   1206.00   1210.00   1211.00
 73 RX       DISTANCE       0.00   1000.00   1600.00   1620.00   1650.00   1670.00   2200.00   2650.00

                                                          ***

                                        COMPUTED STORAGE-OUTFLOW-ELEVATION DATA
          STORAGE      0.00      4.03      8.55     13.56     19.05     25.03     31.50     38.45     45.90     53.83
          OUTFLOW      0.00     28.01     91.02    183.48    304.34    453.67    632.03    840.20   1079.11   1349.78
        ELEVATION   1200.00   1200.58   1201.16   1201.74   1202.32   1202.89   1203.47   1204.05   1204.63   1205.21
          STORAGE     62.25     75.23    107.54    160.49    234.10    328.36    443.26    578.82    757.60   1039.20
          OUTFLOW   1653.25   2042.44   2588.65   3361.10   4431.92   5864.11   7714.99  10037.85  11864.95  15026.76
        ELEVATION   1205.79   1206.37   1206.95   1207.53   1208.11   1208.68   1209.26   1209.84   1210.42   1211.00

     ***          ***          ***          ***          ***
                     HYDROGRAPH AT STATION       4

  PEAK FLOW     TIME                        MAXIMUM AVERAGE FLOW
                                     6-HR       24-HR       72-HR     74.50-HR
+   (CFS)       (HR)
                          (CFS)
+    8088.     20.00                7783.       5046.       1782.       1722.
                        (INCHES)   0.715       1.853       1.963       1.963
                         (AC-FT)   3859.      10009.      10603.      10603.

 PEAK STORAGE   TIME                        MAXIMUM AVERAGE STORAGE
                                     6-HR       24-HR       72-HR     74.50-HR
+  (AC-FT)      (HR)
     465.      20.00                447.        273.         97.         94.

  PEAK STAGE    TIME                        MAXIMUM AVERAGE STAGE
```

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                                  6-HR       24-HR       72-HR     74.50-HR
+  (FEET)      (HR)
   1209.36     20.00             1209.27     1208.04     1203.40     1203.29

                      CUMULATIVE AREA =  101.27 SQ MI


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

           **************
           *            *
  75 KK    *    SUB 6   *
           *            *
           **************
                         RUNOFF FROM SUBBASIN 6

              SUBBASIN RUNOFF DATA

  77 BA         SUBBASIN CHARACTERISTICS
                     TAREA       30.35  SUBBASIN AREA

                PRECIPITATION DATA

  16 PB              STORM        3.98  BASIN TOTAL PRECIPITATION

  17 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

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

  79 UD         SCS DIMENSIONLESS UNITGRAPH
                      TLAG        3.69  LAG

                                                  ***

                                              UNIT HYDROGRAPH
                                         39 END-OF-PERIOD ORDINATES
             182.      553.     1068.     1803.     2662.     3304.     3659.     3717.     3591.     3282.
            2916.     2429.     1899.     1513.     1222.     1001.      828.      676.      539.      444.
             362.      291.      238.      192.      157.      129.      104.       85.       69.       55.
              46.       38.       33.       27.       21.       16.       11.        7.        2.

     ***           ***           ***           ***           ***
                      HYDROGRAPH AT STATION    SUB 6

      TOTAL RAINFALL =  3.98, TOTAL LOSS =  2.11, TOTAL EXCESS =  1.87

 PEAK FLOW     TIME                        MAXIMUM AVERAGE FLOW
                                  6-HR       24-HR       72-HR     74.50-HR
```

```
+  (CFS)      (HR)
                        (CFS)
+   4850.     16.00                3830.       1524.       509.        492.
                       (INCHES)    1.173       1.868       1.871       1.871
                        (AC-FT)    1899.       3024.       3029.       3029.

                       CUMULATIVE AREA =   30.35 SQ MI


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

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          *            *
  80 KK   *    SUB 7   *
          *            *
          **************
                         RUNOFF FROM SUBBASIN 7

             SUBBASIN RUNOFF DATA

  82 BA        SUBBASIN CHARACTERISTICS
                    TAREA        4.95  SUBBASIN AREA

               PRECIPITATION DATA

  16 PB             STORM        3.98  BASIN TOTAL PRECIPITATION

  17 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

  83 LS        SCS LOSS RATE
                    STRTL        0.53  INITIAL ABSTRACTION
                   CRVNBR       79.00  CURVE NUMBER
                    RTIMP        0.00  PERCENT IMPERVIOUS AREA

  84 UD        SCS DIMENSIONLESS UNITGRAPH
                     TLAG        1.35  LAG

                                                   ***

                                                UNIT HYDROGRAPH
                                            15 END-OF-PERIOD ORDINATES
             307.     1048.     1488.     1340.      906.      517.      317.      190.      113.       68.
              41.       25.       15.       10.        5.

    ***           ***           ***           ***           ***
                     HYDROGRAPH AT STATION    SUB 7

     TOTAL RAINFALL =  3.98, TOTAL LOSS =  2.03, TOTAL EXCESS =  1.95

PEAK FLOW     TIME                        MAXIMUM AVERAGE FLOW
                                  6-HR       24-HR       72-HR     74.50-HR
```

```
+   (CFS)      (HR)
                        (CFS)
+    1625.     13.50                809.       259.        86.         83.
                       (INCHES)    1.520      1.947      1.947       1.947
                        (AC-FT)     401.       514.       514.        514.

                       CUMULATIVE AREA =    4.95 SQ MI


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

            **************
            *            *
  85 KK     *        4   *     COMBINE THREE HYDROGRAPHS 1-5 WITH 6 AND 7
            *            *
            **************

  86 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     74.50-HR
+   (CFS)      (HR)
                        (CFS)
+   11376.     17.50                10695.      6755.      2377.       2297.
                       (INCHES)    0.728      1.839      1.942       1.942
                        (AC-FT)    5303.     13397.     14146.      14146.

                       CUMULATIVE AREA =  136.57 SQ MI


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

            **************
            *            *
  87 KK     *        5   *     ROUTE HYDROGRAPHS 1-7 THROUGH REACH 5
            *            *
            **************

              HYDROGRAPH ROUTING DATA

  88 RS         STORAGE ROUTING
                     NSTPS          1  NUMBER OF SUBREACHES
                      ITYP       FLOW  TYPE OF INITIAL CONDITION
                    RSVRIC      -1.00  INITIAL CONDITION
                         X       0.00 WORKING R AND D COEFFICIENT

  89 RC         NORMAL DEPTH CHANNEL ROUTING
                       ANL      0.045  LEFT OVERBANK N-VALUE
                      ANCH      0.030  MAIN CHANNEL N-VALUE
```

```
                    ANR      0.050  RIGHT OVERBANK N-VALUE
                  RLNTH      11600.  REACH LENGTH
                    SEL      0.0026  ENERGY SLOPE
                  ELMAX        0.0  MAX. ELEV. FOR STORAGE/OUTFLOW CALCULATION

                                   CROSS-SECTION DATA
                        --- LEFT OVERBANK --- + ------ MAIN CHANNEL ------- + --- RIGHT OVERBANK ---
 91 RY      ELEVATION  1172.00  1171.00  1167.00  1160.00  1160.00  1167.00  1171.00  1172.00
 90 RX      DISTANCE      0.00  1000.00  1600.00  1620.00  1650.00  1670.00  2200.00  2650.00

                                                   ***

                                   COMPUTED STORAGE-OUTFLOW-ELEVATION DATA
          STORAGE      0.00      5.35     11.31     17.87     25.04     32.82     41.20     50.19     59.79     69.99
          OUTFLOW      0.00     35.94    116.48    234.20    387.49    576.21    800.87   1062.32   1361.58   1699.77
        ELEVATION   1160.00   1160.63   1161.26   1161.89   1162.53   1163.16   1163.79   1164.42   1165.05   1165.68
          STORAGE     80.81     92.23    116.60    170.89    255.18    369.49    513.80    688.12    913.54   1282.23
          OUTFLOW   2078.10   2497.79   3075.81   3876.24   5005.31   6555.49   8608.71  11240.07  13508.79  17152.32
        ELEVATION   1166.32   1166.95   1167.58   1168.21   1168.84   1169.47   1170.11   1170.74   1171.37   1172.00

    ***          ***          ***          ***          ***
                    HYDROGRAPH AT STATION       5

 PEAK FLOW     TIME                      MAXIMUM AVERAGE FLOW
                                   6-HR      24-HR      72-HR     74.50-HR
+  (CFS)       (HR)
                         (CFS)
+  11115.     18.50              10562.      6744.      2377.       2297.
                       (INCHES)   0.719      1.836      1.942       1.942
                        (AC-FT)   5237.     13376.     14144.      14144.

 PEAK STORAGE  TIME                      MAXIMUM AVERAGE STORAGE
                                   6-HR      24-HR      72-HR     74.50-HR
+ (AC-FT)      (HR)
    680.     18.50                643.       382.       135.        131.

 PEAK STAGE    TIME                      MAXIMUM AVERAGE STAGE
                                   6-HR      24-HR      72-HR     74.50-HR
+  (FEET)      (HR)
  1170.71     18.50             1170.57    1169.13    1163.84     1163.71

                       CUMULATIVE AREA =  136.57 SQ MI


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

          **************
          *            *
 92 KK    *    SUB 8   *
          *            *
          **************
                    RUNOFF FROM SUBBASIN 8

            SUBBASIN RUNOFF DATA

 94 BA        SUBBASIN CHARACTERISTICS
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                    TAREA       23.13  SUBBASIN AREA

               PRECIPITATION DATA

 16 PB              STORM        3.98  BASIN TOTAL PRECIPITATION

 17 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

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

 96 UD          SCS DIMENSIONLESS UNITGRAPH
                     TLAG        7.40  LAG

                                                  ***

                                              UNIT HYDROGRAPH
                                          76 END-OF-PERIOD ORDINATES
            29.      75.     142.     227.     324.     439.     587.     750.     931.    1089.
          1228.    1333.    1402.    1448.    1458.    1454.    1436.    1379.    1316.    1248.
          1171.    1084.     988.     873.     768.     673.     606.     543.     486.     438.
           395.     360.     325.     293.     264.     235.     209.     190.     171.     153.
           139.     125.     111.     100.      90.      80.      72.      65.      58.      53.
            48.      42.      39.      35.      31.      28.      25.      22.      20.      18.
            16.      15.      14.      13.      12.      11.       9.       8.       7.       6.
             5.       4.       3.       2.       1.       0.

    ***          ***          ***          ***          ***
                   HYDROGRAPH AT STATION    SUB 8

     TOTAL RAINFALL =  3.98, TOTAL LOSS =  2.11, TOTAL EXCESS =  1.87

  PEAK FLOW     TIME                        MAXIMUM AVERAGE FLOW
                                     6-HR       24-HR      72-HR     74.50-HR
+   (CFS)       (HR)
                            (CFS)
+    2186.     20.00                2041.      1124.       388.        375.
                          (INCHES)  0.821      1.807      1.871       1.871
                           (AC-FT)  1012.      2229.      2308.       2308.

                          CUMULATIVE AREA =   23.13 SQ MI


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

          **************
          *            *
 97 KK    *        5   *     COMBINE TWO HYDROGRAPHS 1-7 WITH 8
          *            *
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          **************

  98 HC         HYDROGRAPH COMBINATION
                     ICOMP          2  NUMBER OF HYDROGRAPHS TO COMBINE

                                                          ***

     ***            ***            ***            ***            ***
                       HYDROGRAPH AT STATION       5

  PEAK FLOW     TIME                        MAXIMUM AVERAGE FLOW
                                     6-HR       24-HR       72-HR     74.50-HR
+   (CFS)       (HR)
                        (CFS)
+   13186.      19.00              12559.       7868.       2765.       2672.
                     (INCHES)      0.731       1.832       1.932       1.932
                      (AC-FT)      6228.      15605.      16452.      16452.

                      CUMULATIVE AREA =  159.70 SQ MI


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

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          *            *
  99 KK   *        6   *      ROUTE HYDROGRAPHS 1-8 THROUGH REACH 6
          *            *
          **************

             HYDROGRAPH ROUTING DATA

  100 RS        STORAGE ROUTING
                     NSTPS          1  NUMBER OF SUBREACHES
                      ITYP       FLOW  TYPE OF INITIAL CONDITION
                    RSVRIC      -1.00  INITIAL CONDITION
                         X       0.00 WORKING R AND D COEFFICIENT

  101 RC        NORMAL DEPTH CHANNEL ROUTING
                       ANL      0.045  LEFT OVERBANK N-VALUE
                      ANCH      0.030  MAIN CHANNEL N-VALUE
                       ANR      0.045  RIGHT OVERBANK N-VALUE
                     RLNTH      9500.  REACH LENGTH
                       SEL     0.0021  ENERGY SLOPE
                     ELMAX        0.0  MAX. ELEV. FOR STORAGE/OUTFLOW CALCULATION

                                   CROSS-SECTION DATA
                        --- LEFT OVERBANK --- + ------ MAIN CHANNEL ------- + --- RIGHT OVERBANK ---
  103 RY       ELEVATION   1145.00   1144.00   1140.00   1133.00   1133.00   1140.00   1144.00   1145.00
  102 RX       DISTANCE       0.00   1010.00   1590.00   1610.00   1640.00   1660.00   1890.00   2650.00

                                                          ***

                                   COMPUTED STORAGE-OUTFLOW-ELEVATION DATA
          STORAGE       0.00      4.38      9.26     14.63     20.51     26.88     33.74     41.10     48.97     57.32
          OUTFLOW       0.00     32.30    104.68    210.48    348.24    517.85    719.76    954.73   1223.67   1527.62
        ELEVATION    1133.00   1133.63   1134.26   1134.89   1135.53   1136.16   1136.79   1137.42   1138.05   1138.68
```

STORAGE	66.18	75.53	92.57	127.17	179.38	249.22	336.66	441.73	587.61	875.63
OUTFLOW	1867.63	2244.81	2756.85	3430.54	4335.68	5534.46	7082.00	9028.84	10377.44	13229.13
ELEVATION	1139.32	1139.95	1140.58	1141.21	1141.84	1142.47	1143.11	1143.74	1144.37	1145.00

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

HYDROGRAPH AT STATION 6

PEAK FLOW	TIME		MAXIMUM AVERAGE FLOW			
			6-HR	24-HR	72-HR	74.50-HR
+ (CFS)	(HR)					
		(CFS)				
+ 12824.	20.50		12298.	7862.	2765.	2672.
		(INCHES)	0.716	1.831	1.931	1.931
		(AC-FT)	6098.	15593.	16450.	16450.

PEAK STORAGE	TIME	MAXIMUM AVERAGE STORAGE			
		6-HR	24-HR	72-HR	74.50-HR
+ (AC-FT)	(HR)				
835.	20.50	782.	430.	151.	146.

PEAK STAGE	TIME	MAXIMUM AVERAGE STAGE			
		6-HR	24-HR	72-HR	74.50-HR
+ (FEET)	(HR)				
1144.91	20.50	1144.79	1143.08	1137.26	1137.12

CUMULATIVE AREA = 159.70 SQ MI

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          *            *
104 KK    *    SUB 9   *
          *            *
          **************
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RUNOFF FROM SUBBASIN 9

SUBBASIN RUNOFF DATA

106 BA SUBBASIN CHARACTERISTICS

TAREA 18.29 SUBBASIN AREA

PRECIPITATION DATA

16 PB STORM 3.98 BASIN TOTAL PRECIPITATION

17 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		

107 LS SCS LOSS RATE

STRTL 0.48 INITIAL ABSTRACTION

CRVNBR 80.50 CURVE NUMBER

```
                    RTIMP       0.00  PERCENT IMPERVIOUS AREA

108 UD         SCS DIMENSIONLESS UNITGRAPH
                    TLAG        3.35  LAG

                                                          ***

                                                   UNIT HYDROGRAPH
                                             35 END-OF-PERIOD ORDINATES
            140.     417.     826.    1412.    1990.    2331.    2447.    2412.    2196.    1935.
           1586.    1210.     949.     755.     612.     491.     389.     312.     248.     197.
            157.     125.      99.      80.      64.      51.      40.      32.      26.      22.
             18.      14.      10.       7.       3.

     ***           ***           ***           ***           ***
                    HYDROGRAPH AT STATION    SUB 9

      TOTAL RAINFALL =  3.98, TOTAL LOSS =  1.92, TOTAL EXCESS =  2.06

  PEAK FLOW     TIME                        MAXIMUM AVERAGE FLOW
                                     6-HR       24-HR       72-HR     74.50-HR
+   (CFS)       (HR)
                         (CFS)
+    3511.     15.50                2664.       1014.        338.        327.
                       (INCHES)    1.354       2.062       2.065       2.065
                        (AC-FT)    1321.       2011.       2014.       2014.

                       CUMULATIVE AREA =   18.29 SQ MI


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

           **************
           *            *
  109 KK   *         6  *     COMBINE TWO HYDROGRAPHS 1-8 WITH 9
           *            *
           **************

  110 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     74.50-HR
+   (CFS)       (HR)
                         (CFS)
+   14130.     19.50                13625.       8845.       3103.       2999.
                       (INCHES)    0.712       1.848       1.945       1.945
                        (AC-FT)    6756.      17545.      18465.      18465.

                       CUMULATIVE AREA =  177.99 SQ MI
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*** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** ***

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          *            *
111 KK    *    SUB10   *
          *            *
          **************
                         RUNOFF FROM SUBBASIN 10

             SUBBASIN RUNOFF DATA

113 BA         SUBBASIN CHARACTERISTICS
                    TAREA       42.46  SUBBASIN AREA

               PRECIPITATION DATA

 16 PB              STORM        3.98  BASIN TOTAL PRECIPITATION

 17 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        0.51  INITIAL ABSTRACTION
                   CRVNBR       79.80  CURVE NUMBER
                    RTIMP        0.00  PERCENT IMPERVIOUS AREA

115 UD         SCS DIMENSIONLESS UNITGRAPH
                     TLAG        5.31  LAG

                                                    ***

                                                UNIT HYDROGRAPH
                                           55 END-OF-PERIOD ORDINATES
            100.     317.     601.     965.    1436.    2011.    2609.    3103.    3451.    3650.
           3685.    3659.    3499.    3278.    3028.    2734.    2381.    1997.    1674.    1442.
           1243.    1073.     941.     820.     710.     611.     522.     455.     390.     341.
            291.     252.     216.     187.     162.     140.     122.     104.      91.      78.
             68.      58.      50.      44.      39.      35.      31.      27.      23.      19.
             15.      12.       9.       5.       2.

    ***          ***          ***          ***          ***
                     HYDROGRAPH AT STATION    SUB10

     TOTAL RAINFALL =  3.98, TOTAL LOSS =  1.97, TOTAL EXCESS =  2.01

 PEAK FLOW     TIME                        MAXIMUM AVERAGE FLOW
                                     6-HR       24-HR      72-HR     74.50-HR
+  (CFS)       (HR)
                          (CFS)
+   5572.     17.50                 4900.      2274.       765.        739.
                         (INCHES)   1.073      1.991      2.009       2.009
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                    (AC-FT)     2430.       4509.       4550.       4550.

                    CUMULATIVE AREA =   42.46 SQ MI


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

          **************
          *            *
 116 KK   *         7  *      ROUTE HYDROGRAPH 10 THROUGH REACH 7
          *            *
          **************

            HYDROGRAPH ROUTING DATA

 117 RS         STORAGE ROUTING
                     NSTPS          1  NUMBER OF SUBREACHES
                      ITYP       FLOW  TYPE OF INITIAL CONDITION
                    RSVRIC      -1.00  INITIAL CONDITION
                         X       0.00 WORKING R AND D COEFFICIENT

 118 RC         NORMAL DEPTH CHANNEL ROUTING
                       ANL      0.045  LEFT OVERBANK N-VALUE
                      ANCH      0.030  MAIN CHANNEL N-VALUE
                       ANR      0.045  RIGHT OVERBANK N-VALUE
                     RLNTH      39600.  REACH LENGTH
                       SEL     0.0051  ENERGY SLOPE
                     ELMAX        0.0  MAX. ELEV. FOR STORAGE/OUTFLOW CALCULATION

                                      CROSS-SECTION DATA
                          --- LEFT OVERBANK --- + ------ MAIN CHANNEL ------- + --- RIGHT OVERBANK ---
 120 RY       ELEVATION   1156.00   1152.00   1148.00   1146.00   1146.00   1148.00   1152.00   1156.00
 119 RX       DISTANCE       0.00     50.00     70.00    120.00    200.00    220.00    235.00    390.00

                                                          ***

                                      COMPUTED STORAGE-OUTFLOW-ELEVATION DATA
          STORAGE      0.00     42.68     94.18    154.50    223.49    296.80    372.32    450.04    529.96    612.09
          OUTFLOW      0.00    101.65    339.01    701.47   1210.96   1928.25   2778.04   3754.32   4852.71   6069.93
        ELEVATION    1146.00   1146.53   1147.05   1147.58   1148.11   1148.63   1149.16   1149.68   1150.21   1150.74
          STORAGE    696.42    782.95    873.61    976.33   1091.95   1220.47   1361.91   1516.24   1683.49   1863.64
          OUTFLOW   7403.50   8851.50  10372.42  12031.70  13849.99  15831.64  17985.31  20320.21  22845.45  25569.89
        ELEVATION   1151.26   1151.79   1152.32   1152.84   1153.37   1153.89   1154.42   1154.95   1155.47   1156.00

     ***            ***            ***            ***            ***
                     HYDROGRAPH AT STATION       7

 PEAK FLOW     TIME                        MAXIMUM AVERAGE FLOW
                                     6-HR       24-HR       72-HR     74.50-HR
+   (CFS)      (HR)
                         (CFS)
+    5367.     18.50                4722.       2244.        765.        739.
                       (INCHES)    1.034       1.965       2.009       2.009
                        (AC-FT)    2341.       4451.       4550.       4550.

 PEAK STORAGE   TIME                        MAXIMUM AVERAGE STORAGE
```

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                                        6-HR       24-HR       72-HR     74.50-HR
+  (AC-FT)      (HR)
     565.     18.50                     519.        300.        107.        103.

 PEAK STAGE    TIME                            MAXIMUM AVERAGE STAGE
                                        6-HR       24-HR       72-HR     74.50-HR
+   (FEET)      (HR)
   1150.43     18.50                  1150.14     1148.60     1146.94     1146.91

                      CUMULATIVE AREA =   42.46 SQ MI


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

          **************
          *            *
 121 KK   *    SUB11   *
          *            *
          **************
                        RUNOFF FROM SUBBASIN 11

             SUBBASIN RUNOFF DATA

 123 BA        SUBBASIN CHARACTERISTICS
                    TAREA       25.62  SUBBASIN AREA

               PRECIPITATION DATA

  16 PB             STORM        3.98  BASIN TOTAL PRECIPITATION

  17 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

 124 LS        SCS LOSS RATE
                    STRTL        0.51  INITIAL ABSTRACTION
                   CRVNBR       79.80  CURVE NUMBER
                    RTIMP        0.00  PERCENT IMPERVIOUS AREA

 125 UD        SCS DIMENSIONLESS UNITGRAPH
                     TLAG        4.89  LAG

                                                  ***

                                              UNIT HYDROGRAPH
                                         51 END-OF-PERIOD ORDINATES
             70.      232.      440.      715.     1080.     1515.     1902.     2183.     2350.     2403.
           2393.     2288.     2132.     1953.     1737.     1475.     1220.     1022.      870.      740.
            637.      551.      472.      401.      339.      292.      248.      213.      180.      154.
            130.      112.       95.       82.       69.       60.       51.       44.       37.       32.
             27.       24.       21.       18.       16.       13.       10.        8.        6.        3.
              1.
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     ***            ***            ***            ***            ***
                      HYDROGRAPH AT STATION    SUB11

      TOTAL RAINFALL =  3.98, TOTAL LOSS =  1.97, TOTAL EXCESS =  2.01

  PEAK FLOW     TIME                        MAXIMUM AVERAGE FLOW
                                     6-HR       24-HR      72-HR     74.50-HR
+   (CFS)       (HR)
                         (CFS)
+    3577.     17.50               3087.       1376.       461.        446.
                        (INCHES)   1.120       1.997      2.009       2.009
                         (AC-FT)   1531.       2729.      2746.       2746.

                        CUMULATIVE AREA =   25.62 SQ MI


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

           **************
           *            *
  126 KK   *        6   *     COMBINE THREE HYDROGRAPHS 1-9 WITH 10 AND 11
           *            *
           **************

  127 HC         HYDROGRAPH COMBINATION
                      ICOMP          3  NUMBER OF HYDROGRAPHS TO COMBINE

                                                                  ***

     ***            ***            ***            ***            ***
                      HYDROGRAPH AT STATION       6

  PEAK FLOW     TIME                        MAXIMUM AVERAGE FLOW
                                     6-HR       24-HR      72-HR     74.50-HR
+   (CFS)       (HR)
                         (CFS)
+   22565.     19.00               21133.      12452.      4329.       4184.
                        (INCHES)   0.798       1.882      1.963       1.963
                         (AC-FT)   10479.      24698.     25761.      25761.

                        CUMULATIVE AREA =  246.07 SQ MI


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

           **************
           *            *
  128 KK   *        8   *     ROUTE HYDROGRAPHS 1-11 THROUGH REACH 8
           *            *
           **************

             HYDROGRAPH ROUTING DATA

  129 RS         STORAGE ROUTING
                      NSTPS          1  NUMBER OF SUBREACHES
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                    ITYP        FLOW  TYPE OF INITIAL CONDITION
                  RSVRIC       -1.00  INITIAL CONDITION
                       X        0.00 WORKING R AND D COEFFICIENT

130 RC         NORMAL DEPTH CHANNEL ROUTING
                     ANL       0.037  LEFT OVERBANK N-VALUE
                    ANCH       0.028  MAIN CHANNEL N-VALUE
                     ANR       0.039  RIGHT OVERBANK N-VALUE
                   RLNTH       9500.  REACH LENGTH
                     SEL      0.0045  ENERGY SLOPE
                   ELMAX         0.0  MAX. ELEV. FOR STORAGE/OUTFLOW CALCULATION

                                      CROSS-SECTION DATA
                        --- LEFT OVERBANK --- + ------ MAIN CHANNEL ------- + --- RIGHT OVERBANK ---
132 RY       ELEVATION   1115.00   1114.00   1114.00   1103.00   1103.00   1111.00   1112.00   1114.00
131 RX       DISTANCE    2767.00   3206.00   4047.00   4063.00   4115.00   4137.00   4339.00   4747.00

                                                          ***

                                      COMPUTED STORAGE-OUTFLOW-ELEVATION DATA
          STORAGE      0.00      7.35     15.06     23.13     31.58     40.38     49.56     59.10     69.00     79.28
          OUTFLOW      0.00     86.74    277.04    548.22    892.06   1304.24   1782.25   2324.66   2930.66   3599.90
        ELEVATION   1103.00   1103.63   1104.26   1104.89   1105.53   1106.16   1106.79   1107.42   1108.05   1108.68
          STORAGE     89.91    100.92    112.29    124.98    151.53    195.82    257.98    338.02    506.96    760.59
          OUTFLOW   4332.34   5128.17   5987.74   6944.39   8124.29   9622.56  11558.03  14032.07  17884.35  24219.47
        ELEVATION   1109.32   1109.95   1110.58   1111.21   1111.84   1112.47   1113.11   1113.74   1114.37   1115.00

*** WARNING *** MODIFIED PULS ROUTING MAY BE NUMERICALLY UNSTABLE FOR OUTFLOWS BETWEEN     1304. TO     6944.
               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       8

 PEAK FLOW     TIME                          MAXIMUM AVERAGE FLOW
                                     6-HR       24-HR       72-HR     74.50-HR
+   (CFS)      (HR)
                          (CFS)
+   22428.     19.50                21025.      12453.       4329.       4184.
                        (INCHES)    0.794       1.882       1.963       1.963
                         (AC-FT)   10426.      24699.      25760.      25760.

 PEAK STORAGE  TIME                          MAXIMUM AVERAGE STORAGE
                                     6-HR       24-HR       72-HR     74.50-HR
+  (AC-FT)     (HR)
     689.     19.50                  633.        328.        116.        113.

 PEAK STAGE    TIME                          MAXIMUM AVERAGE STAGE
                                     6-HR       24-HR       72-HR     74.50-HR
+   (FEET)     (HR)
   1114.82    19.50               1114.68     1112.45     1106.73     1106.60

                        CUMULATIVE AREA =  246.07 SQ MI


*** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** ***
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          *            *
133 KK    *    SUB12   *
          *            *
          **************
                    RUNOFF FROM SUBBASIN 12

            SUBBASIN RUNOFF DATA

135 BA        SUBBASIN CHARACTERISTICS
                   TAREA       25.25  SUBBASIN AREA

              PRECIPITATION DATA

 16 PB             STORM        3.98  BASIN TOTAL PRECIPITATION

 17 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

136 LS        SCS LOSS RATE
                   STRTL        0.52  INITIAL ABSTRACTION
                  CRVNBR       79.40  CURVE NUMBER
                   RTIMP        0.00  PERCENT IMPERVIOUS AREA

137 UO        SCS DIMENSIONLESS UNITGRAPH
                   TLAG        4.45  LAG

                                                  ***

                                              UNIT HYDROGRAPH
                                          46 END-OF-PERIOD ORDINATES
             90.      290.      553.      912.     1379.     1874.     2259.     2496.     2588.     2582.
           2463.     2278.     2062.     1795.     1469.     1192.     1000.      838.      707.      607.
            511.      428.      358.      302.      255.      213.      179.      149.      126.      106.
             90.       75.       64.       53.       45.       37.       32.       27.       24.       21.
             17.       14.       11.        8.        6.        3.

    ***          ***          ***          ***          ***
                   HYDROGRAPH AT STATION    SUB12

     TOTAL RAINFALL =  3.98, TOTAL LOSS =  2.00, TOTAL EXCESS =  1.98

  PEAK FLOW     TIME                      MAXIMUM AVERAGE FLOW
                                    6-HR       24-HR       72-HR     74.50-HR
+   (CFS)       (HR)
                          (CFS)
+    3722.     17.00                3131.       1338.        448.        433.
                         (INCHES)   1.153       1.970       1.978       1.978
                          (AC-FT)   1553.       2654.       2664.       2664.

                         CUMULATIVE AREA =   25.25 SQ MI
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          *            *
 138 KK   *        7   *     COMBINE 2 HYDROGRAPHS 1-11 WITH 14 AND 12
          *            *
          **************

 139 HC         HYDROGRAPH COMBINATION
                     ICOMP          2  NUMBER OF HYDROGRAPHS TO COMBINE

                                                          ***

     ***            ***            ***            ***            ***
                       HYDROGRAPH AT STATION        7

 PEAK FLOW     TIME                        MAXIMUM AVERAGE FLOW
                                   6-HR       24-HR       72-HR     74.50-HR
+  (CFS)       (HR)
                         (CFS)
+  25339.     18.50                23682.      13774.      4777.       4616.
                      (INCHES)     0.812       1.888      1.964       1.964
                       (AC-FT)    11743.      27320.     28424.      28424.

                       CUMULATIVE AREA =  271.32 SQ MI


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

          **************
          *            *
 140 KK   *        9   *     ROUTE HYDROGRAPHS 1-12 THROUGH REACH 9
          *            *
          **************

            HYDROGRAPH ROUTING DATA

 141 RS         STORAGE ROUTING
                     NSTPS          1  NUMBER OF SUBREACHES
                      ITYP       FLOW  TYPE OF INITIAL CONDITION
                    RSVRIC      -1.00  INITIAL CONDITION
                         X       0.00 WORKING R AND D COEFFICIENT

 142 RC         NORMAL DEPTH CHANNEL ROUTING
                       ANL      0.037  LEFT OVERBANK N-VALUE
                      ANCH      0.028  MAIN CHANNEL N-VALUE
                       ANR      0.037  RIGHT OVERBANK N-VALUE
                     RLNTH     22200.  REACH LENGTH
                       SEL     0.0027  ENERGY SLOPE
                     ELMAX        0.0  MAX. ELEV. FOR STORAGE/OUTFLOW CALCULATION

                                   CROSS-SECTION DATA
                         --- LEFT OVERBANK --- + ------ MAIN CHANNEL ------- + --- RIGHT OVERBANK ---
 144 RY       ELEVATION   1066.00   1065.00   1057.00   1057.00   1066.00   1065.00   1065.00   1067.00
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143 RX      DISTANCE    1772.00   3567.00   3599.00   3653.00   3681.00   3841.00   5268.00   5297.00

                                                  ***

                                        COMPUTED STORAGE-OUTFLOW-ELEVATION DATA
          STORAGE      0.00     14.99     30.98     47.97     65.97     84.97    104.98    125.99    148.00    171.02
          OUTFLOW      0.00     51.91    167.01    332.69    544.64    800.71   1099.75   1441.18   1824.77   2250.54
        ELEVATION   1057.00   1057.53   1058.05   1058.58   1059.11   1059.63   1060.16   1060.68   1061.21   1061.74
          STORAGE    195.04    220.07    246.10    273.13    301.17    330.21    755.26   1529.80   2470.87   3415.37
          OUTFLOW   2718.65   3229.39   3783.16   4380.41   5021.65   5707.43   4999.16   7912.01  14832.27  24023.05
        ELEVATION   1062.26   1062.79   1063.32   1063.84   1064.37   1064.89   1065.42   1065.95   1066.47   1067.00

     ***          ***          ***          ***          ***
                    HYDROGRAPH AT STATION       9

  PEAK FLOW     TIME                        MAXIMUM AVERAGE FLOW
                                    6-HR       24-HR       72-HR     74.50-HR
+   (CFS)       (HR)
                          (CFS)
+   24085.     20.50               22590.      13620.       4776.       4616.
                        (INCHES)   0.774       1.867       1.964       1.964
                         (AC-FT)   11202.      27014.      28418.      28418.

  PEAK STORAGE  TIME                        MAXIMUM AVERAGE STORAGE
                                    6-HR       24-HR       72-HR     74.50-HR
+  (AC-FT)      (HR)
     3422.     20.50                3268.       2117.        730.        706.

  PEAK STAGE    TIME                        MAXIMUM AVERAGE STAGE
                                    6-HR       24-HR       72-HR     74.50-HR
+   (FEET)      (HR)
   1067.00     20.50              1066.92     1066.24     1060.83     1060.70

                        CUMULATIVE AREA =  271.32 SQ MI


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

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           *            *
  145 KK   *    SUB13   *
           *            *
           **************
                         RUNOFF FROM SUBBASIN 13

              SUBBASIN RUNOFF DATA

  147 BA        SUBBASIN CHARACTERISTICS
                     TAREA       31.96  SUBBASIN AREA

                PRECIPITATION DATA

   16 PB             STORM        3.98  BASIN TOTAL PRECIPITATION

   17 PI          INCREMENTAL PRECIPITATION PATTERN
                    0.00      0.01      0.01      0.01      0.01      0.01      0.01      0.01      0.01      0.01
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                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

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

149 UD        SCS DIMENSIONLESS UNITGRAPH
                  TLAG       6.37  LAG

                                                  ***

                                              UNIT HYDROGRAPH
                                          66 END-OF-PERIOD ORDINATES
            53.      153.      289.      449.      660.      921.     1223.     1555.     1837.     2054.
          2212.     2310.     2328.     2319.     2263.     2155.     2032.     1895.     1737.     1556.
          1345.     1162.     1012.      892.      786.      695.      620.      555.      491.      437.
           384.      335.      300.      264.      234.      208.      181.      162.      142.      125.
           111.       98.       87.       77.       68.       61.       54.       47.       42.       37.
            33.       29.       26.       23.       21.       19.       17.       15.       13.       11.
             9.        7.        6.        4.        2.        0.

    ***           ***           ***           ***           ***
                    HYDROGRAPH AT STATION    SUB13

      TOTAL RAINFALL =  3.98, TOTAL LOSS =  2.11, TOTAL EXCESS =  1.87

 PEAK FLOW     TIME                          MAXIMUM AVERAGE FLOW
                                     6-HR       24-HR       72-HR     74.50-HR
+  (CFS)       (HR)
                          (CFS)
+   3386.     19.00                3091.       1576.        536.        518.
                        (INCHES)   0.899       1.834       1.871       1.871
                         (AC-FT)   1533.       3127.       3189.       3189.

                        CUMULATIVE AREA =   31.96 SQ MI


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

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          *            *
150 KK    *    SUB14   *
          *            *
          **************
                    RUNOFF FROM SUBBASIN 14

            SUBBASIN RUNOFF DATA

152 BA        SUBBASIN CHARACTERISTICS
                 TAREA       8.88  SUBBASIN AREA

              PRECIPITATION DATA
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 16 PB              STORM       3.98  BASIN TOTAL PRECIPITATION

 17 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

153 LS          SCS LOSS RATE
                    STRTL       0.53  INITIAL ABSTRACTION
                   CRVNBR      79.00  CURVE NUMBER
                    RTIMP       0.00  PERCENT IMPERVIOUS AREA

154 UD          SCS DIMENSIONLESS UNITGRAPH
                     TLAG       2.50  LAG

                                                  ***

                                              UNIT HYDROGRAPH
                                         27 END-OF-PERIOD ORDINATES
            136.      415.      867.     1325.     1545.     1545.     1370.     1131.      816.      591.
            437.      333.      246.      184.      137.      101.       75.       56.       42.       31.
             23.       17.       14.       10.        7.        4.        1.

     ***           ***           ***           ***           ***
                     HYDROGRAPH AT STATION    SUB14

      TOTAL RAINFALL =  3.98, TOTAL LOSS =  2.03, TOTAL EXCESS =  1.95

  PEAK FLOW     TIME                        MAXIMUM AVERAGE FLOW
                                     6-HR       24-HR       72-HR     74.50-HR
+   (CFS)       (HR)
                          (CFS)
+    1972.     14.50                1324.        465.        155.        150.
                         (INCHES)   1.386       1.947       1.947       1.947
                          (AC-FT)    657.        922.        922.        922.

                         CUMULATIVE AREA =    8.88 SQ MI


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

          **************
          *            *
 155 KK   *        8   *     COMBINE THREE HYDROGRAPHS 1-12 WITH 13 AND 14
          *            *
          **************

 156 HC          HYDROGRAPH COMBINATION
                    ICOMP           3  NUMBER OF HYDROGRAPHS TO COMBINE

                                                  ***

     ***           ***           ***           ***           ***
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HYDROGRAPH AT STATION 8

PEAK FLOW (CFS)	TIME (HR)		MAXIMUM AVERAGE FLOW 6-HR	24-HR	72-HR	74.50-HR
+		(CFS)				
+ 27791.	20.00		25928.	15576.	5467.	5283.
		(INCHES)	0.772	1.856	1.954	1.954
		(AC-FT)	12857.	30894.	32529.	32529.

CUMULATIVE AREA = 312.16 SQ MI

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          *            *
157 KK    *    SUB15   *
          *            *
          **************
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RUNOFF FROM SUBBASIN 15

SUBBASIN RUNOFF DATA

159 BA SUBBASIN CHARACTERISTICS

TAREA 25.20 SUBBASIN AREA

PRECIPITATION DATA

16 PB STORM 3.98 BASIN TOTAL PRECIPITATION

17 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		

160 LS SCS LOSS RATE

STRTL 0.56 INITIAL ABSTRACTION

CRVNBR 78.00 CURVE NUMBER

RTIMP 0.00 PERCENT IMPERVIOUS AREA

161 UD SCS DIMENSIONLESS UNITGRAPH

TLAG 4.30 LAG

***

UNIT HYDROGRAPH

45 END-OF-PERIOD ORDINATES

99.	315.	603.	999.	1509.	2019.	2397.	2615.	2672.	2648.
2471.	2260.	2010.	1695.	1369.	1121.	934.	778.	663.	556.
467.	384.	325.	271.	227.	189.	157.	132.	110.	93.
77.	65.	54.	45.	38.	32.	27.	24.	20.	17.
13.	10.	7.	4.	1.					

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     ***            ***            ***            ***            ***
                      HYDROGRAPH AT STATION    SUB15

      TOTAL RAINFALL =  3.98, TOTAL LOSS =  2.11, TOTAL EXCESS =  1.87

  PEAK FLOW     TIME                        MAXIMUM AVERAGE FLOW
                                     6-HR       24-HR      72-HR     74.50-HR
+   (CFS)       (HR)
                          (CFS)
+    3599.     16.50                2985.      1264.       423.        408.
                        (INCHES)    1.101      1.865      1.871       1.871
                         (AC-FT)    1480.      2507.      2515.       2515.

                        CUMULATIVE AREA =   25.20 SQ MI


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

            **************
            *            *
  162 KK    *         9  *     COMBINE TWO HYDROGRAPHS 1-14 WITH 15
            *            *
            **************

  163 HC         HYDROGRAPH COMBINATION
                      ICOMP          2  NUMBER OF HYDROGRAPHS TO COMBINE

                                                          ***

     ***            ***            ***            ***            ***
                      HYDROGRAPH AT STATION       9

  PEAK FLOW     TIME                        MAXIMUM AVERAGE FLOW
                                     6-HR       24-HR      72-HR     74.50-HR
+   (CFS)       (HR)
                          (CFS)
+   29969.     20.00                28038.     16805.      5889.       5692.
                        (INCHES)    0.773      1.853      1.948       1.948
                         (AC-FT)   13903.     33333.     35044.      35044.

                        CUMULATIVE AREA =  337.36 SQ MI


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

            **************
            *            *
  164 KK    *        10  *     ROUTE HYDROGRAPHS 1-15 THROUGH REACH 10
            *            *
            **************

              HYDROGRAPH ROUTING DATA

  165 RS         STORAGE ROUTING
                      NSTPS          1  NUMBER OF SUBREACHES
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                    ITYP       FLOW  TYPE OF INITIAL CONDITION
                  RSVRIC      -1.00  INITIAL CONDITION
                       X       0.00 WORKING R AND D COEFFICIENT

166 RC         NORMAL DEPTH CHANNEL ROUTING
                     ANL      0.036  LEFT OVERBANK N-VALUE
                    ANCH      0.032  MAIN CHANNEL N-VALUE
                     ANR      0.035  RIGHT OVERBANK N-VALUE
                   RLNTH     29000.  REACH LENGTH
                     SEL     0.0028  ENERGY SLOPE
                   ELMAX        0.0  MAX. ELEV. FOR STORAGE/OUTFLOW CALCULATION

                                        CROSS-SECTION DATA
                        --- LEFT OVERBANK --- + ------ MAIN CHANNEL ------- + --- RIGHT OVERBANK ---
168 RY       ELEVATION   995.00    994.00    987.00    988.00    994.00    993.00    993.00    995.00
167 RX       DISTANCE   2069.00   2933.00   3070.00   3135.00   3163.00   3226.00   3834.00   4251.00

                                                          ***

                                        COMPUTED STORAGE-OUTFLOW-ELEVATION DATA
          STORAGE      0.00      4.99     19.96     43.53     70.45    100.24    132.88    168.39    206.76    247.99
          OUTFLOW      0.00      6.37     40.43    126.46    264.49    448.14    677.53    953.44   1277.02   1649.59
        ELEVATION    987.00    987.42    987.84    988.26    988.68    989.11    989.53    989.95    990.37    990.79
          STORAGE    292.08    339.03    388.84    441.51    497.04    692.27    964.01   1277.11   1698.88   2247.23
          OUTFLOW   2072.61   2547.63   3076.21   3659.95   4300.49   4843.96   5935.54   6845.68   8829.98  11998.41
        ELEVATION    991.21    991.63    992.05    992.47    992.89    993.32    993.74    994.16    994.58    995.00

     ***          ***          ***          ***          ***
                     HYDROGRAPH AT STATION      10

 PEAK FLOW     TIME                        MAXIMUM AVERAGE FLOW
                                     6-HR       24-HR       72-HR     74.50-HR
+   (CFS)      (HR)
                          (CFS)
+   27191.     22.00               25894.      16446.       5887.       5689.
                        (INCHES)    0.714       1.813       1.947       1.947
                         (AC-FT)   12840.      32620.      35029.      35029.

 PEAK STORAGE   TIME                       MAXIMUM AVERAGE STORAGE
                                     6-HR       24-HR       72-HR     74.50-HR
+  (AC-FT)     (HR)
    4877.     22.00                4652.       2997.       1067.       1031.

 PEAK STAGE    TIME                        MAXIMUM AVERAGE STAGE
                                     6-HR       24-HR       72-HR     74.50-HR
+   (FEET)     (HR)
   997.02     22.00               996.85      995.55      990.94      990.81

                         CUMULATIVE AREA =  337.36 SQ MI


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          *            *
169 KK    *    SUB16   *
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*          *
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                    RUNOFF FROM SUBBASIN 16

            SUBBASIN RUNOFF DATA

171 BA          SUBBASIN CHARACTERISTICS
                     TAREA       24.30  SUBBASIN AREA

                PRECIPITATION DATA

 16 PB               STORM        3.98  BASIN TOTAL PRECIPITATION

 17 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

172 LS          SCS LOSS RATE
                     STRTL        0.52  INITIAL ABSTRACTION
                    CRVNBR       79.40  CURVE NUMBER
                     RTIMP        0.00  PERCENT IMPERVIOUS AREA

173 UD          SCS DIMENSIONLESS UNITGRAPH
                      TLAG        4.20  LAG

                                                  ***

                                                UNIT HYDROGRAPH
                                          44 END-OF-PERIOD ORDINATES
             102.      322.      618.     1026.     1549.     2054.     2414.     2609.     2634.     2574.
            2386.     2166.     1897.     1562.     1252.     1033.      857.      717.      609.      509.
             420.      350.      291.      244.      200.      168.      138.      116.       97.       81.
              68.       56.       47.       38.       33.       28.       24.       20.       17.       13.
              10.        7.        4.        1.

    ***          ***          ***          ***          ***
                     HYDROGRAPH AT STATION    SUB16

      TOTAL RAINFALL =  3.98, TOTAL LOSS =  2.00, TOTAL EXCESS =  1.98

 PEAK FLOW    TIME                        MAXIMUM AVERAGE FLOW
                                    6-HR       24-HR      72-HR     74.50-HR
+  (CFS)      (HR)
                         (CFS)
+   3757.     16.50                3091.      1288.       431.        416.
                        (INCHES)   1.183      1.972      1.978       1.978
                        (AC-FT)    1533.      2556.      2564.       2564.

                        CUMULATIVE AREA =   24.30 SQ MI

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            *            *
174 KK      *    SUB17   *
            *            *
            **************
                        RUNOFF FROM SUBBASIN 17

          SUBBASIN RUNOFF DATA

176 BA        SUBBASIN CHARACTERISTICS
                  TAREA       31.50  SUBBASIN AREA

              PRECIPITATION DATA

 16 PB            STORM        3.98  BASIN TOTAL PRECIPITATION

 17 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

177 LS        SCS LOSS RATE
                  STRTL        0.52  INITIAL ABSTRACTION
                 CRVNBR       79.40  CURVE NUMBER
                  RTIMP        0.00  PERCENT IMPERVIOUS AREA

178 UD        SCS DIMENSIONLESS UNITGRAPH
                   TLAG        6.47  LAG

                                                  ***

                                              UNIT HYDROGRAPH
                                         67 END-OF-PERIOD ORDINATES
            51.     145.     274.     425.     626.     870.    1154.    1474.    1747.    1966.
          2131.    2232.    2257.    2255.    2220.    2119.    2003.    1876.    1735.    1567.
          1370.    1184.    1024.     906.     801.     708.     627.     565.     504.     447.
           396.     346.     308.     274.     241.     216.     190.     168.     149.     130.
           116.     103.      91.      81.      72.      64.      57.      50.      44.      39.
            34.      31.      27.      24.      22.      20.      18.      16.      14.      12.
            10.       9.       7.       5.       4.       2.       0.

    ***          ***          ***          ***          ***
                    HYDROGRAPH AT STATION    SUB17

      TOTAL RAINFALL =  3.98, TOTAL LOSS =  2.00, TOTAL EXCESS =  1.98

 PEAK FLOW     TIME                        MAXIMUM AVERAGE FLOW
                                    6-HR       24-HR       72-HR     74.50-HR
+  (CFS)       (HR)
                         (CFS)
+   3506.      19.00                3205.       1641.        559.        540.
                        (INCHES)   0.946       1.937       1.978       1.978
                         (AC-FT)   1589.       3254.       3323.       3323.

                        CUMULATIVE AREA =   31.50 SQ MI
```

```
*** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** ***

          **************
          *            *
179 KK    *       10   *     COMBINE THREE HYDROGRAPHS 1-15 WITH 16 AND 17
          *            *
          **************

180 HC         HYDROGRAPH COMBINATION
                    ICOMP          3  NUMBER OF HYDROGRAPHS TO COMBINE

                                                          ***

     ***           ***           ***           ***           ***
                     HYDROGRAPH AT STATION      10

 PEAK FLOW    TIME                        MAXIMUM AVERAGE FLOW
                                   6-HR       24-HR       72-HR     74.50-HR
+  (CFS)      (HR)
                        (CFS)
+  31666.    21.50               30111.      19225.      6876.       6645.
                     (INCHES)    0.712       1.819       1.951       1.951
                      (AC-FT)   14931.      38132.      40916.      40916.

                      CUMULATIVE AREA =  393.16 SQ MI


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

          **************
          *            *
181 KK    *       11   *     ROUTE HYDROGRAPHS 1-19 THROUGH REACH 11
          *            *
          **************

            HYDROGRAPH ROUTING DATA

182 RS         STORAGE ROUTING
                    NSTPS          1  NUMBER OF SUBREACHES
                     ITYP       FLOW  TYPE OF INITIAL CONDITION
                   RSVRIC      -1.00  INITIAL CONDITION
                        X       0.00 WORKING R AND D COEFFICIENT

183 RC         NORMAL DEPTH CHANNEL ROUTING
                      ANL      0.045  LEFT OVERBANK N-VALUE
                     ANCH      0.028  MAIN CHANNEL N-VALUE
                      ANR      0.040  RIGHT OVERBANK N-VALUE
                    RLNTH     15800.  REACH LENGTH
                      SEL     0.0018  ENERGY SLOPE
                    ELMAX        0.0  MAX. ELEV. FOR STORAGE/OUTFLOW CALCULATION

                                   CROSS-SECTION DATA
                      --- LEFT OVERBANK --- + ------ MAIN CHANNEL ------- + --- RIGHT OVERBANK ---
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185 RY      ELEVATION   888.00   884.00   879.00   878.00   881.00   883.00   883.00   888.00
184 RX      DISTANCE   2075.00  2373.00  2406.00  2556.00  2566.00  2752.00  3423.00  3440.00

                                                  ***

                                   COMPUTED STORAGE-OUTFLOW-ELEVATION DATA
          STORAGE      0.00     7.70    30.74    60.61    91.48   123.35   156.62   197.69   248.77   309.85
          OUTFLOW      0.00    19.68   128.66   392.13   763.05  1229.95  1697.41  2106.33  2693.73  3467.34
        ELEVATION    878.00   878.53   879.05   879.58   880.11   880.63   881.16   881.68   882.21   882.74
          STORAGE    443.87   644.06   846.49  1056.20  1273.73  1499.09  1732.28  1973.30  2222.14  2478.82
          OUTFLOW   4731.63  6843.10  9429.27 12514.23 16078.18 20094.55 24550.96 29440.35 34758.51 40503.03
        ELEVATION    883.26   883.79   884.32   884.84   885.37   885.89   886.42   886.95   887.47   888.00

    ***          ***          ***          ***          ***
                     HYDROGRAPH AT STATION      11

 PEAK FLOW     TIME                      MAXIMUM AVERAGE FLOW
                                  6-HR      24-HR      72-HR    74.50-HR
+  (CFS)       (HR)
                          (CFS)
+  31453.     22.00               29937.     19117.      6874.       6644.
                        (INCHES)   0.708      1.808      1.951       1.951
                         (AC-FT)  14845.     37917.     40904.      40904.

 PEAK STORAGE  TIME                      MAXIMUM AVERAGE STORAGE
                                  6-HR      24-HR      72-HR    74.50-HR
+ (AC-FT)      (HR)
   2067.     22.00                1996.      1405.       522.        505.

 PEAK STAGE    TIME                      MAXIMUM AVERAGE STAGE
                                  6-HR      24-HR      72-HR    74.50-HR
+  (FEET)      (HR)
   887.15    22.00               886.99     885.63     881.53      881.41

                        CUMULATIVE AREA =  393.16 SQ MI


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

          **************
          *            *
186 KK    *    SUB18   *
          *            *
          **************
                        RUNOFF FROM SUBBASIN 18

            SUBBASIN RUNOFF DATA

188 BA        SUBBASIN CHARACTERISTICS
                   TAREA        8.40  SUBBASIN AREA

              PRECIPITATION DATA

 16 PB             STORM        3.98  BASIN TOTAL PRECIPITATION

 17 PI          INCREMENTAL PRECIPITATION PATTERN
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```
                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

189 LS        SCS LOSS RATE
                 STRTL       0.48  INITIAL ABSTRACTION
                CRVNBR      80.50  CURVE NUMBER
                 RTIMP       0.00  PERCENT IMPERVIOUS AREA

190 UD        SCS DIMENSIONLESS UNITGRAPH
                  TLAG       2.44  LAG

                                                  ***

                                              UNIT HYDROGRAPH
                                          26 END-OF-PERIOD ORDINATES
          136.     416.     874.    1309.    1498.    1480.    1296.    1045.     735.     535.
          398.     298.     217.     161.     119.      87.      65.      48.      36.      26.
           20.      15.      12.       8.       5.       3.

    ***          ***          ***          ***          ***
                   HYDROGRAPH AT STATION    SUB18

     TOTAL RAINFALL =  3.98, TOTAL LOSS =  1.92, TOTAL EXCESS =  2.06

 PEAK FLOW    TIME                      MAXIMUM AVERAGE FLOW
                                  6-HR       24-HR       72-HR     74.50-HR
+  (CFS)      (HR)
                        (CFS)
+   2028.    14.50                1343.       466.       155.        150.
                      (INCHES)    1.486      2.064      2.065       2.065
                       (AC-FT)     666.       925.       925.        925.

                      CUMULATIVE AREA =    8.40 SQ MI


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

          **************
          *            *
191 KK    *        11  *     COMBINE TWO HYDROGRAPHS 1-17 WITH 18
          *            *
          **************

192 HC        HYDROGRAPH COMBINATION
                 ICOMP          2  NUMBER OF HYDROGRAPHS TO COMBINE

                                                  ***

    ***          ***          ***          ***          ***
                   HYDROGRAPH AT STATION      11

 PEAK FLOW    TIME                      MAXIMUM AVERAGE FLOW
                                  6-HR       24-HR       72-HR     74.50-HR
```

```
+  (CFS)      (HR)
                          (CFS)
+  31765.     22.00                30248.      19417.      7030.       6794.
                         (INCHES)   0.700       1.798      1.953       1.953
                          (AC-FT)  14999.      38514.     41829.      41829.

                         CUMULATIVE AREA =  401.56 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 6-HOUR	24-HOUR	72-HOUR	BASIN AREA	MAXIMUM STAGE	TIME OF MAX STAGE
+	HYDROGRAPH AT	SUB 1	2998.	21.50	2845.	1684.	593.	34.00		
+	ROUTED TO	1	2960.	22.50	2805.	1679.	593.	34.00		
+									1266.73	22.50
+	HYDROGRAPH AT	SUB 2	2749.	14.50	1766.	602.	201.	11.50		
+	2 COMBINED AT	1	3340.	22.00	3192.	2229.	794.	45.50		
+	HYDROGRAPH AT	SUB 3	2752.	15.50	2056.	772.	258.	14.30		
+	ROUTED TO	2	2728.	15.50	2050.	771.	258.	14.30		
+									1225.26	15.50
+	HYDROGRAPH AT	SUB 4	4040.	17.50	3493.	1565.	525.	29.15		
+	3 COMBINED AT	2	8756.	16.00	8122.	4563.	1577.	88.95		
+	ROUTED TO	3	6978.	20.50	6752.	4449.	1575.	88.95		
+									1230.10	20.50
+	HYDROGRAPH AT	SUB	1671.	17.00	1417.	617.	207.	12.32		
+	2 COMBINED AT	3	8163.	19.00	7855.	5052.	1782.	101.27		
+	ROUTED TO	4	8088.	20.00	7783.	5046.	1782.	101.27		
+									1209.36	20.00
	HYDROGRAPH AT									

+		SUB 6	4850.	16.00	3830.	1524.	509.	30.35		
	HYDROGRAPH AT									
+		SUB 7	1625.	13.50	809.	259.	86.	4.95		
	3 COMBINED AT									
+		4	11376.	17.50	10695.	6755.	2377.	136.57		
	ROUTED TO									
+		5	11115.	18.50	10562.	6744.	2377.	136.57		
+									1170.71	18.50
	HYDROGRAPH AT									
+		SUB 8	2186.	20.00	2041.	1124.	388.	23.13		
	2 COMBINED AT									
+		5	13186.	19.00	12559.	7868.	2765.	159.70		
	ROUTED TO									
+		6	12824.	20.50	12298.	7862.	2765.	159.70		
+									1144.91	20.50
	HYDROGRAPH AT									
+		SUB 9	3511.	15.50	2664.	1014.	338.	18.29		
	2 COMBINED AT									
+		6	14130.	19.50	13625.	8845.	3103.	177.99		
	HYDROGRAPH AT									
+		SUB10	5572.	17.50	4900.	2274.	765.	42.46		
	ROUTED TO									
+		7	5367.	18.50	4722.	2244.	765.	42.46		
+									1150.43	18.50
	HYDROGRAPH AT									
+		SUB11	3577.	17.50	3087.	1376.	461.	25.62		
	3 COMBINED AT									
+		6	22565.	19.00	21133.	12452.	4329.	246.07		
	ROUTED TO									
+		8	22428.	19.50	21025.	12453.	4329.	246.07		
+									1114.82	19.50
	HYDROGRAPH AT									
+		SUB12	3722.	17.00	3131.	1338.	448.	25.25		
	2 COMBINED AT									
+		7	25339.	18.50	23682.	13774.	4777.	271.32		
	ROUTED TO									
+		9	24085.	20.50	22590.	13620.	4776.	271.32		
+									1067.00	20.50
	HYDROGRAPH AT									
+		SUB13	3386.	19.00	3091.	1576.	536.	31.96		

+	HYDROGRAPH AT	SUB14	1972.	14.50	1324.	465.	155.	8.88	
+	3 COMBINED AT	8	27791.	20.00	25928.	15576.	5467.	312.16	
+	HYDROGRAPH AT	SUB15	3599.	16.50	2985.	1264.	423.	25.20	
+	2 COMBINED AT	9	29969.	20.00	28038.	16805.	5889.	337.36	
+	ROUTED TO	10	27191.	22.00	25894.	16446.	5887.	337.36	
+									997.02 22.00
+	HYDROGRAPH AT	SUB16	3757.	16.50	3091.	1288.	431.	24.30	
+	HYDROGRAPH AT	SUB17	3506.	19.00	3205.	1641.	559.	31.50	
+	3 COMBINED AT	10	31666.	21.50	30111.	19225.	6876.	393.16	
+	ROUTED TO	11	31453.	22.00	29937.	19117.	6874.	393.16	
+									887.15 22.00
+	HYDROGRAPH AT	SUB18	2028.	14.50	1343.	466.	155.	8.40	
+	2 COMBINED AT	11	31765.	22.00	30248.	19417.	7030.	401.56	

is this all?

435-438

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