Draft

# Gavilan Peak Wash
# Floodplain Delineation Study

## Technical Data Notebook
## Section 4: Hydrology

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## 4.1 Method Description

### 4.1.1 Introduction

The purpose of this study is to develop 100-year hydrology for the 6-hour and 24-hour storms for Gavilan Peak Wash Watershed with an approximate drainage area of 8.1 square miles. The study watershed is located at Town of New River in north Maricopa County, Arizona. Figure 1 shows the location of the watershed. It is within T7N, R2E (Sections 12, 13, 14, 23, 24, 25, 26, 35, and 36) and T7N, R3E (Sections 7, 18, 19, 30, and 31). Gavilan Peak Wash is a tributary of New River. The hydrology to be developed will be used for floodplain delineation study for major washes in Gavilan Peak Watershed and New River downstream of the confluence. This report is organized according to Instructions for Organizing and Submitting Technical Documentation for Flood Studies developed by the Arizona Department of Water Resources (ADWR), Flood Mitigation Section, dated November, 1997 .

### 4.1.2 Method Description

The hydrology is developed by utilizing procedures described in Drainage Design Manual for Maricopa County, Arizona, Volume I, Hydrology, Revision II (Sabol et al., 1995). The hydrologic analysis is performed by using the Brigham Young University's Watershed Modeling System (WMS, also called BOSS WMS) and the U.S. Army Corps of Engineers HEC-1 computer program (HEC, 1991). The 1997 version of HEC-1 is used. WMS 5.1 (BYU, 1998 and BOSS, 1998) is a GIS-based watershed modeling computer program which can process the GIS data, compute the hydrologic parameters required by HEC-1, generate an input file for HEC-1, and graphically display the HEC-1 results. Many hydrologic procedures such as Green-Ampt infiltration parameter computation and S-graph unit hydrograph, which are described in Sabol et



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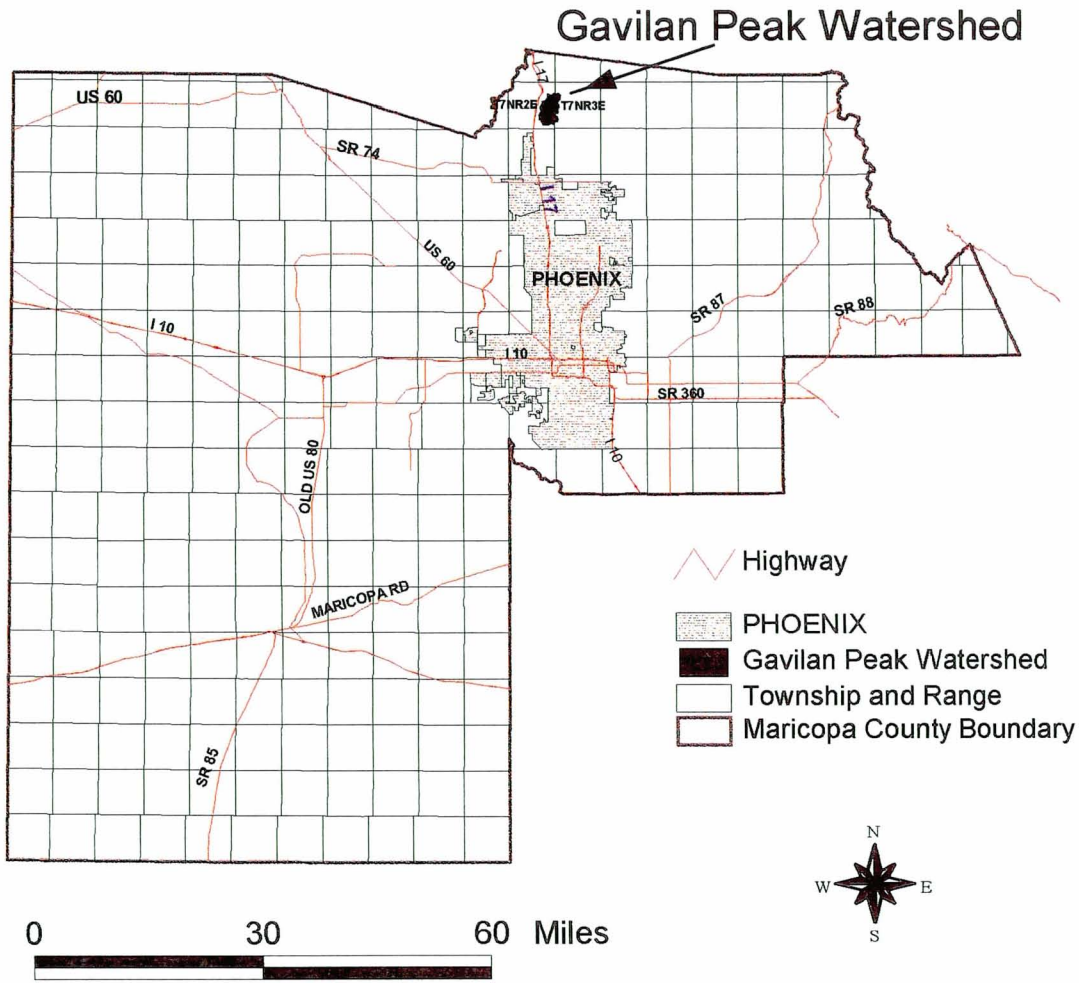


Figure 1. Location of Gavilan Peak Watershed

al. (1995), have been incorporated into WMS 5.1 and tested by Flood Control District of Maricopa County (FCDMC, 1998).

The point precipitation values are obtained from isopluvial maps in Sabol et al. (1995). These point precipitation values are adjusted by using the depth-area reduction curves in Sabol et al. (1995) and the National Oceanic and Atmospheric Administration NWS HYDRO-40 (Zehr and Myers, 1984). The 6-hour rainfall distribution is from Sabol et al. (1995). The 24-hour rainfall distribution is Soil Conservation Services (SCS) Type II distribution. Rainfall losses are estimated by using the Green-Ampt infiltration procedures documented in Sabol et al. (1995). The Phoenix Mountain S-graph is used to derive unit hydrographs based on Sabol et al. (1995). Channel routing is based on normal depth routing.

Peak discharges for the 100-year 6-hour and 100-year 24-hour storms are determined for the most recent available data for existing land use conditions in the watershed. The higher discharge of the two storms will be used in the floodplain delineation study.

## 4.2 Parameter Estimation

### 4.2.1 Drainage Area Boundaries

The study watershed (Figure 1) is located at Town of New River in north Maricopa County, Arizona. It is a contributing area for New River (Figure 2). The drainage area is approximately 8.1 square miles. The general watershed map is shown on Figure 3. Figure 4 shows a photo of Gavilan Peak. The watershed is bounded on the north by Table Mountain, on the south by Gavilan Peak, on the west by New River, on the east by the ridge west of Skunk Creek.

The highest elevation is 3307 feet above mean sea level, the lowest elevation is 2014 feet. The mean basin elevation is 2254 feet. The perimeter of the watershed is about 14.5 miles. The length for the longest water course is 5.3 miles. The centroid length along the main water course is 2.2 miles. The slope for the longest water course is 232 ft/mile. The basin slope is 575 ft/mile.

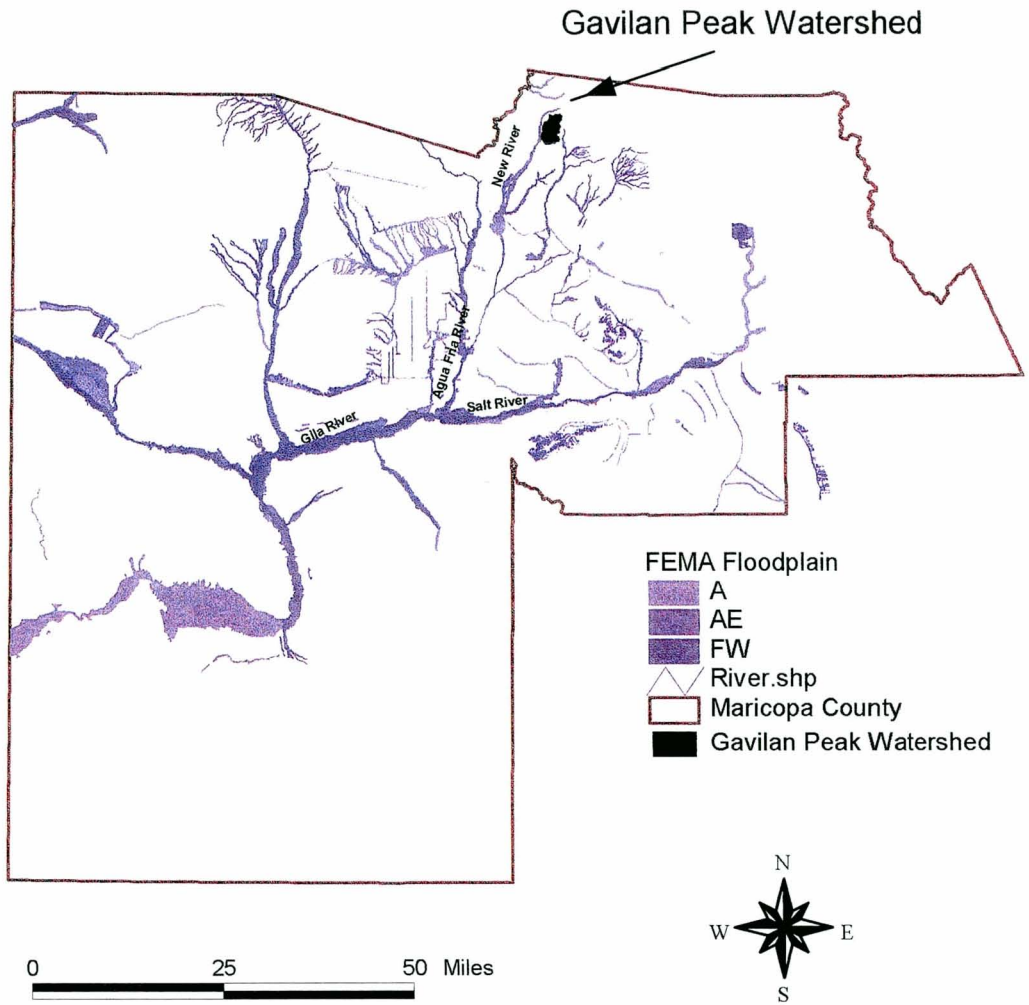


**Figure 2. River System in Maricopa County**

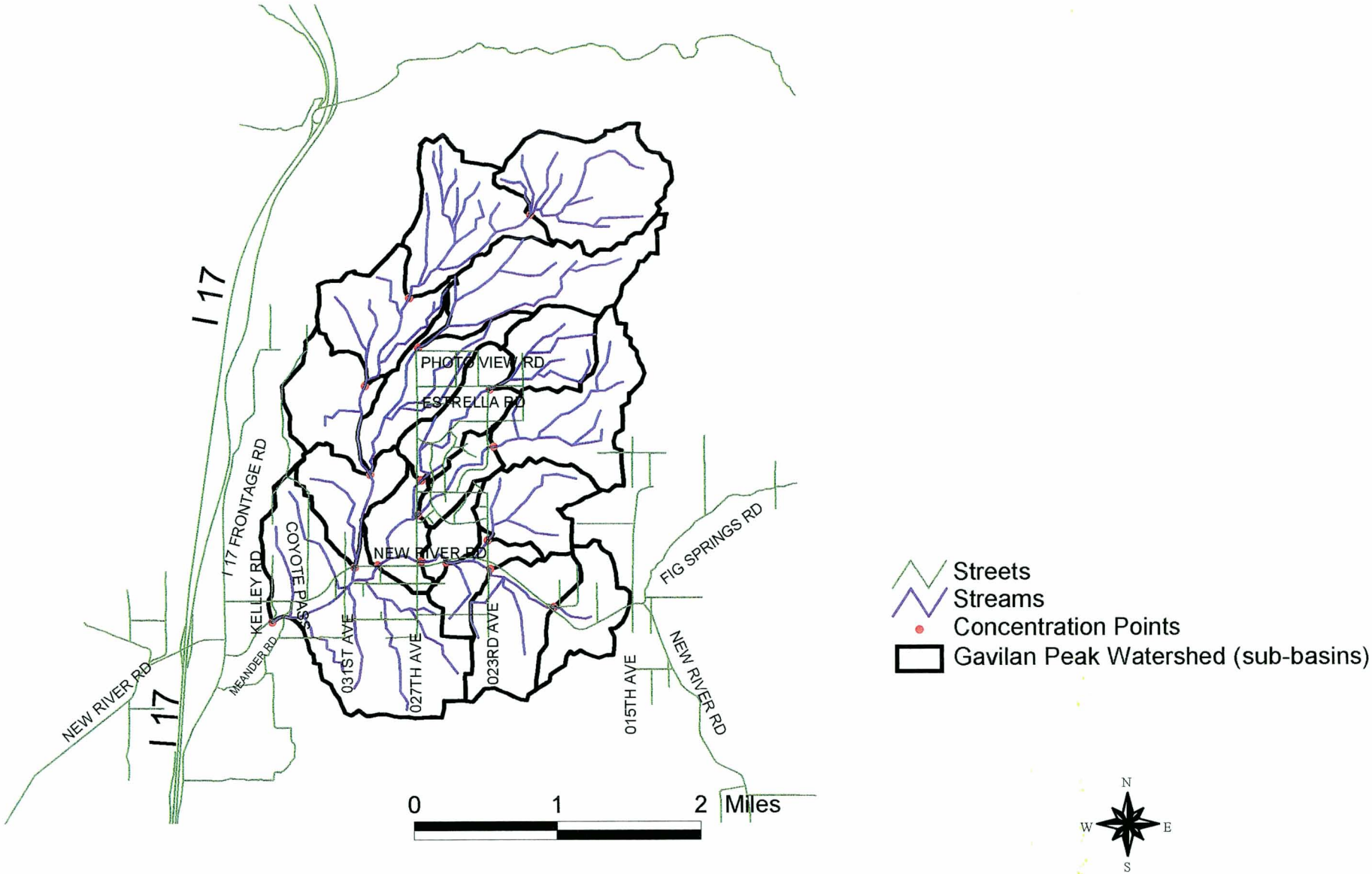


Figure 3. General Watershed Map

Figure 4. Gavilan Peak (looking south downstream of a small wash)

The stream channels are well-defined. The soil types and land use types for the watershed can be seen on Figure 5 and Figure 6, respectively. The topographic data are the current U. S. Geological Survey (USGS) 7.5 Minute Digital Elevation Model (DEM) at a scale of 1" = 2,000' with contour intervals of 20' or 40' (USGS, 1997). Two USGS DEMs, which correspond to two quadrangle maps (New River and Daisy Mountain), are used. The GIS ArcInfo is used to convert the DEMs data into state-plane coordinates data and save the data in an ArcInfo ASCII Grid format. Figure 7 shows the topographic data for the watershed.

The ArcInfo ASCII Grid file is then imported into WMS 5.1 as well as digital aerial photos, streams, streets, soils, and land uses. The delineation of drainage sub-basins is accomplished by using the digital topographic data with the consideration of aerial photos, streams, streets, soils, and land uses. More consideration is given to provide flow rates at the major roadway crossings where there are reported flooding damages. Please see Appendix 7 for the reported flooding damages in Town of New River. The watershed is divided into 18 sub-basins (Figure 8). The area and other geometric parameters for each sub-basin are computed by WMS, and are listed in Table 1.

### 4.2.2 Watershed Work Maps

The watershed work maps include (1) the drainage basin map (Figure 8 or Exhibit 1 in the pocket at the end of the report) showing sub-basin boundaries and concentration points; (2) the HEC-1 schematic map (Figure 9 or Exhibit 2 in the pocket); (3) the drainage basin map with lag time paths (Figure 10 or Exhibit 3 in the pocket); (4) the drainage basin map with hydrograph routing paths (Figure 11 or Exhibit 4 in the pocket); (5) soils map (Figure 5 or Exhibit 5 in the pocket); and (4) land use map (Figure 6 or Exhibit 6 in the pocket).

After the digital 7.5-min topographic map file (ArcInfo ASCII Grid file), GIS stream shape



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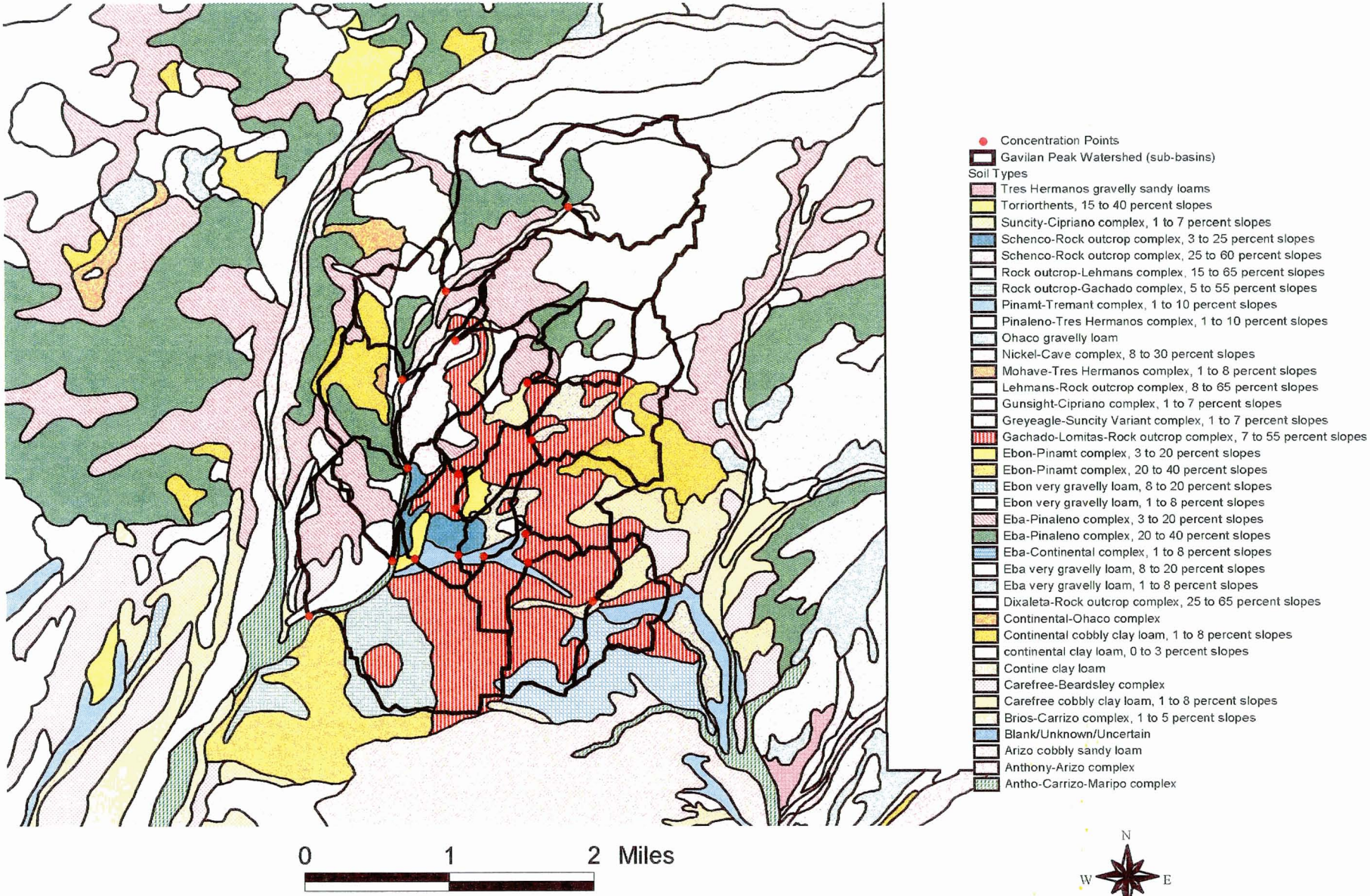


Figure 5. Soil Types for Gavilan Peak Watershed

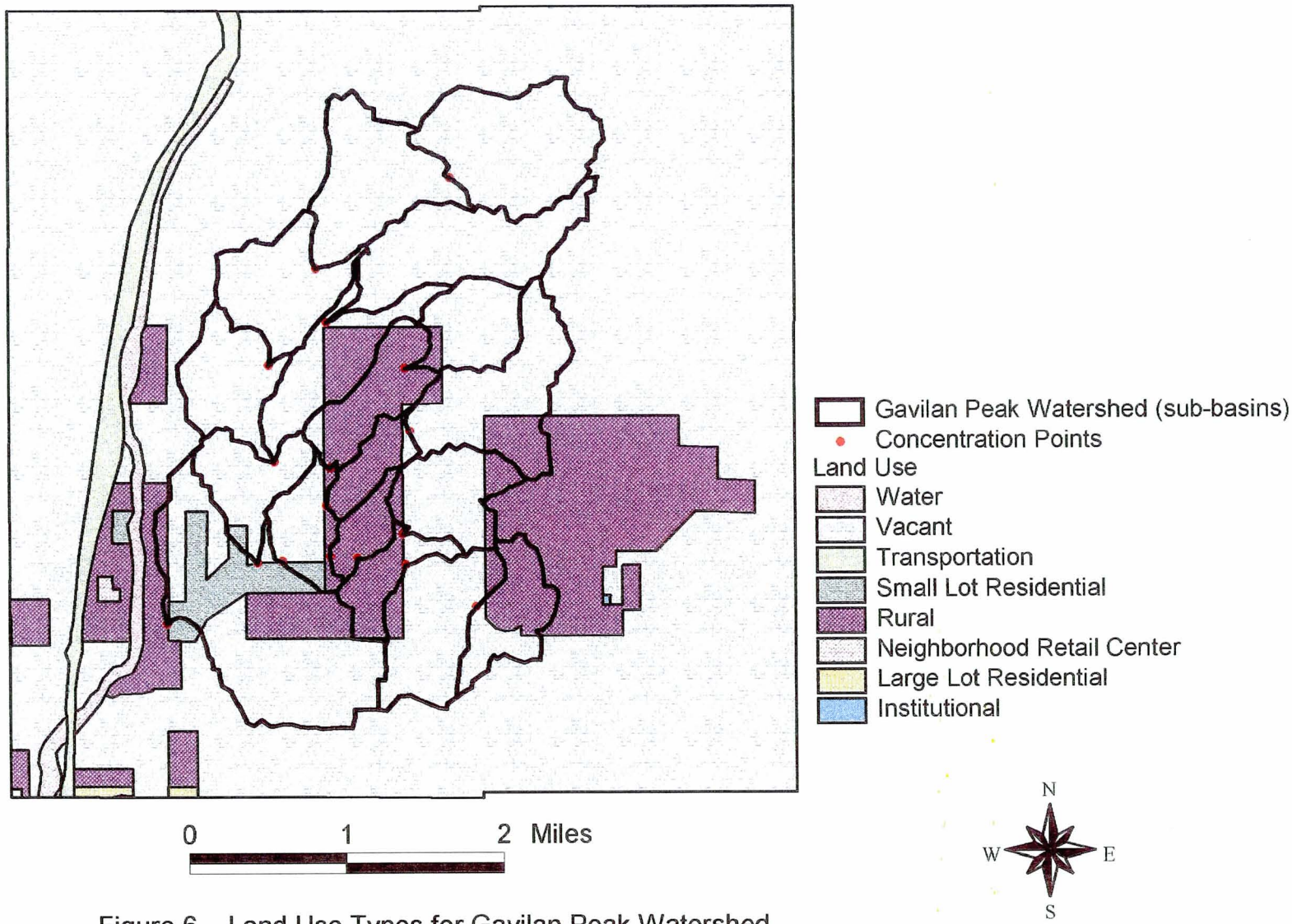


Figure 6. Land Use Types for Gavilan Peak Watershed

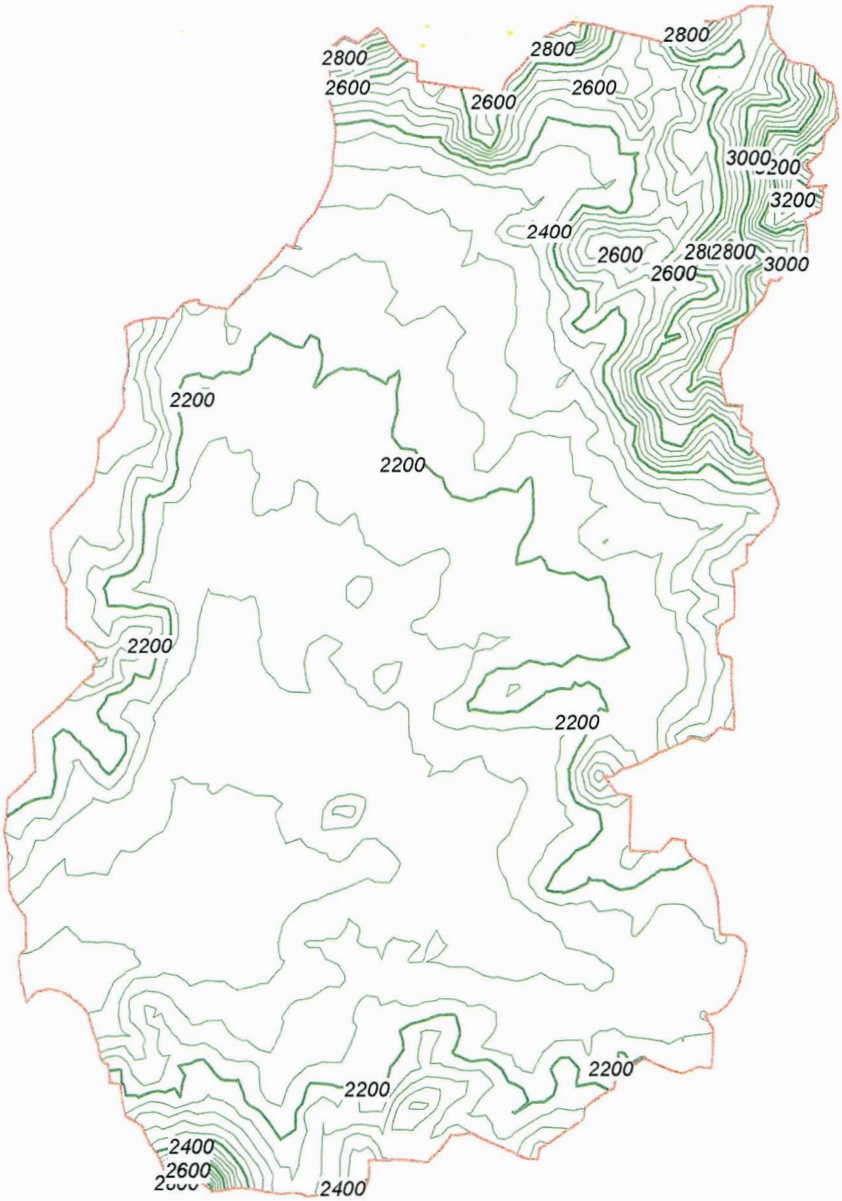


Figure 7. Contour Map for Gavilan Peak Watershed
*(1 inch = 3500.00)*

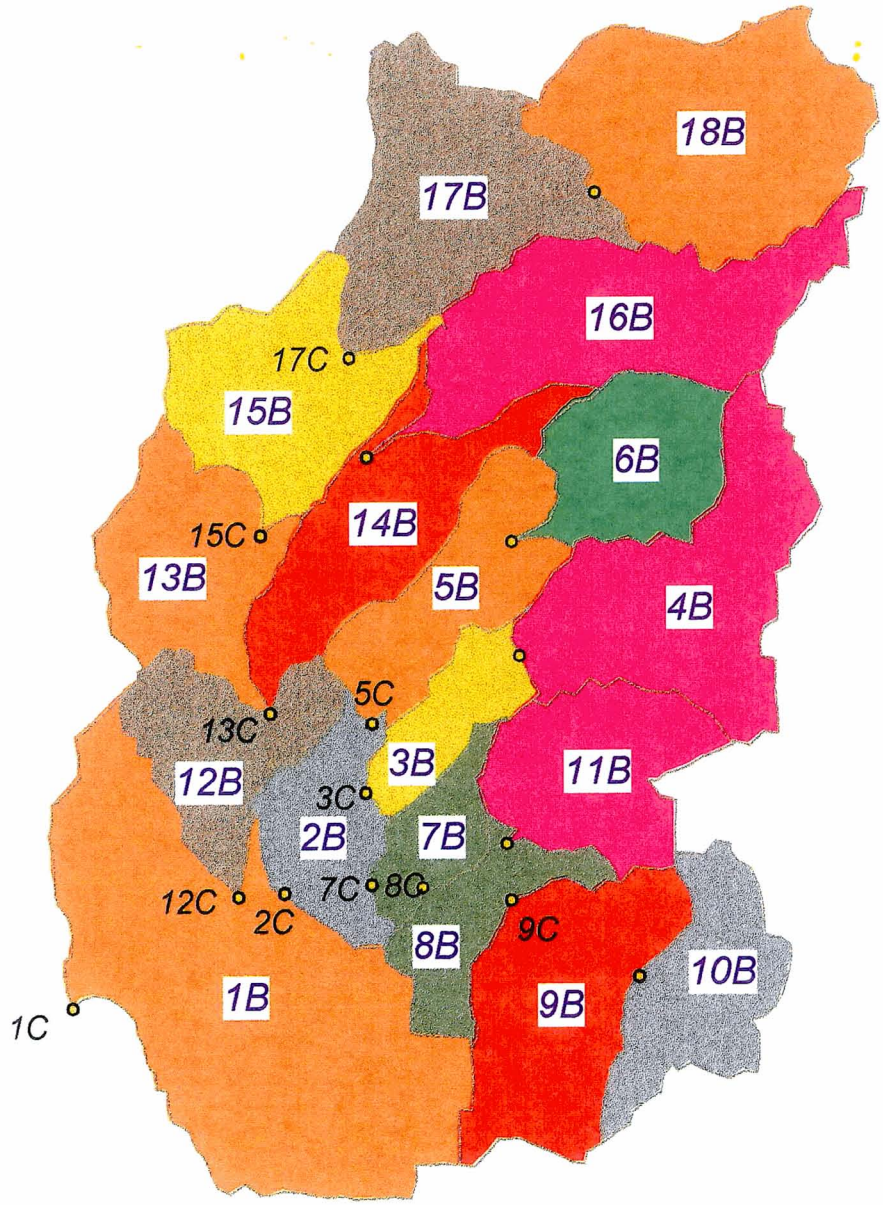


Figure 8. Drainage Basin Map for Gavilan Peak Watershed
*(1 inch = 3500.00)*

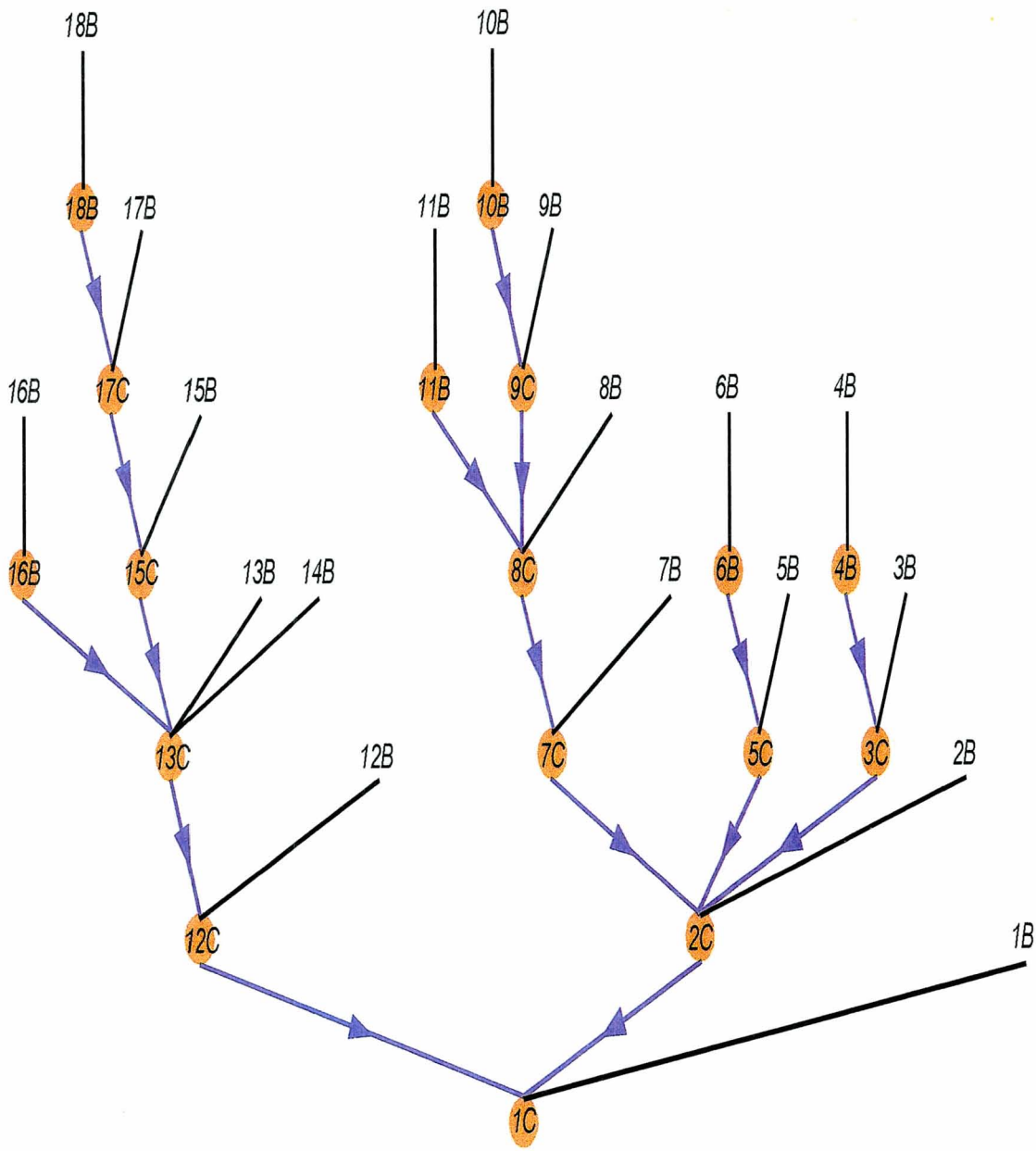


**Figure 9. HEC-1 Schematic Tree**

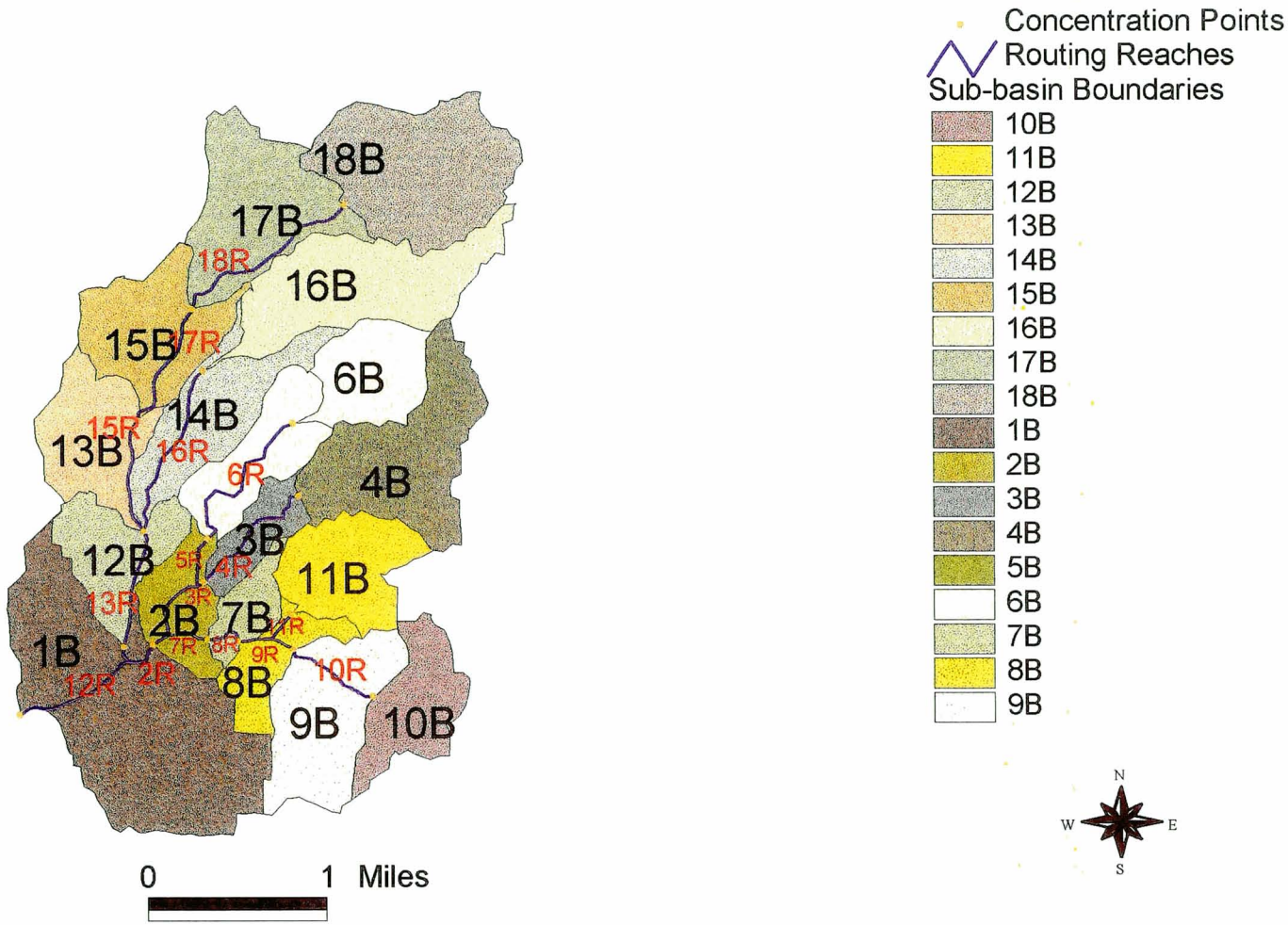


Figure 10. Routing Reaches for Gavilan Peak Watershed

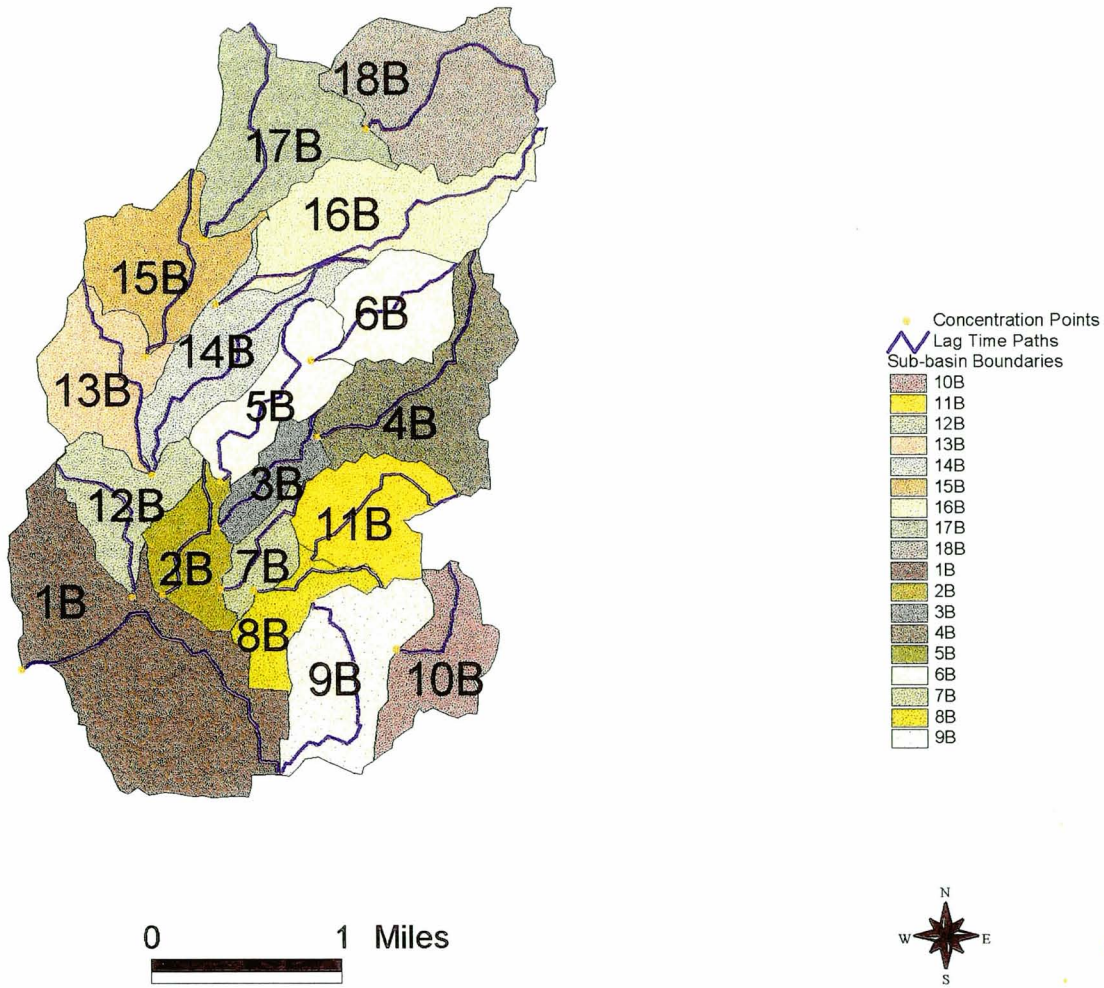


Figure 11. Lag Time Paths (used to compute lag time)

Table 1. Geometric Parameters for Sub-basins

| Sub-basin | Area (mi^2) | L (ft) | S (ft/ft) | Lca (ft) | Sca (ft/ft) | Basin Average Elevation (ft) | Kn | C=24*Kn | Lag Time (min) | 0.25*Lag | S-Graph |
|---|---|---|---|---|---|---|---|---|---|---|---|
| 1B | 1.28 | 11001.5 | 0.0717 | 5702.8 | 0.0121 | 2157.8 | 0.055 | 1.32 | 34.89 | 8.72 | Phoenix Mountain |
| 2B | 0.26 | 4821.0 | 0.0162 | 1762.3 | 0.0187 | 2081.9 | 0.055 | 1.32 | 21.65 | 5.41 | Phoenix Mountain |
| 3B | 0.18 | 5200.8 | 0.0179 | 1992.3 | 0.0179 | 2133.6 | 0.0565 | 1.36 | 23.54 | 5.88 | Phoenix Mountain |
| 4B | 0.62 | 8194.6 | 0.0921 | 3437.4 | 0.015 | 2285.2 | 0.0565 | 1.36 | 25.21 | 6.30 | Phoenix Mountain |
| 5B | 0.35 | 7905.9 | 0.019 | 3986.6 | 0.0101 | 2160.8 | 0.048 | 1.15 | 30.17 | 7.54 | Phoenix Mountain |
| 6B | 0.32 | 5447.4 | 0.0837 | 2520.4 | 0.0279 | 2321.2 | 0.048 | 1.15 | 16.60 | 4.15 | Phoenix Mountain |
| 7B | 0.15 | 4379.9 | 0.0274 | 1635.6 | 0.0057 | 2098.8 | 0.07 | 1.68 | 23.37 | 5.84 | Phoenix Mountain |
| 8B | 0.21 | 3993.8 | 0.0352 | 1128.4 | 0.0027 | 2124.8 | 0.07 | 1.68 | 18.69 | 4.67 | Phoenix Mountain |
| 9B | 0.51 | 7271.0 | 0.036 | 2623.2 | 0.0086 | 2173.2 | 0.07 | 1.68 | 32.20 | 8.05 | Phoenix Mountain |
| 10B | 0.32 | 4178.3 | 0.0106 | 1294.0 | 0.0078 | 2162.5 | 0.07 | 1.68 | 25.16 | 6.29 | Phoenix Mountain |
| 11B | 0.38 | 6163.5 | 0.0427 | 2167.0 | 0.0113 | 2180.4 | 0.0565 | 1.36 | 21.97 | 5.49 | Phoenix Mountain |
| 12B | 0.32 | 5427.7 | 0.0515 | 2957.8 | 0.0177 | 2125.8 | 0.05 | 1.20 | 20.12 | 5.03 | Phoenix Mountain |
| 13B | 0.39 | 7479.1 | 0.0323 | 3300.1 | 0.0151 | 2211.1 | 0.05 | 1.20 | 25.89 | 6.47 | Phoenix Mountain |
| 14B | 0.44 | 9746.8 | 0.0227 | 4989.0 | 0.0131 | 2164.3 | 0.05 | 1.20 | 35.83 | 8.96 | Phoenix Mountain |
| 15B | 0.46 | 5970.1 | 0.0223 | 3978.2 | 0.0152 | 2209.7 | 0.05 | 1.20 | 27.38 | 6.84 | Phoenix Mountain |
| 16B | 0.63 | 11682.2 | 0.0929 | 6422.1 | 0.0349 | 2445.8 | 0.0558 | 1.34 | 36.07 | 9.02 | Phoenix Mountain |
| 17B | 0.58 | 7394.9 | 0.0615 | 4164.6 | 0.02 | 2360.8 | 0.0558 | 1.34 | 27.81 | 6.95 | Phoenix Mountain |
| 18B | 0.71 | 7331.7 | 0.1275 | 2672.1 | 0.0451 | 2618.5 | 0.0558 | 1.34 | 20.39 | 5.10 | Phoenix Mountain |

file, GIS street shape file, GIS soil shape file, and GIS land use file are imported into WMS 5.1, eighteen points along the streams are selected as the concentration points. Then, WMS automatically determines the contributing area for each concentration point, resulting in eighteen sub-basins (1B, 2B, ..., and 18B). The geometric parameters are computed by WMS 5.1. The HEC-1 schematic map is also automatically generated.

The hydrograph routing paths are the stream paths which route the flow from an upstream concentration point to a downstream concentration point. The lag time path for a sub-basin corresponds to the major watercourse from the concentration point to a most hydraulically distant point. The length and slope for each routing path and lag time path are automatically computed by WMS 5.1. The S-graph unit hydrographs (Phoenix Mountain) are also computed by WMS 5.1. The GIS soil shape file is based on SCS soil maps (Camp, 1986). The GIS land use shape file is based on MAG (1995), the most current land use information. The soil and land use information is used by WMS to compute the Green-Ampt rainfall loss parameters.

### 4.2.3 Gage Data

There is no precipitation gage station within the watershed. Two FCDMC operating precipitation gage stations are located within a distance of less than 3 miles from gage stations to the watershed boundary. Figure 12 shows the locations of the FCDMC precipitation gage stations. One precipitation gage station (FCDMC No. 5580 installed on 09/19/1980) at elevation of 2109 feet is about two miles away from the southeast corner of the watershed boundary. The name for this gage station is Upper Skunk Creek. It is located at section 5, T6N, R3E (latitude: 33°53'35"; longitude: 112°04"05". Based on the historic data, there have been 46 storms with rainfall intensity larger than 1.0 inch within 24 hours. There have been 6 storms with rainfall intensity larger than 2.0 inches with 24 hours. There have been two storms larger than 3.0 inches

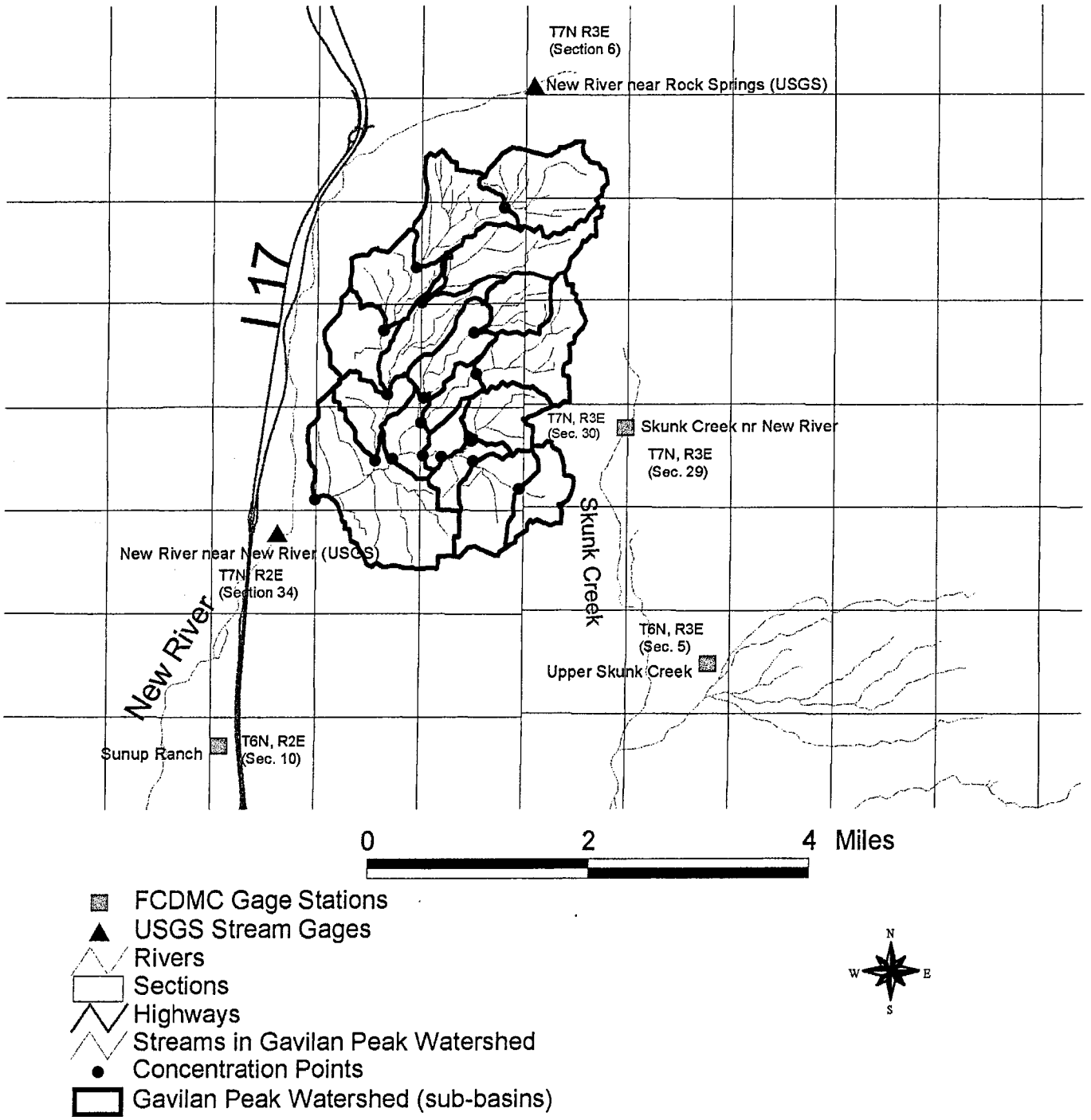


Figure 12. Gage Stations near Gavilan Peak Watershed

within 24 hours. The total annual rainfall depth at this gage ranges from 0.55 inches to 19.92 inches based on 17 years record (1980-1997). The mean total annual rainfall depth is 11.09 inches.

Another precipitation gage station (FCDMC No. 5625 installed on 03/21/1984) at elevation of 2141 feet is about two miles away from the southwest corner of the watershed boundary. The name for this gage station is Sunup Ranch. It is located at section 10, T6N, R2E (latitude: 33°52'53"; longitude: 112°00"00"). Based on the historic data, there have been 356 storms with rainfall intensity larger than 1.0 inch within 24 hours. There have been five storms with rainfall intensity larger than 2.0 inches with 24 hours. There has been no storm larger than 3.0 inches within 24 hours. The total annual rainfall depth at this gage ranges from 3.93 inches to 19.45 inches based on 17 years record (1981-1997). The mean total annual rainfall depth is 11.37 inches.

There is no stream gage station within the watershed. The locations for the stream gage stations in the vicinity of the watershed will be identified and discussed here. There is one FCDMC stream gage station (FCDMC No. 5583 installed on 06/21/1995), and are two USGS stream gage stations (Garrett and Gellenbeck, 1991) in New River which are close to Gavilan Peak Watershed. Figure 12 shows the locations of these stream gage stations. The FCDMC stream gage station (T7N, R3E) at an elevation of 1854 feet is about one mile away from the east boundary of the watershed. The name for this gage station is Skunk Creek near New River. It is located at northeastern corner of section 30, T7N, R3E (latitude: 33°55'36"; longitude: 112°04"57").

One USGS stream gage station (09513800) in New River near Town of New River is located approximately 1 mile south of New River bridge on New River Road, and 2,200 feet south of the confluence of New River and Gavilan Peak Wash. The latitude and longitude for this

stream gage station is 33°54'41" and 112°08'26", respectively. It is in section 34 at T7N and R2E. There are twenty two years runoff record (1961-1982) at this USGS stream gage station (09513800) in New River near Town of New River (Garrett and Gelenbeck, 1991). The drainage area for this gage station is 83.3 square miles. The mean basin elevation and main channel slope for this drainage area are 3,600 feet and 105 feet/mile, respectively. The mean annual precipitation is 19.5 inches, and the 50-year and 24-hour rainfall depth is 4.6 inch. The annual peak discharge at the gage station ranges from 20 cfs (09-23-1981) to 19500 cfs (09-05-1970). The 50-year and 100-year peak discharges estimated by using the procedures in Water Resources Council Bulletin 17B (March 1982) are 28,300 cfs and 37,500 cfs, respectively (Garrett and Gelenbeck, 1991).

Another USGS stream gage station (09513780) in New River (6 miles southeast of Rock Springs, AZ) is located approximately 0.6 miles north of the north boundary of Gavilan Peak Watershed. The latitude and longitude for this stream gage station is 33°58'27" and 112°05'54", respectively. It is in section 6 at T7N and R3E. See Figure 12 for the locations of the USGS stream gage stations. There are twenty eight years runoff record (1962-1989) at the USGS stream gage station (09513780) in New River near Rock Spring (Garrett and Gelenbeck, 1991). The drainage area for this gage station is 67.3 square miles. The mean basin elevation and main channel slope for this drainage area are 3,970 feet and 140 feet/mile, respectively. The mean annual precipitation is 20 inches, and the 50-year and 24-hour rainfall depth is 4.6 inch. The annual peak discharge at the gage station ranges from 4.0 cfs (08-16-1977) to 18,600 cfs (09-05-1970). The 50-year and 100-year peak discharges estimated by using the procedures in Water Resources Council Bulletin 17B (March 1982) are 25,600 cfs and 34,600 cfs, respectively (Garrett and Gelenbeck, 1991).



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### 4.2.4 Statistical Parameters

The statistical parameters such as rainfall depths and rainfall distributions for both 100-year, 24-hour and 100-year, 6-hour storms used for this study are based on the data provided in Sabol et al. (1995). These statistical parameters were obtained by the FCDMC, ADWR, and consulting engineers based on extensive study and analyses. Since there is no stream gage station within the study watershed, the frequency analysis of Water Resources Council Bulletin 17B is not applicable to the study watershed.

### 4.2.5 Precipitation

#### 4.2.5.1 Rainfall depths

The point rainfall depths are obtained from the isopluvial maps in Sabol et al. (1995). The point rainfall depths of the 100-year 6-hour storm and 100-year 24-hour storm for the study watershed centroid are estimated from the isopluvial maps as 3.47 inches and 4.74 inches, respectively. The estimation of the point rainfall depths is performed by using linear interpolation from the neighboring isopluvials. Appendix 3 shows the calculation of the point rainfall depths.

The point rainfall depths are adjusted by aerial reduction factors to develop the rainfall depths to be entered into WMS 5.1 and HEC-1 by using the JD cards. The aerial reduction factors for the 100-year 6-hour storm is performed by using the depth-area reduction curve developed from the historic storm of 1954 over the Queen Creek area (Figure 2.14 and Table 2.2 in Sabol et al.,1995). The aerial reduction factors for the 100-year 24-hour storm is based on the depth-area curve in NOAA HYDRO-40 (Figure 15 in NOAA, 1984 or Table 2.1a in Sabol et al., 1995). Tables 2 and 3 list the adjusted rainfall depths for each drainage area size for the 6-hour and 24-hour, respectively. It may be noted that the area values (0.01, 2.8, and 16 square miles) for 100-year 6-hour storm listed in Table 2 correspond to the rainfall distribution pattern numbers 1, 2, and 3, respectively (see Table 2.4 and Figure 2.17 in Sabol et al., 1995). Refer to section

4.2.4.2 Rainfall Distribution for more details.

Table 2 Adjusted Rainfall Depths Used in WMS and HEC-1 Model for 100-year 6-hour Storm for Gavilan Peak Watershed (Sabol et al., 1995)

| Area (sq. mi.) | Aerial Reduction Factor | Adjusted Rainfall Depth (in.) |
|---|---|---|
| 0.01 | 1.00 | 3.47 |
| 2.8 | 0.98 | 3.40 |
| 16 | 0.92 | 3.2 |

Table 3 Adjusted Rainfall Depths Used in WMS and HEC-1 Model for 100-year 24-hour Storm for Gavilan Peak Watershed (from NOAA HYDRO-40 or Sabol et al. 1995)

| Area (sq. mi.) | Aerial Reduction Factor | Adjusted Rainfall Depth (in.) |
|---|---|---|
| 0 | 1.00 | 4.74 |
| 10 | 0.94 | 4.50 |

4.2.5.2 Rainfall distributions

The 6-hour rainfall distribution contains five dimensionless rainfall patterns documented in Sabol et al.(1995). Each pattern is associated with a drainage area size (Figure 2.17 in Sabol et al., 1995). The rainfall distributions is from Table 2.4 in Sabol et al. (1995). More specifically, pattern numbers 1, 2, and 3 are used in this study. The rainfall distribution patterns are then imported into WMS 5.1. Each pattern (a set of PC cards) follows each JD card which contains the adjusted rainfall depth and drainage area size. The 24-hour rainfall distribution is based on the SCS Type II distribution. It is entered into WMS 5.1 by using PC cards. Unlike the 6-hour storm, the 24-hour rainfall distribution is not dependent on the drainage area size. Therefore, one set of PC cards will be used for all JD cards. The rainfall distributions can be found in the HEC-1 input files (Appendices 1 and 2).

### 4.2.6 Physical Parameters

This section describes the methods used for estimation of the physical hydrologic parameters such as rainfall losses, the unit hydrograph, and lag time.

#### 4.2.6.1 Rainfall losses

The Green-Ampt procedure is used to compute rainfall losses in accordance with Sabol et al. (1995). The digital soil file and land uses file (both in GIS shape file format) for the watershed area are obtained from the Flood Control District of Maricopa County. The digital soil file corresponds to SCS soil maps (Camp, 1986). The GIS land use shape file is based on MAG (1995), the most current land use information. Figures 5 and 6 describe the soil and land use, respectively.

Three major land uses are identified for the watershed, which are vacant, rural, and small lot residential (MAG, 1995). The surface retention losses, percent impervious, and vegetation cover for each land use type are estimated based on Sabol et al. (1995) and MAG (1995). The values used for surface retention loss values, percent impervious, and vegetation cover are shown in Table 4.

Table 4. Surface Retention Losses, Percent Impervious, and Vegetation Cover

| **Land Uses** | **Surfact Retention Losses: IA (inch)** | **Percent Impervious RTIMP (%)** | **Vegetation Cover (%)** |
|---|---|---|---|
| Vacant | 0.35 | 0.0 | 10.0 |
| Rural | 0.30 | 5.0 | 30.0 |
| Small Lot Residential | 0.25 | 30.0 | 50.0 |

The soil and land use information are used by WMS 5.1 to compute the Green-Ampt rainfall loss parameters for each sub-basin (The Maricopa County's procedure for the Green-Ampt method was already incorporated into WMS 5.1). The computed rainfall loss parameters are then automatically saved into an HEC-1 input file. The Green-Ampt rainfall loss parameters can be



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found in Table 5.

4.2.6.2 Unit hydrographs

The S-Graph method was adopted to compute unit hydrographs in accordance with Sabol et al. (1995). Due to the steep slope for the watershed, the Phoenix Mountain S-Graphs are used to compute the unit hydrographs. The unit hydrographs are computed by WMS 5.1 (The Maricopa County's S-Graph procedure was already incorporated into WMS 5.1). The unit hydrographs can be found in UI cards in HEC-1 input files (see Appendices 1 and 2).

4.2.6.3 Lag time

Lag time must be estimated before S-Graph unit hydrographs can be computed. Four parameters must be computed to estimate the lag time for each sub-basin. These four parameters are the longest watercourse length measured from the concentration point to a most hydraulically upstream point, the slope for the longest watercourse, the length from the concentration point along the longest watercourse to a point opposite the centroid, and basin roughness.

The first three parameters are automatically computed by WMS 5.1. The basin roughness is a composite Manning's n value for all channels in the sub-basin. The selection of the basin roughness value is very subjective and subject to great uncertainty. An appropriate basin roughness value is selected by considering field observations, aerial photographs, soils map, land use maps, field photographs, and Appendix K (New River: Mountain and Foothill) in Sabol et al. (1995). The final basin roughness value for each sub-basin is computed by averaging the left bank Manning's n and right bank Manning's n for the representative channel. The Manning's n for the representative channel is obtained from survey data (see section 4.2.6.4). The four routing



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Table 5. Infiltration Loss Parameters by Green-Ampt Method for Sub-basins in Gavilan Peak Watershed

| Sub-basin | IA: Initial Loss (inches) | Volumetric Moisture Deficit (DTHETA) | PSF: Wetting Front Suction (inches) | XKSAT: Hydraulic Conductivity (in/hr) | RTIMP: Impervious Area (percent) |
|---|---|---|---|---|---|
| 1B | 0.322 | 0.304 | 6.586 | 0.131 | 30.387 |
| 2B | 0.33 | 0.334 | 5.299 | 0.21 | 22.571 |
| 3B | 0.306 | 0.203 | 6.681 | 0.116 | 18.225 |
| 4B | 0.338 | 0.251 | 8.576 | 0.056 | 10.225 |
| 5B | 0.306 | 0.197 | 6.746 | 0.113 | 11.495 |
| 6B | 0.346 | 0.338 | 6.899 | 0.105 | 13.75 |
| 7B | 0.3 | 0.244 | 6.063 | 0.147 | 14.981 |
| 8B | 0.312 | 0.281 | 5.485 | 0.186 | 20.336 |
| 9B | 0.344 | 0.342 | 6.695 | 0.115 | 15.157 |
| 10B | 0.321 | 0.253 | 6.762 | 0.112 | 10.437 |
| 11B | 0.339 | 0.305 | 7.05 | 0.098 | 13.767 |
| 12B | 0.345 | 0.387 | 5.87 | 0.16 | 4.568 |
| 13B | 0.35 | 0.272 | 8.766 | 0.051 | 0 |
| 14B | 0.334 | 0.346 | 5.79 | 0.161 | 5.859 |
| 15B | 0.35 | 0.325 | 7.445 | 0.085 | 3.125 |
| 16B | 0.35 | 0.362 | 6.758 | 0.112 | 19.175 |
| 17B | 0.35 | 0.391 | 5.818 | 0.159 | 17.048 |
| 18B | 0.35 | 0.357 | 6.868 | 0.107 | 33.123 |

parameters and lag time for each sub-basin can be found in Table 1. Table 1 shows that 0.25*lag is larger than 5 minutes for all sub-basins except for sub-basin 8B where 0.25*lag is 4.67 minutes which is about 5 minutes. Therefore, the computation time step in HEC-1 modeling is selected as five minutes.

4.2.6.4 Channel routing path parameters

The normal depth storage-outflow channel routing is used to route runoff hydrographs through sub-basins. The routing paths are shown in Figure 10 and Exhibit 3. The HEC-1 schematic tree also shows the routing paths (Figure 9). The channel routing parameters include NSTEPS (the number of sub-reaches to be divided for the routing reach by HEC-1), initial outflow, left bank Manning's n, right bank Manning's n, main channel Manning's n, reach length, energy slope for the routing reach, and eight-point cross section X-Y data. The estimation of NSTEPS will be discussed in section 4.2.6.4.1. The initial outflow is set at the initial inflow which is usually 0.0 cfs, implying empty channel when routing starts. The estimation of Manning's n and eight-point cross section data are obtained by several field trips and will be discussed in section 4.2.6.4.2. The reach length and channel bed slope are automatically computed by WMS 5.1 and saved to the HEC-1 input file. The channel bed slope is used for energy slope because one of the assumptions for using Manning's equation is uniform flow (energy slope equals channel bed slope). The routing length, slope and Manning's n values are shown in Table 6.

4.2.6.4.1 NSTEPS estimation

NSTEPS values for routing reaches are estimated by an iterative process. The estimation of

Table 1. Geometric Parameters for Sub-basins

| Sub-basin | Area (mi^2) | L (ft) | S (ft/ft) | Lca (ft) | Sca (ft/ft) | Basin Average Elevation (ft) | Kn | C=24*Kn | Lag Time (min) | 0.25*Lag | S-Graph |
|---|---|---|---|---|---|---|---|---|---|---|---|
| 1B | 1.28 | 11001.5 | 0.0717 | 5702.8 | 0.0121 | 2157.8 | 0.055 | 1.32 | 34.89 | 8.72 | Phoenix Mountain |
| 2B | 0.26 | 4821.0 | 0.0162 | 1762.3 | 0.0187 | 2081.9 | 0.055 | 1.32 | 21.65 | 5.41 | Phoenix Mountain |
| 3B | 0.18 | 5200.8 | 0.0179 | 1992.3 | 0.0179 | 2133.6 | 0.0565 | 1.36 | 23.54 | 5.88 | Phoenix Mountain |
| 4B | 0.62 | 8194.6 | 0.0921 | 3437.4 | 0.015 | 2285.2 | 0.0565 | 1.36 | 25.21 | 6.30 | Phoenix Mountain |
| 5B | 0.35 | 7905.9 | 0.019 | 3986.6 | 0.0101 | 2160.8 | 0.048 | 1.15 | 30.17 | 7.54 | Phoenix Mountain |
| 6B | 0.32 | 5447.4 | 0.0837 | 2520.4 | 0.0279 | 2321.2 | 0.048 | 1.15 | 16.60 | 4.15 | Phoenix Mountain |
| 7B | 0.15 | 4379.9 | 0.0274 | 1635.6 | 0.0057 | 2098.8 | 0.07 | 1.68 | 23.37 | 5.84 | Phoenix Mountain |
| 8B | 0.21 | 3993.8 | 0.0352 | 1128.4 | 0.0027 | 2124.8 | 0.07 | 1.68 | 18.69 | 4.67 | Phoenix Mountain |
| 9B | 0.51 | 7271.0 | 0.036 | 2623.2 | 0.0086 | 2173.2 | 0.07 | 1.68 | 32.20 | 8.05 | Phoenix Mountain |
| 10B | 0.32 | 4178.3 | 0.0106 | 1294.0 | 0.0078 | 2162.5 | 0.07 | 1.68 | 25.16 | 6.29 | Phoenix Mountain |
| 11B | 0.38 | 6163.5 | 0.0427 | 2167.0 | 0.0113 | 2180.4 | 0.0565 | 1.36 | 21.97 | 5.49 | Phoenix Mountain |
| 12B | 0.32 | 5427.7 | 0.0515 | 2957.8 | 0.0177 | 2125.8 | 0.05 | 1.20 | 20.12 | 5.03 | Phoenix Mountain |
| 13B | 0.39 | 7479.1 | 0.0323 | 3300.1 | 0.0151 | 2211.1 | 0.05 | 1.20 | 25.89 | 6.47 | Phoenix Mountain |
| 14B | 0.44 | 9746.8 | 0.0227 | 4989.0 | 0.0131 | 2164.3 | 0.05 | 1.20 | 35.83 | 8.96 | Phoenix Mountain |
| 15B | 0.46 | 5970.1 | 0.0223 | 3978.2 | 0.0152 | 2209.7 | 0.05 | 1.20 | 27.38 | 6.84 | Phoenix Mountain |
| 16B | 0.63 | 11682.2 | 0.0929 | 6422.1 | 0.0349 | 2445.8 | 0.0558 | 1.34 | 36.07 | 9.02 | Phoenix Mountain |
| 17B | 0.58 | 7394.9 | 0.0615 | 4164.6 | 0.02 | 2360.8 | 0.0558 | 1.34 | 27.81 | 6.95 | Phoenix Mountain |
| 18B | 0.71 | 7331.7 | 0.1275 | 2672.1 | 0.0451 | 2618.5 | 0.0558 | 1.34 | 20.39 | 5.10 | Phoenix Mountain |

Table 6. Geometric Parameters and Manning's n for Routing Reaches

| Routing Reach | In Sub-basin | Length (ft) | Slope (ft/ft) | Manning's n | | |
|---|---|---|---|---|---|---|
| | | | | Left Bank | Main Channe | Right Bank |
| 2R | 1B | 4734.39 | 0.0063 | 0.06 | 0.032 | 0.05 |
| 3R | 2B | 2756.21 | 0.0134 | 0.06 | 0.053 | 0.06 |
| 4R | 3B | 4181.66 | 0.0188 | 0.053 | 0.045 | 0.06 |
| 5R | 2B | 4030.35 | 0.0171 | 0.06 | 0.053 | 0.06 |
| 6R | 5B | 5405.39 | 0.0104 | 0.046 | 0.05 | 0.05 |
| 7R | 2B | 1736.03 | 0.0171 | 0.041 | 0.035 | 0.06 |
| 8R | 7B | 1193.47 | 0.0056 | 0.12 | 0.06 | 0.12 |
| 9R | 8B | 1696.28 | 0.0122 | 0.07 | 0.043 | 0.07 |
| 10R | 9B | 2922.67 | 0.0053 | 0.07 | 0.0675 | 0.07 |
| 11R | 9B | 1903.39 | 0.0125 | 0.07 | 0.0675 | 0.07 |
| 12R | 1B | 3975.34 | 0.0071 | 0.06 | 0.032 | 0.05 |
| 13R | 12B | 3489.47 | 0.015 | 0.049 | 0.041 | 0.05 |
| 15R | 13B | 3455.27 | 0.0116 | 0.05 | 0.039 | 0.05 |
| 16R | 14B | 5286.99 | 0.0139 | 0.05 | 0.038 | 0.05 |
| 17R | 15B | 3923.32 | 0.0159 | 0.05 | 0.039 | 0.05 |
| 18R | 17B | 5887.63 | 0.0213 | 0.052 | 0.062 | 0.0596 |

NSTEPS is usually performed as the last step in HEC-1 model development. The iterative process for estimating NSTEPS is as following. Estimation of NSTEPS for each routing reach must proceed from upstream to downstream. The criterion for estimating NSTEPS is that the final estimated NSTEPS satisfies

$$NSTEPS = \Delta TP/NMIN \qquad (1)$$

where $\Delta TP$ is the difference in time-to-peak between the inflow and outflow hydrographs for the routing reach and NMIN is the computation time step specified in IT card in HEC-1 models. One may start with any initial guess for NSTEPS. The initial guess may be obtained by assuming a velocity (V in ft/s) and using L/(V*NMIN*60) where L is the reach length (feet). The initial guess may be simply assumed by an arbitrary number. After the initial guess is obtained, it is entered into the HEC-1 model. Then, the HEC-1 model is run. The difference in time-to-peak between the inflow and outflow hydrographs is found from the HEC-1 output file. Then, the next NSTEPS is estimated by using Eq. (1). Check if the two consecutive NSTEPS are the same or close enough. If yes, NSTEP for this routing reach is found. If not, the found NSTEPS is entered into the HEC-1 model, and the HEC-1 model is run. Equation(1) is used again. Comparison between the current NSTEPS and the previous NSTEPS is made. This iterative process is continued until two consecutive NSTEPS are the same or close enough. The aforementioned iterative process is performed for each routing reach from upstream to downstream.

4.2.6.4.2 Manning's n and channel cross-section data for routing reaches

Two field trips are conducted to estimate Manning's n and measure channel cross-section data for routing reaches. The surveyed cross sections are selected to represent average conditions in the routing reaches. Eleven cross sections in the watershed were surveyed by using automatic



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levels (David White Instruments' AL10-28/AL10-32 and SOKKIA's B20/B21). Appendix 4 shows the survey results. The level tripod is usually set on the left bank, and the rod reading starts from the left bank, through the main channel, to the right bank. If there is a difficulty in setting the level tripod on the left bank due to the dense bushes or other difficult conditions, the levels are set on the right-bank, and the rod reading starts from the right bank to the left bank. However, the data measured from the right bank to the left bank are reversed and the stations are adjusted for HEC-1 input.

The reference elevation (100 feet) is the ground elevation for the tripod. The tripod is set at the zero station. Eight points are measured for each cross section. For some reaches, more (or less) than eight points are measured. When more than eight points are measured, the data are edited by eliminating some points. When less than eight points are measured, more points are added by simple extrapolation. Microsoft Excel (1997) is used to process the XY data such that they can be imported into WMS' XY series editor. Please see Appendix 5 for the Excel worksheet.

During the measurement of cross-section data for each cross-section, Manning's n is also estimated for the area between each pair of stations across the cross-section. The estimation of Manning's n is based on Chow (1959) or excerpts from Chow's book (Table 3.1 in USCE, 1997). Please see Appendix 4 for this table. The Manning's n for left bank, main channel, and right bank is estimated by using distance-based weighted-average for the Manning's n across each pair of stations. The Manning's n for left bank, main channel, and right bank is entered into WMS 5.1. Microsoft Excel (1997) is used to process the data. Please see Appendix 5 for the Excel worksheet.



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4.2.6.5 Reservoir routing parameters

There is no detention basin or retention basin in the watershed. However, there are three roadway culvert crossings along New River Road, and one roadway culvert crossing at 27th Avenue, which may cause some ponding areas upstream of the culverts (Figure 13). Some of these culverts may not have any significant impact on the hydrology. When the survey for flood insurance study is finished, the issues of reservoir routing at these sites will be investigated. Reservoir routing may be performed for the site(s) if necessary. FHWA HY-8 may be used to develop the rating curve for reservoir routing.

4.2.6.6 Split flows

The issue of split flow or flow diversion is investigated throughout the watershed. Since the watershed is a steep basin, most roads follow the original contours and do not change the drainage flow patterns. However, New River Road is a raised road (about 2 feet higher than the adjacent ground). It intercepts the water flowing from north to south. The interception capacity for a representative section of the road (a concentration point on the north side of New River Road before 23rd Avenue) is about 135 cfs (see Appendix 8) . Flow larger than 135 cfs at this concentration point will overtop the road and flow southwesterly. After an extensive field trip to New River Road and evaluation of each sub-basin covering New River Road, it is found that all the intercepted water at each concentration point will flow over New River Road to join the streams before it reaches the next concentration point. This is because the intercepted flow is stopped by another road intersecting New River Road, and forced to flow over New River Road and finally join the original streams. Therefore, no split flow or diversion is used in the final modeling.

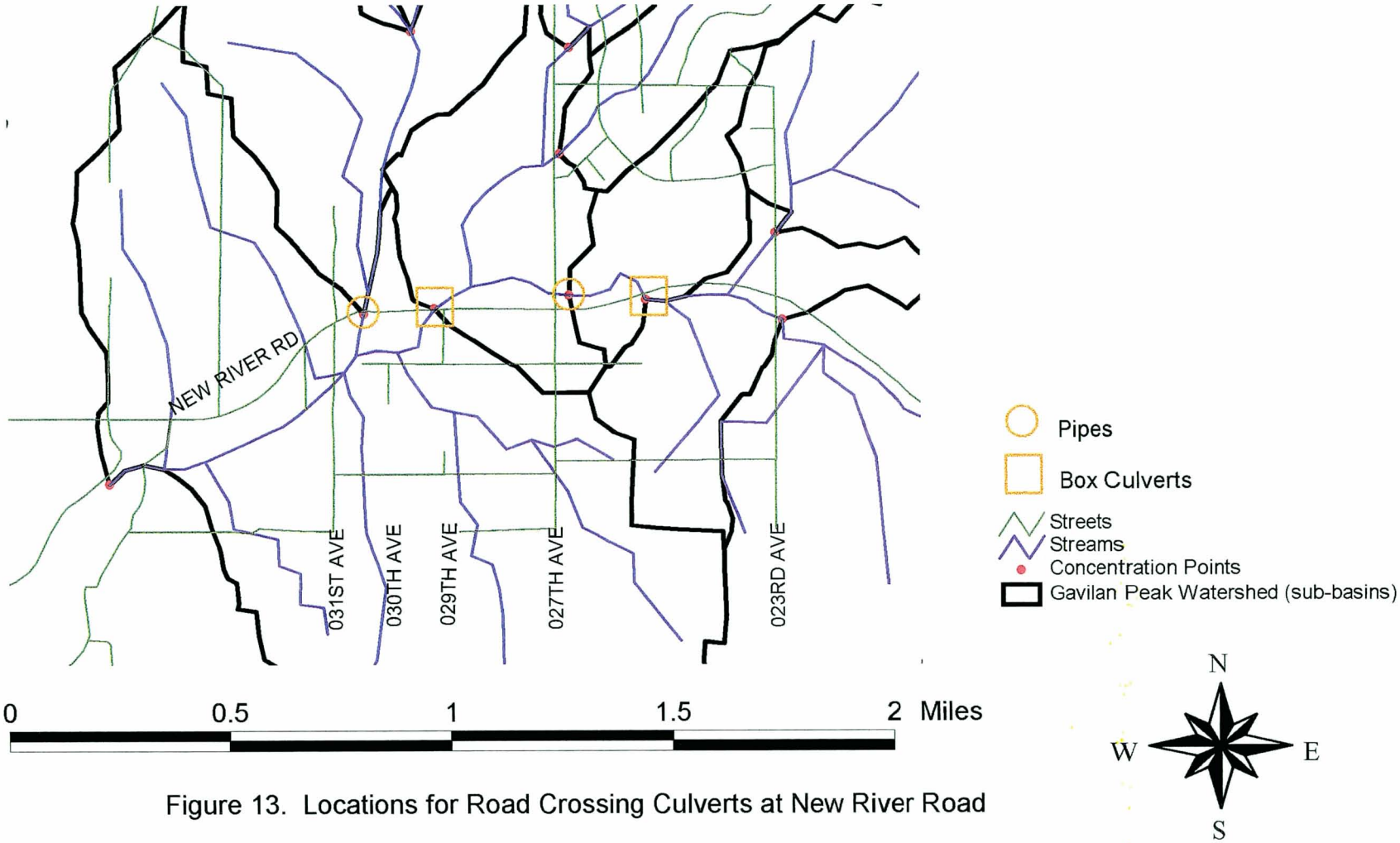


Figure 13. Locations for Road Crossing Culverts at New River Road

## 4.3 Problems Encountered during the Study

### 4.3.1 Special Problems and Solutions

No special problems are encountered.

### 4.3.2 Modeling Warning and Error Messages

Two kinds of warning messages are found in the HEC-1 modeling. The first kind of warning message is that the routed outflow is greater than the maximum outflow for some routing reaches. This warning message can be ignored since HEC-1 automatically expands the channel capacity by adding vertical walls along the channel. Therefore, all flow will reach concentration points downstream. Another warning message warns about the numerical stability for a few routing reaches. After careful examination of those routing reaches, it is found that the outflow is smaller than the inflow, and there is no oscillation among the routed hydrograph ordinates. Therefore, the second warning message can be ignored. No error message is reported in HEC-1 output files.

## 4.4 Calibration

No calibration is performed because there is no gage station within the watershed. However, verification is performed by using USGS regional regression equations. Comparison is also made between this study and a previous flood insurance study. Refer to section 4.5.2 for more details about the verification.

## 4.5 Final Results

### 4.5.1 Hydrologic Analysis Results

The hydrology for Gavilan Peak Watershed is developed by using WMS 5.1 (BYU and BOSS, May, 1998) and the 1997 version of HEC-1 for the 100-year 6-hour and 24-hour storms. The results for peak discharges and time-to-peak at all concentration points are shown in Table 7.

The higher peak discharge of the 6-hour and 24-hour storms is considered as the critical peak discharge, and will be used for flood insurance study. The detailed results can be found in the HEC-1 output files in Appendices 1 and 2.

**Table 7. Summary of 100-year Peak Discharge and Time-to-peak**

| Concentration Point | Drainage Area (sq. mi.) | Peak Discharge for 100-yr, 24-hr Storm (cfs) | Time-to-peak for 100-yr, 24-hr Storm (hr) | Peak Discharge for 100-yr, 6-hr Storm (cfs) | Time-to-peak for 100-yr, 6-hr Storm (hr) | Peak Discharge to Be Used for Flood Insurance Study (hr) |
|---|---|---|---|---|---|---|
| 18B | 0.71 | 1333 | 12.25 | 1502 | 4.25 | 1502 |
| 17B | 0.58 | 863 | 12.33 | 1005 | 4.33 | 1005 |
| 17C | 1.29 | 1889 | 12.42 | 1932 | 4.42 | 1932 |
| 16B | 0.63 | 823 | 12.42 | 946 | 4.42 | 946 |
| 15B | 0.46 | 719 | 12.33 | 856 | 4.33 | 856 |
| 15C | 1.76 | 2345 | 12.42 | 2276 | 4.42 | 2345 |
| 14B | 0.44 | 542 | 12.42 | 645 | 4.42 | 645 |
| 13B | 0.39 | 649 | 12.25 | 774 | 4.33 | 774 |
| 13C | 3.22 | 3823 | 12.50 | 3504 | 4.58 | 3823 |
| 12B | 0.32 | 571 | 12.25 | 681 | 4.25 | 681 |
| 12C | 3.54 | 3926 | 12.58 | 3614 | 4.58 | 3926 |
| 11B | 0.38 | 668 | 12.25 | 800 | 4.25 | 800 |
| 10B | 0.32 | 536 | 12.25 | 642 | 4.25 | 642 |
| 9B | 0.51 | 710 | 12.33 | 845 | 4.42 | 845 |
| 9C | 0.84 | 1154 | 12.42 | 1283 | 4.42 | 1283 |
| 8B | 0.21 | 404 | 12.25 | 488 | 4.25 | 488 |
| 8C | 1.43 | 1921 | 12.42 | 1961 | 4.42 | 1961 |
| 7B | 0.15 | 258 | 12.25 | 309 | 4.25 | 309 |
| 7C | 1.58 | 2049 | 12.42 | 2068 | 4.50 | 2068 |
| 6B | 0.31 | 655 | 12.17 | 783 | 4.17 | 783 |
| 5B | 0.35 | 521 | 12.33 | 627 | 4.33 | 627 |
| 5C | 0.66 | 995 | 12.42 | 1133 | 4.42 | 1133 |
| 4B | 0.62 | 1057 | 12.25 | 1217 | 4.25 | 1217 |
| 3B | 0.18 | 311 | 12.25 | 373 | 4.25 | 373 |
| 3C | 0.80 | 1287 | 12.33 | 1428 | 4.33 | 1428 |
| 2B | 0.26 | 444 | 12.25 | 535 | 4.25 | 535 |
| 2C | 3.29 | 4373 | 12.50 | 3934 | 4.50 | 4373 |
| 1B | 1.28 | 1716 | 12.42 | 1764 | 4.42 | 1764 |
| 1C | 8.11 | 9023 | 12.58 | 7636 | 4.67 | 9023 |

### 4.5.2 Verification of Results

The verification of results is performed in two ways. The first way is to compare the results of this study with a previous flood insurance study (CVL, 1987). The second way is to compare the results of this study with USGS regional regression equations (Jennings et al., 1994; Thomas



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et al., 1995). The comparison shows that the results of this study are reasonable. Table 8 is a summary of the comparison.

4.5.2.1 Comparison with a previous flood insurance study

CVL's study watershed is for New River drainage area from Rock Springs to New River Dam, covering an area of 170 square miles (CVL, 1987) The Gavilan Peak Watershed is only one sub-basin in CVL's study. The comparison of peak discharges and time-to-peak at the outlet of Gavilan Peak Watershed can be made between CVL's study and this study (Table 8). As can be seen in Table 8, the 100-yr, 24-hr peak discharge in this study is higher than that in CVL's study. The time-to-peak in this study is smaller than that in CVL's study. This may be due to the following reasons: (a) the watershed is divided into 18 sub-basins in this study while the same area is not sub-divided in CVL's study; (b) this study is based on the most current land use conditions while CVL study is based on the pre-1987 land use conditions; and (c) the Green-Ampt infiltration loss method is used in this study while the SCS curve number loss method is used in CVL's study. Apparently, the results in this study are more accurate than those in CVL's study.

4.5.2.2 Comparison with USGS regional regression equations

Two USGS regional regression equations are used. The first regional equation computes the 100-year discharge by relating the 100-year peak discharge with drainage area and mean basin elevation (Thomas et al., 1995) as following

$$Q_{100} = 10^{(6.55-3.17\mathrm{AREA}^{-0.11})}(\mathrm{ELEV}/1000)^{-0.454} \qquad (2)$$

where AREA is the drainage area in square miles and ELEV is the mean basin elevation in feet.

The drainage area and mean basin elevation are computed by WMS 5.1 as 8.12 square miles and 2254 feet, respectively (Figure 14). Equation (2) corresponds to the Central Arizona Region 12 in Thomas et al. (1995).

The second regional equation computes the 100-year peak discharge by relating the 100-year peak discharge with drainage area, mean basin elevation, and annual rainfall depth (Jennings et al., 1994) as following

$$Q_{100} = 553 AREA^{0.610} (ELEV/1000)^{-1.30} P^{0.915} \quad (3)$$

where P is the mean annual precipitation in inches, and AREA and ELEV are the same as those defined in Equation (2). Mean annual precipitation data can be found from Figure 2 in Jennings et al. (1994). See Appendix 6 for the mean annual rainfall depth. All regional regression equations (USGS, 1994) throughout the USA are already in WMS 5.1. The drainage area and mean basin elevation are computed by WMS 5.1. For this study watershed, mean annual precipitation is found to be about 16 inches (Figure 2 in Jennings et al., 1994). See Appendix 6 for mean annual precipitation in Arizona. Equation (3) corresponds to Arizona Regional 3 in Jennings et al. (1994). The output file from using WMS can be found in Appendix 6. It should be mentioned that the mean annual precipitation for the New River basin upstream of Town of New River is 19.5 inches (see Page 555 in Garrett and Gellenbeck, 1991). The FCDMC's two rain gages (Upper Skunk Creek and Sunup Ranch) show that the mean rainfall depth is about 11 inches based on 17 years record. Therefore, the selected 16 inches from Figure 2 in Jennings et al.(1994) is reasonable.

The area and mean basin elevation for the watershed is computed by using WMS 5.1 as 8.12 square miles and 2254 feet, respectively (Figure 14). Table 9 lists the 100-year peak discharges

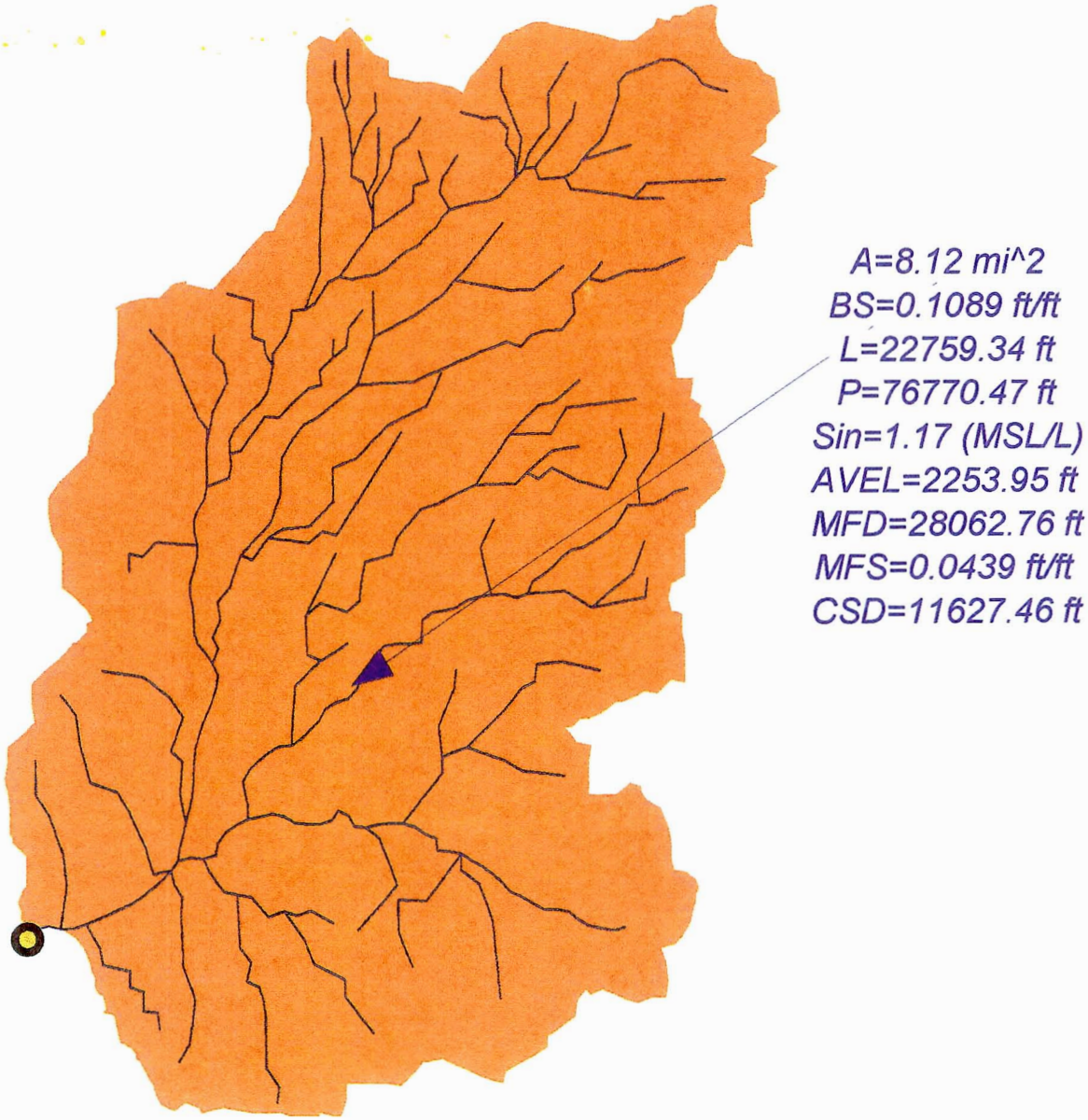


Figure 14. Geometric Parameters Generated by WMS for USGS Regression Equations

(1 inch = 3500.00)

for this study and USGS regional regression equations (1994, 1995). As can be seen in Table 9, the comparison shows that the results from this study and using USGS regression equations are reasonable close to each other. It should be mentioned that the results of this study should be more accurate than those by using regression equations because this study is much more detailed. The comparison of this study with USGS regression equations only serves as a reference.

**Table 9. Peak Discharges Comparison**

| | **100-yr 6-hr (this study by HEC-1)** | **100-yr 24-hr (this study by HEC-1)** | **100-yr 24-hr (CVL, 1987)** | **100-yr (this study by 1995 USGS Regression Equation, Eq. 2)** | **100-yr (this study by 1994 USGS Regression Equation, Eq. 3** |
|---|---|---|---|---|---|
| Peak Discharge (cfs) at Concentration Point of Gavilan Peak Watershed | 7636 | 9023 | 5984 | 7454 | 8720 |
| Time-to-peak (hrs) at Concentration Point of Gavilan Peak Watershed | 4.67 hours | 12.58 hours | 12.75 hours | N/A | N/A |

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# Appendix 1 HEC-1 Output File for 100-year, 6-hour Storm

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1****************************************                                    ****************************************
 *                                      *                                    *                                      *
 *   FLOOD HYDROGRAPH PACKAGE  (HEC-1)  *                                    *    U.S. ARMY CORPS OF ENGINEERS      *
 *             JUL   1997               *                                    *    HYDROLOGIC ENGINEERING CENTER     *
 *           VERSION 4.1                *                                    *          609 SECOND STREET           *
 *                                      *                                    *       DAVIS, CALIFORNIA 95616        *
 *  RUN DATE   12JUN98  TIME  14:22:01  *                                    *          (916) 756-1104              *
 *                                      *                                    *                                      *
 ****************************************                                    ****************************************

                                        X     X  XXXXXXX  XXXXX          X
                                        X     X  X       X     X        XX
                                        X     X  X       X               X
                                        XXXXXXX  XXXX    X       XXXXX   X
                                        X     X  X       X               X
                                        X     X  X       X     X         X
                                        X     X  XXXXXXX  XXXXX        XXX

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. THIS IS THE FORTRAN77 VERSION
NEW OPTIONS: DAMBREAK OUTFLOW SUBMERGENCE , SINGLE EVENT DAMAGE CALCULATION, DSS:WRITE STAGE FREQUENCY,
DSS:READ TIME SERIES AT DESIRED CALCULATION INTERVAL   LOSS RATE:GREEN AND AMPT INFILTRATION
KINEMATIC WAVE: NEW FINITE DIFFERENCE ALGORITHM

1                                                   HEC-1 INPUT                                                    PAGE  1

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

        1           ID    Gavilan Peak Watershed HEC-1 Analysis using WMS (100-year 6-hour storm)
        2           ID    Location: I-17 and Town of New River
        3           ID    FCDMC, 1998
                    *DIAGRAM
        4           IT       5  1JAN98       0     300
        5           IO       5
        6           IN      15  1JAN98       0
        7           JD    3.47    0.01
                    * 6-hourfor0.0sq.mi.
        8           PC       0   0.008   0.016   0.025   0.033   0.041    0.05   0.058   0.066   0.074
        9           PC   0.087   0.099   0.118   0.138   0.216   0.377   0.834   0.911   0.931    0.95
       10           PC   0.962   0.972   0.983   0.991       1
       11           JD    3.45     0.5
       12           IN      15  1JAN98       0
       13           JD     3.4     2.8
                    * 6-hourfor2.8sq.mi.
       14           PC       0   0.009   0.016   0.025   0.034   0.042   0.051   0.059   0.067   0.076
       15           PC   0.087     0.1    0.12   0.163   0.252   0.451   0.694   0.837     0.9   0.938
       16           PC    0.95   0.963   0.975   0.988       1
       17           IN      15  1JAN98       0
       18           JD     3.2      16
                    * 6-hourfor16sq.mi.
       19           PC       0   0.015    0.02    0.03   0.048   0.063   0.076    0.09   0.105   0.119
       20           PC   0.135   0.152   0.175   0.222   0.304   0.472    0.67   0.796   0.868   0.912
       21           PC   0.946    0.96   0.973   0.987       1

       22           KK     16B
       23           KO       0       0       0       0      22
       24           BA  0.6349
       25           LG    0.35   0.362   6.758   0.112  19.175
                    * S-Graph
       26           UI       0   59.23   96.95   228.5   361.8   442.8   576.6   599.3   388.7   334.1
       27           UI   291.3   251.8  213.65  169.81  144.34  130.15  105.36   82.48    71.5   64.87
       28           UI   47.93   45.41   33.83   28.98   28.98   23.49   11.35   11.35   11.35   11.35
       29           UI   11.35   11.35   11.35   11.35       0

       30           KK     16R   CNAME     16B
       31           KO       0       0       0       0      22
       32           RS       2    FLOW      -1       0
       33           RC    0.05   0.038    0.05 5286.99  0.0139       0
                    * rxry1
       34           RX       0   32.81   55.78  101.71   137.8  177.17  203.42  208.42
       35           RY     100   96.26   89.99   90.81   93.04   98.36     100     100

       36           KK     18B
       37           KO       0       0       0       0      22
       38           BA  0.7104
       39           LG    0.35   0.357   6.868   0.107  33.123
                    * S-Graph
       40           UI       0   130.7   506.6   865.7    1180   718.4   558.5   421.2   295.8   231.7
       41           UI   158.4   121.2   89.88    58.6   55.82   22.47   22.47   22.47   22.47       0
1                                                   HEC-1 INPUT                                                    PAGE  2

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

       42           KK     18R   CNAME     18B
       43           KO       0       0       0       0      22
       44           RS       2    FLOW      -1       0
       45           RC   0.052   0.062  0.0596 5887.63  0.0213       0
                    * rxry2
       46           RX       0   39.37   49.22   78.74  108.27  141.08  183.74  229.67
       47           RY     100   97.34   89.47   88.75   88.42   89.89   92.68   95.05

       48           KK     17B
       49           KO       0       0       0       0      22
       50           BA  0.5839
       51           LG    0.35   0.391   5.818   0.159  17.048
                    * S-Graph
       52           UI       0   70.65   184.6   391.2   531.7   763.7   519.1   401.6   336.9   276.4
       53           UI     212   170.5  144.12  105.18   84.86   71.54   54.16   42.77   34.57   34.57
       54           UI   14.26   13.54   13.54   13.54   13.54   13.54       0

       55           KK     17C   CNAME     17R
       56           KO       0       0       0       0      22
       57           HC       2
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 58          KK     17R   CNAME     17C
 59          KO       0       0       0       0      22
 60          RS       1    FLOW      -1       0
 61          RC    0.05   0.039    0.05 3923.32  0.0159       0
             * rxry3
 62          RX       0   26.25   39.37   65.62   98.43  131.24  180.46  242.79
 63          RY     100   98.69    94.1    90.5    88.1    91.2    94.4    94.4

 64          KK     15B
 65          KO       0       0       0       0      22
 66          BA  0.4613
 67          LG    0.35   0.325   7.445   0.085   3.125
             * S-Graph
 68          UI       0   56.73     152   320.6   433.9   616.6   397.7   317.2   264.2   215.4
 69          UI   162.8   134.3  108.73   80.25   65.87   53.01   43.49   30.17   27.76   23.14
 70          UI   10.87   10.87   10.87   10.87   10.87   10.87       0

 71          KK     15C   CNAME     15R
 72          KO       0       0       0       0      22
 73          HC       2

 74          KK     15R   CNAME     15C
 75          KO       0       0       0       0      22
 76          RS       2    FLOW      -1       0
 77          RC    0.05   0.039    0.05 3455.27  0.0116       0
             * rxry3
 78          RX       0   26.25   39.37   65.62   98.43  131.24  180.46  242.79
 79          RY     100   98.69    94.1    90.5    88.1    91.2    94.4    94.4
1                                          HEC-1 INPUT                                          PAGE  3

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

 80          KK     13B
 81          KO       0       0       0       0      22
 82          BA  0.3905
 83          LG    0.35   0.272   8.766   0.051       0
             * S-Graph
 84          UI       0   50.79   150.4   304.3   413.8   527.7   324.9   265.6   217.6   170.6
 85          UI   127.5     110   77.89   61.49   50.96   38.94    28.7   24.85   20.42    9.73
 86          UI    9.73    9.73    9.73    9.73       0

 87          KK     14B
 88          KO       0       0       0       0      22
 89          BA  0.4375
 90          LG   0.334   0.346    5.79   0.161   5.859
             * S-Graph
 91          UI       0   41.13    68.3     160   253.5   309.5   407.2   406.1   266.8   230.2
 92          UI   200.4   172.6  145.44  116.09   98.78   89.42      71   55.39   48.64   44.81
 93          UI   31.53   31.53   21.63   20.13   20.13   13.99    7.88    7.88    7.88    7.88
 94          UI    7.88    7.88    7.88    7.88

 95          KK     13C   CNAME     13R
 96          KO       0       0       0       0      22
 97          HC       4

 98          KK     13R   CNAME     13C
 99          KO       0       0       0       0      22
100          RS       1    FLOW      -1       0
101          RC   0.049   0.041    0.05 3489.47   0.015       0
             * rxry5
102          RX       0      34      61      86     106     115     135     153
103          RY   92.76   92.61   90.86    89.1   87.68   91.98   94.28   99.27

104          KK     12B
105          KO       0       0       0       0      22
106          BA  0.3239
107          LG   0.345   0.387    5.87    0.16   4.568
             * S-Graph
108          UI       0   61.76   237.9   405.7   539.3   325.8     253   189.1   133.4     103
109          UI   69.35   53.39   39.63   26.52   22.71   10.39   10.39   10.39   10.39       0

110          KK     12C   CNAME     12R
111          KO       0       0       0       0      22
112          HC       2

113          KK     12R   CNAME     12C
114          KO       0       0       0       0      22
115          RS       2    FLOW      -1       0
116          RC    0.06   0.032    0.05 3975.34  0.0071       0
             * rxry6
117          RX       0      31      49      75     106     119     145     150
118          RY   96.82    94.2   94.24   90.96   91.57   99.69     100     100
1                                          HEC-1 INPUT                                          PAGE  4

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

119          KK     11B
120          KO       0       0       0       0      22
121          BA    0.38
122          LG   0.339   0.305    7.05   0.098  13.767
             * S-Graph
123          UI       0    55.6   201.2   372.6   550.9   434.1   308.1   247.7   190.1   138.2
124          UI   113.1   79.19   63.23   46.21   36.11   27.21   22.91   10.66   10.66   10.66
125          UI   10.66   10.66       0

126          KK     11R   CNAME     11B
127          KO       0       0       0       0      22
128          RS       1    FLOW      -1       0
129          RC    0.07  0.0675    0.07 1903.39  0.0125       0
             * rxry7
130          RX       0   13.12   32.81   49.22   62.34   65.62   85.31   98.43
131          RY     100   99.11   97.54   95.11   93.47   93.93   95.44   96.75

132          KK     10B
133          KO       0       0       0       0      22
134          BA  0.3246
135          LG   0.321   0.253   6.762   0.112  10.437
             * S-Graph
136          UI       0   43.43     135     268   367.2   433.1   267.8   218.9   178.3   133.6
137          UI     105   85.42   61.42   49.78   38.09   31.44   21.26   21.26   11.05    8.33
138          UI    8.33    8.33    8.33    8.33       0

139          KK     10R   CNAME     10B
140          KO       0       0       0       0      22
141          RS       3    FLOW      -1       0
142          RC    0.07  0.0675    0.07 2922.67  0.0053       0
             * rxry7
143          RX       0   13.12   32.81   49.22   62.34   65.62   85.31   98.43
144          RY     100   99.11   97.54   95.11   93.47   93.93   95.44   96.75

145          KK      9B
146          KO       0       0       0       0      22
147          BA  0.5138
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 148          LG   0.344   0.342   6.695   0.115  15.157
              * S-Graph
 149          UI       0   53.72   106.1   250.2   360.3   452.2   589.6   371.8   306.7   263.4
 150          UI   223.1   183.4  142.18  125.32  103.99   79.53   65.84   58.84   42.37   41.17
 151          UI   26.29   26.29   26.29   10.72    10.3    10.3    10.3    10.3    10.3    10.3
 152          UI       0

 153          KK      9C   CNAME      9R
 154          KO       0       0       0       0      22
 155          HC       2

 156          KK      9R   CNAME      9C
 157          KO       0       0       0       0      22
 158          RS       1    FLOW      -1       0
 159          RC    0.07   0.043    0.07 1696.28  0.0122       0
              * rxry9
 160          RX       0   16.41   42.65   55.78   82.03  101.71  114.83  119.83
1                                        HEC-1 INPUT                                                PAGE  5

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

 161          RY     100   98.79   97.21   93.27   93.44   99.34     100     100

 162          KK      8B
 163          KO       0       0       0       0      22
 164          BA  0.2134
 165          LG   0.312   0.281   5.485   0.186  20.336
              * S-Graph
 166          UI       0   48.58   183.9   314.8   345.4     211   160.9   110.6   83.96   55.39
 167          UI   41.73   29.48   19.08   16.31    7.37    7.37    7.37    7.37       0

 168          KK      8C   CNAME      8R
 169          KO       0       0       0       0      22
 170          HC       3

 171          KK      8R   CNAME      8C
 172          KO       0       0       0       0      22
 173          RS       1    FLOW      -1       0
 174          RC    0.12    0.06    0.12 1193.47  0.0056       0
              * rxry9
 175          RX       0   16.41   42.65   55.78   82.03  101.71  114.83  119.83
 176          RY     100   98.79   97.21   93.27   93.44   99.34     100     100

 177          KK      7B
 178          KO       0       0       0       0      22
 179          BA  0.1487
 180          LG     0.3   0.244   6.063   0.147  14.981
              * S-Graph
 181          UI       0   21.42   75.24     142   205.4   177.6   120.7   97.53   75.94   55.06
 182          UI   45.69   31.78   25.05   19.15   15.17   10.48   10.39    4.11    4.11    4.11
 183          UI    4.11    4.11       0

 184          KK      7C   CNAME      7R
 185          KO       0       0       0       0      22
 186          HC       2

 187          KK      7R   CNAME      7C
 188          KO       0       0       0       0      22
 189          RS       1    FLOW      -1       0
 190          RC   0.041   0.035    0.06 1736.03  0.0171       0
              * rxry11
 191          RX       0      21      37      58      67      87     107     112
 192          RY     100   99.32   92.51   92.37   92.97   97.47   97.47   97.47

 193          KK      6B
 194          KO       0       0       0       0      22
 195          BA   0.315
 196          LG   0.346   0.338   6.899   0.105   13.75
              * S-Graph
 197          UI       0   92.55   352.1   618.3     424   301.8   208.5     146   93.95   66.51
 198          UI   45.09   31.32   18.62   12.27   12.27   12.27       0
1                                        HEC-1 INPUT                                                PAGE  6

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

 199          KK      6R   CNAME      6B
 200          KO       0       0       0       0      22
 201          RS       4    FLOW      -1       0
 202          RC   0.046    0.05    0.05 5405.39  0.0104       0
              * rxry12
 203          RX       0     52.5   72.18   95.15  104.99  109.99  114.99  119.99
 204          RY  100.33   97.54   97.34   99.77     100     100     100     100

 205          KK      5B
 206          KO       0       0       0       0      22
 207          BA  0.3452
 208          LG   0.306   0.197   6.746   0.113  11.495
              * S-Graph
 209          UI       0   38.58   87.88   194.2   272.7   363.1   373.1   240.6   203.9     172
 210          UI   142.5     109   91.61   77.66      58    47.2   41.84   29.58   27.17   18.88
 211          UI   18.88   14.37    7.39    7.39    7.39    7.39    7.39    7.39       0

 212          KK      5C   CNAME      5R
 213          KO       0       0       0       0      22
 214          HC       2

 215          KK      5R   CNAME      5C
 216          KO       0       0       0       0      22
 217          RS       2    FLOW      -1       0
 218          RC    0.06   0.053    0.06 4030.35  0.0171       0
              * rxry13
 219          RX       0      15      30      43      56      76      81      86
 220          RY     100    98.2   93.41   93.41     100    99.3    99.3    99.3

 221          KK      4B
 222          KO       0       0       0       0      22
 223          BA  0.6227
 224          LG   0.338   0.251   8.576   0.056  10.225
              * S-Graph
 225          UI       0   82.92   255.6   509.1   695.4   834.1   514.9   420.3   342.9   258.8
 226          UI   201.7   165.9  118.94   95.95   74.51    61.7   40.58   40.58   23.19   15.89
 227          UI   15.89   15.89   15.89   15.89       0

 228          KK      4R   CNAME      4B
 229          KO       0       0       0       0      22
 230          RS       2    FLOW      -1       0
 231          RC   0.053   0.045    0.06 4181.66  0.0188       0
              * rxry14
 232          RX       0   16.41   22.97   36.09   45.93   55.78    68.9   85.31
 233          RY   98.23   96.72   94.62   88.71   89.44    91.5   95.44   98.23

 234          KK      3B
 235          KO       0       0       0       0      22
 236          BA  0.1756
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 237          LG   0.306   0.203   6.681   0.116  18.225
              * S-Graph
 238          UI       0   25.05   86.27   164.8   235.5   214.6   142.9   115.7   90.51   65.99
 239          UI   54.99   38.19    29.8   23.39   18.68   12.26   12.26    5.86     4.8     4.8
 240          UI     4.8     4.8       0
1                                                HEC-1 INPUT                                          PAGE  7

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

 241          KK      3C   CNAME      3R
 242          KO       0       0       0       0      22
 243          HC       2

 244          KK      3R   CNAME      3C
 245          KO       0       0       0       0      22
 246          RS       3    FLOW      -1       0
 247          RC    0.06   0.053    0.06 2756.21  0.0134       0
              * rxry13
 248          RX       0      15      30      43      56      76      81      86
 249          RY     100    98.2   93.41   93.41     100    99.3    99.3    99.3

 250          KK      2B
 251          KO       0       0       0       0      22
 252          BA  0.2558
 253          LG    0.33   0.334   5.299    0.21  22.571
              * S-Graph
 254          UI       0   40.03   159.8   279.1   411.5   265.6   205.3   160.7   115.3   90.62
 255          UI   65.57   47.69   36.76   28.06   19.46   17.28    7.62    7.62    7.62    7.62
 256          UI    7.62

 257          KK      2C   CNAME      2R
 258          KO       0       0       0       0      22
 259          HC       4

 260          KK      2R   CNAME      2C
 261          KO       0       0       0       0      22
 262          RS       2    FLOW      -1       0
 263          RC    0.06   0.032    0.05 4734.39  0.0063       0
              * rxry6
 264          RX       0      31      49      75     106     119     145     150
 265          RY   96.82    94.2   94.24   90.96   91.57   99.69     100     100

 266          KK      1B
 267          KO       0       0       0       0      22
 268          BA  1.2778
 269          LG   0.322   0.304   6.586   0.131  30.387
              * S-Graph
 270          UI       0   123.3   214.6   502.6   774.7   946.7    1300    1103   770.5   668.6
 271          UI   580.5   496.5  409.28  321.81  289.55  247.16  192.28  157.55  135.67  114.51
 272          UI   94.53    80.4   60.34   60.34   55.45   23.63   23.63   23.63   23.63   23.63
 273          UI   23.63   23.63   23.63       0

 274          KK      1C   CNAME      1R
 275          KO       0       0       0       0      22
 276          HC       3

 277          KK      1R   CNAME      1C
 278          KO       0       0       0       0      22
 279          RN      1R
 280          ZZ
1
              SCHEMATIC DIAGRAM OF STREAM NETWORK
INPUT
 LINE     (V) ROUTING          (--->) DIVERSION OR PUMP FLOW

  NO.     (.) CONNECTOR        (<---) RETURN OF DIVERTED OR PUMPED FLOW

   22       16B
              V
              V
   30       16R
              .
              .
   36         .        18B
              .          V
              .          V
   42         .        18R
              .          .
              .          .
   48         .          .        17B
              .          .          .
              .          .          .
   55         .        17C............
              .          V
              .          V
   58         .        17R
              .          .
              .          .
   64         .          .        15B
              .          .          .
              .          .          .
   71         .        15C............
              .          V
              .          V
   74         .        15R
              .          .
              .          .
   80         .          .        13B
              .          .          .
              .          .          .
   87         .          .          .        14B
              .          .          .          .
              .          .          .          .
   95       13C.................................
              V
              V
   98       13R
              .
              .
  104         .        12B
              .          .
              .          .
  110      12C............
              V
              V
  113      12R
              .
              .
  119         .        11B
              .          V
              .          V
  126         .        11R
              .          .
              .          .
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132          .          .        10B
             .          .         V
             .          .         V
139          .          .        10R
             .          .          .
             .          .          .
145          .          .          .          9B
             .          .          .           .
             .          .          .           .
153          .          .         9C............
             .          .         V
             .          .         V
156          .          .         9R
             .          .          .
             .          .          .
162          .          .          .          8B
             .          .          .           .
             .          .          .           .
168          .        8C........................
             .         V
             .         V
171          .        8R
             .          .
             .          .
177          .          .         7B
             .          .          .
             .          .          .
184          .        7C............
             .         V
             .         V
187          .        7R
             .          .
             .          .
193          .          .         6B
             .          .         V
             .          .         V
199          .          .         6R
             .          .          .
             .          .          .
205          .          .          .          5B
             .          .          .           .
             .          .          .           .
212          .          .         5C............
             .          .         V
             .          .         V
215          .          .         5R
             .          .          .
             .          .          .
221          .          .          .          4B
             .          .          .           V
             .          .          .           V
228          .          .          .          4R
             .          .          .           .
             .          .          .           .
234          .          .          .           .          3B
             .          .          .           .           .
             .          .          .           .           .
241          .          .          .          3C............
             .          .          .           V
             .          .          .           V
244          .          .          .          3R
             .          .          .           .
             .          .          .           .
250          .          .          .           .          2B
             .          .          .           .           .
             .          .          .           .           .
257          .        2C......................................
             .         V
             .         V
260          .        2R
             .          .
             .          .
266          .          .         1B
             .          .          .
             .          .          .
274        1C........................
            V
            V
277        1R
```

```
(***) RUNOFF ALSO COMPUTED AT THIS LOCATION
1****************************************
*                                      *
*   FLOOD HYDROGRAPH PACKAGE  (HEC-1)  *
*              JUL   1997              *
*           VERSION 4.1                *
*                                      *
*  RUN DATE   12JUN98  TIME  14:22:01  *
*                                      *
****************************************
```

```
****************************************
*                                      *
*    U.S. ARMY CORPS OF ENGINEERS      *
*    HYDROLOGIC ENGINEERING CENTER     *
*          609 SECOND STREET           *
*       DAVIS, CALIFORNIA 95616        *
*           (916) 756-1104             *
*                                      *
****************************************
```

```
                    Gavilan Peak Watershed HEC-1 Analysis using WMS (100-year 6-hour storm)
                    Location: I-17 and Town of New River
                    FCDMC, 1998

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

   IT         HYDROGRAPH TIME DATA
                NMIN           5  MINUTES IN COMPUTATION INTERVAL
               IDATE      1JAN98  STARTING DATE
               ITIME        0000  STARTING TIME
                  NQ         300  NUMBER OF HYDROGRAPH ORDINATES
              NDDATE      2JAN98  ENDING DATE
              NDTIME        0055  ENDING TIME
              ICENT          19  CENTURY MARK

           COMPUTATION INTERVAL     .08 HOURS
               TOTAL TIME BASE   24.92 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
```



45

```
  7 JD          INDEX STORM NO. 1
                     STRM        3.47  PRECIPITATION DEPTH
                     TRDA         .01  TRANSPOSITION DRAINAGE AREA

  8 PI           PRECIPITATION PATTERN
                    .00       .00       .00       .00       .00       .00       .00       .00       .00       .00
                    .00       .00       .00       .00       .00       .00       .00       .00       .00       .00
                    .00       .00       .00       .00       .00       .00       .00       .00       .00       .00
                    .00       .00       .00       .01       .01       .01       .01       .01       .01       .03
                    .03       .03       .05       .05       .05       .15       .15       .15       .03       .03
                    .03       .01       .01       .01       .01       .01       .01       .00       .00       .00
                    .00       .00       .00       .00       .00       .00       .00       .00       .00       .00
                    .00       .00

 11 JD          INDEX STORM NO. 2
                     STRM        3.45  PRECIPITATION DEPTH
                     TRDA         .50  TRANSPOSITION DRAINAGE AREA

  0 PI           PRECIPITATION PATTERN
                    .00       .00       .00       .00       .00       .00       .00       .00       .00       .00
                    .00       .00       .00       .00       .00       .00       .00       .00       .00       .00
                    .00       .00       .00       .00       .00       .00       .00       .00       .00       .00
                    .00       .00       .00       .01       .01       .01       .01       .01       .01       .03
                    .03       .03       .05       .05       .05       .15       .15       .15       .03       .03
                    .03       .01       .01       .01       .01       .01       .01       .00       .00       .00
                    .00       .00       .00       .00       .00       .00       .00       .00       .00       .00
                    .00       .00

 13 JD          INDEX STORM NO. 3
                     STRM        3.40  PRECIPITATION DEPTH
                     TRDA        2.80  TRANSPOSITION DRAINAGE AREA

 14 PI           PRECIPITATION PATTERN
                    .00       .00       .00       .00       .00       .00       .00       .00       .00       .00
                    .00       .00       .00       .00       .00       .00       .00       .00       .00       .00
                    .00       .00       .00       .00       .00       .00       .00       .00       .00       .00
                    .00       .00       .00       .01       .01       .01       .01       .01       .01       .03
                    .03       .03       .07       .07       .07       .08       .08       .08       .05       .05
                    .05       .02       .02       .02       .01       .01       .01       .00       .00       .00
                    .00       .00       .00       .00       .00       .00       .00       .00       .00       .00
                    .00       .00

 18 JD          INDEX STORM NO. 4
                     STRM        3.20  PRECIPITATION DEPTH
                     TRDA       16.00  TRANSPOSITION DRAINAGE AREA

 19 PI           PRECIPITATION PATTERN
                    .01       .01       .00       .00       .00       .00       .00       .00       .00       .01
                    .01       .01       .00       .01       .00       .00       .00       .00       .00       .00
                    .00       .00       .01       .00       .00       .00       .00       .01       .01       .01
                    .01       .01       .01       .01       .01       .01       .02       .02       .02       .03
                    .03       .03       .06       .06       .06       .07       .07       .07       .04       .04
                    .04       .02       .02       .02       .01       .01       .01       .01       .01       .01
                    .00       .00       .00       .00       .00       .00       .00       .00       .00       .00
                    .00       .00

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

          **************
          *            *
 22 KK    *      16B   *
          *            *
          **************

 23 KO          OUTPUT CONTROL VARIABLES
                     IPRNT           5  PRINT CONTROL
                     IPLOT           0  PLOT CONTROL
                     QSCAL          0.  HYDROGRAPH PLOT SCALE
                     IPNCH           0  PUNCH COMPUTED HYDROGRAPH
                      IOUT          22  SAVE HYDROGRAPH ON THIS UNIT
                     ISAV1           1  FIRST ORDINATE PUNCHED OR SAVED
                     ISAV2         300  LAST ORDINATE PUNCHED OR SAVED
                    TIMINT        .083  TIME INTERVAL IN HOURS

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

          **************
          *            *
 30 KK    *      16R   *        CNAME     16B
          *            *
          **************

 31 KO          OUTPUT CONTROL VARIABLES
                     IPRNT           5  PRINT CONTROL
                     IPLOT           0  PLOT CONTROL
                     QSCAL          0.  HYDROGRAPH PLOT SCALE
                     IPNCH           0  PUNCH COMPUTED HYDROGRAPH
                      IOUT          22  SAVE HYDROGRAPH ON THIS UNIT
                     ISAV1           1  FIRST ORDINATE PUNCHED OR SAVED
                     ISAV2         300  LAST ORDINATE PUNCHED OR SAVED
                    TIMINT        .083  TIME INTERVAL IN HOURS

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

          **************
          *            *
 36 KK    *      18B   *
          *            *
          **************

 37 KO          OUTPUT CONTROL VARIABLES
                     IPRNT           5  PRINT CONTROL
                     IPLOT           0  PLOT CONTROL
                     QSCAL          0.  HYDROGRAPH PLOT SCALE
                     IPNCH           0  PUNCH COMPUTED HYDROGRAPH
                      IOUT          22  SAVE HYDROGRAPH ON THIS UNIT
                     ISAV1           1  FIRST ORDINATE PUNCHED OR SAVED
                     ISAV2         300  LAST ORDINATE PUNCHED OR SAVED
                    TIMINT        .083  TIME INTERVAL IN HOURS

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

```
              **************
              *            *
 42 KK        *     18R    *        CNAME     18B
              *            *
              **************

 43 KO          OUTPUT CONTROL VARIABLES
                      IPRNT           5  PRINT CONTROL
                      IPLOT           0  PLOT CONTROL
                      QSCAL          0.  HYDROGRAPH PLOT SCALE
                      IPNCH           0  PUNCH COMPUTED HYDROGRAPH
                       IOUT          22  SAVE HYDROGRAPH ON THIS UNIT
                      ISAV1           1  FIRST ORDINATE PUNCHED OR SAVED
                      ISAV2         300  LAST ORDINATE PUNCHED OR SAVED
                     TIMINT        .083  TIME INTERVAL IN HOURS

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

              **************
              *            *
 48 KK        *     17B    *
              *            *
              **************

 49 KO          OUTPUT CONTROL VARIABLES
                      IPRNT           5  PRINT CONTROL
                      IPLOT           0  PLOT CONTROL
                      QSCAL          0.  HYDROGRAPH PLOT SCALE
                      IPNCH           0  PUNCH COMPUTED HYDROGRAPH
                       IOUT          22  SAVE HYDROGRAPH ON THIS UNIT
                      ISAV1           1  FIRST ORDINATE PUNCHED OR SAVED
                      ISAV2         300  LAST ORDINATE PUNCHED OR SAVED
                     TIMINT        .083  TIME INTERVAL IN HOURS

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

              **************
              *            *
 55 KK        *     17C    *        CNAME     17R
              *            *
              **************

 56 KO          OUTPUT CONTROL VARIABLES
                      IPRNT           5  PRINT CONTROL
                      IPLOT           0  PLOT CONTROL
                      QSCAL          0.  HYDROGRAPH PLOT SCALE
                      IPNCH           0  PUNCH COMPUTED HYDROGRAPH
                       IOUT          22  SAVE HYDROGRAPH ON THIS UNIT
                      ISAV1           1  FIRST ORDINATE PUNCHED OR SAVED
                      ISAV2         300  LAST ORDINATE PUNCHED OR SAVED
                     TIMINT        .083  TIME INTERVAL IN HOURS

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

              **************
              *            *
 58 KK        *     17R    *        CNAME     17C
              *            *
              **************

 59 KO          OUTPUT CONTROL VARIABLES
                      IPRNT           5  PRINT CONTROL
                      IPLOT           0  PLOT CONTROL
                      QSCAL          0.  HYDROGRAPH PLOT SCALE
                      IPNCH           0  PUNCH COMPUTED HYDROGRAPH
                       IOUT          22  SAVE HYDROGRAPH ON THIS UNIT
                      ISAV1           1  FIRST ORDINATE PUNCHED OR SAVED
                      ISAV2         300  LAST ORDINATE PUNCHED OR SAVED
                     TIMINT        .083  TIME INTERVAL IN HOURS

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

              **************
              *            *
 64 KK        *     15B    *
              *            *
              **************

 65 KO          OUTPUT CONTROL VARIABLES
                      IPRNT           5  PRINT CONTROL
                      IPLOT           0  PLOT CONTROL
                      QSCAL          0.  HYDROGRAPH PLOT SCALE
                      IPNCH           0  PUNCH COMPUTED HYDROGRAPH
                       IOUT          22  SAVE HYDROGRAPH ON THIS UNIT
                      ISAV1           1  FIRST ORDINATE PUNCHED OR SAVED
                      ISAV2         300  LAST ORDINATE PUNCHED OR SAVED
                     TIMINT        .083  TIME INTERVAL IN HOURS

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

              **************
              *            *
 71 KK        *     15C    *        CNAME     15R
              *            *
              **************

 72 KO          OUTPUT CONTROL VARIABLES
                      IPRNT           5  PRINT CONTROL
                      IPLOT           0  PLOT CONTROL
                      QSCAL          0.  HYDROGRAPH PLOT SCALE
                      IPNCH           0  PUNCH COMPUTED HYDROGRAPH
                       IOUT          22  SAVE HYDROGRAPH ON THIS UNIT
                      ISAV1           1  FIRST ORDINATE PUNCHED OR SAVED
```

```
                    ISAV2        300  LAST ORDINATE PUNCHED OR SAVED
                   TIMINT       .083  TIME INTERVAL IN HOURS


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

            **************
            *            *
 74 KK      *     15R    *      CNAME     15C
            *            *
            **************

 75 KO          OUTPUT CONTROL VARIABLES
                     IPRNT          5  PRINT CONTROL
                     IPLOT          0  PLOT CONTROL
                     QSCAL         0.  HYDROGRAPH PLOT SCALE
                     IPNCH          0  PUNCH COMPUTED HYDROGRAPH
                      IOUT         22  SAVE HYDROGRAPH ON THIS UNIT
                     ISAV1          1  FIRST ORDINATE PUNCHED OR SAVED
                     ISAV2        300  LAST ORDINATE PUNCHED OR SAVED
                    TIMINT       .083  TIME INTERVAL IN HOURS


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

            **************
            *            *
 80 KK      *     13B    *
            *            *
            **************

 81 KO          OUTPUT CONTROL VARIABLES
                     IPRNT          5  PRINT CONTROL
                     IPLOT          0  PLOT CONTROL
                     QSCAL         0.  HYDROGRAPH PLOT SCALE
                     IPNCH          0  PUNCH COMPUTED HYDROGRAPH
                      IOUT         22  SAVE HYDROGRAPH ON THIS UNIT
                     ISAV1          1  FIRST ORDINATE PUNCHED OR SAVED
                     ISAV2        300  LAST ORDINATE PUNCHED OR SAVED
                    TIMINT       .083  TIME INTERVAL IN HOURS


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

            **************
            *            *
 87 KK      *     14B    *
            *            *
            **************

 88 KO          OUTPUT CONTROL VARIABLES
                     IPRNT          5  PRINT CONTROL
                     IPLOT          0  PLOT CONTROL
                     QSCAL         0.  HYDROGRAPH PLOT SCALE
                     IPNCH          0  PUNCH COMPUTED HYDROGRAPH
                      IOUT         22  SAVE HYDROGRAPH ON THIS UNIT
                     ISAV1          1  FIRST ORDINATE PUNCHED OR SAVED
                     ISAV2        300  LAST ORDINATE PUNCHED OR SAVED
                    TIMINT       .083  TIME INTERVAL IN HOURS


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

            **************
            *            *
 95 KK      *     13C    *      CNAME     13R
            *            *
            **************

 96 KO          OUTPUT CONTROL VARIABLES
                     IPRNT          5  PRINT CONTROL
                     IPLOT          0  PLOT CONTROL
                     QSCAL         0.  HYDROGRAPH PLOT SCALE
                     IPNCH          0  PUNCH COMPUTED HYDROGRAPH
                      IOUT         22  SAVE HYDROGRAPH ON THIS UNIT
                     ISAV1          1  FIRST ORDINATE PUNCHED OR SAVED
                     ISAV2        300  LAST ORDINATE PUNCHED OR SAVED
                    TIMINT       .083  TIME INTERVAL IN HOURS


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

            **************
            *            *
 98 KK      *     13R    *      CNAME     13C
            *            *
            **************

 99 KO          OUTPUT CONTROL VARIABLES
                     IPRNT          5  PRINT CONTROL
                     IPLOT          0  PLOT CONTROL
                     QSCAL         0.  HYDROGRAPH PLOT SCALE
                     IPNCH          0  PUNCH COMPUTED HYDROGRAPH
                      IOUT         22  SAVE HYDROGRAPH ON THIS UNIT
                     ISAV1          1  FIRST ORDINATE PUNCHED OR SAVED
                     ISAV2        300  LAST ORDINATE PUNCHED OR SAVED
                    TIMINT       .083  TIME INTERVAL IN HOURS


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

            **************
            *            *
104 KK      *     12B    *
            *            *
            **************
```



48

```
105 KO          OUTPUT CONTROL VARIABLES
                      IPRNT           5  PRINT CONTROL
                      IPLOT           0  PLOT CONTROL
                      QSCAL          0.  HYDROGRAPH PLOT SCALE
                      IPNCH           0  Ppunch COMPUTED HYDROGRAPH
                       IOUT          22  SAVE HYDROGRAPH ON THIS UNIT
                      ISAV1           1  FIRST ORDINATE PUNCHED OR SAVED
                      ISAV2         300  LAST ORDINATE PUNCHED OR SAVED
                     TIMINT        .083  TIME INTERVAL IN HOURS

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

          **************
          *            *
110 KK    *      12C   *        CNAME     12R
          *            *
          **************

111 KO          OUTPUT CONTROL VARIABLES
                      IPRNT           5  PRINT CONTROL
                      IPLOT           0  PLOT CONTROL
                      QSCAL          0.  HYDROGRAPH PLOT SCALE
                      IPNCH           0  PUNCH COMPUTED HYDROGRAPH
                       IOUT          22  SAVE HYDROGRAPH ON THIS UNIT
                      ISAV1           1  FIRST ORDINATE PUNCHED OR SAVED
                      ISAV2         300  LAST ORDINATE PUNCHED OR SAVED
                     TIMINT        .083  TIME INTERVAL IN HOURS

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

          **************
          *            *
113 KK    *      12R   *        CNAME     12C
          *            *
          **************

114 KO          OUTPUT CONTROL VARIABLES
                      IPRNT           5  PRINT CONTROL
                      IPLOT           0  PLOT CONTROL
                      QSCAL          0.  HYDROGRAPH PLOT SCALE
                      IPNCH           0  PUNCH COMPUTED HYDROGRAPH
                       IOUT          22  SAVE HYDROGRAPH ON THIS UNIT
                      ISAV1           1  FIRST ORDINATE PUNCHED OR SAVED
                      ISAV2         300  LAST ORDINATE PUNCHED OR SAVED
                     TIMINT        .083  TIME INTERVAL IN HOURS

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

          **************
          *            *
119 KK    *      11B   *
          *            *
          **************

120 KO          OUTPUT CONTROL VARIABLES
                      IPRNT           5  PRINT CONTROL
                      IPLOT           0  PLOT CONTROL
                      QSCAL          0.  HYDROGRAPH PLOT SCALE
                      IPNCH           0  PUNCH COMPUTED HYDROGRAPH
                       IOUT          22  SAVE HYDROGRAPH ON THIS UNIT
                      ISAV1           1  FIRST ORDINATE PUNCHED OR SAVED
                      ISAV2         300  LAST ORDINATE PUNCHED OR SAVED
                     TIMINT        .083  TIME INTERVAL IN HOURS

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

          **************
          *            *
126 KK    *      11R   *        CNAME     11B
          *            *
          **************

127 KO          OUTPUT CONTROL VARIABLES
                      IPRNT           5  PRINT CONTROL
                      IPLOT           0  PLOT CONTROL
                      QSCAL          0.  HYDROGRAPH PLOT SCALE
                      IPNCH           0  PUNCH COMPUTED HYDROGRAPH
                       IOUT          22  SAVE HYDROGRAPH ON THIS UNIT
                      ISAV1           1  FIRST ORDINATE PUNCHED OR SAVED
                      ISAV2         300  LAST ORDINATE PUNCHED OR SAVED
                     TIMINT        .083  TIME INTERVAL IN HOURS

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

          **************
          *            *
132 KK    *      10B   *
          *            *
          **************

133 KO          OUTPUT CONTROL VARIABLES
                      IPRNT           5  PRINT CONTROL
                      IPLOT           0  PLOT CONTROL
                      QSCAL          0.  HYDROGRAPH PLOT SCALE
                      IPNCH           0  PUNCH COMPUTED HYDROGRAPH
                       IOUT          22  SAVE HYDROGRAPH ON THIS UNIT
                      ISAV1           1  FIRST ORDINATE PUNCHED OR SAVED
                      ISAV2         300  LAST ORDINATE PUNCHED OR SAVED
                     TIMINT        .083  TIME INTERVAL IN HOURS

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



49

```
              **************
              *            *
 139 KK       *     10R    *        CNAME     10B
              *            *
              **************

 140 KO          OUTPUT CONTROL VARIABLES
                      IPRNT          5  PRINT CONTROL
                      IPLOT          0  PLOT CONTROL
                      QSCAL         0.  HYDROGRAPH PLOT SCALE
                      IPNCH          0  PUNCH COMPUTED HYDROGRAPH
                       IOUT         22  SAVE HYDROGRAPH ON THIS UNIT
                      ISAV1          1  FIRST ORDINATE PUNCHED OR SAVED
                      ISAV2        300  LAST ORDINATE PUNCHED OR SAVED
                     TIMINT       .083  TIME INTERVAL IN HOURS


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

              **************
              *            *
 145 KK       *      9B    *
              *            *
              **************

 146 KO          OUTPUT CONTROL VARIABLES
                      IPRNT          5  PRINT CONTROL
                      IPLOT          0  PLOT CONTROL
                      QSCAL         0.  HYDROGRAPH PLOT SCALE
                      IPNCH          0  PUNCH COMPUTED HYDROGRAPH
                       IOUT         22  SAVE HYDROGRAPH ON THIS UNIT
                      ISAV1          1  FIRST ORDINATE PUNCHED OR SAVED
                      ISAV2        300  LAST ORDINATE PUNCHED OR SAVED
                     TIMINT       .083  TIME INTERVAL IN HOURS


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

              **************
              *            *
 153 KK       *      9C    *        CNAME      9R
              *            *
              **************

 154 KO          OUTPUT CONTROL VARIABLES
                      IPRNT          5  PRINT CONTROL
                      IPLOT          0  PLOT CONTROL
                      QSCAL         0.  HYDROGRAPH PLOT SCALE
                      IPNCH          0  PUNCH COMPUTED HYDROGRAPH
                       IOUT         22  SAVE HYDROGRAPH ON THIS UNIT
                      ISAV1          1  FIRST ORDINATE PUNCHED OR SAVED
                      ISAV2        300  LAST ORDINATE PUNCHED OR SAVED
                     TIMINT       .083  TIME INTERVAL IN HOURS


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

              **************
              *            *
 156 KK       *      9R    *        CNAME      9C
              *            *
              **************

 157 KO          OUTPUT CONTROL VARIABLES
                      IPRNT          5  PRINT CONTROL
                      IPLOT          0  PLOT CONTROL
                      QSCAL         0.  HYDROGRAPH PLOT SCALE
                      IPNCH          0  PUNCH COMPUTED HYDROGRAPH
                       IOUT         22  SAVE HYDROGRAPH ON THIS UNIT
                      ISAV1          1  FIRST ORDINATE PUNCHED OR SAVED
                      ISAV2        300  LAST ORDINATE PUNCHED OR SAVED
                     TIMINT       .083  TIME INTERVAL IN HOURS


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

              **************
              *            *
 162 KK       *      8B    *
              *            *
              **************

 163 KO          OUTPUT CONTROL VARIABLES
                      IPRNT          5  PRINT CONTROL
                      IPLOT          0  PLOT CONTROL
                      QSCAL         0.  HYDROGRAPH PLOT SCALE
                      IPNCH          0  PUNCH COMPUTED HYDROGRAPH
                       IOUT         22  SAVE HYDROGRAPH ON THIS UNIT
                      ISAV1          1  FIRST ORDINATE PUNCHED OR SAVED
                      ISAV2        300  LAST ORDINATE PUNCHED OR SAVED
                     TIMINT       .083  TIME INTERVAL IN HOURS


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

              **************
              *            *
 168 KK       *      8C    *        CNAME      8R
              *            *
              **************

 169 KO          OUTPUT CONTROL VARIABLES
                      IPRNT          5  PRINT CONTROL
                      IPLOT          0  PLOT CONTROL
                      QSCAL         0.  HYDROGRAPH PLOT SCALE
                      IPNCH          0  PUNCH COMPUTED HYDROGRAPH
                       IOUT         22  SAVE HYDROGRAPH ON THIS UNIT
                      ISAV1          1  FIRST ORDINATE PUNCHED OR SAVED
                      ISAV2        300  LAST ORDINATE PUNCHED OR SAVED
```



50

```
                    TIMINT        .083  TIME INTERVAL IN HOURS

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

            **************
            *            *
 171 KK     *        8R  *        CNAME      8C
            *            *
            **************

 172 KO           OUTPUT CONTROL VARIABLES
                       IPRNT           5  PRINT CONTROL
                       IPLOT           0  PLOT CONTROL
                       QSCAL          0.  HYDROGRAPH PLOT SCALE
                       IPNCH           0  PUNCH COMPUTED HYDROGRAPH
                        IOUT          22  SAVE HYDROGRAPH ON THIS UNIT
                       ISAV1           1  FIRST ORDINATE PUNCHED OR SAVED
                       ISAV2         300  LAST ORDINATE PUNCHED OR SAVED
                      TIMINT        .083  TIME INTERVAL IN HOURS

WARNING --- ROUTED OUTFLOW (   2061.) IS GREATER THAN MAXIMUM OUTFLOW (   1770.) IN STORAGE-OUTFLOW TABLE

WARNING --- ROUTED OUTFLOW (   2296.) IS GREATER THAN MAXIMUM OUTFLOW (   1770.) IN STORAGE-OUTFLOW TABLE

WARNING --- ROUTED OUTFLOW (   2313.) IS GREATER THAN MAXIMUM OUTFLOW (   1770.) IN STORAGE-OUTFLOW TABLE

WARNING --- ROUTED OUTFLOW (   2140.) IS GREATER THAN MAXIMUM OUTFLOW (   1770.) IN STORAGE-OUTFLOW TABLE

WARNING --- ROUTED OUTFLOW (   1855.) IS GREATER THAN MAXIMUM OUTFLOW (   1770.) IN STORAGE-OUTFLOW TABLE

WARNING --- ROUTED OUTFLOW (   2043.) IS GREATER THAN MAXIMUM OUTFLOW (   1770.) IN STORAGE-OUTFLOW TABLE

WARNING --- ROUTED OUTFLOW (   2277.) IS GREATER THAN MAXIMUM OUTFLOW (   1770.) IN STORAGE-OUTFLOW TABLE

WARNING --- ROUTED OUTFLOW (   2296.) IS GREATER THAN MAXIMUM OUTFLOW (   1770.) IN STORAGE-OUTFLOW TABLE

WARNING --- ROUTED OUTFLOW (   2125.) IS GREATER THAN MAXIMUM OUTFLOW (   1770.) IN STORAGE-OUTFLOW TABLE

WARNING --- ROUTED OUTFLOW (   1842.) IS GREATER THAN MAXIMUM OUTFLOW (   1770.) IN STORAGE-OUTFLOW TABLE

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

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            *            *
 177 KK     *        7B  *
            *            *
            **************

 178 KO           OUTPUT CONTROL VARIABLES
                       IPRNT           5  PRINT CONTROL
                       IPLOT           0  PLOT CONTROL
                       QSCAL          0.  HYDROGRAPH PLOT SCALE
                       IPNCH           0  PUNCH COMPUTED HYDROGRAPH
                        IOUT          22  SAVE HYDROGRAPH ON THIS UNIT
                       ISAV1           1  FIRST ORDINATE PUNCHED OR SAVED
                       ISAV2         300  LAST ORDINATE PUNCHED OR SAVED
                      TIMINT        .083  TIME INTERVAL IN HOURS

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

            **************
            *            *
 184 KK     *        7C  *        CNAME      7R
            *            *
            **************

 185 KO           OUTPUT CONTROL VARIABLES
                       IPRNT           5  PRINT CONTROL
                       IPLOT           0  PLOT CONTROL
                       QSCAL          0.  HYDROGRAPH PLOT SCALE
                       IPNCH           0  PUNCH COMPUTED HYDROGRAPH
                        IOUT          22  SAVE HYDROGRAPH ON THIS UNIT
                       ISAV1           1  FIRST ORDINATE PUNCHED OR SAVED
                       ISAV2         300  LAST ORDINATE PUNCHED OR SAVED
                      TIMINT        .083  TIME INTERVAL IN HOURS

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

            **************
            *            *
 187 KK     *        7R  *        CNAME      7C
            *            *
            **************

 188 KO           OUTPUT CONTROL VARIABLES
                       IPRNT           5  PRINT CONTROL
                       IPLOT           0  PLOT CONTROL
                       QSCAL          0.  HYDROGRAPH PLOT SCALE
                       IPNCH           0  PUNCH COMPUTED HYDROGRAPH
                        IOUT          22  SAVE HYDROGRAPH ON THIS UNIT
                       ISAV1           1  FIRST ORDINATE PUNCHED OR SAVED
                       ISAV2         300  LAST ORDINATE PUNCHED OR SAVED
                      TIMINT        .083  TIME INTERVAL IN HOURS

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

            **************
            *            *
 193 KK     *        6B  *
            *            *
            **************

 194 KO           OUTPUT CONTROL VARIABLES
                       IPRNT           5  PRINT CONTROL
                       IPLOT           0  PLOT CONTROL
```



51

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                    QSCAL          0.  HYDROGRAPH PLOT SCALE
                    IPNCH          0   PUNCH COMPUTED HYDROGRAPH
                     IOUT         22   SAVE HYDROGRAPH ON THIS UNIT
                    ISAV1          1   FIRST ORDINATE PUNCHED OR SAVED
                    ISAV2        300   LAST ORDINATE PUNCHED OR SAVED
                   TIMINT       .083   TIME INTERVAL IN HOURS


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

          **************
          *            *
 199 KK   *        6R  *        CNAME      6B
          *            *
          **************

 200 KO          OUTPUT CONTROL VARIABLES
                    IPRNT          5   PRINT CONTROL
                    IPLOT          0   PLOT CONTROL
                    QSCAL          0.  HYDROGRAPH PLOT SCALE
                    IPNCH          0   PUNCH COMPUTED HYDROGRAPH
                     IOUT         22   SAVE HYDROGRAPH ON THIS UNIT
                    ISAV1          1   FIRST ORDINATE PUNCHED OR SAVED
                    ISAV2        300   LAST ORDINATE PUNCHED OR SAVED
                   TIMINT       .083   TIME INTERVAL IN HOURS


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

          **************
          *            *
 205 KK   *        5B  *
          *            *
          **************

 206 KO          OUTPUT CONTROL VARIABLES
                    IPRNT          5   PRINT CONTROL
                    IPLOT          0   PLOT CONTROL
                    QSCAL          0.  HYDROGRAPH PLOT SCALE
                    IPNCH          0   PUNCH COMPUTED HYDROGRAPH
                     IOUT         22   SAVE HYDROGRAPH ON THIS UNIT
                    ISAV1          1   FIRST ORDINATE PUNCHED OR SAVED
                    ISAV2        300   LAST ORDINATE PUNCHED OR SAVED
                   TIMINT       .083   TIME INTERVAL IN HOURS


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

          **************
          *            *
 212 KK   *        5C  *        CNAME      5R
          *            *
          **************

 213 KO          OUTPUT CONTROL VARIABLES
                    IPRNT          5   PRINT CONTROL
                    IPLOT          0   PLOT CONTROL
                    QSCAL          0.  HYDROGRAPH PLOT SCALE
                    IPNCH          0   PUNCH COMPUTED HYDROGRAPH
                     IOUT         22   SAVE HYDROGRAPH ON THIS UNIT
                    ISAV1          1   FIRST ORDINATE PUNCHED OR SAVED
                    ISAV2        300   LAST ORDINATE PUNCHED OR SAVED
                   TIMINT       .083   TIME INTERVAL IN HOURS


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

          **************
          *            *
 215 KK   *        5R  *        CNAME      5C
          *            *
          **************

 216 KO          OUTPUT CONTROL VARIABLES
                    IPRNT          5   PRINT CONTROL
                    IPLOT          0   PLOT CONTROL
                    QSCAL          0.  HYDROGRAPH PLOT SCALE
                    IPNCH          0   PUNCH COMPUTED HYDROGRAPH
                     IOUT         22   SAVE HYDROGRAPH ON THIS UNIT
                    ISAV1          1   FIRST ORDINATE PUNCHED OR SAVED
                    ISAV2        300   LAST ORDINATE PUNCHED OR SAVED
                   TIMINT       .083   TIME INTERVAL IN HOURS


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

          **************
          *            *
 221 KK   *        4B  *
          *            *
          **************

 222 KO          OUTPUT CONTROL VARIABLES
                    IPRNT          5   PRINT CONTROL
                    IPLOT          0   PLOT CONTROL
                    QSCAL          0.  HYDROGRAPH PLOT SCALE
                    IPNCH          0   PUNCH COMPUTED HYDROGRAPH
                     IOUT         22   SAVE HYDROGRAPH ON THIS UNIT
                    ISAV1          1   FIRST ORDINATE PUNCHED OR SAVED
                    ISAV2        300   LAST ORDINATE PUNCHED OR SAVED
                   TIMINT       .083   TIME INTERVAL IN HOURS


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

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



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```
228 KK      *        4R  *        CNAME      4B
            *            *
            **************

229 KO          OUTPUT CONTROL VARIABLES
                     IPRNT          5  PRINT CONTROL
                     IPLOT          0  PLOT CONTROL
                     QSCAL         0.  HYDROGRAPH PLOT SCALE
                     IPNCH          0  PUNCH COMPUTED HYDROGRAPH
                      IOUT         22  SAVE HYDROGRAPH ON THIS UNIT
                     ISAV1          1  FIRST ORDINATE PUNCHED OR SAVED
                     ISAV2        300  LAST ORDINATE PUNCHED OR SAVED
                    TIMINT       .083  TIME INTERVAL IN HOURS


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

            **************
            *            *
234 KK      *        3B  *
            *            *
            **************

235 KO          OUTPUT CONTROL VARIABLES
                     IPRNT          5  PRINT CONTROL
                     IPLOT          0  PLOT CONTROL
                     QSCAL         0.  HYDROGRAPH PLOT SCALE
                     IPNCH          0  PUNCH COMPUTED HYDROGRAPH
                      IOUT         22  SAVE HYDROGRAPH ON THIS UNIT
                     ISAV1          1  FIRST ORDINATE PUNCHED OR SAVED
                     ISAV2        300  LAST ORDINATE PUNCHED OR SAVED
                    TIMINT       .083  TIME INTERVAL IN HOURS


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

            **************
            *            *
241 KK      *        3C  *        CNAME      3R
            *            *
            **************

242 KO          OUTPUT CONTROL VARIABLES
                     IPRNT          5  PRINT CONTROL
                     IPLOT          0  PLOT CONTROL
                     QSCAL         0.  HYDROGRAPH PLOT SCALE
                     IPNCH          0  PUNCH COMPUTED HYDROGRAPH
                      IOUT         22  SAVE HYDROGRAPH ON THIS UNIT
                     ISAV1          1  FIRST ORDINATE PUNCHED OR SAVED
                     ISAV2        300  LAST ORDINATE PUNCHED OR SAVED
                    TIMINT       .083  TIME INTERVAL IN HOURS


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

            **************
            *            *
244 KK      *        3R  *        CNAME      3C
            *            *
            **************

245 KO          OUTPUT CONTROL VARIABLES
                     IPRNT          5  PRINT CONTROL
                     IPLOT          0  PLOT CONTROL
                     QSCAL         0.  HYDROGRAPH PLOT SCALE
                     IPNCH          0  PUNCH COMPUTED HYDROGRAPH
                      IOUT         22  SAVE HYDROGRAPH ON THIS UNIT
                     ISAV1          1  FIRST ORDINATE PUNCHED OR SAVED
                     ISAV2        300  LAST ORDINATE PUNCHED OR SAVED
                    TIMINT       .083  TIME INTERVAL IN HOURS

WARNING --- ROUTED OUTFLOW (   1374.) IS GREATER THAN MAXIMUM OUTFLOW (   1304.) IN STORAGE-OUTFLOW TABLE

WARNING --- ROUTED OUTFLOW (   1495.) IS GREATER THAN MAXIMUM OUTFLOW (   1304.) IN STORAGE-OUTFLOW TABLE

WARNING --- ROUTED OUTFLOW (   1464.) IS GREATER THAN MAXIMUM OUTFLOW (   1304.) IN STORAGE-OUTFLOW TABLE

WARNING --- ROUTED OUTFLOW (   1317.) IS GREATER THAN MAXIMUM OUTFLOW (   1304.) IN STORAGE-OUTFLOW TABLE

WARNING --- ROUTED OUTFLOW (   1367.) IS GREATER THAN MAXIMUM OUTFLOW (   1304.) IN STORAGE-OUTFLOW TABLE

WARNING --- ROUTED OUTFLOW (   1442.) IS GREATER THAN MAXIMUM OUTFLOW (   1304.) IN STORAGE-OUTFLOW TABLE

WARNING --- ROUTED OUTFLOW (   1408.) IS GREATER THAN MAXIMUM OUTFLOW (   1304.) IN STORAGE-OUTFLOW TABLE

WARNING --- ROUTED OUTFLOW (   1344.) IS GREATER THAN MAXIMUM OUTFLOW (   1304.) IN STORAGE-OUTFLOW TABLE

WARNING --- ROUTED OUTFLOW (   1398.) IS GREATER THAN MAXIMUM OUTFLOW (   1304.) IN STORAGE-OUTFLOW TABLE

WARNING --- ROUTED OUTFLOW (   1364.) IS GREATER THAN MAXIMUM OUTFLOW (   1304.) IN STORAGE-OUTFLOW TABLE

WARNING --- ROUTED OUTFLOW (   1360.) IS GREATER THAN MAXIMUM OUTFLOW (   1304.) IN STORAGE-OUTFLOW TABLE

WARNING --- ROUTED OUTFLOW (   1483.) IS GREATER THAN MAXIMUM OUTFLOW (   1304.) IN STORAGE-OUTFLOW TABLE

WARNING --- ROUTED OUTFLOW (   1454.) IS GREATER THAN MAXIMUM OUTFLOW (   1304.) IN STORAGE-OUTFLOW TABLE

WARNING --- ROUTED OUTFLOW (   1308.) IS GREATER THAN MAXIMUM OUTFLOW (   1304.) IN STORAGE-OUTFLOW TABLE

WARNING --- ROUTED OUTFLOW (   1357.) IS GREATER THAN MAXIMUM OUTFLOW (   1304.) IN STORAGE-OUTFLOW TABLE

WARNING --- ROUTED OUTFLOW (   1432.) IS GREATER THAN MAXIMUM OUTFLOW (   1304.) IN STORAGE-OUTFLOW TABLE

WARNING --- ROUTED OUTFLOW (   1398.) IS GREATER THAN MAXIMUM OUTFLOW (   1304.) IN STORAGE-OUTFLOW TABLE

WARNING --- ROUTED OUTFLOW (   1336.) IS GREATER THAN MAXIMUM OUTFLOW (   1304.) IN STORAGE-OUTFLOW TABLE

WARNING --- ROUTED OUTFLOW (   1389.) IS GREATER THAN MAXIMUM OUTFLOW (   1304.) IN STORAGE-OUTFLOW TABLE

WARNING --- ROUTED OUTFLOW (   1354.) IS GREATER THAN MAXIMUM OUTFLOW (   1304.) IN STORAGE-OUTFLOW TABLE

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



53

```
                **************
                *            *
 250 KK         *     2B     *
                *            *
                **************

 251 KO              OUTPUT CONTROL VARIABLES
                          IPRNT          5  PRINT CONTROL
                          IPLOT          0  PLOT CONTROL
                          QSCAL         0.  HYDROGRAPH PLOT SCALE
                          IPNCH          0  PUNCH COMPUTED HYDROGRAPH
                           IOUT         22  SAVE HYDROGRAPH ON THIS UNIT
                          ISAV1          1  FIRST ORDINATE PUNCHED OR SAVED
                          ISAV2        300  LAST ORDINATE PUNCHED OR SAVED
                         TIMINT       .083  TIME INTERVAL IN HOURS

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

                **************
                *            *
 257 KK         *     2C     *        CNAME      2R
                *            *
                **************

 258 KO              OUTPUT CONTROL VARIABLES
                          IPRNT          5  PRINT CONTROL
                          IPLOT          0  PLOT CONTROL
                          QSCAL         0.  HYDROGRAPH PLOT SCALE
                          IPNCH          0  PUNCH COMPUTED HYDROGRAPH
                           IOUT         22  SAVE HYDROGRAPH ON THIS UNIT
                          ISAV1          1  FIRST ORDINATE PUNCHED OR SAVED
                          ISAV2        300  LAST ORDINATE PUNCHED OR SAVED
                         TIMINT       .083  TIME INTERVAL IN HOURS

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

                **************
                *            *
 260 KK         *     2R     *        CNAME      2C
                *            *
                **************

 261 KO              OUTPUT CONTROL VARIABLES
                          IPRNT          5  PRINT CONTROL
                          IPLOT          0  PLOT CONTROL
                          QSCAL         0.  HYDROGRAPH PLOT SCALE
                          IPNCH          0  PUNCH COMPUTED HYDROGRAPH
                           IOUT         22  SAVE HYDROGRAPH ON THIS UNIT
                          ISAV1          1  FIRST ORDINATE PUNCHED OR SAVED
                          ISAV2        300  LAST ORDINATE PUNCHED OR SAVED
                         TIMINT       .083  TIME INTERVAL IN HOURS

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

                **************
                *            *
 266 KK         *     1B     *
                *            *
                **************

 267 KO              OUTPUT CONTROL VARIABLES
                          IPRNT          5  PRINT CONTROL
                          IPLOT          0  PLOT CONTROL
                          QSCAL         0.  HYDROGRAPH PLOT SCALE
                          IPNCH          0  PUNCH COMPUTED HYDROGRAPH
                           IOUT         22  SAVE HYDROGRAPH ON THIS UNIT
                          ISAV1          1  FIRST ORDINATE PUNCHED OR SAVED
                          ISAV2        300  LAST ORDINATE PUNCHED OR SAVED
                         TIMINT       .083  TIME INTERVAL IN HOURS

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

                **************
                *            *
 274 KK         *     1C     *        CNAME      1R
                *            *
                **************

 275 KO              OUTPUT CONTROL VARIABLES
                          IPRNT          5  PRINT CONTROL
                          IPLOT          0  PLOT CONTROL
                          QSCAL         0.  HYDROGRAPH PLOT SCALE
                          IPNCH          0  PUNCH COMPUTED HYDROGRAPH
                           IOUT         22  SAVE HYDROGRAPH ON THIS UNIT
                          ISAV1          1  FIRST ORDINATE PUNCHED OR SAVED
                          ISAV2        300  LAST ORDINATE PUNCHED OR SAVED
                         TIMINT       .083  TIME INTERVAL IN HOURS

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

                **************
                *            *
 277 KK         *     1R     *        CNAME      1C
                *            *
                **************

 278 KO              OUTPUT CONTROL VARIABLES
                          IPRNT          5  PRINT CONTROL
                          IPLOT          0  PLOT CONTROL
                          QSCAL         0.  HYDROGRAPH PLOT SCALE
                          IPNCH          0  PUNCH COMPUTED HYDROGRAPH
                           IOUT         22  SAVE HYDROGRAPH ON THIS UNIT
                          ISAV1          1  FIRST ORDINATE PUNCHED OR SAVED
                          ISAV2        300  LAST ORDINATE PUNCHED OR SAVED
```

TIMINT .083 TIME INTERVAL IN HOURS

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 | 16B | 946. | 4.42 | 152. | 38. | 37. | .63 | | |
| + | ROUTED TO | 16R | 859. | 4.58 | 152. | 38. | 37. | .63 | | |
| + | HYDROGRAPH AT | 18B | 1502. | 4.25 | 186. | 47. | 45. | .71 | | |
| + | ROUTED TO | 18R | 1266. | 4.42 | 185. | 47. | 45. | .71 | | |
| + | HYDROGRAPH AT | 17B | 1005. | 4.33 | 132. | 33. | 32. | .58 | | |
| + | 2 COMBINED AT | 17C | 1932. | 4.42 | 306. | 77. | 74. | 1.29 | | |
| + | ROUTED TO | 17R | 1821. | 4.50 | 306. | 77. | 74. | 1.29 | | |
| + | HYDROGRAPH AT | 15B | 856. | 4.33 | 105. | 26. | 25. | .46 | | |
| + | 2 COMBINED AT | 15C | 2276. | 4.42 | 402. | 101. | 98. | 1.76 | | |
| + | ROUTED TO | 15R | 2241. | 4.58 | 402. | 101. | 98. | 1.76 | | |
| + | HYDROGRAPH AT | 13B | 774. | 4.33 | 95. | 24. | 23. | .39 | | |
| + | HYDROGRAPH AT | 14B | 645. | 4.42 | 94. | 23. | 23. | .44 | | |
| + | 4 COMBINED AT | 13C | 3504. | 4.58 | 700. | 176. | 170. | 3.22 | | |
| + | ROUTED TO | 13R | 3432. | 4.67 | 700. | 176. | 170. | 3.22 | | |
| + | HYDROGRAPH AT | 12B | 681. | 4.25 | 67. | 17. | 16. | .32 | | |
| + | 2 COMBINED AT | 12C | 3614. | 4.58 | 751. | 189. | 182. | 3.54 | | |
| + | ROUTED TO | 12R | 3566. | 4.75 | 751. | 189. | 182. | 3.54 | | |
| + | HYDROGRAPH AT | 11B | 800. | 4.25 | 92. | 23. | 22. | .38 | | |
| + | ROUTED TO | 11R | 748. | 4.33 | 92. | 23. | 22. | .38 | | |
| + | HYDROGRAPH AT | 10B | 642. | 4.25 | 78. | 20. | 19. | .32 | | |
| + | ROUTED TO | 10R | 585. | 4.50 | 78. | 20. | 19. | .32 | | |
| + | HYDROGRAPH AT | 9B | 845. | 4.42 | 122. | 31. | 29. | .51 | | |
| + | 2 COMBINED AT | 9C | 1283. | 4.42 | 195. | 49. | 47. | .84 | | |
| + | ROUTED TO | 9R | 1267. | 4.50 | 195. | 49. | 47. | .84 | | |
| + | HYDROGRAPH AT | 8B | 488. | 4.25 | 51. | 13. | 12. | .21 | | |
| + | 3 COMBINED AT | 8C | 1961. | 4.42 | 328. | 82. | 79. | 1.43 | | |
| + | ROUTED TO | 8R | 1923. | 4.50 | 328. | 82. | 79. | 1.43 | | |
| + | HYDROGRAPH AT | 7B | 309. | 4.25 | 36. | 9. | 9. | .15 | | |
| + | 2 COMBINED AT | 7C | 2068. | 4.50 | 361. | 91. | 87. | 1.58 | | |
| + | ROUTED TO | 7R | 2070. | 4.50 | 360. | 91. | 87. | 1.58 | | |
| + | HYDROGRAPH AT | 6B | 783. | 4.17 | 75. | 19. | 18. | .31 | | |
| + | ROUTED TO | 6R | 607. | 4.50 | 75. | 19. | 18. | .31 | | |
| + | HYDROGRAPH AT | 5B | 627. | 4.33 | 86. | 22. | 21. | .35 | | |
| + | 2 COMBINED AT | 5C | 1133. | 4.42 | 159. | 40. | 38. | .66 | | |
| + | ROUTED TO | 5R | 1072. | 4.58 | 159. | 40. | 38. | .66 | | |
| + | HYDROGRAPH AT | 4B | 1217. | 4.25 | 158. | 40. | 38. | .62 | | |
| + | ROUTED TO | 4R | 1181. | 4.42 | 158. | 40. | 38. | .62 | | |
| + | HYDROGRAPH AT | 3B | 373. | 4.25 | 45. | 11. | 11. | .18 | | |



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| | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| + | 2 COMBINED AT | 3C | 1428. | 4.33 | 202. | 51. | 49. | .80 |
| + | ROUTED TO | 3R | 1295. | 4.58 | 201. | 51. | 49. | .80 |
| + | HYDROGRAPH AT | 2B | 535. | 4.25 | 60. | 15. | 15. | .26 |
| + | 4 COMBINED AT | 2C | 3934. | 4.50 | 740. | 186. | 179. | 3.29 |
| + | ROUTED TO | 2R | 3827. | 4.67 | 740. | 186. | 179. | 3.29 |
| + | HYDROGRAPH AT | 1B | 1764. | 4.42 | 322. | 81. | 78. | 1.28 |
| + | 3 COMBINED AT | 1C | 7636. | 4.67 | 1668. | 422. | 407. | 8.11 |
| + | ROUTED TO | 1R | 7636. | 4.67 | 1668. | 422. | 407. | 8.11 |

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



56

# Appendix 2 HEC-1 Output File for 100-year, 24-hour Storm

```
1****************************************
*                                      *
*   FLOOD HYDROGRAPH PACKAGE  (HEC-1)  *
*              JUL  1997               *
*            VERSION 4.1               *
*                                      *
*  RUN DATE   12JUN98  TIME  14:23:28  *
*                                      *
****************************************
```

```
************************************
*                                  *
*   U.S. ARMY CORPS OF ENGINEERS   *
*   HYDROLOGIC ENGINEERING CENTER  *
*         609 SECOND STREET        *
*      DAVIS, CALIFORNIA 95616     *
*          (916) 756-1104          *
*                                  *
************************************
```

```
X     X  XXXXXXX   XXXXX          X
X     X  X        X     X        XX
X     X  X        X              X
XXXXXXX  XXXX     X        XXXXX  X
X     X  X        X              X
X     X  X        X     X        X
X     X  XXXXXXX   XXXXX         XXX
```

```
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. THIS IS THE FORTRAN77 VERSION
NEW OPTIONS: DAMBREAK OUTFLOW SUBMERGENCE , SINGLE EVENT DAMAGE CALCULATION, DSS:WRITE STAGE FREQUENCY,
DSS:READ TIME SERIES AT DESIRED CALCULATION INTERVAL   LOSS RATE:GREEN AND AMPT INFILTRATION
KINEMATIC WAVE: NEW FINITE DIFFERENCE ALGORITHM

1                                          HEC-1 INPUT                                                    PAGE  1

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

        1           ID    Gavilan Peak Watershed HEC-1 Analysis using WMS (100-year 24-hour storm)
        2           ID    Location: I-17 and Town of New River
        3           ID    FCDMC, 1998
                    *DIAGRAM
        4           IT       5  1JAN98       0     300
        5           IO       5
        6           IN      15  1JAN98       0
        7           JD    4.74    0.01
                    * typeII-24hour
        8           PC       0   0.002   0.005   0.008   0.011   0.014   0.017    0.02   0.023   0.026
        9           PC   0.029   0.032   0.035   0.038   0.041   0.044   0.048   0.052   0.056    0.06
       10           PC   0.064   0.068   0.072   0.076    0.08   0.085    0.09   0.095     0.1   0.105
       11           PC    0.11   0.115    0.12   0.126   0.133    0.14   0.147   0.155   0.163   0.172
       12           PC   0.181   0.191   0.203   0.218   0.236   0.257   0.283   0.387   0.663   0.707
       13           PC   0.735   0.758   0.776   0.791   0.804   0.815   0.825   0.834   0.842   0.849
       14           PC   0.856   0.863   0.869   0.875   0.881   0.887   0.893   0.898   0.903   0.908
       15           PC   0.913   0.918   0.922   0.926    0.93   0.934   0.938   0.942   0.946    0.95
       16           PC   0.953   0.956   0.959   0.962   0.965   0.968   0.971   0.974   0.977    0.98
       17           PC   0.983   0.986   0.989   0.992   0.995   0.998       1       1       1       1
       18           JD     4.5      10

       19           KK     16B
       20           KO       0       0       0       0      22
       21           BA  0.6349
       22           LG    0.35   0.362   6.758   0.112  19.175
                    * S-Graph
       23           UI       0   59.23   96.95   228.5   361.8   442.8   576.6   599.3   388.7   334.1
       24           UI   291.3   251.8  213.65  169.81  144.34  130.15  105.36   82.48    71.5   64.87
       25           UI   47.93   45.41   33.83   28.98   28.98   23.49   11.35   11.35   11.35   11.35
       26           UI   11.35   11.35   11.35   11.35       0

       27           KK     16R   CNAME     16B
       28           KO       0       0       0       0      22
       29           RS       2    FLOW      -1       0
       30           RC    0.05   0.038    0.05 5286.99  0.0139       0
                    * rxry1
       31           RX       0   32.81   55.78  101.71   137.8  177.17  203.42  208.42
       32           RY     100   96.26   89.99   90.81   93.04   98.36     100     100

       33           KK     18B
       34           KO       0       0       0       0      22
       35           BA  0.7104
       36           LG    0.35   0.357   6.868   0.107  33.123
                    * S-Graph
       37           UI       0   130.7   506.6   865.7    1180   718.4   558.5   421.2   295.8   231.7
       38           UI   158.4   121.2   89.88    58.6   55.82   22.47   22.47   22.47   22.47       0

       39           KK     18R   CNAME     18B
       40           KO       0       0       0       0      22
       41           RS       2    FLOW      -1       0
       42           RC   0.052   0.062  0.0596 5887.63  0.0213       0
                    * rxry2
       43           RX       0   39.37   49.22   78.74  108.27  141.08  183.74  229.67
       44           RY     100   97.34   89.47   88.75   88.42   89.89   92.68   95.05
1                                          HEC-1 INPUT                                                    PAGE  2

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

       45           KK     17B
       46           KO       0       0       0       0      22
       47           BA  0.5839
       48           LG    0.35   0.391   5.818   0.159  17.048
                    * S-Graph
       49           UI       0   70.65   184.6   391.2   531.7   763.7   519.1   401.6   336.9   276.4
       50           UI     212   170.5  144.12  105.18   84.86   71.54   54.16   42.77   34.57   34.57
       51           UI   14.26   13.54   13.54   13.54   13.54   13.54       0

       52           KK     17C   CNAME     17R
       53           KO       0       0       0       0      22
       54           HC       2

       55           KK     17R   CNAME     17C
       56           KO       0       0       0       0      22
       57           RS       1    FLOW      -1       0
       58           RC    0.05   0.039    0.05 3923.32  0.0159       0
                    * rxry3
       59           RX       0   26.25   39.37   65.62   98.43  131.24  180.46  242.79
       60           RY     100   98.69    94.1    90.5    88.1    91.2    94.4    94.4

       61           KK     15B
       62           KO       0       0       0       0      22
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 63          BA  0.4613
 64          LG    0.35   0.325   7.445   0.085   3.125
             * S-Graph
 65          UI       0   56.73     152   320.6   433.9   616.6   397.7   317.2   264.2   215.4
 66          UI   162.8   134.3  108.73   80.25   65.87   53.01   43.49   30.17   27.76   23.14
 67          UI   10.87   10.87   10.87   10.87   10.87   10.87       0

 68          KK     15C   CNAME     15R
 69          KO       0       0       0       0      22
 70          HC       2

 71          KK     15R   CNAME     15C
 72          KO       0       0       0       0      22
 73          RS       1    FLOW      -1       0
 74          RC    0.05   0.039    0.05 3455.27  0.0116       0
             * rxry3
 75          RX       0   26.25   39.37   65.62   98.43  131.24  180.46  242.79
 76          RY     100   98.69    94.1    90.5    88.1    91.2    94.4    94.4

 77          KK     14B
 78          KO       0       0       0       0      22
 79          BA  0.4375
 80          LG   0.334   0.346    5.79   0.161   5.859
             * S-Graph
 81          UI       0   41.13    68.3     160   253.5   309.5   407.2   406.1   266.8   230.2
 82          UI   200.4   172.6  145.44  116.09   98.78   89.42      71   55.39   48.64   44.81
 83          UI   31.53   31.53   21.63   20.13   20.13   13.99    7.88    7.88    7.88    7.88
 84          UI    7.88    7.88    7.88    7.88
1                                        HEC-1 INPUT                                          PAGE  3

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


 85          KK     13B
 86          KO       0       0       0       0      22
 87          BA  0.3905
 88          LG    0.35   0.272   8.766   0.051       0
             * S-Graph
 89          UI       0   50.79   150.4   304.3   413.8   527.7   324.9   265.6   217.6   170.6
 90          UI   127.5     110   77.89   61.49   50.96   38.94    28.7   24.85   20.42    9.73
 91          UI    9.73    9.73    9.73    9.73       0

 92          KK     13C   CNAME     13R
 93          KO       0       0       0       0      22
 94          HC       4

 95          KK     13R   CNAME     13C
 96          KO       0       0       0       0      22
 97          RS       1    FLOW      -1       0
 98          RC   0.049   0.041    0.05 3489.47   0.015       0
             * rxry5
 99          RX       0      34      61      86     106     115     135     153
100          RY   92.76   92.61   90.86    89.1   87.68   91.98   94.28   99.27

101          KK     12B
102          KO       0       0       0       0      22
103          BA  0.3239
104          LG   0.345   0.387    5.87    0.16   4.568
             * S-Graph
105          UI       0   61.76   237.9   405.7   539.3   325.8     253   189.1   133.4     103
106          UI   69.35   53.39   39.63   26.52   22.71   10.39   10.39   10.39   10.39       0

107          KK     12C   CNAME     12R
108          KO       0       0       0       0      22
109          HC       2

110          KK     12R   CNAME     12C
111          KO       0       0       0       0      22
112          RS       1    FLOW      -1       0
113          RC    0.06   0.032    0.05 3975.34  0.0071       0
             * rxry6
114          RX       0      31      49      75     106     119     145     150
115          RY   96.82    94.2   94.24   90.96   91.57   99.69     100     100

116          KK     11B
117          KO       0       0       0       0      22
118          BA    0.38
119          LG   0.339   0.305    7.05   0.098  13.767
             * S-Graph
120          UI       0    55.6   201.2   372.6   550.9   434.1   308.1   247.7   190.1   138.2
121          UI   113.1   79.19   63.23   46.21   36.11   27.21   22.91   10.66   10.66   10.66
122          UI   10.66   10.66       0
1                                        HEC-1 INPUT                                          PAGE  4

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


123          KK     11R   CNAME     11B
124          KO       0       0       0       0      22
125          RS       1    FLOW      -1       0
126          RC    0.07  0.0675    0.07 1903.39  0.0125       0
             * rxry7
127          RX       0   13.12   32.81   49.22   62.34   65.62   85.31   98.43
128          RY     100   99.11   97.54   95.11   93.47   93.93   95.44   96.75

129          KK     10B
130          KO       0       0       0       0      22
131          BA  0.3246
132          LG   0.321   0.253   6.762   0.112  10.437
             * S-Graph
133          UI       0   43.43     135     268   367.2   433.1   267.8   218.9   178.3   133.6
134          UI     105   85.42   61.42   49.78   38.09   31.44   21.26   21.26   11.05    8.33
135          UI    8.33    8.33    8.33    8.33       0

136          KK     10R   CNAME     10B
137          KO       0       0       0       0      22
138          RS       3    FLOW      -1       0
139          RC    0.07  0.0675    0.07 2922.67  0.0053       0
             * rxry7
140          RX       0   13.12   32.81   49.22   62.34   65.62   85.31   98.43
141          RY     100   99.11   97.54   95.11   93.47   93.93   95.44   96.75

142          KK      9B
143          KO       0       0       0       0      22
144          BA  0.5138
145          LG   0.344   0.342   6.695   0.115  15.157
             * S-Graph
146          UI       0   53.72   106.1   250.2   360.3   452.2   589.6   371.8   306.7   263.4
147          UI   223.1   183.4  142.18  125.32  103.99   79.53   65.84   58.84   42.37   41.17
148          UI   26.29   26.29   26.29   10.72    10.3    10.3    10.3    10.3    10.3    10.3
149          UI       0

150          KK      9C   CNAME      9R
151          KO       0       0       0       0      22
152          HC       2
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153          KK      9R   CNAME      9C
154          KO       0       0       0       0      22
155          RS       1    FLOW      -1       0
156          RC    0.07   0.043    0.07 1696.28  0.0122       0
             * rxry9
157          RX       0   16.41   42.65   55.78   82.03  101.71  114.83  119.83
158          RY     100   98.79   97.21   93.27   93.44   99.34     100     100

159          KK      8B
160          KO       0       0       0       0      22
161          BA  0.2134
162          LG   0.312   0.281   5.485   0.186  20.336
             * S-Graph
163          UI       0   48.58   183.9   314.8   345.4     211   160.9   110.6   83.96   55.39
164          UI   41.73   29.48   19.08   16.31    7.37    7.37    7.37    7.37       0
1                                          HEC-1 INPUT                                          PAGE  5

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

165          KK      8C   CNAME      8R
166          KO       0       0       0       0      22
167          HC       3

168          KK      8R   CNAME      8C
169          KO       0       0       0       0      22
170          RS       1    FLOW      -1       0
171          RC    0.12    0.06    0.12 1193.47  0.0056       0
             * rxry9
172          RX       0   16.41   42.65   55.78   82.03  101.71  114.83  119.83
173          RY     100   98.79   97.21   93.27   93.44   99.34     100     100

174          KK      7B
175          KO       0       0       0       0      22
176          BA  0.1487
177          LG     0.3   0.244   6.063   0.147  14.981
             * S-Graph
178          UI       0   21.42   75.24     142   205.4   177.6   120.7   97.53   75.94   55.06
179          UI   45.69   31.78   25.05   19.15   15.17   10.48   10.39    4.11    4.11    4.11
180          UI    4.11    4.11       0

181          KK      7C   CNAME      7R
182          KO       0       0       0       0      22
183          HC       2

184          KK      7R   CNAME      7C
185          KO       0       0       0       0      22
186          RS       1    FLOW      -1       0
187          RC   0.041   0.035    0.06 1736.03  0.0171       0
             * rxry11
188          RX       0      21      37      58      67      87     107     112
189          RY     100   99.32   92.51   92.37   92.97   97.47   97.47   97.47

190          KK      6B
191          KO       0       0       0       0      22
192          BA   0.315
193          LG   0.346   0.338   6.899   0.105   13.75
             * S-Graph
194          UI       0   92.55   352.1   618.3     424   301.8   208.5     146   93.95   66.51
195          UI   45.09   31.32   18.62   12.27   12.27   12.27       0

196          KK      6R   CNAME      6B
197          KO       0       0       0       0      22
198          RS       4    FLOW      -1       0
199          RC   0.046    0.05    0.05 5405.39  0.0104       0
             * rxry12
200          RX       0    52.5   72.18   95.15  104.99  109.99  114.99  119.99
201          RY  100.33   97.54   97.34   99.77     100     100     100     100
1                                          HEC-1 INPUT                                          PAGE  6

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

202          KK      5B
203          KO       0       0       0       0      22
204          BA  0.3452
205          LG   0.306   0.197   6.746   0.113  11.495
             * S-Graph
206          UI       0   38.58   87.88   194.2   272.7   363.1   373.1   240.6   203.9     172
207          UI   142.5     109   91.61   77.66      58    47.2   41.84   29.58   27.17   18.88
208          UI   18.88   14.37    7.39    7.39    7.39    7.39    7.39    7.39       0

209          KK      5C   CNAME      5R
210          KO       0       0       0       0      22
211          HC       2

212          KK      5R   CNAME      5C
213          KO       0       0       0       0      22
214          RS       1    FLOW      -1       0
215          RC    0.06   0.053    0.06 4030.35  0.0171       0
             * rxry13
216          RX       0      15      30      43      56      76      81      86
217          RY     100    98.2   93.41   93.41     100    99.3    99.3    99.3

218          KK      4B
219          KO       0       0       0       0      22
220          BA  0.6227
221          LG   0.338   0.251   8.576   0.056  10.225
             * S-Graph
222          UI       0   82.92   255.6   509.1   695.4   834.1   514.9   420.3   342.9   258.8
223          UI   201.7   165.9  118.94   95.95   74.51    61.7   40.58   40.58   23.19   15.89
224          UI   15.89   15.89   15.89   15.89       0

225          KK      4R   CNAME      4B
226          KO       0       0       0       0      22
227          RS       2    FLOW      -1       0
228          RC   0.053   0.045    0.06 4181.66  0.0188       0
             * rxry14
229          RX       0   16.41   22.97   36.09   45.93   55.78    68.9   85.31
230          RY   98.23   96.72   94.62   88.71   89.44    91.5   95.44   98.23

231          KK      3B
232          KO       0       0       0       0      22
233          BA  0.1756
234          LG   0.306   0.203   6.681   0.116  18.225
             * S-Graph
235          UI       0   25.05   86.27   164.8   235.5   214.6   142.9   115.7   90.51   65.99
236          UI   54.99   38.19    29.8   23.39   18.68   12.26   12.26    5.86     4.8     4.8
237          UI     4.8     4.8       0

238          KK      3C   CNAME      3R
239          KO       0       0       0       0      22
240          HC       2
1                                          HEC-1 INPUT                                          PAGE  7
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LINE          ID.......1.......2.......3.......4.......5.......6.......7.......8.......9......10

 241          KK      3R   CNAME      3C
 242          KO       0       0       0       0      22
 243          RS       2    FLOW      -1       0
 244          RC    0.06   0.053    0.06 2756.21  0.0134       0
              * rxry13
 245          RX       0      15      30      43      56      76      81      86
 246          RY     100    98.2   93.41   93.41     100    99.3    99.3    99.3

 247          KK      2B
 248          KO       0       0       0       0      22
 249          BA  0.2558
 250          LG    0.33   0.334   5.299    0.21  22.571
              * S-Graph
 251          UI       0   40.03   159.8   279.1   411.5   265.6   205.3   160.7   115.3   90.62
 252          UI   65.57   47.69   36.76   28.06   19.46   17.28    7.62    7.62    7.62    7.62
 253          UI    7.62

 254          KK      2C   CNAME      2R
 255          KO       0       0       0       0      22
 256          HC       4

 257          KK      2R   CNAME      2C
 258          KO       0       0       0       0      22
 259          RS       1    FLOW      -1       0
 260          RC    0.06   0.032    0.05 4734.39  0.0063       0
              * rxry6
 261          RX       0      31      49      75     106     119     145     150
 262          RY   96.82    94.2   94.24   90.96   91.57   99.69     100     100

 263          KK      1B
 264          KO       0       0       0       0      22
 265          BA  1.2778
 266          LG   0.322   0.304   6.586   0.131  30.387
              * S-Graph
 267          UI       0   123.3   214.6   502.6   774.7   946.7    1300    1103   770.5   668.6
 268          UI   580.5   496.5  409.28  321.81  289.55  247.16  192.28  157.55  135.67  114.51
 269          UI   94.53    80.4   60.34   60.34   55.45   23.63   23.63   23.63   23.63   23.63
 270          UI   23.63   23.63   23.63       0

 271          KK      1C   CNAME      1R
 272          KO       0       0       0       0      22
 273          HC       3

 274          KK      1R   CNAME      1C
 275          KO       0       0       0       0      22
 276          RN      1R
 277          ZZ
1
              SCHEMATIC DIAGRAM OF STREAM NETWORK
INPUT
 LINE      (V) ROUTING          (--->) DIVERSION OR PUMP FLOW

  NO.      (.) CONNECTOR        (<---) RETURN OF DIVERTED OR PUMPED FLOW

   19        16B
              V
              V
   27        16R
              .
              .
   33         .         18B
              .           V
              .           V
   39         .         18R
              .           .
              .           .
   45         .           .         17B
              .           .           .
              .           .           .
   52         .         17C............
              .           V
              .           V
   55         .         17R
              .           .
              .           .
   61         .           .         15B
              .           .           .
              .           .           .
   68         .         15C............
              .           V
              .           V
   71         .         15R
              .           .
              .           .
   77         .           .         14B
              .           .           .
              .           .           .
   85         .           .           .         13B
              .           .           .           .
              .           .           .           .
   92        13C.................................
              V
              V
   95        13R
              .
              .
  101         .         12B
              .           .
              .           .
  107       12C............
              V
              V
  110       12R
              .
              .
  116         .         11B
              .           V
              .           V
  123         .         11R
              .           .
              .           .
  129         .           .         10B
              .           .           V
              .           .           V
  136         .           .         10R
              .           .           .
              .           .           .
  142         .           .           .          9B
              .           .           .           .
              .           .           .           .
  150         .           .         9C............
```



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```
                .          .          V
                .          .          V
  153           .          .         9R
                .          .          .
                .          .          .
  159           .          .          .          8B
                .          .          .           .
                .          .          .           .
  165           .         8C.........................
                .          V
                .          V
  168           .         8R
                .          .
                .          .
  174           .          .         7B
                .          .          .
                .          .          .
  181           .         7C............
                .          V
                .          V
  184           .         7R
                .          .
                .          .
  190           .          .         6B
                .          .          V
                .          .          V
  196           .          .         6R
                .          .          .
                .          .          .
  202           .          .          .          5B
                .          .          .           .
                .          .          .           .
  209           .          .         5C............
                .          .          V
                .          .          V
  212           .          .         5R
                .          .          .
                .          .          .
  218           .          .          .          4B
                .          .          .           V
                .          .          .           V
  225           .          .          .          4R
                .          .          .           .
                .          .          .           .
  231           .          .          .           .          3B
                .          .          .           .           .
                .          .          .           .           .
  238           .          .          .          3C............
                .          .          .           V
                .          .          .           V
  241           .          .          .          3R
                .          .          .           .
                .          .          .           .
  247           .          .          .           .          2B
                .          .          .           .           .
                .          .          .           .           .
  254           .         2C.......................................
                .          V
                .          V
  257           .         2R
                .          .
                .          .
  263           .          .         1B
                .          .          .
                .          .          .
  271          1C.........................
                V
                V
  274          1R
```

```
(***) RUNOFF ALSO COMPUTED AT THIS LOCATION
1****************************************
*                                      *
*   FLOOD HYDROGRAPH PACKAGE  (HEC-1)  *
*             JUL  1997                *
*           VERSION 4.1                *
*                                      *
*  RUN DATE   12JUN98  TIME  14:23:28  *
*                                      *
****************************************
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****************************************
*                                      *
*    U.S. ARMY CORPS OF ENGINEERS      *
*    HYDROLOGIC ENGINEERING CENTER     *
*    \      609 SECOND STREET          *
*     \  DAVIS, CALIFORNIA 95616       *
*            (916) 756-1104            *
*                                      *
****************************************
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                    Gavilan Peak Watershed HEC-1 Analysis using WMS (100-year 24-hour storm)
                    Location: I-17 and Town of New River
                    FCDMC, 1998

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

   IT         HYDROGRAPH TIME DATA
                    NMIN           5  MINUTES IN COMPUTATION INTERVAL
                   IDATE      1JAN98  STARTING DATE
                   ITIME        0000  STARTING TIME
                      NQ         300  NUMBER OF HYDROGRAPH ORDINATES
                  NDDATE      2JAN98  ENDING DATE
                  NDTIME        0055  ENDING TIME
                   ICENT          19  CENTURY MARK

              COMPUTATION INTERVAL     .08 HOURS
                   TOTAL TIME BASE   24.92 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

  7 JD        INDEX STORM NO. 1
                   STRM        4.74  PRECIPITATION DEPTH
                   TRDA         .01  TRANSPOSITION DRAINAGE AREA

  8 PI          PRECIPITATION PATTERN
                    .00       .00       .00       .00       .00       .00       .00       .00       .00       .00
                    .00       .00       .00       .00       .00       .00       .00       .00       .00       .00
                    .00       .00       .00       .00       .00       .00       .00       .00       .00       .00
                    .00       .00       .00       .00       .00       .00       .00       .00       .00       .00
                    .00       .00       .00       .00       .00       .00       .00       .00       .00       .00
```



61

```
                .00       .00       .00       .00       .00       .00       .00       .00       .00       .00
                .00       .00       .00       .00       .00       .00       .00       .00       .00       .00
                .00       .00       .00       .00       .00       .00       .00       .00       .00       .00
                .00       .00       .00       .00       .00       .00       .00       .00       .00       .00
                .00       .00       .00       .00       .00       .00       .00       .00       .00       .00
                .00       .00       .00       .00       .00       .00       .00       .00       .00       .00
                .00       .00       .00       .00       .00       .00       .00       .00       .00       .00
                .00       .00       .00       .00       .00       .00       .00       .01       .00       .01
                .01       .01       .01       .01       .01       .01       .01       .01       .03       .03
                .03       .09       .09       .09       .01       .01       .01       .01       .01       .01
                .01       .01       .01       .01       .01       .01       .00       .00       .00       .00
                .00       .00       .00       .00       .00       .00       .00       .00       .00       .00
                .00       .00       .00       .00       .00       .00       .00       .00       .00       .00
                .00       .00       .00       .00       .00       .00       .00       .00       .00       .00
                .00       .00       .00       .00       .00       .00       .00       .00       .00       .00
                .00       .00       .00       .00       .00       .00       .00       .00       .00       .00
                .00       .00       .00       .00       .00       .00       .00       .00       .00       .00
                .00       .00       .00       .00       .00       .00       .00       .00       .00       .00
                .00       .00       .00       .00       .00       .00       .00       .00       .00       .00
                .00       .00       .00       .00       .00       .00       .00       .00       .00       .00
                .00       .00       .00       .00       .00       .00       .00       .00       .00       .00
                .00       .00       .00       .00       .00       .00       .00       .00       .00       .00
                .00       .00       .00       .00       .00       .00       .00       .00       .00       .00
                .00       .00       .00       .00       .00       .00       .00       .00
 18 JD        INDEX STORM NO. 2
                  STRM        4.50  PRECIPITATION DEPTH
                  TRDA       10.00  TRANSPOSITION DRAINAGE AREA

  0 PI          PRECIPITATION PATTERN
                .00       .00       .00       .00       .00       .00       .00       .00       .00       .00
                .00       .00       .00       .00       .00       .00       .00       .00       .00       .00
                .00       .00       .00       .00       .00       .00       .00       .00       .00       .00
                .00       .00       .00       .00       .00       .00       .00       .00       .00       .00
                .00       .00       .00       .00       .00       .00       .00       .00       .00       .00
                .00       .00       .00       .00       .00       .00       .00       .00       .00       .00
                .00       .00       .00       .00       .00       .00       .00       .00       .00       .00
                .00       .00       .00       .00       .00       .00       .00       .00       .00       .00
                .00       .00       .00       .00       .00       .00       .00       .00       .00       .00
                .00       .00       .00       .00       .00       .00       .00       .00       .00       .00
                .00       .00       .00       .00       .00       .00       .00       .00       .00       .00
                .00       .00       .00       .00       .00       .00       .00       .00       .00       .00
                .00       .00       .00       .00       .00       .00       .00       .01       .00       .01
                .01       .01       .01       .01       .01       .01       .01       .01       .03       .03
                .03       .09       .09       .09       .01       .01       .01       .01       .01       .01
                .01       .01       .01       .01       .01       .01       .00       .00       .00       .00
                .00       .00       .00       .00       .00       .00       .00       .00       .00       .00
                .00       .00       .00       .00       .00       .00       .00       .00       .00       .00
                .00       .00       .00       .00       .00       .00       .00       .00       .00       .00
                .00       .00       .00       .00       .00       .00       .00       .00       .00       .00
                .00       .00       .00       .00       .00       .00       .00       .00       .00       .00
                .00       .00       .00       .00       .00       .00       .00       .00       .00       .00
                .00       .00       .00       .00       .00       .00       .00       .00       .00       .00
                .00       .00       .00       .00       .00       .00       .00       .00       .00       .00
                .00       .00       .00       .00       .00       .00       .00       .00       .00       .00
                .00       .00       .00       .00       .00       .00       .00       .00
*** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** ***

          **************
          *            *
 19 KK    *     16B    *
          *            *
          **************

 20 KO          OUTPUT CONTROL VARIABLES
                  IPRNT          5  PRINT CONTROL
                  IPLOT          0  PLOT CONTROL
                  QSCAL         0.  HYDROGRAPH PLOT SCALE
                  IPNCH          0  PUNCH COMPUTED HYDROGRAPH
                   IOUT         22  SAVE HYDROGRAPH ON THIS UNIT
                  ISAV1          1  FIRST ORDINATE PUNCHED OR SAVED
                  ISAV2        300  LAST ORDINATE PUNCHED OR SAVED
                 TIMINT       .083  TIME INTERVAL IN HOURS

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

          **************
          *            *
 27 KK    *     16R    *        CNAME     16B
          *            *
          **************

 28 KO          OUTPUT CONTROL VARIABLES
                  IPRNT          5  PRINT CONTROL
                  IPLOT          0  PLOT CONTROL
                  QSCAL         0.  HYDROGRAPH PLOT SCALE
                  IPNCH          0  PUNCH COMPUTED HYDROGRAPH
                   IOUT         22  SAVE HYDROGRAPH ON THIS UNIT
                  ISAV1          1  FIRST ORDINATE PUNCHED OR SAVED
                  ISAV2        300  LAST ORDINATE PUNCHED OR SAVED
                 TIMINT       .083  TIME INTERVAL IN HOURS

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

          **************
          *            *
 33 KK    *     18B    *
          *            *
          **************

 34 KO          OUTPUT CONTROL VARIABLES
                  IPRNT          5  PRINT CONTROL
                  IPLOT          0  PLOT CONTROL
                  QSCAL         0.  HYDROGRAPH PLOT SCALE
                  IPNCH          0  PUNCH COMPUTED HYDROGRAPH
                   IOUT         22  SAVE HYDROGRAPH ON THIS UNIT
                  ISAV1          1  FIRST ORDINATE PUNCHED OR SAVED
                  ISAV2        300  LAST ORDINATE PUNCHED OR SAVED
                 TIMINT       .083  TIME INTERVAL IN HOURS
```



62

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

            **************
            *            *
 39 KK      *      18R   *        CNAME     18B
            *            *
            **************

 40 KO          OUTPUT CONTROL VARIABLES
                      IPRNT           5  PRINT CONTROL
                      IPLOT           0  PLOT CONTROL
                      QSCAL          0.  HYDROGRAPH PLOT SCALE
                      IPNCH           0  PUNCH COMPUTED HYDROGRAPH
                       IOUT          22  SAVE HYDROGRAPH ON THIS UNIT
                      ISAV1           1  FIRST ORDINATE PUNCHED OR SAVED
                      ISAV2         300  LAST ORDINATE PUNCHED OR SAVED
                     TIMINT        .083  TIME INTERVAL IN HOURS

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

            **************
            *            *
 45 KK      *      17B   *
            *            *
            **************

 46 KO          OUTPUT CONTROL VARIABLES
                      IPRNT           5  PRINT CONTROL
                      IPLOT           0  PLOT CONTROL
                      QSCAL          0.  HYDROGRAPH PLOT SCALE
                      IPNCH           0  PUNCH COMPUTED HYDROGRAPH
                       IOUT          22  SAVE HYDROGRAPH ON THIS UNIT
                      ISAV1           1  FIRST ORDINATE PUNCHED OR SAVED
                      ISAV2         300  LAST ORDINATE PUNCHED OR SAVED
                     TIMINT        .083  TIME INTERVAL IN HOURS

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

            **************
            *            *
 52 KK      *      17C   *        CNAME     17R
            *            *
            **************

 53 KO          OUTPUT CONTROL VARIABLES
                      IPRNT           5  PRINT CONTROL
                      IPLOT           0  PLOT CONTROL
                      QSCAL          0.  HYDROGRAPH PLOT SCALE
                      IPNCH           0  PUNCH COMPUTED HYDROGRAPH
                       IOUT          22  SAVE HYDROGRAPH ON THIS UNIT
                      ISAV1           1  FIRST ORDINATE PUNCHED OR SAVED
                      ISAV2         300  LAST ORDINATE PUNCHED OR SAVED
                     TIMINT        .083  TIME INTERVAL IN HOURS

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

            **************
            *            *
 55 KK      *      17R   *        CNAME     17C
            *            *
            **************

 56 KO          OUTPUT CONTROL VARIABLES
                      IPRNT           5  PRINT CONTROL
                      IPLOT           0  PLOT CONTROL
                      QSCAL          0.  HYDROGRAPH PLOT SCALE
                      IPNCH           0  PUNCH COMPUTED HYDROGRAPH
                       IOUT          22  SAVE HYDROGRAPH ON THIS UNIT
                      ISAV1           1  FIRST ORDINATE PUNCHED OR SAVED
                      ISAV2         300  LAST ORDINATE PUNCHED OR SAVED
                     TIMINT        .083  TIME INTERVAL IN HOURS

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

            **************
            *            *
 61 KK      *      15B   *
            *            *
            **************

 62 KO          OUTPUT CONTROL VARIABLES
                      IPRNT           5  PRINT CONTROL
                      IPLOT           0  PLOT CONTROL
                      QSCAL          0.  HYDROGRAPH PLOT SCALE
                      IPNCH           0  PUNCH COMPUTED HYDROGRAPH
                       IOUT          22  SAVE HYDROGRAPH ON THIS UNIT
                      ISAV1           1  FIRST ORDINATE PUNCHED OR SAVED
                      ISAV2         300  LAST ORDINATE PUNCHED OR SAVED
                     TIMINT        .083  TIME INTERVAL IN HOURS

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

            **************
            *            *
 68 KK      *      15C   *        CNAME     15R
            *            *
            **************

 69 KO          OUTPUT CONTROL VARIABLES
                      IPRNT           5  PRINT CONTROL
                      IPLOT           0  PLOT CONTROL
```



63

```
                    QSCAL          0.  HYDROGRAPH PLOT SCALE
                    IPNCH          0   PUNCH COMPUTED HYDROGRAPH
                     IOUT         22   SAVE HYDROGRAPH ON THIS UNIT
                    ISAV1          1   FIRST ORDINATE PUNCHED OR SAVED
                    ISAV2        300   LAST ORDINATE PUNCHED OR SAVED
                   TIMINT       .083   TIME INTERVAL IN HOURS


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

          **************
          *            *
 71 KK    *      15R   *        CNAME     15C
          *            *
          **************

 72 KO          OUTPUT CONTROL VARIABLES
                    IPRNT          5   PRINT CONTROL
                    IPLOT          0   PLOT CONTROL
                    QSCAL          0.  HYDROGRAPH PLOT SCALE
                    IPNCH          0   PUNCH COMPUTED HYDROGRAPH
                     IOUT         22   SAVE HYDROGRAPH ON THIS UNIT
                    ISAV1          1   FIRST ORDINATE PUNCHED OR SAVED
                    ISAV2        300   LAST ORDINATE PUNCHED OR SAVED
                   TIMINT       .083   TIME INTERVAL IN HOURS


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

          **************
          *            *
 77 KK    *      14B   *
          *            *
          **************

 78 KO          OUTPUT CONTROL VARIABLES
                    IPRNT          5   PRINT CONTROL
                    IPLOT          0   PLOT CONTROL
                    QSCAL          0.  HYDROGRAPH PLOT SCALE
                    IPNCH          0   PUNCH COMPUTED HYDROGRAPH
                     IOUT         22   SAVE HYDROGRAPH ON THIS UNIT
                    ISAV1          1   FIRST ORDINATE PUNCHED OR SAVED
                    ISAV2        300   LAST ORDINATE PUNCHED OR SAVED
                   TIMINT       .083   TIME INTERVAL IN HOURS


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

          **************
          *            *
 85 KK    *      13B   *
          *            *
          **************

 86 KO          OUTPUT CONTROL VARIABLES
                    IPRNT          5   PRINT CONTROL
                    IPLOT          0   PLOT CONTROL
                    QSCAL          0.  HYDROGRAPH PLOT SCALE
                    IPNCH          0   PUNCH COMPUTED HYDROGRAPH
                     IOUT         22   SAVE HYDROGRAPH ON THIS UNIT
                    ISAV1          1   FIRST ORDINATE PUNCHED OR SAVED
                    ISAV2        300   LAST ORDINATE PUNCHED OR SAVED
                   TIMINT       .083   TIME INTERVAL IN HOURS


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

          **************
          *            *
 92 KK    *      13C   *        CNAME     13R
          *            *
          **************

 93 KO          OUTPUT CONTROL VARIABLES
                    IPRNT          5   PRINT CONTROL
                    IPLOT          0   PLOT CONTROL
                    QSCAL          0.  HYDROGRAPH PLOT SCALE
                    IPNCH          0   PUNCH COMPUTED HYDROGRAPH
                     IOUT         22   SAVE HYDROGRAPH ON THIS UNIT
                    ISAV1          1   FIRST ORDINATE PUNCHED OR SAVED
                    ISAV2        300   LAST ORDINATE PUNCHED OR SAVED
                   TIMINT       .083   TIME INTERVAL IN HOURS


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

          **************
          *            *
 95 KK    *      13R   *        CNAME     13C
          *            *
          **************

 96 KO          OUTPUT CONTROL VARIABLES
                    IPRNT          5   PRINT CONTROL
                    IPLOT          0   PLOT CONTROL
                    QSCAL          0.  HYDROGRAPH PLOT SCALE
                    IPNCH          0   PUNCH COMPUTED HYDROGRAPH
                     IOUT         22   SAVE HYDROGRAPH ON THIS UNIT
                    ISAV1          1   FIRST ORDINATE PUNCHED OR SAVED
                    ISAV2        300   LAST ORDINATE PUNCHED OR SAVED
                   TIMINT       .083   TIME INTERVAL IN HOURS


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

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



64

```
101 KK      *       12B  *
            *            *
            **************

102 KO          OUTPUT CONTROL VARIABLES
                     IPRNT           5  PRINT CONTROL
                     IPLOT           0  PLOT CONTROL
                     QSCAL          0.  HYDROGRAPH PLOT SCALE
                     IPNCH           0  PUNCH COMPUTED HYDROGRAPH
                      IOUT          22  SAVE HYDROGRAPH ON THIS UNIT
                     ISAV1           1  FIRST ORDINATE PUNCHED OR SAVED
                     ISAV2         300  LAST ORDINATE PUNCHED OR SAVED
                    TIMINT        .083  TIME INTERVAL IN HOURS


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

            **************
            *            *
107 KK      *       12C  *        CNAME     12R
            *            *
            **************

108 KO          OUTPUT CONTROL VARIABLES
                     IPRNT           5  PRINT CONTROL
                     IPLOT           0  PLOT CONTROL
                     QSCAL          0.  HYDROGRAPH PLOT SCALE
                     IPNCH           0  PUNCH COMPUTED HYDROGRAPH
                      IOUT          22  SAVE HYDROGRAPH ON THIS UNIT
                     ISAV1           1  FIRST ORDINATE PUNCHED OR SAVED
                     ISAV2         300  LAST ORDINATE PUNCHED OR SAVED
                    TIMINT        .083  TIME INTERVAL IN HOURS


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

            **************
            *            *
110 KK      *       12R  *        CNAME     12C
            *            *
            **************

111 KO          OUTPUT CONTROL VARIABLES
                     IPRNT           5  PRINT CONTROL
                     IPLOT           0  PLOT CONTROL
                     QSCAL          0.  HYDROGRAPH PLOT SCALE
                     IPNCH           0  PUNCH COMPUTED HYDROGRAPH
                      IOUT          22  SAVE HYDROGRAPH ON THIS UNIT
                     ISAV1           1  FIRST ORDINATE PUNCHED OR SAVED
                     ISAV2         300  LAST ORDINATE PUNCHED OR SAVED
                    TIMINT        .083  TIME INTERVAL IN HOURS


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

            **************
            *            *
116 KK      *       11B  *
            *            *
            **************

117 KO          OUTPUT CONTROL VARIABLES
                     IPRNT           5  PRINT CONTROL
                     IPLOT           0  PLOT CONTROL
                     QSCAL          0.  HYDROGRAPH PLOT SCALE
                     IPNCH           0  PUNCH COMPUTED HYDROGRAPH
                      IOUT          22  SAVE HYDROGRAPH ON THIS UNIT
                     ISAV1           1  FIRST ORDINATE PUNCHED OR SAVED
                     ISAV2         300  LAST ORDINATE PUNCHED OR SAVED
                    TIMINT        .083  TIME INTERVAL IN HOURS


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

            **************
            *            *
123 KK      *       11R  *        CNAME     11B
            *            *
            **************

124 KO          OUTPUT CONTROL VARIABLES
                     IPRNT           5  PRINT CONTROL
                     IPLOT           0  PLOT CONTROL
                     QSCAL          0.  HYDROGRAPH PLOT SCALE
                     IPNCH           0  PUNCH COMPUTED HYDROGRAPH
                      IOUT          22  SAVE HYDROGRAPH ON THIS UNIT
                     ISAV1           1  FIRST ORDINATE PUNCHED OR SAVED
                     ISAV2         300  LAST ORDINATE PUNCHED OR SAVED
                    TIMINT        .083  TIME INTERVAL IN HOURS


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

            **************
            *            *
129 KK      *       10B  *
            *            *
            **************

130 KO          OUTPUT CONTROL VARIABLES
                     IPRNT           5  PRINT CONTROL
                     IPLOT           0  PLOT CONTROL
                     QSCAL          0.  HYDROGRAPH PLOT SCALE
                     IPNCH           0  PUNCH COMPUTED HYDROGRAPH
                      IOUT          22  SAVE HYDROGRAPH ON THIS UNIT
                     ISAV1           1  FIRST ORDINATE PUNCHED OR SAVED
                     ISAV2         300  LAST ORDINATE PUNCHED OR SAVED
                    TIMINT        .083  TIME INTERVAL IN HOURS
```



65

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

          **************
          *            *
 136 KK   *      10R   *        CNAME     10B
          *            *
          **************

 137 KO          OUTPUT CONTROL VARIABLES
                      IPRNT           5  PRINT CONTROL
                      IPLOT           0  PLOT CONTROL
                      QSCAL          0.  HYDROGRAPH PLOT SCALE
                      IPNCH           0  PUNCH COMPUTED HYDROGRAPH
                       IOUT          22  SAVE HYDROGRAPH ON THIS UNIT
                      ISAV1           1  FIRST ORDINATE PUNCHED OR SAVED
                      ISAV2         300  LAST ORDINATE PUNCHED OR SAVED
                     TIMINT        .083  TIME INTERVAL IN HOURS


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

          **************
          *            *
 142 KK   *       9B   *
          *            *
          **************

 143 KO          OUTPUT CONTROL VARIABLES
                      IPRNT           5  PRINT CONTROL
                      IPLOT           0  PLOT CONTROL
                      QSCAL          0.  HYDROGRAPH PLOT SCALE
                      IPNCH           0  PUNCH COMPUTED HYDROGRAPH
                       IOUT          22  SAVE HYDROGRAPH ON THIS UNIT
                      ISAV1           1  FIRST ORDINATE PUNCHED OR SAVED
                      ISAV2         300  LAST ORDINATE PUNCHED OR SAVED
                     TIMINT        .083  TIME INTERVAL IN HOURS


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

          **************
          *            *
 150 KK   *       9C   *        CNAME      9R
          *            *
          **************

 151 KO          OUTPUT CONTROL VARIABLES
                      IPRNT           5  PRINT CONTROL
                      IPLOT           0  PLOT CONTROL
                      QSCAL          0.  HYDROGRAPH PLOT SCALE
                      IPNCH           0  PUNCH COMPUTED HYDROGRAPH
                       IOUT          22  SAVE HYDROGRAPH ON THIS UNIT
                      ISAV1           1  FIRST ORDINATE PUNCHED OR SAVED
                      ISAV2         300  LAST ORDINATE PUNCHED OR SAVED
                     TIMINT        .083  TIME INTERVAL IN HOURS


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

          **************
          *            *
 153 KK   *       9R   *        CNAME      9C
          *            *
          **************

 154 KO          OUTPUT CONTROL VARIABLES
                      IPRNT           5  PRINT CONTROL
                      IPLOT           0  PLOT CONTROL
                      QSCAL          0.  HYDROGRAPH PLOT SCALE
                      IPNCH           0  PUNCH COMPUTED HYDROGRAPH
                       IOUT          22  SAVE HYDROGRAPH ON THIS UNIT
                      ISAV1           1  FIRST ORDINATE PUNCHED OR SAVED
                      ISAV2         300  LAST ORDINATE PUNCHED OR SAVED
                     TIMINT        .083  TIME INTERVAL IN HOURS


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

          **************
          *            *
 159 KK   *       8B   *
          *            *
          **************

 160 KO          OUTPUT CONTROL VARIABLES
                      IPRNT           5  PRINT CONTROL
                      IPLOT           0  PLOT CONTROL
                      QSCAL          0.  HYDROGRAPH PLOT SCALE
                      IPNCH           0  PUNCH COMPUTED HYDROGRAPH
                       IOUT          22  SAVE HYDROGRAPH ON THIS UNIT
                      ISAV1           1  FIRST ORDINATE PUNCHED OR SAVED
                      ISAV2         300  LAST ORDINATE PUNCHED OR SAVED
                     TIMINT        .083  TIME INTERVAL IN HOURS


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

          **************
          *            *
 165 KK   *       8C   *        CNAME      8R
          *            *
          **************

 166 KO          OUTPUT CONTROL VARIABLES
                      IPRNT           5  PRINT CONTROL
                      IPLOT           0  PLOT CONTROL
                      QSCAL          0.  HYDROGRAPH PLOT SCALE
```

```
                IPNCH          0  PUNCH COMPUTED HYDROGRAPH
                 IOUT         22  SAVE HYDROGRAPH ON THIS UNIT
                ISAV1          1  FIRST ORDINATE PUNCHED OR SAVED
                ISAV2        300  LAST ORDINATE PUNCHED OR SAVED
               TIMINT       .083  TIME INTERVAL IN HOURS


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

          **************
          *            *
 168 KK   *        8R  *        CNAME      8C
          *            *
          **************

 169 KO          OUTPUT CONTROL VARIABLES
                IPRNT          5  PRINT CONTROL
                IPLOT          0  PLOT CONTROL
                QSCAL         0.  HYDROGRAPH PLOT SCALE
                IPNCH          0  PUNCH COMPUTED HYDROGRAPH
                 IOUT         22  SAVE HYDROGRAPH ON THIS UNIT
                ISAV1          1  FIRST ORDINATE PUNCHED OR SAVED
                ISAV2        300  LAST ORDINATE PUNCHED OR SAVED
               TIMINT       .083  TIME INTERVAL IN HOURS

WARNING --- ROUTED OUTFLOW (   1947.) IS GREATER THAN MAXIMUM OUTFLOW (   1770.) IN STORAGE-OUTFLOW TABLE

WARNING --- ROUTED OUTFLOW (   1965.) IS GREATER THAN MAXIMUM OUTFLOW (   1770.) IN STORAGE-OUTFLOW TABLE

WARNING --- ROUTED OUTFLOW (   1833.) IS GREATER THAN MAXIMUM OUTFLOW (   1770.) IN STORAGE-OUTFLOW TABLE

WARNING --- ROUTED OUTFLOW (   1813.) IS GREATER THAN MAXIMUM OUTFLOW (   1770.) IN STORAGE-OUTFLOW TABLE

WARNING --- ROUTED OUTFLOW (   1835.) IS GREATER THAN MAXIMUM OUTFLOW (   1770.) IN STORAGE-OUTFLOW TABLE

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

          **************
          *            *
 174 KK   *        7R  *
          *            *
          **************

 175 KO          OUTPUT CONTROL VARIABLES
                IPRNT          5  PRINT CONTROL
                IPLOT          0  PLOT CONTROL
                QSCAL         0.  HYDROGRAPH PLOT SCALE
                IPNCH          0  PUNCH COMPUTED HYDROGRAPH
                 IOUT         22  SAVE HYDROGRAPH ON THIS UNIT
                ISAV1          1  FIRST ORDINATE PUNCHED OR SAVED
                ISAV2        300  LAST ORDINATE PUNCHED OR SAVED
               TIMINT       .083  TIME INTERVAL IN HOURS


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

          **************
          *            *
 181 KK   *        7C  *        CNAME      7R
          *            *
          **************

 182 KO          OUTPUT CONTROL VARIABLES
                IPRNT          5  PRINT CONTROL
                IPLOT          0  PLOT CONTROL
                QSCAL         0.  HYDROGRAPH PLOT SCALE
                IPNCH          0  PUNCH COMPUTED HYDROGRAPH
                 IOUT         22  SAVE HYDROGRAPH ON THIS UNIT
                ISAV1          1  FIRST ORDINATE PUNCHED OR SAVED
                ISAV2        300  LAST ORDINATE PUNCHED OR SAVED
               TIMINT       .083  TIME INTERVAL IN HOURS


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

          **************
          *            *
 184 KK   *        7R  *        CNAME      7C
          *            *
          **************

 185 KO          OUTPUT CONTROL VARIABLES
                IPRNT          5  PRINT CONTROL
                IPLOT          0  PLOT CONTROL
                QSCAL         0.  HYDROGRAPH PLOT SCALE
                IPNCH          0  PUNCH COMPUTED HYDROGRAPH
                 IOUT         22  SAVE HYDROGRAPH ON THIS UNIT
                ISAV1          1  FIRST ORDINATE PUNCHED OR SAVED
                ISAV2        300  LAST ORDINATE PUNCHED OR SAVED
               TIMINT       .083  TIME INTERVAL IN HOURS


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

          **************
          *            *
 190 KK   *        6R  *
          *            *
          **************

 191 KO          OUTPUT CONTROL VARIABLES
                IPRNT          5  PRINT CONTROL
                IPLOT          0  PLOT CONTROL
                QSCAL         0.  HYDROGRAPH PLOT SCALE
                IPNCH          0  PUNCH COMPUTED HYDROGRAPH
                 IOUT         22  SAVE HYDROGRAPH ON THIS UNIT
                ISAV1          1  FIRST ORDINATE PUNCHED OR SAVED
                ISAV2        300  LAST ORDINATE PUNCHED OR SAVED
               TIMINT       .083  TIME INTERVAL IN HOURS
```

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

            **************
            *            *
 196 KK     *        6R  *        CNAME      6B
            *            *
            **************

 197 KO          OUTPUT CONTROL VARIABLES
                      IPRNT           5  PRINT CONTROL
                      IPLOT           0  PLOT CONTROL
                      QSCAL          0.  HYDROGRAPH PLOT SCALE
                      IPNCH           0  PUNCH COMPUTED HYDROGRAPH
                       IOUT          22  SAVE HYDROGRAPH ON THIS UNIT
                      ISAV1           1  FIRST ORDINATE PUNCHED OR SAVED
                      ISAV2         300  LAST ORDINATE PUNCHED OR SAVED
                     TIMINT        .083  TIME INTERVAL IN HOURS


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

            **************
            *            *
 202 KK     *        5B  *
            *            *
            **************

 203 KO          OUTPUT CONTROL VARIABLES
                      IPRNT           5  PRINT CONTROL
                      IPLOT           0  PLOT CONTROL
                      QSCAL          0.  HYDROGRAPH PLOT SCALE
                      IPNCH           0  PUNCH COMPUTED HYDROGRAPH
                       IOUT          22  SAVE HYDROGRAPH ON THIS UNIT
                      ISAV1           1  FIRST ORDINATE PUNCHED OR SAVED
                      ISAV2         300  LAST ORDINATE PUNCHED OR SAVED
                     TIMINT        .083  TIME INTERVAL IN HOURS


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

            **************
            *            *
 209 KK     *        5C  *        CNAME      5R
            *            *
            **************

 210 KO          OUTPUT CONTROL VARIABLES
                      IPRNT           5  PRINT CONTROL
                      IPLOT           0  PLOT CONTROL
                      QSCAL          0.  HYDROGRAPH PLOT SCALE
                      IPNCH           0  PUNCH COMPUTED HYDROGRAPH
                       IOUT          22  SAVE HYDROGRAPH ON THIS UNIT
                      ISAV1           1  FIRST ORDINATE PUNCHED OR SAVED
                      ISAV2         300  LAST ORDINATE PUNCHED OR SAVED
                     TIMINT        .083  TIME INTERVAL IN HOURS


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

            **************
            *            *
 212 KK     *        5R  *        CNAME      5C
            *            *
            **************

 213 KO          OUTPUT CONTROL VARIABLES
                      IPRNT           5  PRINT CONTROL
                      IPLOT           0  PLOT CONTROL
                      QSCAL          0.  HYDROGRAPH PLOT SCALE
                      IPNCH           0  PUNCH COMPUTED HYDROGRAPH
                       IOUT          22  SAVE HYDROGRAPH ON THIS UNIT
                      ISAV1           1  FIRST ORDINATE PUNCHED OR SAVED
                      ISAV2         300  LAST ORDINATE PUNCHED OR SAVED
                     TIMINT        .083  TIME INTERVAL IN HOURS


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

            **************
            *            *
 218 KK     *        4B  *
            *            *
            **************

 219 KO          OUTPUT CONTROL VARIABLES
                      IPRNT           5  PRINT CONTROL
                      IPLOT           0  PLOT CONTROL
                      QSCAL          0.  HYDROGRAPH PLOT SCALE
                      IPNCH           0  PUNCH COMPUTED HYDROGRAPH
                       IOUT          22  SAVE HYDROGRAPH ON THIS UNIT
                      ISAV1           1  FIRST ORDINATE PUNCHED OR SAVED
                      ISAV2         300  LAST ORDINATE PUNCHED OR SAVED
                     TIMINT        .083  TIME INTERVAL IN HOURS


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

            **************
            *            *
 225 KK     *        4R  *        CNAME      4B
            *            *
            **************

 226 KO          OUTPUT CONTROL VARIABLES
                      IPRNT           5  PRINT CONTROL
```



68

```
                    IPLOT          0  PLOT CONTROL
                    QSCAL         0.  HYDROGRAPH PLOT SCALE
                    IPNCH          0  PUNCH COMPUTED HYDROGRAPH
                     IOUT         22  SAVE HYDROGRAPH ON THIS UNIT
                    ISAV1          1  FIRST ORDINATE PUNCHED OR SAVED
                    ISAV2        300  LAST ORDINATE PUNCHED OR SAVED
                   TIMINT       .083  TIME INTERVAL IN HOURS


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

            **************
            *            *
 231 KK     *        3B  *
            *            *
            **************

 232 KO          OUTPUT CONTROL VARIABLES
                    IPRNT          5  PRINT CONTROL
                    IPLOT          0  PLOT CONTROL
                    QSCAL         0.  HYDROGRAPH PLOT SCALE
                    IPNCH          0  PUNCH COMPUTED HYDROGRAPH
                     IOUT         22  SAVE HYDROGRAPH ON THIS UNIT
                    ISAV1          1  FIRST ORDINATE PUNCHED OR SAVED
                    ISAV2        300  LAST ORDINATE PUNCHED OR SAVED
                   TIMINT       .083  TIME INTERVAL IN HOURS


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

            **************
            *            *
 238 KK     *        3C  *        CNAME      3R
            *            *
            **************

 239 KO          OUTPUT CONTROL VARIABLES
                    IPRNT          5  PRINT CONTROL
                    IPLOT          0  PLOT CONTROL
                    QSCAL         0.  HYDROGRAPH PLOT SCALE
                    IPNCH          0  PUNCH COMPUTED HYDROGRAPH
                     IOUT         22  SAVE HYDROGRAPH ON THIS UNIT
                    ISAV1          1  FIRST ORDINATE PUNCHED OR SAVED
                    ISAV2        300  LAST ORDINATE PUNCHED OR SAVED
                   TIMINT       .083  TIME INTERVAL IN HOURS


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

            **************
            *            *
 241 KK     *        3R  *        CNAME      3C
            *            *
            **************

 242 KO          OUTPUT CONTROL VARIABLES
                    IPRNT          5  PRINT CONTROL
                    IPLOT          0  PLOT CONTROL
                    QSCAL         0.  HYDROGRAPH PLOT SCALE
                    IPNCH          0  PUNCH COMPUTED HYDROGRAPH
                     IOUT         22  SAVE HYDROGRAPH ON THIS UNIT
                    ISAV1          1  FIRST ORDINATE PUNCHED OR SAVED
                    ISAV2        300  LAST ORDINATE PUNCHED OR SAVED
                   TIMINT       .083  TIME INTERVAL IN HOURS


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

            **************
            *            *
 247 KK     *        2B  *
            *            *
            **************

 248 KO          OUTPUT CONTROL VARIABLES
                    IPRNT          5  PRINT CONTROL
                    IPLOT          0  PLOT CONTROL
                    QSCAL         0.  HYDROGRAPH PLOT SCALE
                    IPNCH          0  PUNCH COMPUTED HYDROGRAPH
                     IOUT         22  SAVE HYDROGRAPH ON THIS UNIT
                    ISAV1          1  FIRST ORDINATE PUNCHED OR SAVED
                    ISAV2        300  LAST ORDINATE PUNCHED OR SAVED
                   TIMINT       .083  TIME INTERVAL IN HOURS


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

            **************
            *            *
 254 KK     *        2C  *        CNAME      2R
            *            *
            **************

 255 KO          OUTPUT CONTROL VARIABLES
                    IPRNT          5  PRINT CONTROL
                    IPLOT          0  PLOT CONTROL
                    QSCAL         0.  HYDROGRAPH PLOT SCALE
                    IPNCH          0  PUNCH COMPUTED HYDROGRAPH
                     IOUT         22  SAVE HYDROGRAPH ON THIS UNIT
                    ISAV1          1  FIRST ORDINATE PUNCHED OR SAVED
                    ISAV2        300  LAST ORDINATE PUNCHED OR SAVED
                   TIMINT       .083  TIME INTERVAL IN HOURS


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

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



69

```
                *            *
 257 KK         *     2R     *        CNAME      2C
                *            *
                **************

 258 KO          OUTPUT CONTROL VARIABLES
                      IPRNT          5  PRINT CONTROL
                      IPLOT          0  PLOT CONTROL
                      QSCAL         0.  HYDROGRAPH PLOT SCALE
                      IPNCH          0  PUNCH COMPUTED HYDROGRAPH
                       IOUT         22  SAVE HYDROGRAPH ON THIS UNIT
                      ISAV1          1  FIRST ORDINATE PUNCHED OR SAVED
                      ISAV2        300  LAST ORDINATE PUNCHED OR SAVED
                     TIMINT       .083  TIME INTERVAL IN HOURS


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


                **************
                *            *
 263 KK         *     1B     *
                *            *
                **************

 264 KO          OUTPUT CONTROL VARIABLES
                      IPRNT          5  PRINT CONTROL
                      IPLOT          0  PLOT CONTROL
                      QSCAL         0.  HYDROGRAPH PLOT SCALE
                      IPNCH          0  PUNCH COMPUTED HYDROGRAPH
                       IOUT         22  SAVE HYDROGRAPH ON THIS UNIT
                      ISAV1          1  FIRST ORDINATE PUNCHED OR SAVED
                      ISAV2        300  LAST ORDINATE PUNCHED OR SAVED
                     TIMINT       .083  TIME INTERVAL IN HOURS


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


                **************
                *            *
 271 KK         *     1C     *        CNAME      1R
                *            *
                **************

 272 KO          OUTPUT CONTROL VARIABLES
                      IPRNT          5  PRINT CONTROL
                      IPLOT          0  PLOT CONTROL
                      QSCAL         0.  HYDROGRAPH PLOT SCALE
                      IPNCH          0  PUNCH COMPUTED HYDROGRAPH
                       IOUT         22  SAVE HYDROGRAPH ON THIS UNIT
                      ISAV1          1  FIRST ORDINATE PUNCHED OR SAVED
                      ISAV2        300  LAST ORDINATE PUNCHED OR SAVED
                     TIMINT       .083  TIME INTERVAL IN HOURS


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


                **************
                *            *
 274 KK         *     1R     *        CNAME      1C
                *            *
                **************

 275 KO          OUTPUT CONTROL VARIABLES
                      IPRNT          5  PRINT CONTROL
                      IPLOT          0  PLOT CONTROL
                      QSCAL         0.  HYDROGRAPH PLOT SCALE
                      IPNCH          0  PUNCH COMPUTED HYDROGRAPH
                       IOUT         22  SAVE HYDROGRAPH ON THIS UNIT
                      ISAV1          1  FIRST ORDINATE PUNCHED OR SAVED
                      ISAV2        300  LAST ORDINATE PUNCHED OR SAVED
                     TIMINT       .083  TIME INTERVAL IN HOURS

1
                                        RUNOFF SUMMARY
                                   FLOW IN CUBIC FEET PER SECOND
                                 TIME IN HOURS,  AREA IN SQUARE MILES

                                  PEAK   TIME OF    AVERAGE FLOW FOR MAXIMUM PERIOD      BASIN     MAXIMUM     TIME OF
        OPERATION       STATION   FLOW    PEAK                                          AREA      STAGE     MAX STAGE
+                                                     6-HOUR     24-HOUR     72-HOUR
        HYDROGRAPH AT
+                         16B     823.   12.42         140.        39.         38.       .63
        ROUTED TO
+                         16R     743.   12.58         140.        39.         38.       .63
        HYDROGRAPH AT
+                         18B    1333.   12.25         173.        52.         50.       .71
        ROUTED TO
+                         18R    1096.   12.42         173.        51.         50.       .71
        HYDROGRAPH AT
+                         17B     863.   12.33         119.        33.         32.       .58
        2 COMBINED AT
+                         17C    1889.   12.42         289.        84.         81.      1.29
        ROUTED TO
+                         17R    1749.   12.50         289.        84.         81.      1.29
        HYDROGRAPH AT
+                         15B     719.   12.33          97.        25.         24.       .46
        2 COMBINED AT
+                         15C    2345.   12.42         384.       108.        104.      1.76
        ROUTED TO
+                         15R    2189.   12.50         384.       108.        104.      1.76
        HYDROGRAPH AT
+                         14B     542.   12.42          82.        22.         21.       .44
        HYDROGRAPH AT
+                         13B     649.   12.25          93.        23.         22.       .39
```



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| | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| + | 4 COMBINED AT | 13C | 3823. | 12.50 | 690. | 190. | 183. | 3.22 |
| + | ROUTED TO | 13R | 3709. | 12.58 | 690. | 190. | 183. | 3.22 |
| + | HYDROGRAPH AT | 12B | 571. | 12.25 | 59. | 15. | 15. | .32 |
| + | 2 COMBINED AT | 12C | 3926. | 12.58 | 747. | 204. | 197. | 3.54 |
| + | ROUTED TO | 12R | 3766. | 12.67 | 747. | 204. | 196. | 3.54 |
| + | HYDROGRAPH AT | 11B | 668. | 12.25 | 85. | 23. | 22. | .38 |
| + | ROUTED TO | 11R | 616. | 12.33 | 85. | 23. | 22. | .38 |
| + | HYDROGRAPH AT | 10B | 536. | 12.25 | 72. | 19. | 18. | .32 |
| + | ROUTED TO | 10R | 483. | 12.50 | 72. | 19. | 18. | .32 |
| + | HYDROGRAPH AT | 9B | 710. | 12.33 | 111. | 30. | 29. | .51 |
| + | 2 COMBINED AT | 9C | 1154. | 12.42 | 181. | 49. | 47. | .84 |
| + | ROUTED TO | 9R | 1139. | 12.50 | 181. | 49. | 47. | .84 |
| + | HYDROGRAPH AT | 8B | 404. | 12.25 | 46. | 13. | 13. | .21 |
| + | 3 COMBINED AT | 8C | 1921. | 12.42 | 309. | 85. | 81. | 1.43 |
| + | ROUTED TO | 8R | 1871. | 12.50 | 309. | 84. | 81. | 1.43 |
| + | HYDROGRAPH AT | 7B | 258. | 12.25 | 33. | 9. | 9. | .15 |
| + | 2 COMBINED AT | 7C | 2049. | 12.42 | 340. | 93. | 90. | 1.58 |
| + | ROUTED TO | 7R | 2044. | 12.50 | 340. | 93. | 90. | 1.58 |
| + | HYDROGRAPH AT | 6B | 655. | 12.17 | 69. | 19. | 18. | .31 |
| + | ROUTED TO | 6R | 513. | 12.50 | 69. | 19. | 18. | .31 |
| + | HYDROGRAPH AT | 5B | 521. | 12.33 | 79. | 21. | 20. | .35 |
| + | 2 COMBINED AT | 5C | 995. | 12.42 | 147. | 40. | 38. | .66 |
| + | ROUTED TO | 5R | 901. | 12.50 | 147. | 40. | 38. | .66 |
| + | HYDROGRAPH AT | 4B | 1057. | 12.25 | 155. | 41. | 39. | .62 |
| + | ROUTED TO | 4R | 1018. | 12.42 | 155. | 41. | 39. | .62 |
| + | HYDROGRAPH AT | 3B | 311. | 12.25 | 42. | 12. | 11. | .18 |
| + | 2 COMBINED AT | 3C | 1287. | 12.33 | 195. | 52. | 50. | .80 |
| + | ROUTED TO | 3R | 1216. | 12.50 | 195. | 52. | 50. | .80 |
| + | HYDROGRAPH AT | 2B | 444. | 12.25 | 54. | 16. | 15. | .26 |
| + | 4 COMBINED AT | 2C | 4373. | 12.50 | 727. | 198. | 191. | 3.29 |
| + | ROUTED TO | 2R | 4099. | 12.58 | 726. | 198. | 190. | 3.29 |
| + | HYDROGRAPH AT | 1B | 1716. | 12.42 | 302. | 89. | 86. | 1.28 |
| + | 3 COMBINED AT | 1C | 9023. | 12.58 | 1754. | 485. | 468. | 8.11 |
| + | ROUTED TO | 1R | 9023. | 12.58 | 1754. | 485. | 468. | 8.11 |

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



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# Appendix 3 Rainfall Depths

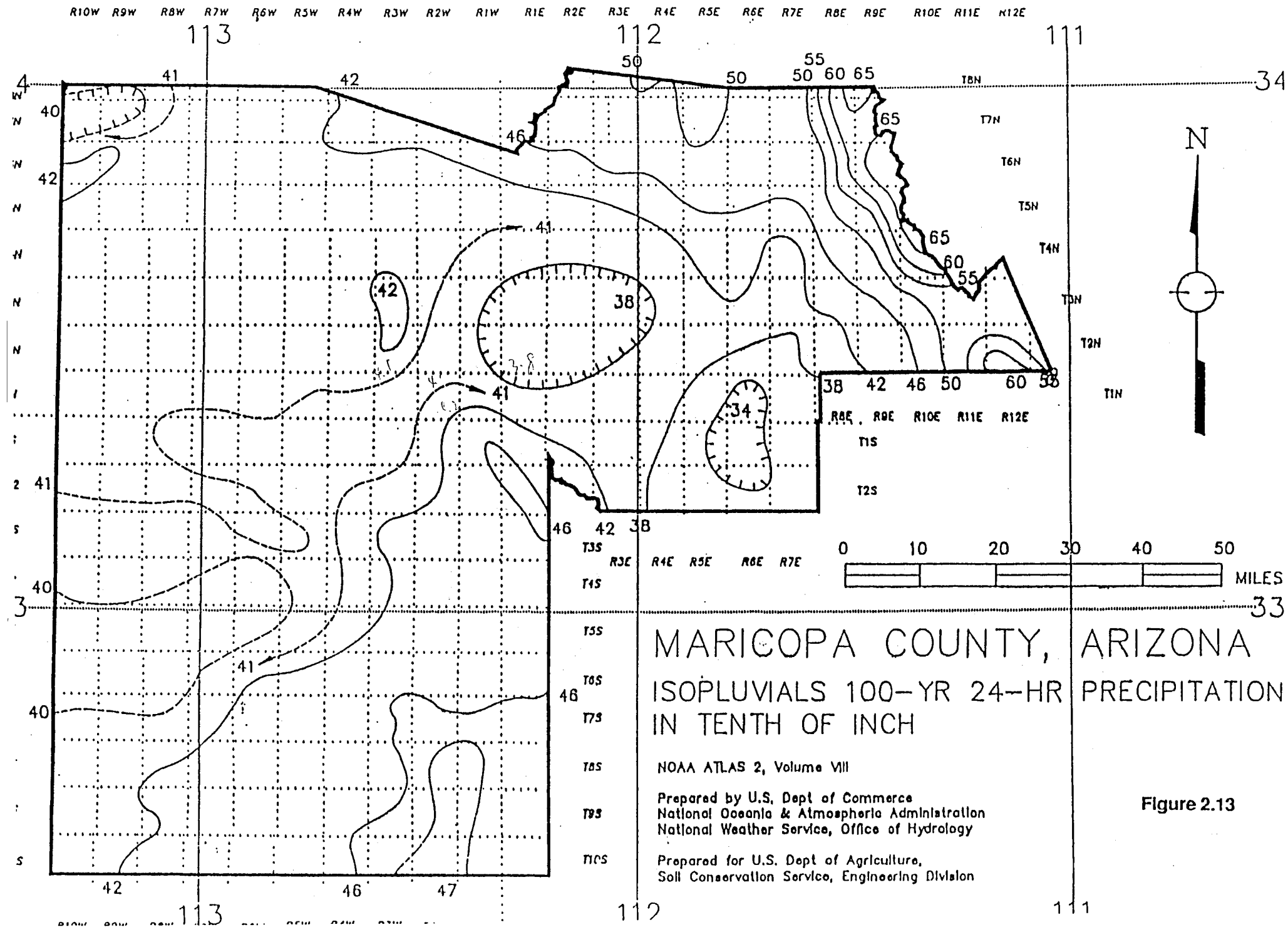

MARICOPA COUNTY, ARIZONA
ISOPLUVIALS 100-YR 24-HR PRECIPITATION
IN TENTH OF INCH
NOAA ATLAS 2, Volume VIII
Prepared by U.S. Dept of Commerce
National Oceanic & Atmospheric Administration
National Weather Service, Office of Hydrology
Prepared for U.S. Dept of Agriculture,
Soil Conservation Service, Engineering Division
N
0 10 20 30 40 50
MILES
R10W R9W R8W R7W R6W R5W R4W R3W R2W R1W R1E R2E R3E R4E R5E R6E R7E R8E R9E R10E R11E R12E
113
112
111
34
33
T8N
T7N
T6N
T5N
T4N
T3N
T2N
T1N
T1S
T2S
T3S
T4S
T5S
T6S
T7S
T8S
T9S
T10S

Figure 2.13

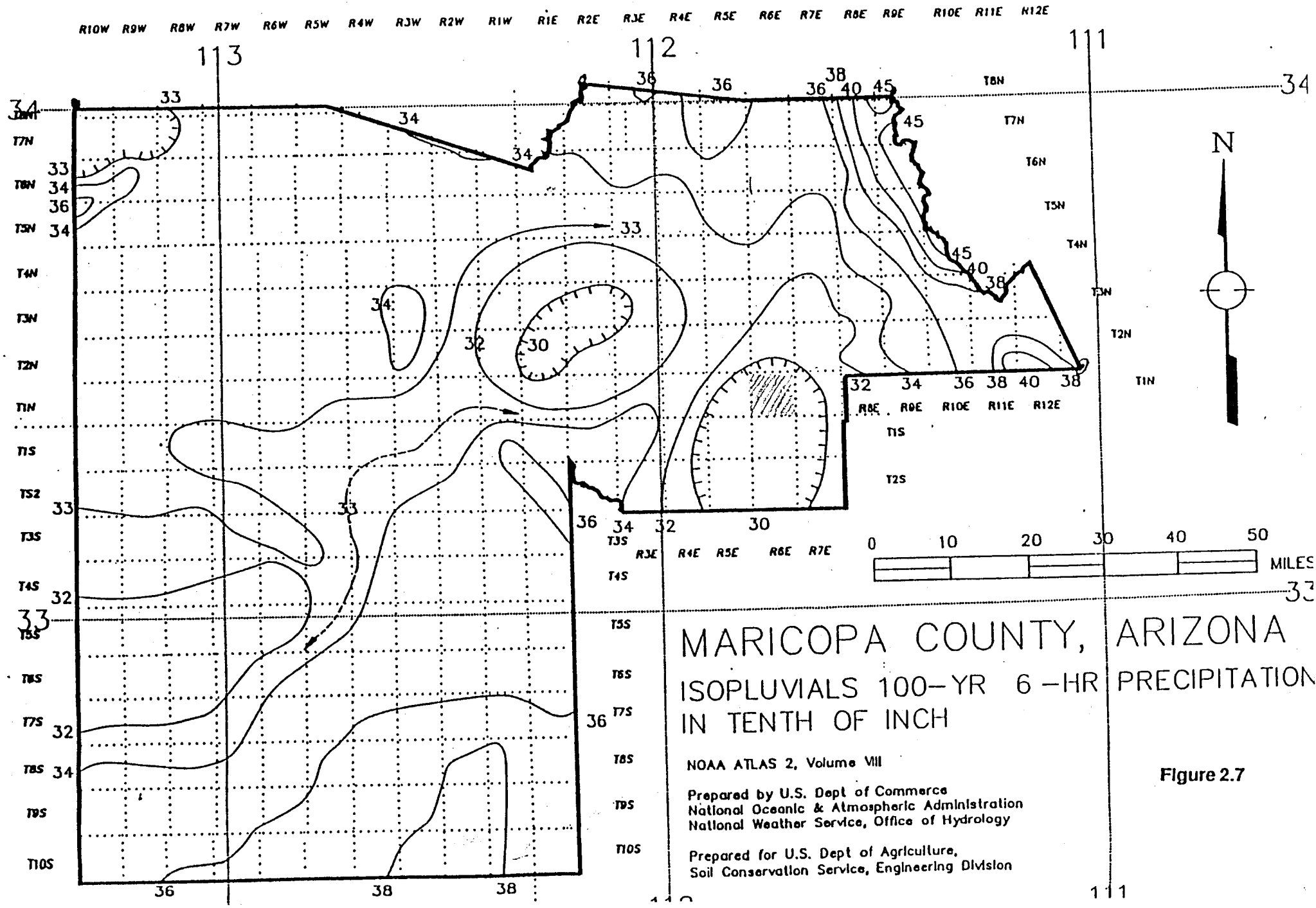
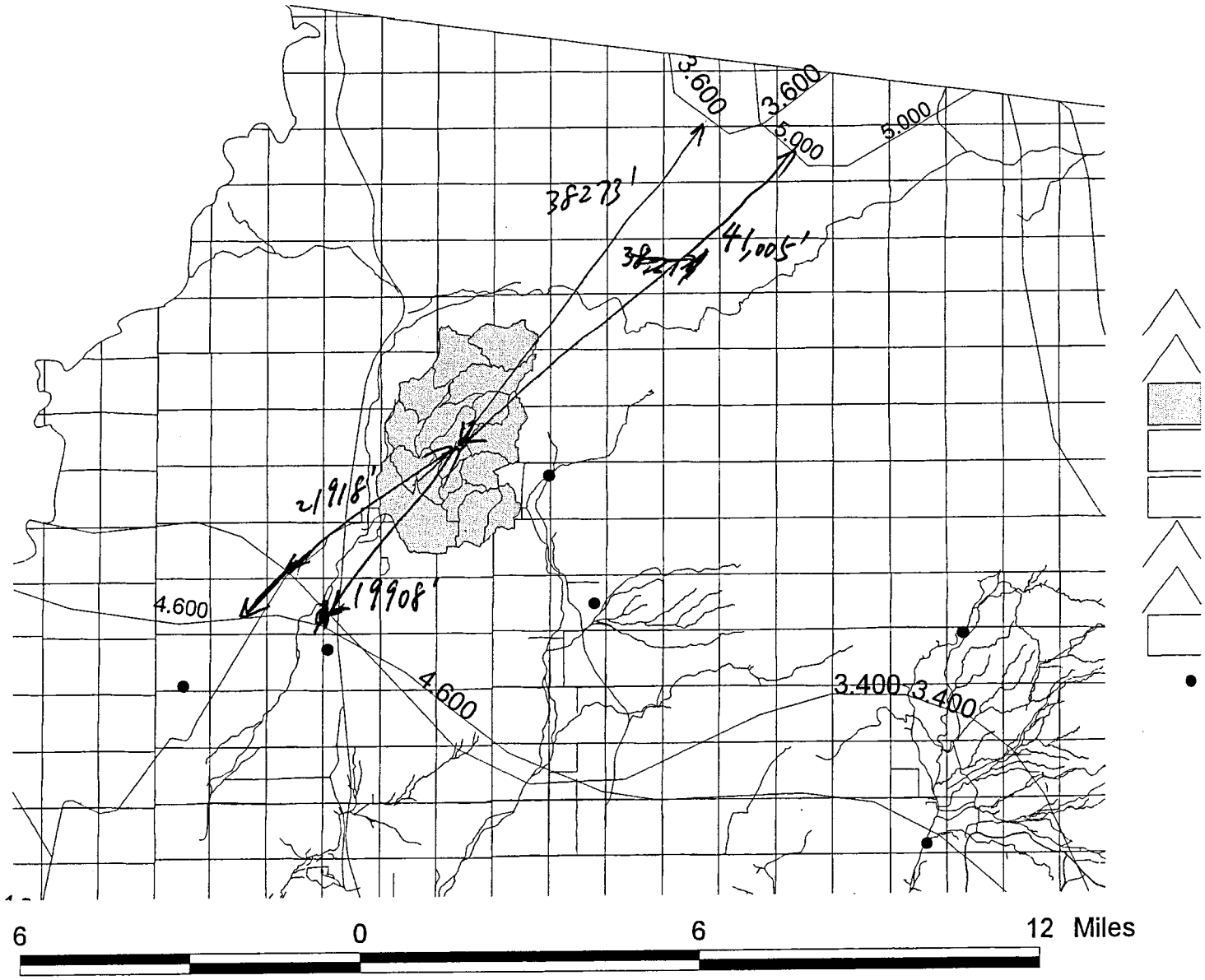

MARICOPA COUNTY, ARIZONA
ISOPLUVIALS 100-YR 6-HR PRECIPITATION
IN TENTH OF INCH
NOAA ATLAS 2, Volume VIII
Prepared by U.S. Dept of Commerce
National Oceanic & Atmospheric Administration
National Weather Service, Office of Hydrology
Prepared for U.S. Dept of Agriculture,
Soil Conservation Service, Engineering Division
N
0 10 20 30 40 50
MILES
113
112
111
34
33
R10W R9W R8W R7W R6W R5W R4W R3W R2W R1W R1E R2E R3E R4E R5E R6E R7E R8E R9E R10E R11E R12E
T8N T7N T6N T5N T4N T3N T2N T1N T1S T2S T3S T4S T5S T6S T7S T8S T9S T10S

Figure 2.7

# View1




~~100-6 hr~~

100-yr, 6-hr: $k = \frac{3.6 - 3.4}{58181'}$ ; $\therefore P_{\text{centroid } 6\,hr} = 3.4 + \frac{0.2''}{58181} \times 19908$

$= 3.47''$

100-yr, 24-hr: $k = \frac{5 - 4.6}{62923}$ $\therefore P_{24\,hr} = 4.6 + \frac{0.4}{62923} \times 21918$

$= 4.74''$

# Appendix 4 Survey Information on Representative Routing Reaches

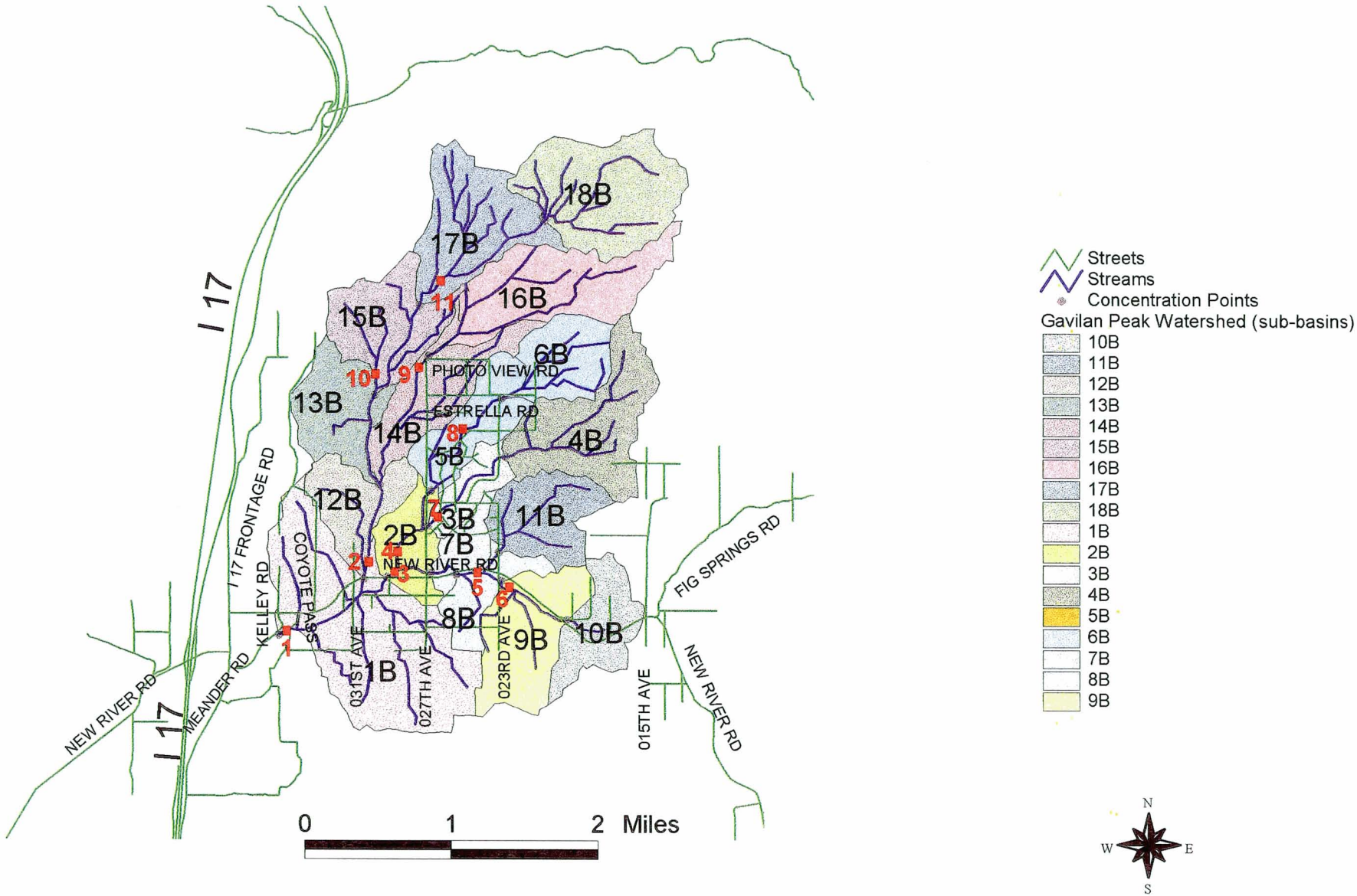
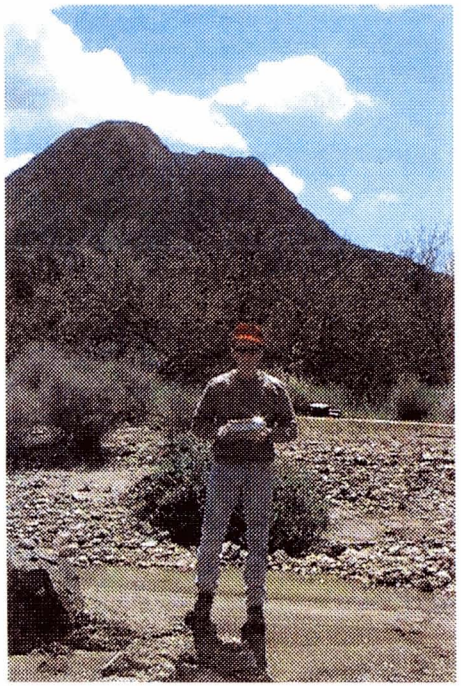



Figure 15. Cross Sections for Representative Routing Reaches for Gavilan Peak Watershed



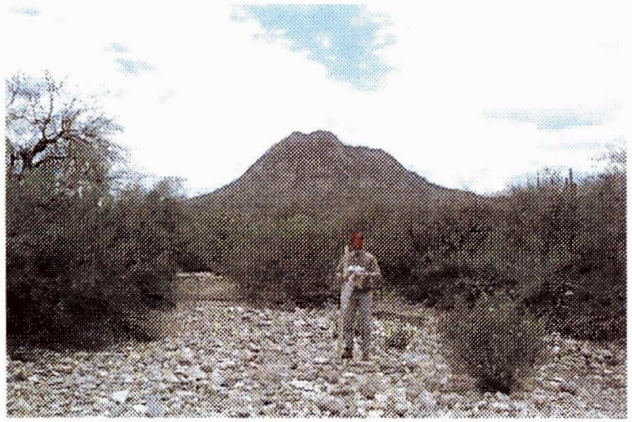
Left Bank

Main Channel

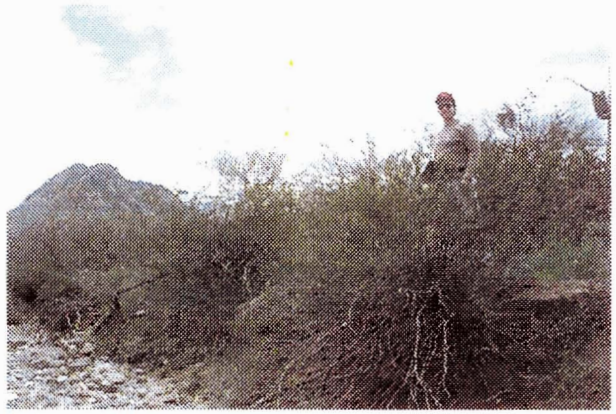
Right Bank

**Looking Upstream at Cross Section No. 1 in Sub-Basin 1B**

Left Bank



Main Channel



Right Bank

**Looking Downstream at Cross Section No. 2 in Sub-Basin 12B**

**Looking Downstream at New River Road and 12B Outlet: 2 CMP (6' in Diameter)**

Left Bank

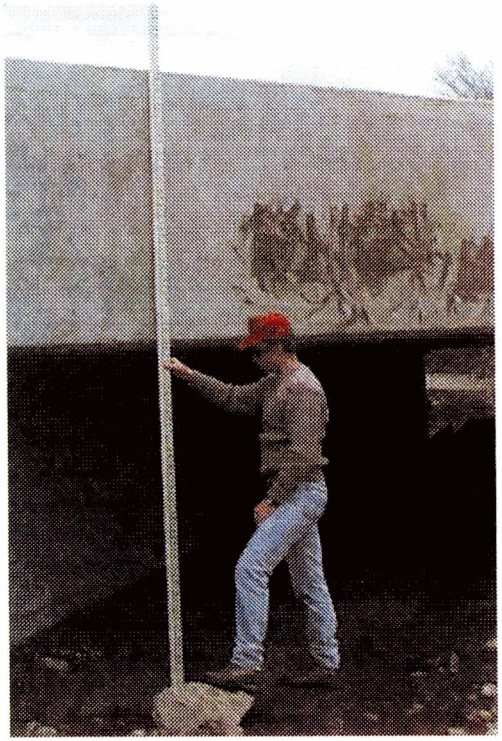
Main Channel and Right Bank

**Looking Downstream at Cross Section No. 3 in Sub-Basin 2B**

Left Bank

Main Channel and Right Bank

**Looking Downstream at Cross Section No. 4 in Sub-Basin 2B**



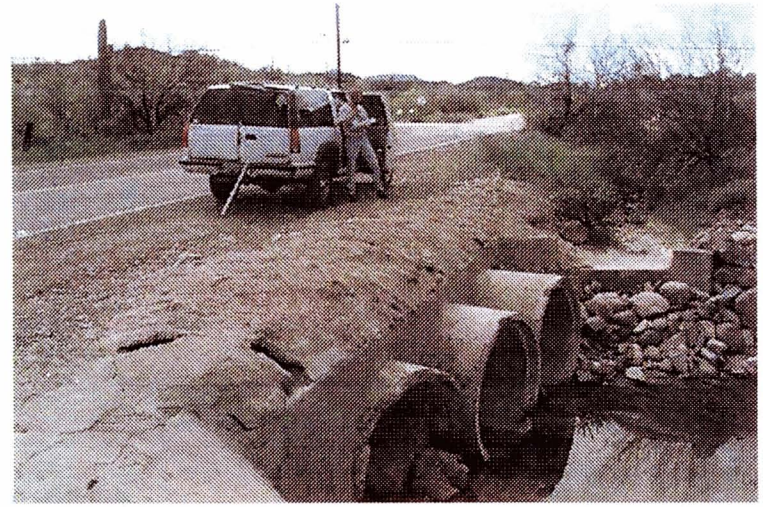
**Looking Downstream at New River Road and 2B Outlet: 3 12'x5.5' Box Culverts**

Left Bank and Main Channel

Small Channel on Right Overbank

**Looking Downstream at 27th Avenue and 7B Outlet**

**Looking Upstream at 27th Avenue and 7B Outlet**



**Roadway Culverts Crossing 27th Avenue near North of New River Road (27th Avenue and 7B Outlet). This is downstream of culverts.**

Left Bank and Main Channel Looking Downstream
at Cross Section No. 5 in 8B

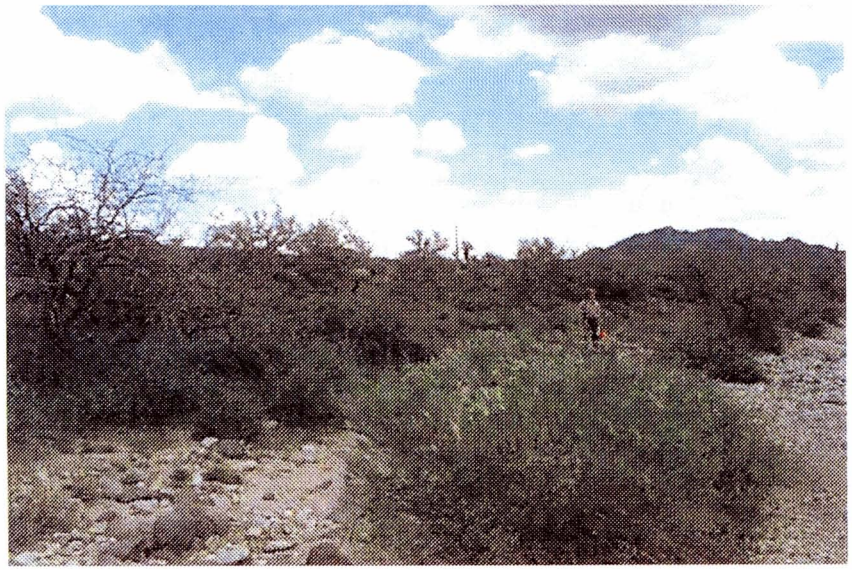
Box Culverts Crossing New River Road
at 8B Outlet (Looking Downstream )

Left Bank

Main Channel

**Looking Downstream at 23rd Avenue and 9B Outlet (Cross Section No. 6 in 9B)**

**Looking Downstream toward Gavilan Peak at Cross Section No. 9 in 14B**
**(near Photo View Road and 27th Avenue)**

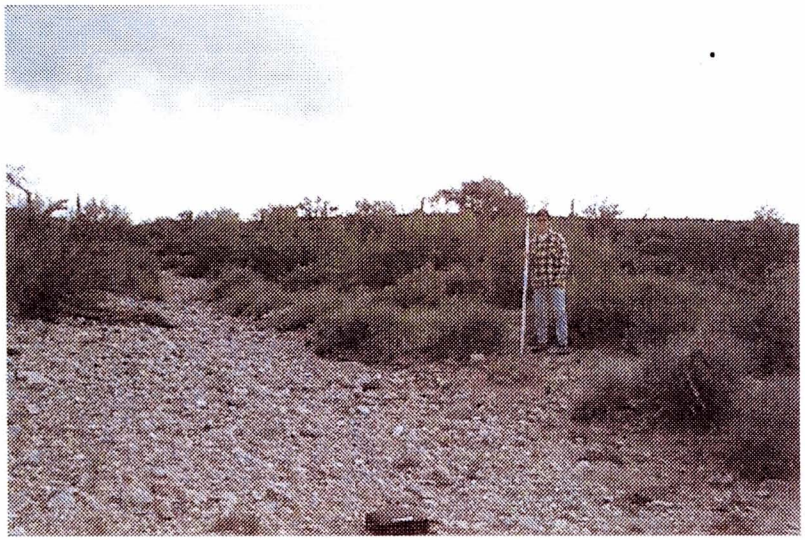


Left Bank and Main Channel

Right Bank and Main Channel

**Looking Downstream at Cross Section No. 10 in Sub-Basin 15B**

Left Bank and Main Channel



Right Bank

**Looking Downstream at Cross Section No. 11 in Sub-Basin 17B**

# SLOPE AREA SURVEYING NOTES

#1

SITE: Concentration point @ outlet of 1B

DATE 4/2/98

resume tripod sets at 100'

| STA | AZIM | T / B | DIST | ROD | ELEV | REMARKS |
|---|---|---|---|---|---|---|
| ~~0~~ | | / | | 5.40 | 100.00 | ~~start at left bank~~ |
| ~~1~~ | | / | ~~R1 = 6.66 R2 = 6.44~~ | ~~6.5~~ | | 1st point |
| ~~2~~ | | / | ~~R1 = 8.95 R2 8.55~~ | ~~8.80~~ | | |
| ~~3~~ | | / | ~~R1 9.35 R2 8.69~~ | ~~9.20~~ | | |
| ~~4~~ | | / | ~~R1 6.71 R2 6.02~~ | 6.35 | | |
| 0 | | / | | 5.10 | 100 | Right bank start n=.050 HI: 5.1 |
| 1 | | 5.54/5.28 | | 5.41 | | n=.050 |
| 2 | | 13.72/13.33 | | 13.53 | | in channel raw n=.030 sand pebbles |
| 3 | | 14.54/13.84 | | 14.14 | | in channel sand pebbles |
| 4 | | 11.34/10.38 | | 10.86 | | left bank pebbles, sand some brush n=.035 |
| 5 | | 11.50/10.36 | | 10.90 | | left bank .050 trees + brush & fell fall trees n=.070 |
| 6 | | 9.01/7.56 | | 8.28 | | left bank trees and brush |
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PARTY:

first picture right bank (shows dropoff due to erosion)

second " main channel (looking upstream)

third " left channel (looking upstream)

PAGE:

✓ PYETT DRAW

✓ HARDSCRABBLE MESA

# SLOPE AREA SURVEYING NOTES

SITE: #2 Subbasin 12B upstream of New River road DATE 4/2/98 Start at Right Bank

| STA | AZIM | T / B | DIST | ROD | ELEV | REMARKS |
|---|---|---|---|---|---|---|
| 0 | | / | | | 100.00 | HI = 3.60 start on right bank |
| 1 | | 4.44 4.25 | | 4.33 | | n=.05 cactus and brushes, small trees |
| 2 | | 9.50/9.13 | | 9.32 | | small brushes dense weeds and cactus n=.05 |
| 3 | | 11.90/11.33 | | 11.62 | | edge of main channel, still floodplain n=.045 |
| 4 | | 16.26 / 15.60 | | 15.92 | | in main channel n=.035 cobbles |
| 5 | | 14.94/14.08 | | 14.50 | | n=.035, main channel cobbles → edge |
| 6 | | 13.30/12.19 | | 12.74 | | start of left bank edge n=.05 to .07 |
| 7 | | 11.69 / 10.31 | | 10.99 | | brushes and trees n=.05 to .07 |
| 8 | | 11.72/10.00 | | 10.84 | | left bank, floodplain, brushes + trees n=.05 to .07 |
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PARTY:

PAGE:

~~RYEST DRAW~~

~~HARDSCRABBLE MESA~~

4 from main channel, view downstream of right overbank

5 from main channel, view downstream of main channel

roadway is 1 foot above top of culvert

6 from main channel, view downstream of left overbank

7. view ~~from~~ looking downstream of culvert at New River road. outlet of basin 12B
culvert is 2 - 6 foot CMPS

# SLOPE AREA SURVEYING NOTES

#3

SITE: upstream of outlet for 28 Start on Left Bank DATE 4/2/98

| STA | AZIM | T / B | DIST | ROD | ELEV | REMARKS |
|---|---|---|---|---|---|---|
| 0 | | / | | | 100.00 | H.I = 5.10 start on left bank |
| 1 | | 5.88 / 5.67 | | 5.78 | | left bank n=.045 small trees and brushes |
| 2 | | 12.77 / 12.40 | | 12.59 | | edge of main channel n=.035 |
| 3 | | 13.03 / 12.45 | | 12.73 | | middle of main channel n=.035 |
| 4 | | 12.47 / 11.80 | | 12.13 | | edge of main channel cobbles + sand n=.03 |
| 5 | | 8.07 / 7.20 | | 7.63 | | n=.06 right overbank dense weeds and brushes |
| 6 | | / | | | | twenty feet from station #5 same n ≈ .06 |
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PARTY:

PAGE:

✓ PYETT DRAW

✓ HARDSCRABBLE MESA

Picture #8. view downstream of left overbank picture w/ tripod

#9. view downstream of main channel

# SLOPE AREA SURVEYING NOTES

#4

SITE: upstream of confluence in subbasin 2B DATE 4/2/98

start @ left bank

| STA | AZIM | T / B | DIST | ROD | ELEV | REMARKS weedy, small trees and brush |
|---|---|---|---|---|---|---|
| 0 | | / | | | 100.00 | HI = 4.80; another station will exist on left bank behind this one |
| 1 | 30' | 6.68 / 6.53 | | 6.60 | | edge of left bank very weedy n = .060 |
| 2 | | 11.54 / 11.24 | | 11.39 | | main channel, cobbles and sand 0.035 |
| 3 | 13' | same | | same | | edge of main channel horizontal distance is 13' from station #2. |
| 4 | 13' | / | | 4.80 | | same elevation as #0 13' from station #3 |
| 5 | 20' | / | | 5.5 | | 20' from station #4 |
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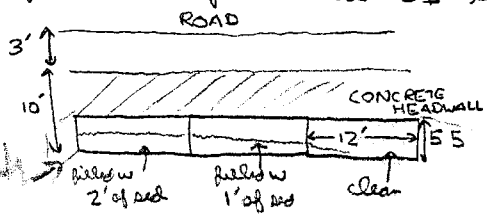
PARTY: PAGE:

#10 downstream view of a tributary in subbasin 2B shot at location #4

#11 same

Triple box in subbasin 2B

#12, 13, 14 at [illegible]




View looking down stream

culvert has wingwalls

culvert has a skew angle to road

# SLOPE AREA SURVEYING NOTES

Meters

cross-sect No. 5

SITE: 8B looking downst, right bank

DATE 4/7/98

| STA | AZIM | T / B | DIST | ROD | ELEV | REMARKS |
|---|---|---|---|---|---|---|
| 0 | | 0 / 0 | 0 | 1.45 M | | |
| | | 1.67 / 1.63 | | 1.65 M | | n=0.07 |
| | | 3.5 / 3.4 | | 3.45 M | | n=0.05 |
| | | 3.58 / 3.4 | | 3.5 M | | n=0.035 |
| | | 2.4 / 2.18 | | 2.3 M | | n=0.05 |
| | | 2 / 1.7 | | 1.82 | | n=0.07 |
| | | +5 M | | 1.45 M | | n=0.07 |
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Pictures

PARTY:

PAGE: 1

#1 View west (Downstream) at 27th ave north of New Rim road

#2 View to the south 3 pipe culverts at 27th AVE, north of New Rim road

#3 small diverted portion 60' north of 3 pipes View is to the west downstream

#4 View upstream, to the east of 27th ave, north of New Rim road

#5 right overbank looking downstream at X-section (8B)

10'x5.5'

✓ PYETT DRAW

✓ HARDSCRABBLE MESA

#6 main channel left bank upstream

X-Sect ~~up stream~~

#7 box culverts NO. 5 cross-section (5x3)x2 ~ New Rim

# SLOPE AREA SURVEYING NOTES

SITE: No. 6 Y-section 9B Left bank

DATE 4/7/18

| STA | AZIM | T / B | DIST | ROD | ELEV | REMARKS |
|---|---|---|---|---|---|---|
| 0 | | / | | 1.45M | | |
| | | 1.74 / 1.7 | | 1.72 M | | n=0.07 |
| | | 2.7 / 2.6 | | 2.2 M | | |
| | | 3.2 / 3.05 | | 2.94 | | |
| | | 3.57 / 3.35 | | 3.44 | | n=0.045 |
| | 10 m | 3.4 / 3.2 | | 3.3 | | |
| | | 2.96 / 2.7 | | 2.84 | | n=0.07 |
| | | 2.58 / 2.28 | | 2.44 | | |
| | | 15m / | | 1.45 | | |
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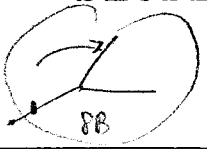
PARTY:

PAGE: 2

Photos: #8 left bank downst to the west
#9 main channel " west

✓ PYETT DRAW
✓ HARDSCRABBLE MESA

# SLOPE AREA SURVEYING NOTES

SITE: 8B 


NO. 6.5

Same as 9B

DATE

| STA | AZIM | T / B | DIST | ROD | ELEV | REMARKS |
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PARTY:

PAGE: 3

✓ PYETT DRAW

✓ HARDSCRABBLE MESA

# SLOPE AREA SURVEYING NOTES

SITE: 3B 27th Ave Rightbank No. 7 X-Sec

DATE 4/07/98

| STA | AZIM | T / B | DIST | ROD | ELEV | REMARKS |
|---|---|---|---|---|---|---|
| 0 | | / | | 1.46M | | |
| 3 | | ~~2~~ / 3.0M | | 2M | | n=0.05 |
| | | 2.88 / 2.8 | | 2.85 | | n=0.06 |
| | | 4.12 / 4 | | ~~4.06~~ 4.05 | | n=0.06 |
| | edge of mat | 4.75 / 4.6 | | 4.68 | | n= 0.035 |
| | edge of mat | 4.98 / 4.8 | | 4.9 | | |
| | | 3.22 / 3 | | 3.1 | | n=0.06 |
| | | 2.58 / 2.34 | | 2.46 | | |
| | | 2.14 / 1.85 | | 2 | | n=0.05 |
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PARTY:

PAGE: 4

Picture # ~~10~~ 9 looking upstream

# SLOPE AREA SURVEYING NOTES

SITE: 5B Rightbank No. 8 X-Sect DATE 4/7/88

| STA | AZIM | T / B | DIST | ROD | ELEV | REMARKS |
|---|---|---|---|---|---|---|
| 0 | | / | | 1.35 M | | |
| | | 3 M | | 1.42 | | 0.05 |
| | [illegible] | 2.2 / 2.1 | | 2.16 | | n = 0.035 |
| | [illegible] | 2.18 / 2.02 | | 2.1 | | |
| | | 1.42 / 1.1 | | 1.25 | | 0.05 |
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PARTY: PAGE: 5

Picture #14. looking downstream

# SLOPE AREA SURVEYING NOTES

Photo View + 77ea Ad

SITE: 14B Right ~~bank~~ bank No. 9 X-sect DATE

| STA | AZIM | T / B | DIST | ROD | ELEV | REMARKS |
|---|---|---|---|---|---|---|
| | | / | | 1.3 M | | |
| | | 80 M | | 1.8 M | | n = 0.03 |
| | | 3.54/3.34 | | 3.42 M | | |
| | | 4.25/3.94 | | 4.1 M | | |
| | | 4.58/4.13 | | 4.35 M | | n = 0.03 |
| | | 2.7/2.18 | | 2.44 | | n = 0.03 |
| | | 1.62/1 | | 1.3 | | |
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PARTY: PAGE: 6

Plot #14 upstream (look in)
#17 downstream (look in) ✓

# SLOPE AREA SURVEYING NOTES

SITE: 1 (off bank
No. 10 X-sec  13 B (upper) or 15 B (lower)  DATE

| STA | AZIM | T / B | DIST | ROD | ELEV | REMARKS |
|---|---|---|---|---|---|---|
| | | / | | 1.15M | | |
| | | 8M | | 1.52 m | | n = 0.05 |
| | | 2.98 / 2.86 | | 2.92 | | |
| | | 4.12 / 3.92 | | 4.02 | | |
| | | 4.9 / 4.6 | | 4.75 | | 0.035 |
| | | 4 / 3.6 | | 3.8 | | |
| | | 3.1 / 2.55 | | 2.82 | | n = 0.05 |
| | | 3.2 / 2.46 | | 2.82 | | |
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PARTY:  PAGE: 17

Picture # 13 looking downstream Right bank & main channel
# 14 - - - - - - left - - - - channel

# SLOPE AREA SURVEYING NOTES

SITE: 17B left bank No. 11

DATE 4/5/98

| STA | AZIM | T / B | DIST | ROD | ELEV | REMARKS |
|---|---|---|---|---|---|---|
| | | / | | 1.17 M | | n |
| | | 10M | | 1.16M | | n > 0.05 |
| | | 2.04 / 1.92 | | 1.98 | | n > 0.05 |
| | left | 4.45 / 4.3 | | 4.38 | | n = 0.05 |
| | left else main | 4.74 / 4.5 | | 4.6 | | n = 0.07 |
| | right else | 4.55 / 4.52 | | 4.7 | | > 0.045 |
| | | 4.48 / 4.05 | | 4.25 M | | > 0.07 |
| | | 3.68 / 3.12 | | 3.4 | | |
| | | 3 / 2.3 | | 2.68 | | > 0.05 |
| | | 1.3 / 0.52 | | 0.9 | | |
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PARTY:

PAGE: 8

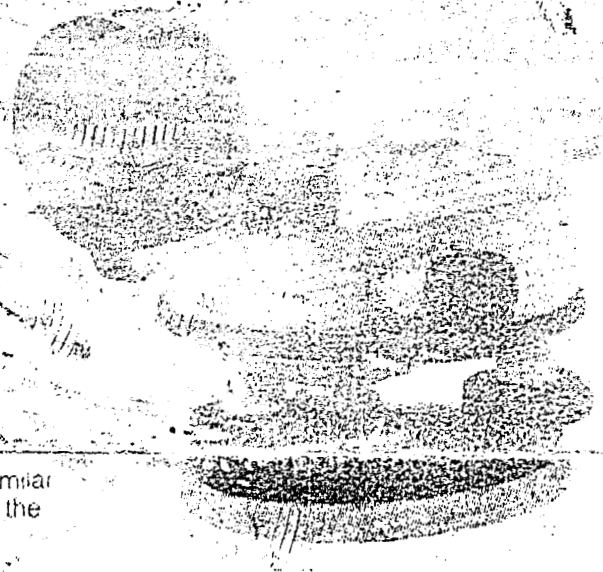
Distance #15 looking downstream left bank + main

#16 — — — right — + main

**Table 3.1**
**Manning's 'n' Values**

| Type of Channel and Description | Minimum | Normal | Maximum |
|---|---|---|---|
| A. *Natural Streams* | | | |
| 1. **Main Channels** | | | |
| a. Clean, straight, full, no rifts or deep pools | 0.025 | 0.030 | 0.033 |
| b. Same as above, but more stones and weeds | 0.030 | 0.035 | 0.040 |
| c. Clean, winding, some pools and shoals | 0.033 | 0.040 | 0.045 |
| d. Same as above, but some weeds and stones | 0.035 | 0.045 | 0.050 |
| e. Same as above, lower stages, more ineffective slopes and sections | 0.040 | 0.048 | 0.055 |
| f. Same as "d" but more stones | 0.045 | 0.050 | 0.060 |
| g. Sluggish reaches, weedy. deep pools | 0.050 | 0.070 | 0.080 |
| h. Very weedy reaches, deep pools, or floodways with heavy stands of timber and brush | 0.070 | 0.100 | 0.150 |
| 2. **Flood Plains** | | | |
| a. Pasture no brush | | | |
| 1. Short grass | 0.025 | 0.030 | 0.035 |
| 2. High grass | 0.030 | 0.035 | 0.050 |
| b. Cultivated areas | | | |
| 1. No crop | 0.020 | 0.030 | 0.040 |
| 2. Mature row crops | 0.025 | 0.035 | 0.045 |
| 3. Mature field crops | 0.030 | 0.040 | 0.050 |
| c. Brush | | | |
| 1. Scattered brush, heavy weeds | 0.035 | 0.050 | 0.070 |
| 2. Light brush and trees, in winter | 0.035 | 0.050 | 0.060 |
| 3. Light brush and trees, in summer | 0.040 | 0.060 | 0.080 |
| 4. Medium to dense brush, in winter | 0.045 | 0.070 | 0.110 |
| 5. Medium to dense brush, in summer | 0.070 | 0.100 | 0.160 |
| d. Trees | | | |
| 1. Cleared land with tree stumps, no sprouts | 0.030 | 0.040 | 0.050 |
| 2. Same as above, but heavy sprouts | 0.050 | 0.060 | 0.080 |
| 3. Heavy stand of timber, few down trees, little undergrowth, flow below branches | 0.080 | 0.100 | 0.120 |
| 4. Same as above, but with flow into branches | 0.100 | 0.120 | 0.160 |
| 5. Dense willows, summer, straight | 0.110 | 0.150 | 0.200 |
| 3. **Mountain Streams, no vegetation in channel, banks usually steep, with trees and brush on banks submerged** | | | |
| a. Bottom: gravels, cobbles, and few boulders | 0.030 | 0.040 | 0.050 |
| b. Bottom: cobbles with large boulders | 0.040 | 0.050 | 0.070 |

# Automatic Levels
# Performance proven for engineering/surveying work.



Models AL10-28 and AL10-32 are similar to the AL8-25, with the exception of the following features:

| | Magnification | Attainable accuracy in 1 km of double run leveling | Additional features |
|---|---|---|---|
| AL10-28 | 28X | ± 1.5mm | |
| AL10-28M | 28X | ± 1.5mm | • 1° metal circle |
| AL10-32 | 32X | ± 1.0mm | • wedge shaped reticle |
| AL10-32M | 32X | ± 1.0mm | • wedge shaped reticle<br>• 1° metal circle |
| AL10-32G | 32X | ± 1.0mm | • wedge shaped reticle<br>• 10' glass circle<br>• Scale mark allows estimation to 1'<br>• Optical micrometer |

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Scott Technical
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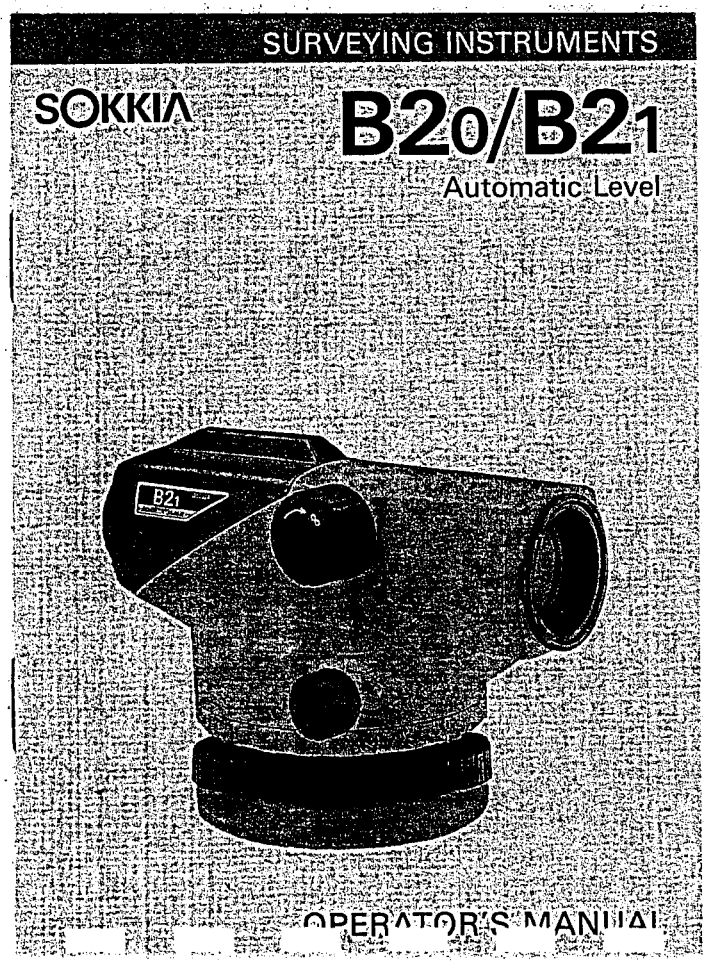
## FUJI-KOH
## your sights are set on precision and accuracy.

Your new FUJI-KOH automatic level features an advanced instrument design which will allow you to level faster, easier, and more accurately than ever before. This booklet will acquaint you with the instrument, its components, and proper care and handling.

The automatic level is constructed to withstand rugged field use and is backed by the FUJI-KOH reputation for quality and reliability. Like all precision instruments, however, it should be treated with reasonable care to prolong life and accuracy. Regular servicing, at least once a year, by a reliable repair station or by FUJI-KOH instruments is recommended. It is also recommended that only qualified personnel service the instrument.

Give added precision to your job by using your new automatic level with FUJI-KOH instrument accessories. See your FUJI-KOH dealer for a complete line of tripods, rods and targets, plumb bobs, and hand tools to fit your exact job requirements.

All instruments are adjusted when they are shipped from the factory. It is the customer's responsibility to check and to ensure instruments are adjusted prior to using.
David White is not responsible for errors caused by instruments that are out of adjustment.
Contact your distributor, dealer or David White for information on the nearest facility to check if your instrument is properly adjusted.




## 1. FEATURES OF B20/B21

The B20/B21 is equipped with a fast-action, magnetically-damped, automatic compensator.
After the instrument has been approximately levelled using the circular level, the line of sight is accurately levelled by the automatic compensating mechanism.
The B20/B21 has been designed to allow stable surveying operations regardless of environmental conditions such as vibration and temperature changes.

The B20/B21 has a simple horizontal circle for angle measurement, and the stadia lines on the reticle can be used for approximate distance measurement.

The B20/B21 is ideally suited for general survey work, civil engineering and construction work.

In this manual, instrument parts and accessories are numbered and described on pages 3 and 22.
Use the manual as shown below:

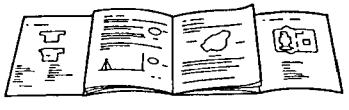


Fig. 1.1

# Appendix 5 Cross Section Data for Representative Routing Reaches

t:\hz\Gavilan Peak Watershed\rcutty3x sec...

This file contains the cross-section data for 11 X-sections surveyed by Dave Degerness and me (Bing Zhao) for Gavilan Peak Watershed
The Manning's n values are also surveyed.
The survey was conducted on April 2 and April 7, 1998.

The ground elevation for tri-pod is 100 feet (relative).
Left bank and right bank are for "looking downstream."

Cross-section No.1: Routing reach in sub-basin 1B (start from the right bank)

| T | B | Dist (feet) | Rod (feet) | Elevation | | | left bank starts Dist (feet) | Elevation |
|---|---|---|---|---|---|---|---|---|
| 0 | 0 | 0 | 5.1 | 100 | 0 | 145 | 0 | 96.82 |
| 5.54 | 5.28 | 26 | 5.41 | 99.69 | 26 | 119 | 31 | 94.2 |
| 13.72 | 13.33 | 39 | 13.53 | 91.57 | 39 | 106 | 49 | 94.24 |
| 14.54 | 13.84 | 70 | 14.14 | 90.96 | 70 | 75 | 75 | 90.96 |
| 11.34 | 10.38 | 96 | 10.86 | 94.24 | 96 | 49 | 106 | 91.57 |
| 11.5 | 10.36 | 114 | 10.9 | 94.2 | 114 | 31 | 119 | 99.69 |
| 9.01 | 7.56 | 145 | 8.28 | 96.82 | 145 | 0 | 145 | 100 |

Cross-section No.2: Routing reach in sub-basin 12B (start from the right bank)

| T | B | Dist (feet) | Rod (feet) | Elevation | | | left bank starts Dist (feet) | Elevation |
|---|---|---|---|---|---|---|---|---|
| 0 | 0 | 0 | 3.6 | 100 | 0 | 172 | 0 | 92.76 |
| 4.44 | 4.25 | 19 | 4.33 | 99.27 | 19 | 153 | 34 | 92.61 |
| 9.5 | 9.13 | 37 | 9.32 | 94.28 | 37 | 135 | 61 | 90.86 |
| 11.9 | 11.33 | 57 | 11.62 | 91.98 | 57 | 115 | 86 | 89.1 |
| 16.26 | 15.6 | 66 | 15.92 | 87.68 | 66 | 106 | 106 | 87.68 |
| 14.94 | 14.08 | 86 | 14.5 | 89.1 | 86 | 86 | 115 | 91.98 |
| 13.3 | 12.19 | 111 | 12.74 | 90.86 | 111 | 61 | 135 | 94.28 |
| 11.69 | 10.31 | 138 | 10.99 | 92.61 | 138 | 34 | 153 | 99.27 |
| 11.72 | 10 | 172 | 10.84 | 92.76 | 172 | 0 | 172 | 100 |

Cross-section No.3: Routing reach in sub-basin 2B (start from the left bank), after the confluence

| T | B | Dist (feet) | Rod (feet) | Elevation | | | Dist (feet) | Elevation |
|---|---|---|---|---|---|---|---|---|
| 0 | 0 | 0 | 5.1 | 100 | 0 | 0 | 0 | 100 |
| 5.88 | 5.67 | 21 | 5.78 | 99.32 | 21 | 21 | 21 | 99.32 |
| 12.77 | 12.4 | 37 | 12.59 | 92.51 | 37 | 37 | 37 | 92.51 |
| 13.03 | 12.45 | 58 | 12.73 | 92.37 | 58 | 58 | 58 | 92.37 |
| 12.47 | 11.8 | 67 | 12.13 | 92.97 | 67 | 67 | 67 | 92.97 |
| 8.07 | 7.2 | 87 | 7.63 | 97.47 | 87 | 87 | 87 | 97.47 |
| | | 107 | 7.63 | 97.47 | 107 | 107 | 107 | 97.47 |

Cross-section No.4: Routing reach in sub-basin 2B (start from the left bank), before the confluence, upper reach

| T | B | Dist (feet) | Rod (feet) | Elevation | | | Dist (feet) | Elevation |
|---|---|---|---|---|---|---|---|---|
| 0 | 0 | 0 | 4.8 | 100 | 0 | 0 | 0 | 100 |
| 6.68 | 6.53 | 15 | 6.6 | 98.2 | 15 | 15 | 15 | 98.2 |
| 11.54 | 11.24 | 30 | 11.39 | 93.41 | 30 | 30 | 30 | 93.41 |
| | | 43 | 11.39 | 93.41 | 43 | 43 | 43 | 93.41 |
| | | 56 | 4.8 | 100 | 56 | 56 | 56 | 100 |
| | | 76 | 5.5 | 99.3 | 76 | 76 | 76 | 99.3 |

Cross-section No.5 : Routing reach in sub-basin 8B (start from the right bank)

| T | B | Dist (meter | Dist (feet) | Rod (meter | Rod (feet) | Elevation | | | left bank starts Dist (feet) | Elevation |
|---|---|---|---|---|---|---|---|---|---|---|
| 0 | 0 | 0 | 0 | 1.45 | 4.75745 | 100 | 0 | 114.835 | 0 | 100 |
| 1.67 | 1.63 | 4 | 13.124 | 1.65 | 5.41365 | 99.3438 | 13.124 | 101.711 | 16.405 | 98.78603 |
| 3.5 | 3.4 | 10 | 32.81 | 3.45 | 11.31945 | 93.438 | 32.81 | 82.025 | 42.653 | 97.21115 |
| 3.58 | 3.4 | 18 | 59.058 | 3.5 | 11.4835 | 93.27395 | 59.058 | 55.777 | 55.777 | 93.27395 |
| 2.4 | 2.18 | 22 | 72.182 | 2.3 | 7.5463 | 97.21115 | 72.182 | 42.653 | 82.025 | 93.438 |
| 2 | 1.7 | 30 | 98.43 | 1.82 | 5.97142 | 98.78603 | 98.43 | 16.405 | 101.711 | 99.3438 |
| | | 35 | 114.835 | 1.45 | 4.75745 | 100 | 114.835 | 0 | 114.835 | 100 |

Cross-section No.6: Routing reach in sub-basin 9B (start from the left bank)

| T | B | Dist (meter | Dist (feet) | Rod (meter | Rod (feet) | Elevation | | | Dist (feet) | Elevation |
|---|---|---|---|---|---|---|---|---|---|---|
| 0 | 0 | 0 | 0 | 1.45 | 4.75745 | 100 | 0 | 0 | 0 | 100 |
| 1.74 | 1.7 | 4 | 13.124 | 1.72 | 5.64332 | 99.11413 | 13.124 | 13.124 | 13.124 | 99.11413 |
| 2.7 | 2.6 | 10 | 32.81 | 2.2 | 7.2182 | 97.53925 | 32.81 | 32.81 | 32.81 | 97.53925 |
| 3.2 | 3.05 | 15 | 49.215 | 2.94 | 9.64614 | 95.11131 | 49.215 | 49.215 | 49.215 | 95.11131 |
| 3.54 | 3.35 | 19 | 62.339 | 3.44 | 11.28664 | 93.47081 | 62.339 | 62.339 | 62.339 | 93.47081 |
| 3.4 | 3.2 | 20 | 65.62 | 3.3 | 10.8273 | 93.93015 | 65.62 | 65.62 | 65.62 | 93.93015 |
| 2.96 | 2.7 | 26 | 85.306 | 2.84 | 9.31804 | 95.43941 | 85.306 | 85.306 | 85.306 | 95.43941 |
| 2.58 | 2.28 | 30 | 98.43 | 2.44 | 8.00564 | 96.75181 | 98.43 | 98.43 | 98.43 | 96.75181 |
| | | 45 | 147.645 | 1.45 | 4.75745 | 100 | 147.645 | 147.645 | 147.645 | 100 |

*Cross-section No.7 : Routing reach in sub-basin 3B (start from the right bank)*

| T | B | Dist (meter | Dist (feet) | Rod (meter | Rod (feet) | Elevation | | | left bank starts Dist (feet) | Elevation |
|---|---|---|---|---|---|---|---|---|---|---|
| 0 | 0 | 0 | 0 | 1.46 | 4.79026 | 100 | 0 | 95.149 | 0 | 98.22826 |
| | | 3 | 9.843 | 2 | 6.562 | 98.22826 | 9.843 | 85.306 | 16.405 | 96.719 |
| 2.88 | 2.8 | 8 | 26.248 | 2.85 | 9.35085 | 95.43941 | 26.248 | 68.901 | 22.967 | 94.61916 |
| 4.12 | 4 | 12 | 39.372 | 4.05 | 13.28805 | 91.50221 | 39.372 | 55.777 | 36.091 | 88.71336 |
| 4.75 | 4.6 | 15 | 49.215 | 4.68 | 15.35508 | 89.43518 | 49.215 | 45.934 | 45.934 | 89.43518 |
| 4.98 | 4.8 | 18 | 59.058 | 4.9 | 16.0769 | 88.71336 | 59.058 | 36.091 | 55.777 | 91.50221 |
| 3.22 | 3 | 22 | 72.182 | 3.1 | 10.1711 | 94.61916 | 72.182 | 22.967 | 68.901 | 95.43941 |
| 2.58 | 2.34 | 24 | 78.744 | 2.46 | 8.07126 | 96.719 | 78.744 | 16.405 | 85.306 | 98.22826 |
| 2.14 | 1.85 | 29 | 95.149 | 2 | 6.562 | 98.22826 | 95.149 | 0 | 95.149 | 100 |

Cross-section No.8 : Routing reach in sub-basin 5B (start from the right bank)

| T | B | Dist (meter | Dist (feet) | Rod (meter | Rod (feet) | Elevation | | | left bank starts Dist (feet) | Elevation |
|---|---|---|---|---|---|---|---|---|---|---|
| 0 | 0 | 0 | 0 | 1.35 | 4.42935 | 100 | 0 | 104.992 | 0 | 100.3281 |
| | | 3 | 9.843 | 1.42 | 4.65902 | 99.77033 | 9.843 | 95.149 | 52.496 | 97.53925 |

| | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| 2.2 | 2.1 | 10 | 32.81 | 2.16 | 7.08696 | 97.34239 | 32.81 | 72.182 | 72.182 | 97.34239 |
| 2.18 | 2.02 | 16 | 52.496 | 2.1 | 6.8901 | 97.53925 | 52.496 | 52.496 | 95.149 | 99.77033 |
| 1.42 | 1.1 | 32 | 104.992 | 1.25 | 4.10125 | 100.3281 | 104.992 | 0 | 104.992 | 100 |

Cross-section No.9 : Routing reach in sub-basin 14B (start from the right bank)

| T | B | Dist (meter | Dist (feet) | Rod (meter | Rod (feet) | Elevation | | | left bank starts | |
|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | | | Dist (feet) | Dist (feet) | Dist (feet) | Elevation |
| 0 | 0 | 0 | 0 | 1.3 | 4.2653 | 100 | 0 | 203.422 | 0 | 100 |
| | | 8 | 26.248 | 1.8 | 5.9058 | 98.3595 | 26.248 | 177.174 | 32.81 | 96.25966 |
| 3.54 | 3.34 | 20 | 65.62 | 3.42 | 11.22102 | 93.04428 | 65.62 | 137.802 | 55.777 | 89.99295 |
| 4.25 | 3.94 | 31 | 101.711 | 4.1 | 13.4521 | 90.8132 | 101.711 | 101.711 | 101.711 | 90.8132 |
| 4.58 | 4.13 | 45 | 147.645 | 4.35 | 14.27235 | 89.99295 | 147.645 | 55.777 | 137.802 | 93.04428 |
| 2.7 | 2.18 | 52 | 170.612 | 2.44 | 8.00564 | 96.25966 | 170.612 | 32.81 | 177.174 | 98.3595 |
| 1.62 | 1 | 62 | 203.422 | 1.3 | 4.2653 | 100 | 203.422 | 0 | 203.422 | 100 |

Cross-section No. 10: Routing reach in sub-basin 13B or 15B (start from the left bank)

| T | B | Dist (meter | Dist (feet) | Rod (meter | Rod (feet) | Elevation | Dist (feet) | Dist (feet) | Dist (feet) | Elevation |
|---|---|---|---|---|---|---|---|---|---|---|
| 0 | 0 | 0 | 0 | 1.12 | 3.67472 | 100 | 0 | 0 | 0 | 100 |
| | | 8 | 26.248 | 1.52 | 4.98712 | 98.6876 | 26.248 | 26.248 | 26.248 | 98.6876 |
| 2.98 | 2.86 | 12 | 39.372 | 2.92 | 9.58052 | 94.0942 | 39.372 | 39.372 | 39.372 | 94.0942 |
| 4.12 | 3.92 | 20 | 65.62 | 4.02 | 13.18962 | 90.4851 | 65.62 | 65.62 | 65.62 | 90.4851 |
| 4.9 | 4.6 | 30 | 98.43 | 4.75 | 15.58475 | 88.08997 | 98.43 | 98.43 | 98.43 | 88.08997 |
| 4 | 3.6 | 40 | 131.24 | 3.8 | 12.4678 | 91.20692 | 131.24 | 131.24 | 131.24 | 91.20692 |
| 3.1 | 2.55 | 55 | 180.455 | 2.82 | 9.25242 | 94.4223 | 180.455 | 180.455 | 180.455 | 94.4223 |
| 3.2 | 2.46 | 74 | 242.794 | 2.82 | 9.25242 | 94.4223 | 242.794 | 242.794 | 242.794 | 94.4223 |

Cross-section No.11: Routing reach in sub-basin 17B (start from the left bank)

| T | B | Dist (meter | Dist (feet) | Rod (meter | Rod (feet) | Elevation | Dist (feet) | Dist (feet) | Dist (feet) | Elevation |
|---|---|---|---|---|---|---|---|---|---|---|
| 0 | 0 | 0 | 0 | 1.17 | 3.83877 | 100 | 0 | 0 | 0 | 100 |
| | | 10 | 32.81 | 1.16 | 3.80596 | 100.0328 | 32.81 | 32.81 | 32.81 | 100.0328 |
| 2.04 | 1.92 | 12 | 39.372 | 1.98 | 6.49638 | 97.34239 | 39.372 | 39.372 | 39.372 | 97.34239 |
| 4.45 | 4.3 | 15 | 49.215 | 4.38 | 14.37078 | 89.46799 | 49.215 | 49.215 | 49.215 | 89.46799 |
| 4.74 | 4.5 | 24 | 78.744 | 4.6 | 15.0926 | 88.74617 | 78.744 | 78.744 | 78.744 | 88.74617 |
| 4.85 | 4.52 | 33 | 108.273 | 4.7 | 15.4207 | 88.41807 | 108.273 | 108.273 | 108.273 | 88.41807 |
| 4.48 | 4.05 | 43 | 141.083 | 4.25 | 13.94425 | 89.89452 | 141.083 | 141.083 | 141.083 | 89.89452 |
| 3.68 | 3.12 | 56 | 183.736 | 3.4 | 11.1554 | 92.68337 | 183.736 | 183.736 | 183.736 | 92.68337 |
| 3 | 2.3 | 70 | 229.67 | 2.68 | 8.79308 | 95.04569 | 229.67 | 229.67 | 229.67 | 95.04569 |
| 1.3 | | 130 | 426.53 | 0.9 | 2.9529 | 100.8859 | 255.918 | 255.918 | 255.918 | 100.8859 |

The following data start from the left bank (looking downstream). The 1st column is station and the 2nd is elevation both in feet. The 1st group data are for cross-section No. 1. The 2nd is for No.2. ...

No. 1

| Dist (feet) | Elevation | Rod (feet) | Manning's rincre. Dist | | Manning's n for left, main, and right | | |
|---|---|---|---|---|---|---|---|
| 0 | 96.82 | 8.28 | | | | | |
| 31 | 94.2 | 8.28 | 0.06 | 31 | | 8 | 8.28 |
| 49 | 94.24 | 10.9 | 0.06 | 18 | 0.06 | 7 | 8.28 |
| 75 | 90.96 | 10.86 | 0.035 | 26 | | 6 | 10.9 |
| 106 | 91.57 | 14.14 | 0.03 | 31 | 0.031857 | 5 | 10.86 |
| 119 | 99.69 | 13.53 | 0.03 | 13 | | 4 | 14.14 |
| 145 | 100 | 5.41 | 0.05 | 26 | 0.05 | 3 | 13.53 |
| 150 | 100 | 5.1 | 0.05 | 5 | | 2 | 5.41 |
| | | | | | | 1 | 5.1 |

No. 2

left bank starts

| Dist (feet) | Elevation | Rod (feet) | Manning's rincre. Dist | | Manning's n for left, main, and right | | |
|---|---|---|---|---|---|---|---|
| 0 | 92.76 | 10.99 | | | | | |
| 34 | 92.61 | 12.74 | 0.06 | 34 | | | |
| 61 | 90.86 | 14.5 | 0.035 | 27 | 0.048934 | | |
| 86 | 89.1 | 15.92 | 0.035 | 25 | | | Rod (feet) |
| 106 | 87.68 | 11.62 | 0.045 | 20 | 0.041204 | 9 | 10.84 |
| 115 | 91.98 | 9.32 | 0.05 | 9 | | 8 | 10.99 |
| 135 | 94.28 | 4.33 | 0.05 | 20 | 0.05 | 7 | 12.74 |
| 153 | 99.27 | 3.6 | 0.05 | 18 | | 6 | 14.5 |
| | | | | | | 5 | 15.92 |
| | | | | | | 4 | 11.62 |
| | | | | | | 3 | 9.32 |
| | | | | | | 2 | 4.33 |
| | | | | | | 1 | 3.6 |

No. 3

| Dist (feet) | Elevation | Rod (feet) | Manning's rincre. Dist | | Manning's n for left, main, and right |
|---|---|---|---|---|---|
| 0 | 100 | 5.1 | | | |
| 21 | 99.32 | 5.78 | 0.045 | 21 | |
| 37 | 92.51 | 12.59 | 0.035 | 16 | 0.040676 |
| 58 | 92.37 | 12.73 | 0.035 | 21 | |
| 67 | 92.97 | 12.13 | 0.035 | 9 | 0.035 |
| 87 | 97.47 | 7.63 | 0.035 | 20 | |
| 107 | 97.47 | 7.63 | 0.06 | 20 | 0.06 |
| 112 | 97.47 | 7.63 | 0.06 | 5 | |

No. 4

| Dist (feet) | Elevation | Rod (feet) | Manning's rincre. Dist | | Manning's n for left, main, and right |
|---|---|---|---|---|---|
| 0 | 100 | 4.8 | | | |
| 15 | 98.2 | 6.6 | 0.06 | 15 | |
| 30 | 93.41 | 11.39 | 0.06 | 15 | 0.06 |
| 43 | 93.41 | 11.39 | 0.035 | 13 | |
| 56 | 100 | 4.8 | 0.06 | 13 | 0.052935 |
| 76 | 99.3 | 5.5 | 0.06 | 20 | |
| 81 | 99.3 | 5.5 | 0.06 | 5 | 0.06 |
| 86 | 99.3 | 5.5 | 0.06 | 5 | |

No.5

left bank starts

| Dist (feet) | Elevation | Rod (meter | Manning's rincre. Dist | | Manning's n for left, main, and right | | |
|---|---|---|---|---|---|---|---|
| 0 | 100 | 1.45 | | | | 7 | 1.45 |
| 16.405 | 98.78603 | 1.82 | 0.07 | 16.405 | | 6 | 1.82 |

| | | | | | | | |
|---|---|---|---|---|---|---|---|
| 42.653 | 97.21115 | 2.3 | 0.07 | 26.248 | 0.07 | 5 | 2.3 |
| 55.777 | 93.27395 | 3.5 | 0.05 | 13.124 | | 4 | 3.5 |
| 82.025 | 93.438 | 3.45 | 0.035 | 26.248 | 0.043333 | 3 | 3.45 |
| 101.711 | 99.3438 | 1.65 | 0.05 | 19.686 | | 2 | 1.65 |
| 114.835 | 100 | 1.45 | 0.07 | 13.124 | 0.07 | 1 | 1.45 |
| 119.835 | 100 | 1.45 | 0.07 | 5 | | | |

No.6

| Dist (feet) | Elevation | Rod (meter | Manning's n | Incre. Dist | Manning's n for left, main, and right |
|---|---|---|---|---|---|
| 0 | 100 | 1.45 | | | |
| 13.124 | 99.11413 | 1.72 | 0.07 | 13.124 | |
| 32.81 | 97.53925 | 2.2 | 0.07 | 19.686 | 0.07 |
| 49.215 | 95.11131 | 2.94 | 0.07 | 16.405 | |
| 62.339 | 93.47081 | 3.44 | 0.07 | 13.124 | 0.0675 |
| 65.62 | 93.93015 | 3.3 | 0.045 | 3.281 | |
| 85.306 | 95.43941 | 2.84 | 0.07 | 19.686 | 0.07 |
| 98.43 | 96.75181 | 2.44 | 0.07 | 13.124 | |
| | | 1.45 | | | |

No.7

left bank starts

| Dist (feet) | Elevation | Rod (meter | Manning's n | Incre. Dist | Manning's n for left, main, and right | | |
|---|---|---|---|---|---|---|---|
| 0 | 98.22826 | 2 | | | | | |
| 16.405 | 96.719 | 2.46 | 0.05 | 16.405 | | 9 | 2 |
| 22.967 | 94.61916 | 3.1 | 0.06 | 6.562 | 0.052857 | 8 | 2.46 |
| 36.091 | 88.71336 | 4.9 | 0.06 | 13.124 | | 7 | 3.1 |
| 45.934 | 89.43518 | 4.68 | 0.035 | 9.843 | 0.045 | 6 | 4.9 |
| 55.777 | 91.50221 | 4.05 | 0.035 | 9.843 | | 5 | 4.68 |
| 68.901 | 95.43941 | 2.85 | 0.06 | 13.124 | 0.06 | 4 | 4.05 |
| 85.306 | 98.22826 | 2 | 0.06 | | | 3 | 2.85 |
| | | | | | | 2 | 2 |
| | | | | | | 1 | 1.46 |

No.8

left bank starts

| Dist (feet) | Elevation | Rod (meter | Manning's n | Incre. Dist | Manning's n | | Rod (meter) |
|---|---|---|---|---|---|---|---|
| 0 | 100.3281 | 1.25 | | | | 5 | 1.25 |
| 52.496 | 97.53925 | 2.1 | 0.05 | 52.496 | | 4 | 2.1 |
| 72.182 | 97.34239 | 2.16 | 0.035 | 19.686 | 0.045909 | 3 | 2.16 |
| 95.149 | 99.77033 | 1.42 | 0.05 | 22.967 | | 2 | 1.42 |
| 104.992 | 100 | 1.35 | 0.05 | 9.843 | 0.05 | 1 | 1.35 |
| 109.992 | 100 | 1.35 | 0.05 | 5 | | | |
| 114.992 | 100 | 1.35 | 0.05 | 5 | 0.05 | | |
| 119.992 | 100 | 1.35 | 0.05 | | | | |

No.9

left bank starts

| Dist (feet) | Elevation | Rod (meter | Manning's n | Incre. Dist | Manning's n for left, main, and right | | |
|---|---|---|---|---|---|---|---|
| 0 | 100 | 1.3 | | | | | |
| 32.81 | 96.25966 | 2.44 | 0.05 | 32.81 | | 7 | 1.3 |
| 55.777 | 89.99295 | 4.35 | 0.05 | 22.967 | 0.05 | 6 | 2.44 |
| 101.711 | 90.8132 | 4.1 | 0.03 | 45.934 | | 5 | 4.35 |
| 137.802 | 93.04428 | 3.42 | 0.05 | 36.091 | 0.037568 | 4 | 4.1 |
| 177.174 | 98.3595 | 1.8 | 0.035 | 39.372 | | 3 | 3.42 |
| 203.422 | 100 | 1.3 | 0.05 | 26.248 | 0.05 | 2 | 1.8 |
| 208.422 | 100 | 1.3 | 0.05 | 5 | | 1 | 1.3 |

No. 10

| Dist (feet) | Elevation | Rod (meter | Manning's n | Incre. Dist | Manning's n for left, main, and right |
|---|---|---|---|---|---|
| 0 | 100 | 1.12 | | | |
| 26.248 | 98.6876 | 1.52 | 0.05 | 26.248 | |
| 39.372 | 94.0942 | 2.92 | 0.05 | 13.124 | 0.05 |
| 65.62 | 90.4851 | 4.02 | 0.05 | 26.248 | |
| 98.43 | 88.08997 | 4.75 | 0.035 | 32.81 | 0.039286 |
| 131.24 | 91.20692 | 3.8 | 0.035 | 32.81 | |
| 180.455 | 94.4223 | 2.82 | 0.05 | 49.215 | 0.05 |
| 242.794 | 94.4223 | 2.82 | 0.05 | 62.339 | |

No. 11

| Dist (feet) | Elevation | Dist (feet) | Incrementa | Manning's n | Manning's m for left bank, main, right bank |
|---|---|---|---|---|---|
| 0 | 100 | 0 | 0 | | |
| 32.81 | 100.0328 | 39.372 | 39.372 | 0.05 | |
| 39.372 | 97.34239 | 49.215 | 9.843 | 0.06 | 0.052 |
| 49.215 | 89.46799 | 78.744 | 29.529 | 0.07 | 0.061964 |
| 78.744 | 88.74617 | 108.273 | 29.529 | 0.045 | 0.05963 |
| 108.273 | 88.41807 | 141.083 | 32.81 | 0.07 | |
| 141.083 | 89.89452 | 183.736 | 42.653 | 0.07 | |
| 183.736 | 92.68337 | 229.67 | 45.934 | 0.05 | |
| 229.67 | 95.04569 | | | | |
| 255.918 | 100.8859 | | | | |

## Appendix 6 Information and Output File for USGS Regression Equation (Jennings et al., 1994)

Flow data computed with the National Flood Frequency Program in WMS.

Arizona, Basin: 1B, Total Area (sq mi): 8.12

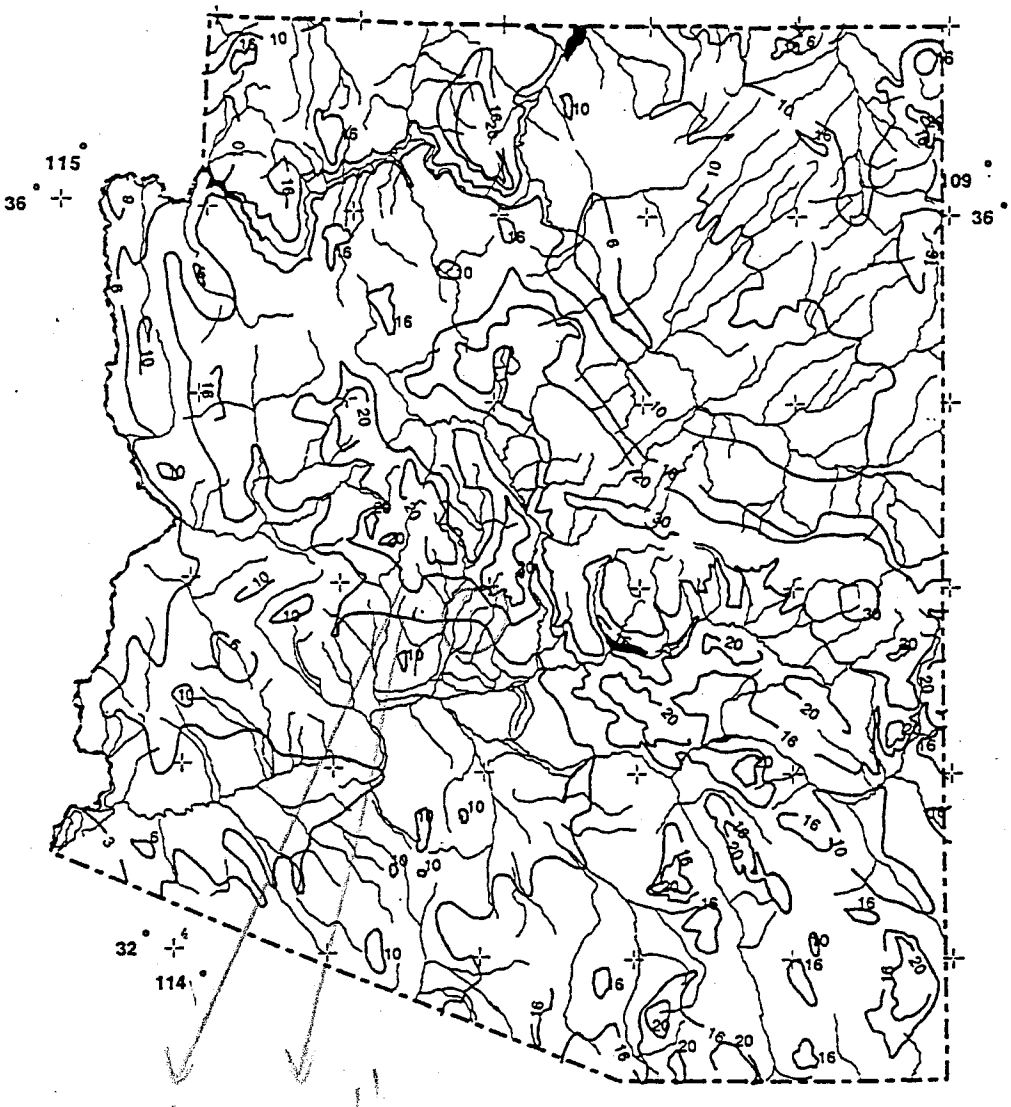
| Region | Variable Descriptor | Input Value | Suggested Minimum | Suggested Maximum | |
|---|---|---|---|---|---|
| Central Mountain Area | | | | | |
| U.S. Max Fld Rgn: 16 | | | | | |
| | Drainage Area (sq mi) A*: | 8.12 | 0.06 | 5499.00 | |
| | Mean Basin Elevation (thousands of feet) E*: | 2.25 | 1.78 | | 7.40 |
| | Mean Annual Precipitation (in) P: | 16.00 | 10.00 | 30.00 | |

**********

MAXIMUM FLOOD ENVELOPE: 53800 (cfs)

| Recurrence Interval | | Peak (cfs) | Std Error | Equiv. Years |
|---|---|---|---|---|
| Rural Peak | Q2 | 246 | 81.0 | 3 |
| Rural Peak | Q5 | 940 | 64.0 | 5 |
| Rural Peak | Q10 | 1860 | 58.0 | 7 |
| Rural Peak | Q25 | 3740 | 58.0 | 8 |
| Rural Peak | Q50 | 5910 | 61.0 | 9 |
| Rural Peak | Q100 | 8720 | 66.0 | 9 |
| Rural Peak | Q500 | 19100 | 78.0 | 10 |

End of flow data.




16" 10"

Use 14" for New Plan

**EXPLANATION**

— 30 — Line of equal mean annual precipitation ( interval, in inches, is variable )

0 50 100 MILES

0 50 100 KILOMETERS

Digital base from U.S. Geological Survey 1:2,000,000 , 1970
Albers equal-area projection based on standard parallels 29.5 and 45.5 degrees

**Figure 2.** Mean annual precipitation in Arizona.

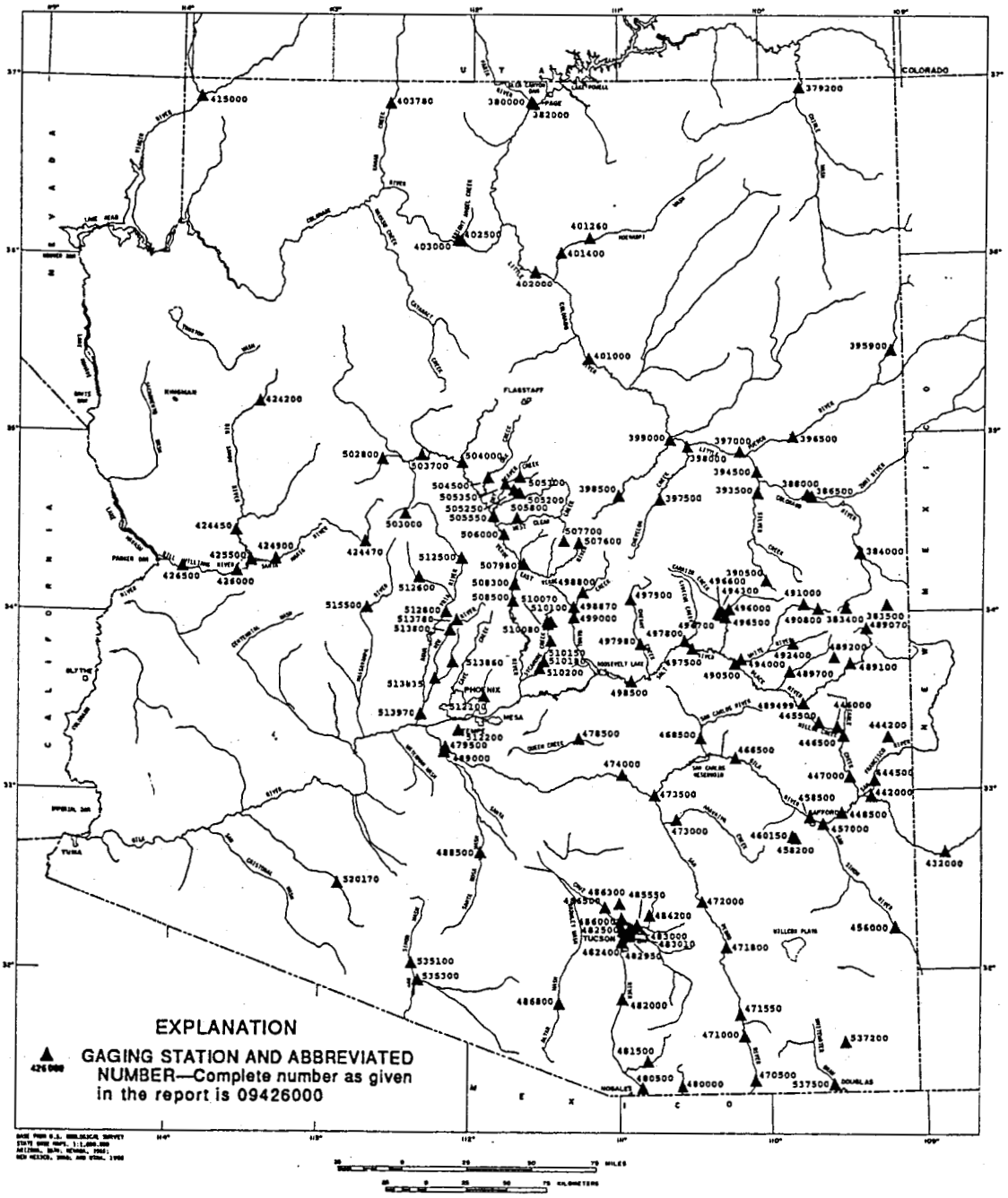



Figure 1.--Location of continuous-gaging stations.

# Appendix 7 Flooding Report at Town of New River (MCDOT)

Maricopa County Department of Transportation
Operations Complaint Report

01/22/1998

**Complaint Num:** 12866

**Main Road:** NEW RIVER RD

**Secondary Road:** 023RD AVE

**Tertiary Road:**

**Title:** NEW RIVER

**First Name:** CITIZEN

**Last Name:**

**Log Date:** 11/08/1997

**Time:** :

**Work Date:** 12/11/1997

**Status Code:** C

**Area Code:** 1

**Purpose:** BROKEN PIPE

**Comments:**

PIPE BLOCKED. WATER RUNNING DOWN SHOULDER OF ROAD. BLUE STAKE NUMBER #416732. PIPE OPENED UP AND CLEANED ON BOTH ENDS. HEADWALL ALSO BEING REPAIRED PER DENNIS CLARK.

**Maricopa County Department of Transportation**
**Operations Complaint Report**

**02/09/1998**

**Complaint Num:** 11732 **Main Road:** 023RD AVE

**Secondary Road:** NEW RIVER RD **Tertiary Road:**

**Title:**

**First Name:** JOE **Last Name:**

**Log Date:** 11/18/1996 **Time:** :

**Work Date:** 11/18/1996 **Status Code:** C **Area Code:** 2

**Purpose:** CULVERT

**Comments:**

MAN REQUESTING CULVERT FOR DRAINAGE PROBLEMS IN AREA. NO

ACTION AT THIS TIME PER DENNIS CLARK. ALSO SEE #11726 IN

A MAGNESIUM CLORIDE REQUEST FOR DUST CONTROL. BOTH REQUESTS

DENIED.DRIVEWAY PIPE IS OWNERS RESPONSIBILITY IN THIS CASE.

Maricopa County Department of Transportation
Operations Complaint Report

02/09/1998

**Complaint Num:** 11851 **Main Road:** COYOTE PASS

**`econdary Road:** NEW RIVER RD **Tertiary Road:**

**Title:** AREA RESIDENT

**First Name:** ROBERTA **Last Name:** BRAMMLET

**Log Date:** 01/13/1997 **Time:** 9 : 30

**Work Date:** 01/15/1997 **Status Code:** C **Area Code:** 1

**Purpose:** DRAINAGE PROBLEM(S)

**Comments:**

DRAINAGE PROBLEMS. PLEASE ADDRESS. WILL CORRECT DRAINAGE ISSUE NEXT TIME ROAD IS GRADED PER SCOTT JOHNSON.

Maricopa County Department of Transportation
Operations Complaint Report

02/09/1998

**Complaint Num:** 1627 **Main Road:** 027TH AVE

**'econdary Road:** NEW RIVER RD **Tertiary Road:**

**Title:**

**First Name:** MRS **Last Name:** DYERS

**Log Date:** 07/22/1986 **Time:** 3 : 30

**Work Date:** 07/22/1986 **Status Code:** C **Area Code:** 1

**Purpose:** ROAD WASHED OUT

**Comments:**

ROAD WASHED OUT.

THE ROAD WAS MAINTAINFED PER DAVID ORNELAS ON 07/25/86.

Maricopa County Department of Transportation
Operations Complaint Report

02/09/1998

**Complaint Num:** 7812 **Main Road:** COYOTE PASS

**Secondary Road:** **Tertiary Road:**

**Title:** RESIDENT

**First Name:** CORY **Last Name:** SILVA

**Log Date:** 01/12/1993 **Time:** :

**Work Date:** 01/16/1993 **Status Code:** C **Area Code:** 1

**Purpose:** ROAD WASHED OUT

**Comments:**

IOPENED UP BOTH ENDS OF ROAD AND PLACED SOME AB ON THE

ROAD. WORK DONE BY AL DESHAZO CREW AND STEVE MITCHAM PER

SCOTT JOHNSON. SEVERE STORM DAMAGE NORTH OF NEW RIVER

SCHOOL.

Maricopa County Department of Transportation
Operations Complaint Report

02/09/1998

**Complaint Num:** 7889 **Main Road:** KELLEY RD

**Secondary Road:** NEW RIVER RD **Tertiary Road:**

**Title:** RESIDENT

**First Name:** STONEY **Last Name:** CONWAY

**Log Date:** 02/04/1993 **Time:** 9 : 40

**Work Date:** 02/19/1993 **Status Code:** C **Area Code:** 1

**Purpose:** ROAD WASHED OUT

**Comments:**

NO ONE THERE SINCE STORM, ROAD IN NEED OF REPAIR.

ROAD BLADED BUT STILL CLOSED AT RIVER, WATER STILL

RUNNING ACROSS ROAD AT THAT LOCATION PER RALPH PETERSON.

Maricopa County Department of Transportation
Operations Complaint Report

02/09/1998

**Complaint Num:** 4107 **Main Road:** 027TH AVE

**Secondary Road:** NEW RIVER RD **Tertiary Road:**

**Title:** HOME OWNER

**First Name:** BARRY **Last Name:** MYRES

**Log Date:** 08/22/1988 **Time:** 3 : 25

**Work Date:** 08/29/1988 **Status Code:** C **Area Code:** 1

**Purpose:** STANDING WATER

**Comments:**

FLOODING PROBLEMS.

HE LIVES ON 027TH AVENUE N/O NEW RIVER ROAD. THERE IS A

PROJECT GOING ON BY COUNTY.WE ARE FLOODING HIS YARD.

HE SPOKE TO CHERLIE PENNINGTON,

I MEET WITH MR.MEYER ON THURESDAY AT 11:30, ON THURSDAY

08/29/88. WE AGREE TO LOWER THE EAST END OF THE WASH IN

ORDER FOR THE WATER STREAM TO FFLOW THRU THIS AREA.

PER OTIS JACKSON ON 08/29/88.

Maricopa County Department of Transportation
Operations Complaint Report

02/09/1998

**Complaint Num:** 1407 **Main Road:** NEW RIVER RD

**Secondary Road:** FIG SPRINGS RD **Tertiary Road:** GIBBONS RD

**Title:**

**First Name:** COLLEN **Last Name:** STEPHENSON

**Log Date:** 03/14/1986 **Time:** 3 : 50

**Work Date:** 03/14/1986 **Status Code:** C **Area Code:** 1

**Purpose:** STANDING WATER

**Comments:**

STANDING WATER/THICK MUD.

THE POST OFFICE WON'T DELIVER MAIL TO SOME OF THE BOXES

BECAUSE OF THE MUD.

TALKED TO COLLEN STEPHENSON-WILL FIND

SOME SHALE IN THE WASHES FOR HER MAIL

BOX.PER JIM BRUNDAGE 3-18-86

Maricopa County Department of Transportation
Operations Complaint Report

02/09/1998

**Complaint Num:** 8686

**Main Road:** 027TH AVE

**Secondary Road:** NEW RIVER RD

**Tertiary Road:** MINGUS RD

**Title:** AREA RESIDENT

**First Name:** KATHY

**Last Name:** DORSEY

**Log Date:** 09/16/1993

**Time:** 4 : 5

**Work Date:** 09/29/1993

**Status Code:** C

**Area Code:** 1

**Purpose:** CULVERT

**Comments:**

SPILL WAY REPAIRED BY RICK STEINER PER SCOTT JOHNSON.

## Gene Coster - MCDOTX

**From:** Gary Lasham - MCDOTX
**Sent:** Wednesday, January 21, 1998 3:52 PM
**To:** Gene Coster - MCDOTX
**Subject:** Drainage Complaints in the area of New River Road; I-17 Frontage to 27th Ave

Please search our complaint data base for drainage complaints in the New river Area, around New River Road; I-17 Frontage to 27th Ave and pass the results on to Bing Zhao, FCD (6-3293).

thanks,

# Appendix 8 Flow Temporarily Intercepted by New River Road

# SLOPE AREA SURVEYING NOTES

Right-bank

SITE: before 23rd NO. 12 DATE 5/18/98

| STA | AZIM | T / B | DIST | ROD | ELEV | REMARKS |
|---|---|---|---|---|---|---|
| 0 | | / | 0 | 4 | 1040 | may not be necessary |
| | | / | 4.6' | 5.1' | 98.9 | |
| | | / | 10' | 6.1 | 97.9 | |
| | | / | 15' | 5.45' | 98.6 | |
| | | / | 20' | 4.5' | 99.5 | |
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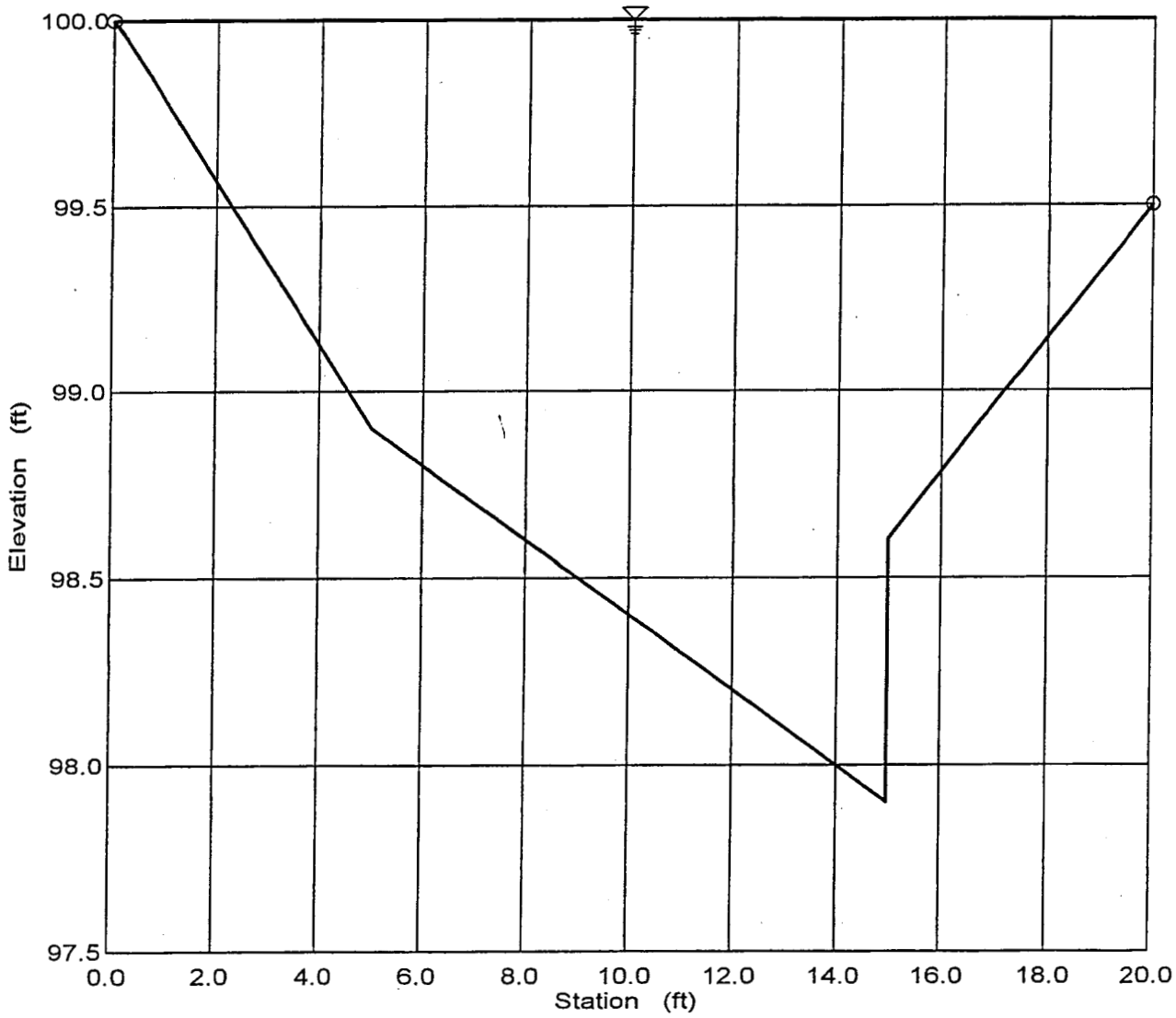
PARTY: PAGE:

# Cross Section
## Cross Section for Irregular Channel

| Project Description | |
|---|---|
| Project File | untitled.fm2 |
| Worksheet | New River Road |
| Flow Element | Irregular Channel |
| Method | Manning's Formula |
| Solve For | Discharge |

| Section Data | | |
|---|---|---|
| Wtd. Mannings Coefficient | 0.030 | |
| Channel Slope | 0.012000 | ft/ft |
| Water Surface Elevation | 100.00 | ft |
| Discharge | 135.51 | cfs |



# Worksheet
## Worksheet for Irregular Channel

| Project Description | |
|---|---|
| Project File | untitled.fm2 |
| Worksheet | New River Road |
| Flow Element | Irregular Channel |
| Method | Manning's Formula |
| Solve For | Discharge |

| Input Data | | |
|---|---|---|
| Channel Slope | 0.012000 | ft/ft |
| Water Surface Elevation | 100.00 | ft |

Elevation range: 97.90 ft to 100.00 ft.

| Station (ft) | Elevation (ft) | Start Station | End Station | Roughness |
|---|---|---|---|---|
| 0.00 | 100.00 | 0.00 | 20.00 | 0.030 |
| 5.00 | 98.90 | | | |
| 15.00 | 97.90 | | | |
| 15.00 | 98.60 | | | |
| 20.00 | 99.50 | | | |

| Results | | |
|---|---|---|
| Wtd. Mannings Coefficient | 0.030 | |
| Discharge | 135.51 | cfs |
| Flow Area | 23.50 | ft² |
| Wetted Perimeter | 21.45 | ft |
| Top Width | 20.00 | ft |
| Height | 2.10 | ft |
| Critical Depth | 99.95 | ft |
| Critical Slope | 0.013765 | ft/ft |
| Velocity | 5.77 | ft/s |
| Velocity Head | 0.52 | ft |
| Specific Energy | 100.52 | ft |
| Froude Number | 0.94 | |

Flow is subcritical.

Water elevation exceeds lowest end station by 0.50 ft.