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Flood Assessment at the Area 5 Radioactive Waste Management Site & The Proposed Hazardous Waste Storage unit, DOE/NTS, Nye County, NV Study of 100-Year Flood Hazard

Author

Schmeltzer, J.S., J. J. Miller & D. L. Gustafson

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Flood Assessment at the Area 5 Radioactive Waste Management Site and the Proposed Hazardous Waste Storage Unit

DOE/Nevada Test Site, Nye County, Nevada

Prepared by Raytheon Services Nevada
Environmental Restoration and
Waste Management Division -
Waste Management Program for the
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on Services Nevada

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REVIEW DRAFT

FLOOD ASSESSMENT AT THE AREA 5 RADIOACTIVE WASTE MANAGEMENT SITE AND THE PROPOSED HAZARDOUS WASTE STORAGE UNIT DOE/NEVADA TEST SITE, NYE COUNTY, NEVADA

J. S. Schmeltzer, J. J. Miller, and D. L. Gustafson

Raytheon Services Nevada
222 South Rainbow Boulevard
Las Vegas, Nevada 89128

Prepared for
The United States Department of Energy
2753 South Highland Drive
Las Vegas, Nevada 89193

under Raytheon Services Nevada Contract DE-AC08-91NV10833

January 1993

APPROVALS

FLOOD ASSESSMENT AT THE AREA 5 RADIOACTIVE WASTE MANAGEMENT SITE AND THE PROPOSED HAZARDOUS WASTE STORAGE UNIT DOE/NEVADA TEST SITE, NYE COUNTY, NEVADA	
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Raytheon Services Nevada
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FLOOD ASSESSMENT

EXECUTIVE SUMMARY

A flood assessment at the Radioactive Waste Management Site (RWMS) and the proposed Hazardous Waste Storage Unit (HWSU) in Area 5 of the Nevada Test Site (NTS) was performed to determine the 100-year flood hazard at these facilities. No previous flood studies of these facilities delineated the 100-year flood hazard. This current study was conducted to determine whether the RWMS and the proposed HWSU are located within a 100-year flood hazard as defined by the Federal Emergency Management Agency (FEMA), and to provide discharges for the design of flood protection.

The overall watershed which could impact the RWMS and the proposed HWSU is approximately 140-square miles. This watershed was divided into 16 subbasins to best represent the hydrology of the study area. United States Geologic Survey (USGS) topographic maps were used to divide the drainage area into subbasins ranging in size from 0.3-square miles to 81.3-square miles. Barren Wash, Scarp Canyon, and Halfpint alluvial fans were delineated. These fans are characterized by incised channels in the upper parts of the fans decreasing to sheetflow in lower parts of the fan.

The 2-year, 10-year, and 100-year discharges were determined using methods and guidelines provided in the Clark County Regional Flood Control District (CCRFCD) *Hydrologic Criteria and Drainage Manual, 1990*. The methodology in the CCRFCD Manual was developed specifically for Southern Nevada by Clark County and the U.S. Army Corps of Engineers, Los Angeles District, and is the most current and region-specific approach to develop discharges. Flood studies conducted in Clark County following the methods provided in the CCRFCD Manual have been accepted by FEMA. The proximity of Area 5 to Clark County and their similar physical and climatic characteristics support the use of this region-specific method as the means of generating discharges for the study area.

As directed in CCRFCD Manual, the HEC-1 rainfall-runoff model developed by the U.S. Army Corps of Engineers was used to generate discharges for the RWMS and the proposed HWSU areas. Hydrologic models were developed for the 2-year, 10-year, and 100-year discharges. Point precipitation values used in this model were taken from NOAA Atlas 2, Volume VII. Field observations were made to determine the vegetation type and cover density, Manning roughness coefficient, slope, channel geometry, and concentration point locations. From this information, curve numbers (a method to quantify precipitation losses) and lag times for each of the subbasins were determined, routing parameters were applied, and discharges were calculated. Discharges developed in this hydrologic analysis were used in the subsequent analysis to define the 100-year flood hazard.

The 100-year flood hazard for the Barren Wash, Scarp Canyon, and Halfpint alluvial fans was analyzed using FAN, a computer program developed by FEMA. This program was used to delineate the flood hazard zones on these alluvial fans in accordance with FEMA methodology. The FAN model requires information regarding apex location, fan boundaries,

potential flow obstructions and diversions, fan surface slopes, Manning roughness coefficients, single-channel versus multiple-channel regions, and the 2-year, 10-year, and 100-year discharges from the hydrologic analysis. This information was gathered from studies of available topographic and surficial geologic maps and intensive field investigations. The results of the alluvial fan analyses are shown on the maps included in this document.

Part of the RWMS is located within the 100-year flood hazard on the Barren Wash Alluvial Fan. The southwest corner of the RWMS is within the Zone AO of the Barren Wash Alluvial Fan. (This part of the RWMS does not include RCRA units covered in the RCRA Part B Permit Application.) FEMA designates alluvial fan flooding, shallow concentrated flow, and sheetflow areas with 100-year flood depths between 1 and 3 feet as Zone AO. FEMA further designates an associated flow velocity for alluvial fan flood hazards.

The HEC-2 model developed by the U.S. Army Corps of Engineers to determine water surface elevations in channels was used to assess the flood hazard of shallow concentrated flow in a channel impacting the southwest corner of the RWMS. This analysis determined that flows exceed a depth of 1 foot along the southwest corner of the RWMS, which places this part of the RWMS in the AO zone.

For the remaining subbasins that could impact the RWMS and the proposed HWSU, flood hazard determinations were conducted assuming sheetflow conditions. This analysis, using FEMA methodology for sheetflow, concluded that depths of flow during the 100-year flow event were less than 1 foot. Thus, the RWMS and the proposed HWSU are not in a 100-year flood hazard as defined by FEMA.

Although the RWMS and the proposed HWSU facilities that are included in the RCRA Part B Permit Application are not within a 100-year flood hazard per FEMA definition (100-year flood depth at or greater than 1 foot), flow from a 100-year event could impact the facilities. Flood protection requirements are being evaluated.

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1.0 INTRODUCTION

1.1 Location

A flood assessment was conducted at the Radioactive Waste Management Site (RWMS) and the proposed Hazardous Waste Storage Unit (HWSU) in Area 5 of the Nevada Test Site (NTS) in Nye County, Nevada (Figure 1). In this report, the RWMS includes the Transuranic (TRU) Radioactive pad, Mixed-Waste Disposal Unit, and Pit 3 within the RWMS. The study area encompasses portions of the Massachusetts Mountains, the Halfpint Range, and the drainages of Barren Wash and Scarp Canyon.

1.2 Purpose

Flood assessment is one of the subtasks related to surficial geology studies at and near the RWMS. Surficial geology studies respond primarily to requirements and guidelines for site characterization found in federal regulations. The principal federal regulations and criteria pertaining to flooding with which the RWMS must comply are:

- Executive Order 11988 (*Floodplain Management*),
- 10 CFR 61.50 (*Technical Requirements for Land Disposal Facilities*),
- 40 CFR 264.18 (*Location Standards for Hazardous Waste Management Facility*),
- 40 CFR 270.14 (*General Requirements for a Hazardous Waste Facility*), and
- Department of Energy (DOE)/Nevada-341, *Environmental Compliance Handbook, September 1990.*

The RWMS must also comply with Nevada Administrative Code 444.8456 (*Restrictions on Locations of Stationary Facilities for Management of Hazardous Waste; Exceptions*). These regulations prohibit the placement of a hazardous waste facility in a 100-year floodplain. This subtask focuses on the potential 100-year flood hazard on the RWMS. Although the flood assessment subtask does not evaluate the erosion hazard over a geologic time scale (10,000 years), as required under 40 CFR 191.13 (*Environmental Standards for the Management and Disposal of Spent Nuclear Fuel, High-Level, and Transuranic Radioactive Waste; Final Rule*), other subtasks are being conducted to gather information regarding erosion on the RWMS. These subtasks include detailed trench and surface mapping, alluvial structure, and seismic fault definitions.

1.3 Objective

The objective of this flood assessment was to determine the 100-year flood hazard on and near the Area 5 RWMS using the most site-specific and applicable approaches for the hydrologic and hydraulic analyses. This flood assessment was conducted to provide hydrologic and hydraulic information for flood protection design and to follow the criteria for flood hazard determination required by the Federal Emergency Management Agency (FEMA), as specified in 40 CFR 270.14.

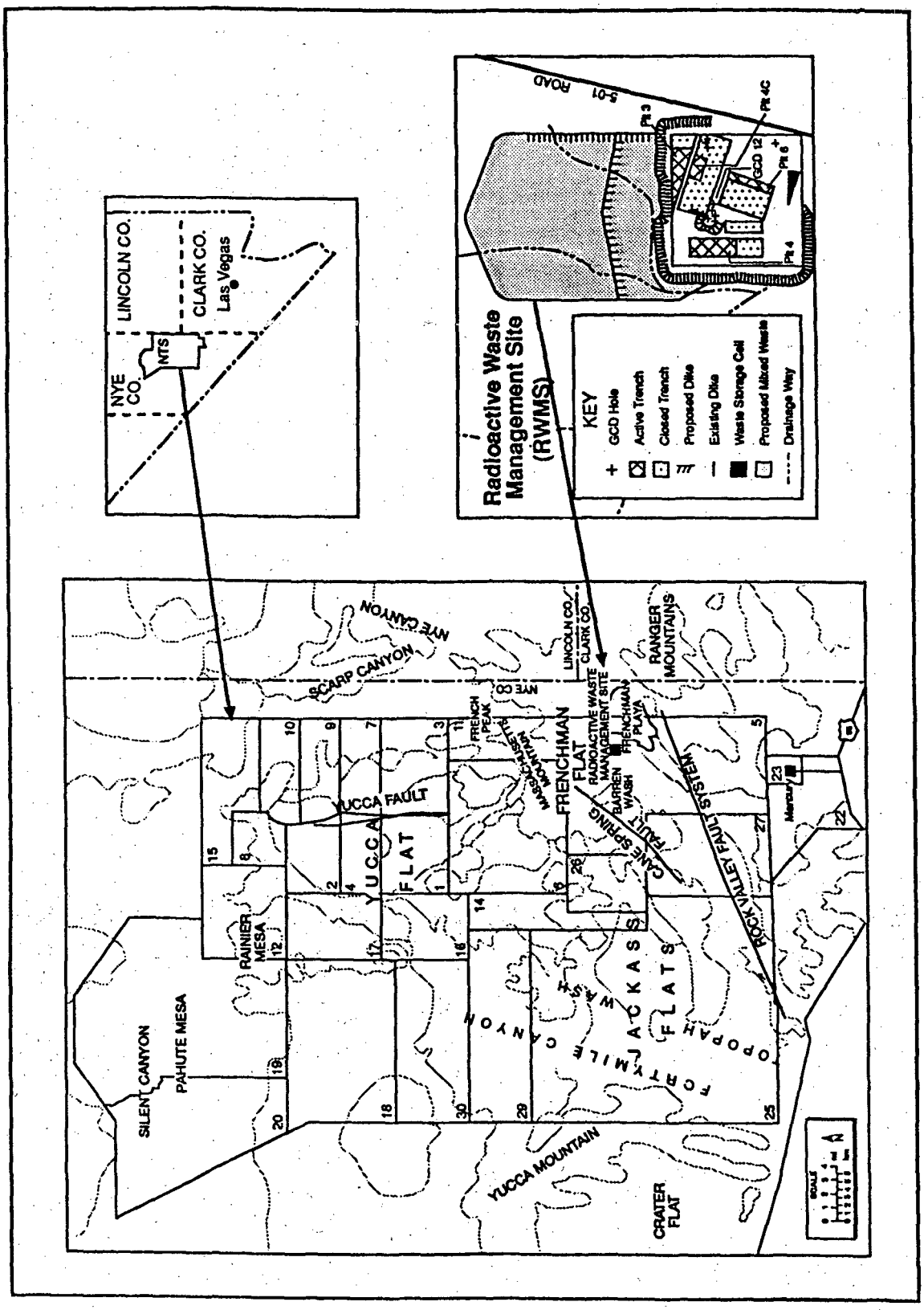

Figure 1. Location Map and Physiographic Features of the Nevada Test Site and the Area 5 Radioactive Waste Management Site

1.4 Previous Studies

Case *et al.*, (1984), French and Lombardo (1984), and Cox (1986) discussed the potential for flooding at the Area 5 RWMS. Rawlinson (1991) reported results of a limited study on surface water at and near the RWMS using methods discussed in these previous studies. These studies used regional flow equations that were developed in the late 1970's and early 1980's. At the time of these studies, the Clark County Regional Flood Control District Manual (CCRFCD Manual, 1990) had not yet been completed and the regional equations were the best method available. Methodology in the CCRFCD Manual is now the accepted method in Clark County. The proximity of Area 5 to Clark County and their similar physical and climatic characteristics support the use of this region-specific method as the means of generating discharges for the study area. Also since these studies, FEMA has adopted a methodology to evaluate flood hazards on alluvial fans. For these reasons, a more detailed flood assessment was required using the most updated information and methods.

2.0 WATERSHED DESCRIPTION

2.1 Introduction

The 140-square-mile watershed that could impact the RWMS and the proposed HWSU was divided into 16 subbasins (Figures 2 and 3). (For more detailed watershed maps, see Sheets 1 and 2.) Concentration points for the flow from the 16 delineated subbasins were chosen to best represent the hydrology of the study area. The apexes of Barren Wash, Scarp Canyon, and Halfpint alluvial fans represent three of these concentration points. The other concentration points were difficult to define because they represented the confluence of large areas of shallow concentrated flow that could impact the RWMS. Concentration point locations were based on aerial photographs, topographic data, and field observations.

2.2 Apex Definitions

In this study, both a geologic definition and a FEMA definition for the apex of an alluvial fan are described. The geologic apex of an alluvial fan is the intersection of the mountain front and the piedmont plain (Figure 4). On many alluvial fans, a channel is entrenched into the upper, and possibly the middle part of the fan (Bull, 1964). Fans with entrenched channels have the active apex farther down the fan. FEMA defines the apex as the point below which the flowpath of the major stream that formed the fan becomes unpredictable and flooding of the fan can occur (FEMA, 1991). The FEMA definition was used in this study to determine the concentration points of flow at the active apex of the three alluvial fans within the study area: Barren Wash, Scarp Canyon, and Halfpint alluvial fans (*Figure 3* and *Sheet 2*) for locations of these apexes.

2.3 Barren Wash Alluvial Fan

The Barren Wash watershed covers 81.3-square miles and is located northwest of the RWMS (*Figure 2* and *Sheet 1*). The wash drains to Frenchman Flat from an area that is bordered to the east by the Massachusetts Mountains, to the north by the CP Hogback, and to the west by the CP Hills. The watershed has been divided into two separate subbasins: Barren Wash 1 (BW1, 60.5-square miles) and Barren Wash 2 (BW2, 20.8-square miles).

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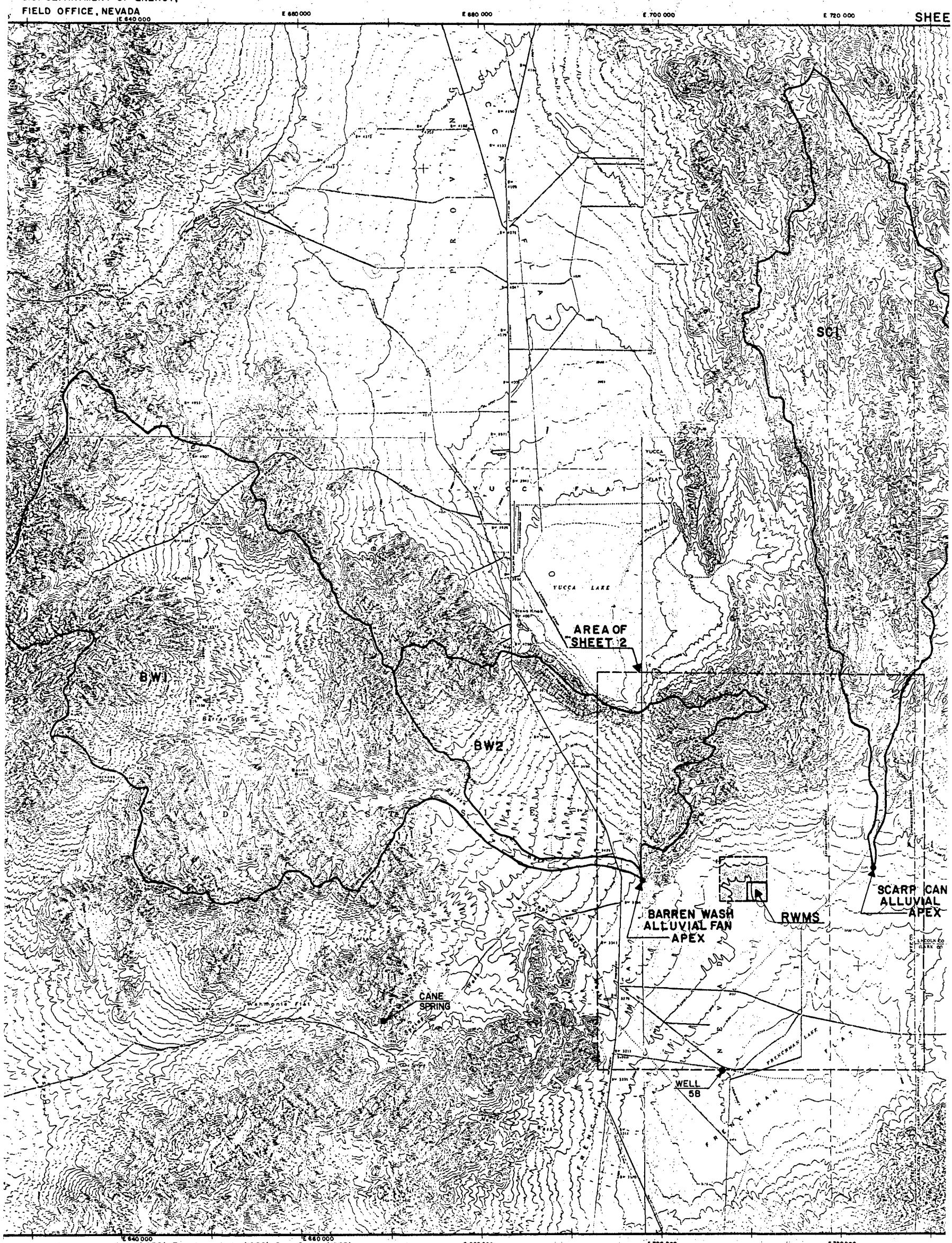

EXPLANATION

- WATERSHED BOUNDARY
- SCI — WATERSHED NAME
- RADIOACTIVE WASTE MANAGEMENT SITE (RWMS)
- AREA PROPOSED FOR RWMS EXPANSION
- AREA OF SHEET 2
- PRECIPITATION GAUGE

WATERSHED MAP OF THE AREA 5 RADIOACTIVE WASTE MANAGEMENT SITE VICINITY

by

John S. Schmeltzer, Julianne J. Miller
and
Dennis L. Gustafson
1992

FIGURE 2

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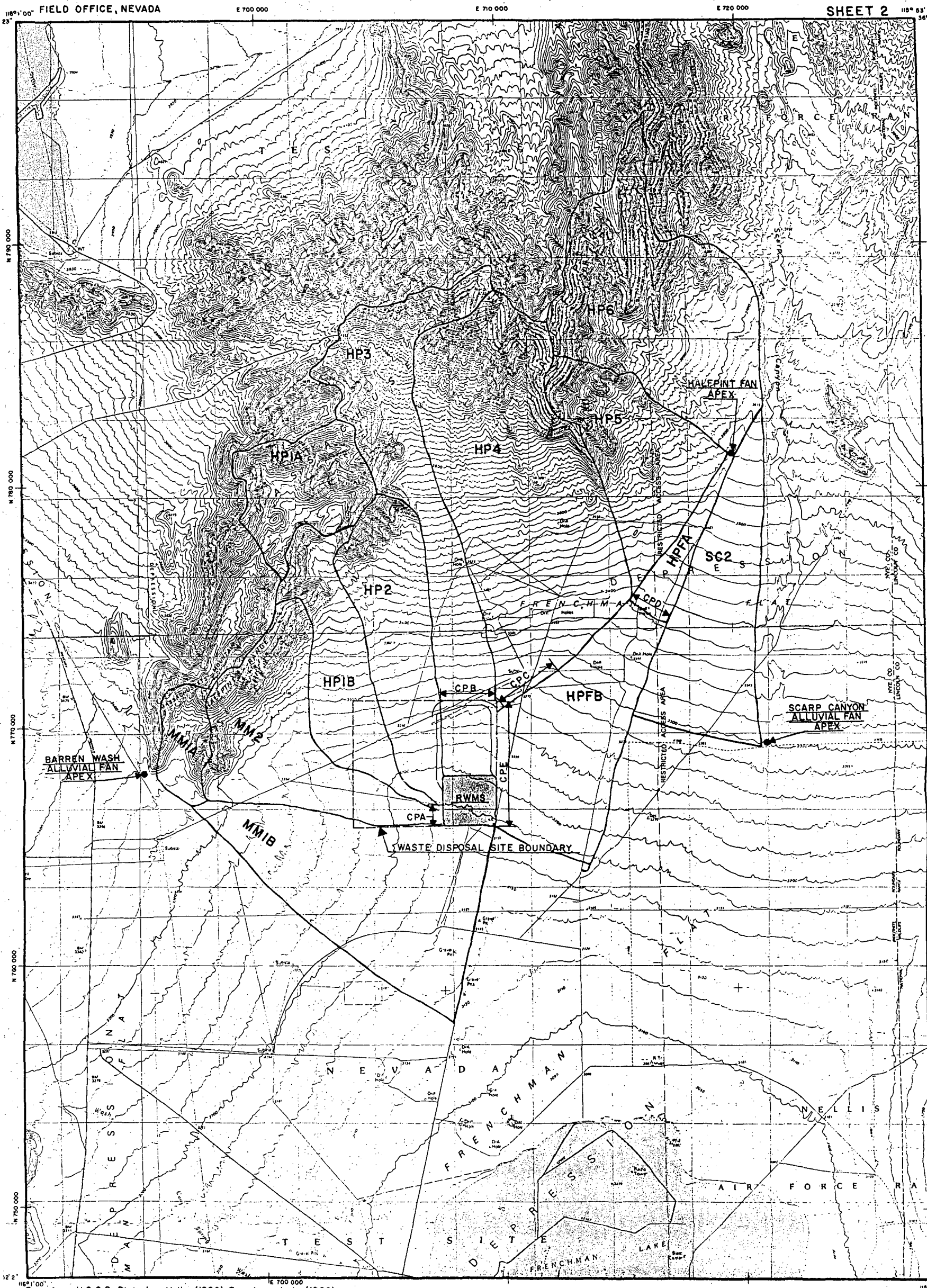
SHEET 2



Base from U.S.G.S. Plutonium Valley (1986), Frenchman Lake (1986)
Yucca Lake (1986), and Cane Spring (1986) Quadrangles, Nevada

SCALE 1: 24 000

EXPLANATION

WATERSHED BOUNDARY
SC2 WATERSHED NAME
RADIOACTIVE WASTE MANAGEMENT SITE (RWMS)
BOUNDARY OF AREA PROPOSED FOR RWMS EXPANSION

0° 38' 11 MILS
MN GN 14 1/2° 258 MILS

1000 0 1000 2000 3000 4000 5000 6000 7000 8000 9000 10,000 FEET
1 .5 0 1 MILES
1 .5 0 1 2 KILOMETERS
1000 0 1000 2000 METERS

CONTOUR INTERVAL 20 FEET
SUPPLEMENTARY CONTOUR INTERVAL 10 FEET

NEVADA
QUADRANGLE LOCAT

WATERSHED MAP OF THE AREA 5 RADIOACTIVE WASTE MANAGEMENT SITE VICINITY

by

John S. Schmeltzer, Julianne J. Miller
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1992

FIGURE 3

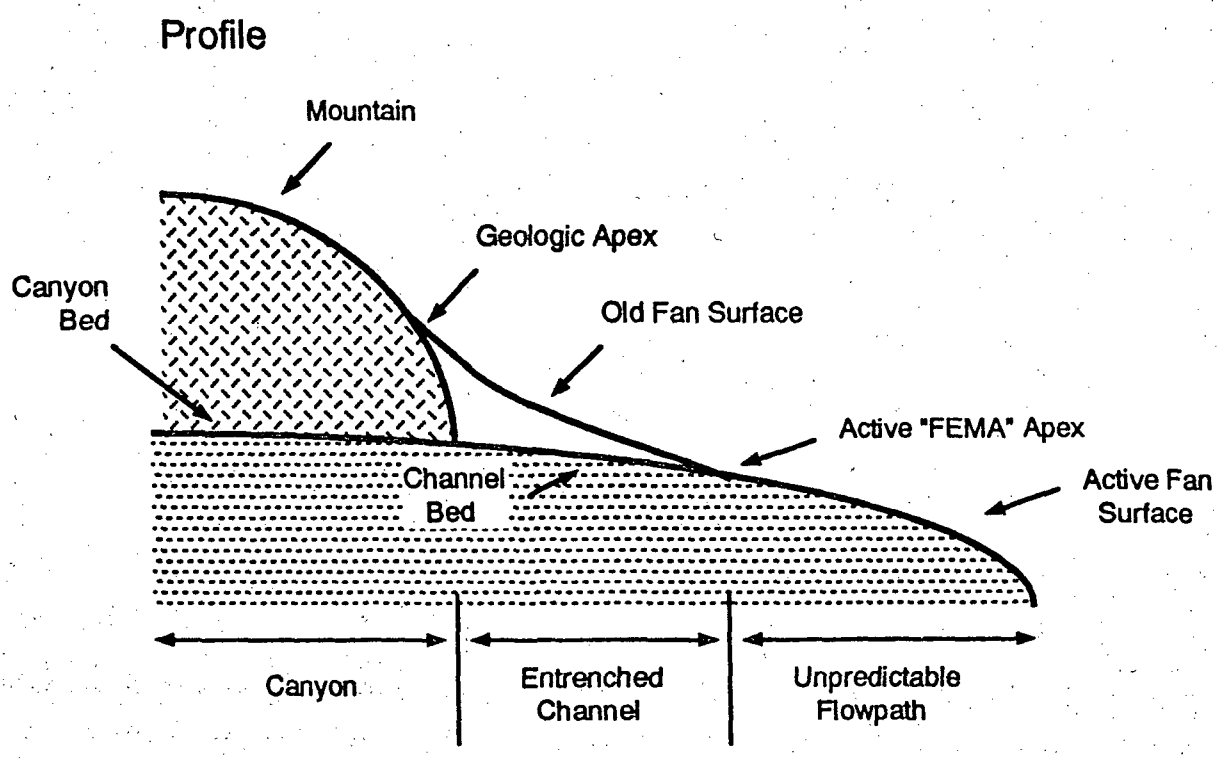


Figure 4. **Idealized Alluvial Fan Profile (modified from French, 1989).** The geologic apex is the intersection of the mountain front and the piedmont plain. The active "FEMA" apex is the point below which the flow of the main channel becomes unpredictable.

The Barren Wash Alluvial Fan is the dominant landform in the watershed. The proximal part of the fan (the area on the alluvial fan near the apex) is deeply entrenched by a stream channel. Significant parts of the fan surface are covered by desert pavement with desert varnish, and vegetation covers 15 to 25 percent of the surface. Erosion is the primary geomorphological process occurring on the proximal part of the fan, as shown by scalloping of the fanhead trench.

Continued trench incision has shifted deposition to a distal part of the fan (the outermost area, or lower zone of the fan). The Barren Wash channel captures the channel draining from the Massachusetts Mountains 1A (MM1A) subbasin at the southwestern corner of the Massachusetts Mountains (*Figure 3* and *Sheet 2*). At this point a new, secondary fan is being formed which extends east toward the RWMS and south to Frenchman Flat. The RWMS is located on the lower-mid part of this secondary fan.

2.4 Scarp Canyon Alluvial Fan

The Scarp Canyon watershed, located northeast and east of the RWMS, covers about 40.9-square miles (*Figure 2* and *Sheet 1*). This watershed drains onto Scarp Canyon Alluvial Fan from an area that extends north to Carbonate Ridge (French and Lombardo, 1984), west to the Massachusetts Mountains, and east to Raysonde Butte. The watershed is divided into two subbasins: Scarp Canyon 1 (SC1, 39.4-square miles), the drainage area above the active apex; and Scarp Canyon 2 (SC2, 1.5-square miles), the area between the channel that drains SC1 and the eastern boundary of Halfpint Alluvial Fan (*Figure 3* and *Sheet 2*).

A large fanhead trench, ranging to a depth of 40 feet, cuts through a thin layer of alluvium and bedrock above the active apex. Below the active apex, the channel cuts through unconsolidated and calcrete-cemented alluvium. Parts of the fan surface are covered by desert pavement with desert varnish. Vegetation density is 15 to 25 percent over the fan surface.

The channel within the trench of Scarp Canyon is braided. Relatively flat interchannel bars and side terraces are approximately 1 to 5 feet above the streambeds, and covered by fine-grained sediment. High-water indicators are present on the bars and terraces several feet above the streambed. These indicators include large clasts and boulders, small logs and sticks, and uprooted Joshua trees found snagged in the vegetation. The vegetation also shows signs of being washed over by water. Concurrence of the high-water indicators with the fine-grained deposits suggests that these deposits are fluvial rather than eolian.

2.5 Halfpint Alluvial Fan

Halfpint Alluvial Fan, located northeast of the RWMS, develops from a channel that collects flow from the drainage area (HP6, 2.2-square miles) along the eastern front of the Halfpint Range (*Figure 3* and *Sheet 2*). The alluvial fan is divided into two separate subbasins: Halfpint Fan A (HPFA, 0.3-square miles) and Halfpint Fan B (HPFB, 1.6-square miles).

The channel located above the apex of the Halfpint Alluvial Fan is incised 2 to 3 feet in depth. The apex of the fan was located where the flowpath of the channel becomes unpredictable. Below the apex, a very braided channel system has developed. Relatively little desert pavement or desert varnish is found on this fan surface; vegetation cover density is approximately 20 percent. The RWMS is located in the lower-mid part of this fan.

2.6 Massachusetts Mountains/Halfpint Range Subbasins

The 13.6-square-mile watershed that drains from the Massachusetts Mountains/ Halfpint Range toward the RWMS was divided into seven subbasins (*Figure 3* and *Sheet 2*). These subbasins include MM1A and MM1B, MM2, HP1A and HP1B, HP2, HP3, HP4, and HP5. The upper parts of these subbasins are located in bedrock consisting of several different tuffs. From a geomorphic viewpoint, the drainages in the lower regions extending into Frenchman Flat form coalescing alluvial fans along the mountain front. From a hydraulic engineering viewpoint, the flow system on these landforms are distributary-flow systems. Hjalmerson and Kemna (1991) states that the "...major physiographic characteristics used to identify and categorize distributary-flow areas...include (1) vegetation density and soil color, (2) drainage texture, and (3) the random nature of channel links."

The proximal parts of these coalescing alluvial fans (geomorphic viewpoint) are characterized by channels incised 5 to 10 feet across the surface. Vegetation density on the fan surface is 20 to 35 percent. Undisturbed deposits covered by desert pavement with desert varnish are present.

Channel incisions, averaging 1 to 3 feet, decrease near the middle part of the fan. Debris flow deposits from the HP1A and HP1B subbasins in part compose the coalescing alluvial fans (geomorphic viewpoint). Channel depths decrease down gradient until sheetflow occurs.

Sheetflow, typical of areas of low relief and poorly established drainage systems, occurs on the distal parts of the coalescing alluvial fans (geomorphic viewpoint). The RWMS is located in the lower-mid parts of these coalescing alluvial fans where channel depths average less than 1 foot. Vegetation covers 20 to 30 percent of the fan surface. There are relatively few undisturbed areas of relic deposits covered by desert pavement with desert varnish.

3.0 HYDROLOGY

3.1 Methodology

Standard statistical methods to determine flood discharges for a specific return period are not applicable to a majority of the watersheds in the arid Southwest because most of the watersheds in this region are ungaged and do not have stream discharge information. Furthermore, arid watersheds that do have discharge data usually have a short period of record with many years of no flow. A study conducted by Hjalmarson and Thomas (1992) found that 20 years is the average recording period for stream gages located in Nevada, western Utah, western Arizona, and southeastern California.

In the arid Southwest, rainfall-runoff models are often used to estimate flood discharges. In this flood assessment, rainfall-runoff models were developed using the HEC-1 computer program developed by the U.S. Army Corps of Engineers (COE) (1990a). The CCRFCD Manual lists the HEC-1 computer program as an acceptable tool to estimate discharges and to generate hydrographs for watersheds within Clark County. Methods in the CCRFCD Manual were used to produce the input parameters required for the HEC-1 computer program. Other jurisdictions in the arid Southwest, such as Maricopa County (central Arizona), Pima County (southern Arizona), and San Bernardino County (southern California), use similar approaches to estimate flood discharges.

The hydrologic approach described in the CCRFCD Manual was developed for Clark County from studies conducted by WRC Engineering and the COE. The methods described in

the CCRFCD Manual were considered the best approach for estimating discharges for the flood assessment of the RWMS and vicinity for these reasons:

a. The physical setting and flood-producing storms for the RWMS and vicinity are similar to those of Clark County;

b. The eastern boundary of the study area is adjacent to the Clark County line;

c. Local and federal agencies (e.g., FEMA) accept the methods in the CCRFCD Manual; and,

d. Clark County is the nearest local jurisdiction with a hydrologic method based on region-specific information.

The Soil Conservation Service (SCS) unit hydrograph option in the HEC-1 computer program was used in the hydrologic models. The SCS unit hydrograph is widely used in rainfall-runoff models and is recommended as an option in the CCRFCD Manual. The input parameters required to run the HEC-1 computer model using the SCS unit hydrograph option are:

- precipitation parameters (depth of precipitation, storm duration and time distribution, and depth-area ratios);
- drainage area (total drainage area and subbasins);
- precipitation losses (curve numbers);
- lag time for each basin; and,
- channel routing parameters.

The procedure used to obtain these parameters generally followed the methods described in the CCRFCD Manual. The following sections provide an overview of how these parameters were determined and substantiate any deviations from the methods provided in the CCRFCD Manual. A detailed description of how these parameters are determined is in the CCRFCD Manual.

3.1.1 *Precipitation*

Rainfall events that cause flooding on the NTS and in southern Nevada are usually convectional storms. According to Christenson and Spahr (1980), the probable flood-generating storm in the NTS area would be from summer convectional storms. These flood-producing storms are normally characterized as short-duration (6-hours or less), high-intensity storms over a localized area. Methods regarding precipitation parameters in the CCRFCD Manual assume that summer convectional storms are the likely precipitation event to produce flooding in Clark County. In an analysis of precipitation records for southern Nevada, WRC Engineering and the COE determined that a 6-hour rainfall should be the design storm. A 6-hour mass curve (intensity of rainfall per 15-minute intervals over the 6-hour design storm) was developed and a relationship between precipitation depth and storm size (depth-area ratios) was determined. These parameters are discussed below in more detail.

a. Point Precipitation Values

As specified in the CCRFCD Manual, the design depths of precipitation for the 6-hour storm were taken from NOAA Atlas 2, Volume VII (1973) and are listed in Table 1.

Table 1. Six-Hour Storm Point Precipitation Values and Correction Factors (CCRFCD Manual, 1990). Correction factors used to adjust precipitation values for design depths of precipitation for the six-hour storm.

	NOAA Values (inches)	Correction Factor	Corrected Point Rainfall (inches)
2-Year, 6-Hour	0.70	1.00	0.70
10-Year, 6-Hour	1.10	1.24	1.36
100-Year, 6-Hour	1.60	1.43	2.43

The 100-year, 6-hour point precipitation value of 1.6-inches (NOAA Atlas 2, Volume VII, 1973) compares well with the 1.8-inch value generated from a figure developed by French (1983) for the Cane Springs precipitation gauge (Figure 5). The preliminary value of 2.6-inches for the 100-year, 24-hour storm taken from a statistical analysis of the rainfall data at Well 5b (*Figure 5*) by Reynolds Electrical & Engineering Co., Inc., (Barker [personal communication], 1992). This rainfall data compares well with the values listed in NOAA Atlas 2, Volume VII (1973). Locations of these gauges are shown on *Figure 2* and *Sheet 1*.

The CCRFCD Manual requires that the point precipitation values listed in NOAA Atlas 2, Volume VII (1973) be used to determine point precipitation; however, the CCRFCD Manual specifies that rainfall events above the 2-year storm be adjusted. *Table 1* shows the correction factors listed in the CCRFCD Manual. These correction factors were identified from studies conducted by WRC Engineering and COE for Clark County (CCRFCD Manual, 1990) based on available rainfall data, primarily from the Las Vegas Valley, so these factors may not be applicable for the RWMS study area.

French (1983) hypothesized that the southern part of Nevada can be divided into three precipitation zones: an excess zone, a transition zone, and a deficient zone (Figure 6). French (1983) indicates that the Las Vegas Valley is located in the excess zone, and the NTS is located in the transition zone. He further hypothesizes that the excess zone is a result of storms tracking up the Colorado River Valley, and the influence of the river on precipitation values lessens with distance away from the Colorado River Valley. The precipitation analysis by French (1983) and Barker (personal communication, 1992) support this hypothesis and suggest that the noncorrected precipitation values for the RWMS study area are more applicable than using the precipitation correction factors specified in the CCRFCD Manual. Hydrologic models in this flood assessment used the nonadjusted values in NOAA Atlas 2, Volume VII (1973); however, a discharge model was developed using the correction factors specified in the CCRFCD Manual to compare with the hydrologic models developed without the adjustment factors. The results of this comparison are discussed in Section 3.4, *Hydrology Discussion*.

b. Storm Duration and Time Distribution

Clark County has adopted two 6-hour storm distribution tables to be used to generate discharges (CCRFCD Manual, 1990). The two storm distributions defined in this manual are for areas less than or larger than 10-square miles. These storm distributions were used for the subbasins in the hydrologic models for the RWMS. A mass curve of the two storm distributions is shown in Figure 7.

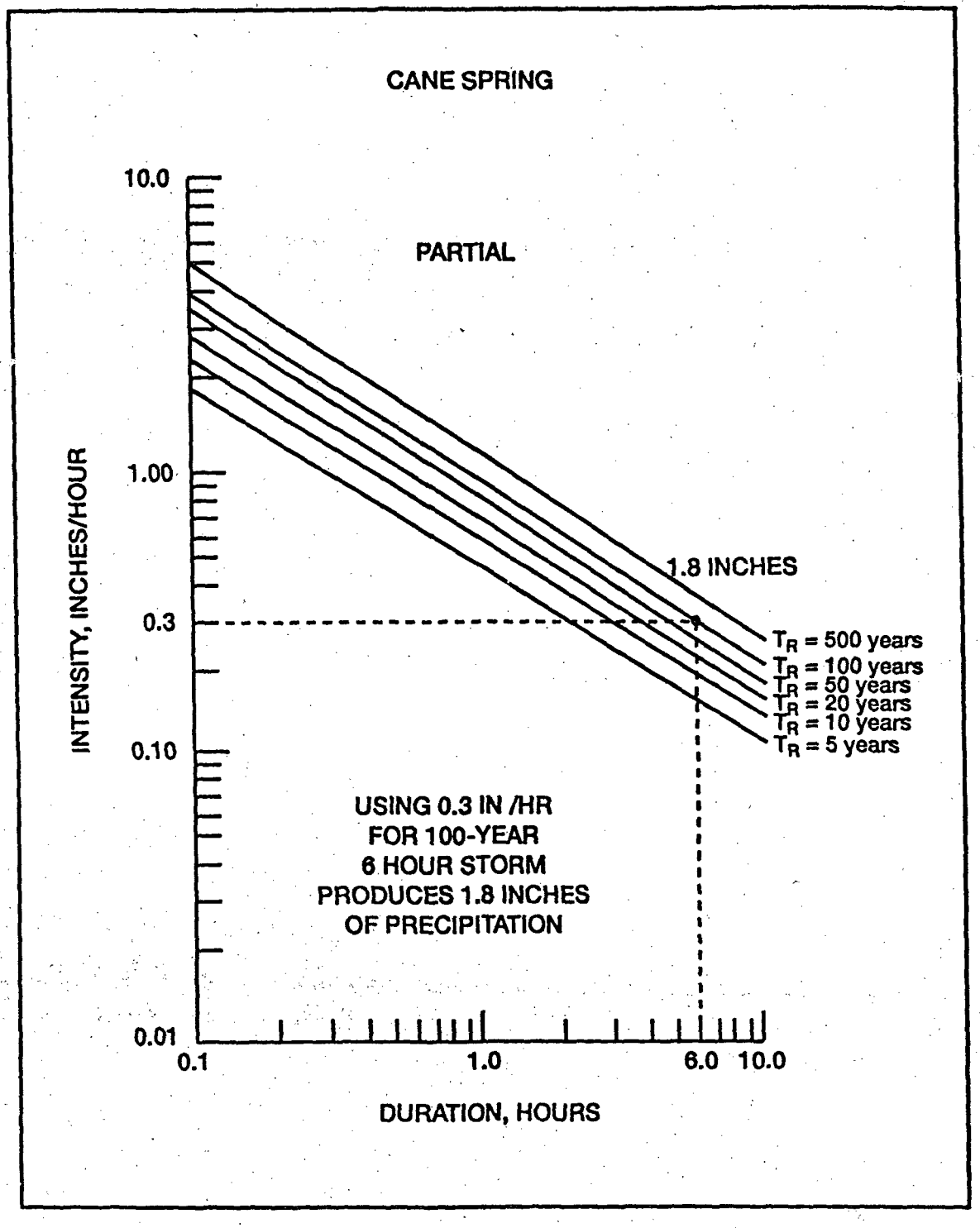


Figure 5. Intensity Duration Relationships for Various Return Periods, Cane Springs, Nevada Test Site, Nevada (modified from French, 1983). The 100-year, 6-hour point precipitation value of 1.6 inches compares well with the value from French, 1983.

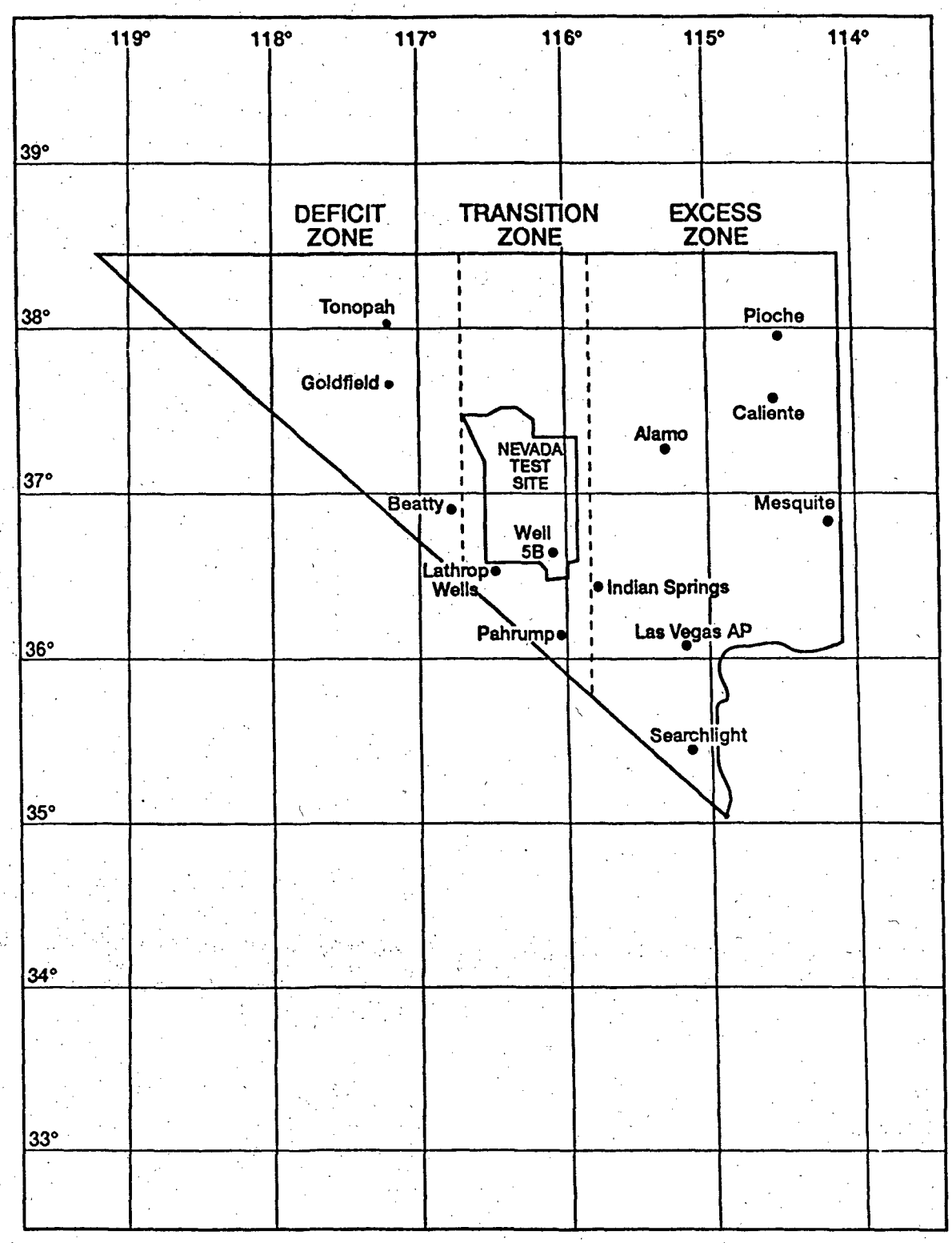
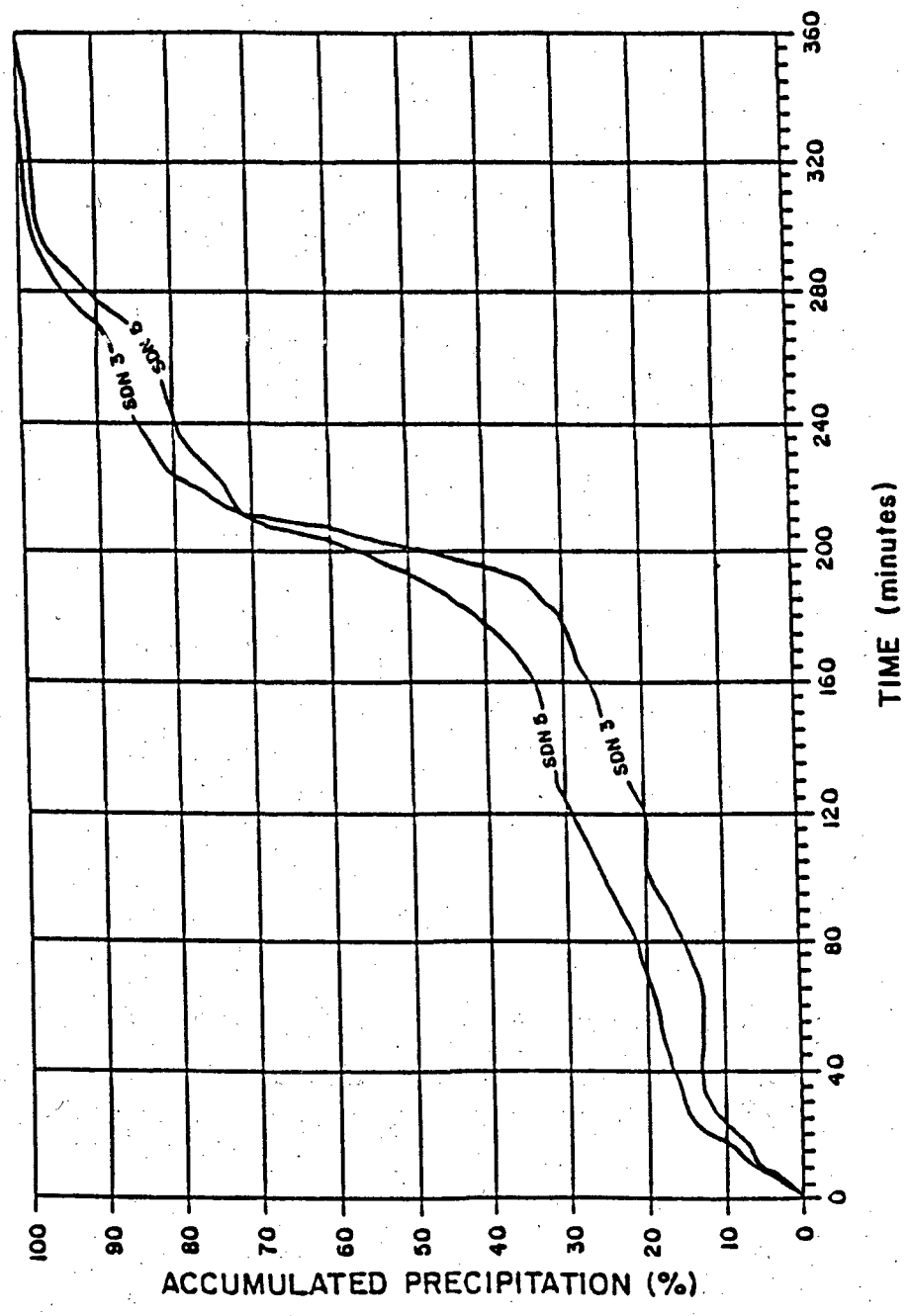


Figure 6. Hypothesized Zones of Precipitation in Southern Nevada (modified from French, 1983). The NTS is located in the transition zone of precipitation.

SIX-HOUR DESIGN STORM DISTRIBUTIONS



Notes:

1. For drainage areas less than 10 square miles in size, use SDN 3.
2. For drainage areas equal to or greater than 10 square miles in size, use SDN 5.

Figure 7. Storm Distributions (CCRFCD Manual, 1990). Storm distribution curves are selected based on drainage basin size.

c. Depth-Area Ratios

During a flood-producing storm, usually a convectional storm in this region, point precipitation values probably would not apply to an entire drainage basin. Depth-area ratios have been developed for arid regions which reduce the point precipitation value for a watershed as a function of area. Clark County uses the depth-area ratios that were developed by the COE for Clark County and vicinity (Table 2). These depth-area ratios are a modification of ratios developed by Zehr (1984) on arid watersheds in Arizona and New Mexico. Ratios in the CCRFCD Manual were used in the hydrologic model for the RWMS.

3.1.2 *Drainage Areas*

The area of each drainage basin defined in the hydrologic model was delineated using 7.5- and 15-minute United States Geological Survey (USGS) topographic quadrangle maps of the area (*Figures 2* and *3*; *Sheets 1* and *2*), along with 1:6,000 orthophotos with a 10-foot contour interval that were developed for the area. Basin delineations were verified by field observations and study of color and infrared aerial photos. The area of each subbasin was determined using a planimeter. The drainage area, and the other watershed parameters for each subbasin used in the HEC-1 model, are listed in Table 3. The USGS topographic maps used to define the drainage area are:

15-minute Topographic Quadrangles (USGS):

- Papoose Lake (1952)
- Frenchman Lake (1952)
- Cane Spring (1952)
- Topopah Spring (1952)
- Tippipah Spring (1952)

7.5-minute Topographic Quadrangles (USGS):

- Plutonium Valley (1986)
- Frenchman Lake (1986)
- Yucca Lake (1986)
- Cane Spring (1986)

3.1.3 *Precipitation Losses*

Precipitation losses were determined using the SCS curve number methodology and the applicable table (Table 4) found in the CCRFCD Manual. The following information is required to determine a curve number for a specific subbasin:

- hydrologic soil group;
- vegetation type; and
- percent ground and vegetation cover.

The following procedures were used to obtain this information:

1. The percent of bedrock and alluvium was determined for each subbasin using aerial photos and geologic and topographic maps. Bedrock areas of the subbasins were assigned as hydrologic soil group D. This soil group has high runoff potential and applies to

Table 2. Six-Hour Precipitation Depth-Area Reduction Factors (CCRFCD Manual, 1990). Depth-area ratios reduce the point precipitation value for a watershed as a function of area.

Drainage Area (mi^2)	Reduction Factor	100-Year (in.)	10-Year (in.)	2-Year (in.)
0.01	1.00	1.60	1.11	0.70
1	0.97	1.55	1.07	0.68
10	0.86	1.38	0.95	0.60
20	0.79	1.26	0.87	0.55
30	0.74	1.18	0.81	0.52
50	0.68	1.09	0.75	0.48
100	0.60	0.96	0.66	0.42

Table 3. Watershed Parameters. Watershed parameters were delineated using topographic maps, aerial photos, and field investigations.

Watershed Name	Basin Area (mi^2)	Curve Numbers AMC I	AMC II	AMC III	Lag Time (hrs)
MM1A	0.9	63	80	90	0.31
BW1	60.5	67	83	93	2.10
BW2	20.8	63	80	90	0.90
MM1B	2.1	59	77	87	0.48
MM2	1.4	62	79	89	0.47
HP1A	0.8	70	85	95	0.30
HP1B	1.0	60	78	88	0.51
HP2	1.2	60	78	88	0.51
HP3	1.7	66	82	92	0.59
HP4	3.3	62	79	89	0.52
HP5	1.2	62	79	89	0.30
HP6	2.2	63	80	90	0.55
HPFA	0.3	59	77	87	0.33
HPFB	1.6	59	77	87	0.44
SC1	39.4	66	82	92	2.10
SC2	1.5	59	77	87	0.48

AMC = abbreviation for antecedent moisture condition. AMC-I assumes the soil is dry and AMC-III assumes the soil is near or at saturation; AMC-II is halfway between AMC-I and AMC-III.

Table 4. Runoff Curve Numbers (Semiarid Rangelands[1]) [CCRFCD Drainage Manual, 1990 {reference SCS TR-55, USDA, June 1986}]. Hydrologic soil group, vegetation type, and percent of ground cover determine curve numbers.

Cover Description		Curve Numbers for Hydrologic Soil Group			
Cover Type	Hydrologic Condition[2]	A[3]	B	C	D
Herbaceous—mixture of grass, weeds, and low-growing brush, with brush the minor element	Poor	--	80	87	93
	Fair	--	71	81	89
	Good	--	62	74	85
Oak-aspen—mountain brush mixture of oak brush, aspen, mountain mahogany, bitter brush, maple, and other brush	Poor	--	66	74	79
	Fair	--	48	57	63
	Good	--	30	41	48
Pinyon-juniper—pinyon, juniper, or both; grass understory	Poor	--	75	85	89
	Fair	--	58	73	80
	Good	--	41	61	71
Sagebrush with grass understory	Poor	--	67	80	85
	Fair	--	51	63	70
	Good	--	35	47	55
Desert shrub—major plants include saltbush, greasewood, creosote bush, blackbrush, bursage, palo verde, mesquite, and cactus	Poor	63	77	85	88
	Fair	55	72	81	86
	Good	49	68	79	84

[1] Assume Antecedent Moisture Condition II.

[2] *Poor:* < 30% ground cover (litter, grass, and brush overstory).
Fair: 30 to 70% ground cover.
Good: > 70% ground cover.

[3] Curve numbers for Group A have been developed only for desert shrub.

areas with shallow soils or exposed bedrock. The alluvium is mostly sand and was assigned as hydrologic soil group B based on the preliminary surficial map by Rawlinson (1991), Romney (1973), and extensive field investigation conducted by the authors.

2. The cover type for the subbasins was determined to be desert shrub based on descriptions given in *Table 4*, field investigation, and study of aerial color and infrared photos.

3. The hydrologic condition was determined to be poor based on 30 ground surveys conducted on the alluvium. Ground cover ranged between 5 and 30 percent (*Table 4*). Results of these surveys were assumed to be representative of all subbasins. This assumption

was verified by study of aerial photos and field investigations. Because of the very steep slopes and minimal or nonexistent soil, bedrock areas have less vegetation than alluvial areas; therefore, the hydrologic condition of the bedrock areas was also classified as poor.

According to the CCRFCD Manual, curve numbers for precipitation losses should be determined assuming an antecedent moisture condition of II (AMC–II). Antecedent moisture condition is dependent on the antecedent rainfall. The antecedent rainfall is the amount of rainfall between 5 and 30 days preceding a flood-producing storm. AMC–I assumes the soil is dry, and AMC–III assumes the soil is near or at saturation; AMC–II is halfway between AMC–I and AMC–III. The CCRFCD Manual designates AMC–II because data required to determine the antecedent moisture condition for an entire area are not quantifiable.

Assuming AMC–II, curve numbers for the alluvium and bedrock were 77 and 88, respectively. The curve number for each subbasin was determined by taking the weighted average between the percentage of alluvium and bedrock present in each subbasin. Curve numbers for each subbasin for AMC–I, AMC–II, and AMC–III are listed in *Table 3*. Hydrologic models in this study developed to estimate the 2-year and 10-year discharges assumed the antecedent moisture conditions were AMC–II. The 100-year hydrologic models developed for this study assumed conditions ranging between AMC–II and AMC–III. The results from all the models and the justification for varying the curve numbers per antecedent moisture conditions are addressed in Section 3.4, *Hydrology Discussion*.

3.1.4 *Lag Time*

In the SCS unit hydrograph method, only one input parameter, the lag time, is required. The CCRFCD Manual uses the lag time equation from the U.S. Bureau of Reclamation (Cudworth, 1989) for subbasins greater than 1-square mile:

$$TLag = 20K_n\left(\frac{LL_c}{S^{1/2}}\right)^{1/3}$$

where:

TLag = the lag time (hours) between the center of mass of rainfall excess and the peak of the unit hydrograph.

K_n = the Manning roughness factor (dimensionless) for the basin channels.

L = the length of the longest watercourse (miles) within the subbasin.

L_c = the length along the longest watercourse (miles) measured upstream to a point opposite the centroid of the basin.

S = the average slope of the longest watercourse (feet per mile).

As indicated in the CCRFCD Manual, K_n is subjective. Therefore, criteria listed in Table 604 in the CCRFCD Manual (Table 5) are recommended and were used for this study. Characteristics of the subbasins fell halfway between the "n" value description for 0.03 and 0.05. Parameters used to determine the lag time are listed in Table 6. The L and S values for each

Table 5. Lag Equation Roughness Factors (CCRFCD Manual, 1990 [reference USACE, Los Angeles District, 1982]). Characteristics of the subbasins fell halfway between the 0.030 and 0.050 "n" values.

Watershed Characteristics	Roughness Factor, K_n
Urbanized Areas: Water courses in the drainage area consist of street, storm sewer, and improved channels.	0.015
Natural Areas: Water courses in the drainage area are well defined, unimproved channels or washes. Watershed has minimal vegetation.	0.030
Natural Areas: Water courses in the drainage area are not well defined, and consist of many small rills and braided wash areas. Runoff from area combines slowly into channels. Includes mountainous channels with large bouiders and flow restrictions.	0.050

Table 6. Lag Time Parameters. Parameters used to calculate lag times.

Watershed Name	L (mi)	Lc (mi)	S (ft/mi)	Kn	Lag Time (hrs)
MM1A	0.87	0.64	97.7	0.04	0.31
MM1B	2.46	0.72	71.9	0.04	0.48
MM2	2.16	1.33	215.3	0.04	0.47
HP1A	1.33	0.83	503.8	0.04	0.30
HP1B	2.54	1.33	173.2	0.04	0.51
HP2	2.58	1.55	242.2	0.04	0.51
HP3	3.79	2.27	459.1	0.04	0.59
HP4	3.18	1.70	415.1	0.04	0.52
HP5	1.48	0.64	378.4	0.04	0.30
HP6	3.37	1.74	332.3	0.04	0.55
HPFA	1.44	0.53	121.5	0.04	0.33
HPFB	2.08	0.80	103.4	0.04	0.44
SC2	2.69	0.85	119.0	0.04	0.48

NOTE:

$$TLag - 20K_n\left(\frac{LL_c}{S^{1/2}}\right)^{1/3}$$

where:

TLag = the lag time (hours) between the center of mass of rainfall excess and the peak of the unit hydrograph.

K_n = the Manning roughness factor (dimensionless) for the basin channels.

L = the length of the longest watercourse (miles) within the subbasin.

L_c = the length along the longest watercourse (miles) measured upstream to a point opposite the centroid of the basin.

S = the average slope of the longest watercourse (feet per mile).

subbasin were determined using a map wheel on the watershed maps (*Sheets 1* and *2*). The L_c value was determined using a planimeter to find the centroid of each subbasin. A point on the longest watercourse of each subbasin which was closest to the respective centroid was selected.

3.1.5 *Channel Routing*

The Muskingum routing method was used for routing reaches. This routing method requires three parameters: x, K, and the integer step. The weighting factor (x) expresses the amount of attenuation of the flood wave within the reach (Dunne and Leopold, 1978), and was determined using criteria cited by the Cudworth (1989). The Muskingum coefficient (K) accounts for the translation of the peak flow for the entire channel reach. This coefficient K is directly related to the length and the average velocity of the reach. The average channel velocity is determined using the Manning Equation. The Manning roughness coefficient was chosen based on field observations. Channel geometry was determined through field measurements. (The integer step and routing reach were determined so that the total travel time through the reach would be equal to K.) Only three reaches were routed in the models. Table 7 lists the routing parameters for these reaches.

Transmission losses for the routing reaches are ignored in the models. Variability of infiltration rates along a channel reach can be extensive; thus, these losses over an entire reach are difficult to quantify. Ignoring these losses adds another conservative assumption into the model.

3.2 Hydrologic Models

Seven hydrologic models were developed using the HEC-1 computer program to determine discharges for this flood assessment (Table 8). All the models have the same hydrologic parameters, with the exception of point precipitation values and curve numbers. The differences between the models are explained in each model description (*Table 8*). Output from the seven hydrologic models are located in Appendix A.

3.2.1 *Model Layout*

The overall watershed that could impact the RWMS was divided into 16 subbasins to provide discharges at key concentration points. Figure 8 is a schematic showing how the subbasins were connected in the HEC-1 models. The model layout was the same for all models.

Conservative assumptions which simplified the model layout were made regarding routing and combining subbasins. For example, subbasins BW1, BW2, and MM1A within the HEC-1 models were considered to combine at the same point (*Figure 8*), but MM1A actually combines with the Barren Wash subbasins (BW1 and BW2) approximately 2,000 feet downstream. The HEC-1 models demonstrated little attenuation and translation of peak flows through this short reach; therefore, combining these basins without routing simplified the model and provided an additional conservative assumption to the model. Also, subbasins were combined along the perimeter of the RWMS without routing. First, flows from Concentration Point A (CPA1) were combined with flows from CPB; then flows from CPC and CPE were combined; and finally flows from CPA (1 and 2), CPC, and CPE were combined at CPF (*Figure 8*). CPF is located downstream from the RWMS. Again, the attenuation and translation of the peak flows as modeled using HEC-1 were minimal and, by combining the subbasins as shown on *Figure 8*, the models were simplified and conservative.

Table 7. Routing Parameters. The Muskingum routing method was used for routing reaches.

Reach name	Integer Step	Storage Constant (K)	Weighting Factor (X)
HP1A to CPA	9	0.43	0.2
HP6 to CPD	5	0.27	0.2
CPD to CPE	8	0.39	0.2

NOTE:

Integer Step: The integer step is the number of subreaches for the Muskingum routing in the HEC-1 models.

Storage Constant (K): The Muskingum "K" coefficient is the travel time (hours) through the reach.

Weighting Factor (X): The weighting factor expresses the amount of attentuation of the flood wave within the reach.

Table 8. Hydrologic Models. Hydrologic models were developed for the 2-year, 10-year, and 100-year flood events.

100-Year Hydrologic Model	
RWMS.OUT	Point precipitation values were taken from NOAA Atlas 2, Volume VII. Curve numbers were developed assuming AMC-II.
RWMSCN.OUT	Point precipitation values were taken from NOAA Atlas 2, Volume VII. Curve numbers for all basins were increased by 5 to account for an AMC greater than II.
RWMSW.OUT	Point precipitation values were taken from NOAA Atlas 2, Volume VII. Curve numbers for all basins were increased by 10 to account for AMC-III.
RWMSC.OUT	Clark County correction factors were used in conjunction with the point precipitation values taken from NOAA Atlas 2, Volume VII. Curve numbers are the same as those used in RWMS.OUT assuming AMC-II.
10-Year Hydrologic Model	
RWMS10.OUT	Point precipitation values were taken from NOAA Atlas 2, Volume VII. Curve numbers are the same as those used in RWMS.OUT assuming AMC-II.
RWMS10C.OUT	Clark County correction factors were used in conjunction with the point precipitation values taken from NOAA Atlas 2, Volume VII. Curve numbers are the same as those used in RWMS.OUT assuming AMC-II.
2-Year Hydrologic Model	
RWMS2.OUT	Point precipitation values were taken from NOAA Atlas 2, Volume VII. Curve numbers are the same as those used in RWMS.OUT assuming AMC-II. No correction factor to the 2-year point precipitation values from the NOAA Atlas 2, Volume VII, is required by the CCRFCD Manual.

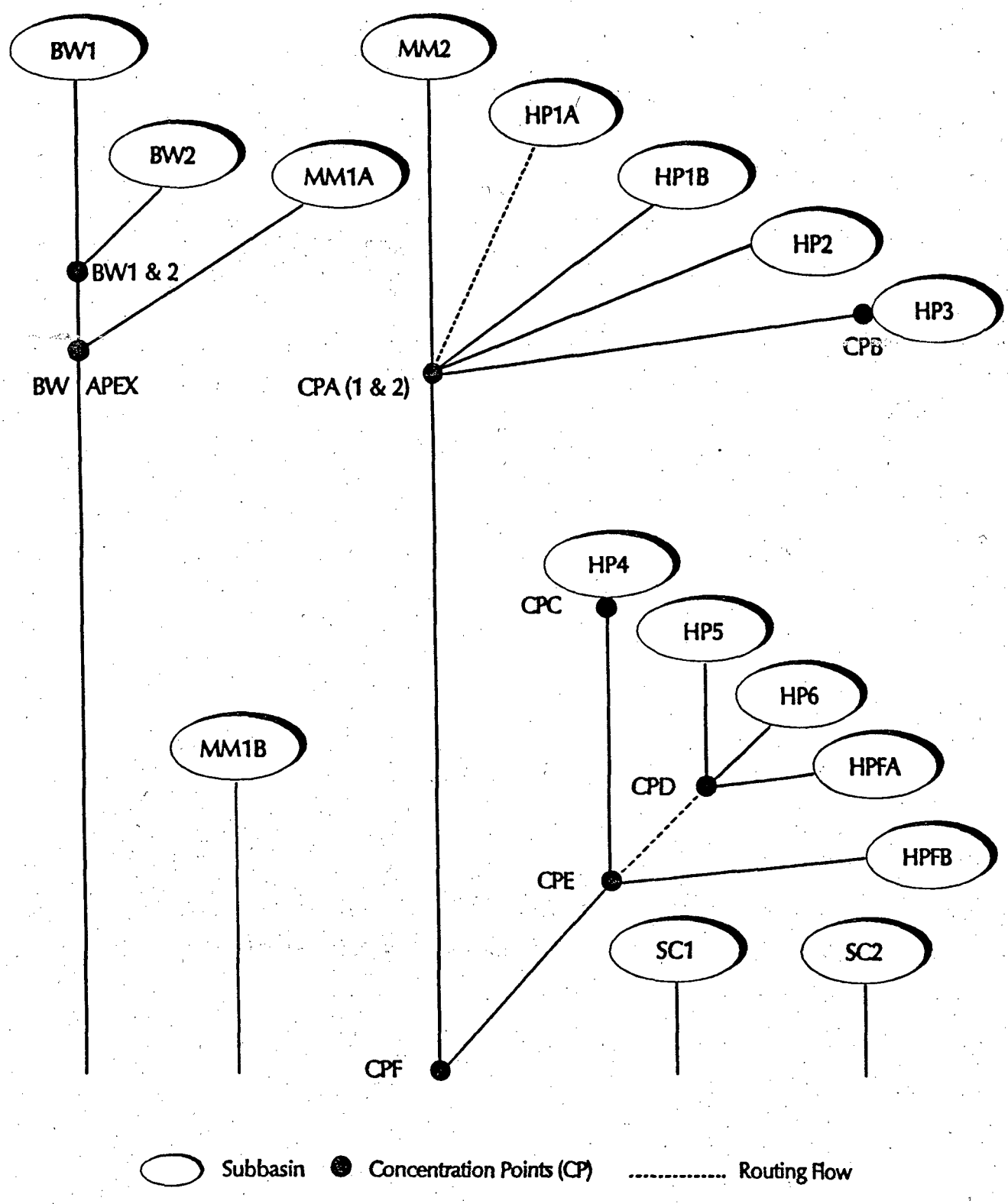


Figure 8. Schematic Diagram of Stream Network. This diagram shows how the 16 subbasins were combined in the HEC-1 models.

Another conservative assumption pertaining to subbasin HPFB was made in the model layout for a part of this subbasin that drains directly towards CPE. Difficulty in determining the percentage of discharge that could reach the RWMS from this subbasin led to the assumption that the entire subbasin would drain towards the RWMS.

Figure 8 shows flow from BW Apex, MM1B, SC1, and SC2 not connected to the major concentration points. Flow from BW Apex was not connected because flow from this drainage does not currently impact the RWMS; however, channel avulsions can potentially occur during a flood, thus directing flow towards the RWMS. This potential is addressed in Section 4.2, *Results and Discussion of Flood Hazard Determination*. Subbasin MM1B encompasses the Barren Wash Alluvial Fan, and flow that falls directly onto the fan would not drain towards the RWMS.

Subbasin SC1 is the Scarp Canyon watershed. The concentration point for this watershed is the apex of the Scarp Canyon Alluvial Fan. Flow from this watershed does not impact the RWMS, as shown in the Section 4.2, *Results and Discussion of Flood Hazard Determination*. Subbasin SC2 is a portion of the nonactive fan surface composed of sediments deposited by the Scarp Canyon channel. Because the channel has become entrenched and has extended the active apex approximately 2.5-miles down the existing fan surface, runoff from this surface would be sheetflow and, as indicated by the topography (*Figure 3* and *Sheet 2*), drains away from the RWMS.

3.2.2 *Concentration Points*

The concentration point locations were determined to provide discharges at the most appropriate location for the hydraulic analysis (*Figures 2* and *3* and *Sheets 1* and *2*). Concentration points were selected for sheetflow locations and at the active apexes of the alluvial fans. In the case of sheetflow, with the exception of CPC and CPD, the concentration points were spread across the area of potential flood impact with the RWMS. CPC was selected where all water from subbasin HP4 would be funneled southwest between subbasins HP4 and HPFB towards the RWMS. CPD was selected where water from subbasins HP5, HP6, and HPFA would be concentrated together before being routed to CPE.

3.3 Hydrology Results

Discharges of key concentration points from the seven models used in this analysis are listed in Table 9.

Discharges from the models RWMS2.OUT, RWMS10.OUT, and RWMSW.OUT (2-year, 10-year, and 100-year discharges, respectively) were used in the analysis to determine the flood hazard zones for the Barren Wash, Scarp Canyon, and Halfpint alluvial fans. Discharges from RWMSW.OUT were used to evaluate the 100-year sheetflow and shallow concentrated flow that could impact the RWMS. Justification for choosing these models is discussed in the following section.

3.4 Hydrology Discussion

Although only three models were used in the flood assessment, a total of seven models were developed and evaluated in this study. A two-step approach was used to select the appropriate models for the 2-year, 10-year, and 100-year discharges. The following paragraphs provide a description of this approach.

Table 9. **Discharges From HEC-1 Models at Key Concentration Points.** The 100-year discharges from RWMSW.OUT were used in the flood hazard determination.

Concentration Point	DA (mi^2)	100-Year Discharges (cfs)				10-Year Discharges (cfs)		2-Year Discharges (cfs)
		RWMS.OUT	RWMSCN.OUT	RWMSW.OUT	RWMSC.OUT	RWMS10.OUT	RWMS10C.OUT	RWMS2.OUT
BWAPX*	82.20	1,848	3,513	6,018	5,498	510	1,083	22
CPA1	4.40	459	786	1,229	1,297	130	278	15
CPA2	6.10	659	1,126	1,757	1,827	187	399	23
CPB	1.70	263	420	624	661	87	170	14
CPC	3.30	360	626	984	1,060	88	210	8
CPD	3.70	333	570	884	945	90	199	10
CPE	8.60	603	1,180	1,819	1,898	168	335	9
CPF	14.70	878	1,462	2,396	2,462	301	576	25
SC1APX**	39.40	1,251	2,178	3,498	3,438	356	769	15

*Barren Wash Apex
**Scarp Canyon Apex

NOTE: Discharges were calculated using the HEC-1 computer program and do not represent significant figures.

The first step focused on the hydrologic model (HEC-1) for the 2-year flood. In arid regions, such as the RWMS location, it is common that no flow will occur in washes for several years; therefore, the 2-year model-generated discharges for the subbasins should be close to zero. The 2-year discharges from RWMS2.OUT (*Table 9*) were low, less than 25 cubic feet per second. These discharges from RWMS2.OUT appear reasonable so no other model was developed for the 2-year flood.

To verify the model-generated discharges for the 10-year and 100-year floods, another step was required. This step compared the skew coefficient developed from model-generated discharges and the regional skew coefficient (Water Resource Council [WRC] 17B, 1981). If the hydrologic models are producing reasonable discharges, then the skew coefficient from these models should be close to the regional skew coefficient.

A major assumption in using skew coefficients is that the relationship between discharge and return period must follow a Log-Pearson Type III (LPIII) probability distribution, as specified in WRC (1981). The FEMA FAN computer program (1990) contains a subroutine that calculates skew coefficients using a least-square fit and a LPIII probability distribution. This program calculated skew coefficients for specific concentration points using model-generated discharges. This program requires discharges for a minimum of three return periods to calculate the skew coefficient. (In this analysis the 2-year, 10-year, and 100-year model-generated discharges were entered into the FAN program.)

WRC (1981) contains a map which shows the regional skew coefficients for the country (Figure 9). According to the information on this map, the skew coefficient for washes on the NTS should be near zero. A zero skew coefficient means that if discharge versus probability were plotted on log-probability paper, then the flood frequency curve would plot as a log-normal distribution (a straight line). Preliminary results from a study by the USGS using stream gage data gathered after 1981 also support a zero skew for this region (Hjalmarson [personal communication], 1992).

The first three models that were evaluated using the skew comparison approach were RWMS2.OUT, RWMS10.OUT, and RWMS.OUT (Model Set 1). These models were developed using the noncorrected precipitation values from NOAA Atlas 2, Volume VII (1973) and followed the methods in CCRFCD Manual for the remaining input parameters. Discharges at the apexes of the Barren Wash, Halfpint, and Scarp Canyon alluvial fans were evaluated. Discharges at these apexes were entered into the FAN program to determine the skew coefficients. The skew coefficients, as shown in Table 10, were negative and were not close to zero. The discharges in this set must be adjusted to move the skew coefficients closer to zero. The 2-year model (RWMS.OUT2) was determined to generate reasonable results; therefore, adjustment must occur either to the 10-year, 100-year or both models.

Modification of curve numbers in the 100-year model were evaluated first. Two additional 100-year models were created from the original 100-year model (RWMS.OUT): RWMSCN.OUT and RWMSW.OUT. In RWMSCN.OUT, curve numbers were 5 greater than the original model, and in RWMSW.OUT, curve numbers were 10 greater than the original model. Increasing the curve numbers by 5 assumes a antecedent moisture condition between AMC-II and AMC-III; increasing the curve numbers by 10 assumes AMC-III.

Using these models, two additional model sets were developed with these two models: Model Set 2 (RWMS2.OUT, RWMS10.OUT, and RWMSCN.OUT) and Model Set 3 (RWMS2.OUT, RWMS10.OUT, and RWMSW.OUT). The 2-year, 10-year, and 100-year

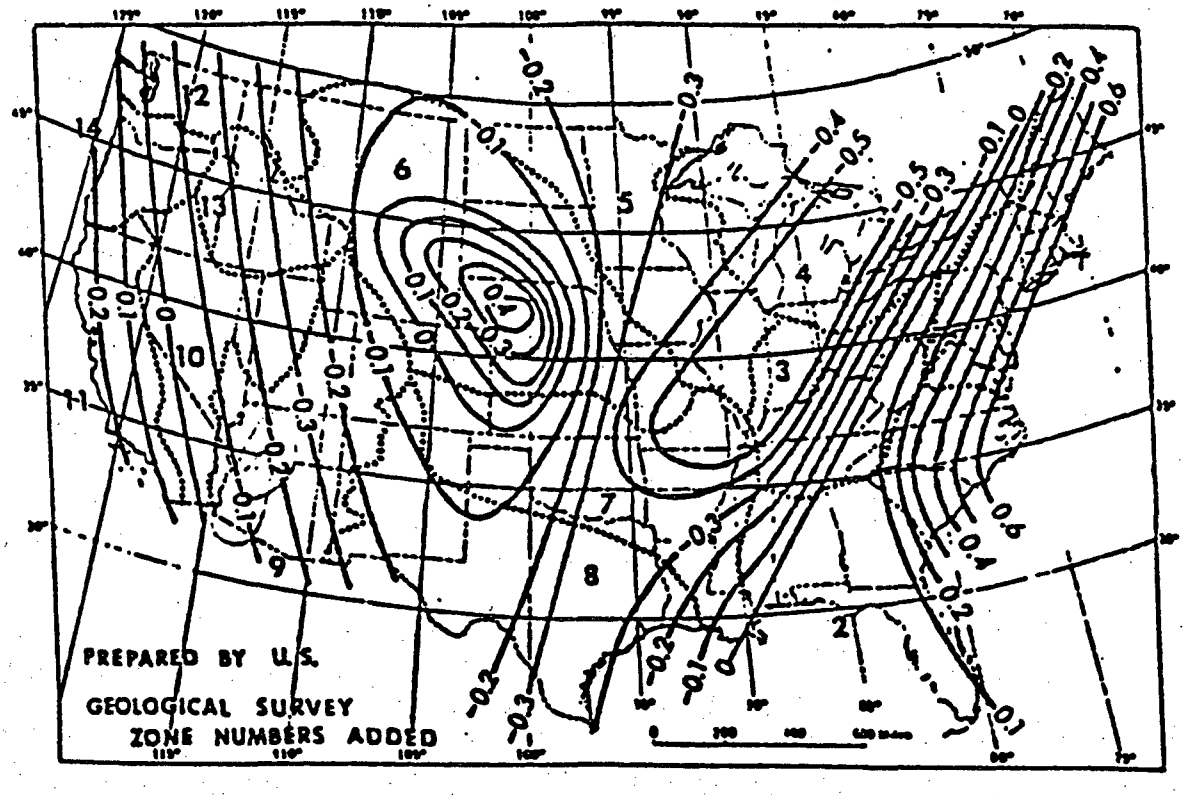


Figure 9. Generalized U.S. Skew Coefficients (WRC [1981]). The Nevada Test Site is located in an area with a zero skew coefficient value.

Table 10. Skew Coefficients From Different Model Sets. Model Set 3 generated skew coefficients closest to zero for the three apexes.

Apex Locations	Model Set 1	Model Set 2	Model Set 3	Model Set 4
Barren Wash	-1.2	-0.6	-0.1	-1.2
Scarp Canyon	-1.2	-0.7	-0.3	-1.3
Halfpint	-1.1	-0.4	0.1	-1.0

Return Period	Model Set 1	Model Set 2	Model Set 3	Model Set 4
2-Year Model	RWMS2.OUT	RWMS2.OUT	RWMS2.OUT	RWMS2.OUT
10-Year Model	RWMS10.OUT	RWMS10.OUT	RWMS10.OUT	RWMS10C.OUT
100-Year Model	RWMS.OUT	RWMSCN.OUT	RWMSW.OUT	RWMSC.OUT

The 10-year and 100-year hydrologic models could be modified by adjusting the curve numbers, depth of precipitation, or lag times. Of these three parameters, curve numbers have the widest variability because they are dependent on antecedent moisture conditions, as indicated in *Table 3*. Curve numbers for the subbasin in this study (*Table 3*) can range in the 50's and 60's under dry soil conditions (AMC-I) to the high 80's and low 90's (AMC-III) for saturated conditions. The CCRFCD Manual assumes AMC-II because antecedent moisture conditions for a drainage basin are impossible to quantify and a standard approach is required in Clark County to assure consistent analysis and design in drainage facilities and structures. The assumption of AMC-II may be reasonable for the 2-year flood event, as reflected in RWMS2.OUT, but may not be for the 10-year and 100-year flood events. For 10-year floods or greater, the antecedent moisture condition as well as rainfall may contribute to flooding.

Precipitation depth and lag times are not as variable. Variation from the precipitation depths in NOAA Atlas 2, Volume VII is not supportable because analysis of precipitation data in the study area (French, 1983; and Barker [personal communication], 1992) do not vary substantially from the values in NOAA Atlas 2, Volume VII, and any variation to precipitation data would be difficult to support. Variability in lag time is limited because three of the four parameters (L, L_c, and S) are measured from a topographic map, and significant variations in the K_n are not defensible using the methods described in the CCRFCD Manual (*Table 5*). Therefore, the curve numbers in the models were considered the most reasonable parameter to modify.

Modification of curve numbers in the 100-year model were evaluated first. Two additional 100-year models were created from the original 100-year model (RWMS.OUT): RWMSCN.OUT and RWMSW.OUT. In RWMSCN. OUT, curve numbers were 5 greater than the original model, and in RWMSW.OUT, curve numbers were 10 greater than the original model. Increasing the curve numbers by 5 assumes an antecedent moisture condition between AMC-II and AMC-III; increasing the curve numbers by 10 assumes AMC-III.

Using these models, two additional model sets were developed with these two models: Model Set 2 (RWMS2.OUT, RWMS10.OUT, and RWMSCN.OUT) and Model Set 3 (RWMS2.OUT, RWMS10.OUT, and RWMSW.OUT). The 2-year, 10-year, and 100-year discharges for each model set were entered into the FAN program. The skew coefficients of the

apexes of the three fans were closer to zero (*Table 10*). Model Set 3 generated skew coefficients closest to zero for the three apexes. These models from Model Set 3 were used to define the 100-year flood hazards in this flood assessment.

The 10-year model was not modified because an increase in the curve numbers would require a corresponding increase in the curve numbers for the 100-year model to maintain a zero skew. Assuming AMC-III (saturated conditions), the discharges generated from RWMSW.OUT are at their upper limit; therefore, an increase in curve numbers for the 10-year model would result in a negative skew.

Additional HEC-1 models were developed using the precipitation correction factors in the CCRFCD Manual for the 10-year and 100-year precipitation depths (*Table 1*). Two additional models were necessary: RWMS10C.OUT and RWMSC.OUT. The skew coefficient using discharges from the models RWMS2.OUT, RWMS10C.OUT, and RWMSC.OUT (Model Set 4) were calculated and are listed in *Table 10*.

Adjusting the curve numbers for the 100-year event and not using precipitation correction factors varies from the methods given in the CCRFCD Manual, but the 100-year discharges generated using this approach (RWMSW.OUT) are comparable to 100-year discharges from the model (RWMSC.OUT). Plus, the skew coefficients calculated using RWMSW.OUT for the 100-year discharges (Model Set 3) are closer to zero than the model following CCRFCD Manual criteria (Model Set 4). For these reasons, Model Set 3 was used in this flood assessment instead of Model Set 4.

As a result of this two-step approach to determine the appropriate hydrologic models, seven models were developed but only three models (RWMS2.OUT, RWMS10.OUT, and RWMSW.OUT) were used in determining the flood hazard of the RWMS and the proposed HWSU facilities.

4.0 HYDRAULICS AND FLOOD HAZARD DETERMINATION

The RWMS and the proposed HWSU are located in an arid region where traditional approaches to define flood hazards (e.g., the hydraulic model HEC-2 [COE, 1990b], which assumes a stable and fixed channel geometry) may not be appropriate for all types of flooding. Potential flooding of the RWMS and the proposed HWSU can occur as alluvial fan flooding, shallow concentrated flow, and sheetflow. FEMA has developed methodology to determine the 100-year flood hazards from these types of flooding. FEMA methodology was used to delineate the flood hazards impacting the RWMS and the proposed HWSU per 40 CFR 270.14. This section provides:

- a brief description of the FEMA methodology used to evaluate alluvial fan flooding, shallow concentrated flow, and sheetflow;
- the results and discussion of the flood hazard evaluation; and
- flood hazard maps.

4.1 Hydraulics and Flood Hazard Determination Methodology

4.1.1 FEMA Alluvial Fan Methodology

Flooding from the Barren Wash, Scarp Canyon, and Halfpint alluvial fans could impact these facilities. Hydraulic processes on alluvial fans are different than in riverine channels. Alluvial fan flooding, as described by FEMA (1991), ". . . is characterized by high-velocity flows; active processes of erosion, sediment transport, and deposition; and unpredictable flowpaths." Channel geometry and direction on alluvial fans can change in direct response to a flood discharge. Field investigations and study of topographic maps and aerial photos of the Barren Wash, Scarp Canyon, and Halfpint alluvial fans support this description because flowpaths are unpredictable, soil development is weak, and evidence of recent erosion and deposition is present.

FEMA (1991) states that if flowpaths below the active apex cannot be predicted (which is the case for the Barren Wash, Scarp Canyon, and Halfpint alluvial fans), the FEMA Alluvial Fan Methodology must be applied to evaluate the 100-year flood hazard. This methodology, which is a modification of the method proposed by Dawdy (1979), relates probability of discharges at the apex to probability of channel depths and flow velocities that occur on the alluvial fan.

According to Dawdy (1979), flood flow from the apex of a typical alluvial fan does not spread evenly over the fan surface, but is instead confined to a surface or channel that carries the flood waters from the apex to the toe of the fan (Figure 10). The active apex is selected at the point where the flowpath becomes unpredictable, and flow is no more likely to follow an existing channel than create a new path. In the upper region of an alluvial fan, flow is confined to a single channel where the depth and width of the channel is a function of the flow itself. In general, flow occurs at critical depth and velocity as a result of steep slopes associated with this upper region. As slopes decrease towards the mid and distal parts of the fans, channel bifurcation can occur resulting in a multiple-channel region. Dawdy (1979) did not incorporate a multiple-channel region into his methodology. FEMA (1991) modified the Dawdy methodology to address multiple-channel regions of alluvial fans.

Key assumptions of the FEMA Alluvial Fan Methodology follow (French, 1989):

1. The location of the flood event channel on the fan surface is random. Furthermore, the probability of the channel passing through any given point on a contour is uniform.

2. Flow occurs in flow-formed channels. Well-defined channels result from the subsequent erosion from this process.

   a. Incised channels do not exist previous to the first flow event.

   b. Existing channel capacity is not adequate to convey the flow, and overbank flooding occurs.

3. The width and depth of the channel is a function of discharge.

4. Transmission losses are not considered.

5. On-fan precipitation is not considered.

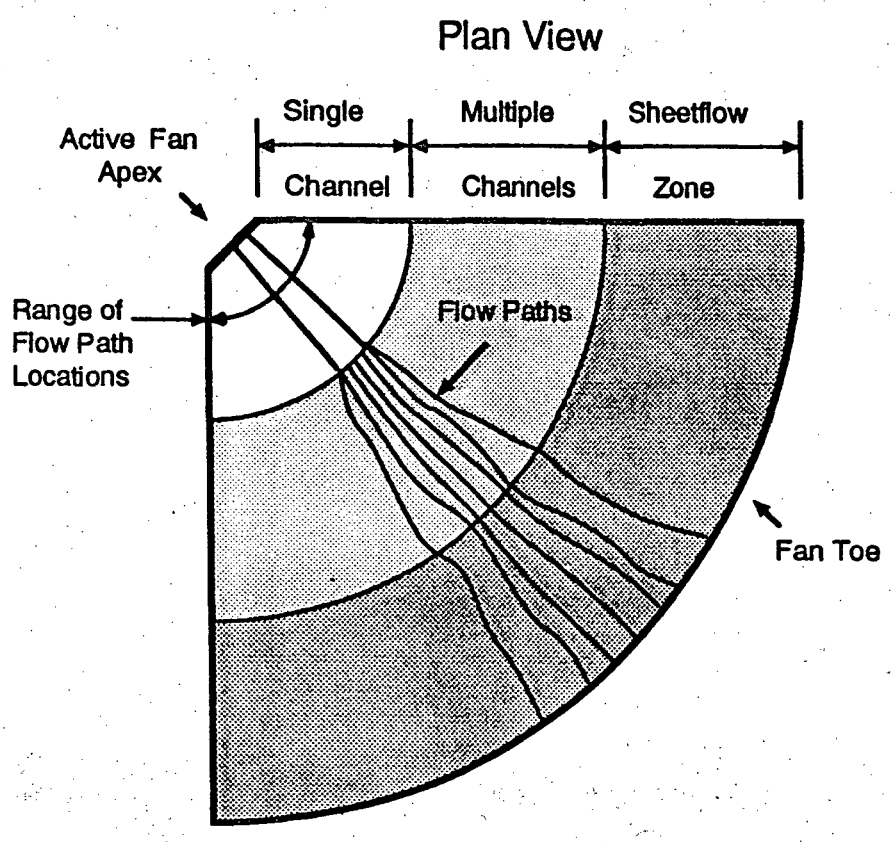


Figure 10. Alluvial Fan Plan View (modified from French, 1989). Plan view of an idealized alluvial fan showing the single channel, multiple channel, and sheetflow regions.

6. The alluvial fan is active; e.g., net deposition is occurring in both time and space and avulsions (the migration of channel from one location to another during a single event) are occurring.

7. Flood discharge frequency distribution must be available at the apex of the alluvial fan.

Field observations, a study of topographic and geologic maps, aerial photographs, and examination of historic records were made during the flood assessment of these alluvial fans. Sources of flooding were defined, an apex selected, active fan boundaries delineated, entrenched reaches of channels located and measured, and locations of barriers to flow determined.

The methodology used for defining flood hazards on alluvial fans incorporates FEMA's computer model, FAN (1990). Delineation of the 100-year flood hazard using the FEMA FAN Model requires the following parameters and assumptions:

- Discharge information
- Apex location
- Fan boundaries and dimensions
- Potential flow obstructions and/or diversions
- Multiple channel region parameters:
  - Manning roughness coefficient
  - Slope

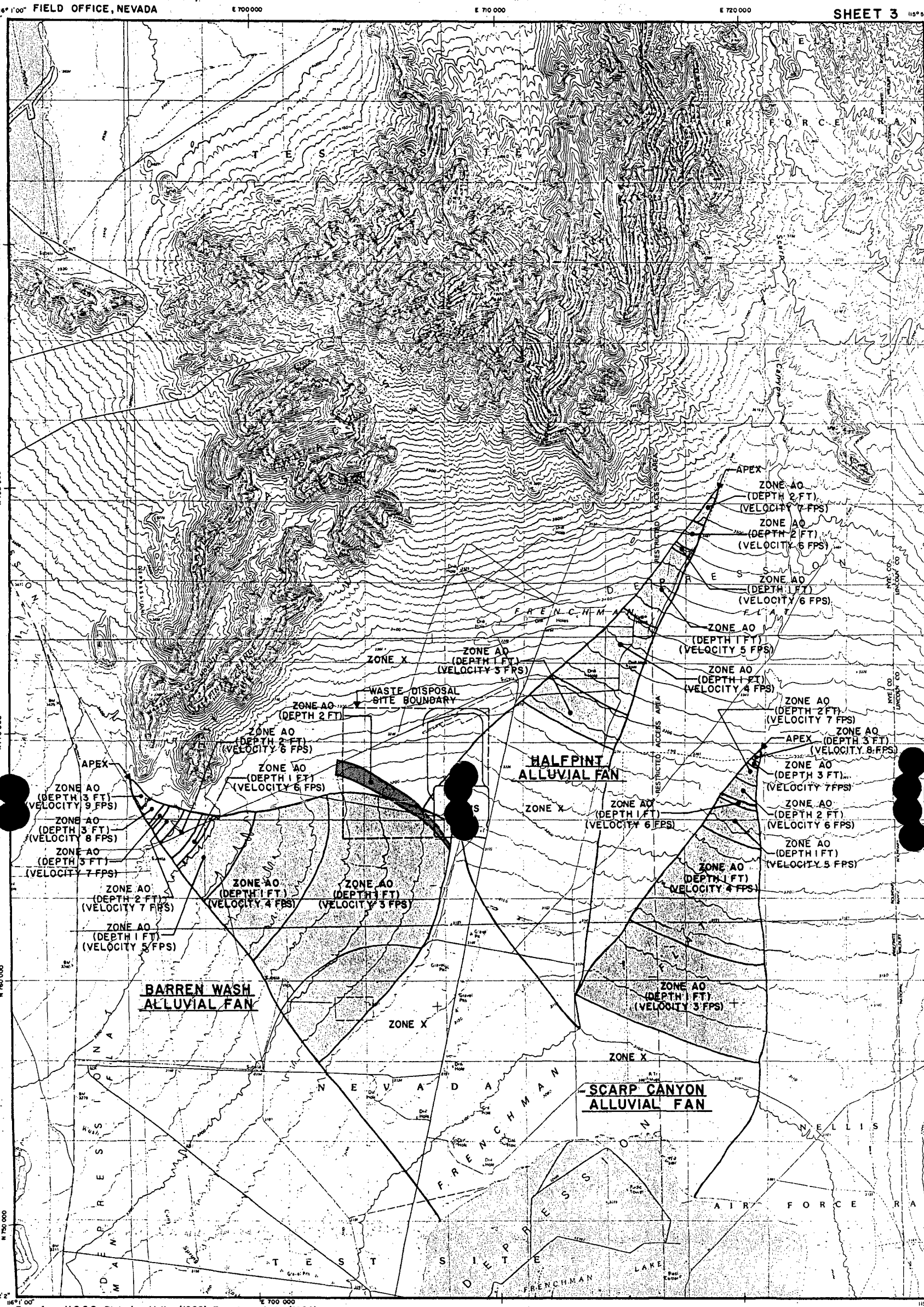
The FAN model requires that at least three discharges of different return periods be used to define the flood hazard zones. The 2-year, 10-year, and 100-year flood discharges for the Barren Wash, Scarp Canyon, and Halfpint alluvial fans were taken from the HEC-1 models labeled RWMS2.OUT, RWMS10.OUT, and RWMSW.OUT, respectively (*Table 9*). Discharges calculated by the HEC-1 models for CPBWAPEX or CPBW1&BW2 (*Figure 8*), whichever were greater, were used as the discharges at the apex of the Barren Wash Alluvial Fan in the FAN model. Discharges used in the FAN model for Scarp Canyon were taken from the HEC-1 models at the active apex of Scarp Canyon (Subbasin SC2). Discharges for Halfpint Alluvial Fan were taken from CPE as calculated within the HEC-1 model, and were assumed to have originated from the fan apex. All approaches for selecting discharges at the apexes are considered to be conservative.

Apex locations and fan boundaries were determined from aerial photographs; available topographic, geologic, and surficial maps; and field investigations. Apexes were located using the FEMA definition for an active apex. Location of the apexes for Barren Wash, Scarp Canyon, and Halfpint alluvial fans are shown in Figure 11 and Sheet 3.

Potential flow obstructions and diversions such as roads, buildings and other structures which can prevent flooding in some areas and increase flooding in others must be designated. In this flood assessment, all barriers such as Mercury Highway, 5-01 road, all secondary roads, the nonengineered berms surrounding the RWMS perimeter, and all disturbed areas diverting flow away from the RWMS were ignored. Quantification of the diversion would be difficult. Assuming that all flow can reach the RWMS produces a more conservative flood analysis.

PREPARED BY RAYTHEON SERVICES NEVADA FOR
U.S. DEPARTMENT OF ENERGY,
FIELD OFFICE, NEVADA

SHEET 3



Base from U.S.G.S. Plutonium Valley (1986), Frenchman Lake (1986)
Yucca Lake (1986), and Cane Spring (1986) Quadrangles, Nevada

SCALE 1: 24 000

EXPLANATION

- ALLUVIAL FAN BOUNDARY
- BOUNDARY OF RADIOACTIVE WASTE MANAGEMENT SITE (RWMS)
- BOUNDARY OF AREA PROPOSED FOR RWMS EXPANSION
- 100-YEAR FLOOD ZONE OF SHALLOW CONCENTRATED FLOW.
- AREA OF ALLUVIAL FAN 100-YEAR FLOOD ZONE.
- ZONE AO: (DEPTH 2 FT) — SHALLOW CONCENTRATED FLOW 100-YEAR FLOOD ZONE DESIGNATION: FEMA FLOOD ZONE THAT CORRESPONDS TO AREAS OF 100-YEAR SHALLOW FLOODING WHERE AVERAGE DEPTHS ARE BETWEEN 1 AND 3 FEET.
- ZONE AO: (DEPTH 2 FT) (VELOCITY 5 FPS) — ALLUVIAL FAN 100-YEAR FLOOD ZONE DESIGNATION: FEMA FLOOD ZONE THAT CORRESPONDS TO AREAS OF 100-YEAR SHALLOW FLOODING WHERE AVERAGE DEPTHS ARE BETWEEN 1 AND 3 FEET. ANYWHERE THROUGHOUT THE ZONE THERE IS AN EQUALLY LIKELY CHANCE THAT A CHANNEL CAN OCCUR OF THE DESIGNATED DEPTH WITH A FLOW OF THE DESIGNATED VELOCITY.
- ZONE X: — FEMA FLOOD ZONE THAT CORRESPONDS TO AREAS OUTSIDE THE 100-YEAR FLOOD HAZARD AND TO AREAS OF 100-YEAR SHEETFLOW FLOODING WHERE AVERAGE DEPTHS ARE LESS THAN 1 FOOT.

GN MN 0° 38' 11 MILS 14 1/2° 258 MILS

1000 0 1000 2000 3000 4000 5000 6000 7000 8000 9000 10,000 FEET
1 0 1 MILES
1 0 1 2 KILOMETERS
1000 0 1000 2000 METERS

CONTOUR INTERVAL 20 FEET
SUPPLEMENTARY CONTOUR INTERVAL 10 FEET

NEVADA
QUADRANGLE LOCA

100-YEAR FLOOD ZONE DELINEATION MAP OF THE AREA 5 RADIOACTIVE WASTE MANAGEMENT SITE VICINITY

by

John S. Schmeltzer, Julianne J. Miller
and
Dennis L. Gustafson

FIGURE 11

APPENDIX B

FEMA FAN MODEL OUTPUT

APPENDIX C

HEC-2 MODEL OUTPUT

APPENDIX D

SHEETFLOW CALCULATIONS

4.2 Results and Discussion of Flood Hazard Determination

Using the methods described in the previous section, the 100-year flood hazard areas were defined on the topographic maps (*Figure 11* and *Sheet 3*). Zone AO and Zone X were used to denote the flood hazards in the vicinity of the RWMS.

FEMA designates alluvial fan, shallow concentrated flow, and sheetflow areas with a 100-year flood depth of greater than 1 foot as a Zone AO. FEMA (1990) defines Zone AO as the area of 100-year shallow flooding where average depths are between 1 and 3 feet. For alluvial fans, anywhere throughout the zone there is a probability of 0.01 that a channel can occur at the designated depth with flow at the designated velocity. Zone X, shown on *Figure 11* and *Sheet 3* and Figure 12 and Sheet 4, represents areas outside the 100-year flood hazard and/or areas of the 100-year shallow flooding (sheetflow or shallow concentrated flow) where average depths are less than 1 foot. A Zone X delineation does not mean that floods will not occur within this zone. For this reason, flood hazard protection must be addressed.

4.2.1 Alluvial Fan Flooding

The 100-year flood hazard zones for the Barren Wash, Scarp Canyon, and the Halfpint fans are shown on *Figure 11* and *Sheet 3*. The 100-year flood hazard for the RWMS and its immediate vicinity is also shown on an 1:6,000 orthophoto (*Figure 12* and *Sheet 4*).

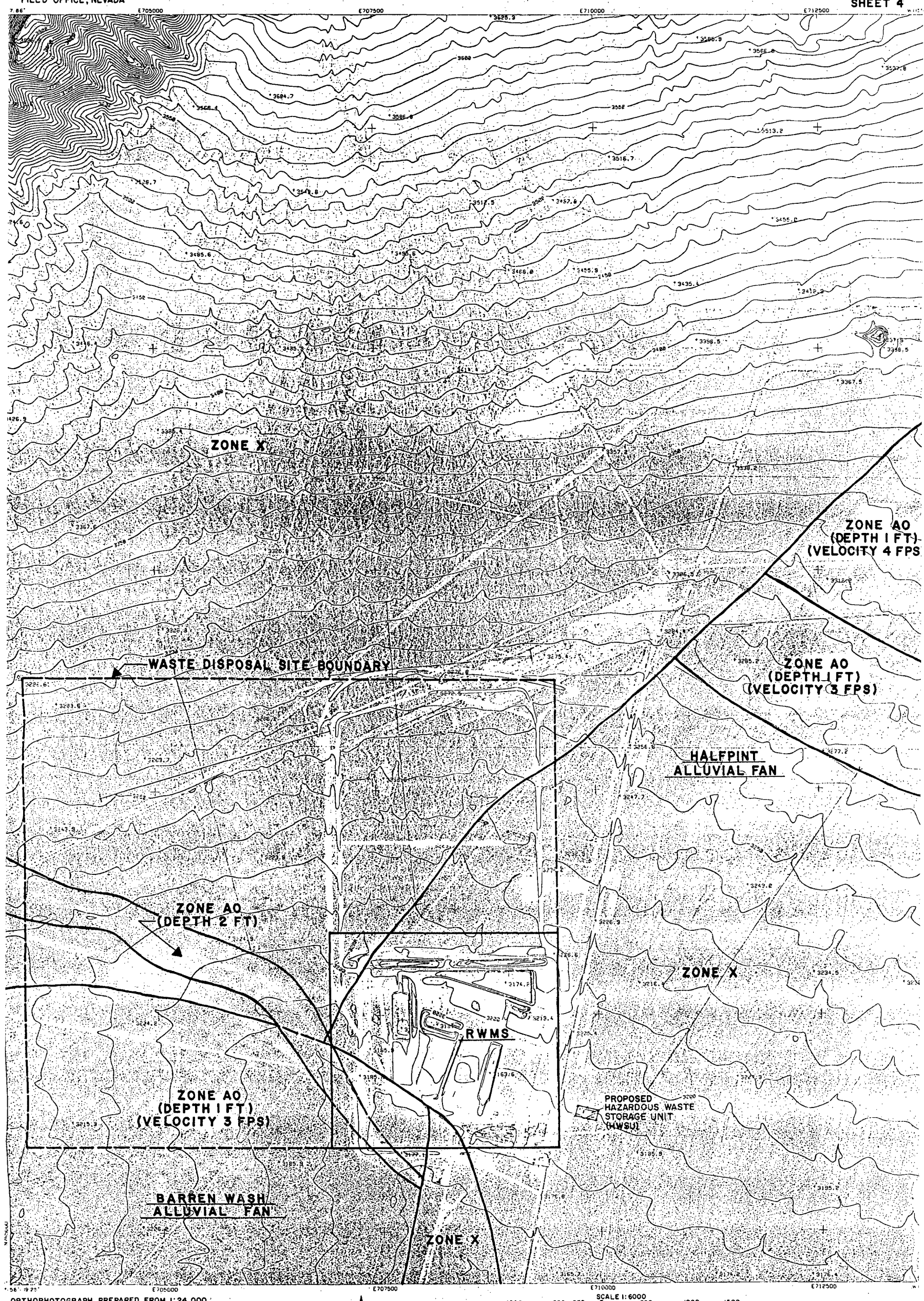
Using the FEMA Fan Methodology, the southwest corner of the RWMS is within the 100-year flood hazard zone, designated as Zone AO; depth 1 foot; velocity 3 feet per second, of the Barren Wash Alluvial Fan. The part of the RWMS that is located within Zone AO of this alluvial fan is not included in the RCRA Part B Permit Application for the Area 5 RWMS because it is not used for storage or disposal of hazardous, mixed, or radioactive waste. This designation means that the southwest corner of the RWMS has a probability of 0.01 (a 100-year event) to be impacted by channelized flow averaging 1 foot of depth and having a velocity of 3 feet per second. The proposed HWSU is not within the 100-year flood hazard of the Barren Wash Alluvial Fan.

Neither the RWMS nor the proposed HWSU are located within the 100-year flood hazard of the Halfpint Alluvial Fan (100-year flow depths 1 foot or greater), but are located in the Zone X area of the Halfpint Alluvial Fan (100-year flow depths less than 1 foot). This study determined that 100-year flow from the Scarp Canyon Alluvial Fan does not impact the RWMS or the proposed HWSU. Appendix B contains the output of the FAN model results.

The review of field data; topographic, geologic, and surficial maps; and aerial photographs does not invalidate the assumptions of the FEMA Alluvial Fan Methodology. However, other methods for determining flood hazards in arid regions are currently being developed. At the time of the writing of this report, none of these other methods have been adopted by FEMA; therefore, the FEMA methods were the only methods used. For example, French (1992) argues that the FEMA assumption of an uniform probability of a channel being formed on any given contour may not be valid. As a result of analyzing channel orientation of over 90 alluvial fans in the United States, French found that fanhead channels tend to form along or near the centerline of alluvial fans (an imaginary line which bisects the alluvial fan from the apex to the toe of the alluvial fan). In his study, French modified the FEMA Alluvial Fan Methodology to incorporate this tendency. Using French's approach, the flood hazard potential from the Barren Wash Alluvial Fan is less than the potential determined from the FEMA methodology because the RWMS is located adjacent to the north boundary of the fan.

PREPARED BY RAYTHEON SERVICES NEVADA FOR
U.S. DEPARTMENT OF ENERGY,
FIELD OFFICE, NEVADA

SHEET 4



ORTHOPHOTOGRAPH PREPARED FROM 1:24,000 SCALE AERIAL PHOTOGRAPHS TAKEN AUGUST, 1991 BY EG&G ENERGY MEASUREMENTS, INC.

TION

ALLUVIAL FAN BOUNDARY

BOUNDARY OF RADIOACTIVE WASTE MANAGEMENT SITE (RWMS)

BOUNDARY OF AREA PROPOSED FOR RWMS EXPANSION

NE AO:
PTH 2 FT)
— SHALLOW CONCENTRATED FLOW 100-YEAR FLOOD ZONE DESIGNATION: FEMA FLOOD ZONE THAT CORRESPONDS TO AREAS OF 100-YEAR SHALLOW FLOODING WHERE AVERAGE DEPTHS ARE BETWEEN 1 AND 3 FEET.

D:
2 FT)
Y 5 FPS)
— ALLUVIAL FAN 100-YEAR FLOOD ZONE DESIGNATION: FEMA FLOOD ZONE THAT CORRESPONDS TO AREAS OF 100-YEAR SHALLOW FLOODING WHERE AVERAGE DEPTHS ARE BETWEEN 1 AND 3 FEET. ANYWHERE THROUGHOUT THE ZONE THERE IS AN EQUALLY LIKELY CHANCE THAT A CHANNEL CAN OCCUR OF THE DESIGNATED DEPTH WITH A FLOW OF THE DESIGNATED VELOCITY.

ZONE X: — FEMA FLOOD ZONE THAT CORRESPONDS TO AREAS OUTSIDE THE 100-YEAR FLOOD HAZARD AND TO AREAS OF 100-YEAR SHEETFLOW FLOODING WHERE AVERAGE DEPTHS ARE LESS THAN 1 FOOT.

GRID NORTH
MAG NORTH
14.5°

SCALE 1:6000
1000 500 250 0 500 1000 1500
1 INCH = 500 FEET
10 FT. CONTOUR INTERVAL

STATE OF NEVA
NYE CO
NTS
SITE LOCATI

100-YEAR FLOOD ZONE DELINEATION MAP AT THE AREA 5 RADIOACTIVE WASTE MANAGEMENT SITE

by

John S. Schmeltzer, Julianne J. Miller
and
Dennis L. Gustafson

FIGURE 12

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APPENDIX A

HEC-1 MODEL OUTPUT

APPENDIX A

HEC-1 MODEL OUTPUT

100-YEAR MODELS			
RWMS.OUT	RWMSCN.OUT	RWMSW.OUT	RWMSC.OUT
10-YEAR MODELS			
RWMS10.OUT		RWMS10C.OUT	
2-YEAR MODEL			
RWMS2.OUT			

```
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*                                      *
*   FLOOD HYDROGRAPH PACKAGE  (HEC-1)  *
*          SEPTEMBER 1990              *
*           VERSION 4.0                *
*                                      *
*  RUN DATE  01/29/1993  TIME  21:56:35 *
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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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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   ID   FLOOD ASSESSMENT FOR RWMS JOB #:51056        FILE: RWMS.DAT
 2   ID   100-YEAR 6-HOUR STORM 1.6 INCHES
 3   ID   POINT RAINFALL VALUES FORM NOAA ATLAS 2 VOL VII
 4   ID   DEPTH-AREA REDUCTION FACTORS FROM TABLE 502 IN
 5   ID   CLARK COUNTY HYDROLOGIC CRITERIA AND DRAINAGE DESIGN MANUAL (CCRFCD, 1990)
 6   ID   CURVE NUMBERS DETERMINED USING TABLE 602 IN CCRFCD, 1990
 7   ID   LAG TIMES DETERMINED USING METHOD IN SECTION 606.3 IN CCRFCD, 1990
 8   ID   DRAINAGE AREAS FROM 7.5 MINUTE AND 15 MINUTE QUADS
 9   ID   THIS MODEL ADDRESSES DRAINAGES THAT COULD IMPACT THE RWMS
     *DIAGRAM
10   IT       3       0       0     300
11   IO       5
12   IN       5
13   JD     1.6     .01
     * RAINFALL DISTRIBUTION FROM CLARK COUNTY MANUAL LESS THAN 10 SQ. MILES
14   PC       0       2     5.7     7.0     8.7    10.8    12.4    13.0    13.0    13.0
15   PC    13.0    13.0    13.0    13.3    14.0    14.2    14.8    15.8    17.2    18.1
16   PC    19.0    19.7    19.9    20.0    20.1    20.4    21.4    22.9    24.1    24.9
17   PC    25.1    25.6    27.0    27.8    28.1    28.3    29.5    32.2    35.2    40.9
18   PC    49.9    59.0    71.0    74.4    78.1    81.2    81.9    83.5    85.1    85.6
19   PC    86.0    86.8    87.6    88.8    91.0    92.6    93.7    95.0    97.0    97.6
20   PC    98.2    98.5    98.7    98.9    99.0    99.3    99.3    99.4    99.5    99.8
21   PC    99.8    99.9   100.0
22   JD    1.55       1
23   JD    1.38    9.99
     * CHANGED RAINFALL DISTRIBUTION ABOVE 10 SQ. MILES PER CLARK COUNTY MANUAL
24   JD    1.38   10.01
25   PC       0     2.0     5.9     8.0    11.0    14.4    15.0    16.0    16.8    17.1
26   PC    18.0    18.2    18.7    19.0    19.7    20.2    21.0    22.0    23.0    24.1
27   PC    25.0    25.9    26.5    28.0    29.0    30.0    30.5    30.9    31.0    31.7
28   PC    32.1    32.7    33.3    34.6    36.1    38.1    40.8    43.0    47.7    51.4
29   PC    56.1    63.0    71.0    72.0    73.1    75.2    77.9    79.0    79.5    80.4
30   PC    81.0    82.0    82.6    84.0    85.9    88.9    91.0    93.8    96.6    97.0
31   PC    97.4    97.9    98.1    98.3    98.5    98.9    99.0    99.2    99.3    99.6
32   PC    99.7    99.9   100.0
33   JD    1.26      20
34   JD    1.18      30
35   JD    1.09      50
36   JD     .96     100

37   KK    MM1A
38   KM   Basin runoff calculation for Mass. Mountains 1A
39   BA      .9
40   LS              80
41   UD     .31

42   KK     BW1
43   KM     Basin runoff calculation for Barren Wash 1
44   BA    60.5
45   LS              83
46   UD     2.1
```

```
KK     BW2
KM     Basin runoff calculation for Barren Wash 2
BA    20.8
LS              80
UD      .9

KK   BW1&2
KM   Combined BW1 and BW2
HC       2

KK  BW APX
KM   Combine BW1,BW2, and MM1A (assume dischcarge of Barren Wash "active apex")
HC       2

KK    MM1B
KM    Basin runoff calulation for Mass. Mountains 1B
*   Flow was not combined with BW APX because flow from this watershed
*   will not directly impact RWMS wereas a channel migration at the apex
*   could impact the RWMS
BA     2.1
LS              77
UD     .48

KK     MM2
KM    Basin runoff calculation for Mass. Mountains 2
BA     1.4
LS              79
UD     .47

KK    HP1A
KM    Basin runoff calculation for Half Pint Range 1A
BA      .8
LS              85
UD     .48

KK   RTCPA
KM   Route Flow from HP1A to CPA
RM       9     .43      .2

KK    HP1B
KM    Basin runoff calculation for Half Pint Range 1B
BA     1.0
LS              78
UD     .51

KK     HP2
KM    Basin runoff calculation for Half Pint Range 2
BA    1.2
LS              78
UD     .51

KK    CPA1
KM    Combine MM2, routed HP1A, HP1B, HP2
HC       4

KK     HP3
KM     (CPB) Basin runoff calculation for Half Pint Range 3
BA     1.7
LS              82
UD     .59

KK    CPA2
KM    Combine HP3 with flow from CPA1
HC       2

KK     HP4
KM     (CPC) Basin runoff calculation for Half Pint Range 4
BA     3.3
LS              79
UD     .52

KK     HP5
KM     Basin runoff calculation for Half Pint Range 5
BA     1.2
LS              79
UD      .3

KK     HP6
KM     Basin runoff calculation for Half Pint Range 6
BA     2.2
LS              80
UD     .55

KK   RTCPD
KM    Route HP6 to CPD
RM       5     .27      .2
```

```
KK    HPFA
KM     Basin runoff calculation for Half Pint Range FA
BA      .3
LS              77
UD     .33

KK     CPD
KM     Combine HP5, routed HP6, and HPFA
HC       3

KK   RTCPE
KM     Route flow from CPD to CPE
RM       8     .39      .2

KK    HPFB
KM     Basin runoff calculation for Half Pint Range FB
BA     1.6
LS              77
UD     .44

KK     CPE
KM    Combine HP4 (CPC) with routed flow from CPD, and HPFB
HC       3

KK     CPF
KM    Combine all flow at Concentration just below RWMS (Flow from CPA & CPE)
HC       2

KK     SC1
KM     Basin runoff calculation for Scarp Canyon 1
* Concentration Pt of this watershed is the active apex of the Scarp Canyon Fan
BA    39.4
LS              82
UD     2.1

KK     SC2
KM     Basin runoff calculation for Scarp Canyon 2
BA     1.5
LS              77
UD     .48
ZZ
```

SCHEMATIC DIAGRAM OF STREAM NETWORK

(V) ROUTING (---->) DIVERSION OR PUMP FLOW

(.) CONNECTOR (<---) RETURN OF DIVERTED OR PUMPED FLOW

```
INPUT
 LINE
 NO.
 37     MM1A
         :
 42      :        BW1
         :         :
 47      :         :        BW2
         :         :         :
 52      :       BW1&2.......:
         :         :
 55     BW APX.....:
         :
 58      :       MM1B
         :         :
 63      :         :        MM2
         :         :         :
 68      :         :         :       HP1A
         :         :         :         V
         :         :         :         V
 73      :         :         :      RTCPA
         :         :         :         :
 76      :         :         :         :        HP1B
         :         :         :         :         :
 81      :         :         :         :         :        HP2
         :         :         :         :         :         :
 86      :         :        CPA1.......:.........:.........:
         :         :         :
 89      :         :         :       HP3
         :         :         :         :
 94      :         :        CPA2......:
         :         :         :
 97      :         :         :       HP4
         :         :         :         :
102      :         :         :         :        HP5
         :         :         :         :         :
107      :         :         :         :         :        HP6
         :         :         :         :         :         V
         :         :         :         :         :         V
112      :         :         :         :         :      RTCPD
         :         :         :         :         :         :
115      :         :         :         :         :         :        HPFA
         :         :         :         :         :         :         :
120      :         :         :         :        CPD.........:.........:
         :         :         :         :         V
         :         :         :         :         V
123      :         :         :         :      RTCPE
         :         :         :         :         :
126      :         :         :         :         :        HPFB
         :         :         :         :         :         :
131      :         :         :       CPE.........:.........:
         :         :         :         :
134      :         :        CPF.......:
         :         :         :
137      :         :         :       SC1
         :         :         :         :
142      :         :         :         :        SC2
```

(***) RUNOFF ALSO COMPUTED AT THIS LOCATION

```
*****************************************
*                                       *
*   FLOOD HYDROGRAPH PACKAGE  (HEC-1)   *
*            SEPTEMBER 1990             *
*             VERSION 4.0               *
*                                       *
*  RUN DATE  01/29/1993  TIME  21:56:35 *
*                                       *
*****************************************
```

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

```
                    FLOOD ASSESSMENT FOR RWMS JOB #:51056        FILE: RWMS.DAT
                    100-YEAR 6-HOUR STORM 1.6 INCHES
                    POINT RAINFALL VALUES FORM NOAA ATLAS 2 VOL VII
                    DEPTH-AREA REDUCTION FACTORS FROM TABLE 502 IN
                    CLARK COUNTY HYDROLOGIC CRITERIA AND DRAINAGE DESIGN MANUAL (CCRFCD, 1990)
                    CURVE NUMBERS DETERMINED USING TABLE 602 IN CCRFCD, 1990
                    LAG TIMES DETERMINED USING METHOD IN SECTION 606.3 IN CCRFCD, 1990
                    DRAINAGE AREAS FROM 7.5 MINUTE AND 15 MINUTE QUADS
                    THIS MODEL ADDRESSES DRAINAGES THAT COULD IMPACT THE RWMS.

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

   IT        HYDROGRAPH TIME DATA
                  NMIN          3  MINUTES IN COMPUTATION INTERVAL
                 IDATE      1   0  STARTING DATE
                 ITIME       0000  STARTING TIME
                    NQ        300  NUMBER OF HYDROGRAPH ORDINATES
                NDDATE      1   0  ENDING DATE
                NDTIME       1457  ENDING TIME
                 ICENT         19  CENTURY MARK

             COMPUTATION INTERVAL     .05 HOURS
                  TOTAL TIME BASE   14.95 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

13 JD        INDEX STORM NO. 1
                  STRM        1.60  PRECIPITATION DEPTH
                  TRDA         .01  TRANSPOSITION DRAINAGE AREA

14 PI          PRECIPITATION PATTERN
                 1.20      1.54      2.22      1.26       .78      1.02      1.10      1.26      1.06       .96
                  .36       .24       .00       .00       .00       .00       .00       .00       .00       .00
                  .18       .26       .42       .22       .12       .36       .44       .60       .76       .84
                  .54       .54       .54       .46       .42       .12       .10       .06       .06       .06
                  .18       .32       .60       .80       .90       .72       .64       .48       .24       .12
                  .30       .48       .84       .60       .48       .18       .16       .12       .52       .72
                 1.62      1.68      1.80      2.88      3.42      5.40      5.42      5.46      6.62      7.20
                 2.04      2.10      2.22      1.98      1.86       .42       .60       .96       .96       .96
                  .30       .28       .24       .40       .48       .48       .56       .72      1.12      1.32
                  .96       .86       .66       .74       .78      1.20       .92       .36       .36       .36
                  .18       .16       .12       .12       .12       .06       .10       .18       .06       .00
                  .06       .06       .06       .14       .18       .00       .02       .06       .06       .06

22 JD        INDEX STORM NO. 2
                  STRM        1.55  PRECIPITATION DEPTH
                  TRDA        1.00  TRANSPOSITION DRAINAGE AREA

 0 PI          PRECIPITATION PATTERN
                 1.20      1.54      2.22      1.26       .78      1.02      1.10      1.26      1.06       .96
                  .36       .24       .00       .00       .00       .00       .00       .00       .00       .00
                  .18       .26       .42       .22       .12       .36       .44       .60       .76       .84
                  .54       .54       .54       .46       .42       .12       .10       .06       .06       .06
                  .18       .32       .60       .80       .90       .72       .64       .48       .24       .12
                  .30       .48       .84       .60       .48       .18       .16       .12       .52       .72
                 1.62      1.68      1.80      2.88      3.42      5.40      5.42      5.46      6.62      7.20
                 2.04      2.10      2.22      1.98      1.86       .42       .60       .96       .96       .96
                  .30       .28       .24       .40       .48       .48       .56       .72      1.12      1.32
                  .96       .86       .66       .74       .78      1.20       .92       .36       .36       .36
                  .18       .16       .12       .12       .12       .06       .10       .18       .06       .00
                  .06       .06       .06       .14       .18       .00       .02       .06       .06       .06
```

23 JD INDEX STORM NO. 3

STRM 1.38 PRECIPITATION DEPTH

TRDA 9.99 TRANSPOSITION DRAINAGE AREA

0 PI PRECIPITATION PATTERN

1.20	1.54	2.22	1.26	.78	1.02	1.10	1.26	1.06	.96
.36	.24	.00	.00	.00	.00	.00	.00	.00	.00
.18	.26	.42	.22	.12	.36	.44	.60	.76	.84
.54	.54	.54	.46	.42	.12	.10	.06	.06	.06
.18	.32	.60	.80	.90	.72	.64	.48	.24	.12
.30	.48	.84	.60	.48	.18	.16	.12	.52	.72
1.62	1.68	1.80	2.88	3.42	5.40	5.42	5.46	6.62	7.20
2.04	2.10	2.22	1.98	1.86	.42	.60	.96	.96	.96
.30	.28	.24	.40	.48	.48	.56	.72	1.12	1.32
.96	.86	.66	.74	.78	1.20	.92	.36	.36	.36
.18	.16	.12	.12	.12	.06	.10	.18	.06	.00
.06	.06	.06	.14	.18	.00	.02	.06	.06	.06

24 JD INDEX STORM NO. 4

STRM 1.38 PRECIPITATION DEPTH

TRDA 10.01 TRANSPOSITION DRAINAGE AREA

25 PI PRECIPITATION PATTERN

1.20	1.58	2.34	1.62	1.26	1.80	1.88	2.04	.92	.36
.60	.56	.48	.28	.18	.54	.40	.12	.24	.30
.18	.26	.42	.34	.30	.48	.52	.60	.60	.60
.66	.62	.54	.54	.54	.36	.54	.90	.70	.60
.60	.50	.30	.26	.24	.06	.18	.42	.30	.24
.36	.36	.36	.64	.78	.90	1.00	1.20	1.48	1.62
1.32	1.82	2.82	2.42	2.22	2.82	3.26	4.14	4.58	4.80
.60	.62	.66	1.06	1.26	1.62	1.30	.66	.42	.30
.54	.48	.36	.52	.60	.36	.52	.84	1.04	1.14
1.80	1.62	1.26	1.54	1.68	1.68	1.20	.24	.24	.24
.30	.24	.12	.12	.12	.12	.16	.24	.12	.06
.12	.10	.06	.14	.18	.06	.08	.12	.08	.06

33 JD INDEX STORM NO. 5

STRM 1.26 PRECIPITATION DEPTH

TRDA 20.00 TRANSPOSITION DRAINAGE AREA

0 PI PRECIPITATION PATTERN

1.20	1.58	2.34	1.62	1.26	1.80	1.88	2.04	.92	.36
.60	.56	.48	.28	.18	.54	.40	.12	.24	.30
.18	.26	.42	.34	.30	.48	.52	.60	.60	.60
.66	.62	.54	.54	.54	.36	.54	.90	.70	.60
.60	.50	.30	.26	.24	.06	.18	.42	.30	.24
.36	.36	.36	.64	.78	.90	1.00	1.20	1.48	1.62
1.32	1.82	2.82	2.42	2.22	2.82	3.26	4.14	4.58	4.80
.60	.62	.66	1.06	1.26	1.62	1.30	.66	.42	.30
.54	.48	.36	.52	.60	.36	.52	.84	1.04	1.14
1.80	1.62	1.26	1.54	1.68	1.68	1.20	.24	.24	.24
.30	.24	.12	.12	.12	.12	.16	.24	.12	.06
.12	.10	.06	.14	.18	.06	.08	.12	.08	.06

34 JD INDEX STORM NO. 6

STRM 1.18 PRECIPITATION DEPTH

TRDA 30.00 TRANSPOSITION DRAINAGE AREA

0 PI PRECIPITATION PATTERN

1.20	1.58	2.34	1.62	1.26	1.80	1.88	2.04	.92	.36
.60	.56	.48	.28	.18	.54	.40	.12	.24	.30
.18	.26	.42	.34	.30	.48	.52	.60	.60	.60
.66	.62	.54	.54	.54	.36	.54	.90	.70	.60
.60	.50	.30	.26	.24	.06	.18	.42	.30	.24
.36	.36	.36	.64	.78	.90	1.00	1.20	1.48	1.62
1.32	1.82	2.82	2.42	2.22	2.82	3.26	4.14	4.58	4.80
.60	.62	.66	1.06	1.26	1.62	1.30	.66	.42	.30
.54	.48	.36	.52	.60	.36	.52	.84	1.04	1.14
1.80	1.62	1.26	1.54	1.68	1.68	1.20	.24	.24	.24
.30	.24	.12	.12	.12	.12	.16	.24	.12	.06
.12	.10	.06	.14	.18	.06	.08	.12	.08	.06

35 JD INDEX STORM NO. 7

STRM 1.09 PRECIPITATION DEPTH

TRDA 50.00 TRANSPOSITION DRAINAGE AREA

0 PI PRECIPITATION PATTERN

1.20	1.58	2.34	1.62	1.26	1.80	1.88	2.04	.92	.36
.60	.56	.48	.28	.18	.54	.40	.12	.24	.30
.18	.26	.42	.34	.30	.48	.52	.60	.60	.60
.66	.62	.54	.54	.54	.36	.54	.90	.70	.60
.60	.50	.30	.26	.24	.06	.18	.42	.30	.24
.36	.36	.36	.64	.78	.90	1.00	1.20	1.48	1.62
1.32	1.82	2.82	2.42	2.22	2.82	3.26	4.14	4.58	4.80
.60	.62	.66	1.06	1.26	1.62	1.30	.66	.42	.30
.54	.48	.36	.52	.60	.36	.52	.84	1.04	1.14
1.80	1.62	1.26	1.54	1.68	1.68	1.20	.24	.24	.24
.30	.24	.12	.12	.12	.12	.16	.24	.12	.06
.12	.10	.06	.14	.18	.06	.08	.12	.08	.06

36 JD INDEX STORM NO. 8

STRM .96 PRECIPITATION DEPTH

TRDA 100.00 TRANSPOSITION DRAINAGE AREA

0 PI PRECIPITATION PATTERN

1.20	1.58	2.34	1.62	1.26	1.80	1.88	2.04	.92	.36
.60	.56	.48	.28	.18	.54	.40	.12	.24	.30
.18	.26	.42	.34	.30	.48	.52	.60	.60	.60
.66	.62	.54	.54	.54	.36	.54	.90	.70	.60
.60	.50	.30	.26	.24	.06	.18	.42	.30	.24
.36	.36	.36	.64	.78	.90	1.00	1.20	1.48	1.62
1.32	1.82	2.82	2.42	2.22	2.82	3.26	4.14	4.58	4.80
.60	.62	.66	1.06	1.26	1.62	1.30	.66	.42	.30
.54	.48	.36	.52	.60	.36	.52	.84	1.04	1.14
1.80	1.62	1.26	1.54	1.68	1.68	1.20	.24	.24	.24
.30	.24	.12	.12	.12	.12	.16	.24	.12	.06
.12	.10	.06	.14	.18	.06	.08	.12	.08	.06

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	MM1A	174.	3.80	30.	12.	12.	.90		
+	HYDROGRAPH AT	BW1	1786.	6.35	961.	405.	405.	60.50		
+	HYDROGRAPH AT	BW2	1016.	5.40	389.	156.	156.	20.80		
+	2 COMBINED AT	BW1&2	1848.	5.95	1003.	421.	421.	81.30		
+	2 COMBINED AT	BW APX	1841.	5.95	1004.	421.	421.	82.20		
+	HYDROGRAPH AT	MM1B	200.	4.05	47.	19.	19.	2.10		
+	HYDROGRAPH AT	MM2	184.	4.00	41.	16.	16.	1.40		
+	HYDROGRAPH AT	HP1A	200.	3.95	42.	17.	17.	.80		
+	ROUTED TO	RTCPA	190.	4.40	42.	17.	17.	.80		
+	HYDROGRAPH AT	HP1B	116.	4.05	27.	11.	11.	1.00		
+	HYDROGRAPH AT	HP2	136.	4.05	32.	13.	13.	1.20		
+	4 COMBINED AT	CPA1	459.	4.15	120.	48.	48.	4.40		
+	HYDROGRAPH AT	HP3	263.	4.10	64.	26.	26.	1.70		
+	2 COMBINED AT	CPA2	659.	4.15	170.	68.	68.	6.10		
+	HYDROGRAPH AT	HP4	360.	4.05	86.	35.	35.	3.30		
+	HYDROGRAPH AT	HP5	206.	3.80	36.	14.	14.	1.20		
+	HYDROGRAPH AT	HP6	277.	4.10	67.	27.	27.	2.20		
+	ROUTED TO	RTCPD	268.	4.35	67.	27.	27.	2.20		
+	HYDROGRAPH AT	HPFA	41.	3.85	8.	3.	3.	.30		
+	3 COMBINED AT	CPD	333.	4.25	99.	40.	40.	3.70		
+	ROUTED TO	RTCPE	326.	4.65	99.	40.	40.	3.70		
+	HYDROGRAPH AT	HPFB	167.	4.00	37.	15.	15.	1.60		
+	3 COMBINED AT	CPE	603.	4.20	191.	77.	77.	8.60		
+	2 COMBINED AT	CPF	878.	5.15	301.	121.	121.	14.70		
+	HYDROGRAPH AT	SC1	1251.	6.35	673.	283.	283.	39.40		
+	HYDROGRAPH AT	SC2	151.	4.05	35.	14.	14.	1.50		

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

HEC-1 MODEL OUTPUT

FILENAME: RWMSCN.OUT

(100-YEAR MODEL)

```
****************************************
*                                      *
*   FLOOD HYDROGRAPH PACKAGE  (HEC-1)  *
*            SEPTEMBER 1990            *
*             VERSION 4.0              *
*                                      *
*  RUN DATE  01/29/1993  TIME  21:59:18 *
*                                      *
****************************************
```

```
****************************************
*                                      *
*    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   ID   FLOOD ASSESSMENT FOR RWMS JOB #:51056        FILE: RWMSCN.DAT
 2   ID   100-YEAR 6-HOUR STORM 1.6 INCHES
 3   ID   POINT RAINFALL VALUES FROM NOAA ATLAS 2 VOL VII
 4   ID   DEPTH-AREA REDUCTION FACTORS FROM TABLE 502 IN
 5   ID   CLARK COUNTY HYDROLOGIC CRITERIA AND DRAINAGE DESIGN MODEL (CCRFCD, 1990)
 6   ID   CURVE NUMBERS DETERMINED USING TABLE 602 IN CCRFCD, 1990
 7   ID   LAG TIMES DETERMINED USING METHOD IN SECTION 606.3 IN CCRFCD, 1990
 8   ID   DRAINAGE AREAS FROM 7.5 MINUTE AND 15 MINUTE QUADS
 9   ID   THIS MODEL ADDRESSES DRAINAGES THAT COULD IMPACT THE RWMS
10   ID   ADJUSTED CURVE NUMBERS BY 5 TO ACCOUNT FOR MOISTER SOILS DURING THE 100-YR EV
     *DIAGRAM
11   IT       3       0       0     300
12   IO       5
13   IN       5
14   JD     1.6     .01
     * RAINFALL DISTRIBUTION FROM CLARK COUNTY MANUAL LESS THAN 10 SQ. MILES
15   PC       0       2     5.7     7.0     8.7    10.8    12.4    13.0    13.0    13.0
16   PC    13.0    13.0    13.0    13.3    14.0    14.2    14.8    15.8    17.2    18.1
17   PC    19.0    19.7    19.9    20.0    20.1    20.4    21.4    22.9    24.1    24.9
18   PC    25.1    25.6    27.0    27.8    28.1    28.3    29.5    32.2    35.2    40.9
19   PC    49.9    59.0    71.0    74.4    78.1    81.2    81.9    83.5    85.1    85.6
20   PC    86.0    86.8    87.6    88.8    91.0    92.6    93.7    95.0    97.0    97.6
21   PC    98.2    98.5    98.7    98.9    99.0    99.3    99.3    99.4    99.5    99.8
22   PC    99.8    99.9   100.0
23   JD    1.55       1
24   JD    1.38    9.99
     * CHANGED RAINFALL DISTRIBUTION ABOVE 10 SQ. MILES PER CLARK COUNTY MANUAL
25   JD    1.38   10.01
26   PC       0     2.0     5.9     8.0    11.0    14.4    15.0    16.0    16.8    17.1
27   PC    18.0    18.2    18.7    19.0    19.7    20.2    21.0    22.0    23.0    24.1
28   PC    25.0    25.9    26.5    28.0    29.0    30.0    30.5    30.9    31.0    31.7
29   PC    32.1    32.7    33.3    34.6    36.1    38.1    40.8    43.0    47.7    51.4
30   PC    56.1    63.0    71.0    72.0    73.1    75.2    77.9    79.0    79.5    80.4
31   PC    81.0    82.0    82.6    84.0    85.9    88.9    91.0    93.8    96.6    97.0
32   PC    97.4    97.9    98.1    98.3    98.5    98.9    99.0    99.2    99.3    99.6
33   PC    99.7    99.9   100.0
34   JD    1.26      20
35   JD    1.18      30
36   JD    1.09      50
37   JD     .96     100

38   KK    MM1A
39   KM   Basin runoff calculation for Mass. Mountains 1A
40   BA      .9
41   LS              85
42   UD     .31

43   KK     BW1
44   KM     Basin runoff calculation for Barren Wash 1
45   BA    60.5
46   LS              88
47   UD     2.1
```

```
48          KK     BW2
49          KM     Basin runoff calculation for Barren Wash 2
50          BA    20.8
51          LS              85
52          UD      .9

53          KK   BW1&2
54          KM   Combined BW1 and BW2
55          HC       2

56          KK  BW APX
57          KM   Combine BW1,BW2, and MM1A (assume dischcarge of Barren Wash "active apex")
58          HC       2

59          KK    MM1B
60          KM    Basin runoff calulation for Mass. Mountains 1B
            *   Flow was not combined with BW APX because flow from this watershed
            *   will not directly impact RWMS wereas a channel migration at the apex
            *   could impact the RWMS
61          BA     2.1
62          LS              82
63          UD     .48

64          KK     MM2
65          KM    Basin runoff calculation for Mass. Mountains 2
66          BA     1.4
67          LS              84
68          UD     .47

69          KK    HP1A
70          KM    Basin runoff calculation for Half Pint Range 1A
71          BA      .8
72          LS              90
73          UD     .48

74          KK   RTCPA
75          KM   Route Flow from HP1A to CPA
76          RM       9     .43      .2

77          KK    HP1B
78          KM    Basin runoff calculation for Half Pint Range 1B
79          BA     1.0
80          LS              83
81          UD     .51

82          KK     HP2
83          KM    Basin runoff calculation for Half Pint Range 2
84          BA    1.2
85          LS              83
86          UD     .51

87          KK    CPA1
88          KM    Combine MM2, routed HP1A, HP1B, HP2
89          HC       4

90          KK     HP3
91          KM     (CPB) Basin runoff calculation for Half Pint Range 3
92          BA     1.7
93          LS              87
94          UD     .59

95          KK    CPA2
96          KM    Combine HP3 with flow from CPA1
97          HC       2

98          KK     HP4
99          KM     (CPC) Basin runoff calculation for Half Pint Range 4
100         BA     3.3
101         LS              84
102         UD     .52

103         KK     HP5
104         KM     Basin runoff calculation for Half Pint Range 5
105         BA     1.2
106         LS              84
107         UD      .3

108         KK     HP6
109         KM     Basin runoff calculation for Half Pint Range 6
110         BA     2.2
111         LS              85
112         UD     .55

113         KK   RTCPD
114         KM    Route HP6 to CPD
115         RM       5     .27      .2
```

```
116     KK    HPFA
117     KM     Basin runoff calculation for Half Pint Range FA
118     BA      .3
119     LS              82
120     UD     .33

121     KK     CPD
122     KM     Combine HP5, routed HP6, and HPFA
123     HC       3

124     KK   RTCPE
125     KM     Route flow from CPD to CPE
126     RM       8     .39      .2

127     KK    HPFB
128     KM     Basin runoff calculation for Half Pint Range FB
129     BA     1.6
130     LS              82
131     UD     .44

132     KK     CPE
133     KM    Combine HP4 (CPC) with routed flow from CPD, and HPFB
134     HC       3

135     KK     CPF
136     KM    Combine all flow at Concentration just below RWMS (Flow from CPA & CPE)
137     HC       2

138     KK     SC1
139     KM     Basin runoff calculation for Scarp Canyon 1
        * Concentration Pt of this watershed is the active apex of the Scarp Canyon Fan
140     BA    39.4
141     LS              87
142     UD     2.1

143     KK     SC2
144     KM     Basin runoff calculation for Scarp Canyon 2
145     BA     1.5
146     LS              82
147     UD     .48
148     ZZ
```

SCHEMATIC DIAGRAM OF STREAM NETWORK

(V) ROUTING (---->) DIVERSION OR PUMP FLOW

(.) CONNECTOR (<---) RETURN OF DIVERTED OR PUMPED FLOW

```
INPUT
LINE
 NO.
 38     MM1A
        :
 43     :       BW1
        :       :
 48     :       :       BW2
        :       :       :
 53     :     BW1&2.....
        :       :
 56   BW APX.....
        :
 59     :     MM1B
        :       :
 64     :       :       MM2
        :       :       :
 69     :       :       :       HP1A
        :       :       :         V
        :       :       :         V
 74     :       :       :      RTCPA
        :       :       :       :
 77     :       :       :       :       HP1B
        :       :       :       :       :
 82     :       :       :       :       :       HP2
        :       :       :       :       :       :
 87     :       :       CPA1.....................
        :       :       :
 90     :       :       :       HP3
        :       :       :       :
 95     :       :       CPA2.....
        :       :       :
 98     :       :       :       HP4
        :       :       :       :
103     :       :       :       :       HP5
        :       :       :       :       :
108     :       :       :       :       :       HP6
        :       :       :       :       :         V
        :       :       :       :       :         V
113     :       :       :       :       :      RTCPD
        :       :       :       :       :       :
116     :       :       :       :       :       :       HPFA
        :       :       :       :       :       :       :
121     :       :       :       :       CPD.....................
        :       :       :       :         V
        :       :       :       :         V
124     :       :       :       :     RTCPE
        :       :       :       :       :
127     :       :       :       :       :       HPFB
        :       :       :       :       :       :
132     :       :       :       CPE.....................
        :       :       :       :
135     :       :       CPF.....
        :       :       :
138     :       :       :       SC1
        :       :       :       :
143     :       :       :       :       SC2
```

(***) RUNOFF ALSO COMPUTED AT THIS LOCATION

```
*****************************************
*                                       *
*   FLOOD HYDROGRAPH PACKAGE  (HEC-1)   *
*          SEPTEMBER 1990               *
*            VERSION 4.0                *
*                                       *
*  RUN DATE  01/29/1993  TIME  21:59:18 *
*                                       *
*****************************************
```

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

```
                    FLOOD ASSESSMENT FOR RWMS JOB #:51056        FILE: RWMSCN.DAT
                    100-YEAR 6-HOUR STORM 1.6 INCHES
                    POINT RAINFALL VALUES FROM NOAA ATLAS 2 VOL VII
                    DEPTH-AREA REDUCTION FACTORS FROM TABLE 502 IN
                    CLARK COUNTY HYDROLOGIC CRITERIA AND DRAINAGE DESIGN MODEL (CCRFCD, 1990)
                    CURVE NUMBERS DETERMINED USING TABLE 602 IN CCRFCD, 1990
                    LAG TIMES DETERMINED USING METHOD IN SECTION 606.3 IN CCRFCD, 1990
                    DRAINAGE AREAS FROM 7.5 MINUTE AND 15 MINUTE QUADS
                    THIS MODEL ADDRESSES DRAINAGES THAT COULD IMPACT THE RWMS
                    ADJUSTED CURVE NUMBERS BY 5 TO ACCOUNT FOR MOISTER SOILS DURING THE 100-YR EV

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

   IT          HYDROGRAPH TIME DATA
                      NMIN          3  MINUTES IN COMPUTATION INTERVAL
                     IDATE      1   0  STARTING DATE
                     ITIME       0000  STARTING TIME
                        NQ        300  NUMBER OF HYDROGRAPH ORDINATES
                    NDDATE      1   0  ENDING DATE
                    NDTIME       1457  ENDING TIME
                     ICENT         19  CENTURY MARK

                 COMPUTATION INTERVAL     .05 HOURS
                      TOTAL TIME BASE   14.95 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

14 JD          INDEX STORM NO. 1
                      STRM       1.60  PRECIPITATION DEPTH
                      TRDA        .01  TRANSPOSITION DRAINAGE AREA

15 PI            PRECIPITATION PATTERN
                  1.20      1.54      2.22      1.26       .78      1.02      1.10      1.26      1.06       .96
                   .36       .24       .00       .00       .00       .00       .00       .00       .00       .00
                   .18       .26       .42       .22       .12       .36       .44       .60       .76       .84
                   .54       .54       .54       .46       .42       .12       .10       .06       .06       .06
                   .18       .32       .60       .80       .90       .72       .64       .48       .24       .12
                   .30       .48       .84       .60       .48       .18       .16       .12       .52       .72
                  1.62      1.68      1.80      2.88      3.42      5.40      5.42      5.46      6.62      7.20
                  2.04      2.10      2.22      1.98      1.86       .42       .60       .96       .96       .96
                   .30       .28       .24       .40       .48       .48       .56       .72      1.12      1.32
                   .96       .86       .66       .74       .78      1.20       .92       .36       .36       .36
                   .18       .16       .12       .12       .12       .06       .10       .18       .06       .00
                   .06       .06       .06       .14       .18       .00       .02       .06       .06       .06

23 JD          INDEX STORM NO. 2
                      STRM       1.55  PRECIPITATION DEPTH
                      TRDA       1.00  TRANSPOSITION DRAINAGE AREA

 0 PI            PRECIPITATION PATTERN
                  1.20      1.54      2.22      1.26       .78      1.02      1.10      1.26      1.06       .96
                   .36       .24       .00       .00       .00       .00       .00       .00       .00       .00
                   .18       .26       .42       .22       .12       .36       .44       .60       .76       .84
                   .54       .54       .54       .46       .42       .12       .10       .06       .06       .06
                   .18       .32       .60       .80       .90       .72       .64       .48       .24       .12
                   .30       .48       .84       .60       .48       .18       .16       .12       .52       .72
                  1.62      1.68      1.80      2.88      3.42      5.40      5.42      5.46      6.62      7.20
                  2.04      2.10      2.22      1.98      1.86       .42       .60       .96       .96       .96
                   .30       .28       .24       .40       .48       .48       .56       .72      1.12      1.32
                   .96       .86       .66       .74       .78      1.20       .92       .36       .36       .36
                   .18       .16       .12       .12       .12       .06       .10       .18       .06       .00
                   .06       .06       .06       .14       .18       .00       .02       .06       .06       .06
```

24 JD INDEX STORM NO. 3

STRM 1.38 PRECIPITATION DEPTH
TRDA 9.99 TRANSPOSITION DRAINAGE AREA

0 PI PRECIPITATION PATTERN

1.20	1.54	2.22	1.26	.78	1.02	1.10	1.26	1.06	.96
.36	.24	.00	.00	.00	.00	.00	.00	.00	.00
.18	.26	.42	.22	.12	.36	.44	.60	.76	.84
.54	.54	.54	.46	.42	.12	.10	.06	.06	.06
.18	.32	.60	.80	.90	.72	.64	.48	.24	.12
.30	.48	.84	.60	.48	.18	.16	.12	.52	.72
1.62	1.68	1.80	2.88	3.42	5.40	5.42	5.46	6.62	7.20
2.04	2.10	2.22	1.98	1.86	.42	.60	.96	.96	.96
.30	.28	.24	.40	.48	.48	.56	.72	1.12	1.32
.96	.86	.66	.74	.78	1.20	.92	.36	.36	.36
.18	.16	.12	.12	.12	.06	.10	.18	.06	.00
.06	.06	.06	.14	.18	.00	.02	.06	.06	.06

25 JD INDEX STORM NO. 4

STRM 1.38 PRECIPITATION DEPTH
TRDA 10.01 TRANSPOSITION DRAINAGE AREA

26 PI PRECIPITATION PATTERN

1.20	1.58	2.34	1.62	1.26	1.80	1.88	2.04	.92	.36
.60	.56	.48	.28	.18	.54	.40	.12	.24	.30
.18	.26	.42	.34	.30	.48	.52	.60	.60	.60
.66	.62	.54	.54	.54	.36	.54	.90	.70	.60
.60	.50	.30	.26	.24	.06	.18	.42	.30	.24
.36	.36	.36	.64	.78	.90	1.00	1.20	1.48	1.62
1.32	1.82	2.82	2.42	2.22	2.82	3.26	4.14	4.58	4.80
.60	.62	.66	1.06	1.26	1.62	1.30	.66	.42	.30
.54	.48	.36	.52	.60	.36	.52	.84	1.04	1.14
1.80	1.62	1.26	1.54	1.68	1.68	1.20	.24	.24	.24
.30	.24	.12	.12	.12	.12	.16	.24	.12	.06
.12	.10	.06	.14	.18	.06	.08	.12	.08	.06

34 JD INDEX STORM NO. 5

STRM 1.26 PRECIPITATION DEPTH
TRDA 20.00 TRANSPOSITION DRAINAGE AREA

0 PI PRECIPITATION PATTERN

1.20	1.58	2.34	1.62	1.26	1.80	1.88	2.04	.92	.36
.60	.56	.48	.28	.18	.54	.40	.12	.24	.30
.18	.26	.42	.34	.30	.48	.52	.60	.60	.60
.66	.62	.54	.54	.54	.36	.54	.90	.70	.60
.60	.50	.30	.26	.24	.06	.18	.42	.30	.24
.36	.36	.36	.64	.78	.90	1.00	1.20	1.48	1.62
1.32	1.82	2.82	2.42	2.22	2.82	3.26	4.14	4.58	4.80
.60	.62	.66	1.06	1.26	1.62	1.30	.66	.42	.30
.54	.48	.36	.52	.60	.36	.52	.84	1.04	1.14
1.80	1.62	1.26	1.54	1.68	1.68	1.20	.24	.24	.24
.30	.24	.12	.12	.12	.12	.16	.24	.12	.06
.12	.10	.06	.14	.18	.06	.08	.12	.08	.06

35 JD INDEX STORM NO. 6

STRM 1.18 PRECIPITATION DEPTH
TRDA 30.00 TRANSPOSITION DRAINAGE AREA

0 PI PRECIPITATION PATTERN

1.20	1.58	2.34	1.62	1.26	1.80	1.88	2.04	.92	.36
.60	.56	.48	.28	.18	.54	.40	.12	.24	.30
.18	.26	.42	.34	.30	.48	.52	.60	.60	.60
.66	.62	.54	.54	.54	.36	.54	.90	.70	.60
.60	.50	.30	.26	.24	.06	.18	.42	.30	.24
.36	.36	.36	.64	.78	.90	1.00	1.20	1.48	1.62
1.32	1.82	2.82	2.42	2.22	2.82	3.26	4.14	4.58	4.80
.60	.62	.66	1.06	1.26	1.62	1.30	.66	.42	.30
.54	.48	.36	.52	.60	.36	.52	.84	1.04	1.14
1.80	1.62	1.26	1.54	1.68	1.68	1.20	.24	.24	.24
.30	.24	.12	.12	.12	.12	.16	.24	.12	.06
.12	.10	.06	.14	.18	.06	.08	.12	.08	.06

36 JD INDEX STORM NO. 7

STRM 1.09 PRECIPITATION DEPTH
TRDA 50.00 TRANSPOSITION DRAINAGE AREA

0 PI PRECIPITATION PATTERN

1.20	1.58	2.34	1.62	1.26	1.80	1.88	2.04	.92	.36
.60	.56	.48	.28	.18	.54	.40	.12	.24	.30
.18	.26	.42	.34	.30	.48	.52	.60	.60	.60
.66	.62	.54	.54	.54	.36	.54	.90	.70	.60
.60	.50	.30	.26	.24	.06	.18	.42	.30	.24
.36	.36	.36	.64	.78	.90	1.00	1.20	1.48	1.62
1.32	1.82	2.82	2.42	2.22	2.82	3.26	4.14	4.58	4.80
.60	.62	.66	1.06	1.26	1.62	1.30	.66	.42	.30
.54	.48	.36	.52	.60	.36	.52	.84	1.04	1.14
1.80	1.62	1.26	1.54	1.68	1.68	1.20	.24	.24	.24
.30	.24	.12	.12	.12	.12	.16	.24	.12	.06
.12	.10	.06	.14	.18	.06	.08	.12	.08	.06

37 JD INDEX STORM NO. 8

STRM .96 PRECIPITATION DEPTH

TRDA 100.00 TRANSPOSITION DRAINAGE AREA

0 PI PRECIPITATION PATTERN

1.20	1.58	2.34	1.62	1.26	1.80	1.88	2.04	.92	.36
.60	.56	.48	.28	.18	.54	.40	.12	.24	.30
.18	.26	.42	.34	.30	.48	.52	.60	.60	.60
.66	.62	.54	.54	.54	.36	.54	.90	.70	.60
.60	.50	.30	.26	.24	.06	.18	.42	.30	.24
.36	.36	.36	.64	.78	.90	1.00	1.20	1.48	1.62
1.32	1.82	2.82	2.42	2.22	2.82	3.26	4.14	4.58	4.80
.60	.62	.66	1.06	1.26	1.62	1.30	.66	.42	.30
.54	.48	.36	.52	.60	.36	.52	.84	1.04	1.14
1.80	1.62	1.26	1.54	1.68	1.68	1.20	.24	.24	.24
.30	.24	.12	.12	.12	.12	.16	.24	.12	.06
.12	.10	.06	.14	.18	.06	.08	.12	.08	.06

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	MM1A	284.	3.75	47.	19.	19.	.90		
+	HYDROGRAPH AT	BW1	3190.	6.15	1762.	745.	745.	60.50		
+	HYDROGRAPH AT	BW2	1645.	4.40	678.	273.	273.	20.80		
+	2 COMBINED AT	BW1&2	3513.	5.75	1943.	817.	817.	81.30		
+	2 COMBINED AT	BW APX	3506.	5.75	1948.	819.	819.	82.20		
+	HYDROGRAPH AT	MM1B	361.	4.00	78.	31.	31.	2.10		
+	HYDROGRAPH AT	MM2	311.	3.95	65.	26.	26.	1.40		
+	HYDROGRAPH AT	HP1A	300.	3.95	62.	25.	25.	.80		
+	ROUTED TO	RTCPA	284.	4.35	62.	25.	25.	.80		
+	HYDROGRAPH AT	HP1B	200.	4.00	44.	18.	18.	1.00		
+	HYDROGRAPH AT	HP2	235.	4.00	52.	21.	21.	1.20		
+	4 COMBINED AT	CPA1	786.	4.10	194.	78.	78.	4.40		
+	HYDROGRAPH AT	HP3	420.	4.10	99.	40.	40.	1.70		
+	2 COMBINED AT	CPA2	1126.	4.10	274.	110.	110.	6.10		
+	HYDROGRAPH AT	HP4	626.	4.00	139.	56.	56.	3.30		
+	HYDROGRAPH AT	HP5	345.	3.75	56.	23.	23.	1.20		
+	HYDROGRAPH AT	HP6	465.	4.05	106.	42.	42.	2.20		
+	ROUTED TO	RTCPD	449.	4.30	106.	42.	42.	2.20		
+	HYDROGRAPH AT	HPFA	71.	3.80	12.	5.	5.	.30		
+	3 COMBINED AT	CPD	570.	4.20	161.	64.	64.	3.70		
+	ROUTED TO	RTCPE	558.	4.55	161.	64.	64.	3.70		
+	HYDROGRAPH AT	HPFB	299.	3.95	61.	25.	25.	1.60		
+	3 COMBINED AT	CPE	1108.	4.15	319.	128.	128.	8.60		
+	2 COMBINED AT	CPF	1462.	4.10	513.	206.	206.	14.70		
+	HYDROGRAPH AT	SC1	2178.	6.15	1201.	508.	508.	39.40		
+	HYDROGRAPH AT	SC2	269.	4.00	58.	23.	23.	1.50		

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

HEC-1 MODEL OUTPUT

FILENAME: RWMSW.OUT

(100-YEAR MODEL)

```
****************************************
*                                      *
*   FLOOD HYDROGRAPH PACKAGE  (HEC-1)  *
*            SEPTEMBER 1990            *
*             VERSION 4.0              *
*                                      *
*  RUN DATE  01/29/1993  TIME  22:01:21 *
*                                      *
****************************************
```

```
****************************************
*                                      *
*    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          1        ID   FLOOD ASSESSMENT FOR RWMS JOB #:51056        FILE: RWMSW.DAT
           2        ID   100-YEAR 6-HOUR STORM 1.6 INCHES
           3        ID   POINT RAINFALL VALUES FROM NOAA ATLAS 2 VOL VII
           4        ID   DEPTH-AREA REDUCTION FACTORS FROM TABLE 502 IN
           5        ID   CLARK COUNTY HYDROLOGIC CRITERIA AND DRAINAGE DESIGN MAUAL (CCRFCD, 1990)
           6        ID   CURVE NUMBER DETERMINED USING TABLE 602 IN CCRFCD, 1990
           7        ID   LAG TIMES DETERMINED USING METHOD IN SECTION 606.3 IN CCRFCD, 1990
           8        ID   DRAINAGE AREAS FROM 7.5 MINUTE AND 15 MINUTE QUADS
           9        ID   THIS MODEL ADDRESSES DRAINAGES THAT COULD IMPACT THE RWMS
          10        ID   ADJUSTED CURVE NUMBERS BY 10 TO ACCOUNT FOR MOISTER SOILS DURING THE 100-YR E
                    *DIAGRAM
          11        IT       3       0       0     300
          12        IO       5
          13        IN       5
          14        JD     1.6     .01
                    * RAINFALL DISTRIBUTION FROM CLARK COUNTY MANUAL LESS THAN 10 SQ. MILES
          15        PC       0       2     5.7     7.0     8.7    10.8    12.4    13.0    13.0    13.0
          16        PC    13.0    13.0    13.0    13.3    14.0    14.2    14.8    15.8    17.2    18.1
          17        PC    19.0    19.7    19.9    20.0    20.1    20.4    21.4    22.9    24.1    24.9
          18        PC    25.1    25.6    27.0    27.8    28.1    28.3    29.5    32.2    35.2    40.9
          19        PC    49.9    59.0    71.0    74.4    78.1    81.2    81.9    83.5    85.1    85.6
          20        PC    86.0    86.8    87.6    88.8    91.0    92.6    93.7    95.0    97.0    97.6
          21        PC    98.2    98.5    98.7    98.9    99.0    99.3    99.3    99.4    99.5    99.8
          22        PC    99.8    99.9   100.0
          23        JD    1.55       1
          24        JD    1.38    9.99
                    * CHANGED RAINFALL DISTRIBUTION ABOVE 10 SQ. MILES PER CLARK COUNTY MANUAL
          25        JD    1.38   10.01
          26        PC       0     2.0     5.9     8.0    11.0    14.4    15.0    16.0    16.8    17.1
          27        PC    18.0    18.2    18.7    19.0    19.7    20.2    21.0    22.0    23.0    24.1
          28        PC    25.0    25.9    26.5    28.0    29.0    30.0    30.5    30.9    31.0    31.7
          29        PC    32.1    32.7    33.3    34.6    36.1    38.1    40.8    43.0    47.7    51.4
          30        PC    56.1    63.0    71.0    72.0    73.1    75.2    77.9    79.0    79.5    80.4
          31        PC    81.0    82.0    82.6    84.0    85.9    88.9    91.0    93.8    96.6    97.0
          32        PC    97.4    97.9    98.1    98.3    98.5    98.9    99.0    99.2    99.3    99.6
          33        PC    99.7    99.9   100.0
          34        JD    1.26      20
          35        JD    1.18      30
          36        JD    1.09      50
          37        JD     .96     100

          38        KK    MM1A
          39        KM    Basin runoff calculation for Mass. Mountains 1A
          40        BA      .9
          41        LS              90
          42        UD     .31

          43        KK     BW1
          44        KM     Basin runoff calculation for Barren Wash 1
          45        BA    60.5
          46        LS              93
          47        UD      2.1
```

```
KK     BW2
KM     Basin runoff calculation for Barren Wash 2
BA    20.8
LS              90
UD      .9

KK   BW1&2
KM   Combined BW1 and BW2
HC       2

KK  BW APX
KM   Combine BW1,BW2, and MM1A (assume dischcarge of Barren Wash "active apex")
HC       2

KK    MM1B
KM   Basin runoff calulation for Mass. Mountains 1B
*   Flow was not combined with BW APX because flow from this watershed
*   will not directly impact RWMS wereas a channel migration at the apex
*   could impact the RWMS
BA     2.1
LS              87
UD     .48

KK     MM2
KM    Basin runoff calculation for Mass. Mountains 2
BA     1.4
LS              89
UD     .47

KK    HP1A
KM    Basin runoff calculation for Half Pint Range 1A
BA      .8
LS              95
UD     .48

KK   RTCPA
KM   Route Flow from HP1A to CPA
RM       9     .43      .2

KK    HP1B
KM    Basin runoff calculation for Half Pint Range 1B
BA     1.0
LS              88
UD     .51

KK     HP2
KM    Basin runoff calculation for Half Pint Range 2
BA    1.2
LS              88
UD     .51

KK    CPA1
KM    Combine MM2, routed HP1A, HP1B, HP2
HC       4

KK     HP3
KM     (CPB) Basin runoff calculation for Half Pint Range 3
BA     1.7
LS              92
UD     .59

KK    CPA2
KM    Combine HP3 with flow from CPA1
HC       2

KK     HP4
KM     (CPC) Basin runoff calculation for Half Pint Range 4
BA     3.3
LS              89
UD     .52

KK     HP5
KM    Basin runoff calculation for Half Pint Range 5
BA     1.2
LS              89
UD      .3

KK     HP6
KM     Basin runoff calculation for Half Pint Range 6
BA     2.2
LS              90
UD     .55

KK   RTCPD
KM    Route HP6 to CPD
RM       5     .27      .2
```

```
KK    HPFA
KM     Basin runoff calculation for Half Pint Range FA
BA      .3
LS              87
UD     .33

KK     CPD
KM     Combine HP5, routed HP6, and HPFA
HC       3

KK   RTCPE
KM     Route flow from CPD to CPE
RM       8     .39      .2

KK    HPFB
KM     Basin runoff calculation for Half Pint Range FB
BA     1.6
LS              87
UD     .44

KK     CPE
KM    Combine HP4 (CPC) with routed flow from CPD, and HPFB
HC       3

KK     CPF
KM    Combine all flow at Concentration just below RWMS (Flow from CPA & CPE)
HC       2

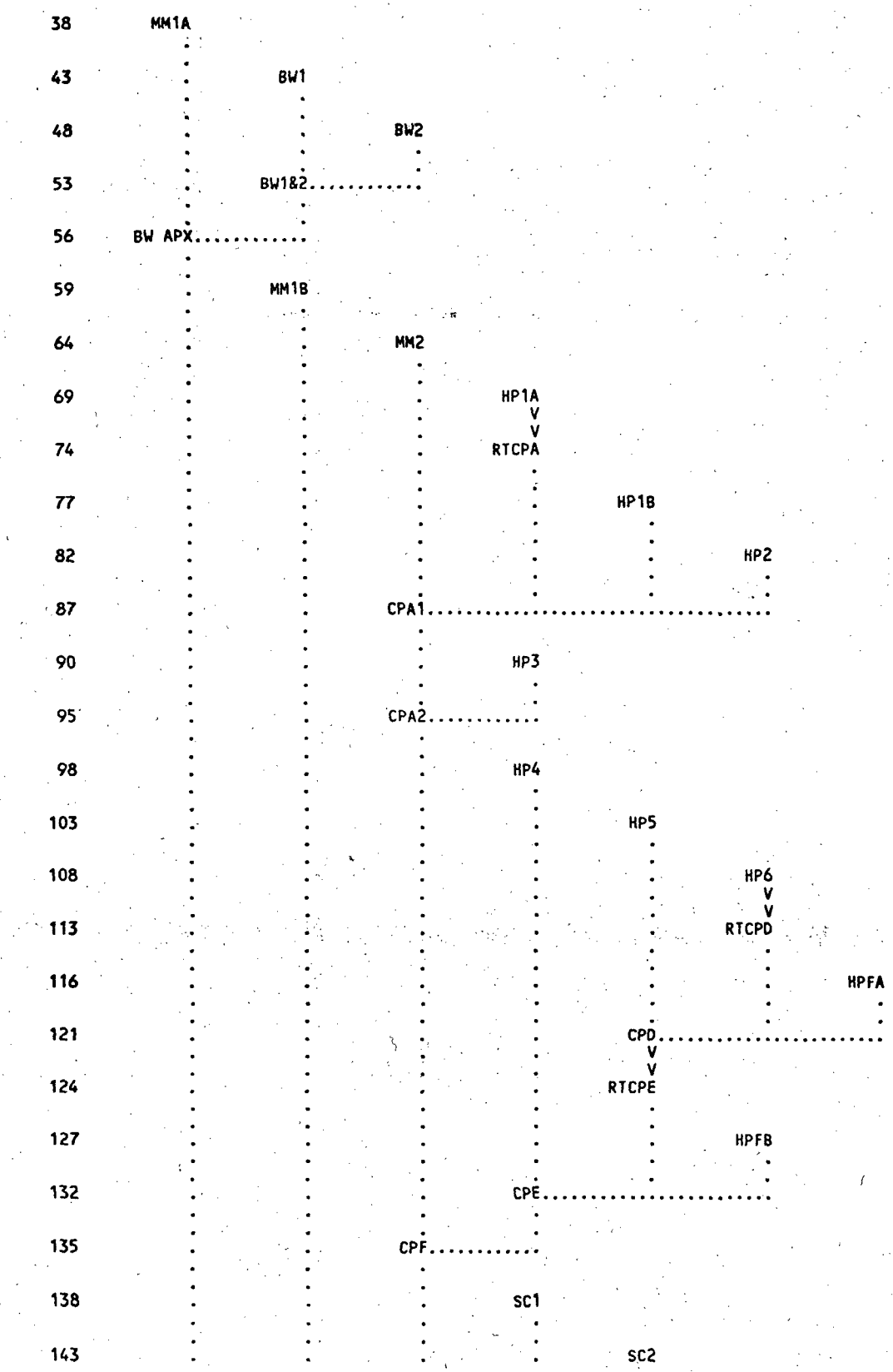
KK     SC1
KM     Basin runoff calculation for Scarp Canyon 1
* Concentration Pt of this watershed is the active apex of the Scarp Canyon Fan
BA    39.4
LS              92
UD     2.1

KK     SC2
KM     Basin runoff calculation for Scarp Canyon 2
BA     1.5
LS              87
UD     .48
ZZ
```

SCHEMATIC DIAGRAM OF STREAM NETWORK

(V) ROUTING (---->) DIVERSION OR PUMP FLOW

(.) CONNECTOR (<---) RETURN OF DIVERTED OR PUMPED FLOW



(***) RUNOFF ALSO COMPUTED AT THIS LOCATION

```
*****************************************
*                                       *
*   FLOOD HYDROGRAPH PACKAGE  (HEC-1)   *
*            SEPTEMBER 1990             *
*             VERSION 4.0               *
*                                       *
*  RUN DATE  01/29/1993  TIME  22:01:21 *
*                                       *
*****************************************
```

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

```
                    FLOOD ASSESSMENT FOR RWMS JOB #:51056        FILE: RWMSW.DAT
                    100-YEAR 6-HOUR STORM 1.6 INCHES
                    POINT RAINFALL VALUES FROM NOAA ATLAS 2 VOL VII
                    DEPTH-AREA REDUCTION FACTORS FROM TABLE 502 IN
                    CLARK COUNTY HYDROLOGIC CRITERIA AND DRAINAGE DESIGN MAUAL (CCRFCD, 1990)
                    CURVE NUMBER DETERMINED USING TABLE 602 IN CCRFCD, 1990
                    LAG TIMES DETERMINED USING METHOD IN SECTION 606.3 IN CCRFCD, 1990
                    DRAINAGE AREAS FROM 7.5 MINUTE AND 15 MINUTE QUADS
                    THIS MODEL ADDRESSES DRAINAGES THAT COULD IMPACT THE RWMS
                    ADJUSTED CURVE NUMBERS BY 10 TO ACCOUNT FOR MOISTEN SOILS DURING THE 100-YR E

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

   IT         HYDROGRAPH TIME DATA
                     NMIN          3  MINUTES IN COMPUTATION INTERVAL
                    IDATE      1   0  STARTING DATE
                    ITIME       0000  STARTING TIME
                       NQ        300  NUMBER OF HYDROGRAPH ORDINATES
                   NDDATE      1   0  ENDING DATE
                   NDTIME       1457  ENDING TIME
                    ICENT         19  CENTURY MARK

              COMPUTATION INTERVAL     .05 HOURS
                   TOTAL TIME BASE   14.95 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

 14 JD        INDEX STORM NO. 1
                   STRM       1.60  PRECIPITATION DEPTH
                   TRDA        .01  TRANSPOSITION DRAINAGE AREA

 15 PI         PRECIPITATION PATTERN
                 1.20      1.54      2.22      1.26       .78      1.02      1.10      1.26      1.06       .96
                  .36       .24       .00       .00       .00       .00       .00       .00       .00       .00
                  .18       .26       .42       .22       .12       .36       .44       .60       .76       .84
                  .54       .54       .54       .46       .42       .12       .10       .06       .06       .06
                  .18       .32       .60       .80       .90       .72       .64       .48       .24       .12
                  .30       .48       .84       .60       .48       .18       .16       .12       .52       .72
                 1.62      1.68      1.80      2.88      3.42      5.40      5.42      5.46      6.62      7.20
                 2.04      2.10      2.22      1.98      1.86       .42       .60       .96       .96       .96
                  .30       .28       .24       .40       .48       .48       .56       .72      1.12      1.32
                  .96       .86       .66       .74       .78      1.20       .92       .36       .36       .36
                  .18       .16       .12       .12       .12       .06       .10       .18       .06       .00
                  .06       .06       .06       .14       .18       .00       .02       .06       .06       .06

 23 JD        INDEX STORM NO. 2
                   STRM       1.55  PRECIPITATION DEPTH
                   TRDA       1.00  TRANSPOSITION DRAINAGE AREA

  0 PI         PRECIPITATION PATTERN
                 1.20      1.54      2.22      1.26       .78      1.02      1.10      1.26      1.06       .96
                  .36       .24       .00       .00       .00       .00       .00       .00       .00       .00
                  .18       .26       .42       .22       .12       .36       .44       .60       .76       .84
                  .54       .54       .54       .46       .42       .12       .10       .06       .06       .06
                  .18       .32       .60       .80       .90       .72       .64       .48       .24       .12
                  .30       .48       .84       .60       .48       .18       .16       .12       .52       .72
                 1.62      1.68      1.80      2.88      3.42      5.40      5.42      5.46      6.62      7.20
                 2.04      2.10      2.22      1.98      1.86       .42       .60       .96       .96       .96
                  .30       .28       .24       .40       .48       .48       .56       .72      1.12      1.32
                  .96       .86       .66       .74       .78      1.20       .92       .36       .36       .36
                  .18       .16       .12       .12       .12       .06       .10       .18       .06       .00
                  .06       .06       .06       .14       .18       .00       .02       .06       .06       .06
```

24 JD INDEX STORM NO. 3

STRM 1.38 PRECIPITATION DEPTH

TRDA 9.99 TRANSPOSITION DRAINAGE AREA

0 PI PRECIPITATION PATTERN

1.20	1.54	2.22	1.26	.78	1.02	1.10	1.26	1.06	.96
.36	.24	.00	.00	.00	.00	.00	.00	.00	.00
.18	.26	.42	.22	.12	.36	.44	.60	.76	.84
.54	.54	.54	.46	.42	.12	.10	.06	.06	.06
.18	.32	.60	.80	.90	.72	.64	.48	.24	.12
.30	.48	.84	.60	.48	.18	.16	.12	.52	.72
1.62	1.68	1.80	2.88	3.42	5.40	5.42	5.46	6.62	7.20
2.04	2.10	2.22	1.98	1.86	.42	.60	.96	.96	.96
.30	.28	.24	.40	.48	.48	.56	.72	1.12	1.32
.96	.86	.66	.74	.78	1.20	.92	.36	.36	.36
.18	.16	.12	.12	.12	.06	.10	.18	.06	.00
.06	.06	.06	.14	.18	.00	.02	.06	.06	.06

25 JD INDEX STORM NO. 4

STRM 1.38 PRECIPITATION DEPTH

TRDA 10.01 TRANSPOSITION DRAINAGE AREA

26 PI PRECIPITATION PATTERN

1.20	1.58	2.34	1.62	1.26	1.80	1.88	2.04	.92	.36
.60	.56	.48	.28	.18	.54	.40	.12	.24	.30
.18	.26	.42	.34	.30	.48	.52	.60	.60	.60
.66	.62	.54	.54	.54	.36	.54	.90	.70	.60
.60	.50	.30	.26	.24	.06	.18	.42	.30	.24
.36	.36	.36	.64	.78	.90	1.00	1.20	1.48	1.62
1.32	1.82	2.82	2.42	2.22	2.82	3.26	4.14	4.58	4.80
.60	.62	.66	1.06	1.26	1.62	1.30	.66	.42	.30
.54	.48	.36	.52	.60	.36	.52	.84	1.04	1.14
1.80	1.62	1.26	1.54	1.68	1.68	1.20	.24	.24	.24
.30	.24	.12	.12	.12	.12	.16	.24	.12	.06
.12	.10	.06	.14	.18	.06	.08	.12	.08	.06

34 JD INDEX STORM NO. 5

STRM 1.26 PRECIPITATION DEPTH

TRDA 20.00 TRANSPOSITION DRAINAGE AREA

0 PI PRECIPITATION PATTERN

1.20	1.58	2.34	1.62	1.26	1.80	1.88	2.04	.92	.36
.60	.56	.48	.28	.18	.54	.40	.12	.24	.30
.18	.26	.42	.34	.30	.48	.52	.60	.60	.60
.66	.62	.54	.54	.54	.36	.54	.90	.70	.60
.60	.50	.30	.26	.24	.06	.18	.42	.30	.24
.36	.36	.36	.64	.78	.90	1.00	1.20	1.48	1.62
1.32	1.82	2.82	2.42	2.22	2.82	3.26	4.14	4.58	4.80
.60	.62	.66	1.06	1.26	1.62	1.30	.66	.42	.30
.54	.48	.36	.52	.60	.36	.52	.84	1.04	1.14
1.80	1.62	1.26	1.54	1.68	1.68	1.20	.24	.24	.24
.30	.24	.12	.12	.12	.12	.16	.24	.12	.06
.12	.10	.06	.14	.18	.06	.08	.12	.08	.06

35 JD INDEX STORM NO. 6

STRM 1.18 PRECIPITATION DEPTH

TRDA 30.00 TRANSPOSITION DRAINAGE AREA

0 PI PRECIPITATION PATTERN

1.20	1.58	2.34	1.62	1.26	1.80	1.88	2.04	.92	.36
.60	.56	.48	.28	.18	.54	.40	.12	.24	.30
.18	.26	.42	.34	.30	.48	.52	.60	.60	.60
.66	.62	.54	.54	.54	.36	.54	.90	.70	.60
.60	.50	.30	.26	.24	.06	.18	.42	.30	.24
.36	.36	.36	.64	.78	.90	1.00	1.20	1.48	1.62
1.32	1.82	2.82	2.42	2.22	2.82	3.26	4.14	4.58	4.80
.60	.62	.66	1.06	1.26	1.62	1.30	.66	.42	.30
.54	.48	.36	.52	.60	.36	.52	.84	1.04	1.14
1.80	1.62	1.26	1.54	1.68	1.68	1.20	.24	.24	.24
.30	.24	.12	.12	.12	.12	.16	.24	.12	.06
.12	.10	.06	.14	.18	.06	.08	.12	.08	.06

36 JD INDEX STORM NO. 7

STRM 1.09 PRECIPITATION DEPTH

TRDA 50.00 TRANSPOSITION DRAINAGE AREA

0 PI PRECIPITATION PATTERN

1.20	1.58	2.34	1.62	1.26	1.80	1.88	2.04	.92	.36
.60	.56	.48	.28	.18	.54	.40	.12	.24	.30
.18	.26	.42	.34	.30	.48	.52	.60	.60	.60
.66	.62	.54	.54	.54	.36	.54	.90	.70	.60
.60	.50	.30	.26	.24	.06	.18	.42	.30	.24
.36	.36	.36	.64	.78	.90	1.00	1.20	1.48	1.62
1.32	1.82	2.82	2.42	2.22	2.82	3.26	4.14	4.58	4.80
.60	.62	.66	1.06	1.26	1.62	1.30	.66	.42	.30
.54	.48	.36	.52	.60	.36	.52	.84	1.04	1.14
1.80	1.62	1.26	1.54	1.68	1.68	1.20	.24	.24	.24
.30	.24	.12	.12	.12	.12	.16	.24	.12	.06
.12	.10	.06	.14	.18	.06	.08	.12	.08	.06

```
37 JD          INDEX STORM NO. 8
                    STRM          .96  PRECIPITATION DEPTH
                    TRDA       100.00  TRANSPOSITION DRAINAGE AREA

 0 PI           PRECIPITATION PATTERN
                   1.20      1.58      2.34      1.62      1.26      1.80      1.88      2.04       .92       .36
                    .60       .56       .48       .28       .18       .54       .40       .12       .24       .30
                    .18       .26       .42       .34       .30       .48       .52       .60       .60       .60
                    .66       .62       .54       .54       .54       .36       .54       .90       .70       .60
                    .60       .50       .30       .26       .24       .06       .18       .42       .30       .24
                    .36       .36       .36       .64       .78       .90      1.00      1.20      1.48      1.62
                   1.32      1.82      2.82      2.42      2.22      2.82      3.26      4.14      4.58      4.80
                    .60       .62       .66      1.06      1.26      1.62      1.30       .66       .42       .30
                    .54       .48       .36       .52       .60       .36       .52       .84      1.04      1.14
                   1.80      1.62      1.26      1.54      1.68      1.68      1.20       .24       .24       .24
                    .30       .24       .12       .12       .12       .12       .16       .24       .12       .06
                    .12       .10       .06       .14       .18       .06       .08       .12       .08       .06
```

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	MM1A	426.	3.75	70.	28.	28.	.90		
+	HYDROGRAPH AT	BW1	5241.	6.00	2989.	1289.	1289.	60.50		
+	HYDROGRAPH AT	BW2	2759.	4.35	1102.	445.	445.	20.80		
+	2 COMBINED AT	BW1&2	6018.	5.65	3425.	1462.	1462.	81.30		
+	2 COMBINED AT	BW APX	6014.	5.65	3441.	1469.	1469.	82.20		
+	HYDROGRAPH AT	MM1B	580.	3.95	120.	48.	48.	2.10		
+	HYDROGRAPH AT	MM2	477.	3.95	98.	39.	39.	1.40		
+	HYDROGRAPH AT	HP1A	423.	3.90	91.	37.	37.	.80		
+	ROUTED TO	RTCPA	401.	4.35	91.	37.	37.	.80		
+	HYDROGRAPH AT	HP1B	309.	4.00	66.	27.	27.	1.00		
+	HYDROGRAPH AT	HP2	365.	4.00	78.	32.	32.	1.20		
+	4 COMBINED AT	CPA1	1229.	4.05	298.	120.	120.	4.40		
+	HYDROGRAPH AT	HP3	624.	4.05	148.	59.	59.	1.70		
+	2 COMBINED AT	CPA2	1757.	4.05	423.	170.	170.	6.10		
+	HYDROGRAPH AT	HP4	984.	4.00	214.	86.	86.	3.30		
+	HYDROGRAPH AT	HP5	526.	3.75	85.	34.	34.	1.20		
+	HYDROGRAPH AT	HP6	711.	4.00	160.	64.	64.	2.20		
+	ROUTED TO	RTCPD	689.	4.30	160.	64.	64.	2.20		
+	HYDROGRAPH AT	HPFA	110.	3.80	19.	8.	8.	.30		
+	3 COMBINED AT	CPD	884.	4.15	246.	99.	99.	3.70		
+	ROUTED TO	RTCPE	868.	4.50	246.	99.	99.	3.70		
+	HYDROGRAPH AT	HPFB	476.	3.90	94.	38.	38.	1.60		
+	3 COMBINED AT	CPE	1819.	4.10	502.	202.	202.	8.60		
+	2 COMBINED AT	CPF	2396.	4.05	820.	330.	330.	14.70		
+	HYDROGRAPH AT	SC1	3498.	6.00	1988.	855.	855.	39.40		
+	HYDROGRAPH AT	SC2	427.	3.95	89.	36.	36.	1.50		

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

HEC-1 MODEL OUTPUT

FILENAME: RWMSC.OUT

(100-YEAR MODEL)

```
*****************************************
*                                       *
*   FLOOD HYDROGRAPH PACKAGE  (HEC-1)   *
*            SEPTEMBER 1990             *
*             VERSION 4.0               *
*                                       *
*  RUN DATE  01/29/1993  TIME  22:03:06 *
*                                       *
*****************************************
```

```
*****************************************
*                                       *
*    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   ID   FLOOD ASSESSMENT FOR RWMS JOB #:51056        FILE: RWMSC.DAT
 2   ID   100-YEAR 6-HOUR STORM 2.43 INCHES
 3   ID   POINT RAINFALL VALUES FROM NOAA ATLAS 2 VOL VII
 4   ID   ADJUSTED RAINFALL PER CORRECTION FACTOR IN TABLE 501 OF
 5   ID   CLARK COUNTY HYDROLOGIC CRITERIA AND DRAINAGE DESIGN MANUAL (CCRFCD, 1990)
 6   ID   DEPTH-AREA REDUCTION FACTORS FROM TABLE 502 IN CCRFCD, 1990
 7   ID   CURVE NUMBERS DETERMINED USING TABLE 602 IN CCRFCD, 1990
 8   ID   LAG TIMES DETERMINED USING METHOD IN SECITON 606.3 IN CCRFCD, 1990
 9   ID   DRAINAGE AREAS FROM 7.5 MINUTE AND 15 MINUTE QUADS
10   ID   THIS MODEL ADDRESSES DRAINAGES THAT COULD IMPACT THE RWMS
     *DIAGRAM
11   IT       3       0       0     300
12   IO       5
13   IN       5
14   JD    2.43     .01
     * RAINFALL DISTRIBUTION FROM CLARK COUNTY MANUAL LESS THAN 10 SQ. MILES
15   PC       0       2     5.7     7.0     8.7    10.8    12.4    13.0    13.0    13.0
16   PC    13.0    13.0    13.0    13.3    14.0    14.2    14.8    15.8    17.2    18.1
17   PC    19.0    19.7    19.9    20.0    20.1    20.4    21.4    22.9    24.1    24.9
18   PC    25.1    25.6    27.0    27.8    28.1    28.3    29.5    32.2    35.2    40.9
19   PC    49.9    59.0    71.0    74.4    78.1    81.2    81.9    83.5    85.1    85.6
20   PC    86.0    86.8    87.6    88.8    91.0    92.6    93.7    95.0    97.0    97.6
21   PC    98.2    98.5    98.7    98.9    99.0    99.3    99.3    99.4    99.5    99.8
22   PC    99.8    99.9   100.0
23   JD    2.36       1
24   JD    2.09    9.99
     * CHANGED RAINFALL DISTRIBUTION ABOVE 10 SQ. MILES PER CLARK COUNTY MANUAL
25   JD    2.09   10.01
26   PC       0     2.0     5.9     8.0    11.0    14.4    15.0    16.0    16.8    17.1
27   PC    18.0    18.2    18.7    19.0    19.7    20.2    21.0    22.0    23.0    24.1
28   PC    25.0    25.9    26.5    28.0    29.0    30.0    30.5    30.9    31.0    31.7
29   PC    32.1    32.7    33.3    34.6    36.1    38.1    40.8    43.0    47.7    51.4
30   PC    56.1    63.0    71.0    72.0    73.1    75.2    77.9    79.0    79.5    80.4
31   PC    81.0    82.0    82.6    84.0    85.9    88.9    91.0    93.8    96.6    97.0
32   PC    97.4    97.9    98.1    98.3    98.5    98.9    99.0    99.2    99.3    99.6
33   PC    99.7    99.9   100.0
34   JD    1.92      20
35   JD    1.80      30
36   JD    1.65      50
37   JD    1.46     100

38   KK    MM1A
39   KM   Basin runoff calculation for Mass. Mountains 1A
40   BA      .9
41   LS              80
42   UD     .31

43   KK     BW1
44   KM     Basin runoff calculation for Barren Wash 1
45   BA    60.5
46   LS              83
47   UD     2.1
```

```
48          KK     BW2
49          KM     Basin runoff calculation for Barren Wash 2
50          BA    20.8
51          LS              80
52          UD      .9

53          KK   BW1&2
54          KM   Combined BW1 and BW2
55          HC       2

56          KK  BW APX
57          KM   Combine BW1,BW2, and MM1A (assume dischcarge of Barren Wash "active apex")
58          HC       2

59          KK    MM1B
60          KM    Basin runoff calulation for Mass. Mountains 1B
            *   Flow was not combined with BW APX because flow from this watershed
            *   will not directly impact RWMS wereas a channel migration at the apex
            *   could impact the RWMS
61          BA     2.1
62          LS              77
63          UD     .48

64          KK     MM2
65          KM    Basin runoff calculation for Mass. Mountains 2
66          BA     1.4
67          LS              79
68          UD     .47

69          KK    HP1A
70          KM    Basin runoff calculation for Half Pint Range 1A
71          BA      .8
72          LS              85
73          UD     .48

74          KK   RTCPA
75          KM   Route Flow from HP1A to CPA
76          RM       9     .43      .2

77          KK    HP1B
78          KM    Basin runoff calculation for Half Pint Range 1B
79          BA     1.0
80          LS              78
81          UD     .51

82          KK     HP2
83          KM    Basin runoff calculation for Half Pint Range 2
84          BA    1.2
85          LS              78
86          UD     .51

87          KK    CPA1
88          KM    Combine MM2, routed HP1A, HP1B, HP2
89          HC       4

90          KK     HP3
91          KM     (CPB) Basin runoff calculation for Half Pint Range 3
92          BA     1.7
93          LS              82
94          UD     .59

95          KK    CPA2
96          KM    Combine HP3 with flow from CPA1
97          HC       2

98          KK     HP4
99          KM     (CPC) Basin runoff calculation for Half Pint Range 4
100         BA     3.3
101         LS              79
102         UD     .52

103         KK     HP5
104         KM     Basin runoff calculation for Half Pint Range 5
105         BA     1.2
106         LS              79
107         UD      .3

108         KK     HP6
109         KM     Basin runoff calculation for Half Pint Range 6
110         BA     2.2
111         LS              80
112         UD     .55

113         KK   RTCPD
114         KM    Route HP6 to CPD
115         RM       5     .27      .2
```

```
116          KK    HPFA
117          KM     Basin runoff calculation for Half Pint Range FA
118          BA      .3
119          LS              77
120          UD     .33

121          KK     CPD
122          KM     Combine HP5, routed HP6, and HPFA
123          HC       3

124          KK   RTCPE
125          KM     Route flow from CPD to CPE
126          RM       8     .39      .2

127          KK    HPFB
128          KM     Basin runoff calculation for Half Pint Range FB
129          BA     1.6
130          LS              77
131          UD     .44

132          KK     CPE
133          KM    Combine HP4 (CPC) with routed flow from CPD, and HPFB
134          HC       3

135          KK     CPF
136          KM    Combine all flow at Concentration just below RWMS (Flow from CPA & CPE)
137          HC       2

138          KK     SC1
139          KM     Basin runoff calculation for Scarp Canyon 1
             * Concentration Pt of this watershed is the active apex of the Scarp Canyon Fan
140          BA    39.4
141          LS              82
142          UD     2.1

143          KK     SC2
144          KM     Basin runoff calculation for Scarp Canyon 2
145          BA     1.5
146          LS              77
147          UD     .48
148          ZZ
```

SCHEMATIC DIAGRAM OF STREAM NETWORK

(V) ROUTING (---->) DIVERSION OR PUMP FLOW

(.) CONNECTOR (<----) RETURN OF DIVERTED OR PUMPED FLOW

```
INPUT
LINE
 NO.
 38     MM1A
         :
 43      :        BW1
         :         :
 48      :         :        BW2
         :         :         :
 53      :       BW1&2.......:
         :         :
 56     BW APX.....:
         :
 59      :        MM1B
         :         :
 64      :         :        MM2
         :         :         :
 69      :         :         :       HP1A
         :         :         :         V
         :         :         :         V
 74      :         :         :      RTCPA
         :         :         :         :
 77      :         :         :         :        HP1B
         :         :         :         :         :
 82      :         :         :         :         :        HP2
         :         :         :         :         :         :
 87      :         :        CPA1.......:.........:.........:
         :         :         :
 90      :         :         :        HP3
         :         :         :         :
 95      :         :        CPA2.......:
         :         :         :
 98      :         :         :        HP4
         :         :         :         :
103      :         :         :         :        HP5
         :         :         :         :         :
108      :         :         :         :         :        HP6
         :         :         :         :         :         V
         :         :         :         :         :         V
113      :         :         :         :         :      RTCPD
         :         :         :         :         :         :
116      :         :         :         :         :         :        HPFA
         :         :         :         :         :         :         :
121      :         :         :         :        CPD.........:.........:
         :         :         :         :         V
         :         :         :         :         V
124      :         :         :         :      RTCPE
         :         :         :         :         :
127      :         :         :         :         :        HPFB
         :         :         :         :         :         :
132      :         :         :        CPE.........:.........:
         :         :         :         :
135      :         :        CPF.......:
         :         :         :
138      :         :         :        SC1
         :         :         :         :
143      :         :         :         :        SC2
```

(***) RUNOFF ALSO COMPUTED AT THIS LOCATION

```
*****************************************
*                                       *
*   FLOOD HYDROGRAPH PACKAGE  (HEC-1)   *
*            SEPTEMBER 1990             *
*             VERSION 4.0               *
*                                       *
*  RUN DATE  01/29/1993  TIME  22:03:06 *
*                                       *
*****************************************
```

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

```
                    FLOOD ASSESSMENT FOR RWMS JOB #:51056        FILE: RWMSC.DAT
                    100-YEAR 6-HOUR STORM 2.43 INCHES
                    POINT RAINFALL VALUES FROM NOAA ATLAS 2 VOL VII
                    ADJUSTED RAINFALL PER CORRECTION FACTOR IN TABLE 501 OF
                    CLARK COUNTY HYDROLOGIC CRITERIA AND DRAINAGE DESIGN MANUAL (CCRFCD, 1990)
                    DEPTH-AREA REDUCTION FACTORS FROM TABLE 502 IN CCRFCD, 1990
                    CURVE NUMBERS DETERMINED USING TABLE 602 IN CCRFCD, 1990
                    LAG TIMES DETERMINED USING METHOD IN SECITON 606.3 IN CCRFCD, 1990
                    DRAINAGE AREAS FROM 7.5 MINUTE AND 15 MINUTE QUADS
                    THIS MODEL ADDRESSES DRAINAGES THAT COULD IMPACT THE RWMS

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

   IT         HYDROGRAPH TIME DATA
                     NMIN          3  MINUTES IN COMPUTATION INTERVAL
                    IDATE      1   0  STARTING DATE
                    ITIME       0000  STARTING TIME
                       NQ        300  NUMBER OF HYDROGRAPH ORDINATES
                   NDDATE      1   0  ENDING DATE
                   NDTIME       1457  ENDING TIME
                    ICENT         19  CENTURY MARK

              COMPUTATION INTERVAL     .05 HOURS
                   TOTAL TIME BASE   14.95 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

 14 JD        INDEX STORM NO. 1
                    STRM        2.43  PRECIPITATION DEPTH
                    TRDA         .01  TRANSPOSITION DRAINAGE AREA

 15 PI        PRECIPITATION PATTERN
                 1.20      1.54      2.22      1.26       .78      1.02      1.10      1.26      1.06       .96
                  .36       .24       .00       .00       .00       .00       .00       .00       .00       .00
                  .18       .26       .42       .22       .12       .36       .44       .60       .76       .84
                  .54       .54       .54       .46       .42       .12       .10       .06       .06       .06
                  .18       .32       .60       .80       .90       .72       .64       .48       .24       .12
                  .30       .48       .84       .60       .48       .18       .16       .12       .52       .72
                 1.62      1.68      1.80      2.88      3.42      5.40      5.42      5.46      6.62      7.20
                 2.04      2.10      2.22      1.98      1.86       .42       .60       .96       .96       .96
                  .30       .28       .24       .40       .48       .48       .56       .72      1.12      1.32
                  .96       .86       .66       .74       .78      1.20       .92       .36       .36       .36
                  .18       .16       .12       .12       .12       .06       .10       .18       .06       .00
                  .06       .06       .06       .14       .18       .00       .02       .06       .06       .06

 23 JD        INDEX STORM NO. 2
                    STRM        2.36  PRECIPITATION DEPTH
                    TRDA        1.00  TRANSPOSITION DRAINAGE AREA

  0 PI        PRECIPITATION PATTERN
                 1.20      1.54      2.22      1.26       .78      1.02      1.10      1.26      1.06       .96
                  .36       .24       .00       .00       .00       .00       .00       .00       .00       .00
                  .18       .26       .42       .22       .12       .36       .44       .60       .76       .84
                  .54       .54       .54       .46       .42       .12       .10       .06       .06       .06
                  .18       .32       .60       .80       .90       .72       .64       .48       .24       .12
                  .30       .48       .84       .60       .48       .18       .16       .12       .52       .72
                 1.62      1.68      1.80      2.88      3.42      5.40      5.42      5.46      6.62      7.20
                 2.04      2.10      2.22      1.98      1.86       .42       .60       .96       .96       .96
                  .30       .28       .24       .40       .48       .48       .56       .72      1.12      1.32
                  .96       .86       .66       .74       .78      1.20       .92       .36       .36       .36
                  .18       .16       .12       .12       .12       .06       .10       .18       .06       .00
                  .06       .06       .06       .14       .18       .00       .02       .06       .06       .06
```

24 JD INDEX STORM NO. 3

STRM 2.09 PRECIPITATION DEPTH

TRDA 9.99 TRANSPOSITION DRAINAGE AREA

0 PI PRECIPITATION PATTERN

1.20	1.54	2.22	1.26	.78	1.02	1.10	1.26	1.06	.96
.36	.24	.00	.00	.00	.00	.00	.00	.00	.00
.18	.26	.42	.22	.12	.36	.44	.60	.76	.84
.54	.54	.54	.46	.42	.12	.10	.06	.06	.06
.18	.32	.60	.80	.90	.72	.64	.48	.24	.12
.30	.48	.84	.60	.48	.18	.16	.12	.52	.72
1.62	1.68	1.80	2.88	3.42	5.40	5.42	5.46	6.62	7.20
2.04	2.10	2.22	1.98	1.86	.42	.60	.96	.96	.96
.30	.28	.24	.40	.48	.48	.56	.72	1.12	1.32
.96	.86	.66	.74	.78	1.20	.92	.36	.36	.36
.18	.16	.12	.12	.12	.06	.10	.18	.06	.00
.06	.06	.06	.14	.18	.00	.02	.06	.06	.06

25 JD INDEX STORM NO. 4

STRM 2.09 PRECIPITATION DEPTH

TRDA 10.01 TRANSPOSITION DRAINAGE AREA

26 PI PRECIPITATION PATTERN

1.20	1.58	2.34	1.62	1.26	1.80	1.88	2.04	.92	.36
.60	.56	.48	.28	.18	.54	.40	.12	.24	.30
.18	.26	.42	.34	.30	.48	.52	.60	.60	.60
.66	.62	.54	.54	.54	.36	.54	.90	.70	.60
.60	.50	.30	.26	.24	.06	.18	.42	.30	.24
.36	.36	.36	.64	.78	.90	1.00	1.20	1.48	1.62
1.32	1.82	2.82	2.42	2.22	2.82	3.26	4.14	4.58	4.80
.60	.62	.66	1.06	1.26	1.62	1.30	.66	.42	.30
.54	.48	.36	.52	.60	.36	.52	.84	1.04	1.14
1.80	1.62	1.26	1.54	1.68	1.68	1.20	.24	.24	.24
.30	.24	.12	.12	.12	.12	.16	.24	.12	.06
.12	.10	.06	.14	.18	.06	.08	.12	.08	.06

34 JD INDEX STORM NO. 5

STRM 1.92 PRECIPITATION DEPTH

TRDA 20.00 TRANSPOSITION DRAINAGE AREA

0 PI PRECIPITATION PATTERN

1.20	1.58	2.34	1.62	1.26	1.80	1.88	2.04	.92	.36
.60	.56	.48	.28	.18	.54	.40	.12	.24	.30
.18	.26	.42	.34	.30	.48	.52	.60	.60	.60
.66	.62	.54	.54	.54	.36	.54	.90	.70	.60
.60	.50	.30	.26	.24	.06	.18	.42	.30	.24
.36	.36	.36	.64	.78	.90	1.00	1.20	1.48	1.62
1.32	1.82	2.82	2.42	2.22	2.82	3.26	4.14	4.58	4.80
.60	.62	.66	1.06	1.26	1.62	1.30	.66	.42	.30
.54	.48	.36	.52	.60	.36	.52	.84	1.04	1.14
1.80	1.62	1.26	1.54	1.68	1.68	1.20	.24	.24	.24
.30	.24	.12	.12	.12	.12	.16	.24	.12	.06
.12	.10	.06	.14	.18	.06	.08	.12	.08	.06

35 JD INDEX STORM NO. 6

STRM 1.80 PRECIPITATION DEPTH

TRDA 30.00 TRANSPOSITION DRAINAGE AREA

0 PI PRECIPITATION PATTERN

1.20	1.58	2.34	1.62	1.26	1.80	1.88	2.04	.92	.36
.60	.56	.48	.28	.18	.54	.40	.12	.24	.30
.18	.26	.42	.34	.30	.48	.52	.60	.60	.60
.66	.62	.54	.54	.54	.36	.54	.90	.70	.60
.60	.50	.30	.26	.24	.06	.18	.42	.30	.24
.36	.36	.36	.64	.78	.90	1.00	1.20	1.48	1.62
1.32	1.82	2.82	2.42	2.22	2.82	3.26	4.14	4.58	4.80
.60	.62	.66	1.06	1.26	1.62	1.30	.66	.42	.30
.54	.48	.36	.52	.60	.36	.52	.84	1.04	1.14
1.80	1.62	1.26	1.54	1.68	1.68	1.20	.24	.24	.24
.30	.24	.12	.12	.12	.12	.16	.24	.12	.06
.12	.10	.06	.14	.18	.06	.08	.12	.08	.06

36 JD INDEX STORM NO. 7

STRM 1.65 PRECIPITATION DEPTH

TRDA 50.00 TRANSPOSITION DRAINAGE AREA

0 PI PRECIPITATION PATTERN

1.20	1.58	2.34	1.62	1.26	1.80	1.88	2.04	.92	.36
.60	.56	.48	.28	.18	.54	.40	.12	.24	.30
.18	.26	.42	.34	.30	.48	.52	.60	.60	.60
.66	.62	.54	.54	.54	.36	.54	.90	.70	.60
.60	.50	.30	.26	.24	.06	.18	.42	.30	.24
.36	.36	.36	.64	.78	.90	1.00	1.20	1.48	1.62
1.32	1.82	2.82	2.42	2.22	2.82	3.26	4.14	4.58	4.80
.60	.62	.66	1.06	1.26	1.62	1.30	.66	.42	.30
.54	.48	.36	.52	.60	.36	.52	.84	1.04	1.14
1.80	1.62	1.26	1.54	1.68	1.68	1.20	.24	.24	.24
.30	.24	.12	.12	.12	.12	.16	.24	.12	.06
.12	.10	.06	.14	.18	.06	.08	.12	.08	.06

37 JD INDEX STORM NO. 8

STRM 1.46 PRECIPITATION DEPTH

TRDA 100.00 TRANSPOSITION DRAINAGE AREA

0 PI PRECIPITATION PATTERN

1.20	1.58	2.34	1.62	1.26	1.80	1.88	2.04	.92	.36
.60	.56	.48	.28	.18	.54	.40	.12	.24	.30
.18	.26	.42	.34	.30	.48	.52	.60	.60	.60
.66	.62	.54	.54	.54	.36	.54	.90	.70	.60
.60	.50	.30	.26	.24	.06	.18	.42	.30	.24
.36	.36	.36	.64	.78	.90	1.00	1.20	1.48	1.62
1.32	1.82	2.82	2.42	2.22	2.82	3.26	4.14	4.58	4.80
.60	.62	.66	1.06	1.26	1.62	1.30	.66	.42	.30
.54	.48	.36	.52	.60	.36	.52	.84	1.04	1.14
1.80	1.62	1.26	1.54	1.68	1.68	1.20	.24	.24	.24
.30	.24	.12	.12	.12	.12	.16	.24	.12	.06
.12	.10	.06	.14	.18	.06	.08	.12	.08	.06

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	MM1A	467.	3.75	77.	31.	31.	.90		
+	HYDROGRAPH AT	BW1	4883.	6.15	2699.	1141.	1141.	60.50		
+	HYDROGRAPH AT	BW2	2778.	4.40	1133.	456.	456.	20.80		
+	2 COMBINED AT	BW1&2	5498.	5.75	3049.	1282.	1282.	81.30		
+	2 COMBINED AT	BW APX	5488.	5.75	3060.	1287.	1287.	82.20		
+	HYDROGRAPH AT	MM1B	644.	4.00	136.	55.	55.	2.10		
+	HYDROGRAPH AT	MM2	526.	3.95	108.	44.	44.	1.40		
+	HYDROGRAPH AT	HP1A	444.	3.95	92.	37.	37.	.80		
+	ROUTED TO	RTCPA	420.	4.40	92.	37.	37.	.80		
+	HYDROGRAPH AT	HP1B	346.	4.00	75.	30.	30.	1.00		
+	HYDROGRAPH AT	HP2	407.	4.00	89.	36.	36.	1.20		
+	4 COMBINED AT	CPA1	1297.	4.05	317.	127.	127.	4.40		
+	HYDROGRAPH AT	HP3	661.	4.05	156.	63.	63.	1.70		
+	2 COMBINED AT	CPA2	1827.	4.10	442.	177.	177.	6.10		
+	HYDROGRAPH AT	HP4	1060.	4.00	233.	94.	94.	3.30		
+	HYDROGRAPH AT	HP5	582.	3.75	94.	38.	38.	1.20		
+	HYDROGRAPH AT	HP6	766.	4.05	174.	70.	70.	2.20		
+	ROUTED TO	RTCPD	741.	4.30	174.	70.	70.	2.20		
+	HYDROGRAPH AT	HPFA	125.	3.80	21.	9.	9.	.30		
+	3 COMBINED AT	CPD	945.	4.15	266.	107.	107.	3.70		
+	ROUTED TO	RTCPE	927.	4.55	266.	107.	107.	3.70		
+	HYDROGRAPH AT	HPFB	533.	3.95	107.	43.	43.	1.60		
+	3 COMBINED AT	CPE	1898.	4.10	537.	215.	215.	8.60		
+	2 COMBINED AT	CPF	2462.	4.05	854.	343.	343.	14.70		
+	HYDROGRAPH AT	SC1	3438.	6.15	1900.	804.	804.	39.40		
+	HYDROGRAPH AT	SC2	478.	4.00	101.	41.	41.	1.50		

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

HEC-1 MODEL OUTPUT

FILENAME: RWMS10.OUT

(10-YEAR MODEL)

```
****************************************
*                                      *
*   FLOOD HYDROGRAPH PACKAGE  (HEC-1)  *
*          SEPTEMBER 1990              *
*           VERSION 4.0                *
*                                      *
*  RUN DATE  01/29/1993  TIME  22:05:10 *
*                                      *
****************************************
```

```
****************************************
*                                      *
*    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   ID   FLOOD ASSESSMENT FOR RWMS JOB #:51056        FILE: RWMS10.DAT
 2   ID   10-YEAR 6-HOUR STORM 1.1 INCHES
 3   ID   POINT RAINFALL VALUE FROM NOAA ATLASS 2 VOL VII
 4   ID   DEPTH-AREA REDUCTION FACTORS FROM TABLE 502 IN
 5   ID   CLARK COUNTY HYDROLOGIC CRITERIA AND DRAINAGE DESIGN MANUAL (CCRFCD, 1990)
 6   ID   CURVE NUMBERS DETERMINED USING TABLE 602 IN CCRFCD, 1990
 7   ID   LAG TIMES DETEMINED USING METHOD IN SECTION 606.3 IN CCRFCD, 1990
 8   ID   DRAINAGE AREAS FROM 7.5 MINUTE AND 15 MINUTE QUADS
 9   ID   THIS MODEL ADDRESSES DRAINAGES THAT COULD IMPACT THE RWMS
      *DIAGRAM
10   IT       3       0       0     300
11   IO       5
12   IN       5
13   JD     1.1     .01
      * RAINFALL DISTRIBUTION FROM CLARK COUNTY MANUAL LESS THAN 10 SQ. MILES
14   PC       0       2     5.7     7.0     8.7    10.8    12.4    13.0    13.0    13.0
15   PC    13.0    13.0    13.0    13.3    14.0    14.2    14.8    15.8    17.2    18.1
16   PC    19.0    19.7    19.9    20.0    20.1    20.4    21.4    22.9    24.1    24.9
17   PC    25.1    25.6    27.0    27.8    28.1    28.3    29.5    32.2    35.2    40.9
18   PC    49.9    59.0    71.0    74.4    78.1    81.2    81.9    83.5    85.1    85.6
19   PC    86.0    86.8    87.6    88.8    91.0    92.6    93.7    95.0    97.0    97.6
20   PC    98.2    98.5    98.7    98.9    99.0    99.3    99.3    99.4    99.5    99.8
21   PC    99.8    99.9   100.0
22   JD    1.07       1
23   JD     .95    9.99
      * CHANGED RAINFALL DISTRIBUTION ABOVE 10 SQ. MILES PER CLARK COUNTY MANUAL
24   JD     .95   10.01
25   PC       0     2.0     5.9     8.0    11.0    14.4    15.0    16.0    16.8    17.1
26   PC    18.0    18.2    18.7    19.0    19.7    20.2    21.0    22.0    23.0    24.1
27   PC    25.0    25.9    26.5    28.0    29.0    30.0    30.5    30.9    31.0    31.7
28   PC    32.1    32.7    33.3    34.6    36.1    38.1    40.8    43.0    47.7    51.4
29   PC    56.1    63.0    71.0    72.0    73.1    75.2    77.9    79.0    79.5    80.4
30   PC    81.0    82.0    82.6    84.0    85.9    88.9    91.0    93.8    96.6    97.0
31   PC    97.4    97.9    98.1    98.3    98.5    98.9    99.0    99.2    99.3    99.6
32   PC    99.7    99.9   100.0
33   JD     .87      20
34   JD     .81      30
35   JD     .75      50
36   JD     .66     100

37   KK    MM1A
38   KM    Basin runoff calculation for Mass. Mountains 1A
39   BA      .9
40   LS              80
41   UD     .31

42   KK     BW1
43   KM     Basin runoff calculation for Barren Wash 1
44   BA    60.5
45   LS              83
46   UD      2.1
```

```
47          KK     BW2
48          KM     Basin runoff calculation for Barren Wash 2
49          BA    20.8
50          LS              80
51          UD      .9

52          KK   BW1&2
53          KM   Combined BW1 and BW2
54          HC       2

55          KK  BW APX
56          KM   Combine BW1,BW2, and MM1A (assume dischcarge of Barren Wash "active apex")
57          HC       2

58          KK    MM1B
59          KM    Basin runoff calulation for Mass. Mountains 1B
            *   Flow was not combined with BW APX because flow from this watershed
            *   will not directly impact RWMS wereas a channel migration at the apex
            *   could impact the RWMS
60          BA     2.1
61          LS              77
62          UD     .48

63          KK     MM2
64          KM    Basin runoff calculation for Mass. Mountains 2
65          BA     1.4
66          LS              79
67          UD     .47

68          KK    HP1A
69          KM    Basin runoff calculation for Half Pint Range 1A
70          BA      .8
71          LS              85
72          UD     .48

73          KK   RTCPA
74          KM   Route Flow from HP1A to CPA
75          RM       9     .43      .2

76          KK    HP1B
77          KM    Basin runoff calculation for Half Pint Range 1B
78          BA     1.0
79          LS              78
80          UD     .51

81          KK     HP2
82          KM    Basin runoff calculation for Half Pint Range 2
83          BA    1.2
84          LS              78
85          UD     .51

86          KK    CPA1
87          KM    Combine MM2, routed HP1A, HP1B, HP2
88          HC       4

89          KK     HP3
90          KM     (CPB) Basin runoff calculation for Half Pint Range 3
91          BA     1.7
92          LS              82
93          UD     .59

94          KK    CPA2
95          KM    Combine HP3 with flow from CPA1
96          HC       2

97          KK     HP4
98          KM     (CPC) Basin runoff calculation for Half Pint Range 4
99          BA     3.3
100         LS              79
101         UD     .52

102         KK     HP5
103         KM     Basin runoff calculation for Half Pint Range 5
104         BA     1.2
105         LS              79
106         UD      .3

107         KK     HP6
108         KM     Basin runoff calculation for Half Pint Range 6
109         BA     2.2
110         LS              80
111         UD     .55

112         KK   RTCPD
113         KM    Route HP6 to CPD
114         RM       5     .27      .2
```

```
115     KK    HPFA
116     KM     Basin runoff calculation for Half Pint Range FA
117     BA      .3
118     LS              77
119     UD     .33

120     KK     CPD
121     KM     Combine HP5, routed HP6, and HPFA
122     HC      3

123     KK   RTCPE
124     KM     Route flow from CPD to CPE
125     RM      8     .39      .2

126     KK    HPFB
127     KM     Basin runoff calculation for Half Pint Range FB
128     BA     1.6
129     LS              77
130     UD     .44

131     KK     CPE
132     KM    Combine HP4 (CPC) with routed flow from CPD, and HPFB
133     HC      3

134     KK     CPF
135     KM    Combine all flow at Concentration just below RWMS (Flow from CPA & CPE)
136     HC      2

137     KK     SC1
138     KM     Basin runoff calculation for Scarp Canyon 1
        * Concentration Pt of this watershed is the active apex of the Scarp Canyon Fan
139     BA    39.4
140     LS              82
141     UD     2.1

142     KK     SC2
143     KM     Basin runoff calculation for Scarp Canyon 2
144     BA     1.5
145     LS              77
146     UD     .48
147     ZZ
```

SCHEMATIC DIAGRAM OF STREAM NETWORK

(V) ROUTING (--->) DIVERSION OR PUMP FLOW

(.) CONNECTOR (<---) RETURN OF DIVERTED OR PUMPED FLOW

```
INPUT
 LINE
  NO.
   37    MM1A
          :
   42     :        BW1
          :         :
   47     :         :        BW2
          :         :         :
   52     :       BW1&2.......:
          :         :
   55    BW APX.....:
          :
   58     :       MM1B
          :         :
   63     :         :        MM2
          :         :         :
   68     :         :         :        HP1A
          :         :         :          V
          :         :         :          V
   73     :         :         :       RTCPA
          :         :         :         :
   76     :         :         :         :        HP1B
          :         :         :         :         :
   81     :         :         :         :         :        HP2
          :         :         :         :         :         :
   86     :         :        CPA1.......:.........:.........:
          :         :         :
   89     :         :         :        HP3
          :         :         :         :
   94     :         :        CPA2.......:
          :         :         :
   97     :         :         :        HP4
          :         :         :         :
  102     :         :         :         :        HP5
          :         :         :         :         :
  107     :         :         :         :         :        HP6
          :         :         :         :         :          V
          :         :         :         :         :          V
  112     :         :         :         :         :      RTCPD
          :         :         :         :         :         :
  115     :         :         :         :         :         :        HPFA
          :         :         :         :         :         :         :
  120     :         :         :         :        CPD.......:.........:
          :         :         :         :          V
          :         :         :         :          V
  123     :         :         :         :      RTCPE
          :         :         :         :         :
  126     :         :         :         :         :        HPFB
          :         :         :         :         :         :
  131     :         :         :        CPE.......:.........:
          :         :         :         :
  134     :         :        CPF.......:
          :         :         :
  137     :         :         :        SC1
          :         :         :         :
  142     :         :         :         :        SC2
```

(***) RUNOFF ALSO COMPUTED AT THIS LOCATION

```
*****************************************
*                                       *
*   FLOOD HYDROGRAPH PACKAGE  (HEC-1)   *
*            SEPTEMBER 1990             *
*             VERSION 4.0               *
*                                       *
*  RUN DATE  01/29/1993  TIME  22:05:10 *
*                                       *
*****************************************
```

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

```
                    FLOOD ASSESSMENT FOR RWMS JOB #:51056        FILE: RWMS10.DAT
                    10-YEAR 6-HOUR STORM 1.1 INCHES
                    POINT RAINFALL VALUE FROM NOAA ATLASS 2 VOL VII
                    DEPTH-AREA REDUCTION FACTORS FROM TABLE 502 IN
                    CLARK COUNTY HYDROLOGIC CRITERIA AND DRAINAGE DESIGN MANUAL (CCRFCD, 1990)
                    CURVE NUMBERS DETERMINED USING TABLE 602 IN CCRFCD, 1990
                    LAG TIMES DETEMINED USING METHOD IN SECTION 606.3 IN CCRFCD, 1990
                    DRAINAGE AREAS FROM 7.5 MINUTE AND 15 MINUTE QUADS
                    THIS MODEL ADDRESSES DRAINAGES THAT COULD IMPACT THE RWMS

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

   IT         HYDROGRAPH TIME DATA
                     NMIN          3  MINUTES IN COMPUTATION INTERVAL
                    IDATE      1    0  STARTING DATE
                    ITIME         0000  STARTING TIME
                       NQ        300  NUMBER OF HYDROGRAPH ORDINATES
                   NDDATE      1    0  ENDING DATE
                   NDTIME       1457  ENDING TIME
                    ICENT         19  CENTURY MARK

              COMPUTATION INTERVAL     .05 HOURS
                   TOTAL TIME BASE   14.95 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

 13 JD        INDEX STORM NO. 1
                     STRM       1.10  PRECIPITATION DEPTH
                     TRDA        .01  TRANSPOSITION DRAINAGE AREA

 14 PI          PRECIPITATION PATTERN
                  1.20      1.54      2.22      1.26       .78      1.02      1.10      1.26      1.06       .96
                   .36       .24       .00       .00       .00       .00       .00       .00       .00       .00
                   .18       .26       .42       .22       .12       .36       .44       .60       .76       .84
                   .54       .54       .54       .46       .42       .12       .10       .06       .06       .06
                   .18       .32       .60       .80       .90       .72       .64       .48       .24       .12
                   .30       .48       .84       .60       .48       .18       .16       .12       .52       .72
                  1.62      1.68      1.80      2.88      3.42      5.40      5.42      5.46      6.62      7.20
                  2.04      2.10      2.22      1.98      1.86       .42       .60       .96       .96       .96
                   .30       .28       .24       .40       .48       .48       .56       .72      1.12      1.32
                   .96       .86       .66       .74       .78      1.20       .92       .36       .36       .36
                   .18       .16       .12       .12       .12       .06       .10       .18       .06       .00
                   .06       .06       .06       .14       .18       .00       .02       .06       .06       .06

 22 JD        INDEX STORM NO. 2
                     STRM       1.07  PRECIPITATION DEPTH
                     TRDA       1.00  TRANSPOSITION DRAINAGE AREA

  0 PI          PRECIPITATION PATTERN
                  1.20      1.54      2.22      1.26       .78      1.02      1.10      1.26      1.06       .96
                   .36       .24       .00       .00       .00       .00       .00       .00       .00       .00
                   .18       .26       .42       .22       .12       .36       .44       .60       .76       .84
                   .54       .54       .54       .46       .42       .12       .10       .06       .06       .06
                   .18       .32       .60       .80       .90       .72       .64       .48       .24       .12
                   .30       .48       .84       .60       .48       .18       .16       .12       .52       .72
                  1.62      1.68      1.80      2.88      3.42      5.40      5.42      5.46      6.62      7.20
                  2.04      2.10      2.22      1.98      1.86       .42       .60       .96       .96       .96
                   .30       .28       .24       .40       .48       .48       .56       .72      1.12      1.32
                   .96       .86       .66       .74       .78      1.20       .92       .36       .36       .36
                   .18       .16       .12       .12       .12       .06       .10       .18       .06       .00
                   .06       .06       .06       .14       .18       .00       .02       .06       .06       .06
```

23 JD INDEX STORM NO. 3

STRM .95 PRECIPITATION DEPTH

TRDA 9.99 TRANSPOSITION DRAINAGE AREA

0 PI PRECIPITATION PATTERN

1.20	1.54	2.22	1.26	.78	1.02	1.10	1.26	1.06	.96
.36	.24	.00	.00	.00	.00	.00	.00	.00	.00
.18	.26	.42	.22	.12	.36	.44	.60	.76	.84
.54	.54	.54	.46	.42	.12	.10	.06	.06	.06
.18	.32	.60	.80	.90	.72	.64	.48	.24	.12
.30	.48	.84	.60	.48	.18	.16	.12	.52	.72
1.62	1.68	1.80	2.88	3.42	5.40	5.42	5.46	6.62	7.20
2.04	2.10	2.22	1.98	1.86	.42	.60	.96	.96	.96
.30	.28	.24	.40	.48	.48	.56	.72	1.12	1.32
.96	.86	.66	.74	.78	1.20	.92	.36	.36	.36
.18	.16	.12	.12	.12	.06	.10	.18	.06	.00
.06	.06	.06	.14	.18	.00	.02	.06	.06	.06

24 JD INDEX STORM NO. 4

STRM .95 PRECIPITATION DEPTH

TRDA 10.01 TRANSPOSITION DRAINAGE AREA

25 PI PRECIPITATION PATTERN

1.20	1.58	2.34	1.62	1.26	1.80	1.88	2.04	.92	.36
.60	.56	.48	.28	.18	.54	.40	.12	.24	.30
.18	.26	.42	.34	.30	.48	.52	.60	.60	.60
.66	.62	.54	.54	.54	.36	.54	.90	.70	.60
.60	.50	.30	.26	.24	.06	.18	.42	.30	.24
.36	.36	.36	.64	.78	.90	1.00	1.20	1.48	1.62
1.32	1.82	2.82	2.42	2.22	2.82	3.26	4.14	4.58	4.80
.60	.62	.66	1.06	1.26	1.62	1.30	.66	.42	.30
.54	.48	.36	.52	.60	.36	.52	.84	1.04	1.14
1.80	1.62	1.26	1.54	1.68	1.68	1.20	.24	.24	.24
.30	.24	.12	.12	.12	.12	.16	.24	.12	.06
.12	.10	.06	.14	.18	.06	.08	.12	.08	.06

33 JD INDEX STORM NO. 5

STRM .87 PRECIPITATION DEPTH

TRDA 20.00 TRANSPOSITION DRAINAGE AREA

0 PI PRECIPITATION PATTERN

1.20	1.58	2.34	1.62	1.26	1.80	1.88	2.04	.92	.36
.60	.56	.48	.28	.18	.54	.40	.12	.24	.30
.18	.26	.42	.34	.30	.48	.52	.60	.60	.60
.66	.62	.54	.54	.54	.36	.54	.90	.70	.60
.60	.50	.30	.26	.24	.06	.18	.42	.30	.24
.36	.36	.36	.64	.78	.90	1.00	1.20	1.48	1.62
1.32	1.82	2.82	2.42	2.22	2.82	3.26	4.14	4.58	4.80
.60	.62	.66	1.06	1.26	1.62	1.30	.66	.42	.30
.54	.48	.36	.52	.60	.36	.52	.84	1.04	1.14
1.80	1.62	1.26	1.54	1.68	1.68	1.20	.24	.24	.24
.30	.24	.12	.12	.12	.12	.16	.24	.12	.06
.12	.10	.06	.14	.18	.06	.08	.12	.08	.06

34 JD INDEX STORM NO. 6

STRM .81 PRECIPITATION DEPTH

TRDA 30.00 TRANSPOSITION DRAINAGE AREA

0 PI PRECIPITATION PATTERN

1.20	1.58	2.34	1.62	1.26	1.80	1.88	2.04	.92	.36
.60	.56	.48	.28	.18	.54	.40	.12	.24	.30
.18	.26	.42	.34	.30	.48	.52	.60	.60	.60
.66	.62	.54	.54	.54	.36	.54	.90	.70	.60
.60	.50	.30	.26	.24	.06	.18	.42	.30	.24
.36	.36	.36	.64	.78	.90	1.00	1.20	1.48	1.62
1.32	1.82	2.82	2.42	2.22	2.82	3.26	4.14	4.58	4.80
.60	.62	.66	1.06	1.26	1.62	1.30	.66	.42	.30
.54	.48	.36	.52	.60	.36	.52	.84	1.04	1.14
1.80	1.62	1.26	1.54	1.68	1.68	1.20	.24	.24	.24
.30	.24	.12	.12	.12	.12	.16	.24	.12	.06
.12	.10	.06	.14	.18	.06	.08	.12	.08	.06

35 JD INDEX STORM NO. 7

STRM .75 PRECIPITATION DEPTH

TRDA 50.00 TRANSPOSITION DRAINAGE AREA

0 PI PRECIPITATION PATTERN

1.20	1.58	2.34	1.62	1.26	1.80	1.88	2.04	.92	.36
.60	.56	.48	.28	.18	.54	.40	.12	.24	.30
.18	.26	.42	.34	.30	.48	.52	.60	.60	.60
.66	.62	.54	.54	.54	.36	.54	.90	.70	.60
.60	.50	.30	.26	.24	.06	.18	.42	.30	.24
.36	.36	.36	.64	.78	.90	1.00	1.20	1.48	1.62
1.32	1.82	2.82	2.42	2.22	2.82	3.26	4.14	4.58	4.80
.60	.62	.66	1.06	1.26	1.62	1.30	.66	.42	.30
.54	.48	.36	.52	.60	.36	.52	.84	1.04	1.14
1.80	1.62	1.26	1.54	1.68	1.68	1.20	.24	.24	.24
.30	.24	.12	.12	.12	.12	.16	.24	.12	.06
.12	.10	.06	.14	.18	.06	.08	.12	.08	.06

36 JD INDEX STORM NO. 8

STRM .66 PRECIPITATION DEPTH

TRDA 100.00 TRANSPOSITION DRAINAGE AREA

0 PI PRECIPITATION PATTERN

1.20	1.58	2.34	1.62	1.26	1.80	1.88	2.04	.92	.36
.60	.56	.48	.28	.18	.54	.40	.12	.24	.30
.18	.26	.42	.34	.30	.48	.52	.60	.60	.60
.66	.62	.54	.54	.54	.36	.54	.90	.70	.60
.60	.50	.30	.26	.24	.06	.18	.42	.30	.24
.36	.36	.36	.64	.78	.90	1.00	1.20	1.48	1.62
1.32	1.82	2.82	2.42	2.22	2.82	3.26	4.14	4.58	4.80
.60	.62	.66	1.06	1.26	1.62	1.30	.66	.42	.30
.54	.48	.36	.52	.60	.36	.52	.84	1.04	1.14
1.80	1.62	1.26	1.54	1.68	1.68	1.20	.24	.24	.24
.30	.24	.12	.12	.12	.12	.16	.24	.12	.06
.12	.10	.06	.14	.18	.06	.08	.12	.08	.06

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	MM1A	50.	3.90	10.	4.	4.	.90		
+	HYDROGRAPH AT	BW1	511.	6.55	265.	111.	111.	60.50		
+	HYDROGRAPH AT	BW2	328.	5.50	104.	42.	42.	20.80		
+	2 COMBINED AT	BW1&2	510.	6.35	268.	112.	112.	81.30		
+	2 COMBINED AT	BW APX	452.	6.40	237.	99.	99.	82.20		
+	HYDROGRAPH AT	MM1B	43.	5.10	13.	5.	5.	2.10		
+	HYDROGRAPH AT	MM2	48.	4.10	13.	5.	5.	1.40		
+	HYDROGRAPH AT	HP1A	81.	4.00	18.	7.	7.	.80		
+	ROUTED TO	RTCPA	77.	4.45	18.	7.	7.	.80		
+	HYDROGRAPH AT	HP1B	28.	4.20	8.	3.	3.	1.00		
+	HYDROGRAPH AT	HP2	33.	4.20	10.	4.	4.	1.20		
+	4 COMBINED AT	CPA1	130.	4.35	39.	16.	16.	4.40		
+	HYDROGRAPH AT	HP3	87.	4.20	24.	10.	10.	1.70		
+	2 COMBINED AT	CPA2	187.	4.30	56.	22.	22.	6.10		
+	HYDROGRAPH AT	HP4	88.	4.20	26.	10.	10.	3.30		
+	HYDROGRAPH AT	HP5	54.	3.90	11.	5.	5.	1.20		
+	HYDROGRAPH AT	HP6	77.	4.20	22.	9.	9.	2.20		
+	ROUTED TO	RTCPD	75.	4.45	22.	9.	9.	2.20		
+	HYDROGRAPH AT	HPFA	9.	3.95	2.	1.	1.	.30		
+	3 COMBINED AT	CPD	90.	4.70	31.	12.	12.	3.70		
+	ROUTED TO	RTCPE	90.	5.05	31.	12.	12.	3.70		
+	HYDROGRAPH AT	HPFB	35.	5.05	10.	4.	4.	1.60		
+	3 COMBINED AT	CPE	168.	5.10	53.	21.	21.	8.60		
+	2 COMBINED AT	CPF	301.	5.20	84.	34.	34.	14.70		
+	HYDROGRAPH AT	SC1	356.	6.55	184.	78.	78.	39.40		
+	HYDROGRAPH AT	SC2	32.	5.10	10.	4.	4.	1.50		

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

HEC-1 MODEL OUTPUT

FILENAME: RWMS10C.OUT

(10-YEAR MODEL)

```
****************************************
*                                      *
*   FLOOD HYDROGRAPH PACKAGE  (HEC-1)  *
*            SEPTEMBER 1990            *
*             VERSION 4.0              *
*                                      *
*  RUN DATE  01/29/1993  TIME  22:06:45 *
*                                      *
****************************************
```

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

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   ID   FLOOD ASSESSMENT FOR RWMS JOB #:51056        FILE: RWMS10C.DAT
 2   ID   10-YEAR 6-HOUR STORM 1.1 INCHES
 3   ID   POINT RAINFALL VALUES FROM NOAA ATLAS 2 VOL VII
 4   ID   ADJUSTED RAINFALL PER CORRECTION FACTOR IN CLARK COUNTY MANUAL TABLE 501
 5   ID   DEPTH-AREA REDUCTION FACTORS FROM TABLE 502 IN
 6   ID   CLARK COUNTY HYDROLOGIC CRITERIA AND DRAINAGE DESIGN MANUAL (CCRFCD, 1990)
 7   ID   CURVE NUMBERS DETERMINED USING TABLE 602 IN CCRFCD, 1990
 8   ID   LAG TIMES DETEMINED USING METHOD IN SECITON 606.3 IN CCRFCD, 1990
 9   ID   DRAINAGE AREAS FROM 7.5 MINUTE AND 15 MINUTE QUADS
10   ID   THIS MODEL ADDRESSES DRAINAGES THAT COULD IMPACT THE RWMS
     *DIAGRAM
11   IT       3       0       0     300
12   IO       5
13   IN       5
14   JD    1.36     .01
     * RAINFALL DISTRIBUTION FROM CLARK COUNTY MANUAL LESS THAN 10 SQ. MILES
15   PC       0       2     5.7     7.0     8.7    10.8    12.4    13.0    13.0    13.0
16   PC    13.0    13.0    13.0    13.3    14.0    14.2    14.8    15.8    17.2    18.1
17   PC    19.0    19.7    19.9    20.0    20.1    20.4    21.4    22.9    24.1    24.9
18   PC    25.1    25.6    27.0    27.8    28.1    28.3    29.5    32.2    35.2    40.9
19   PC    49.9    59.0    71.0    74.4    78.1    81.2    81.9    83.5    85.1    85.6
20   PC    86.0    86.8    87.6    88.8    91.0    92.6    93.7    95.0    97.0    97.6
21   PC    98.2    98.5    98.7    98.9    99.0    99.3    99.3    99.4    99.5    99.8
22   PC    99.8    99.9   100.0
23   JD    1.32       1
24   JD    1.17    9.99
     * CHANGED RAINFALL DISTRIBUTION ABOVE 10 SQ. MILES PER CLARK COUNTY MANUAL
25   JD    1.17   10.01
26   PC       0     2.0     5.9     8.0    11.0    14.4    15.0    16.0    16.8    17.1
27   PC    18.0    18.2    18.7    19.0    19.7    20.2    21.0    22.0    23.0    24.1
28   PC    25.0    25.9    26.5    28.0    29.0    30.0    30.5    30.9    31.0    31.7
29   PC    32.1    32.7    33.3    34.6    36.1    38.1    40.8    43.0    47.7    51.4
30   PC    56.1    63.0    71.0    72.0    73.1    75.2    77.9    79.0    79.5    80.4
31   PC    81.0    82.0    82.6    84.0    85.9    88.9    91.0    93.8    96.6    97.0
32   PC    97.4    97.9    98.1    98.3    98.5    98.9    99.0    99.2    99.3    99.6
33   PC    99.7    99.9   100.0
34   JD    1.07      20
35   JD    1.01      30
36   JD     .92      50
37   JD     .82     100

38   KK    MM1A
39   KM    Basin runoff calculation for Mass. Mountains 1A
40   BA      .9
41   LS              80
42   UD     .31

43   KK     BW1
44   KM     Basin runoff calculation for Barren Wash 1
45   BA    60.5
46   LS              83
47   UD     2.1
```

```
48          KK     BW2
49          KM     Basin runoff calculation for Barren Wash 2
50          BA    20.8
51          LS              80
52          UD      .9

53          KK   BW1&2
54          KM   Combined BW1 and BW2
55          HC       2

56          KK  BW APX
57          KM   Combine BW1,BW2, and MM1A (assume dischcarge of Barren Wash "active apex")
58          HC       2

59          KK    MM1B
60          KM    Basin runoff calulation for Mass. Mountains 1B
            *   Flow was not combined with BW APX because flow from this watershed
            *   will not directly impact RWMS wereas a channel migration at the apex
            *   could impact the RWMS
61          BA     2.1
62          LS              77
63          UD     .48

64          KK     MM2
65          KM    Basin runoff calculation for Mass. Mountains 2
66          BA     1.4
67          LS              79
68          UD     .47

69          KK    HP1A
70          KM    Basin runoff calculation for Half Pint Range 1A
71          BA      .8
72          LS              85
73          UD     .48

74          KK   RTCPA
75          KM   Route Flow from HP1A to CPA
76          RM       9     .43      .2

77          KK    HP1B
78          KM    Basin runoff calculation for Half Pint Range 1B
79          BA     1.0
80          LS              78
81          UD     .51

82          KK     HP2
83          KM    Basin runoff calculation for Half Pint Range 2
84          BA    1.2
85          LS              78
86          UD     .51

87          KK    CPA1
88          KM    Combine MM2, routed HP1A, HP1B, HP2
89          HC       4

90          KK     HP3
91          KM     (CPB) Basin runoff calculation for Half Pint Range 3
92          BA     1.7
93          LS              82
94          UD     .59

95          KK    CPA2
96          KM    Combine HP3 with flow from CPA1
97          HC       2

98          KK     HP4
99          KM     (CPC) Basin runoff calculation for Half Pint Range 4
100         BA     3.3
101         LS              79
102         UD     .52

103         KK     HP5
104         KM     Basin runoff calculation for Half Pint Range 5
105         BA     1.2
106         LS              79
107         UD      .3

108         KK     HP6
109         KM     Basin runoff calculation for Half Pint Range 6
110         BA     2.2
111         LS              80
112         UD     .55

113         KK   RTCPD
114         KM    Route HP6 to CPD
115         RM       5     .27      .2
```

```
116     KK    HPFA
117     KM     Basin runoff calculation for Half Pint Range FA
118     BA      .3
119     LS              77
120     UD     .33

121     KK     CPD
122     KM     Combine HP5, routed HP6, and HPFA
123     HC       3

124     KK   RTCPE
125     KM     Route flow from CPD to CPE
126     RM       8     .39      .2

127     KK    HPFB
128     KM     Basin runoff calculation for Half Pint Range FB
129     BA     1.6
130     LS              77
131     UD     .44

132     KK     CPE
133     KM    Combine HP4 (CPC) with routed flow from CPD, and HPFB
134     HC       3

135     KK     CPF
136     KM    Combine all flow at Concentration just below RWMS (Flow from CPA & CPE)
137     HC       2

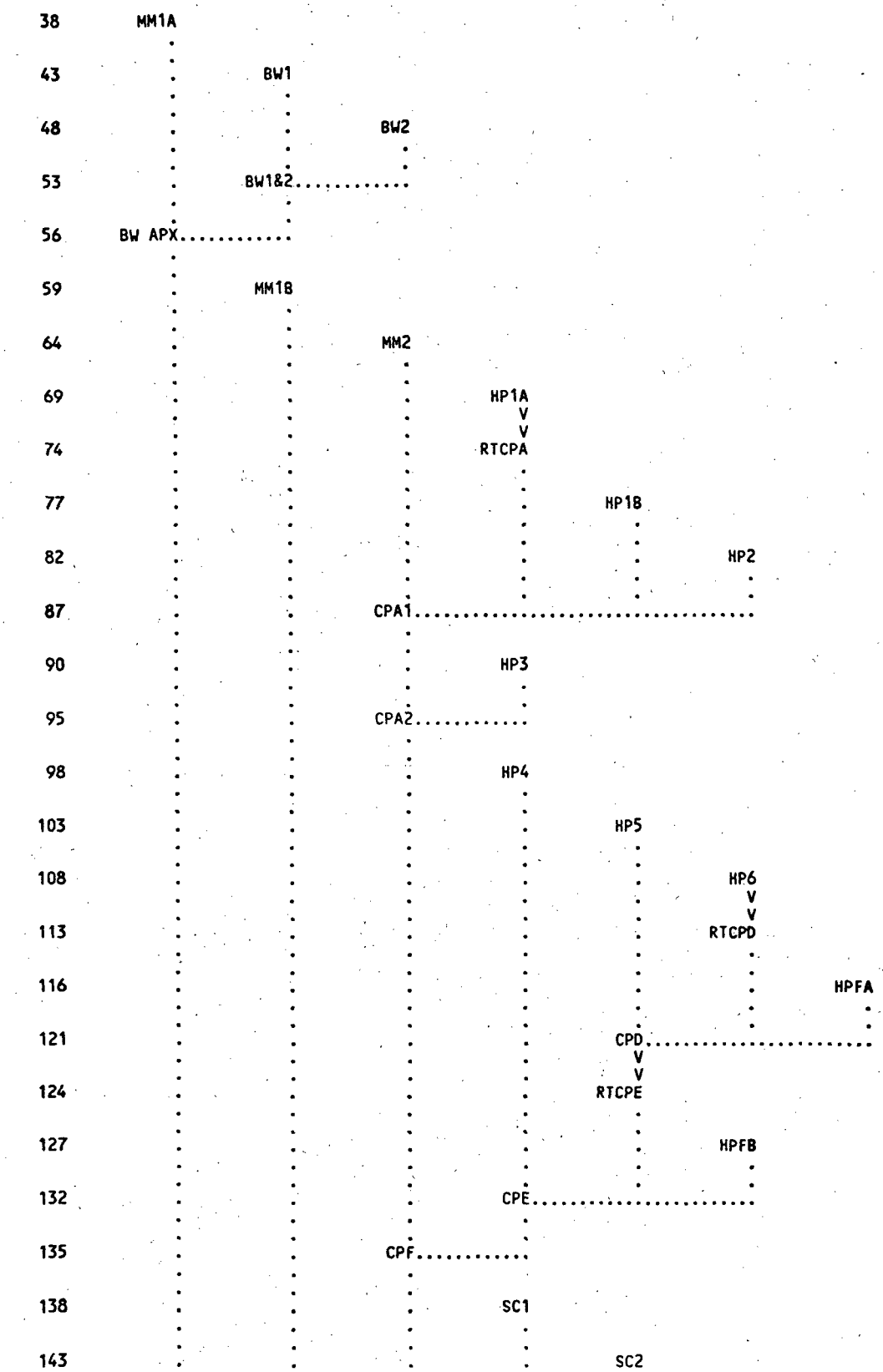
138     KK     SC1
139     KM     Basin runoff calculation for Scarp Canyon 1
        * Concentration Pt of this watershed is the active apex of the Scarp Canyon Fan
140     BA    39.4
141     LS              82
142     UD     2.1

143     KK     SC2
144     KM     Basin runoff calculation for Scarp Canyon 2
145     BA     1.5
146     LS              77
147     UD     .48
148     ZZ
```

SCHEMATIC DIAGRAM OF STREAM NETWORK

(V) ROUTING (---->) DIVERSION OR PUMP FLOW

(.) CONNECTOR (<---) RETURN OF DIVERTED OR PUMPED FLOW



(***) RUNOFF ALSO COMPUTED AT THIS LOCATION

```
*****************************************
*                                       *
*   FLOOD HYDROGRAPH PACKAGE  (HEC-1)   *
*            SEPTEMBER 1990             *
*             VERSION 4.0               *
*                                       *
*  RUN DATE  01/29/1993  TIME  22:06:45 *
*                                       *
*****************************************
```

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

```
                    FLOOD ASSESSMENT FOR RWMS JOB #:51056        FILE: RWMS10C.DAT
                    10-YEAR 6-HOUR STORM 1.1 INCHES
                    POINT RAINFALL VALUES FROM NOAA ATLAS 2 VOL VII
                    ADJUSTED RAINFALL PER CORRECTION FACTOR IN CLARK COUNTY MANUAL TABLE 501
                    DEPTH-AREA REDUCTION FACTORS FROM TABLE 502 IN
                    CLARK COUNTY HYDROLOGIC CRITERIA AND DRAINAGE DESIGN MANUAL (CCRFCD, 1990)
                    CURVE NUMBERS DETERMINED USING TABLE 602 IN CCRFCD, 1990
                    LAG TIMES DETEMINED USING METHOD IN SECITON 606.3 IN CCRFCD, 1990
                    DRAINAGE AREAS FROM 7.5 MINUTE AND 15 MINUTE QUADS
                    THIS MODEL ADDRESSES DRAINAGES THAT COULD IMPACT THE RWMS

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

   IT          HYDROGRAPH TIME DATA
                      NMIN          3  MINUTES IN COMPUTATION INTERVAL
                     IDATE      1   0  STARTING DATE
                     ITIME       0000  STARTING TIME
                        NQ        300  NUMBER OF HYDROGRAPH ORDINATES
                    NDDATE      1   0  ENDING DATE
                    NDTIME       1457  ENDING TIME
                     ICENT         19  CENTURY MARK

                 COMPUTATION INTERVAL     .05 HOURS
                      TOTAL TIME BASE   14.95 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

14 JD          INDEX STORM NO. 1
                      STRM       1.36  PRECIPITATION DEPTH
                      TRDA        .01  TRANSPOSITION DRAINAGE AREA

15 PI            PRECIPITATION PATTERN
                  1.20      1.54      2.22      1.26       .78      1.02      1.10      1.26      1.06       .96
                   .36       .24       .00       .00       .00       .00       .00       .00       .00       .00
                   .18       .26       .42       .22       .12       .36       .44       .60       .76       .84
                   .54       .54       .54       .46       .42       .12       .10       .06       .06       .06
                   .18       .32       .60       .80       .90       .72       .64       .48       .24       .12
                   .30       .48       .84       .60       .48       .18       .16       .12       .52       .72
                  1.62      1.68      1.80      2.88      3.42      5.40      5.42      5.46      6.62      7.20
                  2.04      2.10      2.22      1.98      1.86       .42       .60       .96       .96       .96
                   .30       .28       .24       .40       .48       .48       .56       .72      1.12      1.32
                   .96       .86       .66       .74       .78      1.20       .92       .36       .36       .36
                   .18       .16       .12       .12       .12       .06       .10       .18       .06       .00
                   .06       .06       .06       .14       .18       .00       .02       .06       .06       .06

23 JD          INDEX STORM NO. 2
                      STRM       1.32  PRECIPITATION DEPTH
                      TRDA       1.00  TRANSPOSITION DRAINAGE AREA

 0 PI            PRECIPITATION PATTERN
                  1.20      1.54      2.22      1.26       .78      1.02      1.10      1.26      1.06       .96
                   .36       .24       .00       .00       .00       .00       .00       .00       .00       .00
                   .18       .26       .42       .22       .12       .36       .44       .60       .76       .84
                   .54       .54       .54       .46       .42       .12       .10       .06       .06       .06
                   .18       .32       .60       .80       .90       .72       .64       .48       .24       .12
                   .30       .48       .84       .60       .48       .18       .16       .12       .52       .72
                  1.62      1.68      1.80      2.88      3.42      5.40      5.42      5.46      6.62      7.20
                  2.04      2.10      2.22      1.98      1.86       .42       .60       .96       .96       .96
                   .30       .28       .24       .40       .48       .48       .56       .72      1.12      1.32
                   .96       .86       .66       .74       .78      1.20       .92       .36       .36       .36
                   .18       .16       .12       .12       .12       .06       .10       .18       .06       .00
                   .06       .06       .06       .14       .18       .00       .02       .06       .06       .06
```

24 JD INDEX STORM NO. 3

STRM 1.17 PRECIPITATION DEPTH
TRDA 9.99 TRANSPOSITION DRAINAGE AREA

0 PI PRECIPITATION PATTERN

1.20	1.54	2.22	1.26	.78	1.02	1.10	1.26	1.06	.96
.36	.24	.00	.00	.00	.00	.00	.00	.00	.00
.18	.26	.42	.22	.12	.36	.44	.60	.76	.84
.54	.54	.54	.46	.42	.12	.10	.06	.06	.06
.18	.32	.60	.80	.90	.72	.64	.48	.24	.12
.30	.48	.84	.60	.48	.18	.16	.12	.52	.72
1.62	1.68	1.80	2.88	3.42	5.40	5.42	5.46	6.62	7.20
2.04	2.10	2.22	1.98	1.86	.42	.60	.96	.96	.96
.30	.28	.24	.40	.48	.48	.56	.72	1.12	1.32
.96	.86	.66	.74	.78	1.20	.92	.36	.36	.36
.18	.16	.12	.12	.12	.06	.10	.18	.06	.00
.06	.06	.06	.14	.18	.00	.02	.06	.06	.06

25 JD INDEX STORM NO. 4

STRM 1.17 PRECIPITATION DEPTH
TRDA 10.01 TRANSPOSITION DRAINAGE AREA

26 PI PRECIPITATION PATTERN

1.20	1.58	2.34	1.62	1.26	1.80	1.88	2.04	.92	.36
.60	.56	.48	.28	.18	.54	.40	.12	.24	.30
.18	.26	.42	.34	.30	.48	.52	.60	.60	.60
.66	.62	.54	.54	.54	.36	.54	.90	.70	.60
.60	.50	.30	.26	.24	.06	.18	.42	.30	.24
.36	.36	.36	.64	.78	.90	1.00	1.20	1.48	1.62
1.32	1.82	2.82	2.42	2.22	2.82	3.26	4.14	4.58	4.80
.60	.62	.66	1.06	1.26	1.62	1.30	.66	.42	.30
.54	.48	.36	.52	.60	.36	.52	.84	1.04	1.14
1.80	1.62	1.26	1.54	1.68	1.68	1.20	.24	.24	.24
.30	.24	.12	.12	.12	.12	.16	.24	.12	.06
.12	.10	.06	.14	.18	.06	.08	.12	.08	.06

34 JD INDEX STORM NO. 5

STRM 1.07 PRECIPITATION DEPTH
TRDA 20.00 TRANSPOSITION DRAINAGE AREA

0 PI PRECIPITATION PATTERN

1.20	1.58	2.34	1.62	1.26	1.80	1.88	2.04	.92	.36
.60	.56	.48	.28	.18	.54	.40	.12	.24	.30
.18	.26	.42	.34	.30	.48	.52	.60	.60	.60
.66	.62	.54	.54	.54	.36	.54	.90	.70	.60
.60	.50	.30	.26	.24	.06	.18	.42	.30	.24
.36	.36	.36	.64	.78	.90	1.00	1.20	1.48	1.62
1.32	1.82	2.82	2.42	2.22	2.82	3.26	4.14	4.58	4.80
.60	.62	.66	1.06	1.26	1.62	1.30	.66	.42	.30
.54	.48	.36	.52	.60	.36	.52	.84	1.04	1.14
1.80	1.62	1.26	1.54	1.68	1.68	1.20	.24	.24	.24
.30	.24	.12	.12	.12	.12	.16	.24	.12	.06
.12	.10	.06	.14	.18	.06	.08	.12	.08	.06

35 JD INDEX STORM NO. 6

STRM 1.01 PRECIPITATION DEPTH
TRDA 30.00 TRANSPOSITION DRAINAGE AREA

0 PI PRECIPITATION PATTERN

1.20	1.58	2.34	1.62	1.26	1.80	1.88	2.04	.92	.36
.60	.56	.48	.28	.18	.54	.40	.12	.24	.30
.18	.26	.42	.34	.30	.48	.52	.60	.60	.60
.66	.62	.54	.54	.54	.36	.54	.90	.70	.60
.60	.50	.30	.26	.24	.06	.18	.42	.30	.24
.36	.36	.36	.64	.78	.90	1.00	1.20	1.48	1.62
1.32	1.82	2.82	2.42	2.22	2.82	3.26	4.14	4.58	4.80
.60	.62	.66	1.06	1.26	1.62	1.30	.66	.42	.30
.54	.48	.36	.52	.60	.36	.52	.84	1.04	1.14
1.80	1.62	1.26	1.54	1.68	1.68	1.20	.24	.24	.24
.30	.24	.12	.12	.12	.12	.16	.24	.12	.06
.12	.10	.06	.14	.18	.06	.08	.12	.08	.06

36 JD INDEX STORM NO. 7

STRM .92 PRECIPITATION DEPTH
TRDA 50.00 TRANSPOSITION DRAINAGE AREA

0 PI PRECIPITATION PATTERN

1.20	1.58	2.34	1.62	1.26	1.80	1.88	2.04	.92	.36
.60	.56	.48	.28	.18	.54	.40	.12	.24	.30
.18	.26	.42	.34	.30	.48	.52	.60	.60	.60
.66	.62	.54	.54	.54	.36	.54	.90	.70	.60
.60	.50	.30	.26	.24	.06	.18	.42	.30	.24
.36	.36	.36	.64	.78	.90	1.00	1.20	1.48	1.62
1.32	1.82	2.82	2.42	2.22	2.82	3.26	4.14	4.58	4.80
.60	.62	.66	1.06	1.26	1.62	1.30	.66	.42	.30
.54	.48	.36	.52	.60	.36	.52	.84	1.04	1.14
1.80	1.62	1.26	1.54	1.68	1.68	1.20	.24	.24	.24
.30	.24	.12	.12	.12	.12	.16	.24	.12	.06
.12	.10	.06	.14	.18	.06	.08	.12	.08	.06

37 JD INDEX STORM NO. 8

STRM .82 PRECIPITATION DEPTH

TRDA 100.00 TRANSPOSITION DRAINAGE AREA

0 PI PRECIPITATION PATTERN

1.20	1.58	2.34	1.62	1.26	1.80	1.88	2.04	.92	.36
.60	.56	.48	.28	.18	.54	.40	.12	.24	.30
.18	.26	.42	.34	.30	.48	.52	.60	.60	.60
.66	.62	.54	.54	.54	.36	.54	.90	.70	.60
.60	.50	.30	.26	.24	.06	.18	.42	.30	.24
.36	.36	.36	.64	.78	.90	1.00	1.20	1.48	1.62
1.32	1.82	2.82	2.42	2.22	2.82	3.26	4.14	4.58	4.80
.60	.62	.66	1.06	1.26	1.62	1.30	.66	.42	.30
.54	.48	.36	.52	.60	.36	.52	.84	1.04	1.14
1.80	1.62	1.26	1.54	1.68	1.68	1.20	.24	.24	.24
.30	.24	.12	.12	.12	.12	.16	.24	.12	.06
.12	.10	.06	.14	.18	.06	.08	.12	.08	.06

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	MM1A	108.	3.85	20.	8.	8.	.90		
+	HYDROGRAPH AT	BW1	1083.	6.40	574.	242.	242.	60.50		
+	HYDROGRAPH AT	BW2	653.	5.45	232.	93.	93.	20.80		
+	2 COMBINED AT	BW1&2	1083.	6.10	581.	244.	244.	81.30		
+	2 COMBINED AT	BW APX	1078.	6.10	581.	244.	244.	82.20		
+	HYDROGRAPH AT	MM1B	110.	4.10	28.	11.	11.	2.10		
+	HYDROGRAPH AT	MM2	110.	4.05	26.	10.	10.	1.40		
+	HYDROGRAPH AT	HP1A	139.	4.00	30.	12.	12.	.80		
+	ROUTED TO	RTCPA	132.	4.40	30.	12.	12.	.80		
+	HYDROGRAPH AT	HP1B	68.	4.10	17.	7.	7.	1.00		
+	HYDROGRAPH AT	HP2	79.	4.10	20.	8.	8.	1.20		
+	4 COMBINED AT	CPA1	278.	4.25	76.	31.	31.	4.40		
+	HYDROGRAPH AT	HP3	170.	4.15	43.	17.	17.	1.70		
+	2 COMBINED AT	CPA2	399.	4.20	108.	43.	43.	6.10		
+	HYDROGRAPH AT	HP4	210.	4.10	54.	21.	21.	3.30		
+	HYDROGRAPH AT	HP5	123.	3.85	23.	9.	9.	1.20		
+	HYDROGRAPH AT	HP6	168.	4.10	43.	17.	17.	2.20		
+	ROUTED TO	RTCPD	164.	4.40	43.	17.	17.	2.20		
+	HYDROGRAPH AT	HPFA	23.	3.90	5.	2.	2.	.30		
+	3 COMBINED AT	CPD	199.	4.30	62.	25.	25.	3.70		
+	ROUTED TO	RTCPE	196.	4.70	62.	25.	25.	3.70		
+	HYDROGRAPH AT	HPFB	93.	4.05	23.	9.	9.	1.60		
+	3 COMBINED AT	CPE	335.	4.25	116.	46.	46.	8.60		
+	2 COMBINED AT	CPF	576.	5.20	182.	73.	73.	14.70		
+	HYDROGRAPH AT	SC1	769.	6.40	408.	172.	172.	39.40		
+	HYDROGRAPH AT	SC2	84.	4.10	21.	9.	9.	1.50		

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

HEC-1 MODEL OUTPUT

FILENAME: RWMS2.OUT

(2-YEAR MODEL)

```
*****************************************
*                                       *
*   FLOOD HYDROGRAPH PACKAGE  (HEC-1)   *
*            SEPTEMBER 1990             *
*             VERSION 4.0               *
*                                       *
* RUN DATE  01/29/1993  TIME  22:08:57  *
*                                       *
*****************************************
```

```
*****************************************
*                                       *
*    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   ID   FLOOD ASSESSMENT FOR RWMS JOB #:51056        FILE: RWMS2.DAT
 2   ID    2-YEAR 6-HOUR STORM 0.7 INCHES
 3   ID   POINT RAINFALL FROM NOAA ATLAS 2 VOL VII (NO ADJUSTMENT NECESSARY)
 4   ID   DEPTH-AREA REDUCTION FACTORS FROM TABLE 502 IN
 5   ID   CLARK COUNTY HYDROLOGIC CRITERIA AND DRAINAGE DESIGN MANUAL (CCFRCD, 1990)
 6   ID   CURVE NUMBERS DETERMINED USING TABLE 602 IN CCFRCD, 1990
 7   ID   LAG TIMES DETERMINED USING METHOD IN SECTION 606.3 IN CCFRCD, 1990
 8   ID   DRAINAGE AREAS FROM 7.5 MINUTE AND 15 MINUTE QUADS
 9   ID   THIS MODEL ADDRESSES DRAINAGES THAT COULD IMPACT THE RWMS
     *DIAGRAM
10   IT       3       0       0     300
11   IO       5
12   IN       5
13   JD     0.7     .01
     * RAINFALL DISTRIBUTION FROM CLARK COUNTY MANUAL LESS THAN 10 SQ. MILES
14   PC       0       2     5.7     7.0     8.7    10.8    12.4    13.0    13.0    13.0
15   PC    13.0    13.0    13.0    13.3    14.0    14.2    14.8    15.8    17.2    18.1
16   PC    19.0    19.7    19.9    20.0    20.1    20.4    21.4    22.9    24.1    24.9
17   PC    25.1    25.6    27.0    27.8    28.1    28.3    29.5    32.2    35.2    40.9
18   PC    49.9    59.0    71.0    74.4    78.1    81.2    81.9    83.5    85.1    85.6
19   PC    86.0    86.8    87.6    88.8    91.0    92.6    93.7    95.0    97.0    97.6
20   PC    98.2    98.5    98.7    98.9    99.0    99.3    99.3    99.4    99.5    99.8
21   PC    99.8    99.9   100.0
22   JD     .68       1
23   JD     .60    9.99
     * CHANGED RAINFALL DISTRIBUTION ABOVE 10 SQ. MILES PER CLARK COUNTY MANUAL
24   JD     .60   10.01
25   PC       0     2.0     5.9     8.0    11.0    14.4    15.0    16.0    16.8    17.1
26   PC    18.0    18.2    18.7    19.0    19.7    20.2    21.0    22.0    23.0    24.1
27   PC    25.0    25.9    26.5    28.0    29.0    30.0    30.5    30.9    31.0    31.7
28   PC    32.1    32.7    33.3    34.6    36.1    38.1    40.8    43.0    47.7    51.4
29   PC    56.1    63.0    71.0    72.0    73.1    75.2    77.9    79.0    79.5    80.4
30   PC    81.0    82.0    82.6    84.0    85.9    88.9    91.0    93.8    96.6    97.0
31   PC    97.4    97.9    98.1    98.3    98.5    98.9    99.0    99.2    99.3    99.6
32   PC    99.7    99.9   100.0
33   JD     .55      20
34   JD     .52      30
35   JD     .48      50
36   JD     .42     100

37   KK    MM1A
38   KM   Basin runoff calculation for Mass. Mountains 1A
39   BA      .9
40   LS              80
41   UD     .31

42   KK     BW1
43   KM     Basin runoff calculation for Barren Wash 1
44   BA    60.5
45   LS              83
46   UD      2.1
```

```
47      KK    BW2
48      KM    Basin runoff calculation for Barren Wash 2
49      BA   20.8
50      LS            80
51      UD     .9

52      KK   BW1&2
53      KM   Combined BW1 and BW2
54      HC      2

55      KK  BW APX
56      KM   Combine BW1,BW2, and MM1A (assume dischcarge of Barren Wash "active apex")
57      HC      2

58      KK    MM1B
59      KM   Basin runoff calulation for Mass. Mountains 1B
        *   Flow was not combined with BW APX because flow from this watershed
        *   will not directly impact RWMS wereas a channel migration at the apex
        *   could impact the RWMS
60      BA    2.1
61      LS            77
62      UD    .48

63      KK    MM2
64      KM   Basin runoff calculation for Mass. Mountains 2
65      BA    1.4
66      LS            79
67      UD    .47

68      KK   HP1A
69      KM   Basin runoff calculation for Half Pint Range 1A
70      BA     .8
71      LS            85
72      UD    .48

73      KK   RTCPA
74      KM   Route Flow from HP1A to CPA
75      RM     9    .43     .2

76      KK   HP1B
77      KM   Basin runoff calculation for Half Pint Range 1B
78      BA    1.0
79      LS            78
80      UD    .51

81      KK    HP2
82      KM   Basin runoff calculation for Half Pint Range 2
83      BA   1.2
84      LS            78
85      UD    .51

86      KK   CPA1
87      KM   Combine MM2, routed HP1A, HP1B, HP2
88      HC     4

89      KK    HP3
90      KM    (CPB) Basin runoff calculation for Half Pint Range 3
91      BA    1.7
92      LS            82
93      UD    .59

94      KK   CPA2
95      KM   Combine HP3 with flow from CPA1
96      HC     2

97      KK    HP4
98      KM    (CPC) Basin runoff calculation for Half Pint Range 4
99      BA    3.3
100     LS            79
101     UD    .52

102     KK    HP5
103     KM    Basin runoff calculation for Half Pint Range 5
104     BA    1.2
105     LS            79
106     UD     .3

107     KK    HP6
108     KM    Basin runoff calculation for Half Pint Range 6
109     BA    2.2
110     LS            80
111     UD    .55

112     KK   RTCPD
113     KM   Route HP6 to CPD
114     RM     5    .27     .2
```

```
115     KK    HPFA
116     KM     Basin runoff calculation for Half Pint Range FA
117     BA      .3
118     LS              77
119     UD     .33

120     KK     CPD
121     KM     Combine HP5, routed HP6, and HPFA
122     HC       3

123     KK   RTCPE
124     KM     Route flow from CPD to CPE
125     RM       8     .39      .2

126     KK    HPFB
127     KM     Basin runoff calculation for Half Pint Range FB
128     BA     1.6
129     LS              77
130     UD     .44

131     KK     CPE
132     KM    Combine HP4 (CPC) with routed flow from CPD, and HPFB
133     HC       3

134     KK     CPF
135     KM    Combine all flow at Concentration just below RWMS (Flow from CPA & CPE)
136     HC       2

137     KK     SC1
138     KM     Basin runoff calculation for Scarp Canyon 1
        * Concentration Pt of this watershed is the active apex of the Scarp Canyon Fan
139     BA    39.4
140     LS              82
141     UD     2.1

142     KK     SC2
143     KM     Basin runoff calculation for Scarp Canyon 2
144     BA     1.5
145     LS              77
146     UD     .48
147     ZZ
```

SCHEMATIC DIAGRAM OF STREAM NETWORK

(V) ROUTING (---->) DIVERSION OR PUMP FLOW

(.) CONNECTOR (<---) RETURN OF DIVERTED OR PUMPED FLOW

```
INPUT
 LINE
  NO.
 37      MM1A
         :
 42      :        BW1
         :        :
 47      :        :        BW2
         :        :        :
 52      :      BW1&2.......
         :        :
 55    BW APX.....
         :
 58      :      MM1B
         :        :
 63      :        :        MM2
         :        :        :
 68      :        :        :      HP1A
         :        :        :        V
         :        :        :        V
 73      :        :        :      RTCPA
         :        :        :        :
 76      :        :        :        :        HP1B
         :        :        :        :         :
 81      :        :        :        :         :        HP2
         :        :        :        :         :         :
 86      :        :      CPA1.......................................
         :        :        :
 89      :        :        :      HP3
         :        :        :       :
 94      :        :      CPA2.......
         :        :        :
 97      :        :        :      HP4
         :        :        :       :
102      :        :        :       :        HP5
         :        :        :       :         :
107      :        :        :       :         :        HP6
         :        :        :       :         :         V
         :        :        :       :         :         V
112      :        :        :       :         :      RTCPD
         :        :        :       :         :         :
115      :        :        :       :         :         :        HPFA
         :        :        :       :         :         :         :
120      :        :        :       :        CPD.......................
         :        :        :       :         V
         :        :        :       :         V
123      :        :        :       :      RTCPE
         :        :        :       :         :
126      :        :        :       :         :        HPFB
         :        :        :       :         :         :
131      :        :        :      CPE.......................
         :        :        :       :
134      :        :      CPF.......
         :        :        :
137      :        :        :      SC1
         :        :        :       :
142      :        :        :       :        SC2
```

(***) RUNOFF ALSO COMPUTED AT THIS LOCATION

```
*****************************************
*                                       *
*   FLOOD HYDROGRAPH PACKAGE  (HEC-1)   *
*            SEPTEMBER 1990             *
*             VERSION 4.0               *
*                                       *
*  RUN DATE  01/29/1993  TIME  22:08:57 *
*                                       *
*****************************************
```

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

```
                    FLOOD ASSESSMENT FOR RWMS JOB #:51056        FILE: RWMS2.DAT
                     2-YEAR 6-HOUR STORM 0.7 INCHES
                    POINT RAINFALL FROM NOAA ATLAS 2 VOL VII (NO ADJUSTMENT NECESSARY)
                    DEPTH-AREA REDUCTION FACTORS FROM TABLE 502 IN
                    CLARK COUNTY HYDROLOGIC CRITERIA AND DRAINAGE DESIGN MANUAL (CCFRCD, 1990)
                    CURVE NUMBERS DETERMINED USING TABLE 602 IN CCFRCD, 1990
                    LAG TIMES DETERMINED USING METHOD IN SECTION 606.3 IN CCFRCD, 1990
                    DRAINAGE AREAS FROM 7.5 MINUTE AND 15 MINUTE QUADS
                    THIS MODEL ADDRESSES DRAINAGES THAT COULD IMPACT THE RWMS

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

    IT        HYDROGRAPH TIME DATA
                     NMIN          3  MINUTES IN COMPUTATION INTERVAL
                    IDATE     1    0  STARTING DATE
                    ITIME       0000  STARTING TIME
                       NQ        300  NUMBER OF HYDROGRAPH ORDINATES
                   NDDATE     1    0  ENDING DATE
                   NDTIME       1457  ENDING TIME
                    ICENT         19  CENTURY MARK

                COMPUTATION INTERVAL     .05 HOURS
                     TOTAL TIME BASE   14.95 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

 13 JD        INDEX STORM NO. 1
                     STRM         .70  PRECIPITATION DEPTH
                     TRDA         .01  TRANSPOSITION DRAINAGE AREA

 14 PI          PRECIPITATION PATTERN
                   1.20      1.54      2.22      1.26       .78      1.02      1.10      1.26      1.06       .96
                    .36       .24       .00       .00       .00       .00       .00       .00       .00       .00
                    .18       .26       .42       .22       .12       .36       .44       .60       .76       .84
                    .54       .54       .54       .46       .42       .12       .10       .06       .06       .06
                    .18       .32       .60       .80       .90       .72       .64       .48       .24       .12
                    .30       .48       .84       .60       .48       .18       .16       .12       .52       .72
                   1.62      1.68      1.80      2.88      3.42      5.40      5.42      5.46      6.62      7.20
                   2.04      2.10      2.22      1.98      1.86       .42       .60       .96       .96       .96
                    .30       .28       .24       .40       .48       .48       .56       .72      1.12      1.32
                    .96       .86       .66       .74       .78      1.20       .92       .36       .36       .36
                    .18       .16       .12       .12       .12       .06       .10       .18       .06       .00
                    .06       .06       .06       .14       .18       .00       .02       .06       .06       .06

 22 JD        INDEX STORM NO. 2
                     STRM         .68  PRECIPITATION DEPTH
                     TRDA        1.00  TRANSPOSITION DRAINAGE AREA

  0 PI          PRECIPITATION PATTERN
                   1.20      1.54      2.22      1.26       .78      1.02      1.10      1.26      1.06       .96
                    .36       .24       .00       .00       .00       .00       .00       .00       .00       .00
                    .18       .26       .42       .22       .12       .36       .44       .60       .76       .84
                    .54       .54       .54       .46       .42       .12       .10       .06       .06       .06
                    .18       .32       .60       .80       .90       .72       .64       .48       .24       .12
                    .30       .48       .84       .60       .48       .18       .16       .12       .52       .72
                   1.62      1.68      1.80      2.88      3.42      5.40      5.42      5.46      6.62      7.20
                   2.04      2.10      2.22      1.98      1.86       .42       .60       .96       .96       .96
                    .30       .28       .24       .40       .48       .48       .56       .72      1.12      1.32
                    .96       .86       .66       .74       .78      1.20       .92       .36       .36       .36
                    .18       .16       .12       .12       .12       .06       .10       .18       .06       .00
                    .06       .06       .06       .14       .18       .00       .02       .06       .06       .06
```

23 JD INDEX STORM NO. 3

STRM .60 PRECIPITATION DEPTH

TRDA 9.99 TRANSPOSITION DRAINAGE AREA

0 PI PRECIPITATION PATTERN

1.20	1.54	2.22	1.26	.78	1.02	1.10	1.26	1.06	.96
.36	.24	.00	.00	.00	.00	.00	.00	.00	.00
.18	.26	.42	.22	.12	.36	.44	.60	.76	.84
.54	.54	.54	.46	.42	.12	.10	.06	.06	.06
.18	.32	.60	.80	.90	.72	.64	.48	.24	.12
.30	.48	.84	.60	.48	.18	.16	.12	.52	.72
1.62	1.68	1.80	2.88	3.42	5.40	5.42	5.46	6.62	7.20
2.04	2.10	2.22	1.98	1.86	.42	.60	.96	.96	.96
.30	.28	.24	.40	.48	.48	.56	.72	1.12	1.32
.96	.86	.66	.74	.78	1.20	.92	.36	.36	.36
.18	.16	.12	.12	.12	.06	.10	.18	.06	.00
.06	.06	.06	.14	.18	.00	.02	.06	.06	.06

24 JD INDEX STORM NO. 4

STRM .60 PRECIPITATION DEPTH

TRDA 10.01 TRANSPOSITION DRAINAGE AREA

25 PI PRECIPITATION PATTERN

1.20	1.58	2.34	1.62	1.26	1.80	1.88	2.04	.92	.36
.60	.56	.48	.28	.18	.54	.40	.12	.24	.30
.18	.26	.42	.34	.30	.48	.52	.60	.60	.60
.66	.62	.54	.54	.54	.36	.54	.90	.70	.60
.60	.50	.30	.26	.24	.06	.18	.42	.30	.24
.36	.36	.36	.64	.78	.90	1.00	1.20	1.48	1.62
1.32	1.82	2.82	2.42	2.22	2.82	3.26	4.14	4.58	4.80
.60	.62	.66	1.06	1.26	1.62	1.30	.66	.42	.30
.54	.48	.36	.52	.60	.36	.52	.84	1.04	1.14
1.80	1.62	1.26	1.54	1.68	1.68	1.20	.24	.24	.24
.30	.24	.12	.12	.12	.12	.16	.24	.12	.06
.12	.10	.06	.14	.18	.06	.08	.12	.08	.06

33 JD INDEX STORM NO. 5

STRM .55 PRECIPITATION DEPTH

TRDA 20.00 TRANSPOSITION DRAINAGE AREA

0 PI PRECIPITATION PATTERN

1.20	1.58	2.34	1.62	1.26	1.80	1.88	2.04	.92	.36
.60	.56	.48	.28	.18	.54	.40	.12	.24	.30
.18	.26	.42	.34	.30	.48	.52	.60	.60	.60
.66	.62	.54	.54	.54	.36	.54	.90	.70	.60
.60	.50	.30	.26	.24	.06	.18	.42	.30	.24
.36	.36	.36	.64	.78	.90	1.00	1.20	1.48	1.62
1.32	1.82	2.82	2.42	2.22	2.82	3.26	4.14	4.58	4.80
.60	.62	.66	1.06	1.26	1.62	1.30	.66	.42	.30
.54	.48	.36	.52	.60	.36	.52	.84	1.04	1.14
1.80	1.62	1.26	1.54	1.68	1.68	1.20	.24	.24	.24
.30	.24	.12	.12	.12	.12	.16	.24	.12	.06
.12	.10	.06	.14	.18	.06	.08	.12	.08	.06

34 JD INDEX STORM NO. 6

STRM .52 PRECIPITATION DEPTH

TRDA 30.00 TRANSPOSITION DRAINAGE AREA

0 PI PRECIPITATION PATTERN

1.20	1.58	2.34	1.62	1.26	1.80	1.88	2.04	.92	.36
.60	.56	.48	.28	.18	.54	.40	.12	.24	.30
.18	.26	.42	.34	.30	.48	.52	.60	.60	.60
.66	.62	.54	.54	.54	.36	.54	.90	.70	.60
.60	.50	.30	.26	.24	.06	.18	.42	.30	.24
.36	.36	.36	.64	.78	.90	1.00	1.20	1.48	1.62
1.32	1.82	2.82	2.42	2.22	2.82	3.26	4.14	4.58	4.80
.60	.62	.66	1.06	1.26	1.62	1.30	.66	.42	.30
.54	.48	.36	.52	.60	.36	.52	.84	1.04	1.14
1.80	1.62	1.26	1.54	1.68	1.68	1.20	.24	.24	.24
.30	.24	.12	.12	.12	.12	.16	.24	.12	.06
.12	.10	.06	.14	.18	.06	.08	.12	.08	.06

35 JD INDEX STORM NO. 7

STRM .48 PRECIPITATION DEPTH

TRDA 50.00 TRANSPOSITION DRAINAGE AREA

0 PI PRECIPITATION PATTERN

1.20	1.58	2.34	1.62	1.26	1.80	1.88	2.04	.92	.36
.60	.56	.48	.28	.18	.54	.40	.12	.24	.30
.18	.26	.42	.34	.30	.48	.52	.60	.60	.60
.66	.62	.54	.54	.54	.36	.54	.90	.70	.60
.60	.50	.30	.26	.24	.06	.18	.42	.30	.24
.36	.36	.36	.64	.78	.90	1.00	1.20	1.48	1.62
1.32	1.82	2.82	2.42	2.22	2.82	3.26	4.14	4.58	4.80
.60	.62	.66	1.06	1.26	1.62	1.30	.66	.42	.30
.54	.48	.36	.52	.60	.36	.52	.84	1.04	1.14
1.80	1.62	1.26	1.54	1.68	1.68	1.20	.24	.24	.24
.30	.24	.12	.12	.12	.12	.16	.24	.12	.06
.12	.10	.06	.14	.18	.06	.08	.12	.08	.06

36 JD INDEX STORM NO. 8

STRM .42 PRECIPITATION DEPTH

TRDA 100.00 TRANSPOSITION DRAINAGE AREA

0 PI PRECIPITATION PATTERN

1.20	1.58	2.34	1.62	1.26	1.80	1.88	2.04	.92	.36
.60	.56	.48	.28	.18	.54	.40	.12	.24	.30
.18	.26	.42	.34	.30	.48	.52	.60	.60	.60
.66	.62	.54	.54	.54	.36	.54	.90	.70	.60
.60	.50	.30	.26	.24	.06	.18	.42	.30	.24
.36	.36	.36	.64	.78	.90	1.00	1.20	1.48	1.62
1.32	1.82	2.82	2.42	2.22	2.82	3.26	4.14	4.58	4.80
.60	.62	.66	1.06	1.26	1.62	1.30	.66	.42	.30
.54	.48	.36	.52	.60	.36	.52	.84	1.04	1.14
1.80	1.62	1.26	1.54	1.68	1.68	1.20	.24	.24	.24
.30	.24	.12	.12	.12	.12	.16	.24	.12	.06
.12	.10	.06	.14	.18	.06	.08	.12	.08	.06

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	MM1A	6.	5.00	1.	0.	0.	.90		
+	HYDROGRAPH AT	BW1	22.	7.10	11.	4.	4.	60.50		
+	HYDROGRAPH AT	BW2	7.	6.00	2.	1.	1.	20.80		
+	2 COMBINED AT	BW1&2	22.	7.10	11.	4.	4.	81.30		
+	2 COMBINED AT	BW APX	9.	7.10	4.	2.	2.	82.20		
+	HYDROGRAPH AT	MM1B	2.	5.30	0.	0.	0.	2.10		
+	HYDROGRAPH AT	MM2	5.	5.15	1.	0.	0.	1.40		
+	HYDROGRAPH AT	HP1A	16.	4.15	4.	2.	2.	.80		
+	ROUTED TO	RTCPA	15.	4.55	4.	2.	2.	.80		
+	HYDROGRAPH AT	HP1B	3.	5.25	0.	0.	0.	1.00		
+	HYDROGRAPH AT	HP2	3.	5.25	1.	0.	0.	1.20		
+	4 COMBINED AT	CPA1	15.	5.40	4.	2.	2.	4.40		
+	HYDROGRAPH AT	HP3	14.	5.20	4.	2.	2.	1.70		
+	2 COMBINED AT	CPA2	23.	5.30	6.	3.	3.	6.10		
+	HYDROGRAPH AT	HP4	8.	5.25	2.	1.	1.	3.30		
+	HYDROGRAPH AT	HP5	6.	5.00	1.	0.	0.	1.20		
+	HYDROGRAPH AT	HP6	10.	5.25	2.	1.	1.	2.20		
+	ROUTED TO	RTCPD	10.	5.50	2.	1.	1.	2.20		
+	HYDROGRAPH AT	HPFA	1.	5.10	0.	0.	0.	.30		
+	3 COMBINED AT	CPD	10.	5.40	2.	1.	1.	3.70		
+	ROUTED TO	RTCPE	9.	5.75	2.	1.	1.	3.70		
+	HYDROGRAPH AT	HPFB	2.	5.25	0.	0.	0.	1.60		
+	3 COMBINED AT	CPE	9.	5.55	2.	1.	1.	8.60		
+	2 COMBINED AT	CPF	25.	5.50	6.	3.	3.	14.70		
+	HYDROGRAPH AT	SC1	15.	7.10	7.	3.	3.	39.40		
+	HYDROGRAPH AT	SC2	2.	5.30	0.	0.	0.	1.50		

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

4.2.2 Shallow Concentrated Flooding

Results of the HEC-2 analysis for the watercourses draining subbasins MM2 and HP1A&B estimated the 100-year flow depths at 2 feet. The southwest corner of the site is also located within the 100-year flood hazard of this drainage, and is designated as Zone AO; depth 2 feet (*Figure 11* and *Sheet 3*). Again, this portion of the RWMS is not used for disposal of waste and is not included in the RCRA Part B Permit Application for the Area 5 RWMS. Appendix C contains the output of the HEC-2 model, the workmap, and cross sections used to analyze this drainage.

4.2.3 Sheetflow

FEMA (1991) usually describes areas that experience sheetflow as Zone X (an area of flooding with depths less than 1 foot). Calculations to determine the average 100-year depths for sheetflow areas support this assertion. Calculated depths within the proposed RWMS boundary and the proposed HWSU were all less than 1 foot. These facilities are not in a 100-year flood hazard from flow draining from the Massachusetts Mountains/Halfpint Range. Appendix D contains the calculations used to estimate the depth of flow in sheetflow regions.

Several measures were taken to assure that this flood assessment would be as conservative as reasonable. Discharges were calculated using a "state-of-the-art" approach for this region (i.e., CCRFCD Manual). All flow barriers such as roads, structures and existing nonengineered dikes were ignored to assume that all flow could reach the RWMS. The entire area was assumed to be prone to flooding and was delineated as an area of equal risk because of the inability to distinguish channels from the available topographic maps.

A Zone X designation is somewhat misleading. Although FEMA requires flood protection only for areas listed as Zone AO, a flood hazard must still be recognized within a Zone X. The sheetflow region to the north of the RWMS contains channels which range in depth up to 3 feet. FEMA (1991) states that discharge in sheetflow regions must be spread equally over the entire surface area. To the north of the RWMS, this results in average flow depths of less than 1 foot, and thus the designation of Zone X. Field observations of channels within this region indicate that flows greater than 1 foot could occur in these channels during a 100-year flood. Any type of flood protection design criteria must address the potential of channelized flow for this area.

5.0 REFERENCES

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Clark County Regional Flood Control District, 1990. *Hydrologic Criteria and Drainage Design Manual*; Las Vegas, Nevada.

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APPENDIX B

FEMA FAN MODEL OUTPUT

BARREN WASH ALLUVIAL FAN
SCARP CANYON ALLUVIAL FAN
HALFPINT ALLUVIAL FAN
NOTE: Model Set 3 was used to delineate the flood hazard zones of these fans. See Section 3.4, *Hydrology Discussion.*

FEMA FAN MODEL OUTPUT

BARREN WASH ALLUVIAL FAN

(Model Sets 1, 2, 3 & 4)

Barren Wash Alluvial Fan: Model Set 1

AVULSION FACTOR = 1.5000

FLOOD FREQUENCY CURVE DEFINED BY LEAST-SQUARES FIT OF DATA

RETURN INTERVAL (YEARS)	INPUT DISCHARGE (CFS)	BEST FIT DISCHARGE (CFS)
2	22	22
10	510	511
100	1848	1845

MEAN = 1.042752
STANDARD DEVIATION = 1.533850
SKEW = -1.2

SUMMARY OF DISCHARGES:

10-YEAR DISCHARGE = 511
50-YEAR DISCHARGE = 1440
100-YEAR DISCHARGE = 1845
500-YEAR DISCHARGE = 2633

STATISTICS AFTER TRANSFORMATION OF Y=LOG(Q) TO Z=1.6502+0.5415 LOG(Q)

MEAN OF Z = 2.214841
STANDARD DEVIATION = 0.830596
SKEW = -1.200000
TRANSFORMATION CONSTANT = 4.989660

SINGLE-CHANNEL REGION

ENERGY (FT)	DEPTH (FT)	DISCHARGE (CFS)	PROBABILITY OF DISCHARGE BEING EXCEEDED AT THE APEX BY: Q	44.6869 Q 0.5415	WIDTH (FT)
0.5	0.3	49	0.39939	0.77515	5458
1.5	1.0	756	0.06472	0.22080	1555

VELOCITY (FT/SEC)	DEPTH (FT)	DISCHARGE (CFS)	PROBABILITY OF DISCHARGE BEING EXCEEDED AT THE APEX BY: Q	44.6869 Q 0.5415	WIDTH (FT)
3.5	0.4	68	0.35475	0.72986	5139
4.5	0.6	238	0.18938	0.50031	3523
5.5	0.9	649	0.07853	0.25818	1818
6.5	1.3	1496	0.01847	0.07781	548

MULTIPLE-CHANNEL REGION

SLOPE = 0.0120000
N-VALUE = 0.0300000

ENERGY (FT)	DEPTH (FT)	DISCHARGE (CFS)	PROBABILITY OF DISCHARGE BEING EXCEEDED AT THE APEX BY: Q	44.6869 Q 0.5415	WIDTH (FT)
0.5	0.4	429	0.12044	0.35977	9627

VELOCITY (FT/SEC)	DEPTH (FT)	DISCHARGE (CFS)	PROBABILITY OF DISCHARGE BEING EXCEEDED AT THE APEX BY: Q	44.6869 Q 0.5415	WIDTH (FT)
3.5	0.5	1046	0.03859	0.14838	3970

Barren Wash Alluvial Fan: Model Set 2

AVULSION FACTOR = 1.5000

FLOOD FREQUENCY CURVE DEFINED BY LEAST-SQUARES FIT OF DATA

RETURN INTERVAL (YEARS)	INPUT DISCHARGE (CFS)	BEST FIT DISCHARGE (CFS)
2	22	22
10	510	508
100	3513	3523

MEAN = 1.220155
STANDARD DEVIATION = 1.237478
SKEW = -0.6

SUMMARY OF DISCHARGES:

10-YEAR DISCHARGE = 508
50-YEAR DISCHARGE = 2234
100-YEAR DISCHARGE = 3523
500-YEAR DISCHARGE = 8018

STATISTICS AFTER TRANSFORMATION OF Y=LOG(Q) TO Z=1.3608+0.7454 LOG(Q)

MEAN OF Z = 2.270321
STANDARD DEVIATION = 0.922428
SKEW = -0.600000
TRANSFORMATION CONSTANT = 5.221557

SINGLE-CHANNEL REGION

ENERGY (FT)	DEPTH (FT)	DISCHARGE (CFS)	PROBABILITY OF DISCHARGE BEING EXCEEDED AT THE APEX BY: Q	22.9512 Q 0.7454	WIDTH (FT)
0.5	0.3	49	0.38603	0.75342	5552
1.5	1.0	756	0.07282	0.27335	2014
2.5	1.7	2712	0.01575	0.08826	650

VELOCITY (FT/SEC)	DEPTH (FT)	DISCHARGE (CFS)	PROBABILITY OF DISCHARGE BEING EXCEEDED AT THE APEX BY: Q	22.9512 Q 0.7454	WIDTH (FT)
3.5	0.4	68	0.33839	0.70932	5227
4.5	0.6	238	0.17753	0.49364	3637
5.5	0.9	649	0.08326	0.30011	2211
6.5	1.3	1496	0.03427	0.16404	1209
7.5	1.7	3059	0.01310	0.07724	566

MULTIPLE-CHANNEL REGION

SLOPE = 0.0120000
N-VALUE = 0.0300000

ENERGY (FT)	DEPTH (FT)	DISCHARGE (CFS)	PROBABILITY OF DISCHARGE BEING EXCEEDED AT THE APEX BY: Q	22.9512 Q 0.7454	WIDTH (FT)
0.5	0.4	429	0.11715	0.37930	10621

VELOCITY (FT/SEC)	DEPTH (FT)	DISCHARGE (CFS)	PROBABILITY OF DISCHARGE BEING EXCEEDED AT THE APEX BY: Q	22.9512 Q 0.7454	WIDTH (FT)
3.5	0.5	1046	0.05069	0.21668	6067
4.5	0.8	2981	0.01367	0.07961	2218

Barren Wash Alluvial Fan: Model Set 3

AVULSION FACTOR = 1.5000

FLOOD FREQUENCY CURVE DEFINED BY LEAST-SQUARES FIT OF DATA

RETURN INTERVAL (YEARS)	INPUT DISCHARGE (CFS)	BEST FIT DISCHARGE (CFS)
2	22	22
10	510	511
100	6018	6011

MEAN = 1.323916
STANDARD DEVIATION = 1.089877
SKEW = -0.1

SUMMARY OF DISCHARGES:

10-YEAR DISCHARGE = 511
50-YEAR DISCHARGE = 3187
100-YEAR DISCHARGE = 6011
500-YEAR DISCHARGE = 21319

STATISTICS AFTER TRANSFORMATION OF Y=LOG(Q) TO Z=1.1038+0.9523 LOG(Q)

MEAN OF Z = 2.364550
STANDARD DEVIATION = 1.037845
SKEW = -0.100000
TRANSFORMATION CONSTANT = 5.498632

SINGLE-CHANNEL REGION

ENERGY (FT)	DEPTH (FT)	DISCHARGE (CFS)	PROBABILITY OF DISCHARGE BEING EXCEEDED AT THE APEX BY: Q	12.7010 Q	0.9523	WIDTH (FT)
0.5	0.3	49	0.37636	0.74376		5771
1.5	1.0	756	0.07741	0.31531		2447
2.5	1.7	2712	0.02368	0.15673		1203

VELOCITY (FT/SEC)	DEPTH (FT)	DISCHARGE (CFS)	PROBABILITY OF DISCHARGE BEING EXCEEDED AT THE APEX BY: Q	12.7010 Q	0.9523	WIDTH (FT)
3.5	0.4	68	0.32668	0.70074		5438
4.5	0.6	238	0.17183	0.50209		3896
5.5	0.9	649	0.08625	0.33928		2633
6.5	1.3	1496	0.04176	0.22110		1712
7.5	1.7	3059	0.02093	0.14484		1104
8.5	2.2	5719	0.01078	0.08963		639

MULTIPLE-CHANNEL REGION

SLOPE = 0.0120000
N-VALUE = 0.0300000

ENERGY (FT)	DEPTH (FT)	DISCHARGE (CFS)	PROBABILITY OF DISCHARGE BEING EXCEEDED AT THE APEX BY: Q	0.9523 12.7010 Q	WIDTH (FT)
0.5	0.4	429	0.11639	0.40412	11916

VELOCITY (FT/SEC)	DEPTH (FT)	DISCHARGE (CFS)	PROBABILITY OF DISCHARGE BEING EXCEEDED AT THE APEX BY: Q	0.9523 12.7010 Q	WIDTH (FT)
3.5	0.5	1046	0.05870	0.26939	7936
4.5	0.8	2981	0.02152	0.14740	4278

Barren Wash Alluvial Fan: Model Set 4

AVULSION FACTOR = 1.5000

FLOOD FREQUENCY CURVE DEFINED BY LEAST-SQUARES FIT OF DATA

RETURN INTERVAL (YEARS)	INPUT DISCHARGE (CFS)	BEST FIT DISCHARGE (CFS)
2	22	22
10	1083	1100
100	5498	5436

MEAN = 0.967763
STANDARD DEVIATION = 1.909410
SKEW = -1.2

SUMMARY OF DISCHARGES:

10-YEAR DISCHARGE = 1100
50-YEAR DISCHARGE = 3994
100-YEAR DISCHARGE = 5436
500-YEAR DISCHARGE = 8466

STATISTICS AFTER TRANSFORMATION OF Y=LOG(Q) TO Z=2.1296+0.4869 LOG(Q)

MEAN OF Z = 2.600766
STANDARD DEVIATION = 0.929608
SKEW = -1.200000
TRANSFORMATION CONSTANT = 6.163823

SINGLE-CHANNEL REGION

ENERGY (FT)	DEPTH (FT)	DISCHARGE (CFS)	PROBABILITY OF DISCHARGE BEING EXCEEDED AT THE APEX BY: Q	134.7735 Q 0.4869	WIDTH (FT)
0.5	0.3	49	0.41930	0.84140	7319
1.5	1.0	756	0.13521	0.45395	3949
2.5	1.7	2712	0.03806	0.17863	1554

VELOCITY (FT/SEC)	DEPTH (FT)	DISCHARGE (CFS)	PROBABILITY OF DISCHARGE BEING EXCEEDED AT THE APEX BY: Q	134.7735 Q 0.4869	WIDTH (FT)
3.5	0.4	68	0.38395	0.81578	7096
4.5	0.6	238	0.24947	0.66394	5775
5.5	0.9	649	0.14958	0.48573	4225
6.5	1.3	1496	0.07778	0.30563	2659
7.5	1.7	3059	0.03212	0.15540	1352

MULTIPLE-CHANNEL REGION

SLOPE = 0.0120000
N-VALUE = 0.0300000

ENERGY (FT)	DEPTH (FT)	DISCHARGE (CFS)	PROBABILITY OF DISCHARGE BEING EXCEEDED AT THE APEX BY: Q	134.7735 Q 0.4869	WIDTH (FT)
0.5	0.4	429	0.18835	0.56624	18717

VELOCITY (FT/SEC)	DEPTH (FT)	DISCHARGE (CFS)	PROBABILITY OF DISCHARGE BEING EXCEEDED AT THE APEX BY: Q	134.7735 Q 0.4869	WIDTH (FT)
3.5	0.5	1046	0.10475	0.38461	12713
4.5	0.8	2981	0.03340	0.16040	5302

FEMA FAN MODEL OUTPUT

SCARP CANYON ALLUVIAL FAN

(Model Sets 1, 2, 3 & 4)

Scarp Canyon Alluvial Fan: Model Set 1

AVULSION FACTOR = 1.5000

FLOOD FREQUENCY CURVE DEFINED BY LEAST-SQUARES FIT OF DATA

RETURN INTERVAL (YEARS)	INPUT DISCHARGE (CFS)	BEST FIT DISCHARGE (CFS)
2	15	15
10	356	351
100	1251	1265

MEAN = 0.878659
STANDARD DEVIATION = 1.533991
SKEW = -1.2

SUMMARY OF DISCHARGES:

10-YEAR DISCHARGE = 351
50-YEAR DISCHARGE = 987
100-YEAR DISCHARGE = 1265
500-YEAR DISCHARGE = 1805

STATISTICS AFTER TRANSFORMATION OF Y=LOG(Q) TO Z=1.5751+0.5415 LOG(Q)

MEAN OF Z = 2.050915
STANDARD DEVIATION = 0.830638
SKEW = -1.200000
TRANSFORMATION CONSTANT = 4.290921

SINGLE-CHANNEL REGION

ENERGY (FT)	DEPTH (FT)	DISCHARGE (CFS)	PROBABILITY OF DISCHARGE BEING EXCEEDED AT THE APEX BY: Q	37.5951 Q 0.5415	WIDTH (FT)
0.5	0.3	49	0.34883	0.72387	4383
1.5	1.0	756	0.03535	0.13698	829

VELOCITY (FT/SEC)	DEPTH (FT)	DISCHARGE (CFS)	PROBABILITY OF DISCHARGE BEING EXCEEDED AT THE APEX BY: Q	37.5951 Q 0.5415	WIDTH (FT)
3.5	0.4	68	0.30420	0.67202	4069
4.5	0.6	238	0.14528	0.41207	2495
5.5	0.9	649	0.04559	0.17003	1030

MULTIPLE-CHANNEL REGION

SLOPE = 0.0148000
N-VALUE = 0.0300000

ENERGY (FT)	DEPTH (FT)	DISCHARGE (CFS)	PROBABILITY OF DISCHARGE BEING EXCEEDED AT THE APEX BY: Q	37.5951 Q 0.5415	WIDTH (FT)
0.5	0.4	443	0.07886	0.25909	5962

VELOCITY (FT/SEC)	DEPTH (FT)	DISCHARGE (CFS)	PROBABILITY OF DISCHARGE BEING EXCEEDED AT THE APEX BY: Q	37.5951 Q 0.5415	WIDTH (FT)
3.5	0.4	805	0.03152	0.12353	2842

Scarp Canyon Alluvial Fan: Model Set 2

AVULSION FACTOR = 1.5000

FLOOD FREQUENCY CURVE DEFINED BY LEAST-SQUARES FIT OF DATA

RETURN INTERVAL (YEARS)	INPUT DISCHARGE (CFS)	BEST FIT DISCHARGE (CFS)
2	15	15
10	356	351
100	2178	2198

MEAN = 1.030262
STANDARD DEVIATION = 1.279943
SKEW = -0.7

SUMMARY OF DISCHARGES:

10-YEAR DISCHARGE = 351
50-YEAR DISCHARGE = 1443
100-YEAR DISCHARGE = 2198
500-YEAR DISCHARGE = 4604

STATISTICS AFTER TRANSFORMATION OF Y=LOG(Q) TO Z=1.3680+0.7081 LOG(Q)

MEAN OF Z = 2.097573
STANDARD DEVIATION = 0.906384
SKEW = -0.700000
TRANSFORMATION CONSTANT = 4.459600

SINGLE-CHANNEL REGION

ENERGY (FT)	DEPTH (FT)	DISCHARGE (CFS)	PROBABILITY OF DISCHARGE BEING EXCEEDED AT THE APEX BY: Q	23.3345 Q 0.7081	WIDTH (FT)
0.5	0.3	49	0.33492	0.70714	4450
1.5	1.0	756	0.04683	0.19857	1250

VELOCITY (FT/SEC)	DEPTH (FT)	DISCHARGE (CFS)	PROBABILITY OF DISCHARGE BEING EXCEEDED AT THE APEX BY: Q	23.3345 Q 0.7081	WIDTH (FT)
3.5	0.4	68	0.28883	0.65373	4114
4.5	0.6	238	0.14038	0.42021	2645
5.5	0.9	649	0.05653	0.22635	1425
6.5	1.3	1496	0.01914	0.09895	623

MULTIPLE-CHANNEL REGION

SLOPE = 0.0148000
N-VALUE = 0.0300000

ENERGY (FT)	DEPTH (FT)	DISCHARGE (CFS)	PROBABILITY OF DISCHARGE BEING EXCEEDED AT THE APEX BY: Q	23.3345 Q 0.7081	WIDTH (FT)
0.5	0.4	443	0.08348	0.29635	7087

VELOCITY (FT/SEC)	DEPTH (FT)	DISCHARGE (CFS)	PROBABILITY OF DISCHARGE BEING EXCEEDED AT THE APEX BY: Q	23.3345 Q 0.7081	WIDTH (FT)
3.5	0.4	805	0.04358	0.18942	4530

Scarp Canyon Alluvial Fan: Model Set 3

AVULSION FACTOR = 1.5000

FLOOD FREQUENCY CURVE DEFINED BY LEAST-SQUARES FIT OF DATA

RETURN INTERVAL (YEARS)	INPUT DISCHARGE (CFS)	BEST FIT DISCHARGE (CFS)
2	15	15
10	356	357
100	3498	3491

MEAN = 1.117872
STANDARD DEVIATION = 1.152607
SKEW = -0.3

SUMMARY OF DISCHARGES:

10-YEAR DISCHARGE = 357
50-YEAR DISCHARGE = 1976
100-YEAR DISCHARGE = 3491
500-YEAR DISCHARGE = 10458

STATISTICS AFTER TRANSFORMATION OF Y=LOG(Q) TO Z=1.2079+0.8628 LOG(Q)

MEAN OF Z = 2.172367
STANDARD DEVIATION = 0.994433
SKEW = -0.300000
TRANSFORMATION CONSTANT = 4.652288

SINGLE-CHANNEL REGION

ENERGY (FT)	DEPTH (FT)	DISCHARGE (CFS)	PROBABILITY OF DISCHARGE BEING EXCEEDED AT THE APEX BY: Q	16.1400 Q 0.8628	WIDTH (FT)
0.5	0.3	49	0.32531	0.70098	4602
1.5	1.0	756	0.05446	0.24845	1631
2.5	1.7	2712	0.01444	0.09633	625

VELOCITY (FT/SEC)	DEPTH (FT)	DISCHARGE (CFS)	PROBABILITY OF DISCHARGE BEING EXCEEDED AT THE APEX BY: Q	16.1400 Q 0.8628	WIDTH (FT)
3.5	0.4	68	0.27964	0.64926	4263
4.5	0.6	238	0.13909	0.43758	2873
5.5	0.9	649	0.06377	0.27117	1780
6.5	1.3	1496	0.02760	0.16044	1051
7.5	1.7	3059	0.01232	0.08785	565

MULTIPLE-CHANNEL REGION

SLOPE = 0.0148000
N-VALUE = 0.0300000

ENERGY (FT)	DEPTH (FT)	DISCHARGE (CFS)	PROBABILITY OF DISCHARGE BEING EXCEEDED AT THE APEX BY: Q	16.1400 Q	0.8628	WIDTH (FT)
0.5	0.4	443	0.08692	0.33143		8269

VELOCITY (FT/SEC)	DEPTH (FT)	DISCHARGE (CFS)	PROBABILITY OF DISCHARGE BEING EXCEEDED AT THE APEX BY: Q	16.1400 Q	0.8628	WIDTH (FT)
3.5	0.4	805	0.05067	0.23920		5968
4.5	0.6	2293	0.01738	0.11285		2774

Scarp Canyon Alluvial Fan: Model Set 4

AVULSION FACTOR = 1.5000

FLOOD FREQUENCY CURVE DEFINED BY LEAST-SQUARES FIT OF DATA

RETURN INTERVAL (YEARS)	INPUT DISCHARGE (CFS)	BEST FIT DISCHARGE (CFS)
2	15	15
10	769	779
100	3438	3406

MEAN = 0.751408
STANDARD DEVIATION = 2.011177
SKEW = -1.3

SUMMARY OF DISCHARGES:

10-YEAR DISCHARGE = 779
50-YEAR DISCHARGE = 2597
100-YEAR DISCHARGE = 3406
500-YEAR DISCHARGE = 4925

STATISTICS AFTER TRANSFORMATION OF Y=LOG(Q) TO Z=2.0997+0.4540 LOG(Q)

MEAN OF Z = 2.440823
STANDARD DEVIATION = 0.913058
SKEW = -1.300000
TRANSFORMATION CONSTANT = 5.305945

SINGLE-CHANNEL REGION

ENERGY (FT)	DEPTH (FT)	DISCHARGE (CFS)	PROBABILITY OF DISCHARGE BEING EXCEEDED AT THE APEX BY: Q	125.8027 Q 0.4540	WIDTH (FT)
0.5	0.3	49	0.38263	0.81739	6120
1.5	1.0	756	0.10286	0.37538	2811
2.5	1.7	2712	0.01841	0.09197	689

VELOCITY (FT/SEC)	DEPTH (FT)	DISCHARGE (CFS)	PROBABILITY OF DISCHARGE BEING EXCEEDED AT THE APEX BY: Q	125.8027 Q 0.4540	WIDTH (FT)
3.5	0.4	68	0.34751	0.78692	5892
4.5	0.6	238	0.21491	0.61188	4582
5.5	0.9	649	0.11751	0.41056	3074
6.5	1.3	1496	0.05029	0.21689	1624
7.5	1.7	3059	0.01396	0.07173	537

MULTIPLE-CHANNEL REGION

SLOPE = 0.0148000
N-VALUE = 0.0300000

ENERGY (FT)	DEPTH (FT)	DISCHARGE (CFS)	PROBABILITY OF DISCHARGE BEING EXCEEDED AT THE APEX BY: Q	125.8027 Q 0.4540	WIDTH (FT)
0.5	0.4	443	0.15397	0.49326	14035

VELOCITY (FT/SEC)	DEPTH (FT)	DISCHARGE (CFS)	PROBABILITY OF DISCHARGE BEING EXCEEDED AT THE APEX BY: Q	125.8027 Q 0.4540	WIDTH (FT)
3.5	0.4	805	0.09752	0.36091	10269
4.5	0.6	2293	0.02578	0.12522	3563

FEMA FAN MODEL OUTPUT

HALFPINT ALLUVIAL FAN

(Model Sets 1, 2, 3 & 4)

Halfpint Alluvial Fan: Model Set 1

AVULSION FACTOR = 1.5000

FLOOD FREQUENCY CURVE DEFINED BY LEAST-SQUARES FIT OF DATA

RETURN INTERVAL (YEARS)	INPUT DISCHARGE (CFS)	BEST FIT DISCHARGE (CFS)
2	10	10
10	168	170
100	603	598

MEAN = 0.759609
STANDARD DEVIATION = 1.328618
SKEW = -1.1

SUMMARY OF DISCHARGES:

10-YEAR DISCHARGE = 170
50-YEAR DISCHARGE = 464
100-YEAR DISCHARGE = 598
500-YEAR DISCHARGE = 876

STATISTICS AFTER TRANSFORMATION OF Y=LOG(Q) TO Z=1.2765+0.5980 LOG(Q)

MEAN OF Z = 1.730742
STANDARD DEVIATION = 0.794495
SKEW = -1.100000
TRANSFORMATION CONSTANT = 3.392134

SINGLE-CHANNEL REGION

ENERGY (FT)	DEPTH (FT)	DISCHARGE (CFS)	PROBABILITY OF DISCHARGE BEING EXCEEDED AT THE APEX BY: Q	18.9020 Q	0.5980	WIDTH (FT)
0.5	0.3	49	0.26742	0.59475		2847

VELOCITY (FT/SEC)	DEPTH (FT)	DISCHARGE (CFS)	PROBABILITY OF DISCHARGE BEING EXCEEDED AT THE APEX BY: Q	18.9020 Q	0.5980	WIDTH (FT)
3.5	0.4	68	0.21876	0.52204		2499
4.5	0.6	238	0.06832	0.21587		1033

MULTIPLE-CHANNEL REGION

SLOPE = 0.0196000
N-VALUE = 0.0300000

ENERGY (FT)	DEPTH (FT)	DISCHARGE (CFS)	PROBABILITY OF DISCHARGE BEING EXCEEDED AT THE APEX BY: Q	18.9020 Q 0.5980	WIDTH (FT)
0.5	0.3	449	0.02168	0.08480	1543

VELOCITY (FT/SEC)	DEPTH (FT)	DISCHARGE (CFS)	PROBABILITY OF DISCHARGE BEING EXCEEDED AT THE APEX BY: Q	18.9020 Q 0.5980	WIDTH (FT)
3.5	0.4	566	0.01212	0.04847	882

Halfpint Alluvial Fan: Model Set 2

AVULSION FACTOR = 1.5000

FLOOD FREQUENCY CURVE DEFINED BY LEAST-SQUARES FIT OF DATA

RETURN INTERVAL (YEARS)	INPUT DISCHARGE (CFS)	BEST FIT DISCHARGE (CFS)
2	10	10
10	168	169
100	1180	1176

MEAN = 0.928731
STANDARD DEVIATION = 1.055311
SKEW = -0.4

SUMMARY OF DISCHARGES:

10-YEAR DISCHARGE = 169
50-YEAR DISCHARGE = 731
100-YEAR DISCHARGE = 1176
500-YEAR DISCHARGE = 2890

STATISTICS AFTER TRANSFORMATION OF Y=LOG(Q) TO Z=1.0090+0.8374 LOG(Q)

MEAN OF Z = 1.786716
STANDARD DEVIATION = 0.883714
SKEW = -0.400000
TRANSFORMATION CONSTANT = 3.569505

SINGLE-CHANNEL REGION

ENERGY (FT)	DEPTH (FT)	DISCHARGE (CFS)	PROBABILITY OF DISCHARGE BEING EXCEEDED AT THE APEX BY: Q	10.2094 Q 0.8374	WIDTH (FT)
0.5	0.3	49	0.24808	0.57142	2878
1.5	1.0	756	0.01928	0.09924	500

VELOCITY (FT/SEC)	DEPTH (FT)	DISCHARGE (CFS)	PROBABILITY OF DISCHARGE BEING EXCEEDED AT THE APEX BY: Q	10.2094 Q 0.8374	WIDTH (FT)
3.5	0.4	68	0.20017	0.50667	2552
4.5	0.6	238	0.07596	0.26560	1338
5.5	0.9	649	0.02353	0.11884	599

MULTIPLE-CHANNEL REGION

SLOPE = 0.0196000
N-VALUE = 0.0300000

ENERGY (FT)	DEPTH (FT)	DISCHARGE (CFS)	PROBABILITY OF DISCHARGE BEING EXCEEDED AT THE APEX BY: Q	10.2094 Q 0.8374	WIDTH (FT)
0.5	0.3	449	0.03741	0.16695	3196

VELOCITY (FT/SEC)	DEPTH (FT)	DISCHARGE (CFS)	PROBABILITY OF DISCHARGE BEING EXCEEDED AT THE APEX BY: Q	10.2094 Q 0.8374	WIDTH (FT)
3.5	0.4	566	0.02835	0.13656	2614

Halfpint Alluvial Fan: Model Set 3

AVULSION FACTOR = 1.5000

FLOOD FREQUENCY CURVE DEFINED BY LEAST-SQUARES FIT OF DATA

RETURN INTERVAL (YEARS)	INPUT DISCHARGE (CFS)	BEST FIT DISCHARGE (CFS)
2	10	10
10	168	168
100	1819	1821

MEAN = 1.016033
STANDARD DEVIATION = 0.935309
SKEW = 0.1

SUMMARY OF DISCHARGES:

10-YEAR DISCHARGE = 168
50-YEAR DISCHARGE = 970
100-YEAR DISCHARGE = 1821
500-YEAR DISCHARGE = 6634

STATISTICS AFTER TRANSFORMATION OF Y=LOG(Q) TO Z=0.7953+1.0450 LOG(Q)

MEAN OF Z = 1.857036
STANDARD DEVIATION = 0.977359
SKEW = 0.100000
TRANSFORMATION CONSTANT = 3.728261

SINGLE-CHANNEL REGION

ENERGY (FT)	DEPTH (FT)	DISCHARGE (CFS)	PROBABILITY OF DISCHARGE BEING EXCEEDED AT THE APEX BY: Q	6.2420 Q	WIDTH (FT)
				1.0450	
0.5	0.3	49	0.23709	0.56316	2963
1.5	1.0	756	0.02605	0.15414	802

VELOCITY (FT/SEC)	DEPTH (FT)	DISCHARGE (CFS)	PROBABILITY OF DISCHARGE BEING EXCEEDED AT THE APEX BY: Q	6.2420 Q	WIDTH (FT)
				1.0450	
3.5	0.4	68	0.19242	0.50416	2653
4.5	0.6	238	0.07866	0.29407	1546
5.5	0.9	649	0.03085	0.16909	883
6.5	1.3	1496	0.01313	0.09258	462

MULTIPLE-CHANNEL REGION

SLOPE = 0.0196000
N-VALUE = 0.0300000

ENERGY (FT)	DEPTH (FT)	DISCHARGE (CFS)	PROBABILITY OF DISCHARGE BEING EXCEEDED AT THE APEX BY: Q	6.2420 Q 1.0450	WIDTH (FT)
0.5	0.3	449	0.04315	0.20703	4126

VELOCITY (FT/SEC)	DEPTH (FT)	DISCHARGE (CFS)	PROBABILITY OF DISCHARGE BEING EXCEEDED AT THE APEX BY: Q	6.2420 Q 1.0450	WIDTH (FT)
3.5	0.4	566	0.03509	0.18232	3625
4.5	0.5	1614	0.01192	0.08813	1651

Halfpint Alluvial Fan: Model Set 4

AVULSION FACTOR = 1.5000

FLOOD FREQUENCY CURVE DEFINED BY LEAST-SQUARES FIT OF DATA

RETURN INTERVAL (YEARS)	INPUT DISCHARGE (CFS)	BEST FIT DISCHARGE (CFS)
2	10	10
10	335	343
100	1898	1867

MEAN = 0.734788
STANDARD DEVIATION = 1.596884
SKEW = -1.0

SUMMARY OF DISCHARGES:

10-YEAR DISCHARGE = 343
50-YEAR DISCHARGE = 1310
100-YEAR DISCHARGE = 1867
500-YEAR DISCHARGE = 3269

STATISTICS AFTER TRANSFORMATION OF Y=LOG(Q) TO Z=1.6637+0.5765 LOG(Q)

MEAN OF Z = 2.087308
STANDARD DEVIATION = 0.920624
SKEW = -1.000000
TRANSFORMATION CONSTANT = 4.101043

SINGLE-CHANNEL REGION

ENERGY (FT)	DEPTH (FT)	DISCHARGE (CFS)	PROBABILITY OF DISCHARGE BEING EXCEEDED AT THE APEX BY: Q	46.0992 Q 0.5765	WIDTH (FT)
0.5	0.3	49	0.31010	0.71462	4136
1.5	1.0	756	0.04476	0.19714	1141

VELOCITY (FT/SEC)	DEPTH (FT)	DISCHARGE (CFS)	PROBABILITY OF DISCHARGE BEING EXCEEDED AT THE APEX BY: Q	46.0992 Q 0.5765	WIDTH (FT)
3.5	0.4	68	0.27085	0.66516	3850
4.5	0.6	238	0.13611	0.43540	2520
5.5	0.9	649	0.05423	0.22757	1317
6.5	1.3	1496	0.01626	0.08582	497

MULTIPLE-CHANNEL REGION

SLOPE = 0.0196000
N-VALUE = 0.0300000

ENERGY (FT)	DEPTH (FT)	DISCHARGE (CFS)	PROBABILITY OF DISCHARGE BEING EXCEEDED AT THE APEX BY: Q	46.0992 Q 0.5765	WIDTH (FT)
0.5	0.3	449	0.08068	0.30203	6642

VELOCITY (FT/SEC)	DEPTH (FT)	DISCHARGE (CFS)	PROBABILITY OF DISCHARGE BEING EXCEEDED AT THE APEX BY: Q	46.0992 Q 0.5765	WIDTH (FT)
3.5	0.4	566	0.06397	0.25496	5607
4.5	0.5	1614	0.01411	0.07631	1678

APPENDIX C

HEC-2 MODEL OUTPUT

INCLUDES:

HEC-2 MODEL OUTPUT

WORKMAP

CROSS SECTIONS

```
*****************************************
*  HEC-2 WATER SURFACE PROFILES         *
*                                       *
*  Version   4.6.2;  May 1991           *
*                                       *
*  RUN DATE    29JAN93    TIME   15:20:50 *
*****************************************
```

```
*************************************
*  U.S. ARMY CORPS OF ENGINEERS     *
*  HYDROLOGIC ENGINEERING CENTER    *
*  609 SECOND STREET, SUITE D       *
*  DAVIS, CALIFORNIA 95616-4687     *
*          (916) 756-1104           *
*************************************
```

```
X     X  XXXXXXX   XXXXX              XXXXX
X     X  X        X     X            X     X
X     X  X        X                        X
XXXXXXX  XXXX     X          XXXXX    XXXXX
X     X  X        X                  X
X     X  X        X     X            X
X     X  XXXXXXX   XXXXX             XXXXXXX
```

```
T1  HEC-2 RUN TO DETERMINE 100-YEAR FLOOD HAZARD LIMITS AND DEPTHS
T2  SOUTHWEST CORNER OF RWMS ASSUMING NO BERM
T3  FLOW CONDITION OF "NATURAL CONDITIONS" FILE: SWCRWMS.DAT
    SUBCRITICAL FLOW
    CROSS SECTIONS DEVELOPED FROM 1"=400', 5' C.I. TOPOGRAPHIC MAP OF THE RWMS.
    THE 100-YEAR DISCHARGE AT CROSS SECTION 1 FROM HEC-1 MODEL RWMSW.OUT (CPF)
    IS 2396 CFS.  THE REMAINING CROSS SECTIONS (2-7) USED THE 100-YEAR DISCHARGE
    OF 1230 CFS FROM HEC-1 MODEL RWMSW.OUT (CPA1).

J1  ICHECK    INQ      NINV     IDIR     STRT     METRIC   HVINS    Q        WSEL     FQ

      0        2        0        0       -1        0        0        0      3166       0

J2  NPROF     IPLOT    PRFVS    XSECV    XSECH    FN       ALLDC    IBW      CHNIM    ITRACE

      1        0       -1        0        0       -1        0        0        0        0

NC    0.040    0.040    .035     .1       .3       0        0        0
QT       1     2396
X1     1.0        6       0      670        0       0        0
GR    3175        0    3165      300     3167     340     3165      360     3170      390
GR    3175      670

QT       1     1229
X1     2.0       19     445      661     1240    1240     1240
GR    3180        0  3177.5      420   3177.5     445     3177      446   3176.5      460
GR    3176      461    3176      470   3175.5     471   3175.5      490     3176      491
GR    3176      555    3175      556     3175     590   3176.5      591   3176.5      610
GR    3176      611    3176      660     3178     661     3180      930

X1     3.0        9     765      821      560     560      560
GR    3185        0    3181      740     3181     765     3180      766     3180      775
GR    3181      776    3181      820     3182     821     3185     1100

X1     4.0        3       0     1060      800     800      800
GR    3190        0    3185      660     3190    1060

X1     5.0        3       0     1440     1840    1840     1840
GR    3215        0    3210      770     3215    1440

X1     6.0        3       0     1130      820     820      820
GR    3220        0    3215      440     3220    1130

X1       7        3       0     1150      780     780      780
GR    3230        0    3225      590     3230    1150
```

```
    SECNO      DEPTH      CWSEL      CRIWS      WSELK      EG         HV         HL         OLOSS      L-BANK ELEV
    Q          QLOB       QCH        QROB       ALOB       ACH        AROB       VOL        TWA        R-BANK ELEV
    TIME       VLOB       VCH        VROB       XNL        XNCH       XNR        WTN        ELMIN      SSTA
    SLOPE      XLOBL      XLCH       XLOBR      ITRIAL     IDC        ICONT      CORAR      TOPWID     ENDST

 *PROF 1
0

 CCHV=     .100 CEHV=     .300
 *SECNO 1.000
 3720 CRITICAL DEPTH ASSUMED
     1.000      3.18   3168.18   3168.18   3166.00   3169.09       .91       .00       .00   3175.00
    2396.0        .0    2396.0       .0        .0     312.8        .0        .0        .0   3175.00
       .00       .00      7.66       .00      .000      .035      .000      .000   3165.00    204.61
   .015002        0.        0.        0.         0        22         0       .00    174.47    379.08

 *SECNO 2.000

 3301 HV CHANGED MORE THAN HVINS

     2.000      2.68   3177.68       .00       .00   3177.84       .16      8.67       .08   3177.50
    1229.0       3.6    1225.4        .0       7.0     383.9        .0      10.0       6.3   3178.00
       .11       .52      3.19       .00      .040      .035      .000      .000   3175.00    390.55
   .002669     1240.     1240.     1240.         6         0         0       .00    270.29    660.84

 *SECNO 3.000
 3685 20 TRIALS ATTEMPTED WSEL,CWSEL
 3693 PROBABLE MINIMUM SPECIFIC ENERGY
 3720 CRITICAL DEPTH ASSUMED
     3.000      2.30   3182.30   3182.30       .00   3182.70       .40      2.92       .07   3181.00
    1229.0     691.4     532.6       5.1     187.7      82.1       4.1      14.3      10.3   3182.00
       .14      3.68      6.49      1.25      .040      .035      .040      .000   3180.00    500.26
   .014448      560.      560.      560.        20        12         0       .00    348.26    848.52

 *SECNO 4.000

 3302 WARNING:  CONVEYANCE CHANGE OUTSIDE OF ACCEPTABLE RANGE,  KRATIO =  2.19

     4.000      2.17   3187.17       .00       .00   3187.26       .09      4.54       .03   3190.00
    1229.0        .0    1229.0        .0        .0     499.9        .0      21.4      17.7   3190.00
       .23       .00      2.46       .00      .000      .035      .000      .000   3185.00    373.34
   .003005      800.      800.      800.         5         0         0       .00    460.39    833.73

 *SECNO 5.000
 3685 20 TRIALS ATTEMPTED WSEL,CWSEL
 3693 PROBABLE MINIMUM SPECIFIC ENERGY
 3720 CRITICAL DEPTH ASSUMED
     5.000      1.34   3211.34   3211.34       .00   3211.69       .35     11.64       .08   3215.00
    1229.0        .0    1229.0        .0        .0     260.3        .0      37.4      35.6   3215.00
       .34       .00      4.72       .00      .000      .035      .000      .000   3210.00    562.95
   .021001     1840.     1840.     1840.        20        14         0       .00    387.21    950.16

 *SECNO 6.000

 3302 WARNING:  CONVEYANCE CHANGE OUTSIDE OF ACCEPTABLE RANGE,  KRATIO =  2.55

     6.000      2.09   3217.09       .00       .00   3217.18       .10      5.47       .03   3220.00
    1229.0        .0    1229.0        .0        .0     494.3        .0      44.6      43.7   3220.00
       .43       .00      2.49       .00      .000      .035      .000      .000   3215.00    255.94
   .003231      820.      820.      820.         8         0         0       .00    472.69    728.63

 *SECNO 7.000
 3685 20 TRIALS ATTEMPTED WSEL,CWSEL
 3693 PROBABLE MINIMUM SPECIFIC ENERGY
 3720 CRITICAL DEPTH ASSUMED
     7.000      1.47   3226.47   3226.47       .00   3226.85       .38      5.16       .09   3230.00
    1229.0        .0    1229.0        .0        .0     248.4        .0      51.2      51.0   3230.00
       .47       .00      4.95       .00      .000      .035      .000      .000   3225.00    416.57
   .020478      780.      780.      780.        20        19         0       .00    338.04    754.61

 NOTE- ASTERISK (*) AT LEFT OF CROSS-SECTION NUMBER INDICATES MESSAGE IN SUMMARY OF ERRORS LIST
```

CONDITION OF "NATURAL C

SUMMARY PRINTOUT TABLE 150

	SECNO	XLCH	ELTRD	ELLC	ELMIN	Q	CWSEL	CRIWS	EG	10*KS	VCH	AREA	.01K
*	1.000	.00	.00	.00	3165.00	2396.00	3168.18	3168.18	3169.09	150.02	7.66	312.77	195.62
	2.000	1240.00	.00	.00	3175.00	1229.00	3177.68	.00	3177.84	26.69	3.19	390.85	237.88
*	3.000	560.00	.00	.00	3180.00	1229.00	3182.30	3182.30	3182.70	144.48	6.49	273.88	102.25
*	4.000	800.00	.00	.00	3185.00	1229.00	3187.17	.00	3187.26	30.05	2.46	499.89	224.21
*	5.000	1840.00	.00	.00	3210.00	1229.00	3211.34	3211.34	3211.69	210.01	4.72	260.30	84.81
*	6.000	820.00	.00	.00	3215.00	1229.00	3217.09	.00	3217.18	32.31	2.49	494.33	216.23
*	7.000	780.00	.00	.00	3225.00	1229.00	3226.47	3226.47	3226.85	204.78	4.95	248.41	85.88
*	1.000	2396.00	3168.18	.00	.00	2.18	174.47	.00					
	2.000	1229.00	3177.68	.00	9.50	.00	270.29	1240.00					
*	3.000	1229.00	3182.30	.00	4.62	.00	348.26	560.00					
*	4.000	1229.00	3187.17	.00	4.87	.00	460.39	800.00					
*	5.000	1229.00	3211.34	.00	24.17	.00	387.21	1840.00					
*	6.000	1229.00	3217.09	.00	5.74	.00	472.69	820.00					
*	7.000	1229.00	3226.47	.00	9.38	.00	338.04	780.00					

SUMMARY OF ERRORS AND SPECIAL NOTES

```
CAUTION SECNO=      1.000  PROFILE=  1  CRITICAL DEPTH ASSUMED

CAUTION SECNO=      3.000  PROFILE=  1  CRITICAL DEPTH ASSUMED
CAUTION SECNO=      3.000  PROFILE=  1  PROBABLE MINIMUM SPECIFIC ENERGY
CAUTION SECNO=      3.000  PROFILE=  1  20 TRIALS ATTEMPTED TO BALANCE WSEL

WARNING SECNO=      4.000  PROFILE=  1  CONVEYANCE CHANGE OUTSIDE ACCEPTABLE RANGE

CAUTION SECNO=      5.000  PROFILE=  1  CRITICAL DEPTH ASSUMED
CAUTION SECNO=      5.000  PROFILE=  1  PROBABLE MINIMUM SPECIFIC ENERGY
CAUTION SECNO=      5.000  PROFILE=  1  20 TRIALS ATTEMPTED TO BALANCE WSEL

WARNING SECNO=      6.000  PROFILE=  1  CONVEYANCE CHANGE OUTSIDE ACCEPTABLE RANGE

CAUTION SECNO=      7.000  PROFILE=  1  CRITICAL DEPTH ASSUMED
CAUTION SECNO=      7.000  PROFILE=  1  PROBABLE MINIMUM SPECIFIC ENERGY
CAUTION SECNO=      7.000  PROFILE=  1  20 TRIALS ATTEMPTED TO BALANCE WSEL
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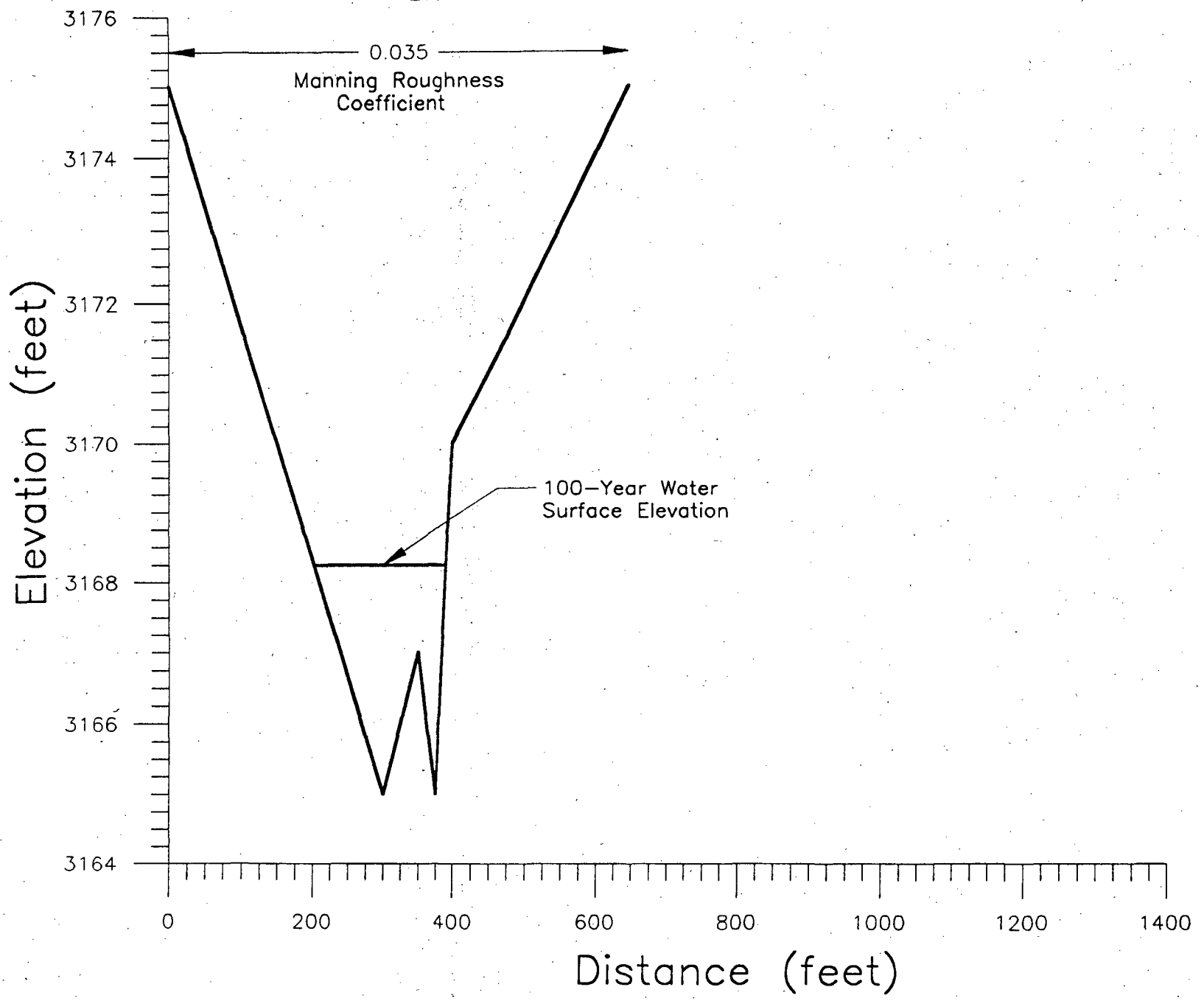
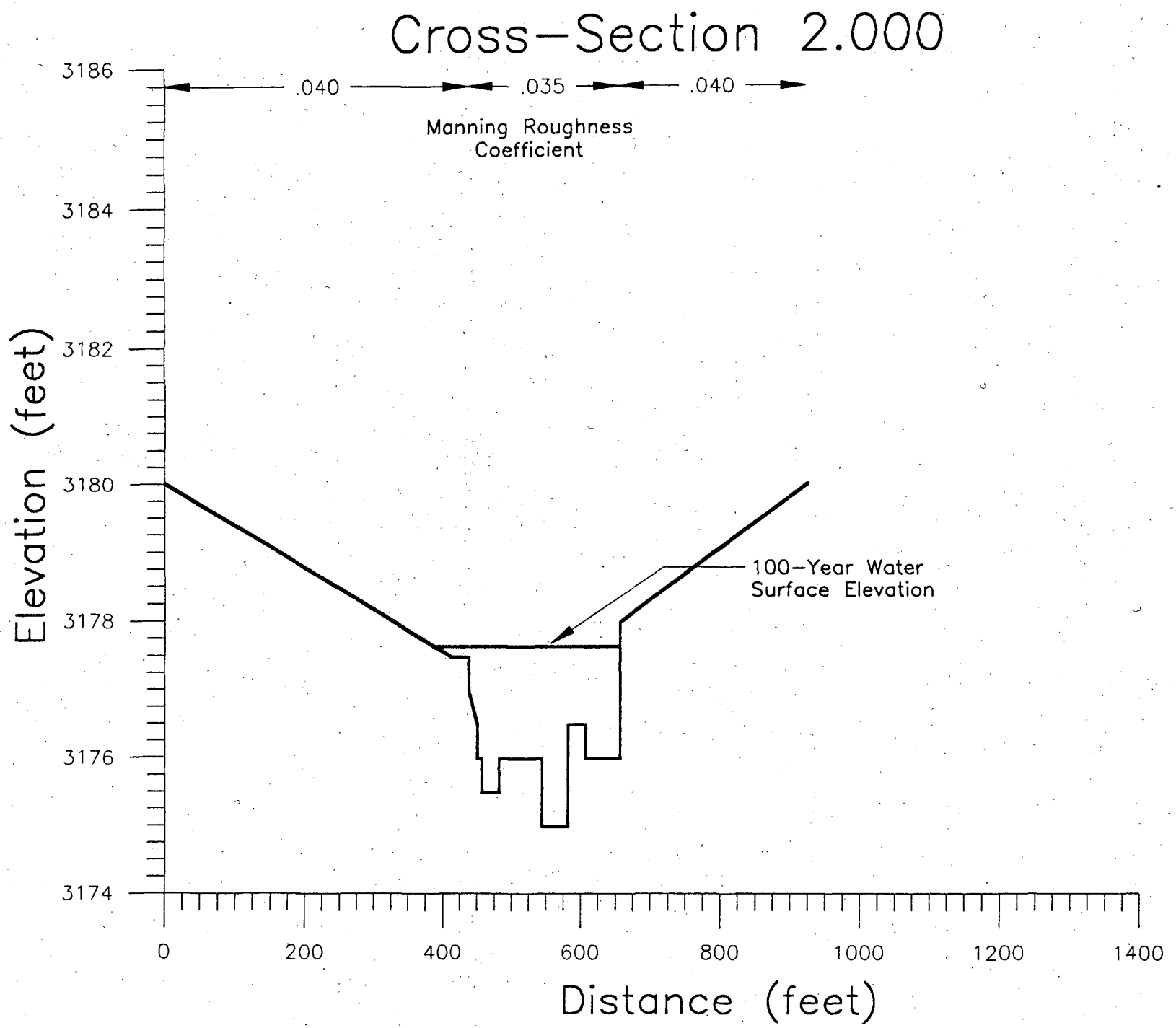
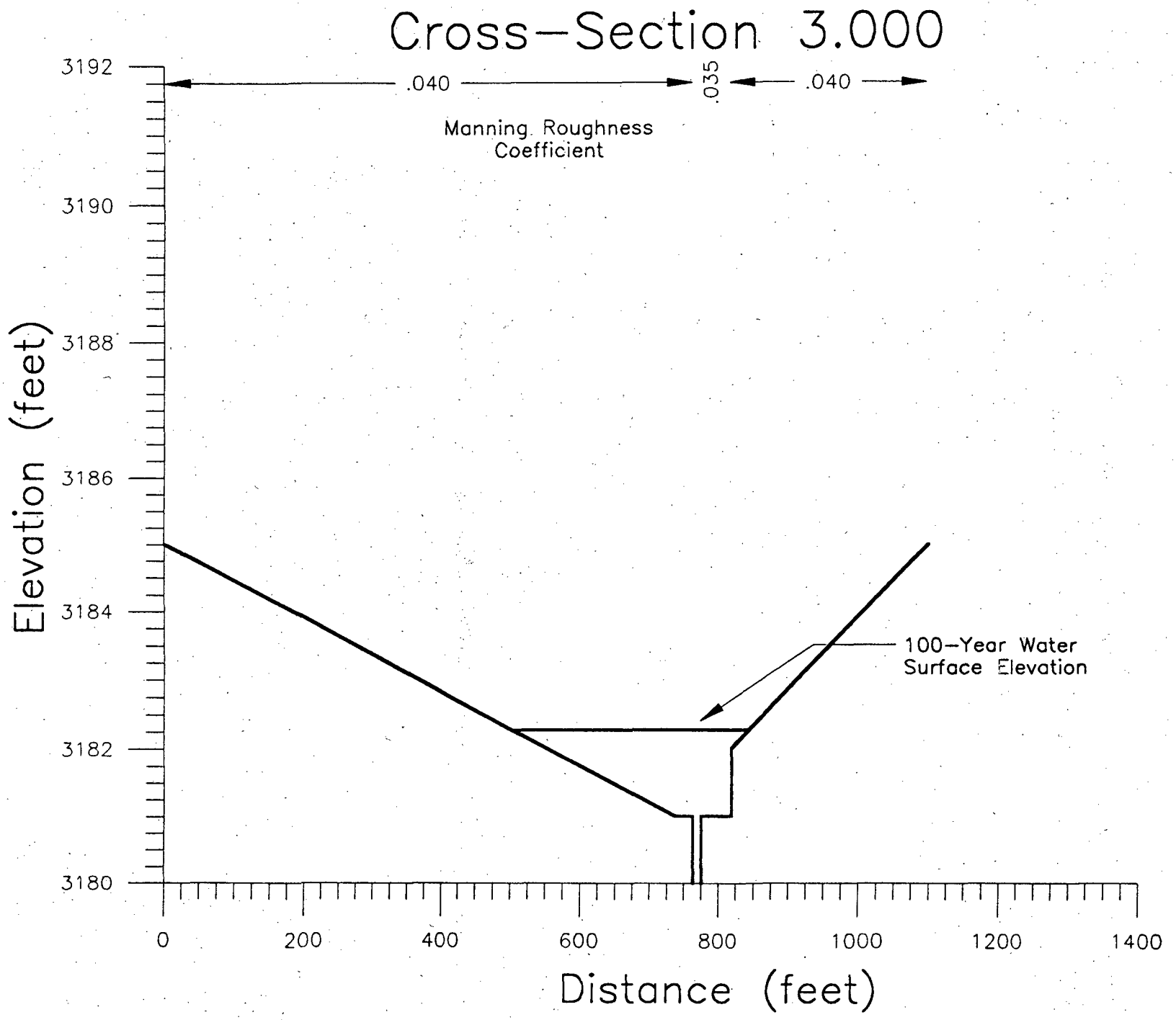
HEC-2 MODEL OUTPUT

CROSS SECTIONS

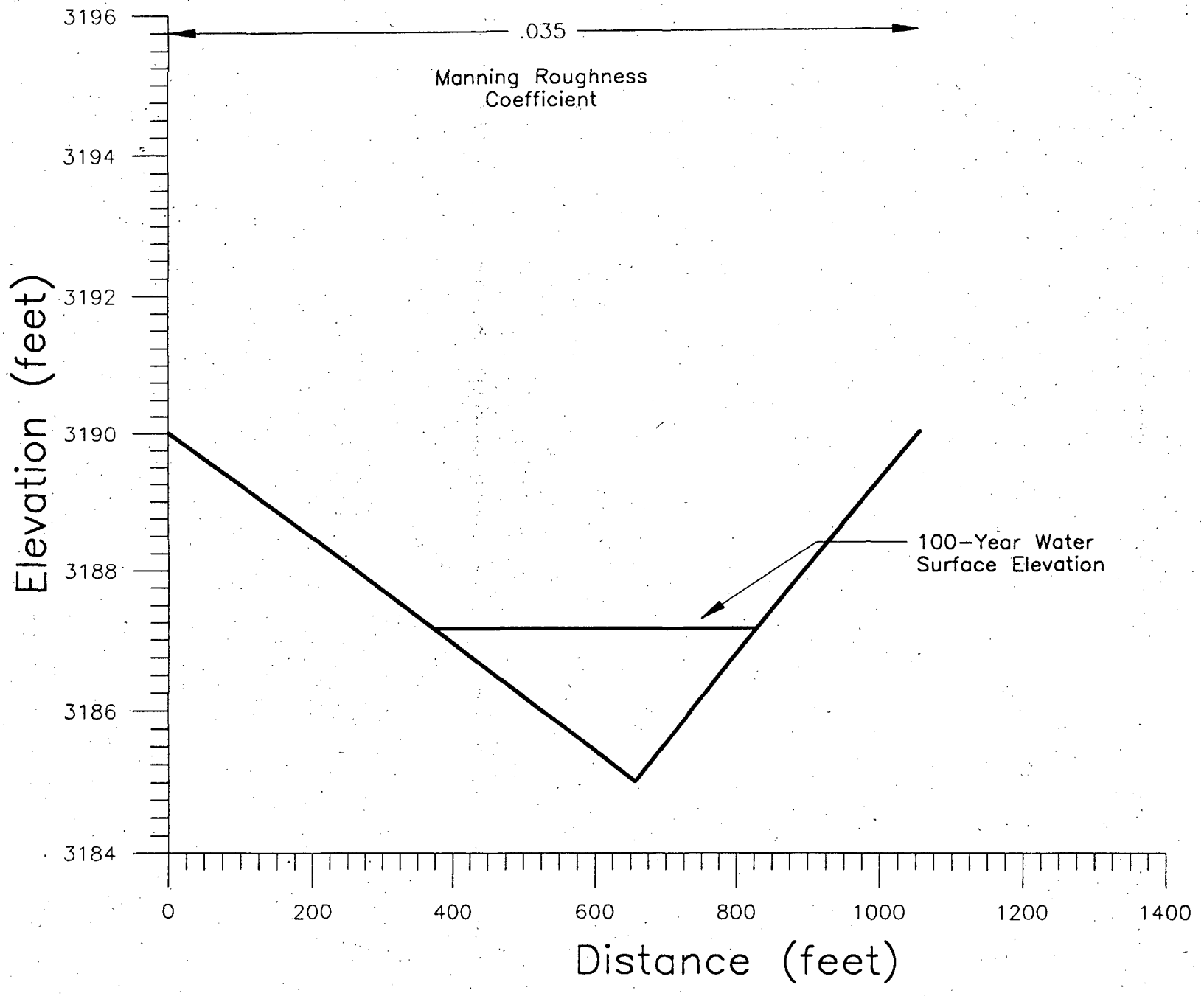
Cross-Section 1.000



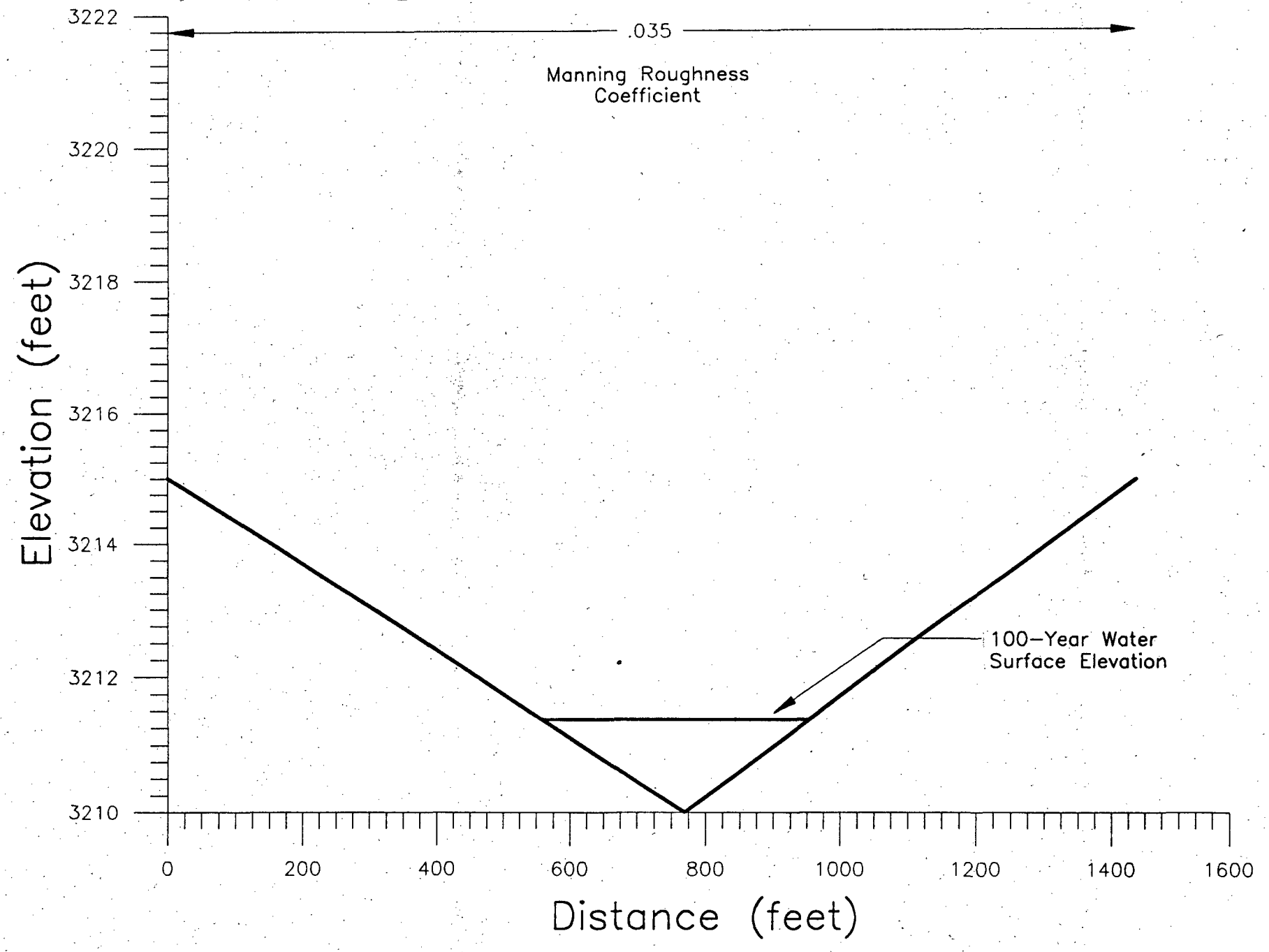

Cross-Section 2.000
.040
.035
.040
Manning Roughness Coefficient
100-Year Water Surface Elevation
Elevation (feet)
3186
3184
3182
3180
3178
3176
3174
0
200
400
600
800
1000
1200
1400
Distance (feet)


Cross-Section 3.000
.040
.035
.040
Manning Roughness Coefficient
100-Year Water Surface Elevation
Elevation (feet)
3192
3190
3188
3186
3184
3182
3180
0
200
400
600
800
1000
1200
1400
Distance (feet)

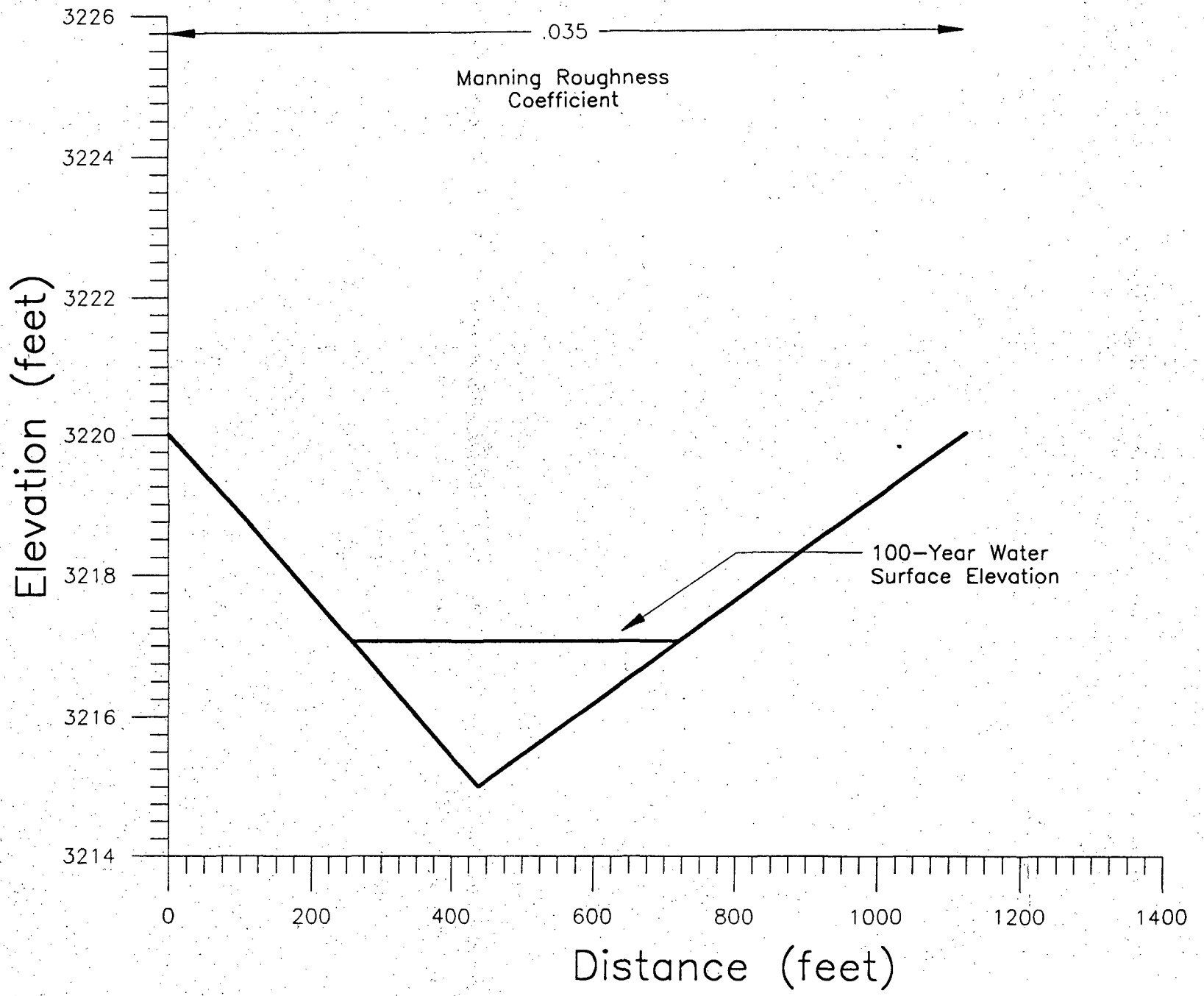
Cross-Section 4.000

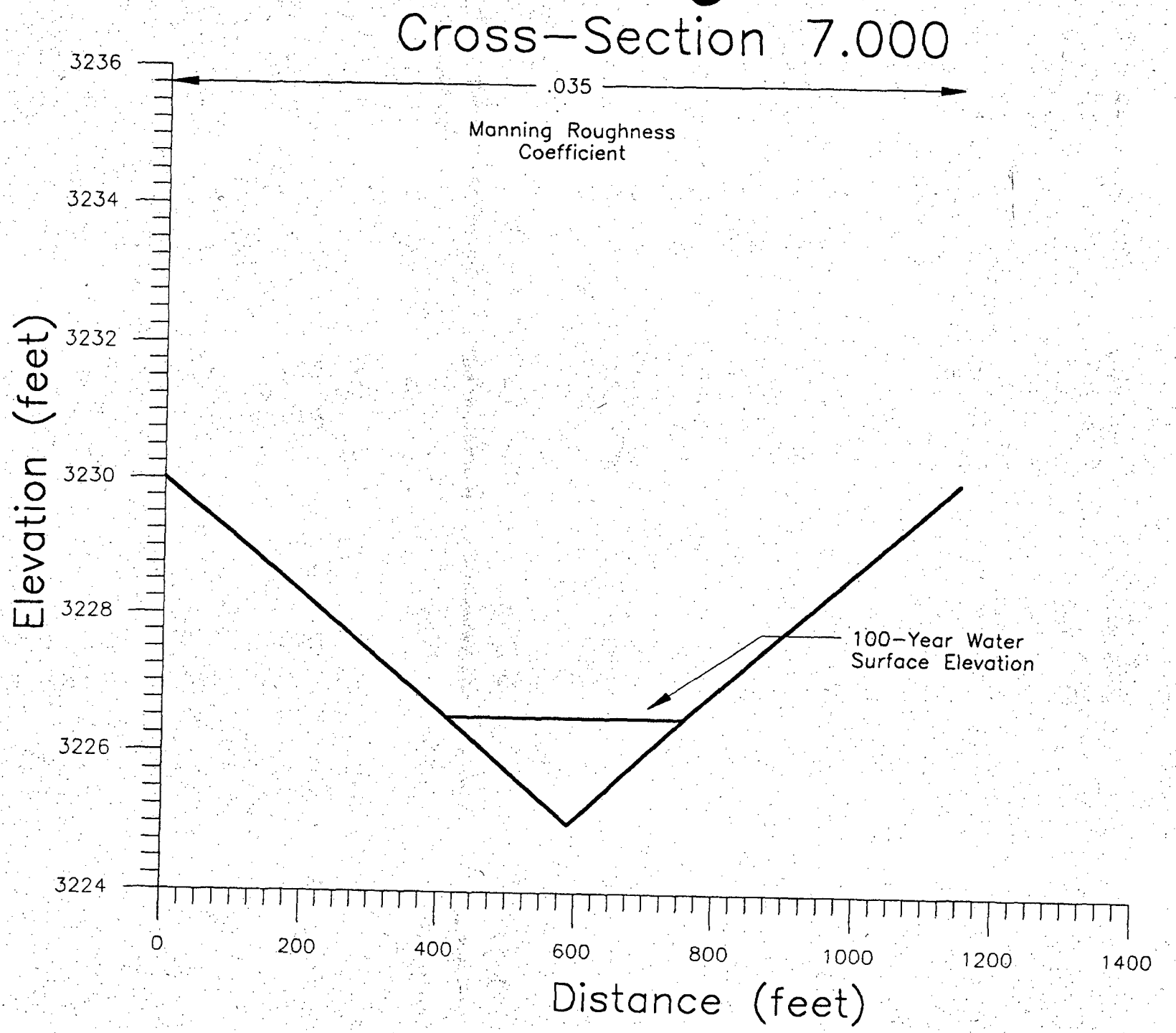


Cross-Section 5.000



Cross-Section 6.000




Cross-Section 7.000
.035
Manning Roughness Coefficient
3236
3234
3232
3230
3228
3226
3224
Elevation (feet)
100-Year Water Surface Elevation
0
200
400
600
800
1000
1200
1400
Distance (feet)

APPENDIX D

SHEETFLOW CALCULATIONS

SHEETFLOW CALCULATIONS ALONG THE NORTH, EAST AND WEST BOUNDARIES OF THE AREA 5 RWMS.

SHEETFLOW CALCULATIONS FOR THE NORTH SIDE OF THE AREA 5 RWMS

CHANGE IN ELEVATION (ft)	REACH LENGTH (ft)	MANNING COEFFICIENT	SLOPE (ft/ft)	WIDTH (ft)	DISCHARGE (ft^3/sec)
90	3500	0.035	0.026	2500	624

Q=DISCHARGE (ft^3/sec)
V=VELOCITY (ft/sec)
A=AREA (ft^2) (For a rectangular channel, area = depth * width)
R=HYDRAULIC RADIUS (ft) (For a shallow channel, assume R=depth)
S=SLOPE (ft/ft)
n=MANNING COEFFICIENT
W=WIDTH (ft)
d=DEPTH (ft)

EQUATIONS:

$$Q=VA$$

$$V=\frac{1.49}{n}R^{2/3}S^{1/2}$$

$$Q=\frac{1.49}{n}R^{2/3}S^{1/2}A$$

CALCULATIONS:

$$Q=\frac{1.49}{n}d^{2/3}S^{1/2}dW$$

$$Q=\frac{1.49}{n}d^{5/3}S^{1/2}W$$

$$d=\frac{Qn}{(1.49S^{1/2}W)^{3/5}}$$

DEPTH CALCULATION:

FLOW DEPTH = 0.11 ft

SHEETFLOW CALCULATIONS FOR THE EAST SIDE OF THE AREA 5 RWMS

CHANGE IN ELEVATION (ft)	REACH LENGTH (ft)	MANNING COEFFICIENT	SLOPE (ft/ft)	WIDTH (ft)	DISCHARGE (ft^3/sec)
75	4250	0.035	0.018	2460	1100

Q=DISCHARGE (ft^3/sec)
V=VELOCITY (ft/sec)
A=AREA (ft^2) (For a rectangular channel, area = depth * width)
R=HYDRAULIC RADIUS (ft) (For a shallow channel, assume R=depth)
S=SLOPE (ft/ft)
n=MANNING COEFFICIENT
W=WIDTH (ft)
d=DEPTH (ft)

EQUATIONS:

$$Q=VA$$

$$V=\frac{1.49}{n}R^{2/3}S^{1/2}$$

$$Q=\frac{1.49}{n}R^{2/3}S^{1/2}A$$

CALCULATIONS:

$$Q=\frac{1.49}{n}d^{2/3}S^{1/2}dW$$

$$Q=\frac{1.49}{n}d^{5/3}S^{1/2}W$$

$$d=\frac{Qn}{(1.49S^{1/2}W)^{3/5}}$$

DEPTH CALCULATION:

FLOW DEPTH = 0.22 ft

SHEETFLOW CALCULATIONS FOR THE WEST SIDE OF THE AREA 5 RWMS

CHANGE IN ELEVATION (ft)	REACH LENGTH (ft)	MANNING COEFFICIENT	SLOPE (ft/ft)	WIDTH (ft)	DISCHARGE (ft^3/sec)
100	3500	0.035	0.029	2780	450

Q=DISCHARGE (ft^3/sec)
V=VELOCITY (ft/sec)
A=AREA (ft^2) (For a rectangular channel, area = depth * width)
R=HYDRAULIC RADIUS (ft) (For a shallow channel, assume R=depth)
S=SLOPE (ft/ft)
n=MANNING COEFFICIENT
W=WIDTH (ft)
d=DEPTH (ft)

EQUATIONS:

$$Q=VA$$

$$V=\frac{1.49}{n}R^{2/3}S^{1/2}$$

$$Q=\frac{1.49}{n}R^{2/3}S^{1/2}A$$

CALCULATIONS:

$$Q=\frac{1.49}{n}d^{2/3}S^{1/2}dW$$

$$Q=\frac{1.49}{n}d^{5/3}S^{1/2}W$$

$$d=\frac{Qn}{(1.49S^{1/2}W)^{3/5}}$$

DEPTH CALCULATION:

FLOW DEPTH = 0.10 ft

RECEIVED
MAY 22 1995