Property of
Flood Control District of MC Library
Please Return to
2801 W. Durango
Phoenix, AZ 85009

CAREFREE HIGHWAY

7TH STREET TO CAVE CREEK ROAD

PROJECT NO. 69003

CONTRACT NO. 1995-60

FINAL DRAINAGE REPORT

Registered Professional Engineer (Civil)
CERTIFICATE NO.
25015
ANDREW JOHN
SPEAR
Date Signed 8/6/97
ARIZONA, U.S.A.

Prepared for:

Maricopa County Department of Transportation

Prepared by:

DIBBLE & ASSOCIATES
CONSULTING ENGINEERS
2633 East Indian School Road, Suite 401
Phoenix, Arizona 85016

August 5, 1997

CAREFREE HIGHWAY

7TH STREET TO CAVE CREEK ROAD

PROJECT NO. 69003

CONTRACT NO. 1995-60

FINAL DRAINAGE REPORT

Prepared for:

Maricopa County Department of Transportation

Prepared by:

DIBBLE & ASSOCIATES
CONSULTING ENGINEERS
2633 East Indian School Road, Suite 401
Phoenix, Arizona 85016

August 5, 1997

Maricopa County Department of Transportation
Carefree Highway- 7th Street to Cave Creek Road
Draft Drainage Report

TABLE OF CONTENTS

I. Introduction
General 1
Scope of Work 1
Existing Conditions 1

II. Design Criteria
Hydrology 3
Hydraulics 3

III. Study approach
Methodology 4
Assumptions 8

IV. Results and Recommendations
Hydrology 8
Culvert Analysis 9
Box Culvert Extension Analysis 12
Roadside Drainage 14
Pavement Drainage 14

APPENDICES
A. Rational Method Summary and Calculations
B. DDMS Method Summary and Calculations
C. HY-8 Summary and Calculations for Existing Culverts
D. HY-8 Summary and Calculations for Recommended Culverts
E. HEC-2 Analysis of Cave Creek Wash
F. Drainage Basin and Culvert Location Map

Maricopa County Department of Transportation
Carefree Highway- 7th Street to Cave Creek Road
Draft Drainage Report

LIST OF TABLES

1. Weighted "c" values 4
2. Rational Method Design Flows 6
3. DDMS Method Design Flows 7
4. Hydrologic Summary Table 9
5. Culvert Summary Table 13
6. Box Culvert Extension Summary Table 14

LIST OF FIGURES

1. Vicinity Map 2
2. Drainage Basin and Culvert Map . . . . . Appx. F

Maricopa County Department of Transportation

Carefree Highway- 7th Street to Cave Creek Road

Draft Drainage Report

I. INTRODUCTION

General

This drainage study and report is part of Project No. 69003 for the Carefree Highway in northeastern Maricopa County. The limits of the study are 3rd Street to Cave Creek Road. **Figure 1** shows the study area.

An area drainage master study (ADMS) was completed for this same area in August of 1992. In addition to calculating 100 year flow values for the drainage area, the ADMS analyzed the capacity of the existing culverts. The ADMS was used as a loose check for this study.

Scope of Work

The delineated drainage basins and the culvert locations along Carefree Highway can be seen on **Figure 2**. Each of these basins was analyzed by one of two methods to determine design flows. For any drainage areas smaller than 160 acres, the MCDOT Rational method was used to calculate peak flow values. Drainage areas greater than 160 acres were analyzed using the computer program Drainage Design Menu System (DDMS), which generates an input file for the computer program HEC-1.

All existing culverts were analyzed hydraulically.

Alternatives were evaluated, hydraulically analyzed, and recommended, where appropriate.

Existing Conditions

The contributing drainage areas affecting this segment of Carefree Highway consist mainly of undeveloped desert with relatively flat and constant slopes. Some of the drainage basins, however, take in portions of the mountainous terrain in the Cave Creek Recreation Area north of Carefree Highway. Much of the runoff originates in these mountains and flows south over the undeveloped desert, crossing Carefree Highway at several major and minor washes. The 6 major washes crossing Carefree Highway within the study limits are Desert Lake Wash, Desert Hills Wash, Apache Wash, Paradise Wash West Fork, Paradise Wash, and Cave Creek Wash. Regardless of which location water crosses Carefree Highway, it eventually flows into either Apache Wash or Cave Creek Wash, which parallel each other and continue south. Only sparse

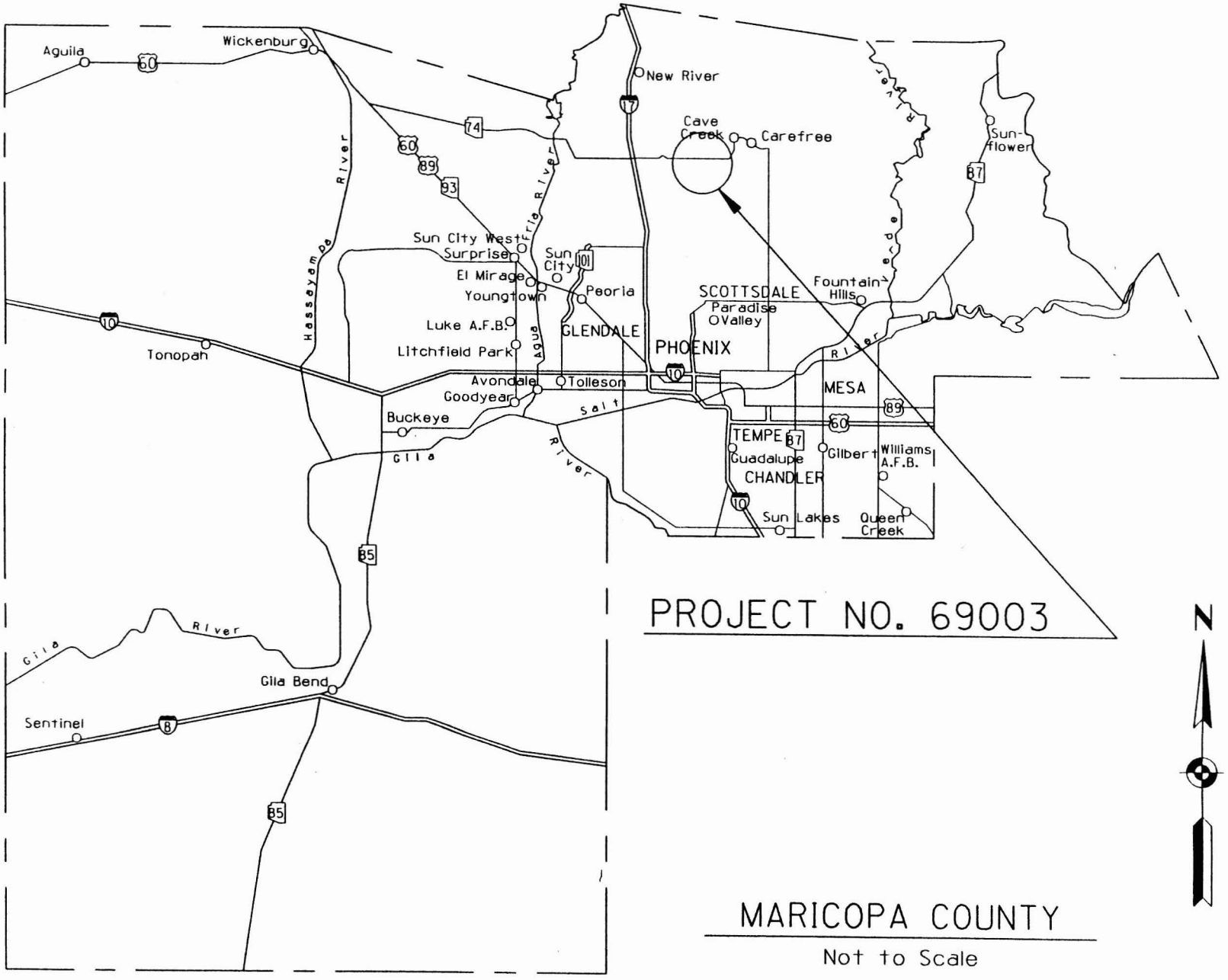

Aguila
Wickenburg
New River
Cave Creek
Carefree
Sun-flower
Sun City West
Surprise
El Mirage
Youngtown
Sun City
Peoria
SCOTTSDALE
Paradise Valley
Fountain Hills
Luke A.F.B.
Litchfield Park
GLENDALE
PHOENIX
Tonopah
Avondale
Tolleson
Goodyear
Buckeye
MESA
TEMPE
Guadalupe
Gilbert
Williams A.F.B.
CHANDLER
Sun Lakes
Queen Creek
Gila Bend
Sentinel
Hassayampa River
Agua Fria River
Salt River
Verde River
Gila River
PROJECT NO. 69003
N
MARICOPA COUNTY
Not to Scale

Figure 1

development is present and the only man-made structure affecting the drainage is the highway itself. Only minor development is expected to occur on the private land.

The project elevations range from 549.750 m at the western terminus to 620.051 m at the eastern terminus.

II. DESIGN CRITERIA

Hydrology

The design flow for the culverts crossing Carefree Highway within the limits of this project is the 50 year peak flow.

Hydraulics

Culverts - The Culverts were sized based on an over-topping analysis. The head water elevation is allowed to approach the roadway elevation as long as it does not over-top Carefree Highway.

Pavement Drainage - The pavement will drain to swales parallel to the highway until it can be diverted into natural channels. In embankment areas with guardrail, the flow will drain over the existing slopes. Pavement drainage will be diverted down embankment slopes in downdrains or spillways prior to and following bridges. The runoff will be directed down the embankment slopes in concrete spillways to natural or man-made drainage channels. Riprap aprons should be used at the base of the spillways for erosion protection.

Erosion Control - The soils in the area are shallow but have a medium resistance to erosion. Erosion problems were noted in larger drainages and at the outlet of several existing culverts. Outlet protection for culvert outlets is provided according to the following criteria:

Ratio of outlet velocity to Natural stream velocity:	Required Protection
less than 1.5	No protection required
1.5 to 2.0 with outlet velocity less than 10 fps	Dumped rock riprap apron
1.5 to 2.5 with outlet velocity between 10 and 15 fps	Wire-tied riprap apron
Greater than 2.5 or outlet velocity greater than 15 fps	Energy Dissipator

III. STUDY APPROACH

Methodology

Rational Method - Fifty-year flows for all drainage basins less than 160 acres were calculated using the rational method. The flow is calculated using the equation:

(Eqn 1) $\mathbf{Q = c \cdot i \cdot A}$

where	Q	=	Peak Flow (cfs)
	c	=	Coefficient Relating Runoff to Rainfall
	i	=	Average Rainfall Intensity (in/hr)
	A	=	Area of Drainage Basin (acres)

The "c" values for use in the above equation are listed according to land use in Table 3.2 of Drainage Design Manual for Maricopa County, Arizona, Volume 1. Most drainage basins for this study consist of more than one land use. To account for this, the "c" value used for each drainage basis was "weighted" according to percent land use of the total basin area. **Table 1** shows the drainage areas analyzed by the rational method broken down into land use, and the calculation of their respective weighted "c" values.

Table 1- Weighted "c" Values

Frequency = 50 year

C adjustment factor = 1.2 (maximum "c" = .95)

Drainage Area	Total Area (acres)	Pavement (acres)	Shoulder (acres)	Undeveloped desert (acres)	Mountainous (S>0.1) (acres)	Weighted "c" Factor
c' factor=		.85	.65	.35	.70	
adj. "c" =		.95	.78	.42	.84	
6	123.97	0.60	0.14	109.46	13.77	**0.47**
F	37.65	0.37	0.46	36.82	0.00	**0.43**
I	4.59	0.28	0.07	4.24	0.00	**0.46**
J	74.38	0.31	0.07	74.00	0.00	**0.42**
K	56.93	0.30	0.07	56.56	0.00	**0.42**
L2	44.99	0.60	0.14	44.25	0.00	**0.43**
19	124.89	0.45	0.41	124.03	0.00	**0.42**
21	13.77	0.33	0.13	13.31	0.00	**0.44**
24	75.30	1.34	2.81	71.15	0.00	**0.44**

The rainfall intensity "i" is determined using the iterative process set forth in Chapter 3 of Drainage Design Manual for Maricopa County, Arizona, Volume 1. First, a time of concentration and its corresponding intensity is selected from the Intensity-Duration-Frequency (I-D-F) curve for the study area. This curve is included in **Appendix A**. The "i" value from the I-D-F curve is plugged into the following equation:

(Eqn 2) $\mathbf{T_c = 11.4 \cdot L^{0.5} \cdot K_b^{0.52} \cdot S^{-0.31} \cdot i^{-0.38}}$

where	T_c	=	Time of Concentration (hr)
	L	=	Length of Flow Path (mi)
	K_b	=	Watershed Resistance Coefficient
	S	=	Watershed Slope (ft/mi)
	i	=	Average Rainfall Intensity (in/hr)

The watershed resistance coefficient "K_b" is determined from the following equation:

(Eqn 3) $\mathbf{K_b = m \cdot \log A + b}$

where	K_b	=	Watershed Resistance coefficient
	m	=	Parameter Determined from Land Type Description
	A	=	Area of Drainage Basin (acres)
	b	=	Parameter Determined from Land Type Description

The parameters "m" and "b" are listed according to land type in table 3.1 of Drainage Design Manual for Maricopa County, Arizona, Volume 1. This table can also be found in **Appendix A.**

The "T_c" which equation 2 yields is compared to the original "T_c" selected from the I-D-F curve. This process is repeated until the "T_c" selected is *reasonably* close to the "T_c" calculated.

The "i" value corresponding to this "T_c" from the I-D-F curve is used in equation 1 to calculate the peak flow. The "i" values used for each drainage area can be seen in **Table 2**, along with the calculated 50 year peak flow for each area.

Table 2- Rational Method Design Flows

Drainage Area	Total Area	Weighted "c" Factor	"i" value	Q_{50} peak (cfs)
6	123.97	0.47	6.19	**360**
F	37.65	0.43	4.99	**81**
I	4.59	0.46	6.39	**13**
J	74.38	0.42	4.02	**126**
K	56.93	0.42	4.34	**105**
L2	44.99	0.43	4.84	**93**
19	124.89	0.42	3.59	**190**
21	13.77	0.44	5.45	**33**
24	75.3	0.44	3.72	**124**

A summary of all parameters used in the calculation of design flows by the rational method is contained in **Appendix A**.

HEC I Analysis - For drainage basins larger than 160 acres, the DDMS computer program from Maricopa County was used to generate an input file for the HEC-I hydrology modeling software from the US Army Corps of Engineers. HEC-1 was used to calculate the 50 year flows.

DDMS makes use of several programs in conjunction to generate the HEC-1 input file. The programs which were used for this analysis are PREFRE, LAND TYPES, SUBBASIN PREP, and MCUHP1.

PREFRE creates a depth-duration-frequency table from rainfall values entered.

LAND TYPES contains a default table listing different land uses and their corresponding values for infiltration parameters. This default value table can be used, or it may be customized. The default land use table was used for this study.

SUBBASIN PREP requires the input of the soil survey being used, and the soil makeup of the basin. Detailed soil information on the soils in this area was obtained from the Soil Conservation Service. The Aguila-Carefree soil survey was used in this study.

MCUHP1 requires the input of storm size, storm duration, and certain physical characteristics of the drainage basin such as high and low elevations, and length of flow path.

DDMS takes the information entered in each of these programs and consolidates it into a single input file for HEC-1. HEC-1 models the basins and calculates peak flows.

In order to confirm the validity of the methodology used, a test run was performed for the drainage area which provides runoff to the Desert Hills Wash. FEMA has calculated 100 year flows for the major washes in the area. The FEMA calculated 100 year peak flow at Desert Hills Wash and Carefree Highway is 4143 cfs. The methodology described above was performed on the Desert Hills Wash drainage area. This methodology yielded a 100 year peak flow of 4117 cfs. The methodology was deemed sound.

Table 3 shows the calculated 50 year peak flows for the drainage areas analyzed by the (HEC-1) method.

Table 3- DDMS Method Design Flows

Drainage Area	Total Area (acres)	Q_{50} peak (cfs)
1	203.86	**589**
G	307.62	**587**
H	258.95	**717**
L	358.13	**634**
N	613.41	**1244**
26	382.00	**536**

Appendix B contains all parameters used as inputs for DDMS in this study, as well as the DDMS output reports. **Appendix B** also includes DDMS parameters and output for the Desert Hills Wash methodology confirmation exercise discussed above.

Culvert Analysis - Both existing and recommended culverts were analyzed using procedures contained in HDS-5, Hydraulic Design of Highway Culverts, September 1985, prepared by the Federal Highway Administration using the computer program HY-8, v 4.0. **Appendix C** contains HY-8 parameters and output for the existing culverts. **Appendix D** contains the HY-8 parameters and output for the

recommended culverts.

HEC 2 Analysis - The proposed bridge over Cave Creek Wash for the east-bound lanes necessitated analysis of the Cave Creek Wash. The wash was analyzed using the computer program HEC-2 to determine if the proposed bridge will adversely affect the water surface elevation (WSE) in the vicinity of Carefree Highway.

Assumptions

Analysis of drainage areas by the Rational method requires certain assumptions. Assumptions made in this study are the same as those set forth in section 3.3 of Drainage Design Manual for Maricopa County, Arizona, Volume 1. They are as follows:

1) The peak discharge rate corresponding to a given intensity would occur only if the rainfall duration is at least equal to the time of concentration.

2) The calculated runoff is directly proportional to the rainfall intensity.

3) The frequency of occurrence for the peak discharge is the same as the frequency for the rainfall producing that event.

4) The runoff coefficient increases as storm frequency decreases.

IV. RESULTS AND RECOMMENDATIONS

Hydrology

Table 4 summarizes the hydrology method used to analyze each drainage area and the resulting design flows. The drainage areas may be seen on **Figure 2** in **Appendix F**.

In the case of Cave Creek Wash, the objective of this study was to extract water surface elevations (WSE's) in the wash from a known design flow. The design flow used in this analysis was 1044 cfs. This flow was calculated by FEMA in the Flood Insurance Study for Maricopa County and Incorporated Areas, September 30,1995 Revision. The WSE corresponding to this flow was determined to be 1865.85 ft (568.71m). This WSE will not encroach on the low chord of the proposed bridge. Thus, Cave Creek Wash will pass under Carefree Highway in a low flow condition during the 100 year storm. The HEC-2 input and output files may be observed in **Appendix E**.

Table 4- Hydrologic Summary Table

Drainage Area	Total Area (acres)	Analysis Method	Design Flow (cfs)
1	203.86	HEC-1	589
6	123.97	RATIONAL	360
F	37.65	RATIONAL	81
G	307.62	HEC-1	587
H	258.95	HEC-1	717
I	4.59	RATIONAL	13
J	74.38	RATIONAL	126
K	56.93	RATIONAL	105
L	358.13	HEC-1	634
L2	44.99	RATIONAL	93
19	124.89	RATIONAL	190
N	613.41	HEC-1	1244
21	13.77	RATIONAL	33
24	75.30	RATIONAL	124
26	382.00	HEC-1	536

Culvert Analysis

Many of the calculated design flows exceed the capacity of the existing culverts. The following is a discussion of these culverts.

Culvert 1 - This 910 mm cmp, along with culverts 3 and 4 passs water from west to east along the south side of Carefree Highway in front of Desert Hills Plaza. The historical path of the water crosses Carefree Highway from south to north west of the plaza and joins Desert Lake Wash. This wash turns to the south and crosses Carefree Highway from north to south at 10th Street. With a capacity of 28 cfs, culvert 1 is severely undersized for the 50-year flow of 589 cfs. Originally, a 3.0m x 1.2m concrete box culvert was designed to pass this water under Carefree Highway and restore it to its historical path. Acquisition of Right of Way proved difficult for the parcel of land north of Carefree Highway just across from the plaza. Due to the difficulty in obtaining this Right of Way, a new drainage scheme was designed. The proposed drainage scheme closely mimics the existing system in this area. A channel is proposed to

run east from 3rd Street to the plaza. The flow enters a storm drain through a drop inlet just west of the plaza. The storm drain carries the water to just east of the plaza, where the runoff is expelled into a new channel. This channel runs south of Carefree Highway to the east until it approaches 10th Street, where it directs the runoff into the proposed improved culvert 6. Right of way constraints prohibited the new channels in this area from being designed to convey the 50-year flow. The approach was taken to avoid making conditions worse than they are with the existing channel. Although the proposed channel-storm drain-channel system will not fully convey the 50-year runoff, it is an improvement over existing conditions.

Culvert 6 - This 610 mm cmp has a capacity of 24 cfs. The design flow for this drainage area is 360 cfs. Adding another 610 mm cmp is recommended. With 2 610 mm cmp's, this culvert will be able to pass more of the flow under 10th Street without over-topping the roadway. This culvert was sized based on the capacity of the channel leading to it from the west.

Culvert 9 (F) - This is a 1070 mm cmp with a capacity of 54 cfs. The design flow for this drainage area is 81 cfs. Removal of the existing pipe and replacement with 3 890 mm x 610 mm cmpa's is recommended. This will bring the capacity to 102 cfs.

Culvert 10 (G) - Culvert 10 is a 2 barrel 1220 mm cmp with a capacity of 166 cfs. The design flow for this drainage area is 587 cfs. It is recommended to remove the existing culvert and replace it with 5 1960 mm x 1320 mm cmpa's. The capacity of the proposed culvert is 754 cfs.

Culvert 12 (H) - This is a 2 barrel 1070 mm cmp with a capacity of 172 cfs. The design flow for this drainage area is 717 cfs. A 2 barrel 3.0 m x 1.5 m concrete box culvert is recommended to replace the 1070 mm cmp's. This new box will have a capacity of 822 cfs.

Culvert 16 (K) - Culvert 16 is a 760 mm cmp with a capacity of 25 cfs. The design flow for this drainage area is 105 cfs. Removing the existing pipe and adding 3 1070 mm x 740 mm cmpa's is recommended. The proposed culvert will pass the design flow.

Culvert 17 (L) - Culvert 17 consists of 2 1220 mm cmp's and 3 1070 mm x 740 mm cmpa's. Four of these pipes cross Carefree Highway in the same wash, and 1 cmpa crosses the Highway in a separate branch of the same wash a few meters to the east. Because the channel splits north of Carefree Highway and rejoins itself south of Carefree Highway, all of these pipes are considered to belong to a single culvert. The capacity of this culvert is 337 cfs. The design flow for this drainage area is 634 cfs. A 2 barrel 3.0m x 1.5m concrete box culvert is proposed to replace these pipes. The new box will have

a capacity of 669 cfs. Some reshaping of the channel will be required at this location to remove the split in the flow path.

Culvert 18 (L2) - This is a 1070 mm x 740 mm cmpa with a capacity of 43 cfs. The design flow for this drainage area is 74 cfs. By adding 2 more 1070 mm x 740 mm cmpa's, the capacity will increase to 128 cfs.

Culvert 19 - This is a 1070 mm x 740 mm cmpa with a capacity of 43 cfs. The design flow for this drainage area is 190 cfs. It is recommended to add 2 more barrels of the same size to this culvert.

Culvert 20 (N) - Culvert 20 is a 4 barrel 1220 mm cmp with a capacity of 756 cfs. The design flow for this drainage area is 1244 cfs. A 3 barrel 3.0 m x 1.5 m concrete box culvert is recommended to replace these cmp's. The new box culvert will have a capacity of 1300 cfs.

Culvert 24 - This culvert consists of a single 760 mm cmp and has a capacity of 30 cfs. The design flow for this drainage area is 124 cfs. It is recommended to remove this 760 mm cmp and replace it with a 2 barrel 1070 mm cmp.

Culvert 26 - This is a 3 barrel 1800 mm x 1190 mm cmpa with a capacity of 418 cfs. The design flow for this drainage area is 536 cfs. By adding another 1800 mm x 1190 mm cmpa, the capacity of this culvert will increase to 564 cfs.

Culvert O - This is a 2 barrel 3.0 m x 1.7 m concrete box culvert with a capacity of 714 cfs. The design flow for this drainage area is 4179 cfs. This is the 100 year flow value calculated by FEMA. Present conditions allow the runoff to over-top Carefree Highway to the west of this culvert. Grouted riprap hugs the Highway on the south side at two locations. The first bed of grouted riprap begins about 230 meters west of the existing box and extends for approximately 50 meters. The second bed begins about 100 meters west of the existing box and extends for about 80 meters. These beds of grouted riprap pose a safety hazard to east bound traffic due to the protruding jagged rocks. A 4 barrel 3.7 m x 3.0 m concrete box culvert is proposed to replace the existing box at the same location. This will require increasing the profile elevation at this location. Although the proposed box will not pass the full 100 year flow, it will more than double the capacity of the existing box. In order to convey the runoff to the box, and attempt to prevent the runoff from draining down to its previously designated over-topping location, a riprap-lined channel is recommended on the north side of Carefree Highway beginning at about station 12+000 and running westerly to the proposed box. Capacity calculations for this channel can be found at the end of **Appendix D**. It is further recommended that the grouted riprap be removed.

All culverts which have adequate capacity to pass the design flow for their respective drainage areas are recommended to remain in place and to be extended to the south beyond the proposed east bound lanes.

Table 5 summarizes the design flows and configurations of the existing culverts, as well as their respective recommended configurations.

Box Culvert Extension Analysis

Three existing box culverts, (at Jonathan Wash, Desert Hills Wash and Apache Wash), are not adequately sized for the 100-year flow. In the Apache Wash Flood Plain Delineation Study performed by David Evans & Associates (DEA) for the Flood Control District of Maricopa County (MCFCD) in 1992, it was recommended that each of these box culverts be replaced by a bridge. However, through discussion with the Maricopa Department of Transportation (MCDOT) and the MCFCD, it was determined that budget constraints prohibit the construction of bridges at this time. It is therefore recommended that these boxes be extended south beyond the proposed east bound lanes. These boxes were analyzed to ensure that the proposed extensions would not raise the water surface elevation by an unacceptable amount. The following is a discussion of this analysis.

The box extension analysis began with HEC-2 files provided by the Flood Control District of Maricopa County for Jonathan Wash, Desert Hills Wash and Apache Wash. These HEC-2 files were developed for the DEA study discussed above. Each HEC-2 file generates output for conditions with and without encroachments. The runs with encroachments were used to determine existing conditions water surface elevations. Existing conditions water surface elevations were taken immediately upstream of the box culverts.

In order to see how the proposed box extensions would affect the water surface elevations, Dibble modified the DEA HEC-2 files to reflect the proposed box lengths. The modified runs were used to determine proposed conditions water surface elevations, which were also taken immediately upstream of the box culverts. **Table 6** presents the results of this analysis.

Table 5 - Culvert Summary

Culvert	Contributing Drainage Area	Design Flow (cfs)	Existing Configuration	Recommended Configuration
1	1	589	1- 36" cmp	1- 36" cmp
2	1	589	1- 24" cmp	1- 24" cmp
3	1	589	1- 36" cmp	1- 36" cmp
4	1	589	1- 12" cmp	remove
5	1	589	1- 24" cmp	2- 24" cmp
6	6	360	1- 24" cmp	2- 24" cmp
7 (D)	7	17	1- 42" cmp	1- 42" cmp
8	Desert Hills Wash	15	1- 24" cmp	extension only
9 (F)	F	81	1- 42" cmp	3- 36" x 24" cmpa
10 (G)	G	587	2- 48" cmp	5- 77" x 52" cmpa
11	G	587	1- 18" cmp	1- 24" cmp
12 (H)	H	717	2- 42" cmp	2- 120" x 60" cbc
13	H	717	2- 48" cmp	remain in place
14 (I)	I	13	1- 24" cmp	extension only
15 (J)	J	126	1- 48" cmp 1- 42" cmp	extension only
16 (K)	K	105	1- 30" cmp	3- 42" x 29" cmpa
17 (L)	L	634	3- 42" x 29" cmpa and 2-48" cmp	2- 120" x 60" cbc
18 (L2)	L2	93	1- 42" x 29" cmpa	2- 42" x 29" cmpa
19	19	190	1- 42" x 29" cmpa	3- 42" x 29" cmpa
20 (N)	N	1244	4- 48" cmp	3- 120" x 60" cbc
21	21	33	1- 42" x 29" cmpa	extension only
22	22	621	1- 30" cmp	remove
23	23	603	4- 24" cmp	4- 24" cmp
24	24	124	1- 30" cmp	2- 42" cmp
26	26	536	3- 71" x 47" cmpa	4- 71" x 47" cmpa
27	26	536	2- 35" x 24" cmpa	2- 35" x 24" cmpa
28	26	536	1- 24" rcp	1- 24" rcp
29	26	536	1- 36" rcp	1- 36" rcp
30	26	536	1- 24" rcp	extension only
C	Jonathan Wash	4772	4- 144" x 62" rbcb	extension only
E	Desert Hills Wash	4143	3- 120" x 60" rcbc	extension only
M	Apache Wash	5739	3- 120" x 60" rcbc	extension only
O	Paradise Wash	4179	2- 120" x 66" rcbc	4- 144" x 120" rcbc

Table 6 - Box Culvert Extension Summary

WASH	STATION	CULVERT	EXISTING LENGTH	EXISTING W.S.E.	PROPOSED LENGTH	PROPOSED W.S.E.	WSE CHANGE
JONATHAN	7+660	C	129'	1780.96'	206'	1780.97'	0.01'
DESERT HILLS	8+000	E	61'	1780.69'	111'	1780.69'	0.0'
APACHE	10+420	M	55'	1809.03'	102'	1809.01'	-0.02'

Roadside Drainage

Cut ditches are proposed parallel to the new and reconstructed roadways. The ditches were analyzed to determine sizing requirements. The design calculations for pavement runoff and roadside ditches can be found at the end of **Appendix A**. The minimum ditch section shown on the typical sections sheet of the construction plans will carry the design flows for pavement runoff.

Pavement Drainage

The pavement runoff will drain into the roadside cut ditches or over the embankment slopes. Embankment curb is not recommended.

Drainage from the proposed bridge will be directed to concrete embankment spillways on the either side of the bridge. The spillways wil convey the bridge runoff into riprap lined ditches, which will outlet into Cave Creek Wash. Bridge drainage calculations are not a part of this report and are prepared by others.

APPENDIX A

RATIONAL METHOD CALCULATIONS

RATIONAL METHOD CALCULATION DATA

Area (Culvert) No.	Area (ac.)	L (ft)	delta H (ft)	m	b	i (in/hr)
6	123.97	5250	306.05	-0.01375	0.08	5.13

Area (Culvert) No.	Area (ac.)	L (ft)	delta H (ft)	m	b	i (in/hr)
F	37.65	3125	34.92	-0.01375	0.08	4.07

Area (Culvert) No.	Area (ac.)	L (ft)	delta H (ft)	m	b	i (in/hr)
I	4.59	1300	19.14	-0.01375	0.08	5.46

Area (Culvert) No.	Area (ac.)	L (ft)	delta H (ft)	m	b	i (in/hr)
J	74.38	6125	73.57	-0.01375	0.08	3.20

Area (Culvert) No.	Area (ac.)	L (ft)	delta H (ft)	m	b	i (in/hr)
K	56.93	4775	55.36	-0.01375	0.08	3.44

Area (Culvert) No.	Area (ac.)	L (ft)	delta H (ft)	m	b	i (in/hr)
L2	44.99	3750	45.37	-0.01375	0.08	3.86

Area (Culvert) No.	Area (ac.)	L (ft)	delta H (ft)	m	b	i (in/hr)
19	124.89	7950	86.41	-0.01375	0.08	2.82

Area (Culvert) No.	Area (ac.)	L (ft)	delta H (ft)	m	b	i (in/hr)
21	13.77	2550	34.45	-0.01375	0.08	4.43

Area (Culvert) No.	Area (ac.)	L (ft)	delta H (ft)	m	b	i (in/hr)
24	75.3	7025	80.71	-0.01375	0.08	2.96

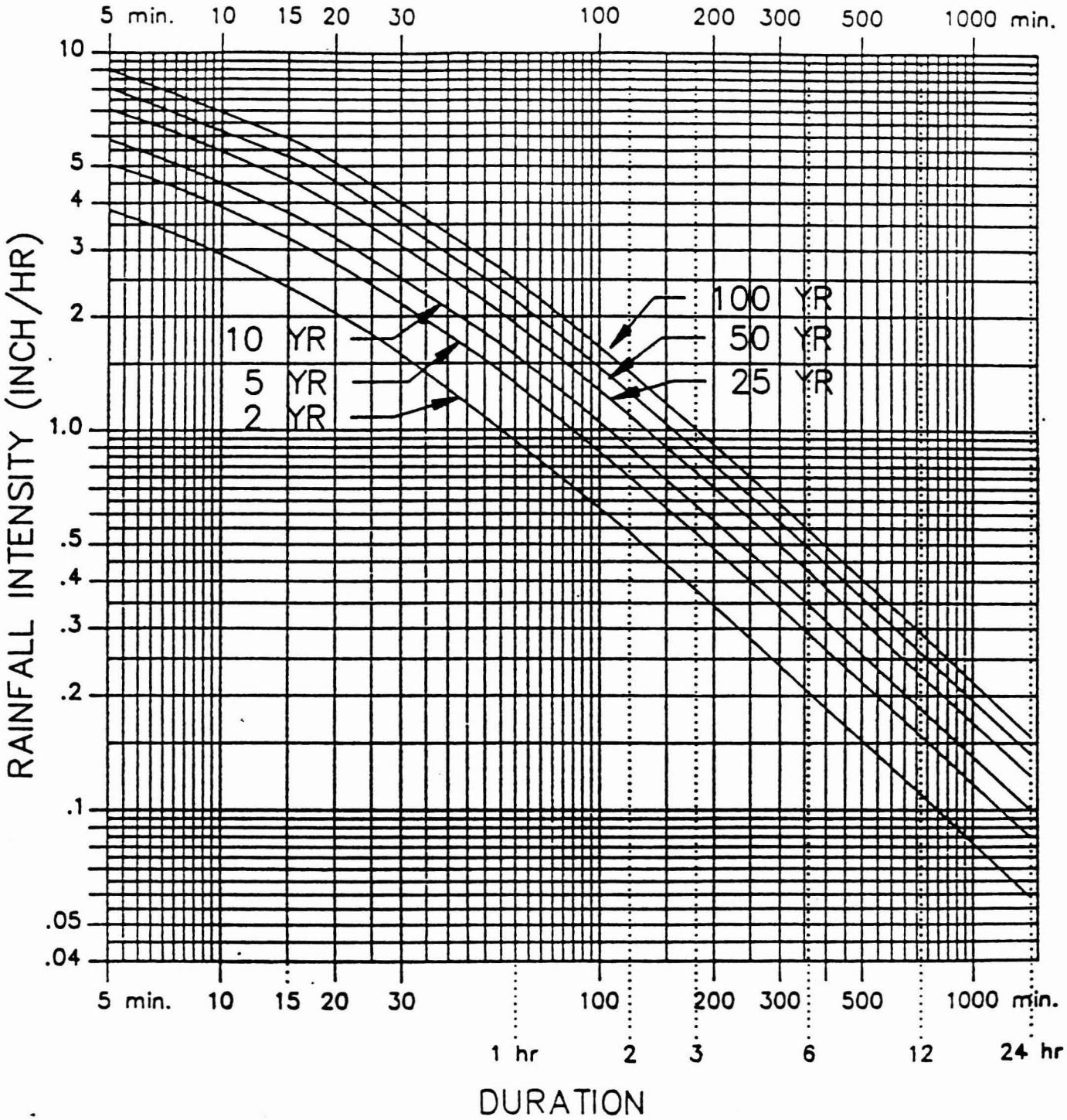


Figure 3.2
Rainfall Intensity-Duration-Frequency Relation
(Phoenix Metro Area)

Table 3.1
Equation for Estimating K_b in the Tc Equation

$K_b = m \log A + b$ Where A is drainage area, in acres				
Type	**Description**	**Typical Applications**	**Equation Parameters**	
			m	**b**
A	Minimal roughness: Relatively smooth and/or well graded and uniform land surfaces. Surface runoff is sheet flow.	Commercial/ industrial areas Residential area Parks and golf courses	–0.00625	0.04
B	Moderately low roughness: Land surfaces have irregularly spaced roughness elements that protrude from the surface but the overall character of the surface is relatively uniform. Surface runoff is predominately sheet flow around the roughness elements.	Agricultural fields Pastures Desert rangelands Undeveloped urban lands	–0.01375	0.08
C	Moderately high roughness: Land surfaces that have significant large- to medium-sized roughness elements and/or poorly graded land surfaces that cause the flow to be diverted around the roughness elements. Surface runoff is sheet flow for short distances draining into meandering drainage paths.	Hillslopes Brushy alluvial fans Hilly rangeland Disturbed land, mining, etc. Forests with underbrush	–0.025	0.15
D	Maximum roughness: Rough land surfaces with torturous flow paths. Surface runoff is concentrated in numerous short flow paths that are often oblique to the main flow direction.	Mountains Some wetlands	–0.030	0.20

Assumptions

Application of the Rational Equation requires consideration of the following:

1. The peak discharge rate corresponding to a given intensity would occur only if the rainfall duration is at least equal to the time of concentration.
2. The calculated runoff is directly proportional to the rainfall intensity.
3. The frequency of occurrence for the peak discharge is the same as the frequency for the rainfall producing that event.
4. The runoff coefficient increases as storm frequency decreases.

Frequency= 50 year
C adjust factor= 1.2

Culvert no.	Total Area (ac.)	Pavement (ac.)	Shoulder (ac.)	Undeveloped Desert (ac.)	Mountainous (S>0.1) (ac.)	Error in Total Area (ac.)	**Weighted C Factor**
C factor=		0.85	0.65	0.35	0.70		
Adj C fact.=		0.95	0.78	0.42	0.84		
6	123.97	0.60	0.14	109.46	13.77	0.00	**0.47**
F	37.65	0.37	0.46	36.82	0.00	0.00	**0.43**
I	4.59	0.28	0.07	4.24	0.00	0.00	**0.46**
J	74.38	0.31	0.07	74.00	0.00	0.00	**0.42**
K	56.93	0.30	0.07	56.56	0.00	0.00	**0.42**
L2	44.99	0.60	0.14	44.25	0.00	0.00	**0.43**
19	124.9	0.45	0.41	124.03	0.00	0.00	**0.42**
21	13.77	0.33	0.13	13.31	0.00	0.00	**0.44**
24	75.30	1.34	2.81	71.15	0.00	0.00	**0.44**

Table 3.2
C Coefficients for Use with the Rational Method

Land Use	Return Period			
	2-10 Year	25 Year	50 Year	100 Year
Streets and Roads				
Paved Roads	0.75 – 0.85	0.83 – 0.94	0.90 – 0.95	0.94 – 0.95
Gravel Roadways & Shoulders	0.60 – 0.70	0.66 – 0.77	0.72 – 0.84	0.75 – 0.88
Industrial Areas				
Heavy	0.70 – 0.80	0.77 – 0.88	0.84 – 0.95	0.88 – 0.95
Light	0.60 – 0.70	0.66 – 0.77	0.72 – 0.84	0.75 – 0.88
Business Areas				
Downtown	0.75 – 0.85	0.83 – 0.94	0.90 – 0.95	0.94 – 0.95
Neighborhood	0.55 – 0.65	0.61 – 0.72	0.66 – 0.78	0.69 – 0.81
Residential Areas				
Lawns – Flat	0.10 – 0.25	0.11 – 0.28	0.12 – 0.30	0.13 – 0.31
– Steep	0.25 – 0.40	0.28 – 0.44	0.30 – 0.48	0.31 – 0.50
Suburban	0.30 – 0.40	0.33 – 0.44	0.36 – 0.48	0.38 – 0.50
Single Family	0.45 – 0.55	0.50 – 0.61	0.54 – 0.66	0.56 – 0.69
Multi-Unit	0.50 – 0.60	0.55 – 0.66	0.60 – 0.72	0.63 – 0.75
Apartments	0.60 – 0.70	0.66 – 0.77	0.72 – 0.84	0.75 – 0.88
Parks/Cemetaries	0.10 – 0.25	0.11 – 0.28	0.12 – 0.30	0.13 – 0.31
Playgrounds	0.40 – 0.50	0.44 – 0.55	0.48 – 0.60	0.50 – 0.63
Agricultural Areas	0.10 – 0.20	0.11 – 0.22	0.12 – 0.24	0.13 – 0.25
Bare Ground	0.20 – 0.30	0.22 – 0.33	0.24 – 0.36	0.25 – 0.38
Undeveloped Desert	0.30 – 0.40	0.33 – 0.44	0.36 – 0.48	0.38 – 0.50
Mountain Terrain (Slopes > 10%)	0.60 – 0.80	0.66 – 0.88	0.72 – 0.95	0.75 – 0.95

Note: Values of C for 25, 50 and 100 Year were derived using frequency adjustment factors of 1.10, 1.20, and 1.25, respectively, with an upper limit of 0.95 for C for the 2-10 Year values.

(50 year precipitation)

Culvert	Total Area	Weighted C factor	i value	**Q peak (cfs)**
6	123.97	0.47	5.13	298.66
F	37.65	0.43	4.07	65.83
I	4.59	0.46	5.46	11.47
J	74.38	0.42	3.20	100.57
K	56.93	0.42	3.44	82.89
L2	44.99	0.43	3.86	74.36
19	124.89	0.42	2.82	149.01
21	13.77	0.44	4.43	26.60
24	75.3	0.44	2.96	98.71

Rational Method Summary of Pavement Drainage Areas and Roadside Ditches

No.	Begin Station	End Station	Side	Paved Area (s.f.)	Desert Area (s.f.)	Length (ft)	Length (mi)	Slope (ft/mi)	Kb	Paved C	Desert C	i (in/hr)	Tc (hr) (10 minute minimum)	Q10 (cfs)	Qcapacity (cfs)
1	6+775	6+848	Lt.	7,386	3,327	240	0.045	47.7	0.088	0.85	0.35	5.85	0.167	1.00	5.55
2	6+878	7+250	Lt.	37,639	41,035	1220	0.231	45.8	0.076	0.85	0.35	3.83	0.264	4.07	5.43
3	7+285	7+335	Lt.	5,059	1,635	164	0.031	43.4	0.091	0.85	0.35	6.16	0.167	0.69	5.29
4	7+365	7+550	Lt.	18,718	29,335	607	0.115	33.7	0.079	0.85	0.35	4.44	0.197	2.67	4.66
5	7+675	7+715	Lt.	4,047	1,085	131	0.025	57.3	0.093	0.85	0.35	6.16	0.167	0.54	6.08
6	7+740	8+000	Lt.	26,307	14,114	853	0.162	26.4	0.080	0.85	0.35	3.83	0.269	2.40	4.13
7	7+750	7+860	Rt.	11,130	17,375	361	0.068	26	0.083	0.85	0.35	4.78	0.167	1.71	4.09
8	8+095	8+230	Lt.	13,659	15,632	443	0.084	56.9	0.082	0.85	0.35	5.26	0.167	2.06	6.06
9	8+095	8+180	Rt.	8,600	3,913	279	0.053	19	0.087	0.85	0.35	4.78	0.167	0.95	3.50
10	8+250	8+425	Lt.	17,707	7,536	574	0.109	13.3	0.083	0.85	0.35	3.72	0.281	1.51	2.93
11	8+285	8+335	Rt.	5,059	2,039	164	0.031	19	0.091	0.85	0.35	5.42	0.167	0.62	3.50
12	8+480	8+725	Lt.	24,789	1,484	804	0.152	15.3	0.083	0.85	0.35	3.40	0.329	1.69	3.14
13	8+480	8+710	Rt.	23,272	7,494	755	0.143	15.8	0.082	0.85	0.35	3.61	0.306	1.86	3.19
14	8+766	8+855	Lt.	9,005	9,686	292	0.055	29.2	0.085	0.85	0.35	5.26	0.167	1.33	4.34
15	8+810	8+855	Rt.	4,553	1,669	148	0.028	26.4	0.092	0.85	0.35	5.85	0.167	0.60	4.13
16	8+893	9+005	Lt.	11,332	4,901	367	0.070	26.7	0.086	0.85	0.35	4.78	0.167	1.25	4.15
17	8+920	8+980	Rt.	6,071	1,360	197	0.037	29	0.091	0.85	0.35	5.42	0.167	0.70	4.32
18	9+095	9+185	Lt.	9,106	2,985	295	0.056	50.1	0.088	0.85	0.35	5.42	0.167	1.09	5.68
19	9+235	9+625	Rt.	39,460	18,613	1280	0.242	15.8	0.078	0.85	0.35	2.98	0.419	2.74	3.19
20	9+260	9+695	Lt.	44,014	12,169	1427	0.270	11.6	0.078	0.85	0.35	2.61	0.512	2.50	2.74
21	9+760	10+068	Lt.	31,164	14,934	1010	0.191	14.5	0.080	0.85	0.35	3.23	0.374	2.35	3.06
22	9+810	9+930	Rt.	12,142	5,041	394	0.075	15.8	0.086	0.85	0.35	4.27	0.212	1.19	3.19
23	10+075	10+310	Lt.	23,777	9,945	771	0.146	21.3	0.082	0.85	0.35	3.72	0.278	2.02	3.71
24	10+200	10+320	Rt.	12,142	5,570	394	0.075	15.8	0.085	0.85	0.35	4.27	0.212	1.20	3.19
25	10+445	10+484	Lt.	3,946	2,915	128	0.024	22.8	0.091	0.85	0.35	5.85	0.167	0.59	3.83
26	10+504	10+620	Rt.	11,737	4,856	381	0.072	13.7	0.086	0.85	0.35	4.27	0.218	1.15	2.97
27	10+525	10+695	Lt.	17,201	10,768	558	0.106	26.4	0.083	0.85	0.35	4.27	0.212	1.80	4.13
28	10+755	10+810	Lt.	5,565	2,024	180	0.034	14.6	0.090	0.85	0.35	5.26	0.167	0.66	3.07
29	10+879	10+900	Lt.	2,125	871	69	0.013	49.4	0.096	0.85	0.35	6.16	0.167	0.30	5.64
30	10+940	11+090	Rt.	15,177	11,578	492	0.093	33.8	0.083	0.85	0.35	4.61	0.179	1.80	4.67
31	10+995	11+115	Lt.	12,142	9,151	394	0.075	26.4	0.084	0.85	0.35	4.78	0.172	1.48	4.13
32	11+440	11+524	Rt.	8,499	3,780	276	0.052	58.5	0.088	0.85	0.35	5.85	0.167	1.15	6.14
33	11+532	11+805	Rt.	27,622	12,323	896	0.170	58.5	0.081	0.85	0.35	4.44	0.204	2.83	6.14
34	12+000	12+315	Rt.	31,872	9,151	1033	0.196	57	0.080	0.85	0.35	4.10	0.227	2.85	6.06
35	12+134	12+395	Lt.	26,408	14,473	856	0.162	57.7	0.080	0.85	0.35	4.44	0.200	2.81	6.10
36	12+540	12+585	Lt.	4,553	1,517	148	0.028	46.7	0.092	0.85	0.35	6.16	0.167	0.62	5.49
37	12+755	12+960	Lt.	20,742	9,728	673	0.127	29.2	0.082	0.85	0.35	4.10	0.228	1.98	4.34

Rational Method Summary of Pavement Drainage Areas and Roadside Ditches

No.	Begin Station	End Station	Side	Paved Area (s.f.)	Desert Area (s.f.)	Length (ft)	Length (mi)	Slope (ft/mi)	Kb	Paved C	Desert C	i (in/hr) (10 minute minimum)	Tc (hr)	Q10 (cfs)	Qcapacity (cfs)
38	12+795	13+000	Rt.	20,742	7,798	673	0.127	21	0.083	0.85	0.35	3.83	0.260	1.79	3.68
39	12+960	13+325	Lt.	36,931	24,044	1198	0.227	25.4	0.078	0.85	0.35	3.40	0.332	3.11	4.05
40	13+000	13+265	Rt.	26,813	27,625	869	0.165	28.1	0.079	0.85	0.35	3.83	0.263	2.85	4.26
41	13+380	13+415	Lt.	3,541	1,432	115	0.022	14.2	0.093	0.85	0.35	5.42	0.167	0.44	3.03
42	13+435	13+460	Lt.	2,530	1,054	82	0.016	17.1	0.095	0.85	0.35	6.16	0.167	0.36	3.32
43	14+000	14+116	Rt.	11,737	6,227	381	0.072	142.6	0.085	0.85	0.35	5.85	0.167	1.63	9.59
44	14+005	14+220	Lt.	21,754	11,160	705	0.134	94.8	0.082	0.85	0.35	4.94	0.167	2.54	7.82
45	14+125	14+540	Rt.	41,990	19,103	1362	0.258	84.9	0.078	0.85	0.35	4.27	0.223	4.16	7.40
46	14+385	14+625	Lt.	24,283	12,913	787	0.149	106.6	0.081	0.85	0.35	4.94	0.167	2.85	8.29
47	14+580	14+735	Rt.	15,683	9,935	509	0.096	76.2	0.083	0.85	0.35	5.26	0.167	2.03	7.01
48	14+870	14+985	Lt.	11,636	4,521	377	0.071	86.4	0.086	0.85	0.35	5.42	0.167	1.43	7.46
49	15+245	15+320	Rt.	7,589	5,580	246	0.047	55	0.087	0.85	0.35	5.85	0.167	1.13	5.96
50	15+275	15+322	Lt.	4,755	1,644	154	0.029	53.9	0.091	0.85	0.35	6.16	0.167	0.65	5.90
51	15+343	15+465	Lt.	12,344	4,901	400	0.076	104.8	0.086	0.85	0.35	5.85	0.167	1.64	8.22
52	15+348	15+465	Rt.	11,838	4,769	384	0.073	106.8	0.086	0.85	0.35	5.85	0.167	1.57	8.30
53	15+605	15+643	Lt.	3,845	931	125	0.024	103.5	0.093	0.85	0.35	5.10	0.167	0.42	8.17
54	15+820	15+940	Lt.	12,142	3,329	394	0.075	95.4	0.086	0.85	0.35	5.42	0.167	1.43	7.84
55	15+972	16+025	Rt.	5,363	2,363	174	0.033	93.9	0.090	0.85	0.35	6.16	0.167	0.76	7.78
56	16+045	16+105	Lt.	6,071	2,323	197	0.037	39.9	0.090	0.85	0.35	5.85	0.167	0.80	5.07
57	16+070	16+128	Rt.	5,868	2,140	190	0.036	56	0.090	0.85	0.35	6.16	0.167	0.81	6.01
58	16+147	16+295	Rt.	14,975	6,132	486	0.092	186.7	0.084	0.85	0.35	5.85	0.167	2.00	10.97
59	16+154	16+347	Lt.	19,528	4,077	633	0.120	135.8	0.084	0.85	0.35	5.42	0.167	2.24	9.36
60	16+480	16+600	Rt.	12,142	5,907	394	0.075	105.6	0.085	0.85	0.35	5.85	0.167	1.66	8.25
61	16+495	16+543	Lt.	4,857	1,388	157	0.030	107.5	0.092	0.85	0.35	6.16	0.167	0.65	8.33
62	16+550	16+600	Lt.	5,059	1,488	164	0.031	87.2	0.091	0.85	0.35	6.16	0.167	0.68	7.50

APPENDIX B

DDMS METHOD CALCULATIONS

DESERT HILLS DRAINAGE AREA

(METHODOLOGY VALIDITY CONFIRMATION)

METHODOLOGY VALIDITY CONFIRMATION:

(TEST RUN FOR DESERT HILLS WASH, 100 YR RAINFALL)

Discharge Summary of data in DESHILLS.OUT

KK ID	RainFall inches	Losses inches	Excess inches	**Peak Flow** cfs	Time to Peak(hrs)	Volume ac-ft	Area sq.mi.
E	3.19	1.34	1.85	**4117***	4.42	348	3.54

*** Compared to 4143 cfs 100 year peak flow calculated by FEMA**

DRAINAGE AREA: **DESERT HILLS- (METHODOLOGY CHECK)**

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

THIS PROGRAM REPLACES ALL PREVIOUS VERSIONS OF HEC-1 KNOWN AS HEC1 (JAN 73), HEC1GS, HEC1DB, AND HEC1KW.

THE DEFINITIONS OF VARIABLES -RTIMP- AND -RTIOR- HAVE CHANGED FROM THOSE USED WITH THE 1973-STYLE INPUT STRUCTURE.
THE DEFINITION OF -AMSKK- ON RM-CARD WAS CHANGED WITH REVISIONS DATED 28 SEP 81. THIS IS THE FORTRAN77 VERSION
NEW OPTIONS: DAMBREAK OUTFLOW SUBMERGENCE , SINGLE EVENT DAMAGE CALCULATION, DSS:WRITE STAGE FREQUENCY,
DSS:READ TIME SERIES AT DESIRED CALCULATION INTERVAL LOSS RATE:GREEN AND AMPT INFILTRATION
KINEMATIC WAVE: NEW FINITE DIFFERENCE ALGORITHM

```
1                                          HEC-1 INPUT                                                    PAGE  1

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

            1           ID
            2           ID   DDM MCUHP1 DESHILLS
            3           IT       5                    300
            4           IO       3
                        * DDM    ***** Updated *****

            5           KK       E
            6           KM   SUB-BASIN E
            7           KM   6-HOUR RAINFALL, PATTERN NO. 2.20 WAS USED TO FIND TC & R FOR THIS BASIN
            8           KM   THIS BASIN USED RAINFALL REDUCTION FACTOR OF  .967
            9           KM     L = 4.28  Kb = .034  Adj. Slope =  183.0
           10           BA   3.544
           11           IN      15
           12           KM   RAINFALL DEPTH OF 3.30 WAS SPACIALLY REDUCED AS SHOWN BY THE PB RECORD
           13           PB   3.190
           14           KM   THE FOLLOWING PC RECORD USED A 6-HOUR STORM WITH A PATTERN No. OF 2.20
           15           PC    .000    .010    .017    .026    .037    .046    .056    .065    .075    .085
           16           PC    .097    .111    .131    .175    .263    .455    .689    .829    .893    .933
           17           PC    .949    .962    .975    .988   1.000
           18           LG    .350    .290   8.400    .070   3.000
           19           UC    .604    .329
           20           UA       0       3       5       8      12      20      43      75      90      96
           21           UA     100
           22           ZZ
1*************************************
*************************************
 *                                  *                                                  *
 *                                  *                                                  *
 *   FLOOD HYDROGRAPH PACKAGE  (HEC-1)  *                                              *   U.S. ARMY CORPS OF ENGINEERS
 *                                  *                                                  *
 *          SEPTEMBER 1990          *                                                  *   HYDROLOGIC ENGINEERING CENTER
 *                                  *                                                  *
 *           VERSION 4.0            *                                                  *        609 SECOND STREET
 *                                  *                                                  *
 *                                  *                                                  *      DAVIS, CALIFORNIA 95616
 *                                  *                                                  *
 *  RUN DATE  04/29/1996  TIME  14:29:11 *                                              *         (916) 756-1104
 *                                  *                                                  *
 *                                  *                                                  *
 *************************************
*************************************
```

```
                        DDM MCUHP1 DESHILLS

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

     IT          HYDROGRAPH TIME DATA
                        NMIN          5  MINUTES IN COMPUTATION INTERVAL
                       IDATE      1    0  STARTING DATE
                       ITIME       0000  STARTING TIME
                          NQ        300  NUMBER OF HYDROGRAPH ORDINATES
                      NDDATE      2    0  ENDING DATE
                      NDTIME       0055  ENDING TIME
                       ICENT         19  CENTURY MARK

                 COMPUTATION INTERVAL     .08 HOURS
                      TOTAL TIME BASE   24.92 HOURS

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

```
                TEMPERATURE          DEGREES FAHRENHEIT

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

              *************
              *           *
   5 KK       *     E     *
              *           *
              *************
                                SUB-BASIN E
                                6-HOUR RAINFALL, PATTERN NO. 2.20 WAS USED TO FIND TC & R FOR THIS BASIN
                                THIS BASIN USED RAINFALL REDUCTION FACTOR OF  .967
                                  L = 4.28  Kb = .034  Adj. Slope =  183.0
                                RAINFALL DEPTH OF 3.30 WAS SPACIALLY REDUCED AS SHOWN BY THE PB RECORD
                                THE FOLLOWING PC RECORD USED A 6-HOUR STORM WITH A PATTERN No. OF 2.20

   11 IN          TIME DATA FOR INPUT TIME SERIES
                        JXMIN          15  TIME INTERVAL IN MINUTES
                       JXDATE      1    0  STARTING DATE
                       JXTIME           0  STARTING TIME

                 SUBBASIN RUNOFF DATA

   10 BA          SUBBASIN CHARACTERISTICS
                        TAREA        3.54  SUBBASIN AREA

                  PRECIPITATION DATA

   14 PB                STORM        3.19  BASIN TOTAL PRECIPITATION

   14 PI            INCREMENTAL PRECIPITATION PATTERN
                        .00       .00       .00       .00       .00       .00       .00       .00       .00       .00
                        .00       .00       .00       .00       .00       .00       .00       .00       .00       .00
                        .00       .00       .00       .00       .00       .00       .00       .00       .00       .00
                        .00       .00       .00       .01       .01       .01       .01       .01       .01       .03
                        .03       .03       .06       .06       .06       .08       .08       .08       .05       .05
                        .05       .02       .02       .02       .01       .01       .01       .01       .01       .01
                        .00       .00       .00       .00       .00       .00       .00       .00       .00       .00
                        .00       .00

   18 LG          GREEN AND AMPT LOSS RATE
                       STRTL         .35  STARTING LOSS
                         DTH         .29  MOISTURE DEFICIT
                        PSIF        8.40  WETTING FRONT SUCTION
                       XKSAT         .07  HYDRAULIC CONDUCTIVITY
                       RTIMP        3.00  PERCENT IMPERVIOUS AREA

   19 UC          CLARK UNITGRAPH
                          TC         .60  TIME OF CONCENTRATION
                           R         .33  STORAGE COEFFICIENT

   20 UA          ACCUMULATED-AREA VS. TIME,  11 ORDINATES
                        .0       3.0       5.0       8.0      12.0      20.0      43.0      75.0      90.0      96.0
                     100.0
                                                                 ***
                                                   UNIT HYDROGRAPH PARAMETERS
                                            CLARK   TC=   .60 HR,       R=   .33 HR
                                           SNYDER   TP=   .50 HR,      CP=   .86

                                                    UNIT HYDROGRAPH
                                              26 END-OF-PERIOD ORDINATES
              116.      314.      532.     1173.     2718.     3950.     3891.     3274.     2580.     2000.
             1550.     1202.      932.      722.      560.      434.      336.      261.      202.      157.
              121.       94.       73.       57.       44.       34.

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

                        HYDROGRAPH AT STATION        E

    TOTAL RAINFALL =    3.19, TOTAL LOSS =    1.34, TOTAL EXCESS =    1.85

  PEAK FLOW     TIME                          MAXIMUM AVERAGE FLOW
                                     6-HR        24-HR       72-HR      24.92-HR
+   (CFS)       (HR)
                                   (CFS)
+   4117.       4.42                701.        175.        169.        169.
                                (INCHES)      1.838       1.839       1.839       1.839
                                (AC-FT)        347.        348.        348.        348.

                        CUMULATIVE AREA =    3.54 SQ MI
1
                                                   RUNOFF SUMMARY
                                          FLOW IN CUBIC FEET PER SECOND
                                        TIME IN HOURS,  AREA IN SQUARE MILES

                                     PEAK   TIME OF     AVERAGE FLOW FOR MAXIMUM PERIOD      BASIN     MAXIMUM     TIME OF
        OPERATION       STATION      FLOW    PEAK                                          AREA      STAGE     MAX STAGE
+                                                          6-HOUR     24-HOUR     72-HOUR

        HYDROGRAPH AT
+                           E       4117.    4.42          701.        175.        169.       3.54

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

DRAINAGE AREA NO. 1

DRAINAGE AREA: 1

(50 YEAR RAINFALL)

Discharge Summary of data in CF1-50.OUT

KK ID	RainFall inches	Losses inches	Excess inches	**Peak Flow** cfs	Time to Peak(hrs)	Volume ac-ft	Area sq.mi.
1	2.95	1.21	1.74	**589**	4.25	29	0.32

DRAINAGE AREA: 1

(50 Year Rainfall)

```
1*****************************************
*****************************************
 *                                      *                                          *
 *                                      *                                          *
 *   FLOOD HYDROGRAPH PACKAGE  (HEC-1)  *                                          *   U.S. ARMY CORPS OF ENGINEERS
 *                                      *                                          *
 *            SEPTEMBER 1990            *                                          *   HYDROLOGIC ENGINEERING CENTER
 *                                      *                                          *
 *             VERSION 4.0              *                                          *         609 SECOND STREET
 *                                      *                                          *
 *                                      *                                          *      DAVIS, CALIFORNIA 95616
 *                                      *                                          *
 *  RUN DATE  05/02/1996  TIME  14:39:42 *                                          *          (916) 756-1104
 *                                      *                                          *
 *                                      *                                          *
 *****************************************
*****************************************
```

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

THIS PROGRAM REPLACES ALL PREVIOUS VERSIONS OF HEC-1 KNOWN AS HEC1 (JAN 73), HEC1GS, HEC1DB, AND HEC1KW.

THE DEFINITIONS OF VARIABLES -RTIMP- AND -RTIOR- HAVE CHANGED FROM THOSE USED WITH THE 1973-STYLE INPUT STRUCTURE.
THE DEFINITION OF -AMSKK- ON RM-CARD WAS CHANGED WITH REVISIONS DATED 28 SEP 81. THIS IS THE FORTRAN77 VERSION
NEW OPTIONS: DAMBREAK OUTFLOW SUBMERGENCE , SINGLE EVENT DAMAGE CALCULATION, DSS:WRITE STAGE FREQUENCY,
DSS:READ TIME SERIES AT DESIRED CALCULATION INTERVAL LOSS RATE:GREEN AND AMPT INFILTRATION
KINEMATIC WAVE: NEW FINITE DIFFERENCE ALGORITHM

1 HEC-1 INPUT PAGE 1

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

  1           ID   DDM MCUHP1 CF1-50
  2           ID
  3           IT       5                    300
  4           IO       3
              * DDM   ***** Inserted *****

  5           KK       1
  6           KM   SUB-BASIN 1
  7           KM   6-HOUR RAINFALL, PATTERN NO. 1.00 WAS USED TO FIND TC & R FOR THIS BASIN
  8           KM   THIS BASIN USED RAINFALL REDUCTION FACTOR OF 1.000
  9           KM     L = 1.14  Kb = .048  Adj. Slope =   94.0
 10           BA    .319
 11           IN      15
 12           KM   RAINFALL DEPTH OF 2.95 WAS SPACIALLY REDUCED AS SHOWN BY THE PB RECORD
 13           PB   2.950
 14           KM   THE FOLLOWING PC RECORD USED A 6-HOUR STORM WITH A PATTERN No. OF 1.00
 15           PC    .000    .008    .016    .025    .033    .041    .050    .058    .066    .074
 16           PC    .087    .099    .118    .138    .216    .377    .834    .911    .931    .950
 17           PC    .962    .972    .983    .991   1.000
 18           LG    .350    .300   8.000    .080   4.000
 19           UC    .367    .259
 20           UA       0       3       5       8      12      20      43      75      90      96
 21           UA     100
 22           ZZ
```


```
1*****************************************
*****************************************
 *                                      *                                          *
 *                                      *                                          *
 *   FLOOD HYDROGRAPH PACKAGE  (HEC-1)  *                                          *   U.S. ARMY CORPS OF ENGINEERS
 *                                      *                                          *
 *            SEPTEMBER 1990            *                                          *   HYDROLOGIC ENGINEERING CENTER
 *                                      *                                          *
 *             VERSION 4.0              *                                          *         609 SECOND STREET
 *                                      *                                          *
 *                                      *                                          *      DAVIS, CALIFORNIA 95616
 *                                      *                                          *
 *  RUN DATE  05/02/1996  TIME  14:39:42 *                                          *          (916) 756-1104
 *                                      *                                          *
 *                                      *                                          *
 *****************************************
*****************************************
```

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

    IT          HYDROGRAPH TIME DATA
                       NMIN          5  MINUTES IN COMPUTATION INTERVAL
                      IDATE      1   0  STARTING DATE
                      ITIME       0000  STARTING TIME
                         NQ        300  NUMBER OF HYDROGRAPH ORDINATES
                     NDDATE      2   0  ENDING DATE
                     NDTIME       0055  ENDING TIME
                      ICENT         19  CENTURY MARK

                 COMPUTATION INTERVAL     .08 HOURS
                      TOTAL TIME BASE   24.92 HOURS

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


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

            *************
            *           *
  5 KK      *         1 *
            *           *
            *************
                          SUB-BASIN 1
                          6-HOUR RAINFALL, PATTERN NO. 1.00 WAS USED TO FIND TC & R FOR THIS BASIN
                          THIS BASIN USED RAINFALL REDUCTION FACTOR OF 1.000
                            L = 1.14  Kb = .048  Adj. Slope =   94.0
                          RAINFALL DEPTH OF 2.95 WAS SPACIALLY REDUCED AS SHOWN BY THE PB RECORD
                          THE FOLLOWING PC RECORD USED A 6-HOUR STORM WITH A PATTERN No. OF 1.00

 11 IN          TIME DATA FOR INPUT TIME SERIES
                      JXMIN         15  TIME INTERVAL IN MINUTES
                     JXDATE      1   0  STARTING DATE
                     JXTIME          0  STARTING TIME

              SUBBASIN RUNOFF DATA

 10 BA          SUBBASIN CHARACTERISTICS
                      TAREA        .32  SUBBASIN AREA

                PRECIPITATION DATA

 14 PB                STORM       2.95  BASIN TOTAL PRECIPITATION

 14 PI            INCREMENTAL PRECIPITATION PATTERN
                     .00       .00       .00       .00       .00       .00       .00       .00       .00       .00
                     .00       .00       .00       .00       .00       .00       .00       .00       .00       .00
                     .00       .00       .00       .00       .00       .00       .00       .00       .00       .00
                     .00       .00       .00       .01       .01       .01       .01       .01       .01       .03
                     .03       .03       .05       .05       .05       .15       .15       .15       .03       .03
                     .03       .01       .01       .01       .01       .01       .01       .00       .00       .00
                     .00       .00       .00       .00       .00       .00       .00       .00       .00       .00
                     .00       .00

 18 LG          GREEN AND AMPT LOSS RATE
                      STRTL        .35  STARTING LOSS
                        DTH        .30  MOISTURE DEFICIT
                       PSIF       8.00  WETTING FRONT SUCTION
                      XKSAT        .08  HYDRAULIC CONDUCTIVITY
                      RTIMP       4.00  PERCENT IMPERVIOUS AREA

 19 UC          CLARK UNITGRAPH
                         TC        .37  TIME OF CONCENTRATION
                          R        .26  STORAGE COEFFICIENT

 20 UA          ACCUMULATED-AREA VS. TIME,  11 ORDINATES
                        .0       3.0       5.0       8.0      12.0      20.0      43.0      75.0      90.0      96.0
                     100.0

                                                          ***

                                                   UNIT HYDROGRAPH PARAMETERS
                                            CLARK   TC=   .37 HR,      R=   .26 HR
                                           SNYDER   TP=   .32 HR,     CP=   .75

                                                     UNIT HYDROGRAPH
                                                 20 END-OF-PERIOD ORDINATES
                20.       70.      267.      467.      444.      333.      241.      174.      126.       91.
                66.       48.       34.       25.       18.       13.        9.        7.        5.        4.

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

                         HYDROGRAPH AT STATION        1

   TOTAL RAINFALL =    2.95, TOTAL LOSS =    1.21, TOTAL EXCESS =    1.74

PEAK FLOW     TIME                          MAXIMUM AVERAGE FLOW
                                      6-HR       24-HR       72-HR     24.92-HR
```

```
+   (CFS)        (HR)
                                  (CFS)
+    589.        4.25                      59.         15.         14.         14.
                                (INCHES)   1.728       1.729       1.729       1.729
                                 (AC-FT)    29.         29.         29.         29.

                                CUMULATIVE AREA =      .32 SQ MI

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

                                          PEAK   TIME OF    AVERAGE FLOW FOR MAXIMUM PERIOD      BASIN    MAXIMUM    TIME OF
        OPERATION          STATION        FLOW    PEAK                                          AREA     STAGE    MAX STAGE
+                                                                6-HOUR      24-HOUR     72-HOUR
        HYDROGRAPH AT
+                                1        589.    4.25          59.         15.         14.       .32

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

DRAINAGE AREA NO. G

DRAINAGE AREA: G

(50 YEAR RAINFALL)

Discharge Summary of data in CFG-50.OUT

KK ID	RainFall inches	Losses inches	Excess inches	**Peak Flow** cfs	Time to Peak(hrs)	Volume ac-ft	Area sq.mi.
G	2.95	1.14	1.81	**587**	4.42	46	0.48

DRAINAGE AREA: G

(50 YEAR RAINFALL)

```
1*************************************
*************************************
 *                                   *                                   *
 *                                   *                                   *
 *  FLOOD HYDROGRAPH PACKAGE  (HEC-1) *                                   *  U.S. ARMY CORPS OF ENGINEERS
 *                                   *                                   *
 *          SEPTEMBER 1990           *                                   *  HYDROLOGIC ENGINEERING CENTER
 *                                   *                                   *
 *           VERSION 4.0             *                                   *        609 SECOND STREET
 *                                   *                                   *
 *                                   *                                   *     DAVIS, CALIFORNIA 95616
 *                                   *                                   *
 * RUN DATE  05/03/1996  TIME  07:11:01 *                                 *         (916) 756-1104
 *                                   *                                   *
 *                                   *                                   *
 *************************************
*************************************
```

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

THIS PROGRAM REPLACES ALL PREVIOUS VERSIONS OF HEC-1 KNOWN AS HEC1 (JAN 73), HEC1GS, HEC1DB, AND HEC1KW.

THE DEFINITIONS OF VARIABLES -RTIMP- AND -RTIOR- HAVE CHANGED FROM THOSE USED WITH THE 1973-STYLE INPUT STRUCTURE.
THE DEFINITION OF -AMSKK- ON RM-CARD WAS CHANGED WITH REVISIONS DATED 28 SEP 81. THIS IS THE FORTRAN77 VERSION
NEW OPTIONS: DAMBREAK OUTFLOW SUBMERGENCE , SINGLE EVENT DAMAGE CALCULATION, DSS:WRITE STAGE FREQUENCY,
DSS:READ TIME SERIES AT DESIRED CALCULATION INTERVAL LOSS RATE:GREEN AND AMPT INFILTRATION
KINEMATIC WAVE: NEW FINITE DIFFERENCE ALGORITHM

```
1                                          HEC-1 INPUT                                                    PAGE  1

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

            1           ID
            2           ID   DDM MCUHP1 CFG-50
            3           IT       5                    300
            4           IO       3
                        * DDM    ***** Updated *****

            5           KK       G
            6           KM   SUB-BASIN G
            7           KM   6-HOUR RAINFALL, PATTERN NO. 1.00 WAS USED TO FIND TC & R FOR THIS BASIN
            8           KM   THIS BASIN USED RAINFALL REDUCTION FACTOR OF 1.000
            9           KM     L = 1.93  Kb = .046  Adj. Slope =   59.0
           10           BA    .481
           11           IN      15
           12           KM   RAINFALL DEPTH OF 2.95 WAS SPACIALLY REDUCED AS SHOWN BY THE PB RECORD
           13           PB   2.950
           14           KM   THE FOLLOWING PC RECORD USED A 6-HOUR STORM WITH A PATTERN No. OF 1.00
           15           PC    .000    .008    .016    .025    .033    .041    .050    .058    .066    .074
           16           PC    .087    .099    .118    .138    .216    .377    .834    .911    .931    .950
           17           PC    .962    .972    .983    .991   1.000
           18           LG    .350    .250   9.700    .050    .000
           19           UC    .613    .551
           20           UA      0       3       5       8      12      20      43      75      90      96
           21           UA    100
           22           ZZ
1*************************************
*************************************
 *                                   *                                   *
 *                                   *                                   *
 *  FLOOD HYDROGRAPH PACKAGE  (HEC-1) *                                   *  U.S. ARMY CORPS OF ENGINEERS
 *                                   *                                   *
 *          SEPTEMBER 1990           *                                   *  HYDROLOGIC ENGINEERING CENTER
 *                                   *                                   *
 *           VERSION 4.0             *                                   *        609 SECOND STREET
 *                                   *                                   *
 *                                   *                                   *     DAVIS, CALIFORNIA 95616
 *                                   *                                   *
 * RUN DATE  05/03/1996  TIME  07:11:01 *                                 *         (916) 756-1104
 *                                   *                                   *
 *                                   *                                   *
 *************************************
*************************************
```

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

    IT          HYDROGRAPH TIME DATA
                       NMIN           5  MINUTES IN COMPUTATION INTERVAL
                      IDATE      1    0  STARTING DATE
                      ITIME        0000  STARTING TIME
                         NQ         300  NUMBER OF HYDROGRAPH ORDINATES
                     NDDATE      2    0  ENDING DATE
                     NDTIME        0055  ENDING TIME
                      ICENT          19  CENTURY MARK

                 COMPUTATION INTERVAL     .08 HOURS
                      TOTAL TIME BASE   24.92 HOURS

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


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

            **************
            *            *
  5 KK      *         G  *
            *            *
            **************
                        SUB-BASIN G
                        6-HOUR RAINFALL, PATTERN NO. 1.00 WAS USED TO FIND TC & R FOR THIS BASIN
                        THIS BASIN USED RAINFALL REDUCTION FACTOR OF 1.000
                          L = 1.93  Kb = .046  Adj. Slope =   59.0
                        RAINFALL DEPTH OF 2.95 WAS SPACIALLY REDUCED AS SHOWN BY THE PB RECORD
                        THE FOLLOWING PC RECORD USED A 6-HOUR STORM WITH A PATTERN No. OF 1.00

 11 IN          TIME DATA FOR INPUT TIME SERIES
                      JXMIN          15  TIME INTERVAL IN MINUTES
                     JXDATE      1    0  STARTING DATE
                     JXTIME           0  STARTING TIME

              SUBBASIN RUNOFF DATA

 10 BA          SUBBASIN CHARACTERISTICS
                      TAREA         .48  SUBBASIN AREA

                PRECIPITATION DATA

 14 PB                STORM        2.95  BASIN TOTAL PRECIPITATION

 14 PI            INCREMENTAL PRECIPITATION PATTERN
                     .00       .00       .00       .00       .00       .00       .00       .00       .00       .00
                     .00       .00       .00       .00       .00       .00       .00       .00       .00       .00
                     .00       .00       .00       .00       .00       .00       .00       .00       .00       .00
                     .00       .00       .00       .01       .01       .01       .01       .01       .01       .03
                     .03       .03       .05       .05       .05       .15       .15       .15       .03       .03
                     .03       .01       .01       .01       .01       .01       .01       .00       .00       .00
                     .00       .00       .00       .00       .00       .00       .00       .00       .00       .00
                     .00       .00

 18 LG          GREEN AND AMPT LOSS RATE
                      STRTL         .35  STARTING LOSS
                        DTH         .25  MOISTURE DEFICIT
                       PSIF        9.70  WETTING FRONT SUCTION
                      XKSAT         .05  HYDRAULIC CONDUCTIVITY
                      RTIMP         .00  PERCENT IMPERVIOUS AREA

 19 UC          CLARK UNITGRAPH
                         TC         .61  TIME OF CONCENTRATION
                          R         .55  STORAGE COEFFICIENT

 20 UA          ACCUMULATED-AREA VS. TIME,  11 ORDINATES
                       .0       3.0       5.0       8.0      12.0      20.0      43.0      75.0      90.0      96.0
                    100.0

                                                   ***

                                                UNIT HYDROGRAPH PARAMETERS
                                         CLARK    TC=    .61 HR,       R=    .55 HR
                                        SNYDER    TP=    .54 HR,      CP=    .67

                                                UNIT HYDROGRAPH
                                            40 END-OF-PERIOD ORDINATES
              10.       27.       47.      100.      232.      359.      386.      355.      311.      267.
             229.      197.      169.      146.      125.      108.       92.       79.       68.       59.
              50.       43.       37.       32.       27.       24.       20.       17.       15.       13.
              11.       10.        8.        7.        6.        5.        4.        4.        3.        3.

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

                        HYDROGRAPH AT STATION        G

  TOTAL RAINFALL =    2.95, TOTAL LOSS =    1.14, TOTAL EXCESS =    1.81
```

	PEAK FLOW (CFS)	TIME (HR)		MAXIMUM AVERAGE FLOW 6-HR	24-HR	72-HR	24.92-HR
+	587.	4.42	(CFS)	93.	23.	23.	23.
			(INCHES)	1.806	1.806	1.806	1.806
			(AC-FT)	46.	46.	46.	46.

CUMULATIVE AREA = .48 SQ MI

1

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

+	OPERATION	STATION	PEAK FLOW	TIME OF PEAK	AVERAGE FLOW FOR MAXIMUM PERIOD 6-HOUR	24-HOUR	72-HOUR	BASIN AREA	MAXIMUM STAGE	TIME OF MAX STAGE
+	HYDROGRAPH AT	G	587.	4.42	93.	23.	23.	.48		

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

DRAINAGE AREA NO. H

DRAINAGE AREA: H

(50 YEAR RAINFALL)

Discharge Summary of data in CFH-50.OUT

KK ID	RainFall inches	Losses inches	Excess inches	**Peak Flow** cfs	Time to Peak(hrs)	Volume ac-ft	Area sq.mi.
H	2.95	0.87	2.08	**717**	4.25	45	0.41

DRAINAGE AREA: H

(50 YEAR RAINFALL)

```
1****************************************
****************************************
 *                                      *                                        *
 *                                      *                                        *
 *   FLOOD HYDROGRAPH PACKAGE  (HEC-1)  *                                        *   U.S. ARMY CORPS OF ENGINEERS
 *                                      *                                        *
 *            SEPTEMBER 1990            *                                        *   HYDROLOGIC ENGINEERING CENTER
 *                                      *                                        *
 *             VERSION 4.0              *                                        *         609 SECOND STREET
 *                                      *                                        *
 *                                      *                                        *       DAVIS, CALIFORNIA 95616
 *                                      *                                        *
 *  RUN DATE  05/02/1996  TIME  15:00:55 *                                        *          (916) 756-1104
 *                                      *                                        *
 *                                      *                                        *
 ****************************************
****************************************
```

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

THIS PROGRAM REPLACES ALL PREVIOUS VERSIONS OF HEC-1 KNOWN AS HEC1 (JAN 73), HEC1GS, HEC1DB, AND HEC1KW.

THE DEFINITIONS OF VARIABLES -RTIMP- AND -RTIOR- HAVE CHANGED FROM THOSE USED WITH THE 1973-STYLE INPUT STRUCTURE.
THE DEFINITION OF -AMSKK- ON RM-CARD WAS CHANGED WITH REVISIONS DATED 28 SEP 81. THIS IS THE FORTRAN77 VERSION
NEW OPTIONS: DAMBREAK OUTFLOW SUBMERGENCE , SINGLE EVENT DAMAGE CALCULATION, DSS:WRITE STAGE FREQUENCY,
DSS:READ TIME SERIES AT DESIRED CALCULATION INTERVAL LOSS RATE:GREEN AND AMPT INFILTRATION
KINEMATIC WAVE: NEW FINITE DIFFERENCE ALGORITHM

```
1                                                HEC-1 INPUT                                                    PAGE  1

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

             1          ID   DDM MCUHP1 CFH-50
             2          ID
             3          IT       5                     300
             4          IO       3
                        * DDM   ***** Inserted *****

             5          KK       H
             6          KM   SUB-BASIN H
             7          KM   6-HOUR RAINFALL, PATTERN NO. 1.00 WAS USED TO FIND TC & R FOR THIS BASIN
             8          KM   THIS BASIN USED RAINFALL REDUCTION FACTOR OF 1.000
             9          KM     L = 1.33  Kb = .047  Adj. Slope =   62.0
            10          BA    .405
            11          IN      15
            12          KM   RAINFALL DEPTH OF 2.95 WAS SPACIALLY REDUCED AS SHOWN BY THE PB RECORD
            13          PB   2.950
            14          KM   THE FOLLOWING PC RECORD USED A 6-HOUR STORM WITH A PATTERN No. OF 1.00
            15          PC    .000    .008    .016    .025    .033    .041    .050    .058    .066    .074
            16          PC    .087    .099    .118    .138    .216    .377    .834    .911    .931    .950
            17          PC    .962    .972    .983    .991   1.000
            18          LG    .350    .190  11.200    .020    .000
            19          UC    .458    .327
            20          UA       0       3       5       8      12      20      43      75      90      96
            21          UA     100
            22          ZZ
1****************************************
****************************************
 *                                      *                                        *
 *                                      *                                        *
 *   FLOOD HYDROGRAPH PACKAGE  (HEC-1)  *                                        *   U.S. ARMY CORPS OF ENGINEERS
 *                                      *                                        *
 *            SEPTEMBER 1990            *                                        *   HYDROLOGIC ENGINEERING CENTER
 *                                      *                                        *
 *             VERSION 4.0              *                                        *         609 SECOND STREET
 *                                      *                                        *
 *                                      *                                        *       DAVIS, CALIFORNIA 95616
 *                                      *                                        *
 *  RUN DATE  05/02/1996  TIME  15:00:55 *                                        *          (916) 756-1104
 *                                      *                                        *
 *                                      *                                        *
 ****************************************
****************************************
```

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

    IT          HYDROGRAPH TIME DATA
                       NMIN           5  MINUTES IN COMPUTATION INTERVAL
                      IDATE      1    0  STARTING DATE
                      ITIME        0000  STARTING TIME
                         NQ         300  NUMBER OF HYDROGRAPH ORDINATES
                     NDDATE      2    0  ENDING DATE
                     NDTIME       0055  ENDING TIME
                      ICENT          19  CENTURY MARK

                 COMPUTATION INTERVAL     .08 HOURS
                      TOTAL TIME BASE   24.92 HOURS

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


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

              *************
              *           *
  5 KK        *         H *
              *           *
              *************
                            SUB-BASIN H
                            6-HOUR RAINFALL, PATTERN NO. 1.00 WAS USED TO FIND TC & R FOR THIS BASIN
                            THIS BASIN USED RAINFALL REDUCTION FACTOR OF 1.000
                              L = 1.33  Kb = .047  Adj. Slope =   62.0
                            RAINFALL DEPTH OF 2.95 WAS SPACIALLY REDUCED AS SHOWN BY THE PB RECORD
                            THE FOLLOWING PC RECORD USED A 6-HOUR STORM WITH A PATTERN No. OF 1.00

 11 IN          TIME DATA FOR INPUT TIME SERIES
                      JXMIN          15  TIME INTERVAL IN MINUTES
                     JXDATE      1    0  STARTING DATE
                     JXTIME           0  STARTING TIME

              SUBBASIN RUNOFF DATA

 10 BA          SUBBASIN CHARACTERISTICS
                      TAREA         .41  SUBBASIN AREA

                PRECIPITATION DATA

 14 PB                STORM        2.95  BASIN TOTAL PRECIPITATION

 14 PI            INCREMENTAL PRECIPITATION PATTERN
                     .00       .00       .00       .00       .00       .00       .00       .00       .00       .00
                     .00       .00       .00       .00       .00       .00       .00       .00       .00       .00
                     .00       .00       .00       .00       .00       .00       .00       .00       .00       .00
                     .00       .00       .00       .01       .01       .01       .01       .01       .01       .03
                     .03       .03       .05       .05       .05       .15       .15       .15       .03       .03
                     .03       .01       .01       .01       .01       .01       .01       .00       .00       .00
                     .00       .00       .00       .00       .00       .00       .00       .00       .00       .00
                     .00       .00

 18 LG          GREEN AND AMPT LOSS RATE
                      STRTL         .35  STARTING LOSS
                        DTH         .19  MOISTURE DEFICIT
                       PSIF       11.20  WETTING FRONT SUCTION
                      XKSAT         .02  HYDRAULIC CONDUCTIVITY
                      RTIMP         .00  PERCENT IMPERVIOUS AREA

 19 UC          CLARK UNITGRAPH
                         TC         .46  TIME OF CONCENTRATION
                          R         .33  STORAGE COEFFICIENT

 20 UA          ACCUMULATED-AREA VS. TIME,  11 ORDINATES
                        .0       3.0       5.0       8.0      12.0      20.0      43.0      75.0      90.0      96.0
                     100.0

                                                          ***

                                                UNIT HYDROGRAPH PARAMETERS
                                          CLARK   TC=   .46 HR,       R=   .33 HR
                                         SNYDER   TP=   .40 HR,      CP=   .78

                                                   UNIT HYDROGRAPH
                                              25 END-OF-PERIOD ORDINATES
              16.       50.      131.      344.      500.      461.      369.      286.      221.      171.
             133.      103.       79.       61.       48.       37.       28.       22.       17.       13.
              10.        8.        6.        5.        4.

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

                     HYDROGRAPH AT STATION        H

  TOTAL RAINFALL =    2.95, TOTAL LOSS =     .87, TOTAL EXCESS =    2.08

PEAK FLOW     TIME                          MAXIMUM AVERAGE FLOW
```

```
+   (CFS)        (HR)                          6-HR        24-HR        72-HR      24.92-HR
                                   (CFS)
+    717.        4.25                           90.          23.          22.          22.
                                (INCHES)        2.070        2.070        2.070        2.070
                                 (AC-FT)         45.          45.          45.          45.

                              CUMULATIVE AREA =      .41 SQ MI

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

                                                PEAK   TIME OF    AVERAGE FLOW FOR MAXIMUM PERIOD      BASIN    MAXIMUM    TIME OF
          OPERATION          STATION           FLOW    PEAK                                          AREA     STAGE     MAX STAGE
+                                                                   6-HOUR      24-HOUR      72-HOUR

          HYDROGRAPH AT
+                                  H           717.    4.25          90.          23.          22.       .41

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

DRAINAGE AREA NO. L

DRAINAGE AREA: L

(50 YEAR RAINFALL)

Discharge Summary of data in CFL-50.OUT

KK ID	RainFall inches	Losses inches	Excess inches	**Peak Flow** cfs	Time to Peak(hrs)	Volume ac-ft	Area sq.mi.
L	2.91	0.88	2.03	**634**	4.50	60	0.56

DRAINAGE AREA: L

(50 YEAR RAINFALL)

```
1*************************************
*************************************
 *                                   *                                   *
 *                                   *                                   *
 *  FLOOD HYDROGRAPH PACKAGE  (HEC-1) *                                   *  U.S. ARMY CORPS OF ENGINEERS
 *                                   *                                   *
 *          SEPTEMBER 1990           *                                   *  HYDROLOGIC ENGINEERING CENTER
 *                                   *                                   *
 *           VERSION 4.0             *                                   *        609 SECOND STREET
 *                                   *                                   *
 *                                   *                                   *     DAVIS, CALIFORNIA 95616
 *                                   *                                   *
 * RUN DATE  05/02/1996  TIME  15:10:24 *                                *        (916) 756-1104
 *                                   *                                   *
 *                                   *                                   *
 *************************************
*************************************
```

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

THIS PROGRAM REPLACES ALL PREVIOUS VERSIONS OF HEC-1 KNOWN AS HEC1 (JAN 73), HEC1GS, HEC1DB, AND HEC1KW.

THE DEFINITIONS OF VARIABLES -RTIMP- AND -RTIOR- HAVE CHANGED FROM THOSE USED WITH THE 1973-STYLE INPUT STRUCTURE.
THE DEFINITION OF -AMSKK- ON RM-CARD WAS CHANGED WITH REVISIONS DATED 28 SEP 81. THIS IS THE FORTRAN77 VERSION
NEW OPTIONS: DAMBREAK OUTFLOW SUBMERGENCE , SINGLE EVENT DAMAGE CALCULATION, DSS:WRITE STAGE FREQUENCY,
DSS:READ TIME SERIES AT DESIRED CALCULATION INTERVAL LOSS RATE:GREEN AND AMPT INFILTRATION
KINEMATIC WAVE: NEW FINITE DIFFERENCE ALGORITHM

```
1                                          HEC-1 INPUT                                                    PAGE  1

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

             1          ID
             2          ID   DDM MCUHP1 CFL-50
             3          IT       5                    300
             4          IO       3
                        * DDM    ***** Updated *****

             5          KK       L
             6          KM   SUB-BASIN L
             7          KM   6-HOUR RAINFALL, PATTERN NO. 1.40 WAS USED TO FIND TC & R FOR THIS BASIN
             8          KM   THIS BASIN USED RAINFALL REDUCTION FACTOR OF  .987
             9          KM     L = 2.08  Kb = .045  Adj. Slope =   59.0
            10          BA    .560
            11          IN      15
            12          KM   RAINFALL DEPTH OF 2.95 WAS SPACIALLY REDUCED AS SHOWN BY THE PB RECORD
            13          PB   2.912
            14          KM   THE FOLLOWING PC RECORD USED A 6-HOUR STORM WITH A PATTERN No. OF 1.40
            15          PC    .000    .008    .016    .025    .033    .041    .050    .058    .066    .075
            16          PC    .087    .099    .119    .148    .230    .407    .778    .881    .919    .945
            17          PC    .957    .968    .980    .990   1.000
            18          LG    .350    .190  11.200    .020    .000
            19          UC    .650    .573
            20          UA       0       3       5       8      12      20      43      75      90      96
            21          UA     100
            22          ZZ
1*************************************
*************************************
 *                                   *                                   *
 *                                   *                                   *
 *  FLOOD HYDROGRAPH PACKAGE  (HEC-1) *                                   *  U.S. ARMY CORPS OF ENGINEERS
 *                                   *                                   *
 *          SEPTEMBER 1990           *                                   *  HYDROLOGIC ENGINEERING CENTER
 *                                   *                                   *
 *           VERSION 4.0             *                                   *        609 SECOND STREET
 *                                   *                                   *
 *                                   *                                   *     DAVIS, CALIFORNIA 95616
 *                                   *                                   *
 * RUN DATE  05/02/1996  TIME  15:10:24 *                                *        (916) 756-1104
 *                                   *                                   *
 *                                   *                                   *
 *************************************
*************************************
```

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

    IT          HYDROGRAPH TIME DATA
                       NMIN          5  MINUTES IN COMPUTATION INTERVAL
                      IDATE      1   0  STARTING DATE
                      ITIME       0000  STARTING TIME
                         NQ        300  NUMBER OF HYDROGRAPH ORDINATES
                    NDDATE      2   0  ENDING DATE
                    NDTIME       0055  ENDING TIME
                     ICENT         19  CENTURY MARK

                 COMPUTATION INTERVAL      .08 HOURS
                      TOTAL TIME BASE   24.92 HOURS

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


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

            **************
            *            *
  5 KK      *          L *
            *            *
            **************
                          SUB-BASIN L
                          6-HOUR RAINFALL, PATTERN NO. 1.40 WAS USED TO FIND TC & R FOR THIS BASIN
                          THIS BASIN USED RAINFALL REDUCTION FACTOR OF  .987
                            L = 2.08  Kb = .045  Adj. Slope =   59.0
                          RAINFALL DEPTH OF 2.95 WAS SPACIALLY REDUCED AS SHOWN BY THE PB RECORD
                          THE FOLLOWING PC RECORD USED A 6-HOUR STORM WITH A PATTERN No. OF 1.40

 11 IN          TIME DATA FOR INPUT TIME SERIES
                      JXMIN         15  TIME INTERVAL IN MINUTES
                     JXDATE      1   0  STARTING DATE
                     JXTIME          0  STARTING TIME

               SUBBASIN RUNOFF DATA

 10 BA          SUBBASIN CHARACTERISTICS
                      TAREA        .56  SUBBASIN AREA

                PRECIPITATION DATA

 14 PB                STORM       2.91  BASIN TOTAL PRECIPITATION

 14 PI            INCREMENTAL PRECIPITATION PATTERN
                     .00       .00       .00       .00       .00       .00       .00       .00       .00       .00
                     .00       .00       .00       .00       .00       .00       .00       .00       .00       .00
                     .00       .00       .00       .00       .00       .00       .00       .00       .00       .00
                     .00       .00       .00       .01       .01       .01       .01       .01       .01       .03
                     .03       .03       .06       .06       .06       .12       .12       .12       .03       .03
                     .03       .01       .01       .01       .01       .01       .01       .00       .00       .00
                     .00       .00       .00       .00       .00       .00       .00       .00       .00       .00
                     .00       .00

 18 LG          GREEN AND AMPT LOSS RATE
                      STRTL        .35  STARTING LOSS
                        DTH        .19  MOISTURE DEFICIT
                       PSIF      11.20  WETTING FRONT SUCTION
                      XKSAT        .02  HYDRAULIC CONDUCTIVITY
                      RTIMP        .00  PERCENT IMPERVIOUS AREA

 19 UC          CLARK UNITGRAPH
                         TC        .65  TIME OF CONCENTRATION
                          R        .57  STORAGE COEFFICIENT

 20 UA          ACCUMULATED-AREA VS. TIME,  11 ORDINATES
                     .0       3.0       5.0       8.0      12.0      20.0      43.0      75.0      90.0      96.0
                  100.0

                                                   ***

                                                UNIT HYDROGRAPH PARAMETERS
                                         CLARK   TC=   .65 HR,      R=   .57 HR
                                        SNYDER   TP=   .58 HR,     CP=   .68

                                                UNIT HYDROGRAPH
                                            42 END-OF-PERIOD ORDINATES
              10.       29.       48.       89.      209.      364.      431.      416.      372.      321.
             278.      240.      207.      179.      155.      134.      116.      100.       87.       75.
              65.       56.       48.       42.       36.       31.       27.       23.       20.       17.
              15.       13.       11.       10.        8.        7.        6.        5.        5.        4.
               4.        3.

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

                     HYDROGRAPH AT STATION        L

  TOTAL RAINFALL =    2.91, TOTAL LOSS =     .88, TOTAL EXCESS =    2.03
```

	PEAK FLOW (CFS)	TIME (HR)		MAXIMUM AVERAGE FLOW 6-HR	24-HR	72-HR	24.92-HR
+	634.	4.50	(CFS)	122.	30.	29.	29.
			(INCHES)	2.024	2.024	2.024	2.024
			(AC-FT)	60.	60.	60.	60.

CUMULATIVE AREA = .56 SQ MI

1

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

	OPERATION	STATION	PEAK FLOW	TIME OF PEAK	AVERAGE FLOW FOR MAXIMUM PERIOD 6-HOUR	24-HOUR	72-HOUR	BASIN AREA	MAXIMUM STAGE	TIME OF MAX STAGE
+	HYDROGRAPH AT	L	634.	4.50	122.	30.	29.	.56		

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

DRAINAGE AREA NO. N

DRAINAGE AREA: N

(50 YEAR RAINFALL)

Discharge Summary of data in CFN-50.OUT

KK ID	RainFall inches	Losses inches	Excess inches	**Peak Flow** cfs	Time to Peak(hrs)	Volume ac-ft	Area sq.mi.
N	2.91	1.12	1.79	**1244**	4.42	91	0.96

DRAINAGE AREA: **N**

(50 YEAR RAINFALL)

```
1*************************************
**************************************
 *                                   *                                   *
 *                                   *                                   *
 *  FLOOD HYDROGRAPH PACKAGE  (HEC-1) *                                   *  U.S. ARMY CORPS OF ENGINEERS
 *                                   *                                   *
 *          SEPTEMBER 1990           *                                   *  HYDROLOGIC ENGINEERING CENTER
 *                                   *                                   *
 *           VERSION 4.0             *                                   *        609 SECOND STREET
 *                                   *                                   *
 *                                   *                                   *     DAVIS, CALIFORNIA 95616
 *                                   *                                   *
 * RUN DATE  05/02/1996  TIME  15:13:36 *                                *        (916) 756-1104
 *                                   *                                   *
 *                                   *                                   *
 *************************************
**************************************
```

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

THIS PROGRAM REPLACES ALL PREVIOUS VERSIONS OF HEC-1 KNOWN AS HEC1 (JAN 73), HEC1GS, HEC1DB, AND HEC1KW.

THE DEFINITIONS OF VARIABLES -RTIMP- AND -RTIOR- HAVE CHANGED FROM THOSE USED WITH THE 1973-STYLE INPUT STRUCTURE.
THE DEFINITION OF -AMSKK- ON RM-CARD WAS CHANGED WITH REVISIONS DATED 28 SEP 81. THIS IS THE FORTRAN77 VERSION
NEW OPTIONS: DAMBREAK OUTFLOW SUBMERGENCE , SINGLE EVENT DAMAGE CALCULATION, DSS:WRITE STAGE FREQUENCY,
DSS:READ TIME SERIES AT DESIRED CALCULATION INTERVAL LOSS RATE:GREEN AND AMPT INFILTRATION
KINEMATIC WAVE: NEW FINITE DIFFERENCE ALGORITHM

```
1                                                HEC-1 INPUT                                                    PAGE  1

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

            1           ID   DDM MCUHP1 CFN-50
            2           ID
            3           IT       5                     300
            4           IO       3
                        * DDM   ***** Inserted *****

            5           KK       N
            6           KM   SUB-BASIN N
            7           KM   6-HOUR RAINFALL, PATTERN NO. 1.40 WAS USED TO FIND TC & R FOR THIS BASIN
            8           KM   THIS BASIN USED RAINFALL REDUCTION FACTOR OF  .987
            9           KM     L = 2.29  Kb = .042  Adj. Slope =   93.0
           10           BA    .959
           11           IN      15
           12           KM   RAINFALL DEPTH OF 2.95 WAS SPACIALLY REDUCED AS SHOWN BY THE PB RECORD
           13           PB   2.912
           14           KM   THE FOLLOWING PC RECORD USED A 6-HOUR STORM WITH A PATTERN No. OF 1.40
           15           PC    .000    .008    .016    .025    .033    .041    .050    .058    .066    .075
           16           PC    .087    .099    .119    .148    .230    .407    .778    .881    .919    .945
           17           PC    .957    .968    .980    .990   1.000
           18           LG    .350    .250   9.700    .050   4.000
           19           UC    .567    .391
           20           UA       0       3       5       8      12      20      43      75      90      96
           21           UA     100
           22           ZZ
1*************************************
**************************************
 *                                   *                                   *
 *                                   *                                   *
 *  FLOOD HYDROGRAPH PACKAGE  (HEC-1) *                                   *  U.S. ARMY CORPS OF ENGINEERS
 *                                   *                                   *
 *          SEPTEMBER 1990           *                                   *  HYDROLOGIC ENGINEERING CENTER
 *                                   *                                   *
 *           VERSION 4.0             *                                   *        609 SECOND STREET
 *                                   *                                   *
 *                                   *                                   *     DAVIS, CALIFORNIA 95616
 *                                   *                                   *
 * RUN DATE  05/02/1996  TIME  15:13:36 *                                *        (916) 756-1104
 *                                   *                                   *
 *                                   *                                   *
 *************************************
**************************************
```

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

    IT          HYDROGRAPH TIME DATA
                       NMIN           5  MINUTES IN COMPUTATION INTERVAL
                      IDATE      1    0  STARTING DATE
                      ITIME        0000  STARTING TIME
                         NQ         300  NUMBER OF HYDROGRAPH ORDINATES
                     NDDATE      2    0  ENDING DATE
                     NDTIME        0055  ENDING TIME
                      ICENT          19  CENTURY MARK

                 COMPUTATION INTERVAL     .08 HOURS
                      TOTAL TIME BASE   24.92 HOURS

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


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

            **************
            *            *
  5 KK      *        N   *
            *            *
            **************
                        SUB-BASIN N
                        6-HOUR RAINFALL, PATTERN NO. 1.40 WAS USED TO FIND TC & R FOR THIS BASIN
                        THIS BASIN USED RAINFALL REDUCTION FACTOR OF  .987
                          L = 2.29  Kb = .042  Adj. Slope =   93.0
                        RAINFALL DEPTH OF 2.95 WAS SPACIALLY REDUCED AS SHOWN BY THE PB RECORD
                        THE FOLLOWING PC RECORD USED A 6-HOUR STORM WITH A PATTERN No. OF 1.40

 11 IN          TIME DATA FOR INPUT TIME SERIES
                      JXMIN          15  TIME INTERVAL IN MINUTES
                     JXDATE      1    0  STARTING DATE
                     JXTIME           0  STARTING TIME

               SUBBASIN RUNOFF DATA

 10 BA          SUBBASIN CHARACTERISTICS
                      TAREA         .96  SUBBASIN AREA

                PRECIPITATION DATA

 14 PB                STORM        2.91  BASIN TOTAL PRECIPITATION

 14 PI            INCREMENTAL PRECIPITATION PATTERN
                     .00       .00       .00       .00       .00       .00       .00       .00       .00
                     .00       .00       .00       .00       .00       .00       .00       .00       .00
                     .00       .00       .00       .00       .00       .00       .00       .00       .00
                     .00       .00       .00       .01       .01       .01       .01       .01       .03
                     .03       .03       .06       .06       .06       .12       .12       .12       .03
                     .03       .01       .01       .01       .01       .01       .01       .00       .00
                     .00       .00       .00       .00       .00       .00       .00       .00       .00
                     .00       .00

 18 LG          GREEN AND AMPT LOSS RATE
                      STRTL         .35  STARTING LOSS
                        DTH         .25  MOISTURE DEFICIT
                       PSIF        9.70  WETTING FRONT SUCTION
                      XKSAT         .05  HYDRAULIC CONDUCTIVITY
                      RTIMP        4.00  PERCENT IMPERVIOUS AREA

 19 UC          CLARK UNITGRAPH
                         TC         .57  TIME OF CONCENTRATION
                          R         .39  STORAGE COEFFICIENT

 20 UA          ACCUMULATED-AREA VS. TIME,  11 ORDINATES
                       .0       3.0       5.0       8.0      12.0      20.0      43.0      75.0      90.0      96.0
                    100.0

                                                          ***

                                                UNIT HYDROGRAPH PARAMETERS
                                          CLARK   TC=   .57 HR,       R=   .39 HR
                                         SNYDER   TP=   .49 HR,      CP=   .79

                                                   UNIT HYDROGRAPH
                                             30 END-OF-PERIOD ORDINATES
              28.       79.      145.      348.      746.      993.      943.      798.      644.      520.
             420.      339.      274.      221.      179.      144.      116.       94.       76.       61.
              49.       40.       32.       26.       21.       17.       14.       11.        9.        7.

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

                        HYDROGRAPH AT STATION        N

   TOTAL RAINFALL =    2.91, TOTAL LOSS =    1.12, TOTAL EXCESS =    1.79

PEAK FLOW     TIME                          MAXIMUM AVERAGE FLOW
```

```
                                        6-HR        24-HR       72-HR     24.92-HR
+   (CFS)       (HR)
                                 (CFS)
+    1244.      4.42                  184.         46.         44.         44.
                             (INCHES)  1.782       1.783       1.783       1.783
                             (AC-FT)    91.         91.         91.         91.

                         CUMULATIVE AREA =      .96 SQ MI

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

                                     PEAK   TIME OF    AVERAGE FLOW FOR MAXIMUM PERIOD      BASIN    MAXIMUM    TIME OF
        OPERATION        STATION     FLOW    PEAK                                          AREA     STAGE     MAX STAGE
+                                                        6-HOUR      24-HOUR     72-HOUR

        HYDROGRAPH AT
+                            N      1244.    4.42         184.         46.         44.       .96

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

DRAINAGE AREA NO. 26

DRAINAGE AREA: 26

(50 YEAR RAINFALL)

Discharge Summary of data in CF26-50.OUT

KK ID	RainFall inches	Losses inches	Excess inches	**Peak Flow** cfs	Time to Peak(hrs)	Volume ac-ft	Area sq.mi.
26	2.91	1.29	1.62	**536**	4.50	51	0.60

DRAINAGE AREA: **26**

(50 YEAR RAINFALL)

```
1*************************************
*************************************
 *                                   *                                   *
 *                                   *                                   *
 *  FLOOD HYDROGRAPH PACKAGE  (HEC-1) *                                   *  U.S. ARMY CORPS OF ENGINEERS
 *                                   *                                   *
 *          SEPTEMBER 1990           *                                   *  HYDROLOGIC ENGINEERING CENTER
 *                                   *                                   *
 *           VERSION 4.0             *                                   *        609 SECOND STREET
 *                                   *                                   *
 *                                   *                                   *     DAVIS, CALIFORNIA 95616
 *                                   *                                   *
 * RUN DATE  05/02/1996  TIME  15:33:17 *                                 *        (916) 756-1104
 *                                   *                                   *
 *                                   *                                   *
 *************************************
*************************************
```

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

THIS PROGRAM REPLACES ALL PREVIOUS VERSIONS OF HEC-1 KNOWN AS HEC1 (JAN 73), HEC1GS, HEC1DB, AND HEC1KW.

THE DEFINITIONS OF VARIABLES -RTIMP- AND -RTIOR- HAVE CHANGED FROM THOSE USED WITH THE 1973-STYLE INPUT STRUCTURE.
THE DEFINITION OF -AMSKK- ON RM-CARD WAS CHANGED WITH REVISIONS DATED 28 SEP 81. THIS IS THE FORTRAN77 VERSION
NEW OPTIONS: DAMBREAK OUTFLOW SUBMERGENCE , SINGLE EVENT DAMAGE CALCULATION, DSS:WRITE STAGE FREQUENCY,
DSS:READ TIME SERIES AT DESIRED CALCULATION INTERVAL LOSS RATE:GREEN AND AMPT INFILTRATION
KINEMATIC WAVE: NEW FINITE DIFFERENCE ALGORITHM

1 HEC-1 INPUT PAGE 1

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

  1           ID
  2           ID   DDM MCUHP1 CF26-50
  3           IT       5                    300
  4           IO       3
              * DDM   ***** Updated *****

  5           KK      26
  6           KM   SUB-BASIN 26
  7           KM   6-HOUR RAINFALL, PATTERN NO. 1.40 WAS USED TO FIND TC & R FOR THIS BASIN
  8           KM   THIS BASIN USED RAINFALL REDUCTION FACTOR OF  .987
  9           KM     L = 2.75  Kb = .044  Adj. Slope =  107.0
 10           BA    .597
 11           IN      15
 12           KM   RAINFALL DEPTH OF 2.95 WAS SPACIALLY REDUCED AS SHOWN BY THE PB RECORD
 13           PB   2.912
 14           KM   THE FOLLOWING PC RECORD USED A 6-HOUR STORM WITH A PATTERN No. OF 1.40
 15           PC    .000    .008    .016    .025    .033    .041    .050    .058    .066    .075
 16           PC    .087    .099    .119    .148    .230    .407    .778    .881    .919    .945
 17           PC    .957    .968    .980    .990   1.000
 18           LG    .350    .290   8.400    .070    .000
 19           UC    .637    .677
 20           UA       0       3       5       8      12      20      43      75      90      96
 21           UA     100
 22           ZZ
```


```
1*************************************
*************************************
 *                                   *                                   *
 *                                   *                                   *
 *  FLOOD HYDROGRAPH PACKAGE  (HEC-1) *                                   *  U.S. ARMY CORPS OF ENGINEERS
 *                                   *                                   *
 *          SEPTEMBER 1990           *                                   *  HYDROLOGIC ENGINEERING CENTER
 *                                   *                                   *
 *           VERSION 4.0             *                                   *        609 SECOND STREET
 *                                   *                                   *
 *                                   *                                   *     DAVIS, CALIFORNIA 95616
 *                                   *                                   *
 * RUN DATE  05/02/1996  TIME  15:33:17 *                                 *        (916) 756-1104
 *                                   *                                   *
 *                                   *                                   *
 *************************************
*************************************
```

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

    IT          HYDROGRAPH TIME DATA
                       NMIN          5  MINUTES IN COMPUTATION INTERVAL
                      IDATE      1   0  STARTING DATE
                      ITIME       0000  STARTING TIME
                         NQ        300  NUMBER OF HYDROGRAPH ORDINATES
                     NDDATE      2   0  ENDING DATE
                     NDTIME       0055  ENDING TIME
                      ICENT         19  CENTURY MARK

                 COMPUTATION INTERVAL     .08 HOURS
                      TOTAL TIME BASE   24.92 HOURS

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


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

            *************
            *           *
  5 KK      *        26 *
            *           *
            *************
                          SUB-BASIN 26
                          6-HOUR RAINFALL, PATTERN NO. 1.40 WAS USED TO FIND TC & R FOR THIS BASIN
                          THIS BASIN USED RAINFALL REDUCTION FACTOR OF  .987
                            L = 2.75  Kb = .044  Adj. Slope =  107.0
                          RAINFALL DEPTH OF 2.95 WAS SPACIALLY REDUCED AS SHOWN BY THE PB RECORD
                          THE FOLLOWING PC RECORD USED A 6-HOUR STORM WITH A PATTERN No. OF 1.40

 11 IN          TIME DATA FOR INPUT TIME SERIES
                      JXMIN         15  TIME INTERVAL IN MINUTES
                     JXDATE      1   0  STARTING DATE
                     JXTIME          0  STARTING TIME

               SUBBASIN RUNOFF DATA

 10 BA          SUBBASIN CHARACTERISTICS
                      TAREA        .60  SUBBASIN AREA

                PRECIPITATION DATA

 14 PB                STORM       2.91  BASIN TOTAL PRECIPITATION

 14 PI            INCREMENTAL PRECIPITATION PATTERN
                     .00       .00       .00       .00       .00       .00       .00       .00       .00       .00
                     .00       .00       .00       .00       .00       .00       .00       .00       .00       .00
                     .00       .00       .00       .00       .00       .00       .00       .00       .00       .00
                     .00       .00       .00       .01       .01       .01       .01       .01       .01       .03
                     .03       .03       .06       .06       .06       .12       .12       .12       .03       .03
                     .03       .01       .01       .01       .01       .01       .01       .00       .00       .00
                     .00       .00       .00       .00       .00       .00       .00       .00       .00       .00
                     .00       .00

 18 LG          GREEN AND AMPT LOSS RATE
                     STRTL        .35  STARTING LOSS
                       DTH        .29  MOISTURE DEFICIT
                      PSIF       8.40  WETTING FRONT SUCTION
                     XKSAT        .07  HYDRAULIC CONDUCTIVITY
                     RTIMP        .00  PERCENT IMPERVIOUS AREA

 19 UC          CLARK UNITGRAPH
                        TC        .64  TIME OF CONCENTRATION
                         R        .68  STORAGE COEFFICIENT

 20 UA          ACCUMULATED-AREA VS. TIME,  11 ORDINATES
                       .0       3.0       5.0       8.0      12.0      20.0      43.0      75.0      90.0      96.0
                    100.0

                                                   ***

                                                UNIT HYDROGRAPH PARAMETERS
                                         CLARK   TC=   .64 HR,       R=   .68 HR
                                        SNYDER   TP=   .58 HR,      CP=   .61

                                                UNIT HYDROGRAPH
                                           48 END-OF-PERIOD ORDINATES
            10.       27.       45.       90.      210.      353.      409.      394.      358.      316.
           280.      247.      219.      193.      171.      151.      133.      118.      104.       92.
            82.       72.       64.       56.       50.       44.       39.       34.       30.       27.
            24.       21.       19.       16.       15.       13.       11.       10.        9.        8.
             7.        6.        5.        5.        4.        4.        3.        3.

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

                     HYDROGRAPH AT STATION       26

  TOTAL RAINFALL =    2.91. TOTAL LOSS =    1.29. TOTAL EXCESS =    1.62
```

PEAK FLOW (CFS)	TIME (HR)		MAXIMUM AVERAGE FLOW 6-HR	24-HR	72-HR	24.92-HR
+		(CFS)				
+ 536.	4.50		103.	26.	25.	25.
		(INCHES)	1.611	1.611	1.611	1.611
		(AC-FT)	51.	51.	51.	51.

CUMULATIVE AREA = .60 SQ MI

1

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

+	OPERATION	STATION	PEAK FLOW	TIME OF PEAK	AVERAGE FLOW FOR MAXIMUM PERIOD 6-HOUR	24-HOUR	72-HOUR	BASIN AREA	MAXIMUM STAGE	TIME OF MAX STAGE
+	HYDROGRAPH AT	26	536.	4.50	103.	26.	25.	.60		

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

APPENDIX C

HY-8 CALCULATIONS- EXISTING CULVERTS

CULVERT NO. 1

CURRENT DATE: 04-16-1996 FILE DATE: 04-16-1996
CURRENT TIME: 09:00:45 FILE NAME: CULV1

FHWA CULVERT ANALYSIS
HY-8, VERSION 4.0

CULV #	SITE DATA: INLET ELEV. (FT)	OUTLET ELEV. (FT)	CULVERT LENGTH (FT)	CULVERT SHAPE, MATERIAL, INLET: BARRELS SHAPE MATERIAL	SPAN (FT)	RISE (FT)	MANNING n	INLET TYPE
1	1792.19	1789.99	50.44	1 CSP	3.00	3.00	.024	CONVENTIONAL
2								
3								
4								
5								
6								

SUMMARY OF CULVERT FLOWS (CFS) FILE: CULV1 DATE: 04-16-1996

ELEV (FT)	TOTAL	1	2	3	4	5	6	ROADWAY	ITR
1792.19	0	0	0	0	0	0	0	0	1
1793.05	4	4	0	0	0	0	0	0	1
1793.37	7	7	0	0	0	0	0	0	1
1793.66	11	11	0	0	0	0	0	0	1
1793.93	14	14	0	0	0	0	0	0	1
1794.18	18	18	0	0	0	0	0	0	1
1794.42	21	21	0	0	0	0	0	0	1
1794.66	25	25	0	0	0	0	0	0	1
1794.70	25	25	0	0	0	0	0	0	1
1794.97	32	29	0	0	0	0	0	2	9
1795.02	35	30	0	0	0	0	0	5	5
1794.89	28	28	0	0	0	0	0	OVERTOPPING	

SUMMARY OF ITERATIVE SOLUTION ERRORS FILE: CULV1 DATE: 04-16-1996

HEAD ELEV(FT)	HEAD ERROR(FT)	TOTAL FLOW(CFS)	FLOW ERROR(CFS)	% FLOW ERROR
1792.19	0.00	0	0	0.00
1793.05	0.00	4	0	0.00
1793.37	0.00	7	0	0.00
1793.66	0.00	11	0	0.00
1793.93	0.00	14	0	0.00
1794.18	0.00	18	0	0.00
1794.42	0.00	21	0	0.00
1794.66	0.00	25	0	0.00
1794.70	0.00	25	0	0.00
1794.97	-0.00	32	0	0.64
1795.02	-0.00	35	0	0.52

<1> TOLERANCE (FT) = 0.010 <2> TOLERANCE (%) = 1.000

CURRENT DATE: 04-16-1996 FILE DATE: 04-16-1996
CURRENT TIME: 09:00:45 FILE NAME: CULV1

PERFORMANCE CURVE FOR CULVERT # 1 - 1 (3 BY 3) CSP

CHARGE FLOW (cfs)	WATER ELEV. (ft)	DIS-CONTROL DEPTH (ft)	HEAD-CONTROL DEPTH (ft)	FLOW TYPE <F4>	INLET NORMAL DEPTH (ft)	OUTLET CRITICAL DEPTH (ft)	OUTLET VEL. (fps)	OUTLET DEPTH (ft)	TAILWATER VEL. (fps)	TAILWATER DEPTH (ft)
0	1792.19	0.00	0.00	0-NF	0.00	0.00	0.00	0.00	0.00	0.00
4	1793.05	0.86	0.86	1-S2n	0.41	0.58	5.73	0.41	1.90	0.26
7	1793.37	1.18	1.18	1-S2n	0.61	0.82	6.76	0.61	2.43	0.39
11	1793.66	1.47	1.47	1-S2n	0.74	1.02	7.64	0.74	2.80	0.49
14	1793.93	1.74	1.74	1-S2n	0.87	1.19	8.20	0.87	3.09	0.58
18	1794.18	1.99	1.99	1-S2n	0.98	1.33	8.64	0.98	3.32	0.66
21	1794.42	2.23	2.23	1-S2n	1.07	1.47	9.21	1.07	3.53	0.74
25	1794.66	2.47	2.47	1-S2n	1.17	1.59	9.57	1.17	3.71	0.81
25	1794.70	2.51	2.51	1-S2n	1.19	1.61	9.61	1.19	3.73	0.81
29	1794.96	2.77	2.77	1-S2n	1.28	1.73	10.00	1.28	4.02	0.93
30	1795.01	2.82	2.82	1-S2n	1.30	1.76	9.93	1.31	4.15	0.99

El. inlet face invert 1792.19 ft El. outlet invert 1789.99 ft
El. inlet throat invert 0.00 ft El. inlet crest 0.00 ft

***** SITE DATA ***** CULVERT INVERT **********

INLET STATION (FT)	2000.00
INLET ELEVATION (FT)	1792.19
OUTLET STATION (FT)	2050.39
OUTLET ELEVATION (FT)	1789.99
NUMBER OF BARRELS	1
SLOPE (V-FT/H-FT)	0.0437
CULVERT LENGTH ALONG SLOPE (FT)	50.44

***** CULVERT DATA SUMMARY **********

BARREL SHAPE	CIRCULAR
BARREL DIAMETER	3.00 FT
BARREL MATERIAL	CORRUGATED STEEL
BARREL MANNING'S N	0.024
INLET TYPE	CONVENTIONAL
INLET EDGE AND WALL	THIN EDGE PROJECTING
INLET DEPRESSION	NONE

CURRENT DATE: 04-16-1996 FILE DATE: 04-16-1996
CURRENT TIME: 09:00:45 FILE NAME: CULV1

++

++++++++++++++++++++++++++ TAILWATER ++++++++++++++++++++++++++

++

******* REGULAR CHANNEL CROSS SECTION ****************

BOTTOM WIDTH (FT)	6.59
SIDE SLOPE H/V (X:1)	2.0
CHANNEL SLOPE V/H (FT/FT)	0.010
MANNING'S N (.01-0.1)	0.030
CHANNEL INVERT ELEVATION (FT)	1789.99
CULVERT NO.1 OUTLET INVERT ELEVATION	1789.99 FT

******* UNIFORM FLOW RATING CURVE FOR DOWNSTREAM CHANNEL

FLOW (CFS)	W.S.E. (FT)	FROUDE NUMBER	DEPTH (FT)	VEL. (FPS)	SHEAR (PSF)
0.00	1789.99	0.000	0.00	0.00	0.00
3.50	1790.25	0.658	0.26	1.90	0.16
7.00	1790.38	0.687	0.39	2.43	0.24
10.50	1790.48	0.702	0.49	2.80	0.31
14.00	1790.57	0.712	0.58	3.09	0.36
17.50	1790.65	0.718	0.66	3.32	0.41
21.00	1790.73	0.724	0.74	3.53	0.46
24.50	1790.80	0.728	0.81	3.71	0.50
25.00	1790.80	0.729	0.81	3.73	0.51
31.50	1790.92	0.734	0.93	4.02	0.58
35.00	1790.98	0.737	0.99	4.15	0.61

++

++++++++++++++++++++++ ROADWAY OVERTOPPING DATA ++++++++++++++++++++++++

++

ROADWAY SURFACE	PAVED
EMBANKMENT TOP WIDTH (FT)	40.00
CREST LENGTH (FT)	40.00
OVERTOPPING CREST ELEVATION (FT)	1794.89

++

CULVERT NO. 6

CURRENT DATE: 05-31-1996
CURRENT TIME: 14:00:12

FILE DATE: 05-06-1996
FILE NAME: C6

FHWA CULVERT ANALYSIS
HY-8, VERSION 4.0

CULV #	SITE DATA: INLET ELEV. (FT)	OUTLET ELEV. (FT)	CULVERT LENGTH (FT)	CULVERT SHAPE, MATERIAL, INLET: BARRELS SHAPE MATERIAL	SPAN (FT)	RISE (FT)	MANNING n	INLET TYPE
1	1773.95	1773.73	82.48	1 CSP	2.00	2.00	.024	CONVENTIONAL
2								
3								
4								
5								
6								

SUMMARY OF CULVERT FLOWS (CFS) FILE: C6 DATE: 05-06-1996

ELEV (FT)	TOTAL	1	2	3	4	5	6	ROADWAY	ITR
1773.95	0	0	0	0	0	0	0	0	1
1780.05	35	23	0	0	0	0	0	12	12
1780.32	70	24	0	0	0	0	0	46	5
1780.53	105	24	0	0	0	0	0	80	4
1780.70	140	25	0	0	0	0	0	114	3
1780.86	175	25	0	0	0	0	0	149	3
1781.01	210	25	0	0	0	0	0	184	3
1781.15	245	26	0	0	0	0	0	219	3
1781.28	280	26	0	0	0	0	0	253	3
1781.35	300	26	0	0	0	0	0	274	3
1781.53	350	26	0	0	0	0	0	323	3
1779.87	23	23	0	0	0	0	0	OVERTOPPING	

SUMMARY OF ITERATIVE SOLUTION ERRORS FILE: C6 DATE: 05-06-1996

HEAD ELEV(FT)	HEAD ERROR(FT)	TOTAL FLOW(CFS)	FLOW ERROR(CFS)	% FLOW ERROR
1773.95	0.00	0	0	0.00
1780.05	-0.00	35	0	0.68
1780.32	-0.00	70	0	0.28
1780.53	-0.01	105	0	0.33
1780.70	-0.01	140	1	0.93
1780.86	-0.00	175	1	0.67
1781.01	-0.00	210	1	0.45
1781.15	-0.00	245	1	0.32
1781.28	-0.00	280	1	0.23
1781.35	-0.01	300	0	0.14
1781.53	-0.00	350	1	0.17

<1> TOLERANCE (FT) = 0.010 <2> TOLERANCE (%) = 1.000

CURRENT DATE: 05-31-1996 FILE DATE: 05-06-1996
CURRENT TIME: 14:00:12 FILE NAME: C6

PERFORMANCE CURVE FOR CULVERT # 1 - 1 (2 BY 2) CSP

CHARGE FLOW (cfs)	WATER ELEV. (ft)	DIS-CONTROL DEPTH (ft)	HEAD-CONTROL DEPTH (ft)	FLOW TYPE <F4>	INLET NORMAL DEPTH (ft)	OUTLET CRITICAL DEPTH (ft)	OUTLET VEL. (fps)	OUTLET DEPTH (ft)	TAILWATER VEL. (fps)	TAILWATER DEPTH (ft)
0	1773.95	0.00	0.00	0-NF	0.00	0.00	0.00	0.00	0.00	0.00
23	1780.05	4.15	6.10	6-FFn	2.00	1.69	7.32	2.00	2.38	0.34
24	1780.32	4.31	6.37	6-FFn	2.00	1.71	7.53	2.00	3.12	0.52
24	1780.52	4.44	6.57	6-FFn	2.00	1.73	7.69	2.00	3.65	0.66
25	1780.70	4.55	6.75	6-FFn	2.00	1.74	7.82	2.00	4.08	0.78
25	1780.85	4.65	6.90	6-FFn	2.00	1.75	7.93	2.00	4.44	0.89
25	1781.00	4.74	7.05	6-FFn	2.00	1.76	8.04	2.00	4.76	0.99
26	1781.14	4.83	7.19	6-FFn	2.00	1.77	8.14	2.00	5.04	1.09
26	1781.27	4.92	7.32	6-FFn	2.00	1.78	8.23	2.00	5.30	1.18
26	1781.35	4.97	7.40	6-FFn	2.00	1.78	8.28	2.00	5.44	1.23
26	1781.52	5.08	7.57	6-FFn	2.00	1.79	8.41	2.00	5.76	1.35

El. inlet face invert 1773.95 ft El. outlet invert 1773.73 ft
El. inlet throat invert 0.00 ft El. inlet crest 0.00 ft

***** SITE DATA ***** CULVERT INVERT **********

INLET STATION (FT)	2000.00
INLET ELEVATION (FT)	1773.95
OUTLET STATION (FT)	2082.48
OUTLET ELEVATION (FT)	1773.73
NUMBER OF BARRELS	1
SLOPE (V-FT/H-FT)	0.0027
CULVERT LENGTH ALONG SLOPE (FT)	82.48

***** CULVERT DATA SUMMARY **********

BARREL SHAPE	CIRCULAR
BARREL DIAMETER	2.00 FT
BARREL MATERIAL	CORRUGATED STEEL
BARREL MANNING'S N	0.024
INLET TYPE	CONVENTIONAL
INLET EDGE AND WALL	THIN EDGE PROJECTING
INLET DEPRESSION	NONE

CURRENT DATE: 05-31-1996
CURRENT TIME: 14:00:12

FILE DATE: 05-06-1996
FILE NAME: C6

++

++++++++++++++++++++++++ TAILWATER ++++++++++++++++++++++++

++

******* REGULAR CHANNEL CROSS SECTION ****************

BOTTOM WIDTH (FT)	42.45
SIDE SLOPE H/V (X:1)	2.0
CHANNEL SLOPE V/H (FT/FT)	0.010
MANNING'S N (.01-0.1)	0.030
CHANNEL INVERT ELEVATION (FT)	1773.73
CULVERT NO.1 OUTLET INVERT ELEVATION	1773.73 FT

******* UNIFORM FLOW RATING CURVE FOR DOWNSTREAM CHANNEL

FLOW (CFS)	W.S.E. (FT)	FROUDE NUMBER	DEPTH (FT)	VEL. (FPS)	SHEAR (PSF)
0.00	1773.73	0.000	0.00	0.00	0.00
35.00	1774.07	0.720	0.34	2.38	0.21
70.00	1774.24	0.767	0.52	3.12	0.32
105.00	1774.39	0.794	0.66	3.65	0.41
140.00	1774.51	0.814	0.78	4.08	0.49
175.00	1774.62	0.829	0.89	4.44	0.56
210.00	1774.72	0.841	0.99	4.76	0.62
245.00	1774.82	0.851	1.09	5.04	0.68
280.00	1774.91	0.860	1.18	5.30	0.74
300.00	1774.96	0.865	1.23	5.44	0.77
350.00	1775.08	0.875	1.35	5.76	0.84

++

++++++++++++++++++++++++ ROADWAY OVERTOPPING DATA ++++++++++++++++++++++++

++

ROADWAY SURFACE	PAVED
EMBANKMENT TOP WIDTH (FT)	40.00
CREST LENGTH (FT)	50.00
OVERTOPPING CREST ELEVATION (FT)	1779.87

++

CULVERT NO. F

CURRENT DATE: 04-09-1996
CURRENT TIME: 15:39:30

FILE DATE: 04-09-1996
FILE NAME: CF9

FHWA CULVERT ANALYSIS
HY-8, VERSION 4.0

CULV #	SITE DATA: INLET ELEV. (FT)	OUTLET ELEV. (FT)	CULVERT LENGTH (FT)	CULVERT SHAPE, MATERIAL, INLET: BARRELS SHAPE MATERIAL	SPAN (FT)	RISE (FT)	MANNING n	INLET TYPE
1	1777.99	1776.72	64.21	1 CSP	3.50	3.50	.024	CONVENTIONAL
2								
3								
4								
5								
6								

SUMMARY OF CULVERT FLOWS (CFS) FILE: CF9 DATE: 04-09-1996

ELEV (FT)	TOTAL	1	2	3	4	5	6	ROADWAY	ITR
1777.99	0	0	0	0	0	0	0	0	1
1778.94	4	4	0	0	0	0	0	0	1
1779.24	8	8	0	0	0	0	0	0	1
1779.52	12	12	0	0	0	0	0	0	1
1779.78	16	16	0	0	0	0	0	0	1
1780.02	20	20	0	0	0	0	0	0	1
1780.26	24	24	0	0	0	0	0	0	1
1780.48	28	28	0	0	0	0	0	0	1
1780.59	30	30	0	0	0	0	0	0	1
1780.92	36	36	0	0	0	0	0	0	1
1781.14	40	40	0	0	0	0	0	0	1
1781.92	54	54	0	0	0	0	0	OVERTOPPING	

SUMMARY OF ITERATIVE SOLUTION ERRORS FILE: CF9 DATE: 04-09-1996

HEAD ELEV(FT)	HEAD ERROR(FT)	TOTAL FLOW(CFS)	FLOW ERROR(CFS)	% FLOW ERROR
1777.99	0.00	0	0	0.00
1778.94	0.00	4	0	0.00
1779.24	0.00	8	0	0.00
1779.52	0.00	12	0	0.00
1779.78	0.00	16	0	0.00
1780.02	0.00	20	0	0.00
1780.26	0.00	24	0	0.00
1780.48	0.00	28	0	0.00
1780.59	0.00	30	0	0.00
1780.92	0.00	36	0	0.00
1781.14	0.00	40	0	0.00

<1> TOLERANCE (FT) = 0.010 <2> TOLERANCE (%) = 1.000

CURRENT DATE: 04-09-1996 FILE DATE: 04-09-1996
CURRENT TIME: 15:39:30 FILE NAME: CF9

PERFORMANCE CURVE FOR CULVERT # 1 - 1 (3.5 BY 3.5) CSP

CHARGE FLOW (cfs)	WATER ELEV. (ft)	DIS-CONTROL DEPTH (ft)	HEAD-CONTROL DEPTH (ft)	FLOW TYPE <F4>	INLET NORMAL DEPTH (ft)	OUTLET CRITICAL DEPTH (ft)	OUTLET VEL. (fps)	OUTLET DEPTH (ft)	TAILWATER VEL. (fps)	TAILWATER DEPTH (ft)
0	1777.99	0.00	0.00	0-NF	0.00	0.00	0.00	0.00	0.00	0.00
4	1778.94	0.95	0.95	1-S2n	0.51	0.58	4.41	0.51	1.21	0.12
8	1779.24	1.25	1.25	1-S2n	0.75	0.84	5.22	0.75	1.59	0.19
12	1779.52	1.53	1.53	1-S2n	0.92	1.05	5.88	0.92	1.86	0.24
16	1779.78	1.79	1.79	1-S2n	1.08	1.21	6.35	1.08	2.09	0.28
20	1780.02	2.03	2.03	1-S2n	1.21	1.37	6.75	1.21	2.27	0.32
24	1780.26	2.27	2.27	1-S2n	1.34	1.50	7.08	1.34	2.44	0.36
28	1780.48	2.49	2.49	1-S2n	1.46	1.62	7.37	1.46	2.59	0.39
30	1780.59	2.60	2.60	1-S2n	1.52	1.69	7.73	1.48	2.66	0.41
36	1780.92	2.93	2.93	1-S2n	1.68	1.85	7.87	1.68	2.85	0.46
40	1781.14	3.15	3.15	1-S2n	1.79	1.96	7.87	1.68	2.97	0.48

El. inlet face invert 1777.99 ft El. outlet invert 1776.72 ft
El. inlet throat invert 0.00 ft El. inlet crest 0.00 ft

***** SITE DATA ***** CULVERT INVERT **********

INLET STATION (FT)	2000.00
INLET ELEVATION (FT)	1777.99
OUTLET STATION (FT)	2064.20
OUTLET ELEVATION (FT)	1776.72
NUMBER OF BARRELS	1
SLOPE (V-FT/H-FT)	0.0198
CULVERT LENGTH ALONG SLOPE (FT)	64.21

***** CULVERT DATA SUMMARY **********

BARREL SHAPE	CIRCULAR
BARREL DIAMETER	3.50 FT
BARREL MATERIAL	CORRUGATED STEEL
BARREL MANNING'S N	0.024
INLET TYPE	CONVENTIONAL
INLET EDGE AND WALL	THIN EDGE PROJECTING
INLET DEPRESSION	NONE

CURRENT DATE: 04-09-1996
CURRENT TIME: 15:39:30

FILE DATE: 04-09-1996
FILE NAME: CF9

++

++++++++++++++++++++++++ TAILWATER ++++++++++++++++++++++++

++

******* REGULAR CHANNEL CROSS SECTION ****************

BOTTOM WIDTH (FT)	26.80
SIDE SLOPE H/V (X:1)	2.0
CHANNEL SLOPE V/H (FT/FT)	0.010
MANNING'S N (.01-0.1)	0.030
CHANNEL INVERT ELEVATION (FT)	1776.72
CULVERT NO.1 OUTLET INVERT ELEVATION	1776.72 FT

******* UNIFORM FLOW RATING CURVE FOR DOWNSTREAM CHANNEL

FLOW (CFS)	W.S.E. (FT)	FROUDE NUMBER	DEPTH (FT)	VEL. (FPS)	SHEAR (PSF)
0.00	1776.72	0.000	0.00	0.00	0.00
4.00	1776.84	0.610	0.12	1.21	0.08
8.00	1776.91	0.651	0.19	1.59	0.12
12.00	1776.96	0.676	0.24	1.86	0.15
16.00	1777.00	0.694	0.28	2.09	0.17
20.00	1777.04	0.708	0.32	2.27	0.20
24.00	1777.08	0.720	0.36	2.44	0.22
28.00	1777.11	0.729	0.39	2.59	0.24
30.00	1777.13	0.734	0.41	2.66	0.25
36.00	1777.18	0.745	0.46	2.85	0.28
40.00	1777.20	0.752	0.48	2.97	0.30

++

++++++++++++++++++++++++ ROADWAY OVERTOPPING DATA ++++++++++++++++++++++++

++

ROADWAY SURFACE	PAVED
EMBANKMENT TOP WIDTH (FT)	26.00
CREST LENGTH (FT)	100.00
OVERTOPPING CREST ELEVATION (FT)	1781.92

++

CULVERT NO. G

CURRENT DATE: 04-16-1996
CURRENT TIME: 13:20:46

FILE DATE: 04-16-1996
FILE NAME: CULV10

FHWA CULVERT ANALYSIS
HY-8, VERSION 4.0

CULV #	SITE DATA: INLET ELEV. (FT)	OUTLET ELEV. (FT)	CULVERT LENGTH (FT)	CULVERT SHAPE, MATERIAL, INLET: BARRELS SHAPE MATERIAL	SPAN (FT)	RISE (FT)	MANNING n	INLET TYPE
1	1778.52	1777.72	60.57	1 CSP	4.00	4.00	.024	CONVENTIONAL
2	1778.46	1777.52	61.23	1 CSP	4.00	4.00	.024	CONVENTIONAL
3								
4								
5								
6								

SUMMARY OF CULVERT FLOWS (CFS) FILE: CULV10 DATE: 04-16-1996

ELEV (FT)	TOTAL	1	2	3	4	5	6	ROADWAY	ITR
1778.52	0	0	0	0	0	0	0	0	0
1781.28	76	37	38	0	0	0	0	0	4
1783.26	151	76	76	0	0	0	0	0	4
1783.82	227	89	90	0	0	0	0	47	5
1784.05	303	93	94	0	0	0	0	114	4
1784.24	379	96	97	0	0	0	0	182	3
1784.42	454	99	100	0	0	0	0	253	3
1784.58	530	101	102	0	0	0	0	324	3
1784.72	606	104	105	0	0	0	0	396	3
1784.86	681	106	107	0	0	0	0	468	3
1784.88	688	106	107	0	0	0	0	473	2
1783.53	166	83	83	0	0	0	0	OVERTOPPING	

SUMMARY OF ITERATIVE SOLUTION ERRORS FILE: CULV10 DATE: 04-16-1996

HEAD ELEV(FT)	HEAD ERROR(FT)	TOTAL FLOW(CFS)	FLOW ERROR(CFS)	% FLOW ERROR
1778.52	0.00	0	0	0.00
1781.28	-0.01	76	0	0.47
1783.26	0.01	151	-1	-0.41
1783.82	-0.00	227	1	0.39
1784.05	-0.00	303	1	0.33
1784.24	-0.01	379	3	0.81
1784.42	-0.00	454	3	0.57
1784.58	-0.00	530	2	0.37
1784.72	-0.00	606	2	0.26
1784.86	-0.00	681	1	0.20
1784.88	-0.00	688	2	0.32

<1> TOLERANCE (FT) = 0.010 <2> TOLERANCE (%) = 1.000

CURRENT DATE: 04-16-1996 FILE DATE: 04-16-1996
CURRENT TIME: 13:20:46 FILE NAME: CULV10

PERFORMANCE CURVE FOR CULVERT # 1 - 1 (4 BY 4) CSP

CHARGE FLOW (cfs)	WATER ELEV. (ft)	DIS-CONTROL DEPTH (ft)	HEAD-CONTROL DEPTH (ft)	FLOW TYPE <F4>	INLET NORMAL DEPTH (ft)	OUTLET CRITICAL DEPTH (ft)	OUTLET VEL. (fps)	OUTLET DEPTH (ft)	TAILWATER VEL. (fps)	TAILWATER DEPTH (ft)
0	1778.52	0.00	0.00	0-NF	0.00	0.00	0.00	0.00	0.00	0.00
37	1781.28	2.76	2.76	1-S2n	1.79	1.80	6.81	1.79	4.15	0.84
76	1783.25	4.59	4.73	2-M2c	2.84	2.64	8.70	2.64	5.31	1.27
89	1783.82	5.30	5.22	2-M2c	3.29	2.86	9.30	2.86	6.11	1.60
93	1784.05	5.53	5.39	2-M2c	3.48	2.92	9.51	2.92	6.72	1.89
96	1784.23	5.71	5.33	6-FFn	4.00	2.96	7.66	4.00	7.23	2.15
99	1784.41	5.89	5.50	6-FFn	4.00	3.00	7.87	4.00	7.68	2.39
101	1784.57	6.05	5.66	6-FFn	4.00	3.04	8.07	4.00	8.06	2.61
104	1784.72	6.20	5.81	6-FFn	4.00	3.07	8.25	4.00	8.41	2.81
106	1784.86	6.34	5.95	6-FFn	4.00	3.10	8.41	4.00	8.72	3.00
106	1784.87	6.35	5.96	6-FFn	4.00	3.10	8.42	4.00	8.75	3.02

El. inlet face invert 1778.52 ft El. outlet invert 1777.72 ft
El. inlet throat invert 0.00 ft El. inlet crest 0.00 ft

***** SITE DATA ***** CULVERT INVERT **********

INLET STATION (FT)	2000.00
INLET ELEVATION (FT)	1778.52
OUTLET STATION (FT)	2060.56
OUTLET ELEVATION (FT)	1777.72
NUMBER OF BARRELS	1
SLOPE (V-FT/H-FT)	0.0132
CULVERT LENGTH ALONG SLOPE (FT)	60.57

***** CULVERT DATA SUMMARY **********

BARREL SHAPE CIRCULAR
BARREL DIAMETER 4.00 FT
BARREL MATERIAL CORRUGATED STEEL
BARREL MANNING'S N 0.024
INLET TYPE CONVENTIONAL
INLET EDGE AND WALL THIN EDGE PROJECTING
INLET DEPRESSION NONE

CURRENT DATE: 04-16-1996 FILE DATE: 04-16-1996
CURRENT TIME: 13:20:46 FILE NAME: CULV10

PERFORMANCE CURVE FOR CULVERT # 2 - 1 (4 BY 4) CSP

CHARGE FLOW (cfs)	WATER ELEV. (ft)	CONTROL DEPTH (ft)	DIS-CONTROL DEPTH (ft)	HEAD-FLOW TYPE <F4>	INLET NORMAL DEPTH (ft)	OUTLET CRITICAL DEPTH (ft)	OUTLET VEL. (fps)	OUTLET DEPTH (ft)	TAILWATER VEL. (fps)	TAILWATER DEPTH (ft)
0	1778.46	0.00	0.00	0-NF	0.00	0.00	0.00	0.00	0.00	0.20
38	1781.28	2.82	2.82	1-S2n	1.75	1.84	7.27	1.75	4.15	1.04
76	1783.26	4.55	4.80	2-M2c	2.67	2.62	8.67	2.62	5.31	1.47
90	1783.81	5.35	5.32	2-M2c	3.08	2.87	9.36	2.87	6.11	1.80
94	1784.05	5.59	5.46	2-M2c	3.20	2.93	9.57	2.93	6.72	2.09
97	1784.23	5.77	5.58	2-M2c	3.33	2.98	9.72	2.98	7.23	2.35
100	1784.41	5.95	5.69	2-M2c	3.46	3.02	9.85	3.02	7.68	2.59
102	1784.57	6.11	5.79	2-M2c	3.57	3.05	9.97	3.05	8.06	2.81
105	1784.72	6.26	5.75	6-FFn	4.00	3.09	8.32	4.00	8.41	3.01
107	1784.86	6.40	5.88	6-FFn	4.00	3.12	8.48	4.00	8.72	3.20
107	1784.87	6.41	5.89	6-FFn	4.00	3.12	8.49	4.00	8.75	3.22

El. inlet face invert 1778.46 ft El. outlet invert 1777.52 ft
El. inlet throat invert 0.00 ft El. inlet crest 0.00 ft

***** SITE DATA ***** CULVERT INVERT **********

INLET STATION (FT)	2000.00
INLET ELEVATION (FT)	1778.46
OUTLET STATION (FT)	2061.22
OUTLET ELEVATION (FT)	1777.52
NUMBER OF BARRELS	1
SLOPE (V-FT/H-FT)	0.0154
CULVERT LENGTH ALONG SLOPE (FT)	61.23

***** CULVERT DATA SUMMARY **********

BARREL SHAPE CIRCULAR
BARREL DIAMETER 4.00 FT
BARREL MATERIAL CORRUGATED STEEL
BARREL MANNING'S N 0.024
INLET TYPE CONVENTIONAL
INLET EDGE AND WALL THIN EDGE PROJECTING
INLET DEPRESSION NONE

CURRENT DATE: 04-16-1996 FILE DATE: 04-16-1996
CURRENT TIME: 13:20:46 FILE NAME: CULV10

++

++++++++++++++++++++++++ TAILWATER ++++++++++++++++++++++++

++

******* REGULAR CHANNEL CROSS SECTION ****************

BOTTOM WIDTH (FT)	19.98
SIDE SLOPE H/V (X:1)	2.0
CHANNEL SLOPE V/H (FT/FT)	0.010
MANNING'S N (.01-0.1)	0.030
CHANNEL INVERT ELEVATION (FT)	1777.72
CULVERT NO.1 OUTLET INVERT ELEVATION	1777.72 FT

******* UNIFORM FLOW RATING CURVE FOR DOWNSTREAM CHANNEL

FLOW (CFS)	W.S.E. (FT)	FROUDE NUMBER	DEPTH (FT)	VEL. (FPS)	SHEAR (PSF)
0.00	1777.72	0.000	0.00	0.00	0.00
75.70	1778.56	0.798	0.84	4.15	0.53
151.40	1778.99	0.832	1.27	5.31	0.79
227.10	1779.32	0.850	1.60	6.11	1.00
302.80	1779.61	0.861	1.89	6.72	1.18
378.50	1779.87	0.869	2.15	7.23	1.34
454.20	1780.11	0.875	2.39	7.68	1.49
529.90	1780.33	0.880	2.61	8.06	1.63
605.60	1780.53	0.884	2.81	8.41	1.75
681.30	1780.72	0.887	3.00	8.72	1.87
688.00	1780.74	0.887	3.02	8.75	1.89

++

++++++++++++++++++++++++ ROADWAY OVERTOPPING DATA ++++++++++++++++++++++++

++

ROADWAY SURFACE	PAVED
EMBANKMENT TOP WIDTH (FT)	26.00
CREST LENGTH (FT)	100.00
OVERTOPPING CREST ELEVATION (FT)	1783.53

++

CULVERT NO. H

CURRENT DATE: 04-16-1996
CURRENT TIME: 13:25:08

FILE DATE: 04-16-1996
FILE NAME: CULV12

FHWA CULVERT ANALYSIS
HY-8, VERSION 4.0

CULV #	SITE DATA: INLET ELEV. (FT)	SITE DATA: OUTLET ELEV. (FT)	SITE DATA: CULVERT LENGTH (FT)	CULVERT SHAPE, MATERIAL, INLET: BARRELS SHAPE MATERIAL	SPAN (FT)	RISE (FT)	MANNING n	INLET TYPE
1	1780.09	1779.14	64.02	1 CSP	3.50	3.50	.024	CONVENTIONAL
2	1780.17	1779.36	63.13	1 CSP	3.50	3.50	.024	CONVENTIONAL
3								
4								
5								
6								

SUMMARY OF CULVERT FLOWS (CFS) FILE: CULV12 DATE: 04-16-1996

ELEV (FT)	TOTAL	1	2	3	4	5	6	ROADWAY	ITR
1780.09	0	0	0	0	0	0	0	0	0
1783.45	79	41	38	0	0	0	0	0	6
1785.97	158	79	79	0	0	0	0	0	5
1786.98	237	90	89	0	0	0	0	57	3
1787.22	316	92	91	0	0	0	0	131	4
1787.42	395	94	93	0	0	0	0	205	3
1787.60	474	96	95	0	0	0	0	281	3
1787.77	553	97	96	0	0	0	0	357	3
1787.93	632	97	97	0	0	0	0	437	3
1788.08	711	96	96	0	0	0	0	517	3
1788.09	718	96	96	0	0	0	0	523	2
1786.65	172	87	86	0	0	0	0	OVERTOPPING	

SUMMARY OF ITERATIVE SOLUTION ERRORS FILE: CULV12 DATE: 04-16-1996

HEAD ELEV(FT)	HEAD ERROR(FT)	TOTAL FLOW(CFS)	FLOW ERROR(CFS)	% FLOW ERROR
1780.09	0.00	0	0	0.00
1783.45	-0.01	79	0	0.42
1785.97	0.00	158	-0	-0.00
1786.98	1.00	237	1	0.48
1787.22	-0.00	316	1	0.31
1787.42	-0.01	395	3	0.76
1787.60	-0.00	474	3	0.54
1787.77	-0.00	553	2	0.36
1787.93	-0.00	632	2	0.31
1788.08	-0.00	711	2	0.25
1788.09	-0.00	718	3	0.43

<1> TOLERANCE (FT) = 0.010 <2> TOLERANCE (%) = 1.000

CURRENT DATE: 04-16-1996 FILE DATE: 04-16-1996
CURRENT TIME: 13:25:08 FILE NAME: CULV12

PERFORMANCE CURVE FOR CULVERT # 1 - 1 (3.5 BY 3.5) CSP

CHARGE FLOW (cfs)	WATER ELEV. (ft)	DIS-CONTROL DEPTH (ft)	HEAD-CONTROL DEPTH (ft)	INLET FLOW TYPE <F4>	NORMAL DEPTH (ft)	OUTLET CRITICAL DEPTH (ft)	OUTLET VEL. (fps)	OUTLET DEPTH (ft)	TAILWATER VEL. (fps)	TAILWATER DEPTH (ft)
0	1780.09	0.00	0.00	0-NF	0.00	0.00	0.00	0.00	0.00	0.00
41	1783.31	3.22	3.22	1-S2n	1.99	1.99	7.29	1.99	4.94	1.23
79	1785.97	5.87	5.56	6-FFn	3.50	2.78	8.26	3.50	6.14	1.81
90	1786.98	6.88	6.57	6-FFn	3.50	2.92	9.35	3.50	6.93	2.27
92	1787.22	7.13	6.81	6-FFn	3.50	2.95	9.59	3.50	7.53	2.65
94	1787.42	7.32	7.00	6-FFn	3.50	2.97	9.77	3.50	8.02	2.98
96	1787.60	7.50	7.21	6-FFn	3.50	2.99	9.94	3.50	8.44	3.28
97	1787.76	7.67	7.63	4-FFt	3.50	3.01	10.10	3.50	8.81	3.55
97	1787.92	7.61	7.83	4-FFt	3.50	3.01	10.04	3.50	9.14	3.80
96	1788.07	7.52	7.98	4-FFt	3.50	3.00	9.96	3.50	9.44	4.04
96	1788.08	7.51	7.99	4-FFt	3.50	3.00	9.95	3.50	9.47	4.06

El. inlet face invert 1780.09 ft El. outlet invert 1779.14 ft
El. inlet throat invert 0.00 ft El. inlet crest 0.00 ft

***** SITE DATA ***** CULVERT INVERT **********

INLET STATION (FT)	2000.00
INLET ELEVATION (FT)	1780.09
OUTLET STATION (FT)	2064.01
OUTLET ELEVATION (FT)	1779.14
NUMBER OF BARRELS	1
SLOPE (V-FT/H-FT)	0.0149
CULVERT LENGTH ALONG SLOPE (FT)	64.02

***** CULVERT DATA SUMMARY **********

BARREL SHAPE	CIRCULAR
BARREL DIAMETER	3.50 FT
BARREL MATERIAL	CORRUGATED STEEL
BARREL MANNING'S N	0.024
INLET TYPE	CONVENTIONAL
INLET EDGE AND WALL	THIN EDGE PROJECTING
INLET DEPRESSION	NONE

CURRENT DATE: 04-16-1996 FILE DATE: 04-16-1996
CURRENT TIME: 13:25:08 FILE NAME: CULV12

PERFORMANCE CURVE FOR CULVERT # 2 - 1 (3.5 BY 3.5) CSP

CHARGE FLOW (cfs)	WATER ELEV. (ft)	DIS-CONTROL DEPTH (ft)	HEAD-CONTROL DEPTH (ft)	INLET FLOW TYPE <F4>	NORMAL DEPTH (ft)	OUTLET CRITICAL DEPTH (ft)	OUTLET VEL. (fps)	OUTLET DEPTH (ft)	TAILWATER VEL. (fps)	TAILWATER DEPTH (ft)
0	1780.17	0.00	0.00	0-NF	0.00	0.00	0.00	0.00	0.00	-0.22
38	1783.46	3.02	3.29	2-M2c	1.97	1.90	7.06	1.90	4.94	1.01
79	1785.97	5.80	5.59	6-FFn	3.50	2.77	8.16	3.50	6.14	1.59
89	1786.98	6.81	6.61	6-FFn	3.50	2.91	9.26	3.50	6.93	2.05
91	1787.22	7.05	6.84	6-FFn	3.50	2.94	9.51	3.50	7.53	2.43
93	1787.42	7.25	7.04	6-FFn	3.50	2.96	9.70	3.50	8.02	2.76
95	1787.60	7.43	7.21	6-FFn	3.50	2.99	9.87	3.50	8.44	3.06
96	1787.76	7.59	7.45	6-FFn	3.50	3.00	10.02	3.50	8.81	3.33
97	1787.92	7.64	7.75	4-FFt	3.50	3.01	10.07	3.50	9.14	3.58
96	1788.07	7.56	7.90	4-FFt	3.50	3.00	9.99	3.50	9.44	3.82
96	1788.08	7.54	7.91	4-FFt	3.50	3.00	9.97	3.50	9.47	3.84

El. inlet face invert 1780.17 ft El. outlet invert 1779.36 ft
El. inlet throat invert 0.00 ft El. inlet crest 0.00 ft

***** SITE DATA ***** CULVERT INVERT **********

INLET STATION (FT)	2000.00
INLET ELEVATION (FT)	1780.17
OUTLET STATION (FT)	2063.12
OUTLET ELEVATION (FT)	1779.36
NUMBER OF BARRELS	1
SLOPE (V-FT/H-FT)	0.0128
CULVERT LENGTH ALONG SLOPE (FT)	63.13

***** CULVERT DATA SUMMARY **********

BARREL SHAPE	CIRCULAR
BARREL DIAMETER	3.50 FT
BARREL MATERIAL	CORRUGATED STEEL
BARREL MANNING'S N	0.024
INLET TYPE	CONVENTIONAL
INLET EDGE AND WALL	THIN EDGE PROJECTING
INLET DEPRESSION	NONE

CURRENT DATE: 04-16-1996 FILE DATE: 04-16-1996
CURRENT TIME: 13:25:08 FILE NAME: CULV12

TAILWATER

******* REGULAR CHANNEL CROSS SECTION ********

BOTTOM WIDTH (FT)	10.56
SIDE SLOPE H/V (X:1)	2.0
CHANNEL SLOPE V/H (FT/FT)	0.010
MANNING'S N (.01-0.1)	0.030
CHANNEL INVERT ELEVATION (FT)	1779.14
CULVERT NO.1 OUTLET INVERT ELEVATION	1779.14 FT

******* UNIFORM FLOW RATING CURVE FOR DOWNSTREAM CHANNEL

FLOW (CFS)	W.S.E. (FT)	FROUDE NUMBER	DEPTH (FT)	VEL. (FPS)	SHEAR (PSF)
0.00	1779.14	0.000	0.00	0.00	0.00
79.00	1780.37	0.786	1.23	4.94	0.77
158.00	1780.95	0.803	1.81	6.14	1.13
237.00	1781.41	0.811	2.27	6.93	1.41
316.00	1781.79	0.816	2.65	7.53	1.65
395.00	1782.12	0.819	2.98	8.02	1.86
474.00	1782.42	0.822	3.28	8.44	2.05
553.00	1782.69	0.824	3.55	8.81	2.22
632.00	1782.94	0.826	3.80	9.14	2.37
711.00	1783.18	0.828	4.04	9.44	2.52
718.00	1783.20	0.828	4.06	9.47	2.53

ROADWAY OVERTOPPING DATA

ROADWAY SURFACE	PAVED
EMBANKMENT TOP WIDTH (FT)	26.00
CREST LENGTH (FT)	100.00
OVERTOPPING CREST ELEVATION (FT)	1786.65

CULVERT NO. I

CURRENT DATE: 04-18-1996
CURRENT TIME: 07:54:24

FILE DATE: 04-18-1996
FILE NAME: CULV14

FHWA CULVERT ANALYSIS
HY-8, VERSION 4.0

CULV #	SITE DATA: INLET ELEV. (FT)	OUTLET ELEV. (FT)	CULVERT LENGTH (FT)	CULVERT SHAPE, MATERIAL, INLET: BARRELS SHAPE MATERIAL	SPAN (FT)	RISE (FT)	MANNING n	INLET TYPE
1	1785.77	1785.41	59.97	1 CSP	2.00	2.00	.024	CONVENTIONAL
2								
3								
4								
5								
6								

SUMMARY OF CULVERT FLOWS (CFS) FILE: CULV14 DATE: 04-18-1996

ELEV (FT)	TOTAL	1	2	3	4	5	6	ROADWAY	ITR
1785.77	0	0	0	0	0	0	0	0	1
1786.75	3	3	0	0	0	0	0	0	1
1787.21	6	6	0	0	0	0	0	0	1
1787.62	9	9	0	0	0	0	0	0	1
1788.03	12	12	0	0	0	0	0	0	1
1788.67	15	15	0	0	0	0	0	0	1
1789.43	18	18	0	0	0	0	0	0	1
1790.00	20	20	0	0	0	0	0	0	1
1790.58	24	22	0	0	0	0	0	1	30
1790.61	27	22	0	0	0	0	0	5	9
1790.64	30	22	0	0	0	0	0	8	6
1790.55	22	22	0	0	0	0	0	OVERTOPPING	

SUMMARY OF ITERATIVE SOLUTION ERRORS FILE: CULV14 DATE: 04-18-1996

HEAD ELEV(FT)	HEAD ERROR(FT)	TOTAL FLOW(CFS)	FLOW ERROR(CFS)	% FLOW ERROR
1785.77	0.00	0	0	0.00
1786.75	0.00	3	0	0.00
1787.21	0.00	6	0	0.00
1787.62	0.00	9	0	0.00
1788.03	0.00	12	0	0.00
1788.67	0.00	15	0	0.00
1789.43	0.00	18	0	0.00
1790.00	0.00	20	0	0.00
1790.58	-0.00	24	1	3.94
1790.61	-0.00	27	0	0.70
1790.64	-0.00	30	0	0.97

<1> TOLERANCE (FT) = 0.010 <2> TOLERANCE (%) = 1.000

CURRENT DATE: 04-18-1996 FILE DATE: 04-18-1996
CURRENT TIME: 07:54:24 FILE NAME: CULV14

PERFORMANCE CURVE FOR CULVERT # 1 - 1 (2 BY 2) CSP

CHARGE FLOW (cfs)	WATER ELEV. (ft)	DIS-CONTROL DEPTH (ft)	HEAD-CONTROL DEPTH (ft)	FLOW TYPE <F4>	INLET NORMAL DEPTH (ft)	OUTLET CRITICAL DEPTH (ft)	OUTLET VEL. (fps)	OUTLET DEPTH (ft)	TAILWATER VEL. (fps)	TAILWATER DEPTH (ft)
0	1785.77	0.00	0.00	0-NF	0.00	0.00	0.00	0.00	0.00	0.00
3	1786.75	0.90	0.98	2-M2c	0.77	0.60	3.75	0.60	1.57	0.19
6	1787.21	1.32	1.44	2-M2c	1.15	0.86	4.63	0.86	2.04	0.28
9	1787.62	1.70	1.85	2-M2c	1.56	1.07	5.28	1.07	2.37	0.36
12	1788.03	2.09	2.26	6-FFn	2.00	1.24	3.82	2.00	2.63	0.43
15	1788.67	2.53	2.90	6-FFn	2.00	1.40	4.77	2.00	2.85	0.49
18	1789.43	3.05	3.66	6-FFn	2.00	1.52	5.73	2.00	3.04	0.54
20	1790.00	3.45	4.23	6-FFn	2.00	1.60	6.37	2.00	3.16	0.58
22	1790.57	3.87	4.80	6-FFn	2.00	1.66	6.97	2.00	3.37	0.64
22	1790.61	3.90	4.84	6-FFn	2.00	1.66	7.01	2.00	3.51	0.69
22	1790.64	3.92	4.87	6-FFn	2.00	1.67	7.03	2.00	3.64	0.73

El. inlet face invert 1785.77 ft El. outlet invert 1785.41 ft
El. inlet throat invert 0.00 ft El. inlet crest 0.00 ft

***** SITE DATA ***** CULVERT INVERT **********

INLET STATION (FT)	2000.00
INLET ELEVATION (FT)	1785.77
OUTLET STATION (FT)	2059.97
OUTLET ELEVATION (FT)	1785.41
NUMBER OF BARRELS	1
SLOPE (V-FT/H-FT)	0.0060
CULVERT LENGTH ALONG SLOPE (FT)	59.97

***** CULVERT DATA SUMMARY **********

BARREL SHAPE	CIRCULAR
BARREL DIAMETER	2.00 FT
BARREL MATERIAL	CORRUGATED STEEL
BARREL MANNING'S N	0.024
INLET TYPE	CONVENTIONAL
INLET EDGE AND WALL	THIN EDGE PROJECTING
INLET DEPRESSION	NONE

CURRENT DATE: 04-18-1996
CURRENT TIME: 07:54:24

FILE DATE: 04-18-1996
FILE NAME: CULV14

TAILWATER

******* REGULAR CHANNEL CROSS SECTION ****************

BOTTOM WIDTH (FT)	9.84
SIDE SLOPE H/V (X:1)	2.0
CHANNEL SLOPE V/H (FT/FT)	0.010
MANNING'S N (.01-0.1)	0.030
CHANNEL INVERT ELEVATION (FT)	1785.41
CULVERT NO.1 OUTLET INVERT ELEVATION	1785.41 FT

******* UNIFORM FLOW RATING CURVE FOR DOWNSTREAM CHANNEL

FLOW (CFS)	W.S.E. (FT)	FROUDE NUMBER	DEPTH (FT)	VEL. (FPS)	SHEAR (PSF)
0.00	1785.41	0.000	0.00	0.00	0.00
3.00	1785.60	0.640	0.19	1.57	0.12
6.00	1785.69	0.677	0.28	2.04	0.18
9.00	1785.77	0.697	0.36	2.37	0.22
12.00	1785.84	0.711	0.43	2.63	0.27
15.00	1785.90	0.721	0.49	2.85	0.30
18.00	1785.95	0.729	0.54	3.04	0.34
20.00	1785.99	0.734	0.58	3.16	0.36
24.00	1786.05	0.741	0.64	3.37	0.40
27.00	1786.10	0.746	0.69	3.51	0.43
30.00	1786.14	0.750	0.73	3.64	0.46

ROADWAY OVERTOPPING DATA

ROADWAY SURFACE	PAVED
EMBANKMENT TOP WIDTH (FT)	26.00
CREST LENGTH (FT)	100.00
OVERTOPPING CREST ELEVATION (FT)	1790.55

CULVERT NO. J

CURRENT DATE: 04-16-1996
CURRENT TIME: 13:30:24

FILE DATE: 04-16-1996
FILE NAME: CULV15

FHWA CULVERT ANALYSIS
HY-8, VERSION 4.0

CULV #	SITE DATA: INLET ELEV. (FT)	SITE DATA: OUTLET ELEV. (FT)	SITE DATA: CULVERT LENGTH (FT)	CULVERT SHAPE, MATERIAL, INLET: BARRELS SHAPE MATERIAL	SPAN (FT)	RISE (FT)	MANNING n	INLET TYPE
1	1785.04	1784.56	80.12	1 CSP	4.00	4.00	.024	CONVENTIONAL
2	1785.64	1785.17	82.05	1 CSP	3.50	3.50	.024	CONVENTIONAL
3								
4								
5								
6								

SUMMARY OF CULVERT FLOWS (CFS) FILE: CULV15 DATE: 04-16-1996

ELEV (FT)	TOTAL	1	2	3	4	5	6	ROADWAY	ITR
1785.04	0	0	0	0	0	0	0	0	0
1787.53	42	27	15	0	0	0	0	0	5
1788.64	83	50	33	0	0	0	0	0	4
1789.61	125	74	51	0	0	0	0	0	2
1790.65	166	91	65	0	0	0	0	9	5
1790.84	208	94	67	0	0	0	0	47	5
1790.98	250	96	68	0	0	0	0	84	4
1791.09	291	98	70	0	0	0	0	121	3
1791.20	333	99	71	0	0	0	0	160	3
1791.31	374	101	72	0	0	0	0	200	3
1791.31	378	101	72	0	0	0	0	202	2
1790.55	153	90	63	0	0	0	0	OVERTOPPING	

SUMMARY OF ITERATIVE SOLUTION ERRORS FILE: CULV15 DATE: 04-16-1996

HEAD ELEV(FT)	HEAD ERROR(FT)	TOTAL FLOW(CFS)	FLOW ERROR(CFS)	% FLOW ERROR
1785.04	0.00	0	0	0.00
1787.53	0.00	42	-0	-0.00
1788.64	-0.00	83	0	0.01
1789.61	0.01	125	-0	-0.33
1790.65	-0.01	166	1	0.90
1790.84	-0.01	208	1	0.36
1790.98	-0.01	250	1	0.38
1791.09	-0.01	291	3	0.93
1791.20	-0.01	333	2	0.75
1791.31	-0.00	374	2	0.59
1791.31	1.00	378	3	0.78

<1> TOLERANCE (FT) = 0.010 <2> TOLERANCE (%) = 1.000

CURRENT DATE: 04-16-1996 FILE DATE: 04-16-1996
CURRENT TIME: 13:30:24 FILE NAME: CULV15

++

PERFORMANCE CURVE FOR CULVERT # 1 - 1 (4 BY 4) CSP

++

CHARGE FLOW (cfs)	WATER ELEV. (ft)	DIS-CONTROL DEPTH (ft)	HEAD-CONTROL DEPTH (ft)	FLOW TYPE <F4>	INLET NORMAL DEPTH (ft)	OUTLET CRITICAL DEPTH (ft)	OUTLET VEL. (fps)	OUTLET DEPTH (ft)	TAILWATER VEL. (fps)	TAILWATER DEPTH (ft)
0	1785.04	0.00	0.00	0-NF	0.00	0.00	0.00	0.00	0.00	0.00
27	1787.54	2.30	2.50	2-M2c	1.86	1.52	6.08	1.52	4.23	0.98
50	1788.64	3.36	3.60	2-M2c	2.78	2.12	7.43	2.12	5.25	1.45
74	1789.60	4.48	4.56	6-FFn	4.00	2.59	5.88	4.00	5.92	1.81
91	1790.64	5.41	5.60	6-FFn	4.00	2.88	7.24	4.00	6.43	2.11
94	1790.84	5.59	5.80	6-FFn	4.00	2.93	7.48	4.00	6.85	2.37
96	1790.98	5.72	5.94	6-FFn	4.00	2.96	7.64	4.00	7.21	2.61
98	1791.09	5.82	6.05	6-FFn	4.00	2.98	7.78	4.00	7.52	2.83
99	1791.20	5.93	6.16	6-FFn	4.00	3.01	7.90	4.00	7.80	3.03
101	1791.30	6.01	6.26	6-FFn	4.00	3.03	8.01	4.00	8.06	3.21
101	1791.30	6.02	6.26	6-FFn	4.00	3.03	8.01	4.00	8.08	3.23

++

El. inlet face invert 1785.04 ft El. outlet invert 1784.56 ft
El. inlet throat invert 0.00 ft El. inlet crest 0.00 ft

++

***** SITE DATA ***** CULVERT INVERT **********

INLET STATION (FT)	2000.00
INLET ELEVATION (FT)	1785.04
OUTLET STATION (FT)	2080.12
OUTLET ELEVATION (FT)	1784.56
NUMBER OF BARRELS	1
SLOPE (V-FT/H-FT)	0.0060
CULVERT LENGTH ALONG SLOPE (FT)	80.12

***** CULVERT DATA SUMMARY **********

BARREL SHAPE	CIRCULAR
BARREL DIAMETER	4.00 FT
BARREL MATERIAL	CORRUGATED STEEL
BARREL MANNING'S N	0.024
INLET TYPE	CONVENTIONAL
INLET EDGE AND WALL	THIN EDGE PROJECTING
INLET DEPRESSION	NONE

++

CURRENT DATE: 04-16-1996 FILE DATE: 04-16-1996
CURRENT TIME: 13:30:24 FILE NAME: CULV15

PERFORMANCE CURVE FOR CULVERT # 2 - 1 (3.5 BY 3.5) CSP

CHARGE FLOW (cfs)	WATER ELEV. (ft)	DIS-CONTROL DEPTH (ft)	HEAD-CONTROL DEPTH (ft)	FLOW TYPE <F4>	INLET NORMAL DEPTH (ft)	OUTLET CRITICAL DEPTH (ft)	OUTLET VEL. (fps)	OUTLET DEPTH (ft)	TAILWATER VEL. (fps)	TAILWATER DEPTH (ft)
0	1785.64	0.00	0.00	0-NF	0.00	0.00	0.00	0.00	0.00	-0.61
15	1787.54	1.74	1.90	2-M2c	1.44	1.16	5.29	1.16	4.23	0.37
33	1788.65	2.80	3.01	2-M2c	2.37	1.78	6.74	1.78	5.25	0.84
51	1789.60	3.82	3.96	6-FFn	3.50	2.23	5.33	3.50	5.92	1.20
65	1790.65	4.69	5.01	6-FFn	3.50	2.51	6.71	3.50	6.43	1.50
67	1790.84	4.85	5.20	6-FFn	3.50	2.55	6.93	3.50	6.85	1.76
68	1790.98	4.97	5.34	6-FFn	3.50	2.58	7.10	3.50	7.21	2.00
70	1791.09	5.06	5.45	6-FFn	3.50	2.60	7.23	3.50	7.52	2.22
71	1791.20	5.16	5.56	6-FFn	3.50	2.62	7.35	3.50	7.80	2.42
72	1791.31	5.24	5.67	6-FFn	3.50	2.65	7.47	3.50	8.06	2.60
72	1791.31	5.25	5.67	6-FFn	3.50	2.65	7.48	3.50	8.08	2.62

El. inlet face invert 1785.64 ft El. outlet invert 1785.17 ft
El. inlet throat invert 0.00 ft El. inlet crest 0.00 ft

***** SITE DATA ***** CULVERT INVERT **********

INLET STATION (FT)	2000.00
INLET ELEVATION (FT)	1785.64
OUTLET STATION (FT)	2082.05
OUTLET ELEVATION (FT)	1785.17
NUMBER OF BARRELS	1
SLOPE (V-FT/H-FT)	0.0057
CULVERT LENGTH ALONG SLOPE (FT)	82.05

***** CULVERT DATA SUMMARY **********

BARREL SHAPE	CIRCULAR
BARREL DIAMETER	3.50 FT
BARREL MATERIAL	CORRUGATED STEEL
BARREL MANNING'S N	0.024
INLET TYPE	CONVENTIONAL
INLET EDGE AND WALL	THIN EDGE PROJECTING
INLET DEPRESSION	NONE

CURRENT DATE: 04-16-1996
CURRENT TIME: 13:30:24

FILE DATE: 04-16-1996
FILE NAME: CULV15

++

++++++++++++++++++++++++ TAILWATER ++++++++++++++++++++++++

++

******* REGULAR CHANNEL CROSS SECTION ****************

BOTTOM WIDTH (FT)	8.04
SIDE SLOPE H/V (X:1)	2.0
CHANNEL SLOPE V/H (FT/FT)	0.010
MANNING'S N (.01-0.1)	0.030
CHANNEL INVERT ELEVATION (FT)	1784.56
CULVERT NO.1 OUTLET INVERT ELEVATION	1784.56 FT

******* UNIFORM FLOW RATING CURVE FOR DOWNSTREAM CHANNEL

FLOW (CFS)	W.S.E. (FT)	FROUDE NUMBER	DEPTH (FT)	VEL. (FPS)	SHEAR (PSF)
0.00	1784.56	0.000	0.00	0.00	0.00
41.60	1785.54	0.753	0.98	4.23	0.61
83.20	1786.01	0.769	1.45	5.25	0.90
124.80	1786.37	0.776	1.81	5.92	1.13
166.40	1786.67	0.781	2.11	6.43	1.32
208.00	1786.93	0.784	2.37	6.85	1.48
249.60	1787.17	0.786	2.61	7.21	1.63
291.20	1787.39	0.789	2.83	7.52	1.76
332.80	1787.59	0.790	3.03	7.80	1.89
374.40	1787.77	0.792	3.21	8.06	2.00
378.00	1787.79	0.792	3.23	8.08	2.01

++

++++++++++++++++++++++++ ROADWAY OVERTOPPING DATA ++++++++++++++++++++++++

++

ROADWAY SURFACE	PAVED
EMBANKMENT TOP WIDTH (FT)	26.00
CREST LENGTH (FT)	100.00
OVERTOPPING CREST ELEVATION (FT)	1790.55

++

CULVERT NO. K

CURRENT DATE: 04-09-1996
CURRENT TIME: 16:23:32

FILE DATE: 04-09-1996
FILE NAME: CF16

FHWA CULVERT ANALYSIS
HY-8, VERSION 4.0

CULV #	SITE DATA: INLET ELEV. (FT)	OUTLET ELEV. (FT)	CULVERT LENGTH (FT)	CULVERT SHAPE, MATERIAL, INLET: BARRELS SHAPE MATERIAL	SPAN (FT)	RISE (FT)	MANNING n	INLET TYPE
1	1792.55	1791.80	82.06	1 CSP	2.50	2.50	.024	CONVENTIONAL
2								
3								
4								
5								
6								

SUMMARY OF CULVERT FLOWS (CFS) FILE: CF16 DATE: 04-09-1996

ELEV (FT)	TOTAL	1	2	3	4	5	6	ROADWAY	ITR
1792.55	0	0	0	0	0	0	0	0	1
1793.53	4	4	0	0	0	0	0	0	1
1793.99	7	7	0	0	0	0	0	0	1
1794.34	11	11	0	0	0	0	0	0	1
1794.66	14	14	0	0	0	0	0	0	1
1794.97	18	18	0	0	0	0	0	0	1
1795.28	21	21	0	0	0	0	0	0	1
1795.62	25	25	0	0	0	0	0	0	1
1795.70	25	25	0	0	0	0	0	0	1
1795.80	32	26	0	0	0	0	0	6	11
1795.83	35	26	0	0	0	0	0	9	6
1795.73	25	25	0	0	0	0	0	OVERTOPPING	

SUMMARY OF ITERATIVE SOLUTION ERRORS FILE: CF16 DATE: 04-09-1996

HEAD ELEV(FT)	HEAD ERROR(FT)	TOTAL FLOW(CFS)	FLOW ERROR(CFS)	% FLOW ERROR
1792.55	0.00	0	0	0.00
1793.53	0.00	4	0	0.00
1793.99	0.00	7	0	0.00
1794.34	0.00	11	0	0.00
1794.66	0.00	14	0	0.00
1794.97	0.00	18	0	0.00
1795.28	0.00	21	0	0.00
1795.62	0.00	25	0	0.00
1795.70	0.00	25	0	0.00
1795.80	-0.00	32	0	0.63
1795.83	-0.00	35	0	0.73

<1> TOLERANCE (FT) = 0.010 <2> TOLERANCE (%) = 1.000

CURRENT DATE: 04-09-1996 FILE DATE: 04-09-1996
CURRENT TIME: 16:23:32 FILE NAME: CF16

PERFORMANCE CURVE FOR CULVERT # 1 - 1 (2.5 BY 2.5) CSP

CHARGE FLOW (cfs)	WATER ELEV. (ft)	DIS-CONTROL DEPTH (ft)	HEAD-CONTROL DEPTH (ft)	FLOW TYPE <F4>	INLET NORMAL DEPTH (ft)	OUTLET CRITICAL DEPTH (ft)	OUTLET VEL. (fps)	OUTLET DEPTH (ft)	TAILWATER VEL. (fps)	TAILWATER DEPTH (ft)
0	1792.55	0.00	0.00	0-NF	0.00	0.00	0.00	0.00	0.00	0.00
4	1793.53	0.92	0.98	2-M2c	0.68	0.60	3.81	0.60	2.10	0.32
7	1793.99	1.30	1.44	2-M2c	0.99	0.87	4.60	0.87	2.65	0.48
11	1794.34	1.65	1.79	2-M2c	1.24	1.08	5.18	1.08	3.02	0.60
14	1794.66	1.97	2.11	2-M2c	1.48	1.26	5.65	1.26	3.31	0.71
18	1794.97	2.28	2.42	2-M2c	1.73	1.41	6.13	1.41	3.54	0.80
21	1795.28	2.61	2.73	2-M2c	2.03	1.55	6.56	1.55	3.74	0.88
25	1795.62	2.97	3.07	6-FFn	2.50	1.68	4.99	2.50	3.92	0.96
25	1795.70	3.02	3.15	6-FFn	2.50	1.70	5.09	2.50	3.94	0.97
26	1795.79	3.09	3.24	6-FFn	2.50	1.72	5.21	2.50	4.22	1.10
26	1795.83	3.11	3.28	6-FFn	2.50	1.73	5.25	2.50	4.35	1.16

El. inlet face invert 1792.55 ft El. outlet invert 1791.80 ft
El. inlet throat invert 0.00 ft El. inlet crest 0.00 ft

***** SITE DATA ***** CULVERT INVERT **********

INLET STATION (FT)	2000.00
INLET ELEVATION (FT)	1792.55
OUTLET STATION (FT)	2082.06
OUTLET ELEVATION (FT)	1791.80
NUMBER OF BARRELS	1
SLOPE (V-FT/H-FT)	0.0091
CULVERT LENGTH ALONG SLOPE (FT)	82.06

***** CULVERT DATA SUMMARY **********

BARREL SHAPE CIRCULAR
BARREL DIAMETER 2.50 FT
BARREL MATERIAL CORRUGATED STEEL
BARREL MANNING'S N 0.024
INLET TYPE CONVENTIONAL
INLET EDGE AND WALL THIN EDGE PROJECTING
INLET DEPRESSION NONE

CURRENT DATE: 04-09-1996
CURRENT TIME: 16:23:32

FILE DATE: 04-09-1996
FILE NAME: CF16

++

++++++++++++++++++++++++++ TAILWATER ++++++++++++++++++++++++++

++

******* REGULAR CHANNEL CROSS SECTION ****************

BOTTOM WIDTH (FT)	4.59
SIDE SLOPE H/V (X:1)	2.0
CHANNEL SLOPE V/H (FT/FT)	0.010
MANNING'S N (.01-0.1)	0.030
CHANNEL INVERT ELEVATION (FT)	1791.80
CULVERT NO.1 OUTLET INVERT ELEVATION	1791.80 FT

******* UNIFORM FLOW RATING CURVE FOR DOWNSTREAM CHANNEL

FLOW (CFS)	W.S.E. (FT)	FROUDE NUMBER	DEPTH (FT)	VEL. (FPS)	SHEAR (PSF)
0.00	1791.80	0.000	0.00	0.00	0.00
3.50	1792.12	0.656	0.32	2.10	0.20
7.00	1792.28	0.678	0.48	2.65	0.30
10.50	1792.40	0.688	0.60	3.02	0.37
14.00	1792.51	0.695	0.71	3.31	0.44
17.50	1792.60	0.699	0.80	3.54	0.50
21.00	1792.68	0.702	0.88	3.74	0.55
24.50	1792.76	0.705	0.96	3.92	0.60
25.00	1792.77	0.705	0.97	3.94	0.61
31.50	1792.90	0.708	1.10	4.22	0.69
35.00	1792.96	0.710	1.16	4.35	0.73

++

++++++++++++++++++++++++ ROADWAY OVERTOPPING DATA ++++++++++++++++++++++++

++

ROADWAY SURFACE	PAVED
EMBANKMENT TOP WIDTH (FT)	26.00
CREST LENGTH (FT)	100.00
OVERTOPPING CREST ELEVATION (FT)	1795.73

++

CULVERT NO. L

CURRENT DATE: 04-16-1996
CURRENT TIME: 14:31:10

FILE DATE: 04-16-1996
FILE NAME: CULV17

FHWA CULVERT ANALYSIS
HY-8, VERSION 4.0

CULV #	SITE DATA: INLET ELEV. (FT)	OUTLET ELEV. (FT)	CULVERT LENGTH (FT)	CULVERT SHAPE, MATERIAL, INLET: BARRELS SHAPE MATERIAL	SPAN (FT)	RISE (FT)	MANNING n	INLET TYPE
1	1795.64	1794.64	62.97	1 CMPA	3.50	2.42	.025	CONVENTIONAL
2	1794.67	1793.14	61.54	1 CSP	4.00	4.00	.024	CONVENTIONAL
3	1794.71	1793.19	60.16	1 CSP	4.00	4.00	.024	CONVENTIONAL
4	1795.65	1793.77	61.78	1 CMPA	3.50	2.42	.025	CONVENTIONAL
5	1796.02	1794.25	61.51	1 CMPA	3.50	2.42	.025	CONVENTIONAL
6								

SUMMARY OF CULVERT FLOWS (CFS) FILE: CULV17 DATE: 04-16-1996

ELEV (FT)	TOTAL	1	2	3	4	5	6	ROADWAY	ITR
1795.64	0	0	0	0	0	0	0	0	0
1796.89	79	10	26	25	11	6	0	0	4
1797.79	157	24	45	45	24	18	0	0	2
1798.69	236	36	65	65	37	32	0	0	2
1799.79	314	47	87	86	48	45	0	0	6
1800.46	393	52	98	97	54	51	0	40	5
1800.69	471	53	101	101	56	53	0	103	3
1800.89	550	55	104	104	56	54	0	173	3
1801.07	628	55	107	106	55	55	0	246	3
1801.24	707	55	109	109	55	55	0	322	3
1801.25	712	54	109	109	55	55	0	326	2
1800.20	337	50	93	93	52	49	0	OVERTOPPING	

SUMMARY OF ITERATIVE SOLUTION ERRORS FILE: CULV17 DATE: 04-16-1996

HEAD ELEV(FT)	HEAD ERROR(FT)	TOTAL FLOW(CFS)	FLOW ERROR(CFS)	% FLOW ERROR
1795.64	0.00	0	0	0.00
1796.89	-0.00	79	0	0.28
1797.79	-0.00	157	0	0.04
1798.69	-0.00	236	0	0.09
1799.79	-0.01	314	1	0.35
1800.46	-0.00	393	1	0.19
1800.69	-0.01	471	5	0.98
1800.89	-0.01	550	4	0.69
1801.07	-0.01	628	3	0.48
1801.24	-0.00	707	3	0.36
1801.25	1.00	712	4	0.53

<1> TOLERANCE (FT) = 0.010 <2> TOLERANCE (%) = 1.000

CURRENT DATE: 04-16-1996 FILE DATE: 04-16-1996
CURRENT TIME: 14:31:10 FILE NAME: CULV17

PERFORMANCE CURVE FOR CULVERT # 1 - 1 (3.5 BY 2.416667) CMPA

CHARGE FLOW (cfs)	WATER ELEV. (ft)	DIS-CONTROL DEPTH (ft)	HEAD-CONTROL DEPTH (ft)	FLOW TYPE <F4>	INLET NORMAL DEPTH (ft)	OUTLET CRITICAL DEPTH (ft)	OUTLET VEL. (fps)	OUTLET DEPTH (ft)	TAILWATER VEL. (fps)	TAILWATER DEPTH (ft)
0	1795.64	0.00	0.00	0-NF	0.00	0.00	0.00	0.00	0.00	-1.50
10	1796.88	1.24	1.24	1-S2n	0.74	0.78	4.86	0.74	4.95	-0.26
24	1797.78	2.14	2.14	1-S2n	1.25	1.26	6.20	1.25	6.14	0.32
36	1798.68	2.93	3.04	2-M2c	1.69	1.56	7.26	1.56	6.93	0.78
47	1799.79	4.01	4.15	6-FFn	2.42	1.82	6.97	2.42	7.53	1.16
52	1800.46	4.55	4.82	6-FFn	2.42	1.92	7.66	2.42	8.02	1.49
53	1800.68	4.73	5.04	6-FFn	2.42	1.94	7.88	2.42	8.44	1.79
55	1800.89	4.90	5.25	6-FFn	2.42	1.96	8.07	2.42	8.81	2.06
55	1801.07	4.95	5.43	6-FFn	2.42	1.97	8.12	2.42	9.14	2.32
55	1801.24	4.89	5.60	4-FFt	2.42	1.96	8.39	2.42	9.43	2.55
54	1801.24	4.88	5.60	4-FFt	2.42	1.96	8.37	2.42	9.45	2.57

El. inlet face invert 1795.64 ft El. outlet invert 1794.64 ft
El. inlet throat invert 0.00 ft El. inlet crest 0.00 ft

***** SITE DATA ***** CULVERT INVERT **********

INLET STATION (FT)	2000.00
INLET ELEVATION (FT)	1795.64
OUTLET STATION (FT)	2062.96
OUTLET ELEVATION (FT)	1794.64
NUMBER OF BARRELS	1
SLOPE (V-FT/H-FT)	0.0159
CULVERT LENGTH ALONG SLOPE (FT)	62.97

***** CULVERT DATA SUMMARY **********

BARREL SHAPE	PIPE ARCH
BARREL SPAN	3.50 FT
BARREL RISE	2.42 FT
BARREL MATERIAL	STEEL OR ALUMINUM
BARREL MANNING'S N	0.025
INLET TYPE	CONVENTIONAL
INLET EDGE AND WALL	PROJECTING
INLET DEPRESSION	NONE

CURRENT DATE: 04-16-1996 FILE DATE: 04-16-1996
CURRENT TIME: 14:31:10 FILE NAME: CULV17

PERFORMANCE CURVE FOR CULVERT # 2 - 1 (4 BY 4) CSP

CHARGE FLOW (cfs)	WATER ELEV. (ft)	DIS-CONTROL DEPTH (ft)	HEAD-CONTROL DEPTH (ft)	FLOW TYPE <F4>	INLET NORMAL DEPTH (ft)	OUTLET CRITICAL DEPTH (ft)	OUTLET VEL. (fps)	OUTLET DEPTH (ft)	TAILWATER VEL. (fps)	TAILWATER DEPTH (ft)
0	1794.67	0.00	0.00	0-NF	0.00	0.00	0.00	0.00	0.00	0.00
26	1796.89	2.22	2.22	1-S2n	1.24	1.50	7.83	1.24	4.95	1.24
45	1797.79	3.12	3.12	1-S2n	1.68	2.02	9.07	1.68	6.14	1.82
65	1798.69	4.02	4.02	5-S2n	2.07	2.44	9.94	2.07	6.93	2.28
87	1799.78	5.11	5.11	5-S2n	2.48	2.82	10.60	2.48	7.53	2.66
98	1800.46	5.79	5.79	5-S2n	2.70	2.98	10.85	2.70	8.02	2.99
101	1800.68	6.01	6.01	5-S2n	2.77	3.04	10.92	2.77	8.44	3.29
104	1800.88	6.21	6.21	5-S2n	2.83	3.08	10.96	2.83	8.81	3.56
107	1801.07	6.40	6.40	5-S2n	2.89	3.12	11.00	2.89	9.14	3.82
109	1801.24	6.57	6.06	4-FFt	2.95	3.16	8.69	4.00	9.43	4.05
109	1801.25	6.58	6.08	4-FFt	2.95	3.16	8.70	4.00	9.45	4.07

El. inlet face invert 1794.67 ft El. outlet invert 1793.14 ft
El. inlet throat invert 0.00 ft El. inlet crest 0.00 ft

***** SITE DATA ***** CULVERT INVERT **********

INLET STATION (FT)	2000.00
INLET ELEVATION (FT)	1794.67
OUTLET STATION (FT)	2061.52
OUTLET ELEVATION (FT)	1793.14
NUMBER OF BARRELS	1
SLOPE (V-FT/H-FT)	0.0249
CULVERT LENGTH ALONG SLOPE (FT)	61.54

***** CULVERT DATA SUMMARY **********

BARREL SHAPE	CIRCULAR
BARREL DIAMETER	4.00 FT
BARREL MATERIAL	CORRUGATED STEEL
BARREL MANNING'S N	0.024
INLET TYPE	CONVENTIONAL
INLET EDGE AND WALL	THIN EDGE PROJECTING
INLET DEPRESSION	NONE

CURRENT DATE: 04-16-1996 FILE DATE: 04-16-1996
CURRENT TIME: 14:31:10 FILE NAME: CULV17

PERFORMANCE CURVE FOR CULVERT # 5 - 1 (3.5 BY 2.416667) CMPA

CHARGE FLOW (cfs)	WATER ELEV. (ft)	DIS-CONTROL DEPTH (ft)	HEAD-CONTROL DEPTH (ft)	FLOW TYPE <F4>	INLET NORMAL DEPTH (ft)	OUTLET CRITICAL DEPTH (ft)	OUTLET VEL. (fps)	OUTLET DEPTH (ft)	TAILWATER VEL. (fps)	TAILWATER DEPTH (ft)
0	1796.02	0.00	0.00	0-NF	0.00	0.00	0.00	0.00	0.00	-1.11
6	1796.89	0.87	0.87	1-S2n	0.46	0.56	4.93	0.46	4.95	0.13
18	1797.78	1.76	1.76	1-S2n	0.86	1.07	7.11	0.86	6.14	0.71
32	1798.69	2.67	2.67	5-S2n	1.24	1.48	8.33	1.24	6.93	1.17
45	1799.78	3.76	3.76	5-S2n	1.59	1.78	8.98	1.59	7.53	1.55
51	1800.45	4.43	4.43	5-S2n	1.79	1.90	9.14	1.79	8.02	1.88
53	1800.68	4.66	4.66	5-S2n	1.86	1.94	9.17	1.86	8.44	2.18
54	1800.88	4.86	4.67	4-FFt	1.92	1.96	8.37	2.42	8.81	2.45
55	1801.07	4.97	5.05	4-FFt	1.97	1.97	8.50	2.42	9.14	2.71
55	1801.24	4.91	5.22	4-FFt	1.94	1.96	8.43	2.42	9.43	2.94
55	1801.25	4.91	5.23	4-FFt	1.94	1.96	8.43	2.42	9.45	2.96

El. inlet face invert 1796.02 ft El. outlet invert 1794.25 ft
El. inlet throat invert 0.00 ft El. inlet crest 0.00 ft

***** SITE DATA ***** CULVERT INVERT **********

INLET STATION (FT)	2000.00
INLET ELEVATION (FT)	1796.02
OUTLET STATION (FT)	2061.48
OUTLET ELEVATION (FT)	1794.25
NUMBER OF BARRELS	1
SLOPE (V-FT/H-FT)	0.0288
CULVERT LENGTH ALONG SLOPE (FT)	61.51

***** CULVERT DATA SUMMARY **********

BARREL SHAPE PIPE ARCH
BARREL SPAN 3.50 FT
BARREL RISE 2.42 FT
BARREL MATERIAL STEEL OR ALUMINUM
BARREL MANNING'S N 0.025
INLET TYPE CONVENTIONAL
INLET EDGE AND WALL PROJECTING
INLET DEPRESSION NONE

CURRENT DATE: 04-16-1996
CURRENT TIME: 14:31:10

FILE DATE: 04-16-1996
FILE NAME: CULV17

++

++++++++++++++++++++++++ TAILWATER ++++++++++++++++++++++++

++

******* REGULAR CHANNEL CROSS SECTION ****************

BOTTOM WIDTH (FT)	10.37
SIDE SLOPE H/V (X:1)	2.0
CHANNEL SLOPE V/H (FT/FT)	0.010
MANNING'S N (.01-0.1)	0.030
CHANNEL INVERT ELEVATION (FT)	1793.14
CULVERT NO.1 OUTLET INVERT ELEVATION	1794.64 FT

******* UNIFORM FLOW RATING CURVE FOR DOWNSTREAM CHANNEL

FLOW (CFS)	W.S.E. (FT)	FROUDE NUMBER	DEPTH (FT)	VEL. (FPS)	SHEAR (PSF)
0.00	1793.14	0.000	0.00	0.00	0.00
78.50	1794.38	0.784	1.24	4.95	0.77
157.00	1794.96	0.801	1.82	6.14	1.14
235.50	1795.42	0.809	2.28	6.93	1.42
314.00	1795.80	0.814	2.66	7.53	1.66
392.50	1796.13	0.817	2.99	8.02	1.87
471.00	1796.43	0.820	3.29	8.44	2.05
549.50	1796.70	0.822	3.56	8.81	2.22
628.00	1796.96	0.824	3.82	9.14	2.38
706.50	1797.19	0.826	4.05	9.43	2.53
712.00	1797.21	0.826	4.07	9.45	2.54

++

++++++++++++++++++++++++ ROADWAY OVERTOPPING DATA ++++++++++++++++++++++++

++

ROADWAY SURFACE	PAVED
EMBANKMENT TOP WIDTH (FT)	26.00
CREST LENGTH (FT)	100.00
OVERTOPPING CREST ELEVATION (FT)	1800.20

++

CULVERT NO. L2

CURRENT DATE: 04-29-1996 FILE DATE: 04-29-1996
CURRENT TIME: 09:49:32 FILE NAME: CULV18

FHWA CULVERT ANALYSIS
HY-8, VERSION 4.0

CULV #	SITE DATA: INLET ELEV. (FT)	OUTLET ELEV. (FT)	CULVERT LENGTH (FT)	CULVERT SHAPE, MATERIAL, INLET: BARRELS SHAPE MATERIAL	SPAN (FT)	RISE (FT)	MANNING n	INLET TYPE
1	1800.63	1800.05	61.58	1 CMPA	3.50	2.42	.025	CONVENTIONAL
2								
3								
4								
5								
6								

SUMMARY OF CULVERT FLOWS (CFS) FILE: CULV18 DATE: 04-29-1996

ELEV (FT)	TOTAL	1	2	3	4	5	6	ROADWAY	ITR
1800.63	0	0	0	0	0	0	0	0	1
1801.54	5	5	0	0	0	0	0	0	1
1801.94	10	10	0	0	0	0	0	0	1
1802.32	15	15	0	0	0	0	0	0	1
1802.64	20	20	0	0	0	0	0	0	1
1802.96	25	25	0	0	0	0	0	0	1
1803.27	30	30	0	0	0	0	0	0	1
1803.68	35	35	0	0	0	0	0	0	1
1804.25	40	40	0	0	0	0	0	0	1
1804.60	45	43	0	0	0	0	0	2	26
1804.65	50	43	0	0	0	0	0	6	7
1804.57	43	43	0	0	0	0	0	OVERTOPPING	

SUMMARY OF ITERATIVE SOLUTION ERRORS FILE: CULV18 DATE: 04-29-1996

HEAD ELEV(FT)	HEAD ERROR(FT)	TOTAL FLOW(CFS)	FLOW ERROR(CFS)	% FLOW ERROR
1800.63	0.00	0	0	0.00
1801.54	0.00	5	0	0.00
1801.94	0.00	10	0	0.00
1802.32	0.00	15	0	0.00
1802.64	0.00	20	0	0.00
1802.96	0.00	25	0	0.00
1803.27	0.00	30	0	0.00
1803.68	0.00	35	0	0.00
1804.25	0.00	40	0	0.00
1804.60	-0.00	45	0	0.84
1804.65	-0.00	50	0	0.70

<1> TOLERANCE (FT) = 0.010 <2> TOLERANCE (%) = 1.000

CULVERT NO. 19

CURRENT DATE: 04-15-1996
CURRENT TIME: 13:49:22

FILE DATE: 04-15-1996
FILE NAME: CF19

FHWA CULVERT ANALYSIS
HY-8, VERSION 4.0

CULV #	SITE DATA: INLET ELEV. (FT)	OUTLET ELEV. (FT)	CULVERT LENGTH (FT)	CULVERT SHAPE, MATERIAL, INLET: BARRELS SHAPE MATERIAL	SPAN (FT)	RISE (FT)	MANNING n	INLET TYPE
1	1805.50	1805.06	61.50	1 CMPA	3.50	2.42	.025	CONVENTIONAL
2								
3								
4								
5								
6								

SUMMARY OF CULVERT FLOWS (CFS) FILE: CF19 DATE: 04-15-1996

ELEV (FT)	TOTAL	1	2	3	4	5	6	ROADWAY	ITR
1805.50	0	0	0	0	0	0	0	0	1
1806.37	5	5	0	0	0	0	0	0	1
1806.80	10	10	0	0	0	0	0	0	1
1807.17	15	15	0	0	0	0	0	0	1
1807.51	20	20	0	0	0	0	0	0	1
1807.84	25	25	0	0	0	0	0	0	1
1808.19	30	30	0	0	0	0	0	0	1
1808.69	35	35	0	0	0	0	0	0	1
1809.26	40	40	0	0	0	0	0	0	1
1809.69	45	43	0	0	0	0	0	0	30
1809.75	50	44	0	0	0	0	0	6	8
1809.68	43	43	0	0	0	0	0	OVERTOPPING	

SUMMARY OF ITERATIVE SOLUTION ERRORS FILE: CF19 DATE: 04-15-1996

HEAD ELEV(FT)	HEAD ERROR(FT)	TOTAL FLOW(CFS)	FLOW ERROR(CFS)	% FLOW ERROR
1805.50	0.00	0	0	0.00
1806.37	0.00	5	0	0.00
1806.80	0.00	10	0	0.00
1807.17	0.00	15	0	0.00
1807.51	0.00	20	0	0.00
1807.84	0.00	25	0	0.00
1808.19	0.00	30	0	0.00
1808.69	0.00	35	0	0.00
1809.26	0.00	40	0	0.00
1809.69	-0.00	45	1	2.31
1809.75	-0.00	50	0	0.68

<1> TOLERANCE (FT) = 0.010 <2> TOLERANCE (%) = 1.000

CURRENT DATE: 04-15-1996 FILE DATE: 04-15-1996
CURRENT TIME: 13:49:22 FILE NAME: CF19

++

PERFORMANCE CURVE FOR CULVERT # 1 - 1 (3.5 BY 2.416667) CMPA

++

CHARGE FLOW (cfs)	WATER ELEV. (ft)	DIS-CONTROL DEPTH (ft)	HEAD-CONTROL DEPTH (ft)	FLOW TYPE <F4>	INLET NORMAL DEPTH (ft)	OUTLET CRITICAL DEPTH (ft)	OUTLET VEL. (fps)	OUTLET DEPTH (ft)	TAILWATER VEL. (fps)	TAILWATER DEPTH (ft)
0	1805.50	0.00	0.00	0-NF	0.00	0.00	0.00	0.00	0.00	0.00
5	1806.37	0.81	0.87	2-M2c	0.61	0.51	3.69	0.51	1.64	0.20
10	1806.80	1.22	1.30	2-M2c	0.91	0.76	4.54	0.76	2.13	0.30
15	1807.17	1.57	1.67	2-M2c	1.18	0.96	5.16	0.96	2.49	0.38
20	1807.51	1.89	2.01	2-M2c	1.45	1.12	5.75	1.12	2.77	0.45
25	1807.84	2.20	2.34	2-M2c	1.76	1.28	6.25	1.28	3.01	0.51
30	1808.19	2.52	2.69	6-FFn	2.42	1.42	4.44	2.42	3.22	0.57
35	1808.69	2.89	3.19	6-FFn	2.42	1.55	5.18	2.42	3.41	0.62
40	1809.26	3.31	3.76	6-FFn	2.42	1.67	5.91	2.42	3.58	0.68
43	1809.69	3.64	4.19	6-FFn	2.42	1.75	6.43	2.42	3.73	0.72
44	1809.75	3.69	4.25	6-FFn	2.42	1.76	6.50	2.42	3.87	0.77

++

El. inlet face invert 1805.50 ft El. outlet invert 1805.06 ft
El. inlet throat invert 0.00 ft El. inlet crest 0.00 ft

++

***** SITE DATA ***** CULVERT INVERT **********

INLET STATION (FT)	2000.00
INLET ELEVATION (FT)	1805.50
OUTLET STATION (FT)	2061.50
OUTLET ELEVATION (FT)	1805.06
NUMBER OF BARRELS	1
SLOPE (V-FT/H-FT)	0.0072
CULVERT LENGTH ALONG SLOPE (FT)	61.50

***** CULVERT DATA SUMMARY **********

BARREL SHAPE	PIPE ARCH
BARREL SPAN	3.50 FT
BARREL RISE	2.42 FT
BARREL MATERIAL	STEEL OR ALUMINUM
BARREL MANNING'S N	0.025
INLET TYPE	CONVENTIONAL
INLET EDGE AND WALL	PROJECTING
INLET DEPRESSION	NONE

++

CURRENT DATE: 04-15-1996 FILE DATE: 04-15-1996
CURRENT TIME: 13:49:22 FILE NAME: CF19

++

++++++++++++++++++++++++ TAILWATER ++++++++++++++++++++++++

++

******* REGULAR CHANNEL CROSS SECTION ****************

BOTTOM WIDTH (FT)	15.22
SIDE SLOPE H/V (X:1)	2.0
CHANNEL SLOPE V/H (FT/FT)	0.010
MANNING'S N (.01-0.1)	0.030
CHANNEL INVERT ELEVATION (FT)	1805.06
CULVERT NO.1 OUTLET INVERT ELEVATION	1805.06 FT

******* UNIFORM FLOW RATING CURVE FOR DOWNSTREAM CHANNEL

FLOW (CFS)	W.S.E. (FT)	FROUDE NUMBER	DEPTH (FT)	VEL. (FPS)	SHEAR (PSF)
0.00	1805.06	0.000	0.00	0.00	0.00
5.00	1805.26	0.651	0.20	1.64	0.12
10.00	1805.36	0.691	0.30	2.13	0.18
15.00	1805.44	0.714	0.38	2.49	0.24
20.00	1805.51	0.730	0.45	2.77	0.28
25.00	1805.57	0.742	0.51	3.01	0.32
30.00	1805.63	0.752	0.57	3.22	0.36
35.00	1805.68	0.760	0.62	3.41	0.39
40.00	1805.74	0.767	0.68	3.58	0.42
45.00	1805.78	0.773	0.72	3.73	0.45
50.00	1805.83	0.778	0.77	3.87	0.48

++

++++++++++++++++++++++++ ROADWAY OVERTOPPING DATA ++++++++++++++++++++++++

++

ROADWAY SURFACE	PAVED
EMBANKMENT TOP WIDTH (FT)	26.00
CREST LENGTH (FT)	100.00
OVERTOPPING CREST ELEVATION (FT)	1809.68

++

CULVERT NO. N

CURRENT DATE: 04-09-1996
CURRENT TIME: 16:47:58

FILE DATE: 04-09-1996
FILE NAME: CF20

FHWA CULVERT ANALYSIS
HY-8, VERSION 4.0

CULV #	SITE DATA: INLET ELEV. (FT)	OUTLET ELEV. (FT)	CULVERT LENGTH (FT)	CULVERT SHAPE, MATERIAL, INLET: BARRELS SHAPE MATERIAL	SPAN (FT)	RISE (FT)	MANNING n	INLET TYPE
1	1803.47	1802.80	18.42	4 CSP	4.00	4.00	.024	CONVENTIONAL
2								
3								
4								
5								
6								

SUMMARY OF CULVERT FLOWS (CFS) FILE: CF20 DATE: 04-09-1996

ELEV (FT)	TOTAL	1	2	3	4	5	6	ROADWAY	ITR
1803.47	0	0	0	0	0	0	0	0	1
1806.88	210	210	0	0	0	0	0	0	1
1809.72	420	420	0	0	0	0	0	0	1
1814.45	630	630	0	0	0	0	0	0	1
1818.79	840	767	0	0	0	0	0	71	8
1819.32	1050	782	0	0	0	0	0	265	3
1819.74	1260	793	0	0	0	0	0	465	3
1820.10	1470	803	0	0	0	0	0	665	3
1820.42	1680	812	0	0	0	0	0	867	3
1820.73	1890	820	0	0	0	0	0	1069	3
1820.76	1915	821	0	0	0	0	0	1091	2
1818.41	756	756	0	0	0	0	0	OVERTOPPING	

SUMMARY OF ITERATIVE SOLUTION ERRORS FILE: CF20 DATE: 04-09-1996

HEAD ELEV(FT)	HEAD ERROR(FT)	TOTAL FLOW(CFS)	FLOW ERROR(CFS)	% FLOW ERROR
1803.47	0.00	0	0	0.00
1806.88	0.00	210	0	0.00
1809.72	0.00	420	0	0.00
1814.45	0.00	630	0	0.00
1818.79	-0.01	840	2	0.27
1819.32	-0.01	1050	3	0.32
1819.74	-0.00	1260	2	0.18
1820.10	-0.00	1470	2	0.11
1820.42	-0.00	1680	1	0.08
1820.73	-0.00	1890	1	0.06
1820.76	-0.00	1915	3	0.17

<1> TOLERANCE (FT) = 0.010 <2> TOLERANCE (%) = 1.000

CURRENT DATE: 04-09-1996 FILE DATE: 04-09-1996
CURRENT TIME: 16:47:58 FILE NAME: CF20

PERFORMANCE CURVE FOR CULVERT # 1 - 4 (4 BY 4) CSP

CHARGE FLOW (cfs)	WATER ELEV. (ft)	DIS-CONTROL DEPTH (ft)	HEAD-CONTROL DEPTH (ft)	FLOW TYPE <F4>	INLET NORMAL DEPTH (ft)	OUTLET CRITICAL DEPTH (ft)	OUTLET VEL. (fps)	OUTLET DEPTH (ft)	TAILWATER VEL. (fps)	TAILWATER DEPTH (ft)
0	1803.47	0.00	0.00	0-NF	0.00	0.00	0.00	0.00	0.00	0.00
210	1806.88	3.41	3.41	1-S2n	1.64	2.17	9.94	1.75	5.89	1.50
420	1809.72	6.25	6.25	5-S2n	2.48	3.09	11.88	2.65	7.42	2.24
630	1814.45	10.98	10.98	5-S2n	3.57	3.67	13.32	3.57	8.46	2.82
767	1818.79	15.32	11.31	6-FFn	4.00	4.00	15.26	4.00	9.25	3.31
782	1819.32	15.85	11.62	6-FFn	4.00	4.00	15.55	4.00	9.90	3.75
793	1819.73	16.26	12.01	4-FFt	4.00	4.00	15.78	4.00	10.45	4.14
803	1820.09	16.62	12.58	4-FFt	4.00	4.00	15.97	4.00	10.94	4.50
812	1820.42	16.95	13.11	4-FFt	4.00	4.00	16.15	4.00	11.37	4.84
820	1820.72	17.25	13.61	4-FFt	4.00	4.00	16.31	4.00	11.77	5.16
821	1820.76	17.29	13.66	4-FFt	4.00	4.00	16.33	4.00	11.81	5.19

El. inlet face invert 1803.47 ft El. outlet invert 1802.80 ft
El. inlet throat invert 0.00 ft El. inlet crest 0.00 ft

***** SITE DATA ***** CULVERT INVERT **********

INLET STATION (FT)	2000.00
INLET ELEVATION (FT)	1803.47
OUTLET STATION (FT)	2018.41
OUTLET ELEVATION (FT)	1802.80
NUMBER OF BARRELS	4
SLOPE (V-FT/H-FT)	0.0364
CULVERT LENGTH ALONG SLOPE (FT)	18.42

***** CULVERT DATA SUMMARY **********

BARREL SHAPE	CIRCULAR
BARREL DIAMETER	4.00 FT
BARREL MATERIAL	CORRUGATED STEEL
BARREL MANNING'S N	0.024
INLET TYPE	CONVENTIONAL
INLET EDGE AND WALL	THIN EDGE PROJECTING
INLET DEPRESSION	NONE

CURRENT DATE: 04-09-1996 FILE DATE: 04-09-1996
CURRENT TIME: 16:47:58 FILE NAME: CF20

TAILWATER

******* REGULAR CHANNEL CROSS SECTION ****************

BOTTOM WIDTH (FT)	20.83
SIDE SLOPE H/V (X:1)	2.0
CHANNEL SLOPE V/H (FT/FT)	0.010
MANNING'S N (.01-0.1)	0.030
CHANNEL INVERT ELEVATION (FT)	1802.80
CULVERT NO.1 OUTLET INVERT ELEVATION	1802.80 FT

******* UNIFORM FLOW RATING CURVE FOR DOWNSTREAM CHANNEL

FLOW (CFS)	W.S.E. (FT)	FROUDE NUMBER	DEPTH (FT)	VEL. (FPS)	SHEAR (PSF)
0.00	1802.80	0.000	0.00	0.00	0.00
210.00	1804.30	0.848	1.50	5.89	0.93
420.00	1805.04	0.874	2.24	7.42	1.40
630.00	1805.62	0.888	2.82	8.46	1.76
840.00	1806.11	0.896	3.31	9.25	2.07
1050.00	1806.55	0.901	3.75	9.90	2.34
1260.00	1806.94	0.905	4.14	10.45	2.58
1470.00	1807.30	0.908	4.50	10.94	2.81
1680.00	1807.64	0.911	4.84	11.37	3.02
1890.00	1807.96	0.913	5.16	11.77	3.22
1915.00	1807.99	0.913	5.19	11.81	3.24

ROADWAY OVERTOPPING DATA

ROADWAY SURFACE	PAVED
EMBANKMENT TOP WIDTH (FT)	26.00
CREST LENGTH (FT)	100.00
OVERTOPPING CREST ELEVATION (FT)	1818.41

CULVERT NO. 21

CURRENT DATE: 04-10-1996
CURRENT TIME: 07:16:30

FILE DATE: 04-10-1996
FILE NAME: CF21

FHWA CULVERT ANALYSIS
HY-8, VERSION 4.0

CULV #	SITE DATA: INLET ELEV. (FT)	OUTLET ELEV. (FT)	CULVERT LENGTH (FT)	CULVERT SHAPE, MATERIAL, INLET: BARRELS SHAPE MATERIAL	SPAN (FT)	RISE (FT)	MANNING n	INLET TYPE
1	1813.46	1813.20	19.01	1 CMPA	3.50	2.42	.025	CONVENTIONAL
2								
3								
4								
5								
6								

SUMMARY OF CULVERT FLOWS (CFS) FILE: CF21 DATE: 04-10-1996

ELEV (FT)	TOTAL	1	2	3	4	5	6	ROADWAY	ITR
1813.46	0	0	0	0	0	0	0	0	1
1814.37	5	5	0	0	0	0	0	0	1
1814.67	10	10	0	0	0	0	0	0	1
1815.20	15	15	0	0	0	0	0	0	1
1815.56	20	20	0	0	0	0	0	0	1
1815.82	25	25	0	0	0	0	0	0	1
1816.14	30	30	0	0	0	0	0	0	1
1816.42	35	35	0	0	0	0	0	0	1
1816.76	40	40	0	0	0	0	0	0	1
1817.24	45	45	0	0	0	0	0	0	1
1817.80	50	50	0	0	0	0	0	0	1
1818.41	55	55	0	0	0	0	0	OVERTOPPING	

SUMMARY OF ITERATIVE SOLUTION ERRORS FILE: CF21 DATE: 04-10-1996

HEAD ELEV(FT)	HEAD ERROR(FT)	TOTAL FLOW(CFS)	FLOW ERROR(CFS)	% FLOW ERROR
1813.46	0.00	0	0	0.00
1814.37	0.00	5	0	0.00
1814.67	0.00	10	0	0.00
1815.20	0.00	15	0	0.00
1815.56	0.00	20	0	0.00
1815.82	0.00	25	0	0.00
1816.14	0.00	30	0	0.00
1816.42	0.00	35	0	0.00
1816.76	0.00	40	0	0.00
1817.24	0.00	45	0	0.00
1817.80	0.00	50	0	0.00

<1> TOLERANCE (FT) = 0.010 <2> TOLERANCE (%) = 1.000

CURRENT DATE: 04-10-1996 FILE DATE: 04-10-1996
CURRENT TIME: 07:16:30 FILE NAME: CF21

++

PERFORMANCE CURVE FOR CULVERT # 1 - 1 (3.5 BY 2.416667) CMPA

++

CHARGE FLOW (cfs)	WATER ELEV. (ft)	DIS- CONTROL DEPTH (ft)	HEAD- CONTROL DEPTH (ft)	FLOW TYPE <F4>	INLET NORMAL DEPTH (ft)	OUTLET CRITICAL DEPTH (ft)	OUTLET VEL. (fps)	OUTLET DEPTH (ft)	TAILWATER VEL. (fps)	TAILWATER DEPTH (ft)
0	1813.46	0.00	0.00	0-NF	0.00	0.00	0.00	0.00	0.00	0.00
5	1814.37	0.81	0.91	2-M2c	0.51	0.51	3.69	0.51	2.50	0.45
10	1814.67	1.21	1.21	1-S2n	0.76	0.76	4.55	0.76	3.09	0.66
15	1815.20	1.56	1.74	2-M2c	0.96	0.96	5.16	0.96	3.49	0.82
20	1815.56	1.88	2.10	2-M2c	1.15	1.12	5.75	1.12	3.79	0.96
25	1815.82	2.19	2.36	2-M2c	1.35	1.28	6.25	1.28	4.04	1.08
30	1816.14	2.51	2.68	2-M2c	1.55	1.42	6.71	1.42	4.25	1.18
35	1816.42	2.88	2.96	2-M2c	1.79	1.55	7.20	1.55	4.43	1.28
40	1816.76	3.30	3.27	2-M2c	2.15	1.67	7.63	1.67	4.59	1.37
45	1817.24	3.78	3.66	6-FFn	2.42	1.78	6.65	2.42	4.74	1.45
50	1817.80	4.34	4.13	6-FFn	2.42	1.88	7.39	2.42	4.88	1.53

++

El. inlet face invert 1813.46 ft El. outlet invert 1813.20 ft
El. inlet throat invert 0.00 ft El. inlet crest 0.00 ft

++

***** SITE DATA ***** CULVERT INVERT **********

INLET STATION (FT)	2000.00
INLET ELEVATION (FT)	1813.46
OUTLET STATION (FT)	2019.01
OUTLET ELEVATION (FT)	1813.20
NUMBER OF BARRELS	1
SLOPE (V-FT/H-FT)	0.0137
CULVERT LENGTH ALONG SLOPE (FT)	19.01

***** CULVERT DATA SUMMARY **********

BARREL SHAPE	PIPE ARCH
BARREL SPAN	3.50 FT
BARREL RISE	2.42 FT
BARREL MATERIAL	STEEL OR ALUMINUM
BARREL MANNING'S N	0.025
INLET TYPE	CONVENTIONAL
INLET EDGE AND WALL	PROJECTING
INLET DEPRESSION	NONE

++

CURRENT DATE: 04-10-1996 FILE DATE: 04-10-1996
CURRENT TIME: 07:16:30 FILE NAME: CF21

++

++++++++++++++++++++++++++ TAILWATER ++++++++++++++++++++++++++

++

******* REGULAR CHANNEL CROSS SECTION ****************

BOTTOM WIDTH (FT)	3.61
SIDE SLOPE H/V (X:1)	2.0
CHANNEL SLOPE V/H (FT/FT)	0.010
MANNING'S N (.01-0.1)	0.030
CHANNEL INVERT ELEVATION (FT)	1813.20
CULVERT NO.1 OUTLET INVERT ELEVATION	1813.20 FT

******* UNIFORM FLOW RATING CURVE FOR DOWNSTREAM CHANNEL

FLOW (CFS)	W.S.E. (FT)	FROUDE NUMBER	DEPTH (FT)	VEL. (FPS)	SHEAR (PSF)
0.00	1813.20	0.000	0.00	0.00	0.00
5.00	1813.65	0.659	0.45	2.50	0.28
10.00	1813.86	0.673	0.66	3.09	0.41
15.00	1814.02	0.679	0.82	3.49	0.51
20.00	1814.16	0.683	0.96	3.79	0.60
25.00	1814.28	0.686	1.08	4.04	0.67
30.00	1814.38	0.688	1.18	4.25	0.74
35.00	1814.48	0.690	1.28	4.43	0.80
40.00	1814.57	0.692	1.37	4.59	0.86
45.00	1814.65	0.693	1.45	4.74	0.91
50.00	1814.73	0.694	1.53	4.88	0.96

++

++++++++++++++++++++++++++ ROADWAY OVERTOPPING DATA ++++++++++++++++++++++++++

++

ROADWAY SURFACE	PAVED
EMBANKMENT TOP WIDTH (FT)	26.00
CREST LENGTH (FT)	100.00
OVERTOPPING CREST ELEVATION (FT)	1818.41

++

CULVERT NO. 24

CURRENT DATE: 04-17-1996
CURRENT TIME: 08:06:49

FILE DATE: 04-17-1996
FILE NAME: CULV24

FHWA CULVERT ANALYSIS
HY-8, VERSION 4.0

CULV #	SITE DATA: INLET ELEV. (FT)	SITE DATA: OUTLET ELEV. (FT)	SITE DATA: CULVERT LENGTH (FT)	CULVERT SHAPE, MATERIAL, INLET: BARRELS SHAPE MATERIAL	SPAN (FT)	RISE (FT)	MANNING n	INLET TYPE
1	1867.20	1867.02	57.87	1 CSP	2.50	2.50	.024	CONVENTIONAL
2								
3								
4								
5								
6								

SUMMARY OF CULVERT FLOWS (CFS) FILE: CULV24 DATE: 04-17-1996

ELEV (FT)	TOTAL	1	2	3	4	5	6	ROADWAY	ITR
1867.20	0	0	0	0	0	0	0	0	1
1868.22	4	4	0	0	0	0	0	0	1
1868.67	7	7	0	0	0	0	0	0	1
1869.04	11	11	0	0	0	0	0	0	1
1869.37	14	14	0	0	0	0	0	0	1
1869.71	18	18	0	0	0	0	0	0	1
1870.10	21	21	0	0	0	0	0	0	1
1870.55	25	25	0	0	0	0	0	0	1
1870.61	25	25	0	0	0	0	0	0	1
1871.41	32	30	0	0	0	0	0	1	23
1871.45	35	31	0	0	0	0	0	4	8
1871.39	30	30	0	0	0	0	0	OVERTOPPING	

SUMMARY OF ITERATIVE SOLUTION ERRORS FILE: CULV24 DATE: 04-17-1996

HEAD ELEV(FT)	HEAD ERROR(FT)	TOTAL FLOW(CFS)	FLOW ERROR(CFS)	% FLOW ERROR
1867.20	0.00	0	0	0.00
1868.22	0.00	4	0	0.00
1868.67	0.00	7	0	0.00
1869.04	0.00	11	0	0.00
1869.37	0.00	14	0	0.00
1869.71	0.00	18	0	0.00
1870.10	0.00	21	0	0.00
1870.55	0.00	25	0	0.00
1870.61	0.00	25	0	0.00
1871.41	-0.00	32	0	0.81
1871.45	-0.00	35	0	0.76

<1> TOLERANCE (FT) = 0.010 <2> TOLERANCE (%) = 1.000

CURRENT DATE: 04-17-1996 FILE DATE: 04-17-1996
CURRENT TIME: 08:06:49 FILE NAME: CULV24

++

PERFORMANCE CURVE FOR CULVERT # 1 - 1 (2.5 BY 2.5) CSP

++

CHARGE FLOW (cfs)	WATER ELEV. (ft)	DIS-CONTROL DEPTH (ft)	HEAD-CONTROL DEPTH (ft)	INLET FLOW TYPE <F4>	NORMAL DEPTH (ft)	OUTLET CRITICAL DEPTH (ft)	OUTLET VEL. (fps)	OUTLET DEPTH (ft)	TAILWATER VEL. (fps)	TAILWATER DEPTH (ft)
0	1867.20	0.00	0.00	0-NF	0.00	0.00	0.00	0.00	0.00	0.00
4	1868.22	0.92	1.02	2-M2c	0.90	0.60	3.81	0.60	2.07	0.31
7	1868.67	1.31	1.47	2-M2c	1.34	0.87	4.60	0.87	2.61	0.46
11	1869.04	1.65	1.84	2-M2c	1.77	1.08	5.18	1.08	2.99	0.58
14	1869.37	1.97	2.17	6-FFn	2.50	1.26	2.85	2.50	3.27	0.68
18	1869.71	2.29	2.51	6-FFn	2.50	1.41	3.57	2.50	3.51	0.77
21	1870.10	2.62	2.90	6-FFn	2.50	1.55	4.28	2.50	3.71	0.85
25	1870.55	2.98	3.35	6-FFn	2.50	1.68	4.99	2.50	3.88	0.93
25	1870.61	3.03	3.41	6-FFn	2.50	1.70	5.09	2.50	3.91	0.94
30	1871.41	3.67	4.21	6-FFn	2.50	1.87	6.19	2.50	4.18	1.07
31	1871.45	3.70	4.25	6-FFn	2.50	1.88	6.24	2.50	4.32	1.13

++

El. inlet face invert 1867.20 ft El. outlet invert 1867.02 ft
El. inlet throat invert 0.00 ft El. inlet crest 0.00 ft

++

***** SITE DATA ***** CULVERT INVERT **********

INLET STATION (FT)	2000.00
INLET ELEVATION (FT)	1867.20
OUTLET STATION (FT)	2057.87
OUTLET ELEVATION (FT)	1867.02
NUMBER OF BARRELS	1
SLOPE (V-FT/H-FT)	0.0031
CULVERT LENGTH ALONG SLOPE (FT)	57.87

***** CULVERT DATA SUMMARY **********

BARREL SHAPE	CIRCULAR
BARREL DIAMETER	2.50 FT
BARREL MATERIAL	CORRUGATED STEEL
BARREL MANNING'S N	0.024
INLET TYPE	CONVENTIONAL
INLET EDGE AND WALL	THIN EDGE PROJECTING
INLET DEPRESSION	NONE

++

CURRENT DATE: 04-17-1996
CURRENT TIME: 08:06:49

FILE DATE: 04-17-1996
FILE NAME: CULV24

++

++++++++++++++++++++++++ TAILWATER ++++++++++++++++++++++++

++

******* REGULAR CHANNEL CROSS SECTION ****************

BOTTOM WIDTH (FT)	4.92
SIDE SLOPE H/V (X:1)	2.0
CHANNEL SLOPE V/H (FT/FT)	0.010
MANNING'S N (.01-0.1)	0.030
CHANNEL INVERT ELEVATION (FT)	1867.02
CULVERT NO.1 OUTLET INVERT ELEVATION	1867.02 FT

******* UNIFORM FLOW RATING CURVE FOR DOWNSTREAM CHANNEL

FLOW (CFS)	W.S.E. (FT)	FROUDE NUMBER	DEPTH (FT)	VEL. (FPS)	SHEAR (PSF)
0.00	1867.02	0.000	0.00	0.00	0.00
3.50	1867.33	0.658	0.31	2.07	0.19
7.00	1867.48	0.680	0.46	2.61	0.29
10.50	1867.60	0.692	0.58	2.99	0.36
14.00	1867.70	0.699	0.68	3.27	0.42
17.50	1867.79	0.703	0.77	3.51	0.48
21.00	1867.87	0.707	0.85	3.71	0.53
24.50	1867.95	0.710	0.93	3.88	0.58
25.00	1867.96	0.710	0.94	3.91	0.59
31.50	1868.09	0.714	1.07	4.18	0.67
35.00	1868.15	0.716	1.13	4.32	0.70

++

++++++++++++++++++++++++ ROADWAY OVERTOPPING DATA ++++++++++++++++++++++++

++

ROADWAY SURFACE	PAVED
EMBANKMENT TOP WIDTH (FT)	26.00
CREST LENGTH (FT)	100.00
OVERTOPPING CREST ELEVATION (FT)	1871.39

++

CULVERT NO. 26

CURRENT DATE: 04-17-1996
CURRENT TIME: 08:25:59

FILE DATE: 04-17-1996
FILE NAME: CULV26

FHWA CULVERT ANALYSIS
HY-8, VERSION 4.0

CULV #	SITE DATA: INLET ELEV. (FT)	SITE DATA: OUTLET ELEV. (FT)	SITE DATA: CULVERT LENGTH (FT)	CULVERT SHAPE, MATERIAL, INLET: BARRELS SHAPE MATERIAL	SPAN (FT)	RISE (FT)	MANNING n	INLET TYPE
1	1914.66	1910.74	113.29	1 CMPA	5.92	3.92	.024	CONVENTIONAL
2	1914.58	1911.18	113.04	1 CMPA	5.92	3.92	.024	CONVENTIONAL
3	1914.69	1911.43	113.47	1 CMPA	5.92	3.92	.024	CONVENTIONAL
4								
5								
6								

SUMMARY OF CULVERT FLOWS (CFS) FILE: CULV26 DATE: 04-17-1996

ELEV (FT)	TOTAL	1	2	3	4	5	6	ROADWAY	ITR
1914.66	0	0	0	0	0	0	0	0	0
1915.48	25	8	9	7	0	0	0	0	4
1915.88	50	16	18	15	0	0	0	0	3
1916.22	75	25	27	24	0	0	0	0	3
1916.51	100	33	35	32	0	0	0	0	3
1916.80	125	41	43	40	0	0	0	0	3
1917.07	150	50	52	48	0	0	0	0	3
1917.31	175	58	60	56	0	0	0	0	2
1917.56	200	66	69	65	0	0	0	0	2
1917.80	225	75	77	73	0	0	0	0	2
1918.05	250	83	86	82	0	0	0	0	2
1919.95	418	139	141	138	0	0	0	OVERTOPPING	

SUMMARY OF ITERATIVE SOLUTION ERRORS FILE: CULV26 DATE: 04-17-1996

HEAD ELEV(FT)	HEAD ERROR(FT)	TOTAL FLOW(CFS)	FLOW ERROR(CFS)	% FLOW ERROR
1914.66	0.00	0	0	0.00
1915.48	-0.01	25	0	0.08
1915.88	-0.01	50	0	0.88
1916.22	-0.00	75	0	0.27
1916.51	-0.00	100	0	0.03
1916.80	-0.00	125	0	0.20
1917.07	-0.00	150	0	0.10
1917.31	-0.00	175	0	0.19
1917.56	-0.00	200	0	0.11
1917.80	-0.00	225	0	0.01
1918.05	0.01	250	-1	-0.22

<1> TOLERANCE (FT) = 0.010 <2> TOLERANCE (%) = 1.000

CURRENT DATE: 04-17-1996 FILE DATE: 04-17-1996
CURRENT TIME: 08:25:59 FILE NAME: CULV26

++

PERFORMANCE CURVE FOR CULVERT # 1 - 1 (5.916667 BY 3.916667) CMPA

++

CHARGE FLOW (cfs)	WATER ELEV. (ft)	DIS-CONTROL DEPTH (ft)	HEAD-CONTROL DEPTH (ft)	FLOW TYPE <F4>	INLET NORMAL DEPTH (ft)	OUTLET CRITICAL DEPTH (ft)	OUTLET VEL. (fps)	OUTLET DEPTH (ft)	TAILWATER VEL. (fps)	TAILWATER DEPTH (ft)
0	1914.66	0.00	0.00	0-NF	0.00	0.00	0.00	0.00	0.00	0.00
8	1915.49	0.83	0.83	1-S2n	0.42	0.53	5.95	0.42	2.30	0.32
16	1915.89	1.23	1.23	1-S2n	0.57	0.80	6.95	0.57	3.01	0.49
25	1916.23	1.57	1.57	1-S2n	0.74	1.01	7.75	0.74	3.52	0.63
33	1916.52	1.86	1.86	1-S2n	0.86	1.20	8.54	0.86	3.92	0.74
41	1916.80	2.14	2.14	1-S2n	0.96	1.35	9.23	0.96	4.27	0.85
50	1917.07	2.41	2.41	1-S2n	1.07	1.50	9.75	1.07	4.57	0.95
58	1917.32	2.66	2.66	1-S2n	1.17	1.64	9.75	1.07	4.84	1.04
66	1917.57	2.91	2.91	1-S2n	1.26	1.77	10.66	1.26	5.08	1.12
75	1917.80	3.14	3.14	1-S2n	1.35	1.90	11.08	1.35	5.31	1.20
83	1918.05	3.39	3.39	1-S2n	1.44	2.02	11.33	1.45	5.52	1.28

++

El. inlet face invert 1914.66 ft El. outlet invert 1910.74 ft
El. inlet throat invert 0.00 ft El. inlet crest 0.00 ft

++

***** SITE DATA ***** CULVERT INVERT **********

INLET STATION (FT)	2000.00
INLET ELEVATION (FT)	1914.66
OUTLET STATION (FT)	2113.22
OUTLET ELEVATION (FT)	1910.74
NUMBER OF BARRELS	1
SLOPE (V-FT/H-FT)	0.0346
CULVERT LENGTH ALONG SLOPE (FT)	113.29

***** CULVERT DATA SUMMARY **********

BARREL SHAPE	PIPE ARCH
BARREL SPAN	5.92 FT
BARREL RISE	3.92 FT
BARREL MATERIAL	STEEL OR ALUMINUM
BARREL MANNING'S N	0.024
INLET TYPE	CONVENTIONAL
INLET EDGE AND WALL	PROJECTING
INLET DEPRESSION	NONE

++

CURRENT DATE: 04-17-1996 FILE DATE: 04-17-1996
CURRENT TIME: 08:25:59 FILE NAME: CULV26

++

PERFORMANCE CURVE FOR CULVERT # 2 - 1 (5.916667 BY 3.916667) CMPA

++

CHARGE FLOW (cfs)	WATER ELEV. (ft)	DIS-CONTROL DEPTH (ft)	HEAD-CONTROL DEPTH (ft)	FLOW TYPE <F4>	INLET NORMAL DEPTH (ft)	OUTLET CRITICAL DEPTH (ft)	OUTLET VEL. (fps)	OUTLET DEPTH (ft)	TAILWATER VEL. (fps)	TAILWATER DEPTH (ft)
0	1914.58	0.00	0.00	0-NF	0.00	0.00	0.00	0.00	0.00	-0.44
9	1915.49	0.91	0.91	1-S2n	0.46	0.58	5.51	0.46	2.30	-0.12
18	1915.89	1.31	1.31	1-S2n	0.63	0.85	6.81	0.63	3.01	0.05
27	1916.22	1.64	1.64	1-S2n	0.80	1.05	7.54	0.80	3.52	0.19
35	1916.52	1.94	1.94	1-S2n	0.92	1.24	8.35	0.92	3.92	0.30
43	1916.80	2.22	2.22	1-S2n	1.03	1.39	8.93	1.03	4.27	0.41
52	1917.07	2.49	2.49	1-S2n	1.15	1.55	9.38	1.15	4.57	0.51
60	1917.32	2.74	2.74	1-S2n	1.25	1.68	9.85	1.25	4.84	0.60
69	1917.56	2.98	2.98	1-S2n	1.34	1.81	10.28	1.34	5.08	0.68
77	1917.80	3.22	3.22	1-S2n	1.44	1.94	10.64	1.44	5.31	0.76
86	1918.05	3.47	3.47	1-S2n	1.54	2.05	10.96	1.54	5.52	0.84

++

El. inlet face invert 1914.58 ft El. outlet invert 1911.18 ft
El. inlet throat invert 0.00 ft El. inlet crest 0.00 ft

++

***** SITE DATA ***** CULVERT INVERT **********

INLET STATION (FT)	2000.00
INLET ELEVATION (FT)	1914.58
OUTLET STATION (FT)	2112.99
OUTLET ELEVATION (FT)	1911.18
NUMBER OF BARRELS	1
SLOPE (V-FT/H-FT)	0.0301
CULVERT LENGTH ALONG SLOPE (FT)	113.04

***** CULVERT DATA SUMMARY **********

BARREL SHAPE	PIPE ARCH
BARREL SPAN	5.92 FT
BARREL RISE	3.92 FT
BARREL MATERIAL	STEEL OR ALUMINUM
BARREL MANNING'S N	0.024
INLET TYPE	CONVENTIONAL
INLET EDGE AND WALL	PROJECTING
INLET DEPRESSION	NONE

++

CURRENT DATE: 04-17-1996 FILE DATE: 04-17-1996
CURRENT TIME: 08:25:59 FILE NAME: CULV26

++

PERFORMANCE CURVE FOR CULVERT # 3 - 1 (5.916667 BY 3.916667) CMPA

++

CHARGE FLOW (cfs)	WATER ELEV. (ft)	DIS-CONTROL DEPTH (ft)	HEAD-CONTROL DEPTH (ft)	INLET FLOW TYPE <F4>	INLET NORMAL DEPTH (ft)	OUTLET CRITICAL DEPTH (ft)	OUTLET VEL. (fps)	OUTLET DEPTH (ft)	TAILWATER VEL. (fps)	TAILWATER DEPTH (ft)
0	1914.69	0.00	0.00	0-NF	0.00	0.00	0.00	0.00	0.00	-0.69
7	1915.49	0.80	0.80	1-S2n	0.42	0.51	5.52	0.42	2.30	-0.37
15	1915.89	1.20	1.20	1-S2n	0.59	0.79	6.43	0.59	3.01	-0.20
24	1916.22	1.53	1.53	1-S2n	0.76	0.98	7.13	0.76	3.52	-0.06
32	1916.52	1.83	1.83	1-S2n	0.88	1.18	7.94	0.88	3.92	0.05
40	1916.80	2.11	2.11	1-S2n	1.00	1.33	8.58	1.00	4.27	0.16
48	1917.07	2.38	2.38	1-S2n	1.11	1.48	9.05	1.11	4.57	0.26
56	1917.32	2.63	2.63	1-S2n	1.22	1.62	9.50	1.22	4.84	0.35
65	1917.57	2.88	2.88	1-S2n	1.32	1.75	9.94	1.32	5.08	0.43
73	1917.81	3.12	3.12	1-S2n	1.41	1.88	10.32	1.41	5.31	0.51
82	1918.05	3.36	3.36	1-S2n	1.51	2.00	10.65	1.51	5.52	0.59

++

El. inlet face invert 1914.69 ft El. outlet invert 1911.43 ft
El. inlet throat invert 0.00 ft El. inlet crest 0.00 ft

++

***** SITE DATA ***** CULVERT INVERT **********

INLET STATION (FT)	2000.00
INLET ELEVATION (FT)	1914.69
OUTLET STATION (FT)	2113.42
OUTLET ELEVATION (FT)	1911.43
NUMBER OF BARRELS	1
SLOPE (V-FT/H-FT)	0.0287
CULVERT LENGTH ALONG SLOPE (FT)	113.47

***** CULVERT DATA SUMMARY **********

BARREL SHAPE	PIPE ARCH
BARREL SPAN	5.92 FT
BARREL RISE	3.92 FT
BARREL MATERIAL	STEEL OR ALUMINUM
BARREL MANNING'S N	0.024
INLET TYPE	CONVENTIONAL
INLET EDGE AND WALL	PROJECTING
INLET DEPRESSION	NONE

++

CURRENT DATE: 04-17-1996 FILE DATE: 04-17-1996
CURRENT TIME: 08:25:59 FILE NAME: CULV26

++
++++++++++++++++++++++++ TAILWATER ++++++++++++++++++++++++
++

******* REGULAR CHANNEL CROSS SECTION ****************

BOTTOM WIDTH (FT)	32.81
SIDE SLOPE H/V (X:1)	2.0
CHANNEL SLOPE V/H (FT/FT)	0.010
MANNING'S N (.01-0.1)	0.030
CHANNEL INVERT ELEVATION (FT)	1910.74
CULVERT NO.1 OUTLET INVERT ELEVATION	1910.74 FT

******* UNIFORM FLOW RATING CURVE FOR DOWNSTREAM CHANNEL

FLOW (CFS)	W.S.E. (FT)	FROUDE NUMBER	DEPTH (FT)	VEL. (FPS)	SHEAR (PSF)
0.00	1910.74	0.000	0.00	0.00	0.00
25.00	1911.06	0.712	0.32	2.30	0.20
50.00	1911.23	0.757	0.49	3.01	0.31
75.00	1911.37	0.784	0.63	3.52	0.39
100.00	1911.48	0.802	0.74	3.92	0.46
125.00	1911.59	0.817	0.85	4.27	0.53
150.00	1911.69	0.828	0.95	4.57	0.59
175.00	1911.78	0.838	1.04	4.84	0.65
200.00	1911.86	0.846	1.12	5.08	0.70
225.00	1911.94	0.853	1.20	5.31	0.75
250.00	1912.02	0.859	1.28	5.52	0.80

++
++++++++++++++++++++++++ ROADWAY OVERTOPPING DATA ++++++++++++++++++++++++
++

ROADWAY SURFACE	PAVED
EMBANKMENT TOP WIDTH (FT)	26.00
CREST LENGTH (FT)	100.00
OVERTOPPING CREST ELEVATION (FT)	1919.95

++

CULVERT NO. O

CURRENT DATE: 04-17-1996 FILE DATE: 04-17-1996
CURRENT TIME: 15:52:54 FILE NAME: O-UPSIZE

FHWA CULVERT ANALYSIS
HY-8, VERSION 4.0

CULV #	SITE DATA: INLET ELEV. (FT)	OUTLET ELEV. (FT)	CULVERT LENGTH (FT)	CULVERT SHAPE, MATERIAL, INLET: BARRELS SHAPE MATERIAL	SPAN (FT)	RISE (FT)	MANNING n	INLET TYPE
1	1817.32	1816.60	86.48	2 RCB	10.00	5.50	.012	CONVENTIONAL
2								
3								
4								
5								
6								

SUMMARY OF CULVERT FLOWS (CFS) FILE: O-UPSIZE DATE: 04-17-1996

ELEV (FT)	TOTAL	1	2	3	4	5	6	ROADWAY	ITR
1817.32	0	0	0	0	0	0	0	0	1
1821.54	450	450	0	0	0	0	0	0	1
1823.58	900	794	0	0	0	0	0	101	4
1824.36	1350	919	0	0	0	0	0	430	3
1824.99	1800	1013	0	0	0	0	0	787	3
1825.54	2250	1091	0	0	0	0	0	1159	3
1826.05	2700	1159	0	0	0	0	0	1541	3
1826.53	3150	1219	0	0	0	0	0	1930	3
1826.98	3600	1273	0	0	0	0	0	2326	3
1827.41	4050	1322	0	0	0	0	0	2733	2
1827.50	4147	1332	0	0	0	0	0	2822	2
1823.10	714	714	0	0	0	0	0	OVERTOPPING	

SUMMARY OF ITERATIVE SOLUTION ERRORS FILE: O-UPSIZE DATE: 04-17-1996

HEAD ELEV(FT)	HEAD ERROR(FT)	TOTAL FLOW(CFS)	FLOW ERROR(CFS)	% FLOW ERROR
1817.32	0.00	0	0	0.00
1821.54	0.00	450	0	0.00
1823.58	-0.01	900	5	0.53
1824.36	-0.00	1350	1	0.04
1824.99	-0.00	1800	1	0.04
1825.54	-0.00	2250	1	0.02
1826.05	-0.00	2700	0	0.01
1826.53	-0.00	3150	1	0.02
1826.98	-0.00	3600	1	0.03
1827.41	0.00	4050	-5	-0.13
1827.50	0.01	4147	-7	-0.18

<1> TOLERANCE (FT) = 0.010 <2> TOLERANCE (%) = 1.000

CURRENT DATE: 04-17-1996 FILE DATE: 04-17-1996
CURRENT TIME: 15:52:54 FILE NAME: O-UPSIZE

PERFORMANCE CURVE FOR CULVERT # 1 - 2 (10 BY 5.5) RCB

CHARGE FLOW (cfs)	WATER ELEV. (ft)	DIS-CONTROL DEPTH (ft)	HEAD-CONTROL DEPTH (ft)	FLOW TYPE <F4>	INLET NORMAL DEPTH (ft)	OUTLET CRITICAL DEPTH (ft)	OUTLET VEL. (fps)	OUTLET DEPTH (ft)	TAILWATER VEL. (fps)	TAILWATER DEPTH (ft)
0	1817.32	0.00	0.00	0-NF	0.00	0.00	0.00	0.00	0.00	0.00
450	1821.54	4.22	4.22	1-S2n	1.69	2.51	11.80	1.91	6.67	1.73
794	1823.58	6.26	6.26	5-S2n	2.49	3.67	13.71	2.90	8.50	2.60
919	1824.36	7.04	7.04	5-S2n	2.76	4.04	14.25	3.23	9.75	3.30
1013	1824.99	7.67	7.67	5-S2n	2.95	4.31	14.62	3.46	10.71	3.89
1091	1825.54	8.22	8.22	5-S2n	3.11	4.53	14.91	3.66	11.51	4.42
1159	1826.05	8.73	8.73	5-S2n	3.25	4.72	15.14	3.83	12.20	4.90
1219	1826.53	9.21	9.21	5-S2n	3.37	4.88	15.35	3.97	12.80	5.34
1273	1826.97	9.65	8.50	4-FFt	3.48	5.02	11.57	5.50	13.34	5.75
1322	1827.40	10.08	9.16	4-FFt	3.57	5.15	12.02	5.50	13.82	6.14
1332	1827.49	10.17	9.30	4-FFt	3.59	5.18	12.11	5.50	13.92	6.22

El. inlet face invert 1817.32 ft El. outlet invert 1816.60 ft
El. inlet throat invert 0.00 ft El. inlet crest 0.00 ft

***** SITE DATA ***** CULVERT INVERT **********

INLET STATION (FT)	2000.00
INLET ELEVATION (FT)	1817.32
OUTLET STATION (FT)	2086.48
OUTLET ELEVATION (FT)	1816.60
NUMBER OF BARRELS	2
SLOPE (V-FT/H-FT)	0.0083
CULVERT LENGTH ALONG SLOPE (FT)	86.48

***** CULVERT DATA SUMMARY **********

BARREL SHAPE	BOX
BARREL SPAN	10.00 FT
BARREL RISE	5.50 FT
BARREL MATERIAL	CONCRETE
BARREL MANNING'S N	0.012
INLET TYPE	CONVENTIONAL
INLET EDGE AND WALL	SQUARE EDGE (90-45 DEG.)
INLET DEPRESSION	NONE

CURRENT DATE: 04-17-1996
CURRENT TIME: 15:52:54

FILE DATE: 04-17-1996
FILE NAME: O-UPSIZE

++

++++++++++++++++++++++++ TAILWATER ++++++++++++++++++++++++

++

******* REGULAR CHANNEL CROSS SECTION ****************

BOTTOM WIDTH (FT)	35.43
SIDE SLOPE H/V (X:1)	2.0
CHANNEL SLOPE V/H (FT/FT)	0.010
MANNING'S N (.01-0.1)	0.030
CHANNEL INVERT ELEVATION (FT)	1816.60
CULVERT NO.1 OUTLET INVERT ELEVATION	1816.60 FT

******* UNIFORM FLOW RATING CURVE FOR DOWNSTREAM CHANNEL

FLOW (CFS)	W.S.E. (FT)	FROUDE NUMBER	DEPTH (FT)	VEL. (FPS)	SHEAR (PSF)
0.00	1816.60	0.000	0.00	0.00	0.00
450.00	1818.33	0.892	1.73	6.67	1.08
900.00	1819.20	0.928	2.60	8.50	1.63
1350.00	1819.90	0.946	3.30	9.75	2.06
1800.00	1820.49	0.957	3.89	10.71	2.43
2250.00	1821.02	0.966	4.42	11.51	2.76
2700.00	1821.49	0.972	4.90	12.20	3.05
3150.00	1821.94	0.976	5.34	12.80	3.33
3600.00	1822.35	0.980	5.75	13.34	3.59
4050.00	1822.74	0.983	6.14	13.82	3.83
4147.00	1822.82	0.984	6.22	13.92	3.88

++

++++++++++++++++++++++++ ROADWAY OVERTOPPING DATA ++++++++++++++++++++++++

++

ROADWAY SURFACE	PAVED
EMBANKMENT TOP WIDTH (FT)	26.00
CREST LENGTH (FT)	100.00
OVERTOPPING CREST ELEVATION (FT)	1823.10

++

APPENDIX D

HY-8 CALCULATIONS- RECOMMENDED CULVERTS

CURRENT DATE: 07-23-1997
CURRENT TIME: 15:50:45

CULVERT 6

FILE DATE: 05-06-1996
FILE NAME: **C6**

++

++++++++++++++++++++++++++++ FHWA CULVERT ANALYSIS ++++++++++++++++++++++++++++
++++++++++++++++++++++++++++ HY-8, VERSION 4.0 ++++++++++++++++++++++++++++

++

CULV #	SITE DATA: INLET ELEV. (FT)	SITE DATA: OUTLET ELEV. (FT)	SITE DATA: CULVERT LENGTH (FT)	CULVERT SHAPE, MATERIAL, INLET: BARRELS SHAPE MATERIAL	SPAN (FT)	RISE (FT)	MANNING n	INLET TYPE
1	1773.95	1773.73	82.48	2 CSP	2.00	2.00	.024	CONVENTIONAL
2								
3								
4								
5								
6								

++

SUMMARY OF CULVERT FLOWS (CFS) FILE: C6 DATE: 05-06-1996

ELEV (FT)	TOTAL	1	2	3	4	5	6	ROADWAY	ITR
1773.95	0	0	0	0	0	0	0	0	1
1777.88	35	35	0	0	0	0	0	0	1
1780.14	70	48	0	0	0	0	0	21	7
1780.38	105	49	0	0	0	0	0	55	4
1780.57	140	50	0	0	0	0	0	89	4
1780.74	175	51	0	0	0	0	0	123	3
1780.89	210	52	0	0	0	0	0	157	3
1781.04	245	53	0	0	0	0	0	192	3
1781.18	280	53	0	0	0	0	0	226	3
1781.25	300	54	0	0	0	0	0	246	3
1781.43	350	54	0	0	0	0	0	295	3
1779.87	**47**	47	0	0	0	0	0	OVERTOPPING	

++

SUMMARY OF ITERATIVE SOLUTION ERRORS FILE: C6 DATE: 05-06-1996

HEAD ELEV(FT)	HEAD ERROR(FT)	TOTAL FLOW(CFS)	FLOW ERROR(CFS)	% FLOW ERROR
1773.95	0.00	0	0	0.00
1777.88	0.00	35	0	0.00
1780.14	-0.00	70	1	0.92
1780.38	-0.00	105	1	0.58
1780.57	-0.01	140	0	0.23
1780.74	-0.00	175	1	0.68
1780.89	-0.00	210	1	0.50
1781.04	-0.00	245	1	0.35
1781.18	-0.00	280	1	0.26
1781.25	-0.00	300	0	0.15
1781.43	-0.00	350	1	0.18

++

<1> TOLERANCE (FT) = 0.010 <2> TOLERANCE (%) = 1.000

++

CURRENT DATE: 07-23-1997
CURRENT TIME: 15:51:04

CULVERT 9 (F)

FILE DATE: 05-02-1996
FILE NAME: **C9**

++

++++++++++++++++++++++++++++ FHWA CULVERT ANALYSIS ++++++++++++++++++++++++++++
++++++++++++++++++++++++++++ HY-8, VERSION 4.0 ++++++++++++++++++++++++++++

++

CULV #	SITE DATA: INLET ELEV. (FT)	SITE DATA: OUTLET ELEV. (FT)	SITE DATA: CULVERT LENGTH (FT)	CULVERT SHAPE, MATERIAL, INLET: BARRELS SHAPE MATERIAL	SPAN (FT)	RISE (FT)	MANNING n	INLET TYPE
1	1779.08	1777.81	64.22	3 CMPA	2.92	2.00	.025	CONVENTIONAL
2								
3								
4								
5								
6								

++

++

SUMMARY OF CULVERT FLOWS (CFS) FILE: C9 DATE: 05-02-1996

ELEV (FT)	TOTAL	1	2	3	4	5	6	ROADWAY	ITR
1779.08	0	0	0	0	0	0	0	0	1
1779.66	8	8	0	0	0	0	0	0	1
1779.94	16	16	0	0	0	0	0	0	1
1780.19	24	24	0	0	0	0	0	0	1
1780.41	32	32	0	0	0	0	0	0	1
1780.61	40	40	0	0	0	0	0	0	1
1780.81	48	48	0	0	0	0	0	0	1
1781.01	56	56	0	0	0	0	0	0	1
1781.22	64	64	0	0	0	0	0	0	1
1781.37	66	66	0	0	0	0	0	0	1
1781.69	80	80	0	0	0	0	0	0	1
1783.02	**102**	102	0	0	0	0	0	OVERTOPPING	

++

++

SUMMARY OF ITERATIVE SOLUTION ERRORS FILE: C9 DATE: 05-02-1996

HEAD ELEV(FT)	HEAD ERROR(FT)	TOTAL FLOW(CFS)	FLOW ERROR(CFS)	% FLOW ERROR
1779.08	0.00	0	0	0.00
1779.66	0.00	8	0	0.00
1779.94	0.00	16	0	0.00
1780.19	0.00	24	0	0.00
1780.41	0.00	32	0	0.00
1780.61	0.00	40	0	0.00
1780.81	0.00	48	0	0.00
1781.01	0.00	56	0	0.00
1781.22	0.00	64	0	0.00
1781.37	0.00	66	0	0.00
1781.69	0.00	80	0	0.00

++

<1> TOLERANCE (FT) = 0.010 <2> TOLERANCE (%) = 1.000

++

CURRENT DATE: 07-23-1997
CURRENT TIME: 15:57:17

CULVERT 10 (G)

FILE DATE: 05-02-1996
FILE NAME: **C10**

FHWA CULVERT ANALYSIS
HY-8, VERSION 4.0

CULV #	SITE DATA: INLET ELEV. (FT)	OUTLET ELEV. (FT)	CULVERT LENGTH (FT)	CULVERT SHAPE, MATERIAL, INLET: BARRELS	SHAPE MATERIAL	SPAN (FT)	RISE (FT)	MANNING n	INLET TYPE
1	1779.56	1778.62	61.01	5	CMPA	6.42	4.33	.024	CONVENTIONAL
2									
3									
4									
5									
6									

SUMMARY OF CULVERT FLOWS (CFS) FILE: C10 DATE: 05-02-1996

ELEV (FT)	TOTAL	1	2	3	4	5	6	ROADWAY	ITR
1779.56	0	0	0	0	0	0	0	0	1
1780.45	46	46	0	0	0	0	0	0	1
1780.87	92	92	0	0	0	0	0	0	1
1781.21	138	138	0	0	0	0	0	0	1
1781.51	184	184	0	0	0	0	0	0	1
1781.79	231	231	0	0	0	0	0	0	1
1782.06	277	277	0	0	0	0	0	0	1
1782.32	323	323	0	0	0	0	0	0	1
1782.56	369	369	0	0	0	0	0	0	1
1782.63	382	382	0	0	0	0	0	0	1
1783.03	461	461	0	0	0	0	0	0	1
1784.62	**754**	754	0	0	0	0	0	OVERTOPPING	

SUMMARY OF ITERATIVE SOLUTION ERRORS FILE: C10 DATE: 05-02-1996

HEAD ELEV(FT)	HEAD ERROR(FT)	TOTAL FLOW(CFS)	FLOW ERROR(CFS)	% FLOW ERROR
1779.56	0.00	0	0	0.00
1780.45	0.00	46	0	0.00
1780.87	0.00	92	0	0.00
1781.21	0.00	138	0	0.00
1781.51	0.00	184	0	0.00
1781.79	0.00	231	0	0.00
1782.06	0.00	277	0	0.00
1782.32	0.00	323	0	0.00
1782.56	0.00	369	0	0.00
1782.63	0.00	382	0	0.00
1783.03	0.00	461	0	0.00

<1> TOLERANCE (FT) = 0.010 <2> TOLERANCE (%) = 1.000

CURRENT DATE: 05-31-1996
CURRENT TIME: 13:14:29

CULVERT 12 (H)

FILE DATE: 05-02-1996
FILE NAME: **C12**

FHWA CULVERT ANALYSIS
HY-8, VERSION 4.0

CULV #	SITE DATA: INLET ELEV. (FT)	SITE DATA: OUTLET ELEV. (FT)	SITE DATA: CULVERT LENGTH (FT)	CULVERT SHAPE, MATERIAL, INLET: BARRELS SHAPE MATERIAL	SPAN (FT)	RISE (FT)	MANNING n	INLET TYPE
1	1781.18	1780.23	64.01	2 RCB	10.00	5.00	.012	CONVENTIONAL
2								
3								
4								
5								
6								

SUMMARY OF CULVERT FLOWS (CFS) FILE: C12 DATE: 05-02-1996

ELEV (FT)	TOTAL	1	2	3	4	5	6	ROADWAY	ITR
1781.18	0	0	0	0	0	0	0	0	1
1782.20	53	53	0	0	0	0	0	0	1
1782.80	106	106	0	0	0	0	0	0	1
1783.30	159	159	0	0	0	0	0	0	1
1783.74	212	212	0	0	0	0	0	0	1
1784.15	265	265	0	0	0	0	0	0	1
1784.52	318	318	0	0	0	0	0	0	1
1784.88	371	371	0	0	0	0	0	0	1
1785.22	424	424	0	0	0	0	0	0	1
1785.38	450	450	0	0	0	0	0	0	1
1785.87	530	530	0	0	0	0	0	0	1
1787.74	**822**	822	0	0	0	0	0	OVERTOPPING	

SUMMARY OF ITERATIVE SOLUTION ERRORS FILE: C12 DATE: 05-02-1996

HEAD ELEV(FT)	HEAD ERROR(FT)	TOTAL FLOW(CFS)	FLOW ERROR(CFS)	% FLOW ERROR
1781.18	0.00	0	0	0.00
1782.20	0.00	53	0	0.00
1782.80	0.00	106	0	0.00
1783.30	0.00	159	0	0.00
1783.74	0.00	212	0	0.00
1784.15	0.00	265	0	0.00
1784.52	0.00	318	0	0.00
1784.88	0.00	371	0	0.00
1785.22	0.00	424	0	0.00
1785.38	0.00	450	0	0.00
1785.87	0.00	530	0	0.00

<1> TOLERANCE (FT) = 0.010 <2> TOLERANCE (%) = 1.000

CURRENT DATE: 07-23-1997
CURRENT TIME: 15:46:41

CULVERT 16(K)

FILE DATE: 05-02-1996
FILE NAME: **C16**

FHWA CULVERT ANALYSIS
HY-8, VERSION 4.0

CULV #	SITE DATA: INLET ELEV. (FT)	OUTLET ELEV. (FT)	CULVERT LENGTH (FT)	CULVERT SHAPE, MATERIAL, INLET: BARRELS SHAPE MATERIAL	SPAN (FT)	RISE (FT)	MANNING n	INLET TYPE
1	1793.64	1792.89	82.00	3 CMPA	3.50	2.42	.025	CONVENTIONAL
2								
3								
4								
5								
6								

SUMMARY OF CULVERT FLOWS (CFS) FILE: C16 DATE: 05-02-1996

ELEV (FT)	TOTAL	1	2	3	4	5	6	ROADWAY	ITR
1793.64	0	0	0	0	0	0	0	0	1
1794.40	12	12	0	0	0	0	0	0	1
1794.79	24	24	0	0	0	0	0	0	1
1795.10	36	36	0	0	0	0	0	0	1
1795.38	48	48	0	0	0	0	0	0	1
1795.65	60	60	0	0	0	0	0	0	1
1795.91	72	72	0	0	0	0	0	0	1
1796.15	83	83	0	0	0	0	0	0	1
1796.45	96	96	0	0	0	0	0	0	1
1796.87	108	105	0	0	0	0	0	3	14
1796.97	120	104	0	0	0	0	0	15	5
1796.83	**104**	104	0	0	0	0	0	OVERTOPPING	

SUMMARY OF ITERATIVE SOLUTION ERRORS FILE: C16 DATE: 05-02-1996

HEAD ELEV(FT)	HEAD ERROR(FT)	TOTAL FLOW(CFS)	FLOW ERROR(CFS)	% FLOW ERROR
1793.64	0.00	0	0	0.00
1794.40	0.00	12	0	0.00
1794.79	0.00	24	0	0.00
1795.10	0.00	36	0	0.00
1795.38	0.00	48	0	0.00
1795.65	0.00	60	0	0.00
1795.91	0.00	72	0	0.00
1796.15	0.00	83	0	0.00
1796.45	0.00	96	0	0.00
1796.87	-0.01	108	1	0.80
1796.97	-0.01	120	1	0.93

<1> TOLERANCE (FT) = 0.010 <2> TOLERANCE (%) = 1.000

CURRENT DATE: 05-29-1996
CURRENT TIME: 10:11:34

CULVERT 17(L)

FILE DATE: 05-02-1996
FILE NAME: **C17**

++

++++++++++++++++++++++++++ FHWA CULVERT ANALYSIS ++++++++++++++++++++++++++
++++++++++++++++++++++++++ HY-8, VERSION 4.0 ++++++++++++++++++++++++++

++

CULV #	SITE DATA: INLET ELEV. (FT)	SITE DATA: OUTLET ELEV. (FT)	SITE DATA: CULVERT LENGTH (FT)	CULVERT SHAPE, MATERIAL, INLET: BARRELS SHAPE MATERIAL	SPAN (FT)	RISE (FT)	MANNING n	INLET TYPE
1	1795.76	1794.24	62.02	2 RCB	10.00	5.00	.012	CONVENTIONAL
2								
3								
4								
5								
6								

++

++

SUMMARY OF CULVERT FLOWS (CFS) FILE: C17 DATE: 05-02-1996

ELEV (FT)	TOTAL	1	2	3	4	5	6	ROADWAY	ITR
1795.76	0	0	0	0	0	0	0	0	1
1796.86	60	60	0	0	0	0	0	0	1
1797.50	120	120	0	0	0	0	0	0	1
1798.04	180	180	0	0	0	0	0	0	1
1798.52	240	240	0	0	0	0	0	0	1
1798.95	300	300	0	0	0	0	0	0	1
1799.36	360	360	0	0	0	0	0	0	1
1799.75	420	420	0	0	0	0	0	0	1
1800.12	480	480	0	0	0	0	0	0	1
1800.27	504	504	0	0	0	0	0	0	1
1800.86	600	600	0	0	0	0	0	0	1
1801.29	**669**	669	0	0	0	0	0	OVERTOPPING	

++

++

SUMMARY OF ITERATIVE SOLUTION ERRORS FILE: C17 DATE: 05-02-1996

HEAD ELEV(FT)	HEAD ERROR(FT)	TOTAL FLOW(CFS)	FLOW ERROR(CFS)	% FLOW ERROR
1795.76	0.00	0	0	0.00
1796.86	0.00	60	0	0.00
1797.50	0.00	120	0	0.00
1798.04	0.00	180	0	0.00
1798.52	0.00	240	0	0.00
1798.95	0.00	300	0	0.00
1799.36	0.00	360	0	0.00
1799.75	0.00	420	0	0.00
1800.12	0.00	480	0	0.00
1800.27	0.00	504	0	0.00
1800.86	0.00	600	0	0.00

++

<1> TOLERANCE (FT) = 0.010 <2> TOLERANCE (%) = 1.000

++

CURRENT DATE: 07-23-1997 CULVERT 18 (L2) FILE DATE: 05-02-1996
CURRENT TIME: 15:47:39 FILE NAME: **C18**

++
++++++++++++++++++++++++++++ FHWA CULVERT ANALYSIS ++++++++++++++++++++++++++++
++++++++++++++++++++++++++++ HY-8, VERSION 4.0 ++++++++++++++++++++++++++++
++

CULV #	SITE DATA INLET ELEV. (FT)	OUTLET ELEV. (FT)	CULVERT LENGTH (FT)	CULVERT SHAPE, MATERIAL, INLET BARRELS SHAPE MATERIAL	SPAN (FT)	RISE (FT)	MANNING n	INLET TYPE
1	1800.63	1800.05	62.00	3 CMPA	3.50	2.42	.025	CONVENTIONAL
2								
3								
4								
5								
6								

++

SUMMARY OF CULVERT FLOWS (CFS) FILE: C18 DATE: 05-02-1996

ELEV (FT)	TOTAL	1	2	3	4	5	6	ROADWAY	ITR
1800.63	0	0	0	0	0	0	0	0	1
1801.33	10	10	0	0	0	0	0	0	1
1801.66	20	20	0	0	0	0	0	0	1
1801.94	30	30	0	0	0	0	0	0	1
1802.20	40	40	0	0	0	0	0	0	1
1802.43	50	50	0	0	0	0	0	0	1
1802.64	60	60	0	0	0	0	0	0	1
1802.85	70	70	0	0	0	0	0	0	1
1802.96	75	75	0	0	0	0	0	0	1
1803.28	90	90	0	0	0	0	0	0	1
1803.51	100	100	0	0	0	0	0	0	1
1804.57	**128**	128	0	0	0	0	0	OVERTOPPING	

++

SUMMARY OF ITERATIVE SOLUTION ERRORS FILE: C18 DATE: 05-02-1996

HEAD ELEV(FT)	HEAD ERROR(FT)	TOTAL FLOW(CFS)	FLOW ERROR(CFS)	% FLOW ERROR
1800.63	0.00	0	0	0.00
1801.33	0.00	10	0	0.00
1801.66	0.00	20	0	0.00
1801.94	0.00	30	0	0.00
1802.20	0.00	40	0	0.00
1802.43	0.00	50	0	0.00
1802.64	0.00	60	0	0.00
1802.85	0.00	70	0	0.00
1802.96	0.00	75	0	0.00
1803.28	0.00	90	0	0.00
1803.51	0.00	100	0	0.00

++

<1> TOLERANCE (FT) = 0.010 <2> TOLERANCE (%) = 1.000

++

CURRENT DATE: 07-23-1997
CURRENT TIME: 15:48:23

CULVERT 19

FILE DATE: 05-02-1996
FILE NAME: **C19**

FHWA CULVERT ANALYSIS
HY-8, VERSION 4.0

CULV #	SITE DATA: INLET ELEV. (FT)	OUTLET ELEV. (FT)	CULVERT LENGTH (FT)	CULVERT SHAPE, MATERIAL, INLET: BARRELS SHAPE MATERIAL	SPAN (FT)	RISE (FT)	MANNING n	INLET TYPE
1	1806.59	1806.15	62.00	3 CMPA	3.50	2.42	.025	CONVENTIONAL
2								
3								
4								
5								
6								

SUMMARY OF CULVERT FLOWS (CFS) FILE: C19 DATE: 05-02-1996

ELEV (FT)	TOTAL	1	2	3	4	5	6	ROADWAY	ITR
1806.59	0	0	0	0	0	0	0	0	1
1807.62	20	20	0	0	0	0	0	0	1
1808.14	40	40	0	0	0	0	0	0	1
1808.60	60	60	0	0	0	0	0	0	1
1809.04	80	80	0	0	0	0	0	0	1
1809.61	100	100	0	0	0	0	0	0	1
1810.36	120	120	0	0	0	0	0	0	1
1810.85	140	132	0	0	0	0	0	7	10
1810.91	149	133	0	0	0	0	0	15	5
1811.05	180	136	0	0	0	0	0	43	5
1811.12	200	138	0	0	0	0	0	61	4
1810.77	**130**	130	0	0	0	0	0	OVERTOPPING	

SUMMARY OF ITERATIVE SOLUTION ERRORS FILE: C19 DATE: 05-02-1996

HEAD ELEV(FT)	HEAD ERROR(FT)	TOTAL FLOW(CFS)	FLOW ERROR(CFS)	% FLOW ERROR
1806.59	0.00	0	0	0.00
1807.62	0.00	20	0	0.00
1808.14	0.00	40	0	0.00
1808.60	0.00	60	0	0.00
1809.04	0.00	80	0	0.00
1809.61	0.00	100	0	0.00
1810.36	0.00	120	0	0.00
1810.85	-0.01	140	1	0.72
1810.91	-0.00	149	1	0.49
1811.05	-0.00	180	1	0.37
1811.12	-0.01	200	1	0.37

<1> TOLERANCE (FT) = 0.010 <2> TOLERANCE (%) = 1.000

CURRENT DATE: 05-29-1996 CULVERT 20(N) FILE DATE: 05-02-1996
CURRENT TIME: 10:13:55 FILE NAME: **C20**

++

++++++++++++++++++++++++++++ FHWA CULVERT ANALYSIS ++++++++++++++++++++++++++++
++++++++++++++++++++++++++++ HY-8, VERSION 4.0 ++++++++++++++++++++++++++++

++

C U L V #	SITE DATA INLET ELEV. (FT)	OUTLET ELEV. (FT)	CULVERT LENGTH (FT)	CULVERT SHAPE, MATERIAL, INLET BARRELS SHAPE MATERIAL	SPAN (FT)	RISE (FT)	MANNING n	INLET TYPE
1	1804.36	1803.97	61.00	3 RCB	10.00	5.00	.012	CONVENTIONAL
2								
3								
4								
5								
6								

++

SUMMARY OF CULVERT FLOWS (CFS) FILE: C20 DATE: 05-02-1996

ELEV (FT)	TOTAL	1	2	3	4	5	6	ROADWAY	ITR
1804.36	0	0	0	0	0	0	0	0	1
1805.66	111	111	0	0	0	0	0	0	1
1806.41	223	223	0	0	0	0	0	0	1
1807.03	334	334	0	0	0	0	0	0	1
1807.58	445	445	0	0	0	0	0	0	1
1808.08	557	557	0	0	0	0	0	0	1
1808.55	668	668	0	0	0	0	0	0	1
1809.01	779	779	0	0	0	0	0	0	1
1809.47	890	890	0	0	0	0	0	0	1
1809.62	927	927	0	0	0	0	0	0	1
1810.40	1113	1113	0	0	0	0	0	0	1
1811.26	**1301**	1301	0	0	0	0	0	OVERTOPPING	

++

SUMMARY OF ITERATIVE SOLUTION ERRORS FILE: C20 DATE: 05-02-1996

HEAD ELEV(FT)	HEAD ERROR(FT)	TOTAL FLOW(CFS)	FLOW ERROR(CFS)	% FLOW ERROR
1804.36	0.00	0	0	0.00
1805.66	0.00	111	0	0.00
1806.41	0.00	223	0	0.00
1807.03	0.00	334	0	0.00
1807.58	0.00	445	0	0.00
1808.08	0.00	557	0	0.00
1808.55	0.00	668	0	0.00
1809.01	0.00	779	0	0.00
1809.47	0.00	890	0	0.00
1809.62	0.00	927	0	0.00
1810.40	0.00	1113	0	0.00

++

<1> TOLERANCE (FT) = 0.010 <2> TOLERANCE (%) = 1.000

++

CURRENT DATE: 06-03-1996
CURRENT TIME: 09:10:54

CULVERT 0

FILE DATE: 05-06-1996
FILE NAME: CO

FHWA CULVERT ANALYSIS
HY-8, VERSION 4.0

CULV #	SITE DATA: INLET ELEV. (FT)	OUTLET ELEV. (FT)	CULVERT LENGTH (FT)	CULVERT SHAPE, MATERIAL, INLET: BARRELS SHAPE MATERIAL	SPAN (FT)	RISE (FT)	MANNING n	INLET TYPE
1	1818.42	1817.69	87.00	4 RCB	12.00	10.00	.012	CONVENTIONAL
2								
3								
4								
5								
6								

SUMMARY OF CULVERT FLOWS (CFS) FILE: CO DATE: 05-06-1996

ELEV (FT)	TOTAL	1	2	3	4	5	6	ROADWAY	ITR
1818.42	0	0	0	0	0	0	0	0	1
1821.31	596	596	0	0	0	0	0	0	1
1822.99	1191	1191	0	0	0	0	0	0	1
1824.32	1787	1770	0	0	0	0	0	14	5
1825.07	2382	2129	0	0	0	0	0	252	3
1825.67	2978	2430	0	0	0	0	0	547	3
1826.20	3574	2708	0	0	0	0	0	865	3
1826.69	4169	2967	0	0	0	0	0	1201	3
1826.70	4179	2971	0	0	0	0	0	1207	2
1827.58	5360	3455	0	0	0	0	0	1898	2
1828.01	5956	3689	0	0	0	0	0	2266	3
1824.19	1714	1714	0	0	0	0	0	OVERTOPPING	

SUMMARY OF ITERATIVE SOLUTION ERRORS FILE: CO DATE: 05-06-1996

HEAD ELEV(FT)	HEAD ERROR(FT)	TOTAL FLOW(CFS)	FLOW ERROR(CFS)	% FLOW ERROR
1818.42	0.00	0	0	0.00
1821.31	0.00	596	0	0.00
1822.99	0.00	1191	0	0.00
1824.32	-0.00	1787	3	0.18
1825.07	-0.00	2382	2	0.08
1825.67	-0.00	2978	1	0.03
1826.20	-0.00	3574	1	0.02
1826.69	-0.00	4169	1	0.02
1826.70	1.00	4179	2	0.04
1827.58	-0.01	5360	7	0.13
1828.01	-0.00	5956	1	0.02

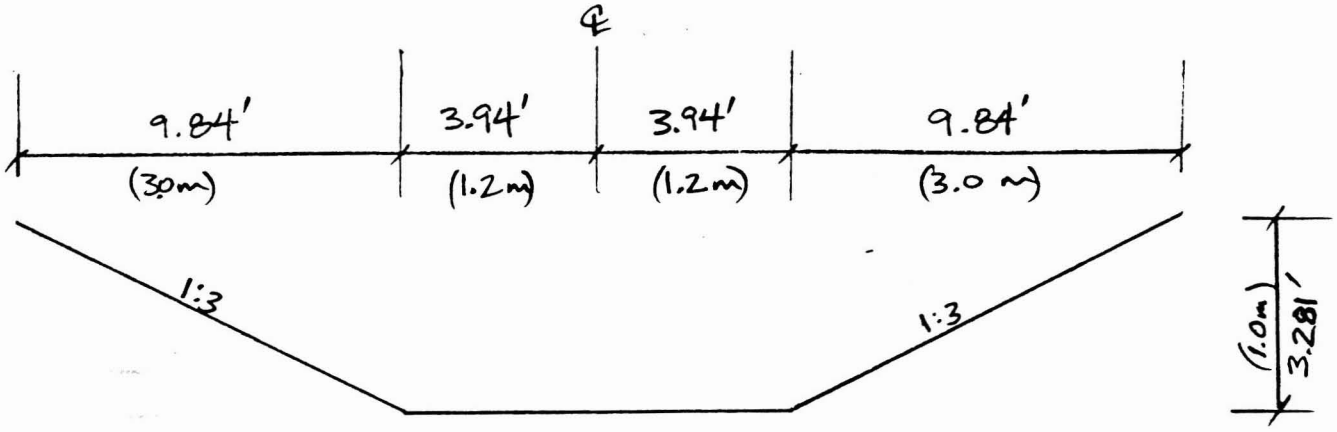
<1> TOLERANCE (FT) = 0.010 <2> TOLERANCE (%) = 1.000

DIBBLE & ASSOCIATES
CONSULTING ENGINEERS
Since 1962

CALC _____ DATE _____ JOB _____
CHKD _____ DATE _____ SHT 1 OF 2

TITLE _____

PROPOSED CHANNEL EAST OF PROPOSED CULVERT O



$$A = \tfrac{1}{2}\left[(9.84 + 3.94 + 3.94 + 9.84) + (3.94 + 3.94)\right](3.281')$$

$$= \boxed{58.1 \text{ FT}^2}$$

$$P = 2 \cdot \sqrt{(3.281)^2 + (9.84)^2} + 3.94 + 3.94 = \boxed{28.6'}$$

$$n = \boxed{.035}$$

S @ STA 12+000 = 0.6%
S @ STA 11+750 = 1.0%
S @ STA 11+500 = 2.5%

STA 12+000

$$Q_{CAP} = \frac{1.486}{.035}(58.1)\left(\frac{58.1}{28.6}\right)^{2/3}(.006)^{1/2}$$

$$Q_{CAP} = \boxed{306 \text{ CFS}}$$

STA 11+750

$$Q_{CAP} = \frac{1.486}{.035}(58.1)\left(\frac{58.1}{28.6}\right)^{2/3}(.01)^{1/2}$$

$$Q_{CAP} = \boxed{396 \text{ CFS}}$$

STA 11+500

$$Q_{CAP} = \frac{1.486}{.035}(58.1)\left(\frac{58.1}{28.6}\right)^{2/3}(.025)^{1/2}$$

$$Q_{CAP} = \boxed{626 \text{ CFS}}$$

APPENDIX E

HEC-2 Analysis of Cave Creek Wash

HEC-2 INPUT FILE FOR CAVE CREEK WASH AND CARFREE HIGHWAY WITH PROPOSED BRIDGE

```
C
C       4
C       1     BEGIN MODEL APPROX. 200 METERS DOWNSTREAM OF BRIDGE
C       4     DOWNSTREAM SIDE OF NEW BRIDGE
C       7     UPSTREAM SIDE OF EXISTING BRIDGE
C      10     THIS IS THE UPSTREAM LIMIT OF THE STUDY
T1            CAVE CREEK WASH  CAREFREE HIGHWAY, JUNE 1996
T2            10 YEAR FREQUENCY, NOTE: DATA IN METRIC
T3            CAVE CREEK WASH AT CAREFREE HIGHWAY BRIDGES
J1              2       0       0       0       1       0       0  567.55       0
J2      1              -1
J3     38      43       1       2      26      39      21      22      27      28
J3     53      54       0      38      13      14      15      55      26      56
J3     63       1      51       4      42      57       0      38      39      33
J3      3      10      11      12       5       7       8      16      17      18
J3      0     201
NC   .040    .040    .040    .300    .500
QT      5     583     934    1044    1472    1044
X1      1      20   0.000   200.0  25.000  25.000  25.000   1.000       0       0
GR569.19   0.000 569.239  32.571 569.422  49.140  565.87  60.835 565.412  62.391
GR564.94 100.323 564.945 100.493 564.948 100.556  565.60 114.184 565.603 116.220
GR565.04 140.750 564.552 149.595 564.435 150.869  564.39 151.991 564.215 158.519
GR565.67 161.200 566.875 163.651 566.921 177.996  567.42 183.071 575.831 200.000
X1      2      27   0.000   200.0  25.000  25.000  25.000   1.000       0       0
GR569.47   0.000 569.456   2.620 569.614  13.356 569.860  37.019 567.514  44.994
GR565.94  50.919 565.938  52.049 565.654  68.966 565.141 100.448 565.377 105.333
GR565.35 126.425 565.410 134.256 564.649 142.253 564.530 142.655 564.559 143.383
GR564.23 151.931 564.437 152.312 567.039 156.767 566.992 166.014 567.023 181.265
GR567.02 186.543 567.098 192.533 567.091 193.527 567.098 195.040  567.12 195.354
GR567.14 199.514 567.189 200.000
X1      3      25   0.000   200.0  25.000  25.000  25.000   1.000       0       0
GR569.51   0.000 569.511   6.333 569.927  32.664 569.954  34.730 569.861  35.026
GR566.12  48.511 566.107  51.682 565.721  78.665 565.244 101.688 565.504 107.249
GR565.62 130.685 565.566 133.172 564.531 136.514 564.260 137.230 564.522 144.492
GR564.58 146.382 565.187 147.738 567.643 152.889 567.668 156.208 567.728 177.475
GR567.75 183.667 567.719 188.794 567.719 195.266 567.694 198.169 567.710 200.000
X1      4      13 1967.43 2058.29    88.0    88.0    88.0     1.0       0       0 1 1
GR    570 1967.43   566.5 1978.14   566.0 1981.14  565.62 1985.00  565.73 1997.86
GR 566.0 2006.43  566.45 2014.14   566.0 2021.00  565.76 2022.71   566.0 2030.00
GR 566.0 2038.57  565.88 2043.72  568.22 2058.29
X1      5      25 1967.43 2059.14     1.0     1.0     1.0     1.0       0       0  1
GR 570.0 1967.43   566.5 1977.71   566.0 1980.29  565.62 1985.00  565.63 1988.33
GR 570.6 1988.43   570.6 1989.71  565.73 1989.72  565.72 1997.43   566.0 2005.57
GR566.01 2011.13   570.6 2011.14   570.6 2012.43  566.47 2012.44  566.46 2013.71
GR 566.0 2020.57  565.79 2022.29   566.0 2028.29  566.10 2033.85   570.6 2033.86
GR 570.6 2035.14  566.01 2035.15   566.0 2038.14  565.90 2043.72  568.23 2059.14
X1      6      21 1968.53 2049.35    29.0    29.0    29.0     1.0       0       0
GR 570.0 1968.53  566.40 1975.52   566.0 1977.07  565.84 1981.74  565.85 1986.78
GR 570.6 1986.79   570.6 1987.95  566.10 1987.96   566.0 1995.34  566.10 2007.37
GR 570.6 2007.38   570.6 2008.55  566.12 2008.56  566.11 2013.21  566.12 2027.97
GR 570.6 2027.98   570.6 2029.14  566.42 2029.15  566.41 2033.03   566.5  2040.8
GR 570.0 2049.35
X1      7      10 1967.75 2049.35     1.0     1.0     1.0     1.0       0       0
GR 570.0 1967.75  566.40 1974.74   566.0 1976.69  565.85 1981.35   566.0 1994.95
GR566.15 2007.38  566.12 2012.82  566.43 2032.64   566.5 2040.80   570.0 2049.35
X1      8      41   0.000   200.0    55.0    55.0    55.0   1.000       0       0
GR573.01   0.000 571.183  49.094 571.305  52.113 571.309  52.448  571.15  53.048
GR571.15  53.591 571.156  54.160 571.158  54.854 571.167  56.747  571.15  57.598
GR571.16  60.168 568.211  66.142 566.680  68.809 566.612  74.279  566.61  82.988
GR566.45 107.029 566.779 109.853 566.967 114.347 567.157 125.150  567.06 129.941
GR566.40 137.709 566.579 138.162 570.123 148.307 570.236 152.027  570.32 154.419
GR569.70 157.028 569.846 157.828 569.436 158.319 569.351 159.189 569.396 159.525
GR569.57 160.214 570.750 162.791  571.82 166.221 571.865 171.483 571.862 173.063
GR571.90 174.027 571.901 177.313  571.87 189.534 571.732 193.747 571.317 198.339
GR571.03 200.000
X1      9      29   0.000   200.0  25.000  25.000  25.000   1.000       0       0
GR574.56   0.000 571.597  79.595 571.721  83.507 566.924  89.726 566.481  90.779
GR566.46  93.863 566.483  94.060 567.085 108.438 567.129 110.931 566.816 126.701
GR566.83 135.428 566.432 139.015 569.491 147.597 570.266 149.945 570.369 150.238
```

```
GR570.40 150.911 570.507 154.338 569.149 160.248 568.345 164.191 568.220 165.051
GR567.59 166.603 567.541 168.275 568.918 178.932 570.704 194.555 570.900 196.545
GR571.04 197.455 571.067 197.679 571.143 199.245 571.182 200.000
X1    10      29   0.000   200.0  16.025  16.025  16.025   1.000       0       0
GR575.56   0.000 571.936  97.183 572.173 104.687 567.018 111.370 567.120 115.507
GR566.89 116.769 566.888 117.289 567.345 121.104 567.280 127.672 566.935 128.592
GR567.23 130.897 566.723 141.701 566.657 147.443 566.711 148.213 567.529 150.553
GR569.07 155.616 569.350 156.405 569.447 157.102 569.593 159.930 569.657 161.200
GR569.32 162.826 567.168 167.686 567.147 171.632 567.116 176.345 567.290 186.715
GR567.27 187.338 567.807 195.700 568.218 199.878 568.237 200.000
EJ
T1          CAVE CREEK WASH - CAREFREE HIGHWAY, JUNE 1996
T2          50 YEAR FREQUENCY - NOTE: DATA IN METRIC
T3          CAVE CREEK WASH AT CAREFREE HIGHWAY BRIDGES (TWO)
J1     0       3       0       0  .01074       1                  568.01
J2     2              -1
T1          CAVE CREEK WASH - CAREFREE HIGHWAY, JUNE 1996
T2          100 YEAR FREQUENCY - NOTE: DATA IN METRIC
T3          CAVE CREEK WASH AT CAREFREE HIGHWAY BRIDGES (TWO)
J1     0       4       0       0  .01074       1                  568.160
J2     3              -1
T1          CAVE CREEK WASH - CAREFREE HIGHWAY, JUNE 1996
T2          500 YEAR FREQUENCY - NOTE: DATA IN METRIC
T3          CAVE CREEK WASH AT CAREFREE HIGHWAY BRIDGES (TWO)
J1     0       5       0       0  .01074       1                  568.560
J2     4              -1
ER
```

```
1*******************************************
 *  HEC-2 WATER SURFACE PROFILES           *
 *                                         *
 *  Version   4.6.2;  May 1991             *
 *                                         *
 *  RUN DATE    25JUL97    TIME   07:53:37 *
 *******************************************
```

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

1

25JUL97 07:53:37 PAGE 1

THIS RUN EXECUTED 25JUL97 07:53:37

```
*************************************
 HEC-2 WATER SURFACE PROFILES

 Version   4.6.2;  May 1991
*************************************
```

T1 CAVE CREEK WASH CAREFREE HIGHWAY, JUNE 1996
T2 10 YEAR FREQUENCY, NOTE: DATA IN METRIC
T3 CAVE CREEK WASH AT CAREFREE HIGHWAY BRIDGES

J1	ICHECK	INQ	NINV	IDIR	STRT	METRIC	HVINS	Q	WSEL	FQ
		2	0	0	0	1	0	0	567.55	0

J2	NPROF	IPLOT	PRFVS	XSECV	XSECH	FN	ALLDC	IBW	CHNIM	ITRACE
	1		-1							

J3 VARIABLE CODES FOR SUMMARY PRINTOUT

38	43	1	2	26	39	21	22	27	28

```
     53        54         0        38        13        14        15        55        26        56
     63         1        51         4        42        57         0        38        39        33
      3        10        11        12         5         7         8        16        17        18
      0       201

NC     .040      .040      .040      .300      .500
QT        5       583       934      1044      1472      1044
            BEGIN MODEL APPROX. 200 METERS DOWNSTREAM OF BRIDGE
X1        1        20     0.000     200.0    25.000    25.000    25.000     1.000         0         0
GR   569.19     0.000   569.239    32.571   569.422    49.140    565.87    60.835   565.412    62.391
GR   564.94   100.323   564.945   100.493   564.948   100.556    565.60   114.184   565.603   116.220
GR   565.04   140.750   564.552   149.595   564.435   150.869    564.39   151.991   564.215   158.519
GR   565.67   161.200   566.875   163.651   566.921   177.996    567.42   183.071   575.831   200.000

X1        2        27     0.000     200.0    25.000    25.000    25.000     1.000         0         0
GR   569.47     0.000   569.456     2.620   569.614    13.356   569.860    37.019   567.514    44.994
GR   565.94    50.919   565.938    52.049   565.654    68.966   565.141   100.448   565.377   105.333
GR   565.35   126.425   565.410   134.256   564.649   142.253   564.530   142.655   564.559   143.383
GR   564.23   151.931   564.437   152.312   567.039   156.767   566.992   166.014   567.023   181.265
GR   567.02   186.543   567.098   192.533   567.091   193.527   567.098   195.040    567.12   195.354
GR   567.14   199.514   567.189   200.000
1
   25JUL97      07:53:37                                                                          PAGE     2


X1        3        25     0.000     200.0    25.000    25.000    25.000     1.000         0         0
GR   569.51     0.000   569.511     6.333   569.927    32.664   569.954    34.730   569.861    35.026
GR   566.12    48.511   566.107    51.682   565.721    78.665   565.244   101.688   565.504   107.249
GR   565.62   130.685   565.566   133.172   564.531   136.514   564.260   137.230   564.522   144.492
GR   564.58   146.382   565.187   147.738   567.643   152.889   567.668   156.208   567.728   177.475
GR   567.75   183.667   567.719   188.794   567.719   195.266   567.694   198.169   567.710   200.000

            DOWNSTREAM SIDE OF NEW BRIDGE
X1        4        13   1967.43   2058.29      88.0      88.0      88.0       1.0         0         0
GR      570   1967.43     566.5   1978.14     566.0   1981.14    565.62   1985.00    565.73   1997.86
GR    566.0   2006.43    566.45   2014.14     566.0   2021.00    565.76   2022.71     566.0   2030.00
GR    566.0   2038.57    565.88   2043.72    568.22   2058.29

X1        5        25   1967.43   2059.14       1.0       1.0       1.0       1.0         0         0
GR    570.0   1967.43     566.5   1977.71     566.0   1980.29    565.62   1985.00    565.63   1988.33
GR    570.6   1988.43     570.6   1989.71    565.73   1989.72    565.72   1997.43     566.0   2005.57
GR   566.01   2011.13     570.6   2011.14     570.6   2012.43    566.47   2012.44    566.46   2013.71
GR    566.0   2020.57    565.79   2022.29     566.0   2028.29    566.10   2033.85     570.6   2033.86
GR    570.6   2035.14    566.01   2035.15     566.0   2038.14    565.90   2043.72    568.23   2059.14

X1        6        21   1968.53   2049.35      29.0      29.0      29.0       1.0         0         0
GR    570.0   1968.53    566.40   1975.52     566.0   1977.07    565.84   1981.74    565.85   1986.78
GR    570.6   1986.79     570.6   1987.95    566.10   1987.96     566.0   1995.34    566.10   2007.37
GR    570.6   2007.38     570.6   2008.55    566.12   2008.56    566.11   2013.21    566.12   2027.97
GR    570.6   2027.98     570.6   2029.14    566.42   2029.15    566.41   2033.03     566.5    2040.8
```

```
GR     570.0     2049.35

             UPSTREAM SIDE OF EXISTING BRIDGE
X1         7         10    1967.75    2049.35       1.0       1.0       1.0       1.0         0         0
GR     570.0    1967.75     566.40    1974.74     566.0   1976.69    565.85   1981.35     566.0   1994.95
GR    566.15    2007.38     566.12    2012.82    566.43   2032.64     566.5   2040.80     570.0   2049.35

X1         8         41      0.000      200.0      55.0      55.0      55.0     1.000         0         0
GR    573.01      0.000    571.183     49.094   571.305    52.113   571.309    52.448    571.15    53.048
GR    571.15     53.591    571.156     54.160   571.158    54.854   571.167    56.747    571.15    57.598
GR    571.16     60.168    568.211     66.142   566.680    68.809   566.612    74.279    566.61    82.988
GR    566.45    107.029    566.779    109.853   566.967   114.347   567.157   125.150    567.06   129.941
GR    566.40    137.709    566.579    138.162   570.123   148.307   570.236   152.027    570.32   154.419
GR    569.70    157.028    569.846    157.828   569.436   158.319   569.351   159.189   569.396   159.525
GR    569.57    160.214    570.750    162.791    571.82   166.221   571.865   171.483   571.862   173.063
GR    571.90    174.027    571.901    177.313    571.87   189.534   571.732   193.747   571.317   198.339
GR    571.03    200.000

X1         9         29      0.000      200.0    25.000    25.000    25.000     1.000         0         0
GR    574.56      0.000    571.597     79.595   571.721    83.507   566.924    89.726   566.481    90.779
GR    566.46     93.863    566.483     94.060   567.085   108.438   567.129   110.931   566.816   126.701
GR    566.83    135.428    566.432    139.015   569.491   147.597   570.266   149.945   570.369   150.238
GR    570.40    150.911    570.507    154.338   569.149   160.248   568.345   164.191   568.220   165.051
GR    567.59    166.603    567.541    168.275   568.918   178.932   570.704   194.555   570.900   196.545
GR    571.04    197.455    571.067    197.679   571.143   199.245   571.182   200.000
1
   25JUL97      07:53:37                                                                          PAGE     3


             THIS IS THE UPSTREAM LIMIT OF THE STUDY
X1        10         29      0.000      200.0    16.025    16.025    16.025     1.000         0         0
GR    575.56      0.000    571.936     97.183   572.173   104.687   567.018   111.370   567.120   115.507
GR    566.89    116.769    566.888    117.289   567.345   121.104   567.280   127.672   566.935   128.592
GR    567.23    130.897    566.723    141.701   566.657   147.443   566.711   148.213   567.529   150.553
GR    569.07    155.616    569.350    156.405   569.447   157.102   569.593   159.930   569.657   161.200
GR    569.32    162.826    567.168    167.686   567.147   171.632   567.116   176.345   567.290   186.715
GR    567.27    187.338    567.807    195.700   568.218   199.878   568.237   200.000
1
   25JUL97      07:53:37                                                                          PAGE     4

    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=      .300 CEHV=      .500
*SECNO 1.000
            BEGIN MODEL APPROX. 200 METERS DOWNSTREAM OF BRIDGE
     1.000      3.33    567.55       .00    567.55    567.80       .25       .00       .00    569.19
     583.0        .0     583.0        .0        .0     262.3        .0        .0        .0    575.83
       .00       .00      2.22       .00      .000      .040      .000      .000    564.22     55.30
   .003071       25.       25.       25.         0         0         0       .00    128.03    183.33


*SECNO 2.000
3280 CROSS SECTION      2.00 EXTENDED       .48 METERS

     2.000      3.44    567.67       .00       .00    567.89       .22       .08       .01    569.47
     583.0        .0     583.0        .0        .0     278.5        .0       6.8       3.5    567.19
       .00       .00      2.09       .00      .000      .040      .000      .000    564.23     44.48
   .003268       25.       25.       25.         2         0         0       .00    155.52    200.00


*SECNO 3.000

3265 DIVIDED FLOW

3280 CROSS SECTION      3.00 EXTENDED       .01 METERS

     3.000      3.46    567.72       .00       .00    568.04       .32       .10       .05    569.51
     583.0        .0     583.0        .0        .0     231.7        .0      13.1       7.3    567.71
       .01       .00      2.52       .00      .000      .040      .000      .000    564.26     42.74
   .005395       25.       25.       25.         2         0         0       .00    143.31    200.00


*SECNO 4.000
            DOWNSTREAM SIDE OF NEW BRIDGE
     4.000      2.53    568.15       .00       .00    568.79       .64       .59       .16    570.00
     583.0        .0     583.0        .0        .0     164.3        .0      30.6      17.3    568.22
       .01       .00      3.55       .00      .000      .040      .000      .000    565.62   1973.10
   .008405       88.       88.       88.         2         0         0       .00     84.73   2057.83


*SECNO 5.000
1
   25JUL97      07:53:37                                                                          PAGE     5


    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


3265 DIVIDED FLOW
```

```
     5.000      2.49    568.11       .00       .00    568.84       .72       .01       .04    570.00
     583.0        .0     583.0        .0        .0     154.6        .0      30.7      17.4    568.23
       .01       .00      3.77       .00      .000      .040      .000      .000    565.62   1972.97
   .011828        1.        1.        1.         2         0         0       .00     81.48   2058.38


*SECNO 6.000

3265 DIVIDED FLOW

     6.000      2.59    568.43       .00       .00    569.19       .76       .33       .02    570.00
     583.0        .0     583.0        .0        .0     151.0        .0      35.2      19.6    570.00
       .02       .00      3.86       .00      .000      .040      .000      .000    565.84   1971.58
   .011108       29.       29.       29.         2         0         0       .00     70.41   2045.51


*SECNO 7.000

3302 WARNING:  CONVEYANCE CHANGE OUTSIDE OF ACCEPTABLE RANGE,  KRATIO =  1.48

            UPSTREAM SIDE OF EXISTING BRIDGE
     7.000      2.90    568.75       .00       .00    569.27       .51       .01       .07    570.00
     583.0        .0     583.0        .0        .0     183.5        .0      35.3      19.7    570.00
       .02       .00      3.18       .00      .000      .040      .000      .000    565.85   1970.17
   .005092        1.        1.        1.         4         0         0       .00     76.13   2046.30


*SECNO 8.000
     8.000      2.64    569.04       .00       .00    569.61       .57       .31       .03    573.01
     583.0        .0     583.0        .0        .0     174.7        .0      45.2      24.0    571.03
       .02       .00      3.34       .00      .000      .040      .000      .000    566.40     64.46
   .006481       55.       55.       55.         3         0         0       .00     80.76    145.21


*SECNO 9.000

3265 DIVIDED FLOW

     9.000      2.69    569.12    569.09       .00    569.97       .85       .22       .14    574.56
     583.0        .0     583.0        .0        .0     142.4        .0      49.1      26.0    571.18
       .02       .00      4.09       .00      .000      .040      .000      .000    566.43     86.88
   .012773       25.       25.       25.         4         5         0       .00     80.01    180.71


1
   25JUL97      07:53:37                                                                          PAGE     6

    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

 *SECNO 10.000
 3280 CROSS SECTION      10.00 EXTENDED       1.60 METERS

 3302 WARNING:  CONVEYANCE CHANGE OUTSIDE OF ACCEPTABLE RANGE,  KRATIO =  1.75

             THIS IS THE UPSTREAM LIMIT OF THE STUDY
    10.000      3.18     569.84       .00        .00     570.22       .38        .11        .14     575.56
     583.0        .0      583.0        .0         .0      212.8        .0       52.0       27.4     568.24
       .02       .00       2.74       .00       .000       .040      .000       .000     566.66     107.71
   .004155       16.        16.       16.          4          0         0        .00      92.29     200.00

1
   25JUL97      07:53:37                                                                                PAGE     7

 T1          CAVE CREEK WASH - CAREFREE HIGHWAY, JUNE 1996
 T2          50 YEAR FREQUENCY - NOTE: DATA IN METRIC
 T3          CAVE CREEK WASH AT CAREFREE HIGHWAY BRIDGES (TWO)

 J1  ICHECK    INQ       NINV      IDIR      STRT      METRIC    HVINS     Q         WSEL      FQ

       0        3         0         0     .01074        1                         568.01

 J2  NPROF     IPLOT     PRFVS     XSECV     XSECH     FN        ALLDC     IBW       CHNIM     ITRACE

      2                  -1

1
   25JUL97      07:53:37                                                                                PAGE     8

    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 2

 CCHV=     .300 CEHV=     .500
 *SECNO 1.000
             BEGIN MODEL APPROX. 200 METERS DOWNSTREAM OF BRIDGE
     1.000      3.14     567.35       .00     568.01     568.14       .79        .00        .00     569.19
     934.0        .0      934.0        .0         .0      237.0        .0         .0         .0     575.83
       .00       .00       3.94       .00       .000       .040      .000       .000     564.22      55.96
   .010856       25.        25.       25.          0          0         5        .00     126.42     182.38
```

```
*SECNO 2.000
3280 CROSS SECTION      2.00 EXTENDED       .85 METERS

3302 WARNING:  CONVEYANCE CHANGE OUTSIDE OF ACCEPTABLE RANGE,  KRATIO =  1.55

     2.000      3.81    568.04       .00       .00    568.43       .39       .17       .12    569.47
     934.0        .0     934.0        .0        .0     336.0        .0       7.2       3.5    567.19
       .00       .00      2.78       .00      .000      .040      .000      .000    564.23     43.22
   .004547       25.       25.       25.         4         0         0       .00    156.78    200.00

*SECNO 3.000
3280 CROSS SECTION      3.00 EXTENDED       .41 METERS

     3.000      3.86    568.12       .00       .00    568.63       .51       .14       .06    569.51
     934.0        .0     934.0        .0        .0     294.3        .0      15.0       7.5    567.71
       .00       .00      3.17       .00      .000      .040      .000      .000    564.26     41.31
   .007166       25.       25.       25.         2         0         0       .00    158.69    200.00

*SECNO 4.000
3280 CROSS SECTION      4.00 EXTENDED       .39 METERS

3301 HV CHANGED MORE THAN HVINS

            DOWNSTREAM SIDE OF NEW BRIDGE
     4.000      2.99    568.61       .00       .00    569.68      1.07       .77       .28    570.00
     934.0        .0     934.0        .0        .0     203.9        .0      37.0      18.3    568.22
       .01       .00      4.58       .00      .000      .040      .000      .000    565.62   1971.69
   .010878       88.       88.       88.         2         0         0       .00     86.60   2058.29
```



```
    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

*SECNO 5.000

3265 DIVIDED FLOW

3280 CROSS SECTION      5.00 EXTENDED       .36 METERS
```

7185 MINIMUM SPECIFIC ENERGY
3720 CRITICAL DEPTH ASSUMED

5.000	2.97	568.59	568.59	.00	569.77	1.18	.01	.06	570.00
934.0	.0	934.0	.0	.0	194.0	.0	37.2	18.4	568.23
.01	.00	4.81	.00	.000	.040	.000	.000	565.62	1971.57
.015350	1.	1.	1.	2	5	0	.00	83.66	2059.14

*SECNO 6.000

3265 DIVIDED FLOW

6.000	3.16	569.00	.00	.00	570.21	1.20	.43	.01	570.00
934.0	.0	934.0	.0	.0	192.2	.0	42.8	20.6	570.00
.01	.00	4.86	.00	.000	.040	.000	.000	565.84	1970.46
.014014	29.	29.	29.	3	0	0	.00	72.94	2046.92

*SECNO 7.000

3301 HV CHANGED MORE THAN HVINS

3302 WARNING: CONVEYANCE CHANGE OUTSIDE OF ACCEPTABLE RANGE, KRATIO = 1.78

UPSTREAM SIDE OF EXISTING BRIDGE

7.000	3.87	569.72	.00	.00	570.38	.66	.01	.16	570.00
934.0	.0	934.0	.0	.0	259.6	.0	43.0	20.7	570.00
.01	.00	3.60	.00	.000	.040	.000	.000	565.85	1968.28
.004447	1.	1.	1.	5	0	0	.00	80.40	2048.68

*SECNO 8.000

3265 DIVIDED FLOW

8.000	3.58	569.98	.00	.00	570.66	.68	.27	.01	573.01
934.0	.0	934.0	.0	.0	254.9	.0	57.1	25.4	571.03
.02	.00	3.66	.00	.000	.040	.000	.000	566.40	62.55
.005558	55.	55.	55.	3	0	0	.00	90.67	161.12

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

*SECNO 9.000

3265 DIVIDED FLOW

9.000	3.62	570.06	.00	.00	570.94	.88	.18	.10	574.56
934.0	.0	934.0	.0	.0	224.7	.0	63.1	27.7	571.18
.02	.00	4.16	.00	.000	.040	.000	.000	566.43	85.67
.009205	25.	25.	25.	2	0	0	.00	96.22	188.88

*SECNO 10.000
3280 CROSS SECTION 10.00 EXTENDED 2.31 METERS

3302 WARNING: CONVEYANCE CHANGE OUTSIDE OF ACCEPTABLE RANGE, KRATIO = 1.44

THIS IS THE UPSTREAM LIMIT OF THE STUDY

10.000	3.90	570.55	.00	.00	571.13	.57	.10	.09	575.56
934.0	.0	934.0	.0	.0	278.4	.0	67.2	29.3	568.24
.02	.00	3.36	.00	.000	.040	.000	.000	566.66	106.80
.004465	16.	16.	16.	3	0	0	.00	93.20	200.00

T1 CAVE CREEK WASH - CAREFREE HIGHWAY, JUNE 1996
T2 100 YEAR FREQUENCY - NOTE: DATA IN METRIC
T3 CAVE CREEK WASH AT CAREFREE HIGHWAY BRIDGES (TWO)

J1	ICHECK	INQ	NINV	IDIR	STRT	METRIC	HVINS	Q	WSEL	FQ
	0	4	0	0	.01074	1			568.160	

J2	NPROF	IPLOT	PRFVS	XSECV	XSECH	FN	ALLDC	IBW	CHNIM	ITRACE
	3		-1							

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 3

```
CCHV=     .300 CEHV=     .500
*SECNO 1.000
            BEGIN MODEL APPROX. 200 METERS DOWNSTREAM OF BRIDGE
     1.000      3.27    567.49       .00    568.16    568.35       .86       .00       .00    569.19
    1044.0        .0    1044.0        .0        .0     254.5        .0        .0        .0    575.83
       .00       .00      4.10       .00      .000      .040      .000      .000    564.22     55.50
   .010849       25.       25.       25.         0         0         5       .00    127.71    183.21


*SECNO 2.000
3280 CROSS SECTION      2.00 EXTENDED      1.04 METERS


3302 WARNING:  CONVEYANCE CHANGE OUTSIDE OF ACCEPTABLE RANGE,  KRATIO =  1.59

     2.000      4.00    568.23       .00       .00    568.64       .41       .16       .13    569.47
    1044.0        .0    1044.0        .0        .0     366.0        .0       7.8       3.6    567.19
       .00       .00      2.85       .00      .000      .040      .000      .000    564.23     42.58
   .004306       25.       25.       25.         4         0         0       .00    157.42    200.00


*SECNO 3.000
3280 CROSS SECTION      3.00 EXTENDED       .59 METERS

     3.000      4.04    568.30       .00       .00    568.83       .53       .13       .06    569.51
    1044.0        .0    1044.0        .0        .0     323.4        .0      16.4       7.5    567.71
       .00       .00      3.23       .00      .000      .040      .000      .000    564.26     40.65
   .006588       25.       25.       25.         2         0         0       .00    159.35    200.00


*SECNO 4.000
3280 CROSS SECTION      4.00 EXTENDED       .49 METERS


3301 HV CHANGED MORE THAN HVINS

            DOWNSTREAM SIDE OF NEW BRIDGE
     4.000      3.09    568.71    568.70       .00    569.94      1.22       .76       .35    570.00
    1044.0        .0    1044.0        .0        .0     213.2        .0      40.0      18.4    568.22
       .01       .00      4.90       .00      .000      .040      .000      .000    565.62   1971.36
   .011802       88.       88.       88.         4        15         0       .00     86.93   2058.29


1
   25JUL97      07:53:37                                                                          PAGE   13

    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
```

```
*SECNO 5.000

3265 DIVIDED FLOW

3280 CROSS SECTION      5.00 EXTENDED       .56 METERS

7185 MINIMUM SPECIFIC ENERGY
3720 CRITICAL DEPTH ASSUMED
     5.000      3.17    568.79    568.79       .00    570.04      1.25       .01       .01    570.00
    1044.0        .0    1044.0        .0        .0     210.8        .0      40.2      18.4    568.23
       .01       .00      4.95       .00      .000      .040      .000      .000    565.62   1970.98
   .014935        1.        1.        1.         2         5         0       .00     84.25   2059.14


*SECNO 6.000

3265 DIVIDED FLOW

     6.000      3.34    569.18    569.11       .00    570.50      1.32       .43       .03    570.00
    1044.0        .0    1044.0        .0        .0     205.3        .0      46.2      20.7    570.00
       .01       .00      5.08       .00      .000      .040      .000      .000    565.84   1970.12
   .014456       29.       29.       29.         4         8         0       .00     73.73   2047.35


*SECNO 7.000
3280 CROSS SECTION      7.00 EXTENDED       .00 METERS


3301 HV CHANGED MORE THAN HVINS


3302 WARNING:  CONVEYANCE CHANGE OUTSIDE OF ACCEPTABLE RANGE,  KRATIO =  1.83

3685 20 TRIALS ATTEMPTED WSEL,CWSEL
           UPSTREAM SIDE OF EXISTING BRIDGE
     7.000      4.14    569.99    569.03       .00    570.69       .70       .01       .19    570.00
    1044.0        .0    1044.0        .0        .0     282.1        .0      46.5      20.8    570.00
       .01       .00      3.70       .00      .000      .040      .000      .000    565.85   1967.75
   .004304        1.        1.        1.        24         8         0       .00     81.60   2049.35


*SECNO 8.000
1
   25JUL97      07:53:37                                                                          PAGE   14


    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
```

3265 DIVIDED FLOW

8.000	3.86	570.26	.00	.00	570.96	.70	.27	.00	573.01
1044.0	.0	1044.0	.0	.0	281.3	.0	62.0	25.8	571.03
.02	.00	3.71	.00	.000	.040	.000	.000	566.40	61.97
.005555	55.	55.	55.	2	0	0	.00	98.12	161.74

*SECNO 9.000

3265 DIVIDED FLOW

9.000	3.91	570.35	.00	.00	571.21	.86	.17	.08	574.56
1044.0	.0	1044.0	.0	.0	253.4	.0	68.7	28.2	571.18
.02	.00	4.12	.00	.000	.040	.000	.000	566.43	85.29
.008259	25.	25.	25.	2	0	0	.00	101.27	191.42

*SECNO 10.000
3280 CROSS SECTION 10.00 EXTENDED 2.51 METERS

THIS IS THE UPSTREAM LIMIT OF THE STUDY

10.000	4.09	570.75	.00	.00	571.38	.63	.10	.07	575.56
1044.0	.0	1044.0	.0	.0	297.0	.0	73.1	29.8	568.24
.02	.00	3.52	.00	.000	.040	.000	.000	566.66	106.54
.004531	16.	16.	16.	3	0	0	.00	93.46	200.00

1
25JUL97 07:53:37 PAGE 15

T1 CAVE CREEK WASH - CAREFREE HIGHWAY, JUNE 1996
T2 500 YEAR FREQUENCY - NOTE: DATA IN METRIC
T3 CAVE CREEK WASH AT CAREFREE HIGHWAY BRIDGES (TWO)

J1	ICHECK	INQ	NINV	IDIR	STRT	METRIC	HVINS	Q	WSEL	FQ
	0	5	0	0	.01074	1			568.560	

J2	NPROF	IPLOT	PRFVS	XSECV	XSECH	FN	ALLDC	IBW	CHNIM	ITRACE
	4		-1							

1
25JUL97 07:53:37 PAGE 16

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 4

CCHV=      .300 CEHV=      .500
*SECNO 1.000
            BEGIN MODEL APPROX. 200 METERS DOWNSTREAM OF BRIDGE
     1.000      3.75     567.97       .00     568.56     569.07      1.10       .00       .00     569.19
    1472.0        .0     1472.0        .0         .0      316.2        .0        .0        .0     575.83
       .00       .00       4.66       .00       .000       .040      .000      .000    564.22      53.93
   .010762       25.        25.       25.          0          0         5       .00    130.24     184.17

*SECNO 2.000
3280 CROSS SECTION      2.00 EXTENDED      1.72 METERS

3301 HV CHANGED MORE THAN HVINS

3302 WARNING:  CONVEYANCE CHANGE OUTSIDE OF ACCEPTABLE RANGE,  KRATIO =  1.71

     2.000      4.68     568.91       .00        .00     569.40       .49       .15       .18     569.47
    1472.0        .0     1472.0        .0         .0      474.4        .0       9.9       3.6     567.19
       .00       .00       3.10       .00       .000       .040      .000      .000    564.23      40.25
   .003698       25.        25.       25.          4          0         0       .00    159.75     200.00

*SECNO 3.000
3280 CROSS SECTION      3.00 EXTENDED      1.26 METERS

     3.000      4.71     568.97       .00        .00     569.56       .59       .11       .05     569.51
    1472.0        .0     1472.0        .0         .0      430.6        .0      21.2       7.6     567.71
       .00       .00       3.42       .00       .000       .040      .000      .000    564.26      38.24
   .005174       25.        25.       25.          2          0         0       .00    161.76     200.00

*SECNO 4.000
3280 CROSS SECTION      4.00 EXTENDED      1.12 METERS

3301 HV CHANGED MORE THAN HVINS

7185 MINIMUM SPECIFIC ENERGY
3720 CRITICAL DEPTH ASSUMED
1
   25JUL97      07:53:37                                                                                PAGE    17
```

```
            DOWNSTREAM SIDE OF NEW BRIDGE
     4.000       3.72    569.34    569.34       .00    570.87      1.53       .65       .47    570.00
    1472.0         .0    1472.0        .0        .0     268.3        .0      51.9      18.7    568.22
       .01        .00      5.49       .00      .000      .040      .000      .000    565.62   1969.45
   .011347        88.       88.       88.         3        15         0       .00     88.84   2058.29


*SECNO 5.000

3265 DIVIDED FLOW

3280 CROSS SECTION      5.00 EXTENDED      1.20 METERS

7185 MINIMUM SPECIFIC ENERGY
3720 CRITICAL DEPTH ASSUMED
     5.000       3.81    569.43    569.43       .00    571.00      1.56       .01       .02    570.00
    1472.0         .0    1472.0        .0        .0     265.5        .0      52.2      18.8    568.23
       .01        .00      5.54       .00      .000      .040      .000      .000    565.62   1969.10
   .014934         1.        1.        1.         2         8         0       .00     86.16   2059.14


*SECNO 6.000

3265 DIVIDED FLOW

7185 MINIMUM SPECIFIC ENERGY
3720 CRITICAL DEPTH ASSUMED
     6.000       4.01    569.85    569.85       .00    571.54      1.69       .44       .06    570.00
    1472.0         .0    1472.0        .0        .0     255.9        .0      59.8      21.1    570.00
       .01        .00      5.75       .00      .000      .040      .000      .000    565.84   1968.81
   .015253        29.       29.       29.         2         8         0       .00     76.68   2048.99


*SECNO 7.000
3280 CROSS SECTION      7.00 EXTENDED       .95 METERS


3301 HV CHANGED MORE THAN HVINS


3302 WARNING:  CONVEYANCE CHANGE OUTSIDE OF ACCEPTABLE RANGE,  KRATIO =  1.97

3685 20 TRIALS ATTEMPTED WSEL,CWSEL
            UPSTREAM SIDE OF EXISTING BRIDGE
     7.000       5.09    570.94    569.74       .00    571.80       .85       .01       .25    570.00
    1472.0         .0    1472.0        .0        .0     359.5        .0      60.1      21.2    570.00
       .01        .00      4.09       .00      .000      .040      .000      .000    565.85   1967.75
   .003929         1.        1.        1.        24         8         0       .00     81.60   2049.35
```

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

*SECNO 8.000

3265 DIVIDED FLOW

3280 CROSS SECTION 8.00 EXTENDED .36 METERS

8.000	4.99	571.39	.00	.00	572.08	.69	.24	.05	573.01
1472.0	.0	1472.0	.0	.0	398.7	.0	80.9	26.8	571.03
.01	.00	3.69	.00	.000	.040	.000	.000	566.40	43.61
.004717	55.	55.	55.	2	0	0	.00	123.66	200.00

*SECNO 9.000
3280 CROSS SECTION 9.00 EXTENDED .29 METERS

9.000	5.04	571.47	.00	.00	572.24	.77	.12	.04	574.56
1472.0	.0	1472.0	.0	.0	379.0	.0	90.7	29.8	571.18
.02	.00	3.88	.00	.000	.040	.000	.000	566.43	83.83
.005173	25.	25.	25.	2	0	0	.00	116.17	200.00

*SECNO 10.000
3280 CROSS SECTION 10.00 EXTENDED 3.31 METERS

THIS IS THE UPSTREAM LIMIT OF THE STUDY

10.000	4.88	571.53	.00	.00	572.33	.80	.08	.01	575.56
1472.0	.0	1472.0	.0	.0	372.0	.0	96.7	31.5	568.24
.02	.00	3.96	.00	.000	.040	.000	.000	566.66	105.50
.004371	16.	16.	16.	1	0	0	.00	94.50	200.00

1

THIS RUN EXECUTED 25JUL97 07:53:37

****
HEC-2 WATER SURFACE PROFILES

Version 4.6.2; May 1991

****

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

CAVE CREEK WASH AT C

SUMMARY PRINTOUT

	SECNO	Q	CWSEL	CRIWS	VCH	XLCH	STCHL	STCHR	STENCL	STENCR	SSTA	ENDST
	1.000	583.00	567.55	.00	2.22	.00	.00	200.00	.00	.00	55.30	183.33
	1.000	934.00	567.35	.00	3.94	.00	.00	200.00	.00	.00	55.96	182.38
	1.000	1044.00	567.49	.00	4.10	.00	.00	200.00	.00	.00	55.50	183.21
	1.000	1472.00	567.97	.00	4.66	.00	.00	200.00	.00	.00	53.93	184.17
	2.000	583.00	567.67	.00	2.09	25.00	.00	200.00	.00	.00	44.48	200.00
*	2.000	934.00	568.04	.00	2.78	25.00	.00	200.00	.00	.00	43.22	200.00
*	2.000	1044.00	568.23	.00	2.85	25.00	.00	200.00	.00	.00	42.58	200.00
*	2.000	1472.00	568.91	.00	3.10	25.00	.00	200.00	.00	.00	40.25	200.00
	3.000	583.00	567.72	.00	2.52	25.00	.00	200.00	.00	.00	42.74	200.00
	3.000	934.00	568.12	.00	3.17	25.00	.00	200.00	.00	.00	41.31	200.00
	3.000	1044.00	568.30	.00	3.23	25.00	.00	200.00	.00	.00	40.65	200.00
	3.000	1472.00	568.97	.00	3.42	25.00	.00	200.00	.00	.00	38.24	200.00
	4.000	583.00	568.15	.00	3.55	88.00	1967.43	2058.29	.00	.00	1973.10	2057.83
	4.000	934.00	568.61	.00	4.58	88.00	1967.43	2058.29	.00	.00	1971.69	2058.29
	4.000	1044.00	568.71	568.70	4.90	88.00	1967.43	2058.29	.00	.00	1971.36	2058.29
*	4.000	1472.00	569.34	569.34	5.49	88.00	1967.43	2058.29	.00	.00	1969.45	2058.29
	5.000	583.00	568.11	.00	3.77	1.00	1967.43	2059.14	.00	.00	1972.97	2058.38
*	5.000	934.00	568.59	568.59	4.81	1.00	1967.43	2059.14	.00	.00	1971.57	2059.14
*	5.000	1044.00	568.79	568.79	4.95	1.00	1967.43	2059.14	.00	.00	1970.98	2059.14
*	5.000	1472.00	569.43	569.43	5.54	1.00	1967.43	2059.14	.00	.00	1969.10	2059.14
	6.000	583.00	568.43	.00	3.86	29.00	1968.53	2049.35	.00	.00	1971.58	2045.51
	6.000	934.00	569.00	.00	4.86	29.00	1968.53	2049.35	.00	.00	1970.46	2046.92
	6.000	1044.00	569.18	569.11	5.08	29.00	1968.53	2049.35	.00	.00	1970.12	2047.35
*	6.000	1472.00	569.85	569.85	5.75	29.00	1968.53	2049.35	.00	.00	1968.81	2048.99
*	7.000	583.00	568.75	.00	3.18	1.00	1967.75	2049.35	.00	.00	1970.17	2046.30
*	7.000	934.00	569.72	.00	3.60	1.00	1967.75	2049.35	.00	.00	1968.28	2048.68
*	7.000	1044.00	569.99	569.03	3.70	1.00	1967.75	2049.35	.00	.00	1967.75	2049.35
*	7.000	1472.00	570.94	569.74	4.09	1.00	1967.75	2049.35	.00	.00	1967.75	2049.35

	SECNO	Q	CWSEL	CRIWS	VCH	XLCH	STCHL	STCHR	STENCL	STENCR	SSTA	ENDST
	8.000	583.00	569.04	.00	3.34	55.00	.00	200.00	.00	.00	64.46	145.21
	8.000	934.00	569.98	.00	3.66	55.00	.00	200.00	.00	.00	62.55	161.12
	8.000	1044.00	570.26	.00	3.71	55.00	.00	200.00	.00	.00	61.97	161.74
	8.000	1472.00	571.39	.00	3.69	55.00	.00	200.00	.00	.00	43.61	200.00
	9.000	583.00	569.12	569.09	4.09	25.00	.00	200.00	.00	.00	86.88	180.71
	9.000	934.00	570.06	.00	4.16	25.00	.00	200.00	.00	.00	85.67	188.88
	9.000	1044.00	570.35	.00	4.12	25.00	.00	200.00	.00	.00	85.29	191.42
	9.000	1472.00	571.47	.00	3.88	25.00	.00	200.00	.00	.00	83.83	200.00
*	10.000	583.00	569.84	.00	2.74	16.02	.00	200.00	.00	.00	107.71	200.00
*	10.000	934.00	570.55	.00	3.36	16.02	.00	200.00	.00	.00	106.80	200.00
	10.000	1044.00	570.75	.00	3.52	16.02	.00	200.00	.00	.00	106.54	200.00
	10.000	1472.00	571.53	.00	3.96	16.02	.00	200.00	.00	.00	105.50	200.00

CAVE CREEK WASH AT C

SUMMARY PRINTOUT

	SECNO	QLOB	QCH	QROB	VLOB	VCH	VROB	TELMX	CWSEL	DIFWSX	TOPWID	ELMIN	ALPHA
	1.000	.00	583.00	.00	.00	2.22	.00	569.19	567.55	.00	128.03	564.22	1.00
	1.000	.00	934.00	.00	.00	3.94	.00	569.19	567.35	.00	126.42	564.22	1.00
	1.000	.00	1044.00	.00	.00	4.10	.00	569.19	567.49	.00	127.71	564.22	1.00
	1.000	.00	1472.00	.00	.00	4.66	.00	569.19	567.97	.00	130.24	564.22	1.00
	2.000	.00	583.00	.00	.00	2.09	.00	567.19	567.67	.12	155.52	564.23	1.00
*	2.000	.00	934.00	.00	.00	2.78	.00	567.19	568.04	.68	156.78	564.23	1.00
*	2.000	.00	1044.00	.00	.00	2.85	.00	567.19	568.23	.74	157.42	564.23	1.00
*	2.000	.00	1472.00	.00	.00	3.10	.00	567.19	568.91	.94	159.75	564.23	1.00
	3.000	.00	583.00	.00	.00	2.52	.00	567.71	567.72	.05	143.31	564.26	1.00
	3.000	.00	934.00	.00	.00	3.17	.00	567.71	568.12	.08	158.69	564.26	1.00
	3.000	.00	1044.00	.00	.00	3.23	.00	567.71	568.30	.07	159.35	564.26	1.00
	3.000	.00	1472.00	.00	.00	3.42	.00	567.71	568.97	.06	161.76	564.26	1.00
	4.000	.00	583.00	.00	.00	3.55	.00	568.22	568.15	.43	84.73	565.62	1.00
	4.000	.00	934.00	.00	.00	4.58	.00	568.22	568.61	.49	86.60	565.62	1.00
	4.000	.00	1044.00	.00	.00	4.90	.00	568.22	568.71	.41	86.93	565.62	1.00
*	4.000	.00	1472.00	.00	.00	5.49	.00	568.22	569.34	.37	88.84	565.62	1.00
	5.000	.00	583.00	.00	.00	3.77	.00	568.23	568.11	-.03	81.48	565.62	1.00
*	5.000	.00	934.00	.00	.00	4.81	.00	568.23	568.59	-.02	83.66	565.62	1.00
*	5.000	.00	1044.00	.00	.00	4.95	.00	568.23	568.79	.08	84.25	565.62	1.00

*	5.000	.00	1472.00	.00	.00	5.54	.00	568.23	569.43	.09	86.16	565.62	1.00
	6.000	.00	583.00	.00	.00	3.86	.00	570.00	568.43	.31	70.41	565.84	1.00
	6.000	.00	934.00	.00	.00	4.86	.00	570.00	569.00	.41	72.94	565.84	1.00
	6.000	.00	1044.00	.00	.00	5.08	.00	570.00	569.18	.39	73.73	565.84	1.00
*	6.000	.00	1472.00	.00	.00	5.75	.00	570.00	569.85	.42	76.68	565.84	1.00
*	7.000	.00	583.00	.00	.00	3.18	.00	570.00	568.75	.33	76.13	565.85	1.00
*	7.000	.00	934.00	.00	.00	3.60	.00	570.00	569.72	.71	80.40	565.85	1.00
*	7.000	.00	1044.00	.00	.00	3.70	.00	570.00	569.99	.81	81.60	565.85	1.00
*	7.000	.00	1472.00	.00	.00	4.09	.00	570.00	570.94	1.09	81.60	565.85	1.00
	8.000	.00	583.00	.00	.00	3.34	.00	571.03	569.04	.29	80.76	566.40	1.00
	8.000	.00	934.00	.00	.00	3.66	.00	571.03	569.98	.26	90.67	566.40	1.00
	8.000	.00	1044.00	.00	.00	3.71	.00	571.03	570.26	.27	98.12	566.40	1.00
	8.000	.00	1472.00	.00	.00	3.69	.00	571.03	571.39	.44	123.66	566.40	1.00
	9.000	.00	583.00	.00	.00	4.09	.00	571.18	569.12	.08	80.01	566.43	1.00
	9.000	.00	934.00	.00	.00	4.16	.00	571.18	570.06	.08	96.22	566.43	1.00
	9.000	.00	1044.00	.00	.00	4.12	.00	571.18	570.35	.09	101.27	566.43	1.00
	9.000	.00	1472.00	.00	.00	3.88	.00	571.18	571.47	.09	116.17	566.43	1.00

	SECNO	QLOB	QCH	QROB	VLOB	VCH	VROB	TELMX	CWSEL	DIFWSX	TOPWID	ELMIN	ALPHA
*	10.000	.00	583.00	.00	.00	2.74	.00	568.24	569.84	.72	92.29	566.66	1.00
*	10.000	.00	934.00	.00	.00	3.36	.00	568.24	570.55	.50	93.20	566.66	1.00
	10.000	.00	1044.00	.00	.00	3.52	.00	568.24	570.75	.40	93.46	566.66	1.00
	10.000	.00	1472.00	.00	.00	3.96	.00	568.24	571.53	.06	94.50	566.66	1.00

CAVE CREEK WASH AT C

SUMMARY PRINTOUT

	SECNO	XLCH	K*CHSL	EG	HV	HL	OLOSS	10*KS	VOL	DEPTH	K*XNL	K*XNCH	K*XNR
	1.000	.00	.00	567.80	.25	.00	.00	30.71	.00	3.33	.00	40.00	.00
	1.000	.00	.00	568.14	.79	.00	.00	108.56	.00	3.14	.00	40.00	.00
	1.000	.00	.00	568.35	.86	.00	.00	108.49	.00	3.27	.00	40.00	.00
	1.000	.00	.00	569.07	1.10	.00	.00	107.62	.00	3.75	.00	40.00	.00
	2.000	25.00	.60	567.89	.22	.08	.01	32.68	6.76	3.44	.00	40.00	.00
*	2.000	25.00	.60	568.43	.39	.17	.12	45.47	7.16	3.81	.00	40.00	.00

*	2.000	25.00	.60	568.64	.41	.16	.13	43.06	7.76	4.00	.00	40.00	.00
*	2.000	25.00	.60	569.40	.49	.15	.18	36.98	9.88	4.68	.00	40.00	.00
	3.000	25.00	1.20	568.04	.32	.10	.05	53.95	13.14	3.46	.00	40.00	.00
	3.000	25.00	1.20	568.63	.51	.14	.06	71.66	15.04	3.86	.00	40.00	.00
	3.000	25.00	1.20	568.83	.53	.13	.06	65.88	16.37	4.04	.00	40.00	.00
	3.000	25.00	1.20	569.56	.59	.11	.05	51.74	21.19	4.71	.00	40.00	.00
	4.000	88.00	15.45	568.79	.64	.59	.16	84.05	30.56	2.53	.00	40.00	.00
	4.000	88.00	15.45	569.68	1.07	.77	.28	108.78	36.97	2.99	.00	40.00	.00
	4.000	88.00	15.45	569.94	1.22	.76	.35	118.02	39.98	3.09	.00	40.00	.00
*	4.000	88.00	15.45	570.87	1.53	.65	.47	113.47	51.95	3.72	.00	40.00	.00
	5.000	1.00	.00	568.84	.72	.01	.04	118.28	30.72	2.49	.00	40.00	.00
*	5.000	1.00	.00	569.77	1.18	.01	.06	153.50	37.17	2.97	.00	40.00	.00
*	5.000	1.00	.00	570.04	1.25	.01	.01	149.35	40.19	3.17	.00	40.00	.00
*	5.000	1.00	.00	571.00	1.56	.01	.02	149.34	52.21	3.81	.00	40.00	.00
	6.000	29.00	7.59	569.19	.76	.33	.02	111.08	35.15	2.59	.00	40.00	.00
	6.000	29.00	7.59	570.21	1.20	.43	.01	140.14	42.77	3.16	.00	40.00	.00
	6.000	29.00	7.59	570.50	1.32	.43	.03	144.56	46.23	3.34	.00	40.00	.00
*	6.000	29.00	7.59	571.54	1.69	.44	.06	152.53	59.77	4.01	.00	40.00	.00
*	7.000	1.00	9.95	569.27	.51	.01	.07	50.92	35.32	2.90	.00	40.00	.00
*	7.000	1.00	9.95	570.38	.66	.01	.16	44.47	42.99	3.87	.00	40.00	.00
*	7.000	1.00	9.95	570.69	.70	.01	.19	43.04	46.47	4.14	.00	40.00	.00
*	7.000	1.00	9.95	571.80	.85	.01	.25	39.29	60.08	5.09	.00	40.00	.00
	8.000	55.00	10.00	569.61	.57	.31	.03	64.81	45.17	2.64	.00	40.00	.00
	8.000	55.00	10.00	570.66	.68	.27	.01	55.58	57.14	3.58	.00	40.00	.00
	8.000	55.00	10.00	570.96	.70	.27	.00	55.55	61.97	3.86	.00	40.00	.00
	8.000	55.00	10.00	572.08	.69	.24	.05	47.17	80.93	4.99	.00	40.00	.00
	9.000	25.00	1.28	569.97	.85	.22	.14	127.73	49.13	2.69	.00	40.00	.00
	9.000	25.00	1.28	570.94	.88	.18	.10	92.05	63.14	3.62	.00	40.00	.00
	9.000	25.00	1.28	571.21	.86	.17	.08	82.59	68.65	3.91	.00	40.00	.00
	9.000	25.00	1.28	572.24	.77	.12	.04	51.73	90.65	5.04	.00	40.00	.00

	SECNO	XLCH	K*CHSL	EG	HV	HL	OLOSS	10*KS	VOL	DEPTH	K*XNL	K*XNCH	K*XNR
*	10.000	16.02	14.04	570.22	.38	.11	.14	41.55	51.98	3.18	.00	40.00	.00
*	10.000	16.02	14.04	571.13	.57	.10	.09	44.65	67.17	3.90	.00	40.00	.00
	10.000	16.02	14.04	571.38	.63	.10	.07	45.31	73.06	4.09	.00	40.00	.00
	10.000	16.02	14.04	572.33	.80	.08	.01	43.71	96.67	4.88	.00	40.00	.00

SUMMARY OF ERRORS AND SPECIAL NOTES

```
WARNING SECNO=      2.000  PROFILE=  2  CONVEYANCE CHANGE OUTSIDE ACCEPTABLE RANGE
WARNING SECNO=      2.000  PROFILE=  3  CONVEYANCE CHANGE OUTSIDE ACCEPTABLE RANGE
WARNING SECNO=      2.000  PROFILE=  4  CONVEYANCE CHANGE OUTSIDE ACCEPTABLE RANGE

CAUTION SECNO=      4.000  PROFILE=  4  CRITICAL DEPTH ASSUMED
CAUTION SECNO=      4.000  PROFILE=  4  MINIMUM SPECIFIC ENERGY

CAUTION SECNO=      5.000  PROFILE=  2  CRITICAL DEPTH ASSUMED
CAUTION SECNO=      5.000  PROFILE=  2  MINIMUM SPECIFIC ENERGY
CAUTION SECNO=      5.000  PROFILE=  3  CRITICAL DEPTH ASSUMED
CAUTION SECNO=      5.000  PROFILE=  3  MINIMUM SPECIFIC ENERGY
CAUTION SECNO=      5.000  PROFILE=  4  CRITICAL DEPTH ASSUMED
CAUTION SECNO=      5.000  PROFILE=  4  MINIMUM SPECIFIC ENERGY

CAUTION SECNO=      6.000  PROFILE=  4  CRITICAL DEPTH ASSUMED
CAUTION SECNO=      6.000  PROFILE=  4  MINIMUM SPECIFIC ENERGY

WARNING SECNO=      7.000  PROFILE=  1  CONVEYANCE CHANGE OUTSIDE ACCEPTABLE RANGE
WARNING SECNO=      7.000  PROFILE=  2  CONVEYANCE CHANGE OUTSIDE ACCEPTABLE RANGE
CAUTION SECNO=      7.000  PROFILE=  3  20 TRIALS ATTEMPTED TO BALANCE WSEL
WARNING SECNO=      7.000  PROFILE=  3  CONVEYANCE CHANGE OUTSIDE ACCEPTABLE RANGE
CAUTION SECNO=      7.000  PROFILE=  4  20 TRIALS ATTEMPTED TO BALANCE WSEL
WARNING SECNO=      7.000  PROFILE=  4  CONVEYANCE CHANGE OUTSIDE ACCEPTABLE RANGE

WARNING SECNO=     10.000  PROFILE=  1  CONVEYANCE CHANGE OUTSIDE ACCEPTABLE RANGE
WARNING SECNO=     10.000  PROFILE=  2  CONVEYANCE CHANGE OUTSIDE ACCEPTABLE RANGE
```


FLOOD INSURANCE ZONE DATA FOR CAVE CREEK WASH AT C

FLOOD HAZARD FACTOR FOR ENTIRE REACH USING SECTIONS

SECTION NUMBER	CUMULATIVE DISTANCE	ELEVATION DIFFERENCE BETWEEN BASE FLOOD AND 10	2	0.2
1.000	0.	.06	-.14	.48
2.000	25.	-.56	-.19	.69
3.000	50.	-.58	-.18	.67
4.000	138.	-.57	-.11	.63

5.000	139.	-.68	-.20	.64
6.000	168.	-.75	-.18	.67
7.000	169.	-1.24	-.28	.95
8.000	224.	-1.22	-.28	1.13
9.000	249.	-1.23	-.29	1.13
10.000	265.	-.91	-.19	.79
WEIGHTED AVG FOR REACH		-.79	-.20	.79

FHF FOR THE REACH = 025 WITH 60.4 PERCENT OF THE REACH WITHIN .30 METERS
ZONE FOR THE REACH = A 5

CONTINUOUS FLOOD HAZARD FACTORS BY EVEN INCREMENTS

INC NO.	TOTAL LENGTH	AVG ELEVATION DATA 10	1	DIFF.	WTD. AVG.	FHF	PERCENT WITHIN
	0.				SEC.		1.000
	25.				SEC.		2.000
1	30.	567.61	567.86	-.25	-.25	010	100.
	50.				SEC.		3.000
2	60.	567.72	568.29	-.57	-.41	015	0.
3	90.	567.84	568.42	-.58	-.47	015	67.
4	120.	567.99	568.56	-.57	-.49	015	75.
	138.				SEC.		4.000
	139.				SEC.		5.000
5	150.	568.15	568.78	-.63	-.52	015	80.
	168.				SEC.		6.000
	169.				SEC.		7.000
6	180.	568.52	569.49	-.97	-.59	020	67.
7	210.	568.89	570.12	-1.23	-.69	025	71.
	224.				SEC.		8.000
8	240.	569.03	570.25	-1.22	-.75	025	63.
	249.				SEC.		9.000
	265.				SEC.		10.000

1

THIS REACH CAN BE SUBDIVIDED BY INC NO. TO MEET FIA REQUIREMENTS
INPUT 20N WHERE N IS THE NUMBER OF REACHES AND THEN INPUT THE END
OF EACH REACH BY INC NO. FOR EXAMPLE 202 5 8
A NEGATIVE INC NO. WILL SUPPRESS INTERMEDIATE INC OUTPUT.

CONTINUOUS FLOOD HAZARD FACTORS BY EVEN INCREMENTS

INC NO.	TOTAL LENGTH	WEIGHTED AVG DIFFERENCE BETWEEN BASE FLOOD AND 10	2	0.2
5	150.	-.52	-.16	.64

FHF FOR REACH 1 = 015 WITH 80. PERCENT OF THE REACH WITHIN .15 METERS
ZONE FOR THE REACH = A 3
==========

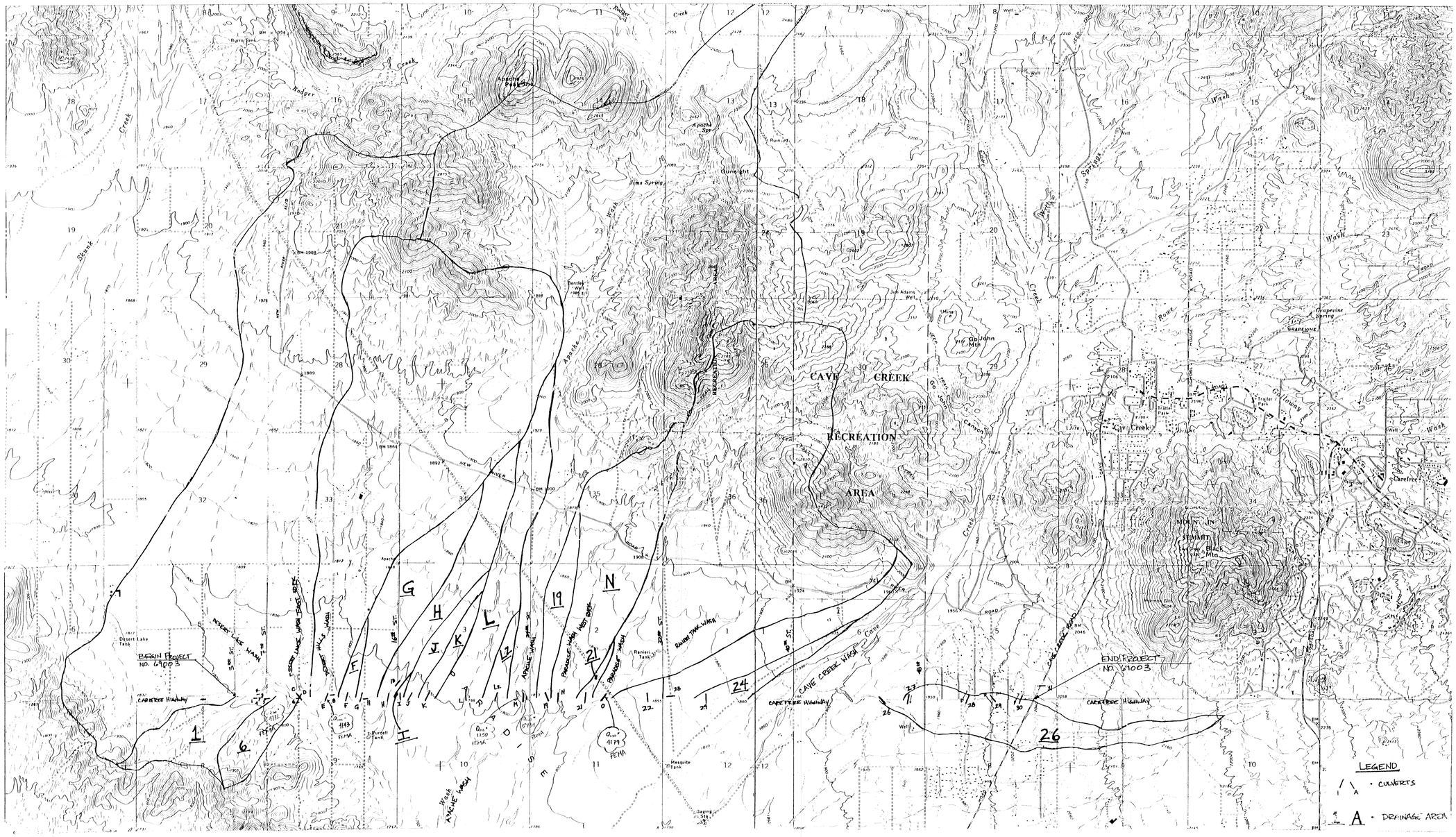
8	240.	-1.14	-.26	.99

FHF FOR REACH 2 = 035 WITH 100. PERCENT OF THE REACH WITHIN .30 METERS
ZONE FOR THE REACH = A 7
==========

APPENDIX F

Drainage Basin and Culvert Location Map

F.W.H.A. REGION	STATE	PROJECT NO.	SHEET NO.	TOTAL SHEETS	RECORD DRAWING
9	AZ.	69003	—	—	



NO.	REVISION	BY	DATE
1			
2			
3			

MARICOPA COUNTY
DEPARTMENT OF TRANSPORTATION
ENGINEERING DIVISION

CAREFREE HIGHWAY
7TH STREET TO CAVE CREEK ROAD
PROJECT NO. 69003

	BY	DATE
DESIGNED	AJS	5/30/96
DRAWN	KWR	5/30/96
CHECKED		

NOT FOR CONSTRUCTION

DIBBLE & ASSOCIATES
CONSULTING ENGINEERS

DRAINAGE AREA MAP

SHEET 1 OF 1

TRACS NO.

mb.dgn 12/02/94