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Report 12

CASE STUDY EVALUATION OF ALTERNATIVE DAM-BREACH FLOOD WAVE MODELS

Volume III: Hypothetical Prismatic
Channel Case Study

by

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empirical data base for analyzing the performance of the models under various conditions. -1 -

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PREFACE

The work reported herein was conducted under Department of the Army Project No. 4A762719AT40, "Mobility and Weapon Effects Technology," Task Area B0, "AirLand Battlefield Environment," Mission Area, "Combat Support," Work Unit 052, "Induced Floods as Linear/Area Obstacles," under the auspices of the Battlefield Terrain Working Group of the AirLand Battlefield Environment Thrust. The study was sponsored by the Office, Chief of Engineers (OCE). Dr. Clemens A. Meyer was the OCE Technical Monitor.

The study was conducted by the US Army Engineer Waterways Experiment Station (WES) under the general supervision of Dr. John Harrison, Chief of the Environmental Laboratory, and Dr. Lewis E. Link, Chief of the Environmental Systems Division, and under the direct supervision of Mr. M. P. Keown, Chief of the Environmental Constraints Group (ECG), and Mr. J. G. Collins, ECG. Mr. M. R. Jourdan, ECG, Principal Investigator, Work Unit 052, provided technical assistance and review. This report was prepared by Dr. Ralph A. Wurbs, who is an Assistant Professor at Texas A&M University working under an Inter-governmental Personnel Act agreement as a Research Engineer, ECG.

COL Allen F. Grum, USA, was the previous Director of WES. COL Dwayne G. Lee, CE, is the present Commander and Director. Dr. Robert W. Whalin is Technical Director.

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INTRODUCTION

Hypothetical Prismatic Channel

Computational difficulties associated with the complex valley geometry was the dominant consideration in the Teton case study. Irregular valley geometry was also an important complicating factor in the Laurel Run case study. The hypothetical prismatic channel case study was developed to test the model under conditions for which irregular valley geometry was not a major concern. The reservoir data for the Teton Reservoir was combined with a prismatic channel. The prismatic channel is essentially an extension of the 5-mile long Teton canyon to 50 miles.

The prismatic channel, as shown in Figure 1, consists of two reaches of constant cross-section joined by a transition reach. The channel cross-section from mile 0 to mile 5 is constant, and the reach between miles 10 and 50 has a slightly wider constant cross-section. Miles 5 to 10 provide the transition between the two sections. The cross-section for miles 0 to 5 approximates the geometry of the narrow, steep-walled Teton canyon just below the dam. However, the remaining 45 miles of slightly wider prismatic channel does not approximate the wide, flat, abruptly changing topography of the valley of the Teton and Snake Rivers below the Teton canyon. The prismatic channel has a constant bottom slope of ten feet per mile and a constant Manning roughness coefficient of 0.040 which are representative of the canyon of the Teton River.

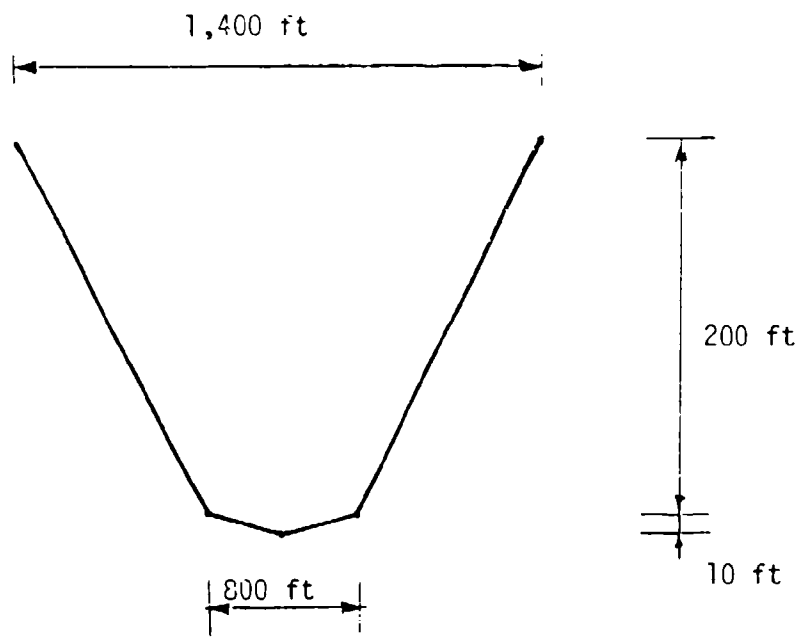
Overview of Analysis

DAMBRK, FLOW SIM 1, FLOW SIM 2, HEC-1, SMPDBK, TR66, and the HEC dimensionless graph procedure were tested using the hypothetical prismatic channel. For purposes of comparing models, an initial "base run" set of

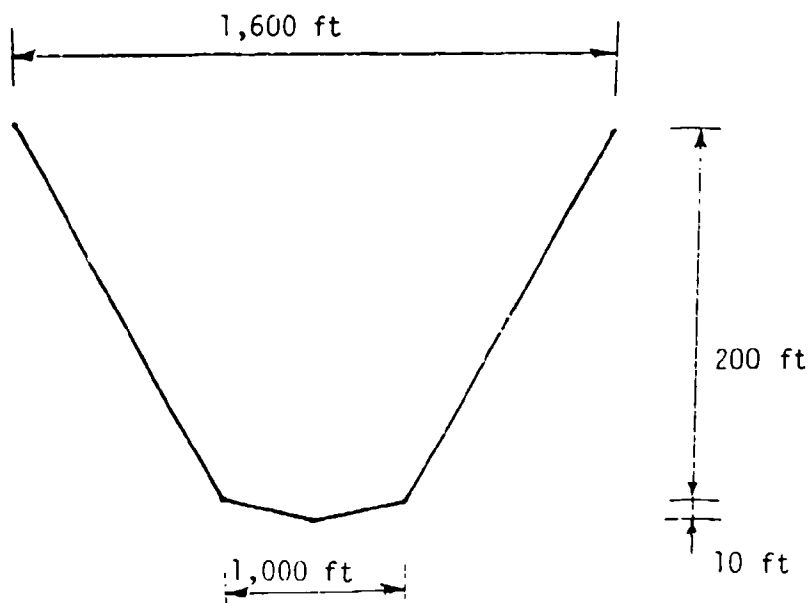
breach parameters was defined as follows: time to maximum breach size of 1.0 hour, breach width of 500 feet; and vertical side slopes. However, the HEC dimensionless graph procedure is based on an instantaneous complete removal of the dam, and TR66 uses a reservoir water depth versus maximum breach discharge relationship based on data from actual past dam failures. The other models have breach simulation routines which can reflect the above listed breach parameters. However, a solution could not be obtained for these parameter values with FLOW SIM 1 and 2 due to instabilities in the computations.

Computational instability was a major problem in applying FLOW SIM 1 and 2 and became the primary focus of the analysis with these models. Obtaining solutions was not a problem with DAMBRK. The DAMBRK analysis was used to test the sensitivity of the flow wave to variations in breach size and manning roughness coefficient. The HEC-1 analysis included testing the sensitivity of model results to the parameters NMIN and NSTPS. The TR66 procedure was applied alternatively with the peak discharge at the dam computed with the TR66 method and DAMBRK, with valley routing by the TR66 procedure in both cases. SMPDBK and the dimensionless graph procedure were applied without particular difficulties being encountered or sensitivity studies being made.

Figure 1 - Channel Cross-Section



Mile 0 to 5



Mile 10 to 50

DAMBRK RESULTS

The results of the DAMBRK analysis are summarized in Tables 1 through 4 and Figures 2 through 4. DAMBRK was used to test the sensitivity of the dam breach flood wave characteristics to breach width and Manning roughness coefficient. A constant manning n is assumed all along the channel. The results of four runs are presented in the tables and figures with alternative n values of 0.04, 0.06, 0.08, and 0.12 and all other input data constant. Likewise, alternative runs are presented with alternative final breach widths of 100 feet, 300 feet, 500 feet, and 700 feet and all other input data constant. Appendix A is a listing of the DAMBRK base run (breach width of 500 feet and n values of 0.40).

Several unsuccessful trial runs were required to debug the input data and establish workable distance steps. After these initial runs to get the model running, computational problems, such as nonconvergence and instability, were not encountered.

Table 1
DAMBRK - Prismatic
Peak Discharges

		: <u>Maximum Discharge in 1,000 cfs</u>												
Distance	:	Manning Roughness Coefficient (n)												
From	:	0.04	:	0.04	:	0.04	:	0.04	:	0.06	:	0.08	:	0.12
Dam	:	Final Breach Width in Feet												
(miles)	:	100	:	300	:	500	:	700	:	500	:	500	:	500
0		1,224		2,995		3,841		4,563		3,717		3,380		3,108
5		1,110		2,603		3,468		4,145		3,218		2,838		2,219
10		1,060		2,349		3,220		3,840		2,840		2,400		1,782
16		995		2,066		2,864		3,374		2,378		1,926		1,368
22		933		1,897		2,536		2,876		1,978		1,542		1,067
30		867		1,716		2,135		2,317		1,598		1,241		839
40		804		1,508		1,777		1,905		1,313		1,027		683
50		757		1,357		1,567		1,674		1,136		892		587

Table 2
DAMBRK - Prismatic
Peak Water Surface Elevations

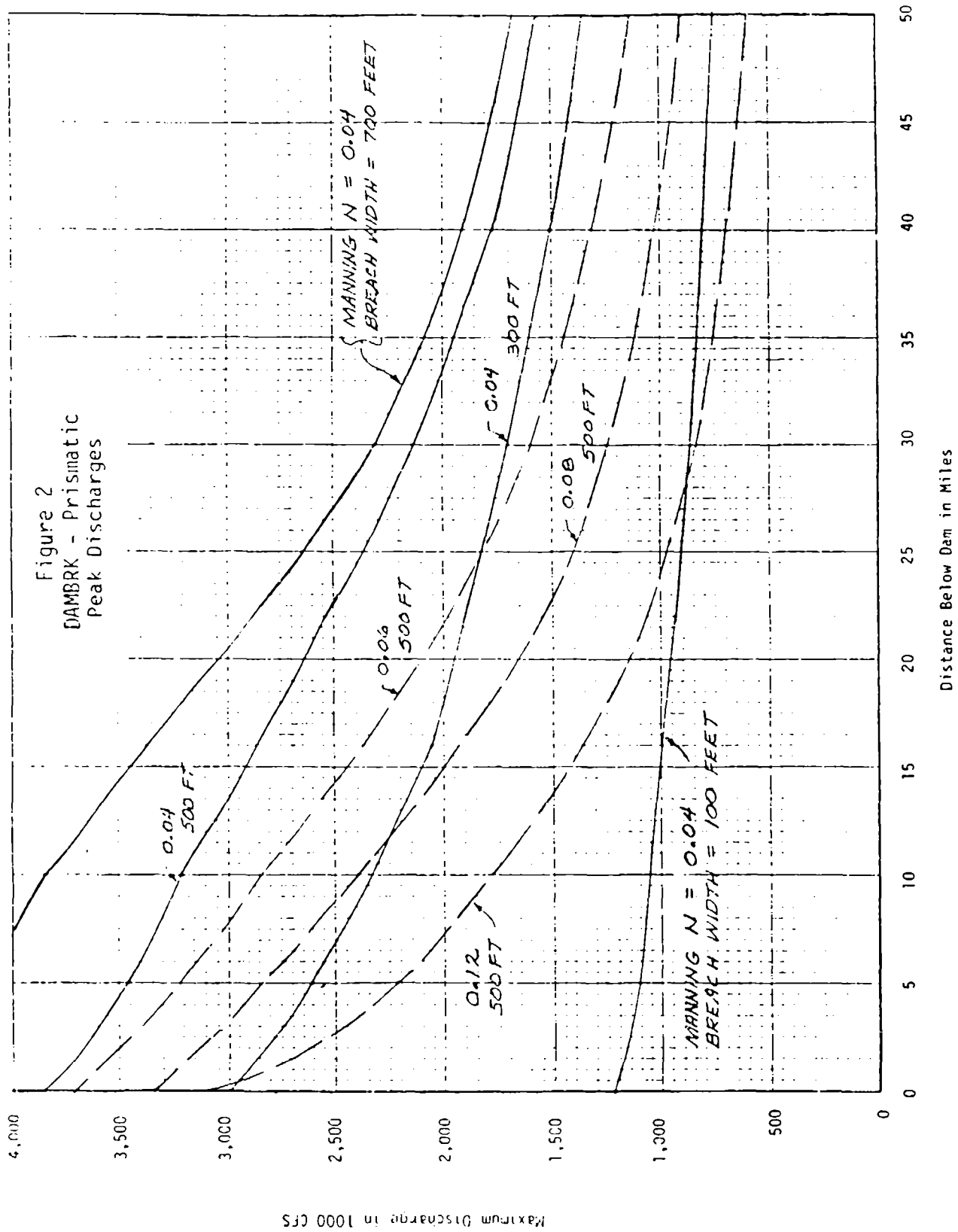
		: <u>Maximum Water Surface Elevation in Feet MSL</u>						
Distance :		Manning Roughness Coefficient (n)						
From :		0.04	0.04	0.04	0.04	0.06	0.08	0.012
Dam :		Final Breach Width in Feet						
(feet) :		100	300	500	700	500	500	500
0		5092.5	5129.2	5144.6	5155.9	5166.5	5178.9	5193.9
5		5038.6	5068.8	5083.9	5093.7	5101.6	5110.6	5119.2
10		4982.9	5008.6	5023.6	5032.1	5036.8	5042.6	5047.8
16		4921.1	4944.7	4958.0	4964.6	4967.2	4970.0	4972.8
22		4859.4	4881.7	4892.3	4896.8	4898.6	4900.3	4901.8
30		4777.7	4798.0	4805.3	4808.4	4810.1	4811.8	4812.2
40		4675.9	4693.5	4698.9	4701.5	4702.9	4704.7	4704.5
45		4625.2	4641.6	4646.4	4648.8	4650.1	4651.9	4651.6
50		4572.6	4580.9	4583.0	4584.1	4594.4	4598.1	4598.6

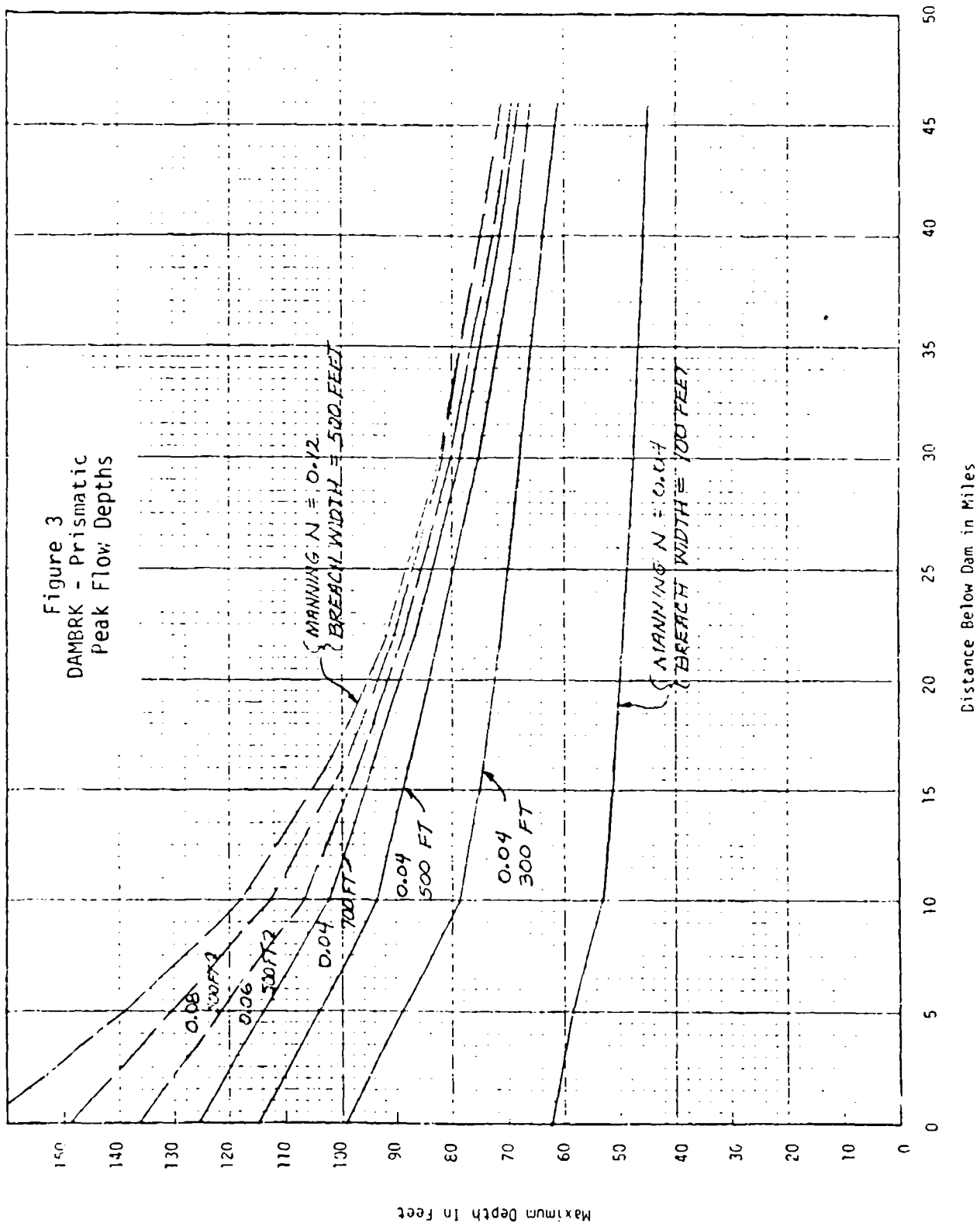
Table 3
DAMBRK - Prismatic
Maximum Flow Depths

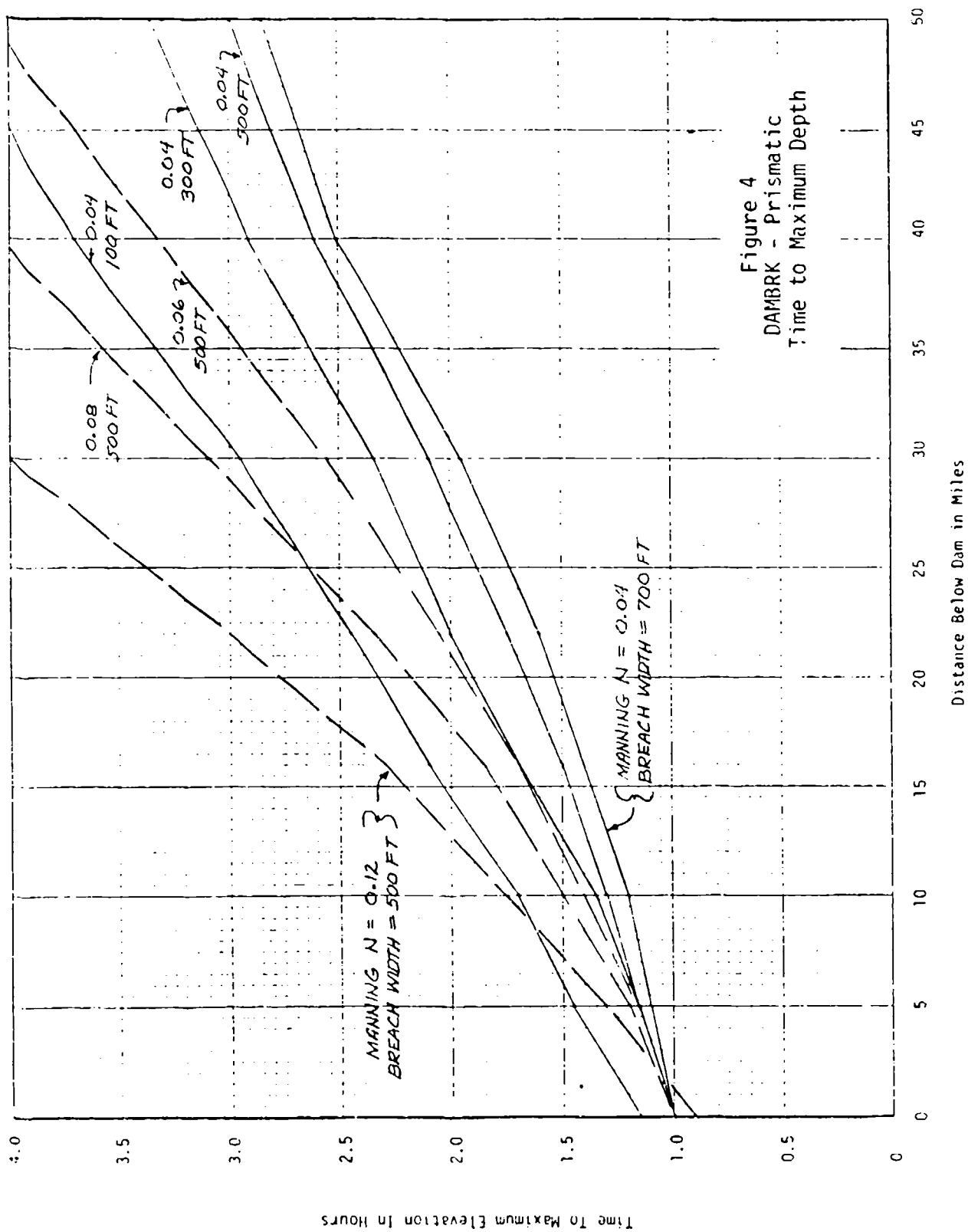
		Maximum Depth in Feet					
Distance :	Manning Roughness Coefficient (n)						
From :	0.04	0.04	0.04	0.04	0.06	0.08	0.12
Dam :	Final Breach Width in Feet						
(miles) :	100	300	500	700	500	500	500
0	62.5	99.2	114.6	125.9	136.5	148.9	163.9
5	58.6	88.8	103.9	113.7	121.6	130.6	139.2
10	52.9	78.6	93.6	102.1	106.8	112.6	117.8
16	51.0	74.7	88.0	94.6	97.2	100.0	102.8
22	49.4	71.7	82.3	86.8	88.6	90.3	91.8
30	47.7	68.0	75.3	78.4	80.1	81.8	82.2
40	45.9	63.5	68.9	71.5	72.9	74.7	74.5
45	45.2	61.6	66.4	68.8	70.1	71.9	71.6
50	42.6	50.9	53.0	54.1	64.4	68.1	68.6

Table 4
DAMBRK - Prismatic
Time to Peak Stage

		Time to Maximum Elevation in Hours												
Distance :		Manning Roughness Coefficient (n)												
From	:	0.04	:	0.04	:	0.04	:	0.04	:	0.06	:	0.08	:	0.12
Dam	:	Final Breach Width in Feet												
(miles)	:	100	:	300	:	500	:	700	:	500	:	500	:	500
0		1.15		1.00		1.00		1.00		1.00		1.00		0.90
5		1.45		1.15		1.15		1.10		1.15		1.20		1.30
10		1.70		1.35		1.30		1.20		1.40		1.50		1.75
16		2.10		1.70		1.50		1.40		1.70		1.85		2.30
22		2.45		2.00		1.75		1.60		2.05		2.35		3.00
30		2.95		2.35		2.10		1.95		2.55		3.10		4.00
40		3.71		2.91		2.61		2.51		3.32		4.03		5.37
50		4.52		3.35		2.99		2.83		4.09		5.07		6.89







FLOW SIM 1 RESULTS

Computational instability was a major problem in applying FLOW SIM 1 to the prismatic case study. A solution could not be obtained with the original set of parameter values which included a 500-foot breach width, 1.0 hour breach time, and constant 0.04 Manning n. Numerous runs were made in an effort to obtain a solution with input data as close to these parameter values as possible. Alternative runs included various combinations of values for the following input parameters: spatial step size (DELX), maximum hydraulic depth (HMAX) which is used by the program to determine the time step, Manning roughness coefficients (n), breach time, and breach width. A few runs were successful. Most runs terminated without obtaining a solution. The output from the unsuccessful runs usually included a message that the program terminated because of an instability in the calculations.

Spatial step sizes of 1.0 mile, 0.5 mile, 0.2 mile, and 0.13 mile resulted in the same difficulties with computational instability. HMAX was varied from 40 feet to 400 feet with most runs using a value of 80 or 100 feet. The effects of DELX and HMAX on stability were never clearly established. A DELX of 5,280 feet and HMAX of 80 feet seemed to perform as well as, and in some cases better than, other values of these parameters.

Table 5 illustrates how obtaining a solution depends upon breach characteristics and n values. Several runs with alternative combinations of breach width, breach time, and constant Manning n are tabulated along with an indication of whether a solution was obtained or the run terminated due to instability. Input data other than the three parameters indicated were held constant for all the runs in the table. Values for DELX and HMAX of 5,280 feet and 80 feet were used.

A run with the same breach characteristics used in the Teton case study

(one-hour breach time, bottom width of 50 feet, and 0.66 sideslopes) and Manning n values of 0.040 also terminated without reaching a solution.

The prismatic channel is representative of a steep-walled canyon. The cross-section side-slopes change abruptly from the canyon floor to the walls. An alternative run was made with the topwidths at the top of the canyon three times wider than the cross sections used in all the runs discussed above. This meant a much less drastic change in sideslope between the canyon floor and walls. With a breach width of 500 feet, breach time of 1 hour, and n -values of 0.04, DELX of 5,280 feet, and HMAX of 80 feet, the program still terminated due to an instability in the calculations. However, the stability characteristics of this widened prismatic channel were not investigated further.

Table 6 summarizes the FLOW SIM 1 results for a breach width of 100 feet, breach time of 1.0 hour, and Manning n values of 0.06. The computer printout for this run is provided in Appendix B. The results of a DAMBRK run with these same parameters are presented in Table 7 for purposes of comparison. Figures 5 through 7 also provide a comparison of the FLOW SIM 1 and DAMBRK results for a breach width of 100 feet, breach time of 1.0 hour, and n values of 0.06.

Appendix C provides a computer printout for one of the unsuccessful FLOW SIM 1 runs. This run used a DELX of 1056 feet, HMAX of 80 feet, breach width of 300 feet, breach time of 1.0 hour, and Manning n values of 0.060. The output includes a message that execution of the program was terminated because of an instability in the calculations. The output from the other unsuccessful runs is similar to the Appendix C printout.

Table 5
FLOW SIM 1 - Prismatic
Computational Stability

Breach Time (hours)	Breach Width (feet)	Manning n	Solution
1	500	0.04	no
1	500	0.08	no
1	500	0.12	no
1	300	0.04	no
1	300	0.06	no
1	300	0.08	yes
1	100	0.04	no
1	100	0.06	yes
1	100	0.08	yes
2	500	0.04	no
2	500	0.06	no
2	500	0.08	yes
2	300	0.04	no
2	300	0.06	no
2	300	0.08	yes
2	100	0.04	no
2	100	0.06	yes
2	100	0.08	yes
5	500	0.04	no
5	500	0.08	yes
5	100	0.04	yes

Table 6
FLOW SIM 1 - Prismatic Channel
Results from a Successful Run

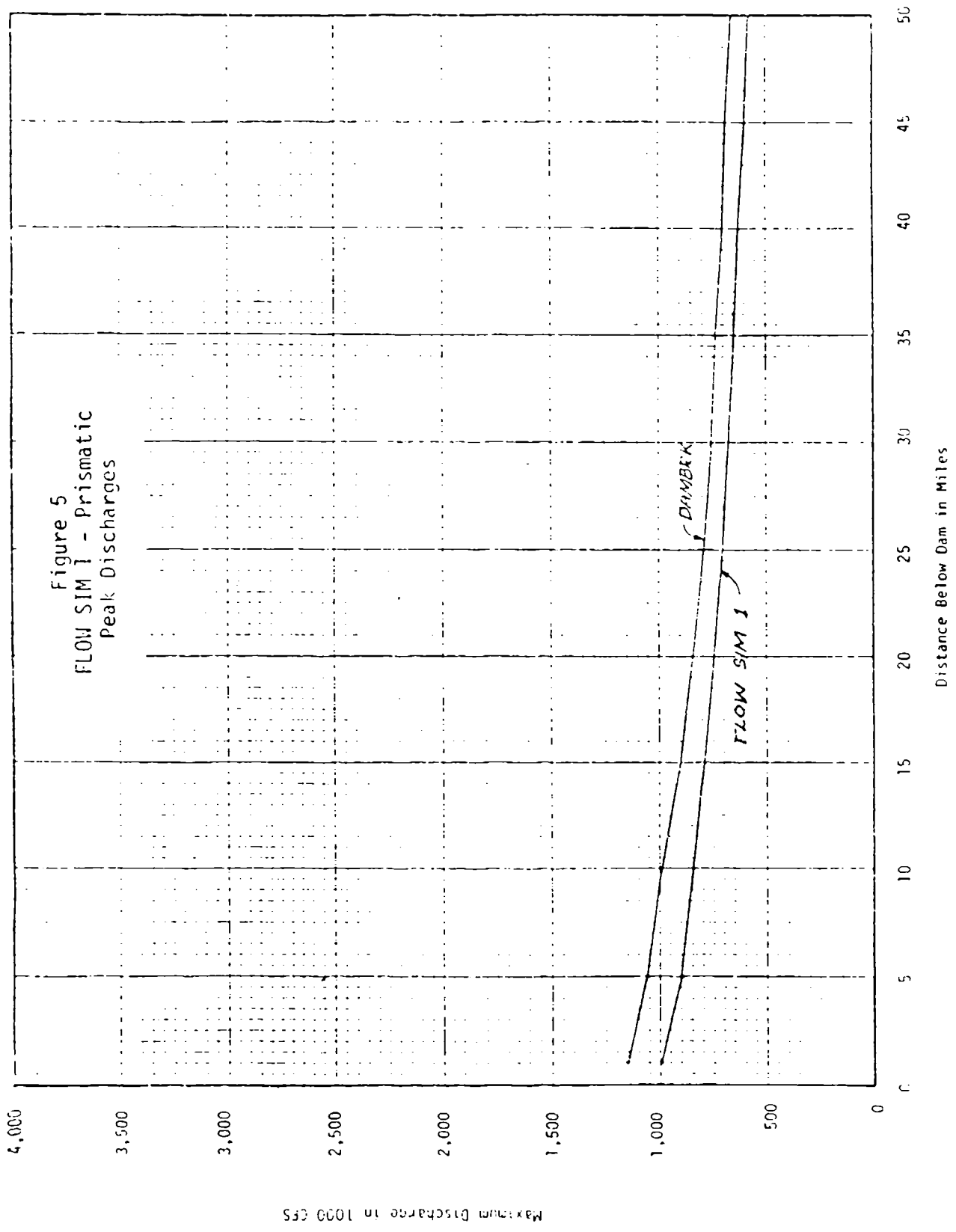
Distance Below Dam (miles)	: Peak Discharge (1000 cfs)	: Maximum W.S. Elevation (feet msl)	: Maximum Flow Depth (feet)	: Time to Maximum Stage (hours)
1	995	5091.8	71.8	1.22
5	898	5047.2	67.2	1.53
10	846	4989.9	59.9	2.06
15	792	4938.0	58.0	2.53
20	748	4886.4	56.4	3.00
25	711	4834.9	54.9	3.53
30	677	4783.6	53.6	4.06
35	648	4732.3	52.3	4.56
40	621	4681.2	51.2	5.08
45	595	4630.1	50.1	5.61
50	575	4579.7	49.7	5.94

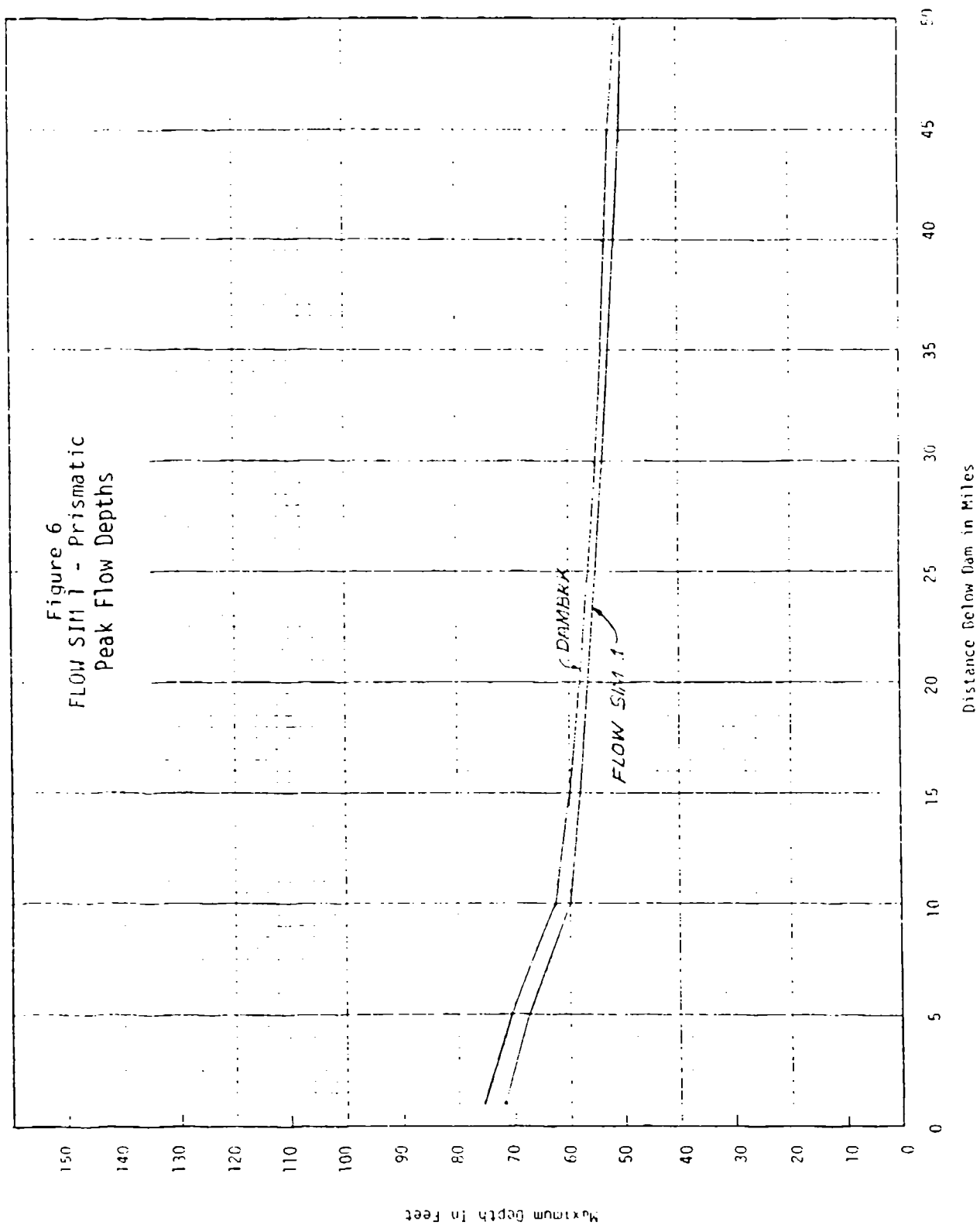
Note: Breach width of 100 feet, breach time of 1.0 hour,
Manning n values of 0.06, DELX of 5,280 feet, and HMAX
of 80 feet.

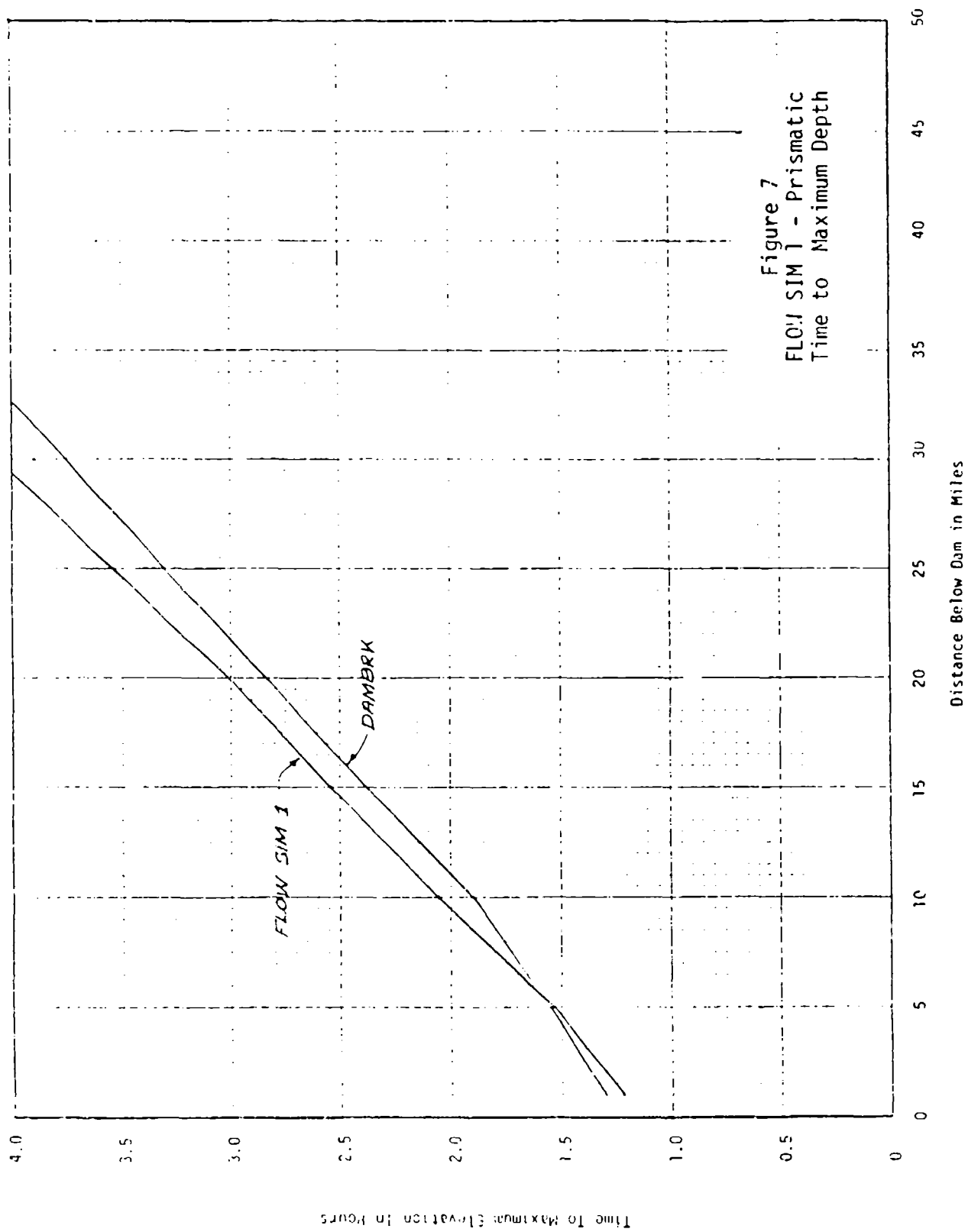
Table 7
DAMBRK - Prismatic Channel
For Comparison with FLOW SIM 1

Distance Below Dam (miles)	: Peak Discharge (cfs)	: Maximum W.S. Elevation (feet msl)	: Maximum Flow Depth (feet)	: Time to Maximum Stage (hours)
1	1,166	5095.5	75.5	1.30
5	1,066	5050.5	70.5	1.55
10	989	4992.6	62.6	1.90
15	906	4940.0	60.0	2.38
20	844	4888.0	58.0	2.83
25	797	4836.4	56.4	3.30
30	760	4785.1	55.1	3.75
35	730	4734.0	54.0	4.20
40	705	4683.1	53.1	4.67
45	682	4632.2	52.2	5.13
50	661	4580.7	50.7	5.69

Note: Breach width of 100 feet, breach time of 1.0 hour, and
Manning n values of 0.06.







FLOW SIM 2 RESULTS

FLOW SIM 2 was also run with numerous combinations of values for the input parameters. Almost all runs terminated without obtaining a solution. The output from the unsuccessful runs usually included a message that the program terminated because of an instability in the calculations. Essentially the same ranges of values for DELX, HMAX, breach time, breach width, and Manning roughness coefficient investigated with FLOW SIM 1 were repeated with FLOW SIM 2. However, most of the combinations of input parameter values which ran successfully in FLOW SIM 1 terminated without solutions in FLOW SIM 2. The only successful runs of FLOW SIM 2 had a breach time of 5 hours.

The printout for an unsuccessful FLOW SIM 2 run is provided in Appendix D. The input data for this run includes a DELX of 1056 feet, HMAX of 80 feet, breach width of 100 feet, breach time of two hours, and Manning n values of 0.06. The output from the other unsuccessful runs is similar to the Appendix D printout.

HEC-1 RESULTS

Tables 8 and 9 and Figures 8 through 10 summarize the results of several HEC-1 runs with alternative sets of values for the parameters NSTPS and NMIN. The computational interval (NMIN) is not a critical parameter as long as it is small enough. Selection of a NMIN value is essentially a tradeoff between accuracy and computation costs. Since HEC-1 computer costs are modest, setting NMIN is not a problem. The number of steps (NSTPS) to be used in the storage routing is a somewhat arbitrarily determined parameter which can significantly affect the computed hydrograph. The HEC-1 users manual states that NSTPS is usually approximated by the following relationship.

$$\text{NSTPS} = (\text{reach length}/\text{average velocity})/\text{time interval}$$

Computer runs are labeled by number in the following tables and figures. A value for NMIN of 4 minutes was used in runs 1 through 4 and 10 minutes in runs 5 through 7. NSTPS values used for each of 5 reaches were alternatively assumed to be a constant 1, 5, and 10 for each reach. Runs were also made in which the NSTPS values were estimated from the above relationship. For NMIN of 4 minutes, this resulted in NSTPS values of 4, 5, 7, 8, and 13 for the five reaches (run 4). For NMIN of 10 minutes, NSTPS values were estimated to be 2, 2, 3, 3, and 5 (run 7). The five reaches are: miles 0 to 7.5, miles 7.5 to 15, miles 15 to 25, miles 25 to 35, and miles 35 to 50.

The results for NMIN values of 4 minutes and 10 minutes are very close. However, changing the NSTPS parameters significantly changes the resulting discharges and stages. Run 4 (NMIN = 4 minute and NSTPS values of 4, 5, 7, 8, 13 for the five reaches) is probably the most realistic run. The computer printout for run 4 is provided in Appendix E.

Table 8
HEC-1 - Prismatic
Peak Discharges and Water Surface Elevations

Run	:	1	:	2	:	3	:	4	:	5	:	6	:	7
NMIN	:	4	:	4	:	4	:	4	:	10	:	10	:	10
NSTPS	:	1	:	5	:	10	:	varies	:	1	:	5	:	varies

Distance :	Maximum Discharges in 1000 cfs						
(mile)							

0	3,911	3,911	3,911	3,911	3,911	3,911	3,911
7.5	2,803	3,447	3,584	3,382	2,850	3,366	3,091
15	2,159	3,162	3,428	3,110	2,182	3,338	2,641
25	1,542	2,596	3,107	2,704	1,553	2,798	2,180
35	1,183	2,140	2,617	2,344	1,193	2,317	1,811
50	799	1,507	1,823	1,856	803	1,576	1,428

Miles :	Maximum Water Surface Elevations						
---------	----------------------------------	--	--	--	--	--	--

0	5301.7	5301.7	5301.7	5301.7	5301.7	5301.7	5301.7
7.5	5094.7	5107.0	5109.5	5105.8	5095.6	5105.5	5100.4
15	4996.3	5014.7	5019.2	5013.8	4996.7	5017.7	5005.5
25	4895.5	4917.2	4926.3	4919.2	4895.8	4920.9	4909.2
35	4786.7	4808.4	4817.6	4812.4	4787.0	4811.9	4801.5
50	4650.8	4669.7	4677.1	4677.5	4651.0	4671.2	4667.9

Table 9
HEC-1 Prismatic
Maximum Depth and Time to Maximum Depth

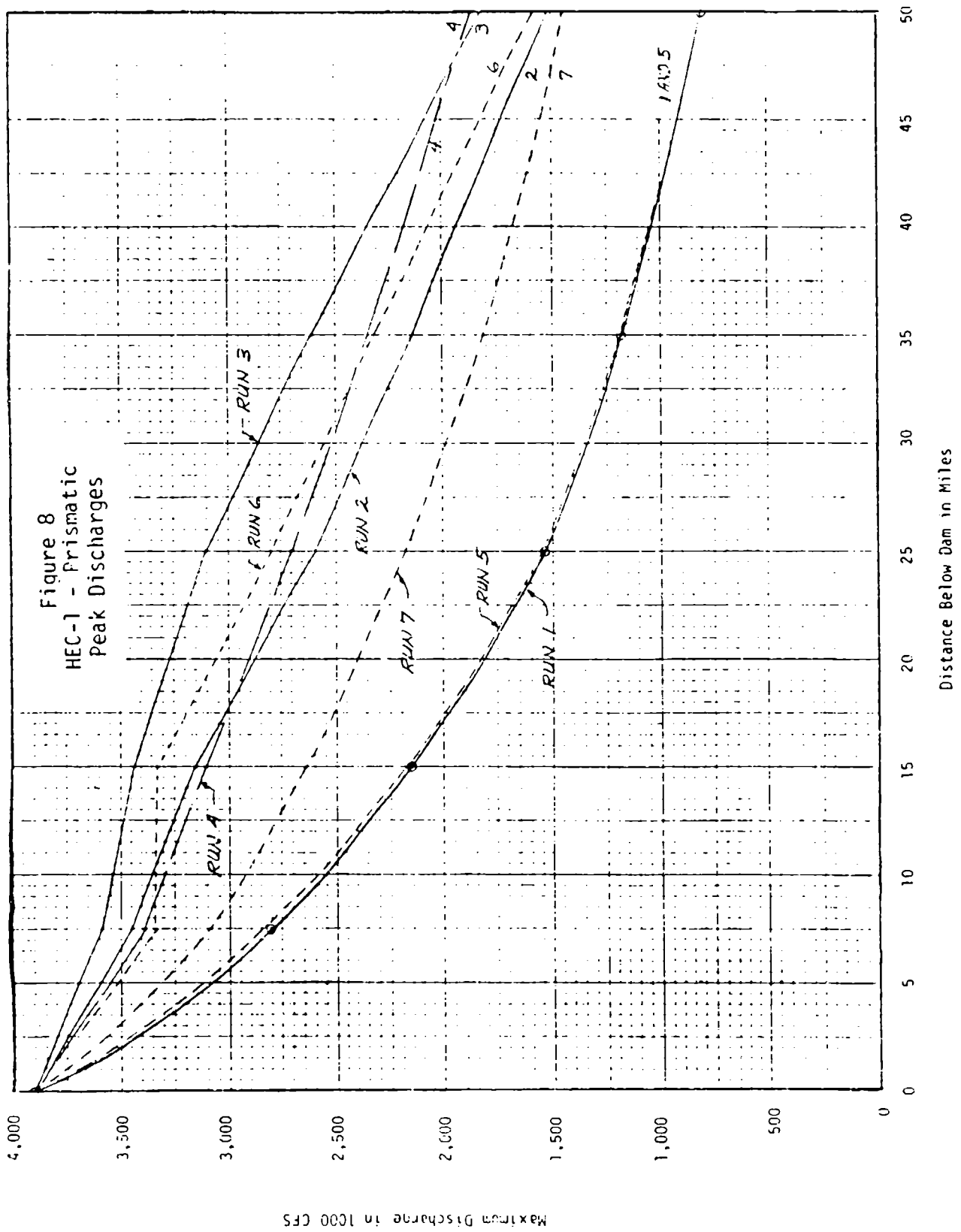
Run	:	1	:	2	:	3	:	4	:	5	:	6	:	7
NMIN	:	4	:	4	:	4	:	4	:	10	:	10	:	10
NSTPS	:	1	:	5	:	10	:	varies	:	1	:	5	:	varies

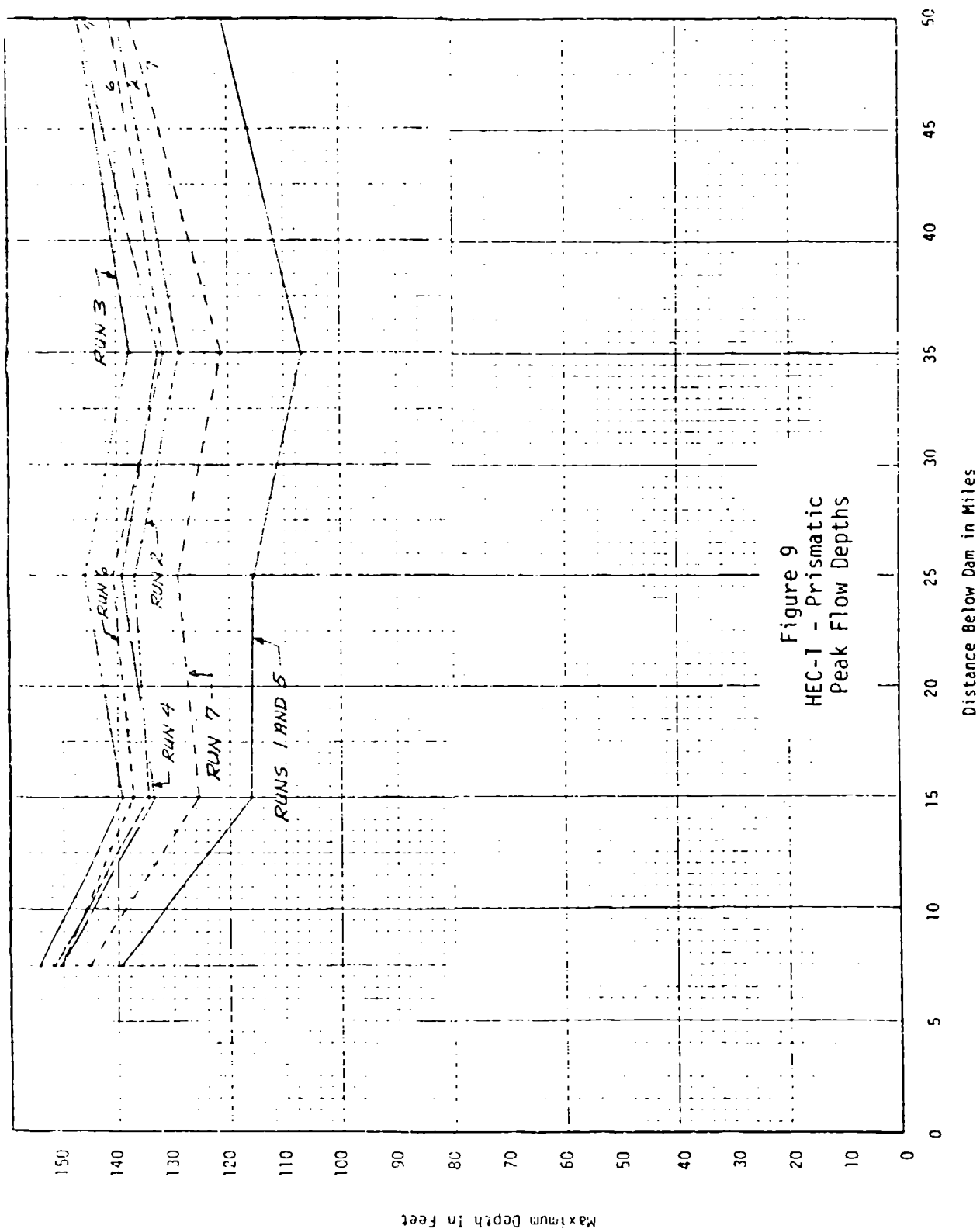
Distance :	Maximum Depth in Feet						
(miles)							

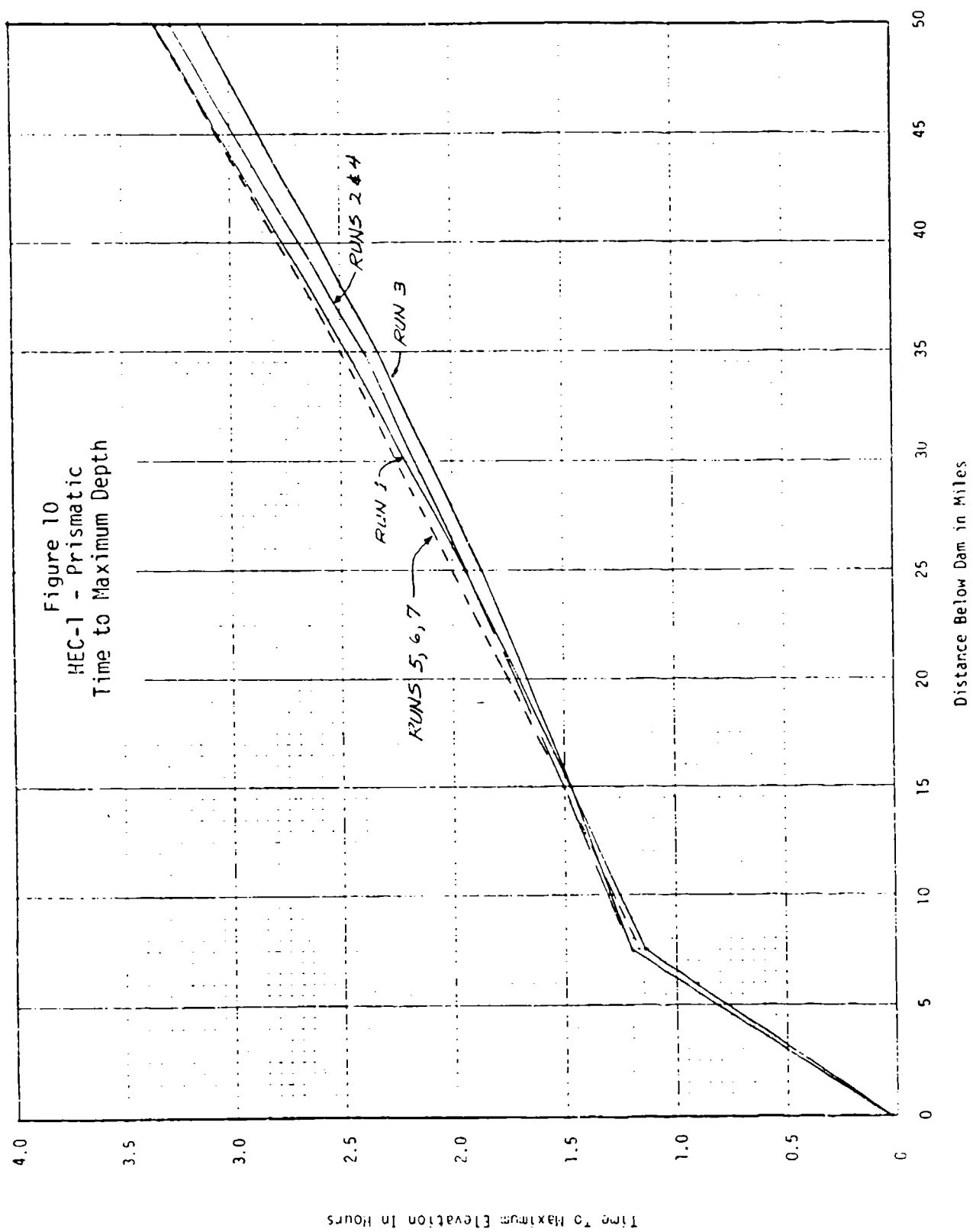
0	-	-	-	-	-	-	-
7.5	139.7	152.0	154.5	150.8	139.6	150.5	145.4
15	116.3	134.7	139.2	133.8	116.7	137.7	125.4
25	115.5	137.2	146.3	139.2	115.8	140.9	129.2
35	106.7	128.4	137.6	132.4	107.0	131.9	121.5
50	120.8	139.7	147.1	147.5	121.0	141.2	137.9

Miles :	Time to Maximum Depth in Hours						
---------	--------------------------------	--	--	--	--	--	--

0	0.02	0.02	0.02	0.02	0.02	0.02	0.02
7.5	1.13	1.20	1.20	1.20	1.17	1.17	1.17
15	1.47	1.47	1.47	1.50	1.50	1.50	1.50
25	1.93	1.93	1.87	1.93	2.00	2.00	2.00
35	2.47	2.40	2.33	2.40	2.50	2.50	2.50
50	3.33	3.27	3.13	3.13	3.33	3.33	3.33







SMPDBK RESULTS

The printout from the SMPDBK microcomputer program is presented as Table 10. The results are plotted in Figures 11 through 13. Appendix F presents the results obtained from the manual computational procedure.

TABLE 10

PROFILE OF CRESTS AND TIMES FOR
SIMPLIFIED TETON DAM
ON ALMOST PRISMATIC RIVER

LONG OPTION

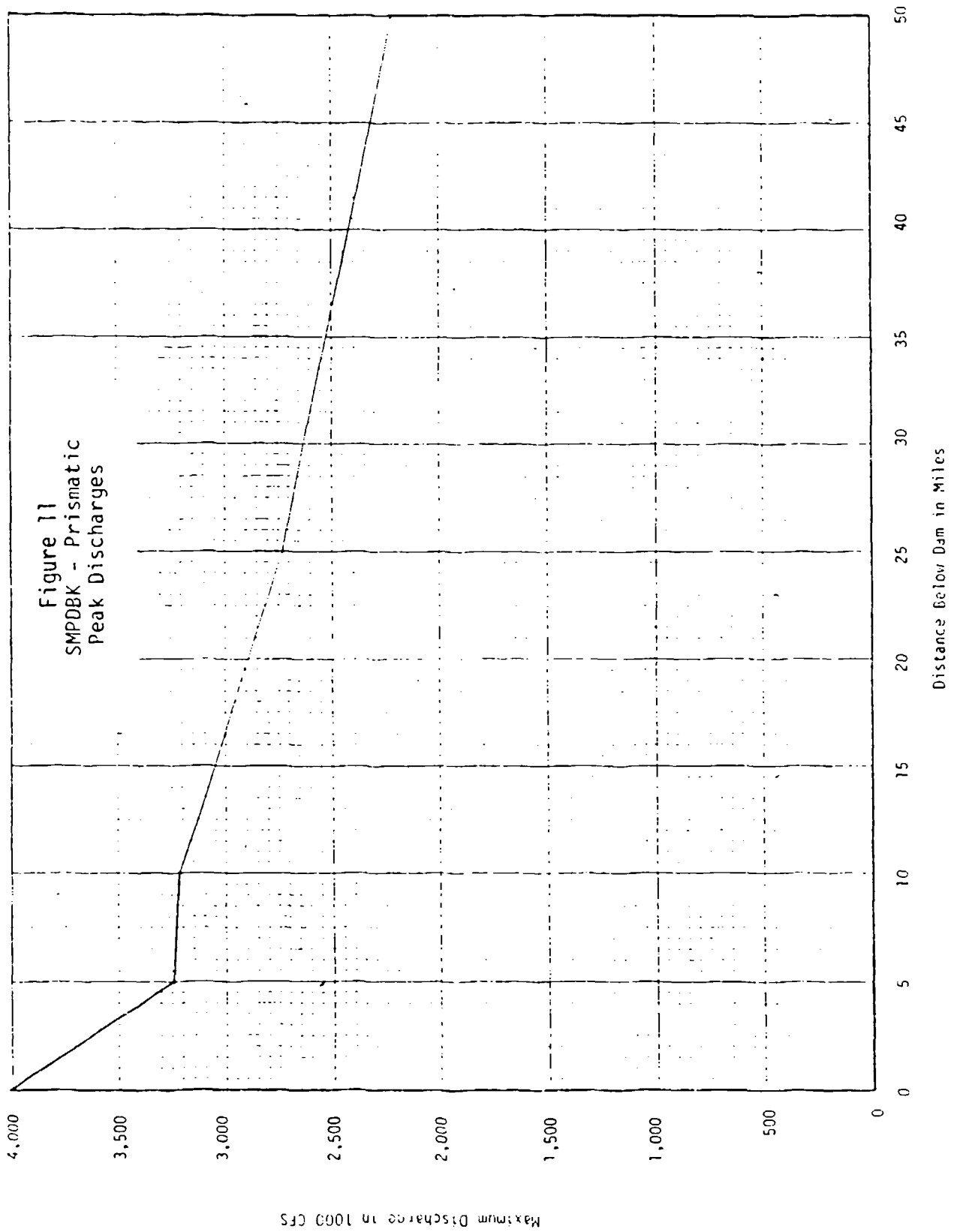
DISTANCE (MILES)	PEAK FLOW (CFS)	PEAK DEPTH (FT)	TIME PEAK (HRS)	FLOOD STAGE (FT)	TIME FLOOD (HRS)	TIME FALL BELOW FS (HRS)
0	4015982	112.58	1	30	.1	1.5
5	3234869	100.16	1.2	30	.3	2
10	3211780	89.53	1.5	30	.6	2.3
25	2723214	81.77	2.2	30	1.3	3.2
50	2216183	73.03	3.5	30	2.7	5

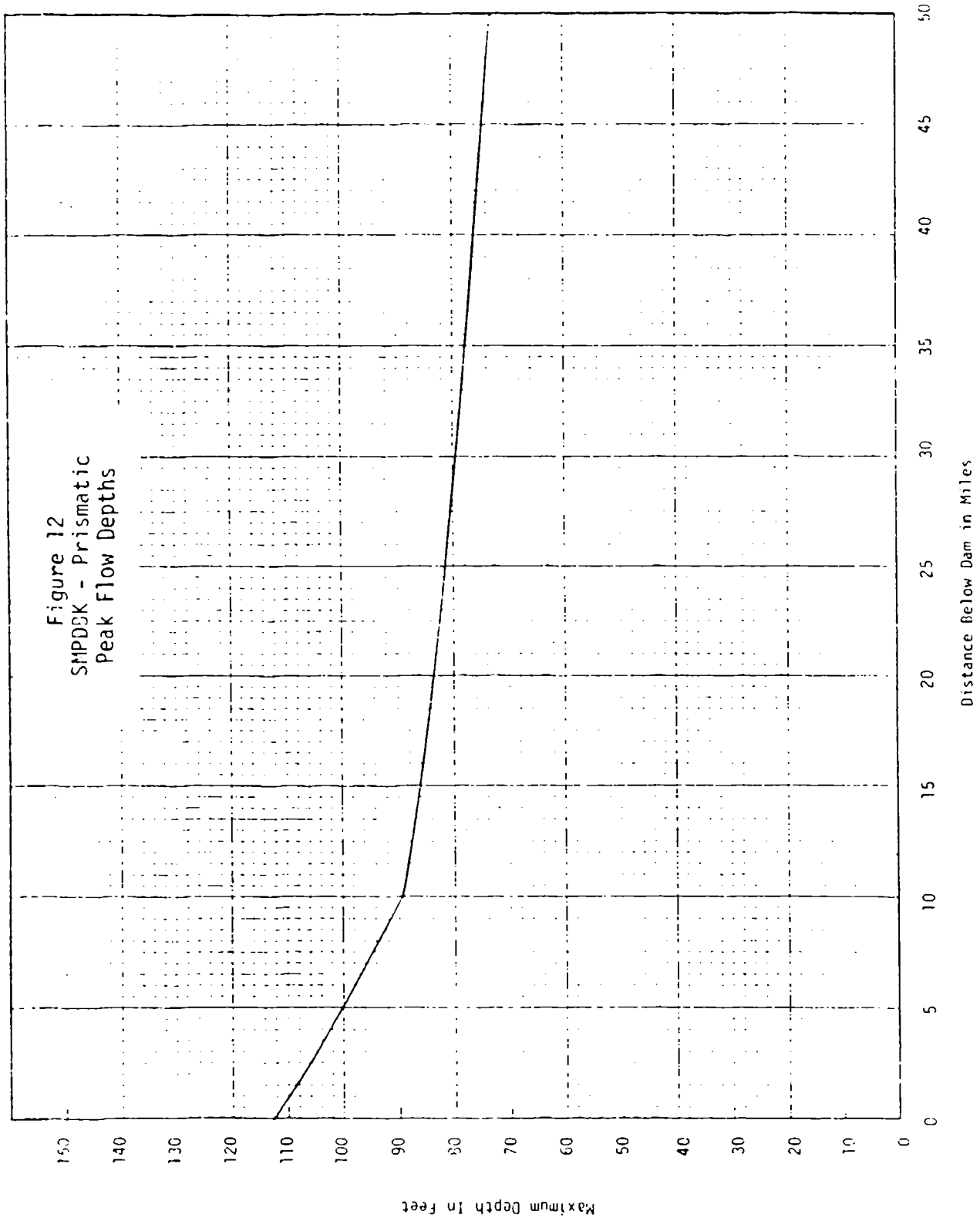
** SUMMARY OF INPUT DATA **

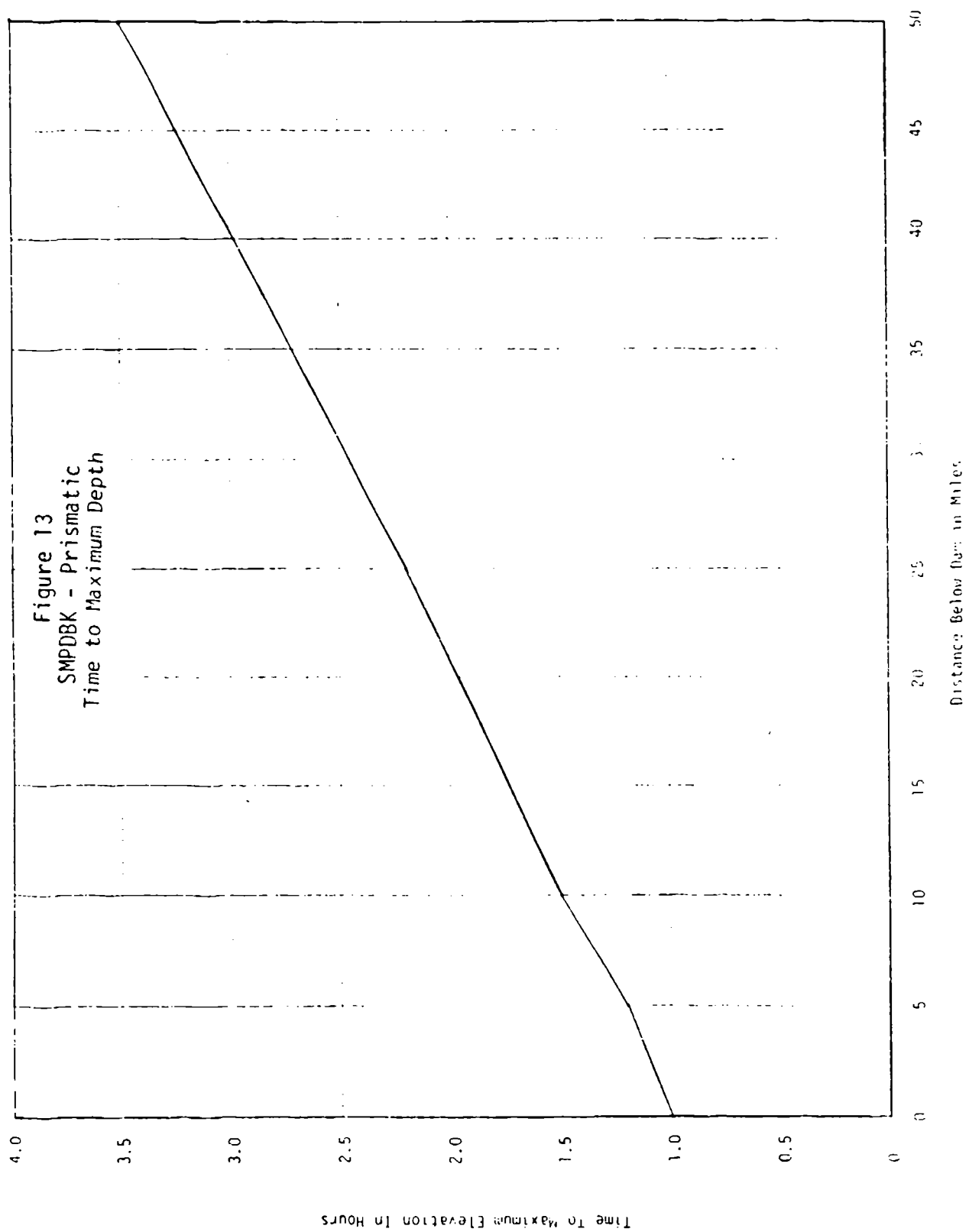
NAME OF DAM = SIMPLIFIED TETON
 NAME OF RIVER = ALMOST PRISMATIC
 DAM CREST ELEVATION (FT. MSL) = 5301.7
 BREACH BOTTOM ELEV (FT. MSL) = 5040
 FINAL BREACH WIDTH (FT) = 500
 VOLUME OF RESERVOIR (AC-FT) = 254192.872
 SURFACE AREA (ACRES) = 1940
 TIME OF FAILURE (MIN) = 60
 SPILLWAY/TURBINE FLOW (CFS) = 3580

** CROSS SECTION DATA **

X-SEC NO.	MILE NO.	ELEV	TOPWIDTH	MANNING N	VALLEY HT	FS
1	0	5030 5040 5240	0 800 1400	.04	210	30
2	5	4980 4990 5190	0 800 1400	.04	210	30
3	10	4930 4940 5140	0 1000 1600	.04	210	30
4	25	4780 4790 4990	0 1000 1600	.04	210	30
5	50	4530 4540 4740	0 1000 1600	.04	210	30







HEC DIMENSIONLESS GRAPHS PROCEDURE RESULTS

The HEC dimensionless graph procedure is based on the assumption of an instantaneous complete removal of the dam. Thus, the breach characteristics (500 feet width and 1.0 hour breach time) used in the other models could not be incorporated in the dimensionless graph procedure. The prismatic channel characteristics are the same as used in the other models. The required computations for the procedure are presented in Table 12 and the results are summarized in Table 11.

Table 11
HEC Dimensionless Graphs - Prismatic
Summary of Results

Distance	:	Maximum	:	Time to
From	:	Flow	:	Maximum
Dam	:	Depth	:	Depth
(miles)	:	(feet)	:	(hours)
0		119.5		0.00
5		101.6		0.43
10		95.8		0.68
15		91.3		0.79
20		87.4		1.07
25		84.5		1.18
30		81.5		1.36
40		75.3		1.75
50		72.8		2.22

Table 12
Computations for HEC Dimensions Graphs Procedure

$$S_o = 10\text{ft/mile} = 0.001894$$

$$\bar{Y}_o = 5310.7 - 5030 = 271.7 \text{ feet}$$

$$\bar{L}_o = \bar{Y}_o / S_o = 271.7 \text{ ft} / 0.001894 = 143,458 \text{ ft} = 27.17 \text{ mile}$$

	: Head	: Channel	: Pool	:	<u>Reservoir Volume</u>
Point	: (feet)	: Elevation	: Elevation	:	(acre-feet) : (ft ³)
1	271.7	5030	5301.7		251,300 1.095 X 10 ¹⁰
2	120.8	5030	5150.8		50,000 2.178 X 10 ⁹

$$M = (\log (\text{Vol}_2 / \text{Vol}_1) / \log (\bar{Y}_2 / \bar{Y}_1)) - 2$$

$$M = (\log (50,000 / 251,300) / \log (120.8 / 271.7)) - 2$$

$$M = -0.008 \approx 0$$

$$\bar{C} = (\text{Vol}_1)(3)(M+1) \left[\frac{S_o}{\bar{Y}_1^{M+2}} \right]$$

$$\bar{C} = (1.095 \times 10^{10})(3)(1) \left[\frac{0.001894}{271.7^2} \right] = 842.6$$

$$\bar{C} = (2.178 \times 10^9)(3)(1) \left[\frac{0.001894}{120.8^2} \right] = 848.1$$

$$\text{use } \bar{C} = 845.4$$

$$C = \bar{C}(\bar{Y}_o^{M-1}) = 845.4 (271.7^{-1}) = 3.11$$

Table 12 Continued
Computations for HEC Dimensionless Graphs Procedure

$$\bar{B}_0 = 1,585 \text{ ft}$$

$$\bar{Y}_0 = 271.7 \text{ ft}$$

$$\bar{A}_0 = \bar{B}_0 \cdot \bar{Y}_0 = (1,585)(271.7) = 430,645 \text{ ft}^2$$

$$\bar{P}_0 = \bar{B}_0 + 2\bar{Y}_0 = 1,585 + 2(271.7) = 2128 \text{ ft}$$

$$\bar{R}_0 = \bar{A}_0/\bar{P}_0 = 430645/2128 = 202.3 \text{ ft}$$

$$V_0 = \frac{1.486}{n} \bar{R}_0^{2/3} S_0^{1/2} = \frac{1.486}{n} (202.3)^{2/3} (.001894)^{1/2}$$

$$V_0 = 55.7 \text{ fps}$$

$$F = \frac{\bar{V}}{\sqrt{g_0 Y_0}} = \frac{55.7}{\sqrt{32.2(271.7)}} = .596 = .60$$

$$L_0 = \bar{Y}_0/S_0 = 271.7/.001894 = 143,453 \text{ ft} = 27.2 \text{ mile}$$

$$\begin{aligned} \bar{T}_0 &= \bar{L}_0/\bar{V}_0 = 143,453/55.7 = 2575 \text{ seconds} \\ &= 0.7153 \text{ hours} \end{aligned}$$

Summary

$$C = 3.11$$

$$M = 0$$

$$F_0 = .60$$

$$\bar{L}_0 = 27.17 \text{ mile}$$

$$\bar{Y}_0 = 271.7 \text{ ft}$$

$$\bar{T}_0 = 42.9 \text{ hours}$$

Table 12 Continued
Computations for HEC Dimensionless Graphs Procedure

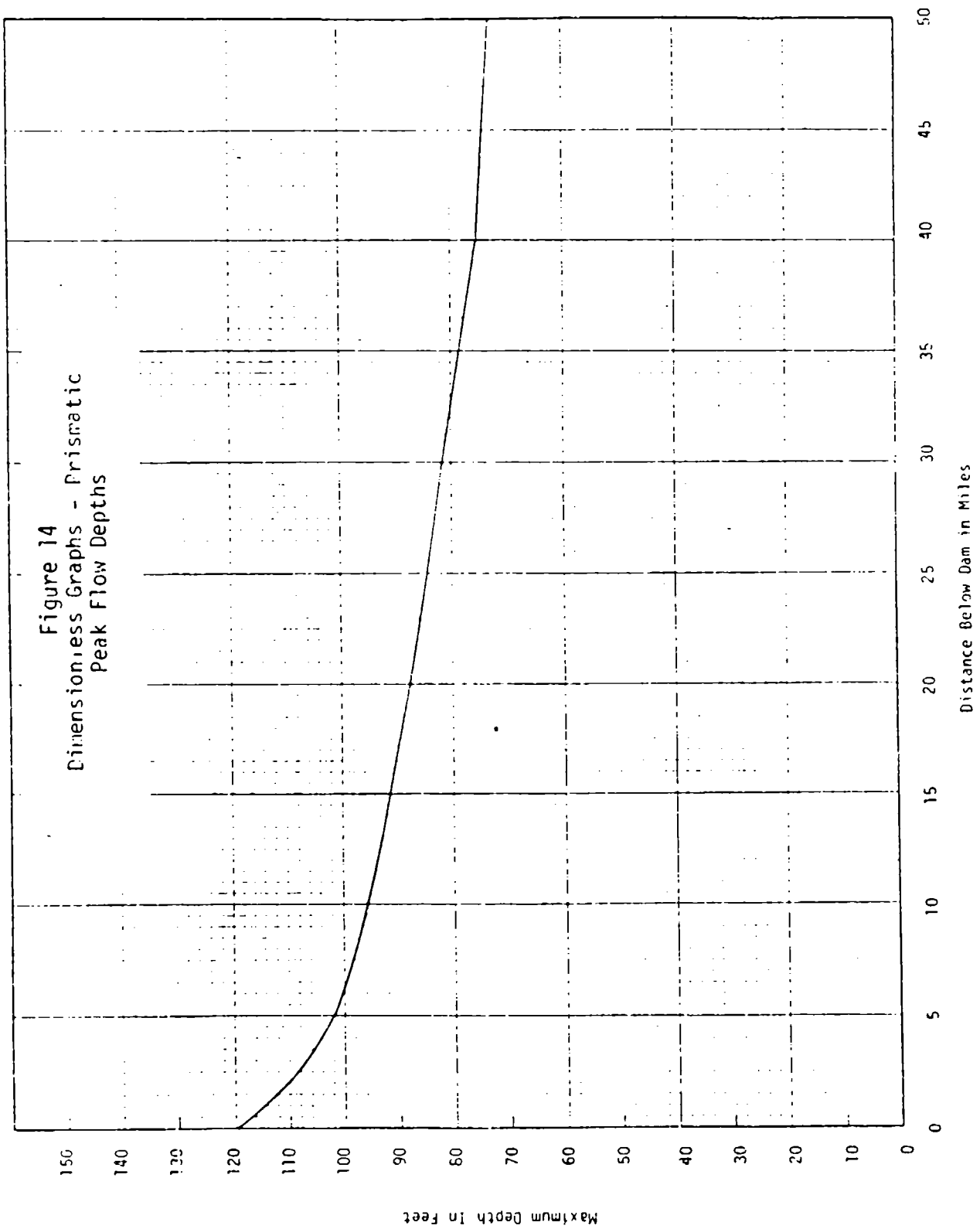
Maximum Flood Depth

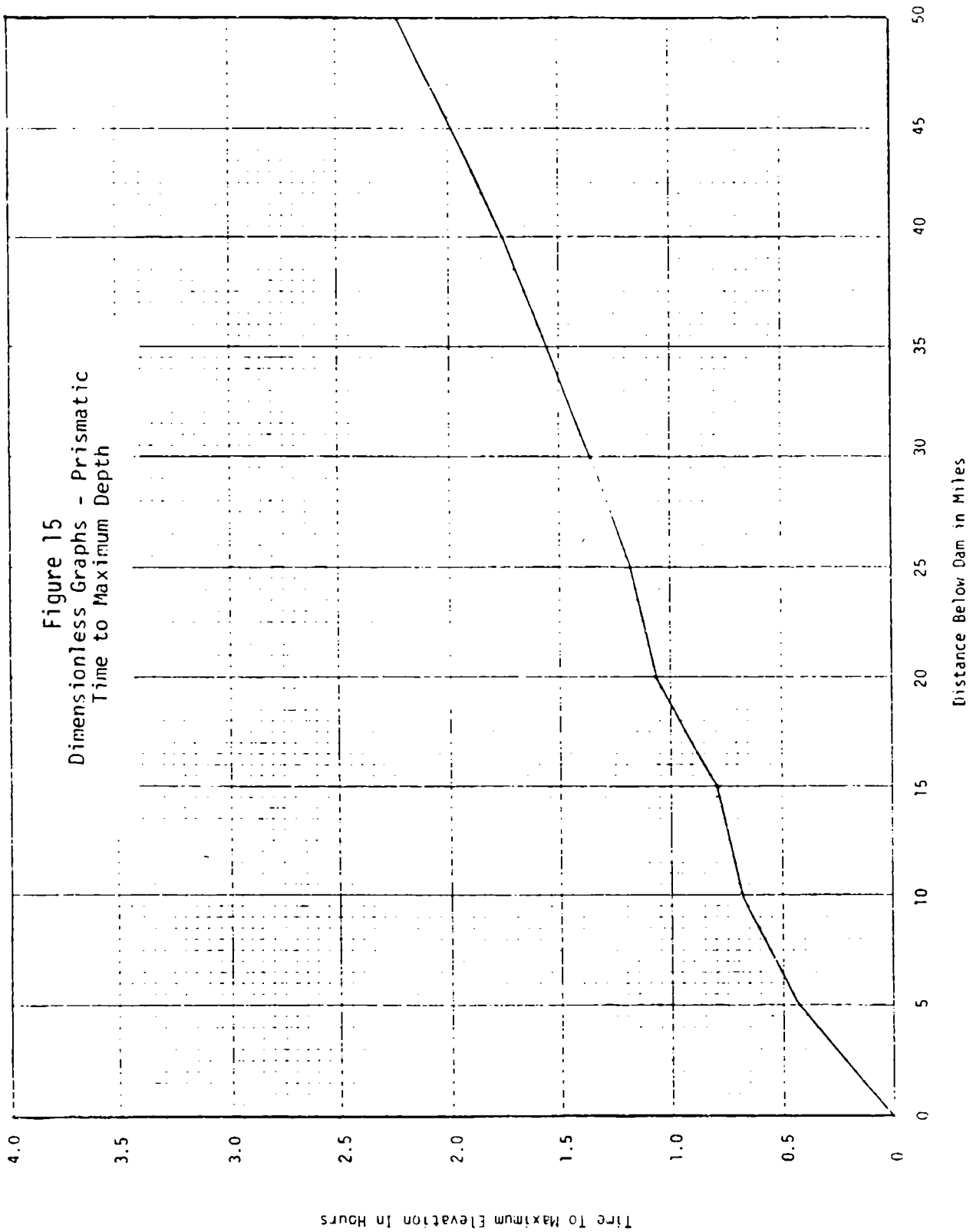
$\bar{X}$	X	Fo = 0.5	Fo = 1.0	Fo = 0.6	$\bar{Y}_o$ (feet)
0	0	.460	.420	.440	119.5
5	0.134	.410	.338	.374	101.6
10	0.368	.380	.325	.353	95.8
15	0.552	.360	.312	.336	91.3
20	0.736	.340	.303	.322	87.4
25	0.920	.325	.297	.311	84.5
30	1.104	.311	.289	.300	81.5
40	1.472	.292	.262	.277	75.3
50	1.840	.278	.258	.268	72.8

Time of Occurrence of Maximum Flood Level

$\bar{X}$	X	Fo = 0.5	Fo = 1.0	Fo = 0.6	$\bar{t}_w$ (hours)
0	0	0	0	0	0
5	0.184	0.5	0.7	0.6	0.43
10	0.368	0.8	1.1	0.95	0.68
15	0.552	1.0	1.2	1.1	0.79
20	0.736	1.3	1.7	1.5	1.07
25	0.920	1.5	1.8	1.65	1.18
30	1.104	1.8	2.0	1.9	1.36
40	1.472	2.3	2.6	2.45	1.75
50	1.840	3.0	3.2	3.1	2.22

Figure 14
Dimensionless Graphs - Prismatic
Peak Flow Depths





TR66 RESULTS

The SCS Technical Release No. 66 simplified dam breach routing procedure results are presented in Table 13 and Figures 16 and 17. The calculations are summarized in Table 14. This manual computation procedure provides peak discharges and depths at selected locations. The peak discharge at the dam is determined from a relationship between peak discharge and reservoir water depth which was developed based on data from actual past dam failures. The peak discharge of 1,931,000 cfs computed with the TR66 procedure is about half the magnitude of the peak outflow from the 500-foot wide breach computed by the other models. Consequently, an additional simulation was made in which the 3,841,000 cfs peak discharge at the dam computed with the DAMBRK model was routed downstream with the TR66 valley routing procedure. The results using TR66 for both breach outflow and valley routing are labeled TR66 in the tables and figures. The label TR66 (DAMBRK) is used to signify that the DAMBRK peak breach outflow is combined with TR66 valley routing.

Table 13
TR66 - Prismatic
Peak Discharges and Flow Depths

Distance	:	TR66	:	TR66 (DAMBRK)
From Dam	:	Discharge	:	Discharge
(miles)	:	(cfs)	:	(cfs)
	:	Depth	:	Depth
	:	(feet)	:	(feet)
0		1,931		3,841
5		1,506		2,996
10		1,313		2,612
15		1,130		2,247
25		834		1,659
35		715		1,421
50		525		1,045

Table 14a
TR66 Calculation Summary
Depth Versus Area and Volume Relationships

Depth :		Miles Downstream From Dam							
(feet) :	0	:	5	:	10	:	25	:	50
Cross-Sectional Area (ft ²)									
0	0		0		0		0		0
10	4,000		4,000		5,000		5,000		5,000
60	47,750		47,750		58,750		58,750		58,750
110	99,000		99,000		120,000		120,000		120,000
160	157,750		157,750		188,750		188,750		188,750
Incremental Volume (million ft ³)									
0			0		0		0		0
10			105.6		118.8		396.0		660
60			1,261		1,406		4,653		7,755
110			2,614		2,891		9,504		15,840
160			4,165		4,574		14,949		24,915
Total Volume (million ft ³)									
0	0		0		0		0		0
10	0		105.6		224.4		620.4		1,280.4
60	0		1,261		2,667		7,320		15,075
110	0		2,614		5,505		15,009		30,849
160	0		4,165		8,739		23,688		48,603

Table 14b
TR66 Calculation Summary
Depth Versus Discharge Relationships

$$Q = \frac{1.49}{n} AR^{2/3} S^{1/2} = \frac{1.49}{.04} AR^{2/3} (.0018939)^{1/2} = 1.6211 AR^{2/3}$$

mile 0.0 to 5.0

Depth (ft)	Topwidth (ft)	Area (A) (ft ²)	: Wetted Perimeter (P) (ft)	: Hydraulic Radius (R) (ft)	: Discharge (Q) (cfs)
0	0	0	0	0	0
10	800	4000	800.25	4.998	18,955
60	950	47,750	980.53	48.698	1,032,268
110	1100	99,000	1160.58	85.302	3,109,943
160	1250	157,750	1340.85	117.65	6,140,045

mile 10.0 to 50.0

Depth (ft)	Topwidth (ft)	Area (A) (ft ²)	: Wetted Perimeter (P) (ft)	: Hydraulic Radius (R) (ft)	: Discharge (Q) (cfs)
0	0	0	0	0	0
10	1000	5000	1000.2	4.999	23,697
60	1150	58,750	1180.5	49.767	1,288,584
110	1300	120,000	1360.8	88.183	3,854,036
160	1450	188,750	1541.0	122.485	7,546,630

Table 14c
TR66 Calculation Summary
Outflow Hydrograph

$$Q_{\max} = 65 H^{1.85} = 65 (261.7)^{1.85} = 1,931,300 \text{ cfs}$$

$$Q_c^2 = \frac{gA^3}{T} = \frac{(32.2)(74,000)}{1,023.5}$$

$$Q_c = 3,570,520$$

Since flow is subcritical, the curvilinear hydrograph is used.

Table 14d
TR66 Calculation Summary
Maximum Discharge and Depth

$$m = \frac{(N-n) \sum_{i=1}^n \log Q_i - n \sum_{i=n+1}^N \log Q_i}{(N-n) \sum_{i=1}^n \log S_{j,i} - n \sum_{i=n+1}^N \log S_{j,i}}$$

$$K = \log^{-1} \left[\frac{\sum_{i=1}^n \log Q_i - m \sum_{i=1}^n \log S_{j,i}}{n} \right]$$

$$K_o^* = \frac{Q_{\max}^*}{K V^m} = \frac{1,931,300 \text{ cfs}}{K (10,947 \text{ million ft}^3)^m}$$

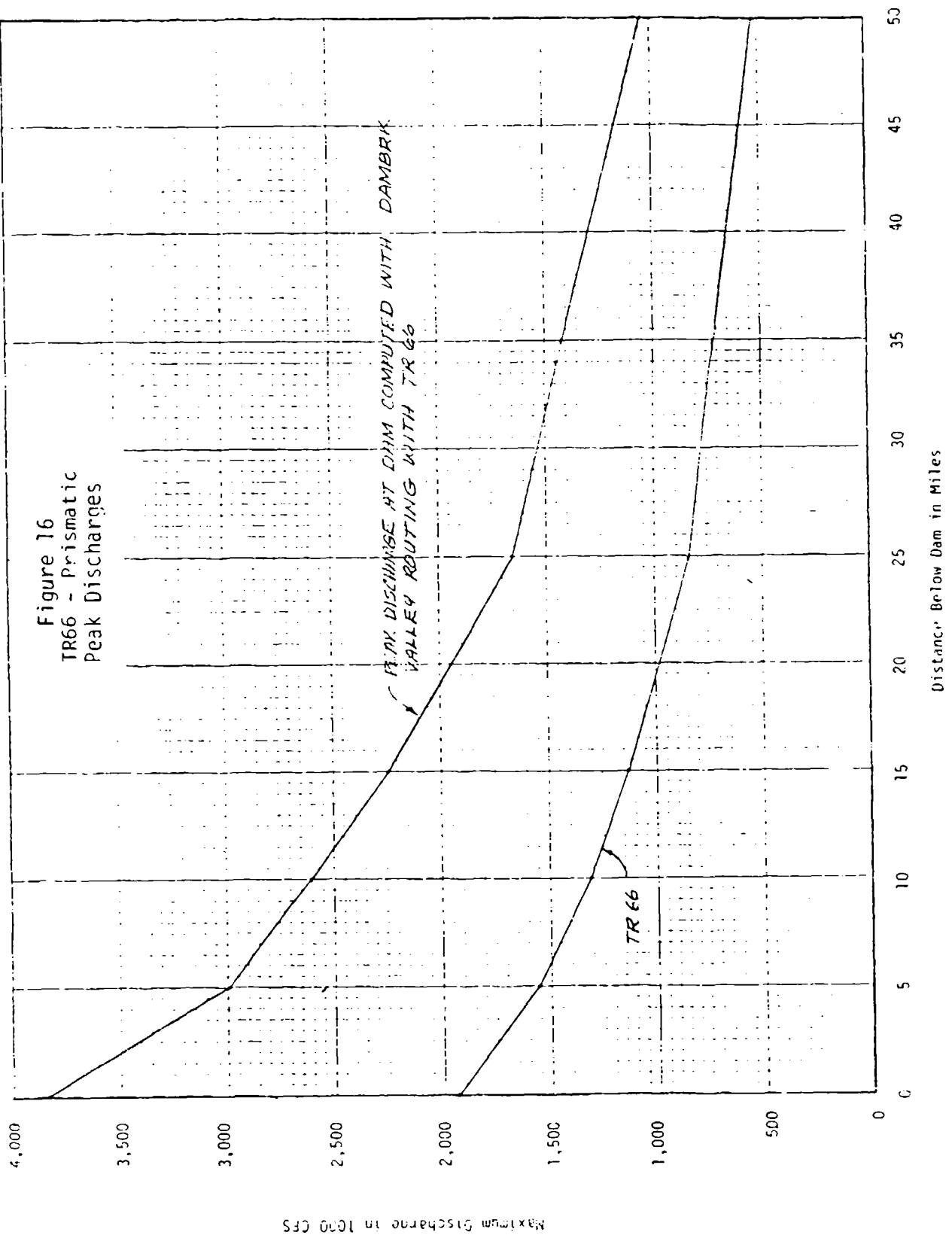
$$K = K_o^* (1 - Q_o^*)^{(5/3 - m)} \text{ from figure 2 of TR66}$$

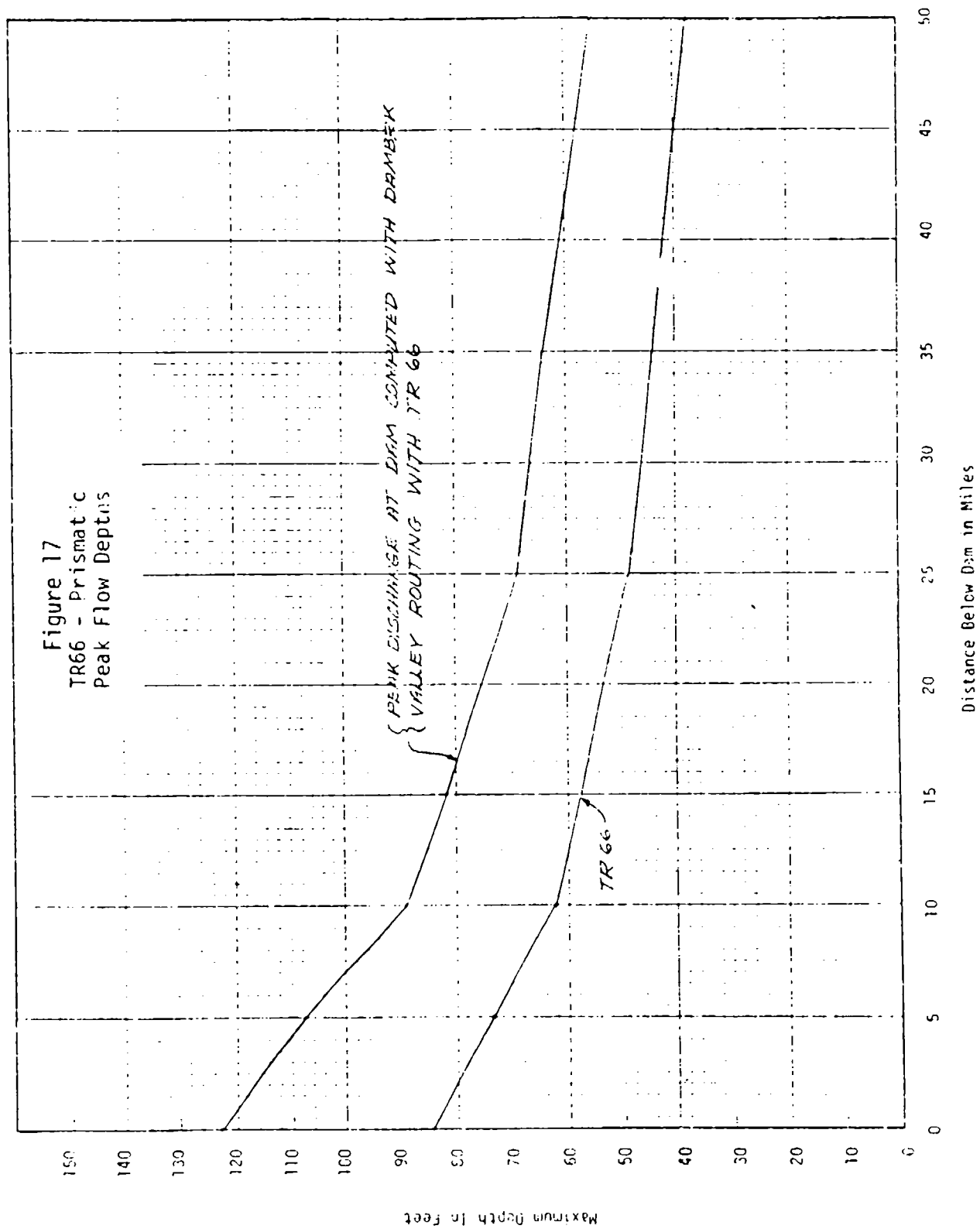
Q_o^* and Q^* from ES-212 of TR66

d from curve of Q versus d

Table 14e
TR66 Calculation Summary
Maximum Discharge and Depth

Location : (miles)	m	K	K_O^*	Q_O^*	K^*	Q^*	Q (cfs)	d (feet)
0	-	-	-	-	-	-	1,931,300	84.5
5	1.563	13.84	0.06783	0.770	0.0582	0.780	1,506,000	73.5
10	1.564	5.306	0.1752	0.665	0.157	0.680	1,313,000	62.3
15	1.569	2.492	0.3562	0.540	0.330	0.585	1,130,000	57.5
25	1.573	1.015	0.8425	0.450	0.946	0.432	834,000	48.7
35	1.593	.4956	1.433	0.360	1.387	0.370	715,000	44.2
50	1.576	.3175	2.619	0.265	2.547	0.272	525,000	37.5





COMPARISON OF MODEL RESULTS

A comparison of the results obtained using DAMBRK, HEC-1, SMPDBK, TR66, and the HEC dimensionless graphs procedure are presented in Tables 15 through 18 and Figures 18 through 20. Both HEC-1 runs 1 and 4 are shown. HEC-1 run 1 used a NSTPS value of 1 for all reaches, whereas run 4 used NSTPS values of 4, 5, 7, 8, and 13 for the five reaches. The HEC dimensionless graph procedure assumes an instantaneous complete removal of the dam. The other models reflect a breach width of 500 feet and breach time of 1.0 hour. Solutions could not be obtained with these breach parameters using FLOW SIM 1 and FLOW SIM 2. Runs with these two models terminated with a message that an instability in the calculations had occurred.

Table 15
Comparison of Models - Prismatic
Peak Discharges

Distance :		Maximum Discharge in 1000 cfs									
From Dam :	DAMBRK	:	HEC-1	:	HEC-1	:	SMPDBK	:	TR66	:	TR66
(miles) :		:	(Run-1)	:	(Run-4)	:		:		:	(DAMBRK)
0	3,841		3,911		3,911		4,016		1,931		3,841
5	3,468		3,172		3,558		3,235		1,506		2,996
10	3,220		2,588		3,291		3,212		1,313		2,612
15	2,925		2,159		3,110		3,049		1,130		2,247
20	2,529		1,815		2,910		2,880		985		1,950
25	2,380		1,542		2,704		2,723		834		1,659
30	2,135		1,340		2,520		2,620		780		1,540
35	1,936		1,183		2,344		2,520		715		1,421
40	1,777		1,040		2,180		2,410		660		1,300
45	1,770		920		2,020		2,310		600		1,175
50	1,567		799		1,856		2,216		525		1,044

Table 16
Comparison of Models ~ Prismatic
Peak Water Surface Elevations

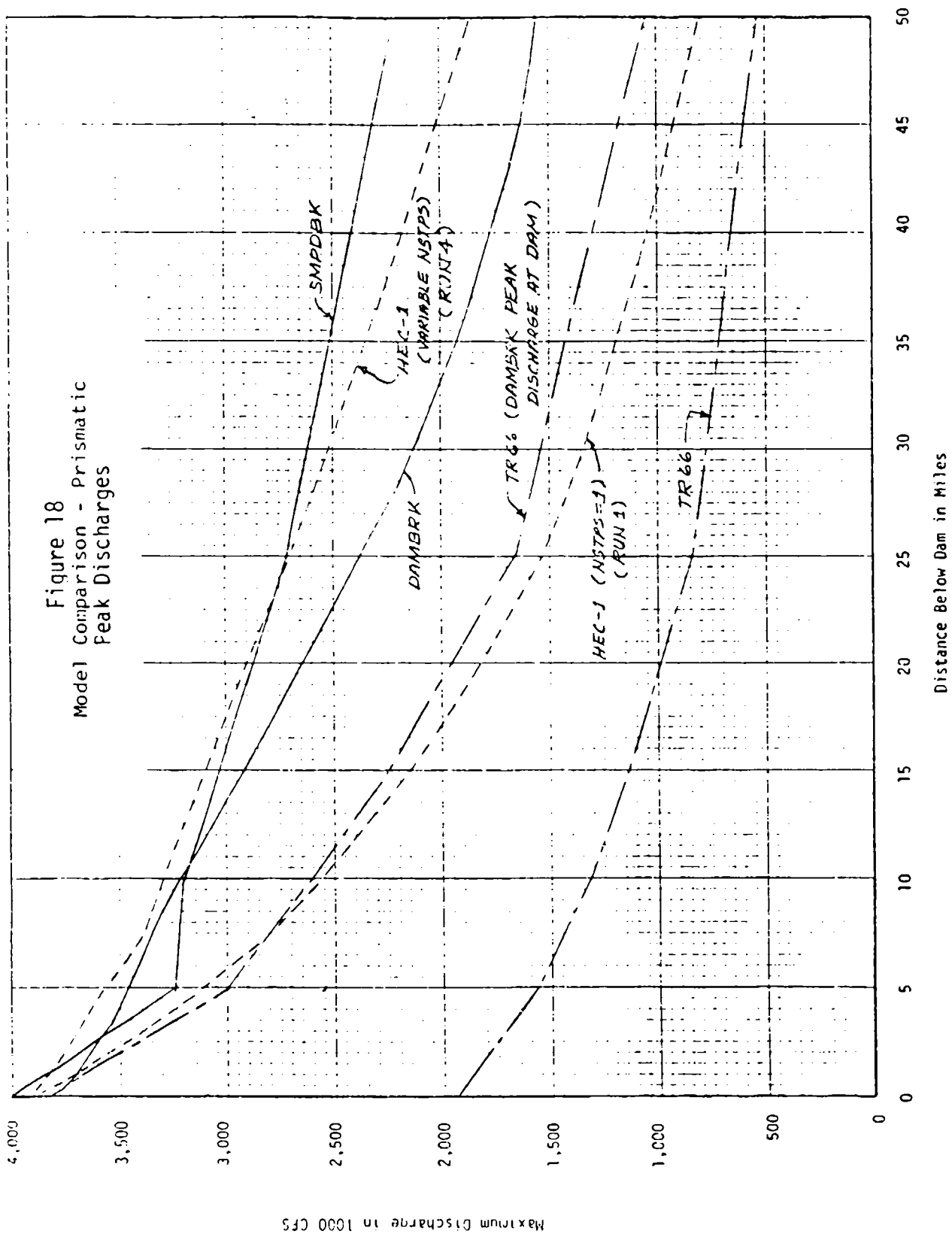
Distance :		Maximum Water Surface Elevation in Feet msl					
From Dam :	DAMBRK :	HEC-1 :	HEC-1 :	SMPDBK :	Dimensionless :	TR66 :	TR66
(miles) :	:	(Run-1) :	(Run-4) :	:	Graphs :	:	(DAMBRK)
0	5144.6	-	-	5142.6	5149.5	5114.5	5153.0
5	5083.9	-	-	5080.2	5081.6	5053.5	5087.9
10	5023.6	5061.9	5075.1	5019.5	5025.8	4992.3	5019.0
15	4968.9	4996.3	5013.8	4966.9	4971.3	4937.5	4962.0
20	4913.9	4945.5	4965.8	4914.0	4917.7	4883.0	4905.3
25	4859.6	4895.5	4919.2	4861.8	4864.5	4828.7	4849.0
30	4805.3	4840.8	4866.0	4809.9	4811.8	4776.4	4796.4
35	4751.8	4786.7	4812.4	4758.3	4758.4	4724.2	4744.2
40	4698.9	4741.1	4767.8	4706.7	4708.1	4672.1	4691.0
45	4646.5	4696.0	4722.6	4654.5	4654.0	4620.0	4638.0
50	4583.0	4650.8	4677.5	4603.0	4602.8	4567.5	4584.4

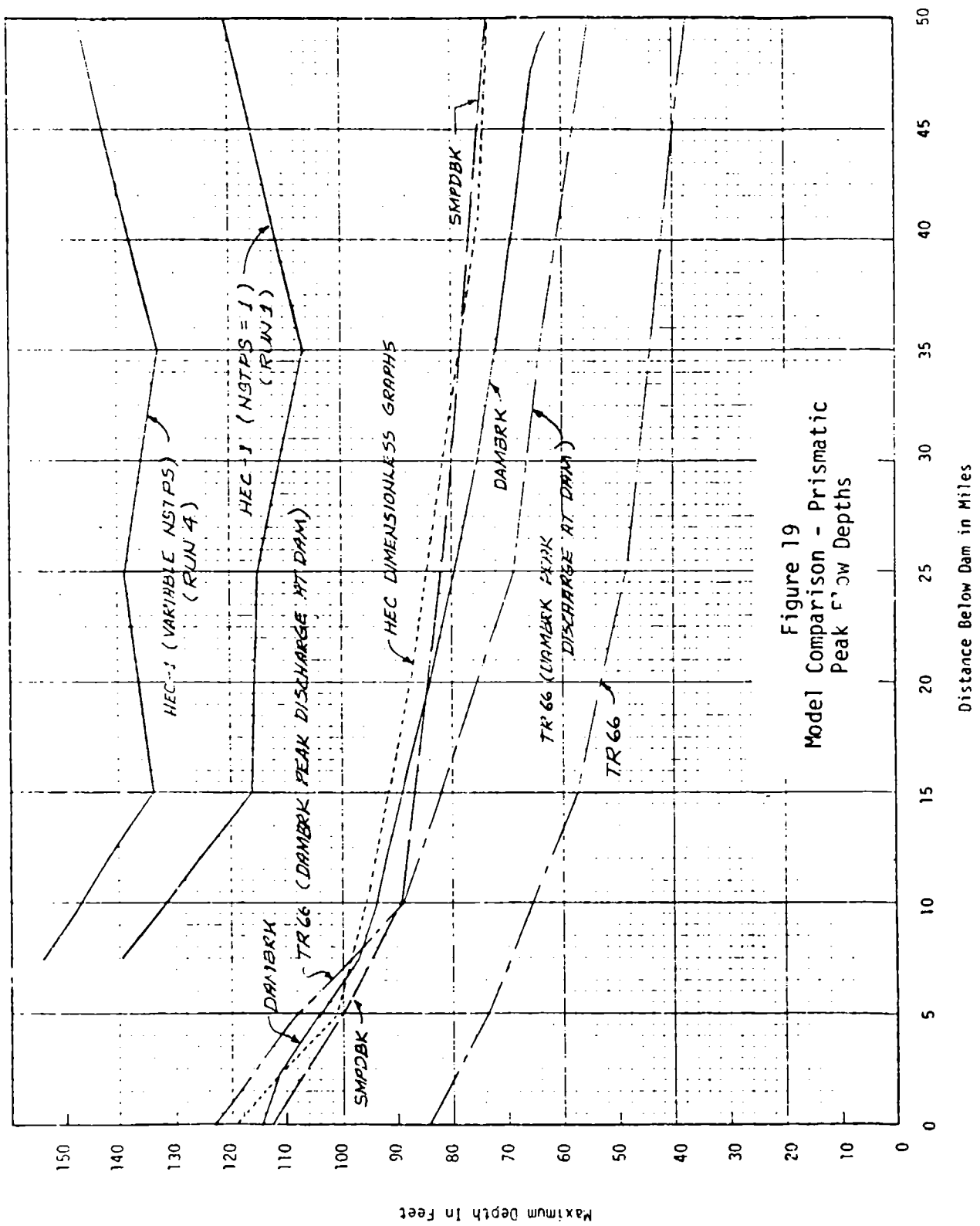
Table 17
Comparison of Models - Prismatic
Maximum Flow Depths

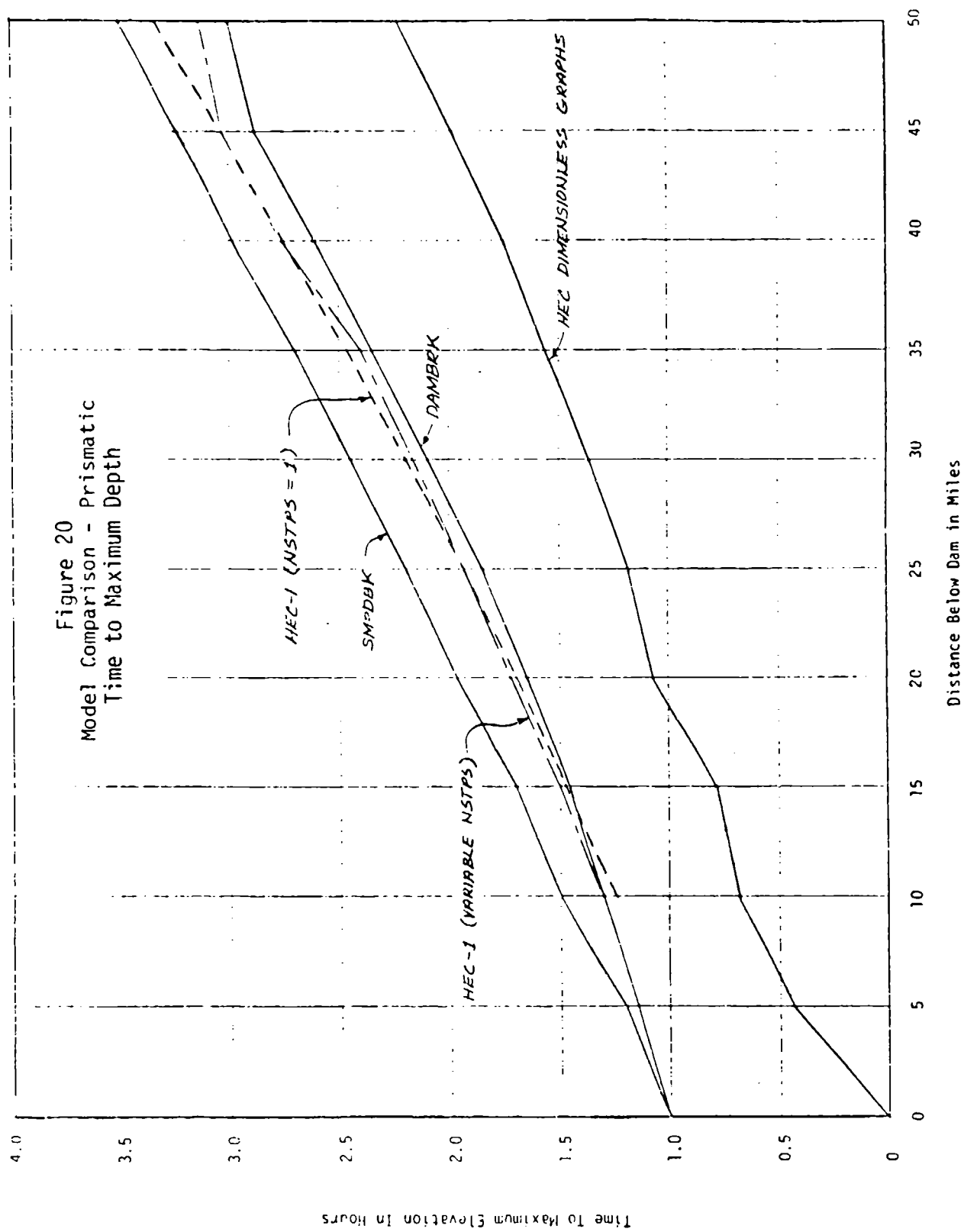
Distance :		Maximum Flow Depth in Feet					
From Dam : DAMBRK :		HEC-1	HEC-1	SMPDBK	Dimensionless	TR66	TR66
(miles) :		: (Run 1)	: (Run 4)		: Graphs		: (DAMBRK)
0	114.6	-	-	112.6	119.5	84.5	123.0
5	103.9	-	-	100.2	101.6	73.5	107.9
10	93.6	131.9	145.1	89.5	95.8	62.3	89.0
15	88.9	116.3	133.8	86.9	91.3	57.5	82.0
20	83.9	115.5	135.8	84.0	87.7	53.0	75.3
25	79.6	115.5	139.2	81.8	84.5	48.7	69.0
30	75.3	110.8	136.0	79.9	81.8	46.4	66.4
35	71.8	106.7	132.4	78.3	78.4	44.2	64.2
40	68.9	111.1	137.8	76.7	78.1	42.1	61.0
45	66.5	116.0	142.6	74.5	74.0	40.0	58.0
50	53.0	120.8	147.5	73.0	72.8	37.5	54.4

Table 18
Comparison of Models - Prismatic
Time to Peak Stage

Distance : _____		Time to Maximum Depth in Hours							
From Dam :	DAMBRK	:	HEC-1	:	HEC-1	:	SMPDBK	:	Dimensionless
(miles) :		:	(Run 1)	:	(Run 4)	:		:	Graphs
0	1.00	-	-	-	-	1.0	0.00		
5	1.15	-	-	-	-	1.2	0.43		
10	1.30	1.24	1.30	1.5	0.68				
15	1.46	1.47	1.50	1.7	0.79				
20	1.65	1.70	1.72	1.97	1.07				
25	1.85	1.93	1.93	2.2	1.18				
30	2.10	2.20	2.17	2.45	1.36				
35	2.35	2.47	2.40	2.7	1.56				
40	2.61	2.75	2.76	2.98	1.75				
45	2.88	3.04	3.04	3.24	1.98				
50	2.99	3.33	3.13	3.5	2.22				







Appendix A

DAMBRK Base Run

PROGRAM DAMBRK . . . VERSION A-01/30/82

ANALYSIS OF THE DOWNSTREAM FLOOD HYDROGRAPH
PRODUCED BY THE DAM BREAK OF

SIMPLIFIED TETON

ON

ALMOST PRISMATIC

ANALYSIS BY

SIMPLIFIED TEST CASE
RALPH WURBS
OCTOBER 1983

BASED ON PROCEDURE DEVELOPED BY

DANNY L. FREAD, PH.D., RESEARCH HYDROLOGIST
HYDROLOGIC RESEARCH LABORATORY
W23, OFFICE OF HYDROLOGY
NOAA, NATIONAL WEATHER SERVICE
SILVER SPRING, MARYLAND 20910

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... SUMMARY OF INPUT DATA ...
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INPUT CONTROL PARAMETERS FOR SIMPLIFIED TETON

PARAMETER	VARIABLE	VALUE
NUMBER OF DYNAMIC ROUTING REACHES	KKN	1
TYPE OF RESERVOIR ROUTING	KUT	0
MULTIPLE DAM INDICATOR	MULDAM	0
PRINTING INSTRUCTIONS FOR INPUT SUMMARY	KDWP	3
NO OF RESERVOIR INFLOW HYDROGRAPH POINTS	ITEH	2
INTERVAL OF CROSS-SECTION INFO PRINTED OUT WHEN JNK=9	NPRT	0
FLOOD-PLAIN MODEL PARAMETER	KFLP	0
LANDSLIDE PARAMETER	KSL	0

SIMPLIFIED TETON RESERVOIR

TABLE OF ELEVATION VS VOLUME

VOLUME (ACRE-FEET) ELEVATION (FT)

SA(K) HSA(K)

286000 0	5320 00
249000 0	5300 00
167000 0	5250 00
102000 0	5200 00
51000 0	5150 00
17500 0	5100 00
750 0	5075 00
500 0	5040 00

SIMPLIFIED TETON RESERVOIR

TABLE OF ELEVATION VS SURFACE AREA

SURFACE AREA (ACRES) ELEVATION (FT)

SA(K) HSA(K)

993 3	5320 00
2706 7	5300 00
573 3	5250 00
2026 7	5200 00
13 3	5150 00
132F 7	5100 00
13 3	5075 00
1 0	5040 00

SIMPLIFIED TETON RESERVOIR AND BREACH PARAMETERS

PARAMETER	UNITS	VARIABLE	VALUE
LENGTH OF RESERVOIR	MI	RLM	15.00
ELEVATION OF WATER SURFACE	FT	Y0	5301.70
SIDE SLOPE OF BREACH	Z		0.0
ELEVATION OF BOTTOM OF BREACH	FT	YBMIN	5040.00
WIDTH OF BASE OF BREACH	FT	BB	500.00
TIME TO MAXIMUM BREACH SIZE	HR	TFH	1.00
ELEVATION (MSL) OF BOTTOM OF DAM	FT	DATUM	5030.00
VOLUME - SURFACE AREA PARAMETER	VOL		1.00
ELEVATION OF WATER WHEN BREACHED	FT	HF	5301.70
ELEVATION OF TOP OF DAM	FT	HD	5330.00
ELEVATION OF UNCONTROLLED SPILLWAY CREST	FT	HSP	0.0
ELEVATION OF CENTER OF GATE OPENINGS	FT	HGT	0.0
DISCHARGE COEF. FOR UNCONTROLLED SPILLWAY	CS		0.0
DISCHARGE COEF. FOR GATE FLOW	CG		0.0
DISCHARGE COEF. FOR UNCONTROLLED WEIR FLOW	CD0		0.0
DISCHARGE THRU TURBINES	CFS	QT	30000.00

COO SHOULD NOT BE 0.00 IF OVERTOPPING MAY OCCUR

DHF (INTERVAL BETWEEN INPUT HYDROGRAPH ORDINATES) = 0.0 HRS
 TTH (TIME AT WHICH COMPUTATIONS TERMINATE) = 60.0000 HRS

INFLOW HYDROGRAPH TO SIMPLIFIED TETON

3580.00 3580.00

TIME OF INFLOW HYDROGRAPH ORDINATES

0.0 60.0000

CROSS-SECTIONAL PARAMETERS FOR ALMOST PRISMATIC
BELOW SIMPLIFIED TETON

PARAMETER	VARIABLE	VALUE
NUMBER OF CROSS-SECTIONS	NS	5
MAXIMUM NUMBER OF TOP WIDTHS	NCS	3
NUMBER OF CROSS-SECTIONAL HYDROGRAPHS TO PLOT	NTT	0
TYPE OF OUTPUT OTHER THAN HYDROGRAPH PLOTS	JMK	1
CROSS SECTIONAL SMOOTHING PARAMETER	KSA	0
DOWNSREAM SUPERCRITICAL OR NOT	KSUPC	0
NO OF LATERAL INFLOW HYDROGRAPHS	LQ	0
NO OF POINTS IN GATE CONTROL CURVE	KCS	0

CROSS-SECTIONAL VARIABLES FOR ALMOST PRISMATIC
BELOW SIMPLIFIED TETON

PARAMETER	UNITS	VARIABLE
LOCATION OF CROSS-SECTION ELEVATION (MSL) OF FLOODING AT CROSS-SECTION	MT FT	XS(1) FSTG(1)
ELEV CORRESPONDING TO EACH TOP WIDTH	FT	HS(K,1)
TOP WIDTH CORRESPONDING TO EACH ELEV (ACTIVE FLOW PORTION)	FT	BS(K,1)
TOP WIDTH CORRESPONDING TO EACH ELEV (OFF-CHANNEL PORTION)	FT	BSS(K,1)
SURFACE AREA CORRESPONDING TO EACH ELEV (ACTIVE FLOW PORTION)	ACRES	OSA(K,1)
SURFACE AREA CORRESPONDING TO EACH ELEV (OFF-CHANNEL PORTION)	ACRES	SSA(K,1)
NUMBER OF CROSS-SECTION		I
NUMBER OF ELEVATION LEVEL		K

CROSS-SECTION NUMBER 1
.....

XS(1) = 0 0 FSTG(1) = 5060 00 XSL(1) = 0 0 XSR(1) = 0 0

MS 5030 0 5040 0 5040 0
BS 0 0 800 0 1400 0
BSS 0 0 0 0 0 0

CROSS-SECTION NUMBER 2
.....

XS(1) = 5 000 FSTG(1) = 5010 00 XSL(1) = 0 0 XSR(1) = 0 0

MS 4980 0 4990 0 5190 0
BS 0 0 800 0 1400 0
BSS 0 0 0 0 0 0

CROSS-SECTION NUMBER 3
.....

XS(1) = 10 000 FSTG(1) = 4960 00 XSL(1) = 0 0 XSR(1) = 0 0

MS 4930 0 4940 0 5110 0
BS 0 0 1000 0 1400 0
BSS 0 0 0 0 0 0

CROSS-SECTION NUMBER 4
.....

XS(1) = 25 000 FSTG(1) = 4810 00 XSL(1) = 0 0 XSR(1) = 0 0

MS 4780 0 4790 0 4990 0
BS 0 0 1000 0 1600 0
BSS 0 0 0 0 0 0

CROSS-SECTION NUMBER 5
.....

XS(1) = 50 000 FSTG(1) = 4560 00 XSL(1) = 0 0 XSR(1) = 0 0

MS 4530 0 4540 0 4740 0
BS 0 0 1000 0 1600 0
BSS 0 0 0 0 0 0

MANIPULATING ROUGHNESS COEFFICIENTS FOR THE GIVEN REACHES
 (CHECK I) K-1 NCS) WHERE I = REACH NUMBER

REACH 1 0 040 0 040 0 040
 REACH 2 0 040 0 040 0 040
 REACH 3 0 040 0 040 0 040
 REACH 4 0 040 0 040 0 040

CROSS-SECTIONAL VARIABLES FOR ALMOST PRISMATIC
 BELOW SIMPLIFIED TETON

PARAMETER UNITS VARIABLE

 MINIMUM COMPUTATIONAL DISTANCE USED MT DXM(I)
 BETWEEN CROSS-SECTIONS
 CONTRACTION - EXPANSION COEFFICIENTS PKC(I)
 BETWEEN CROSS-SECTIONS

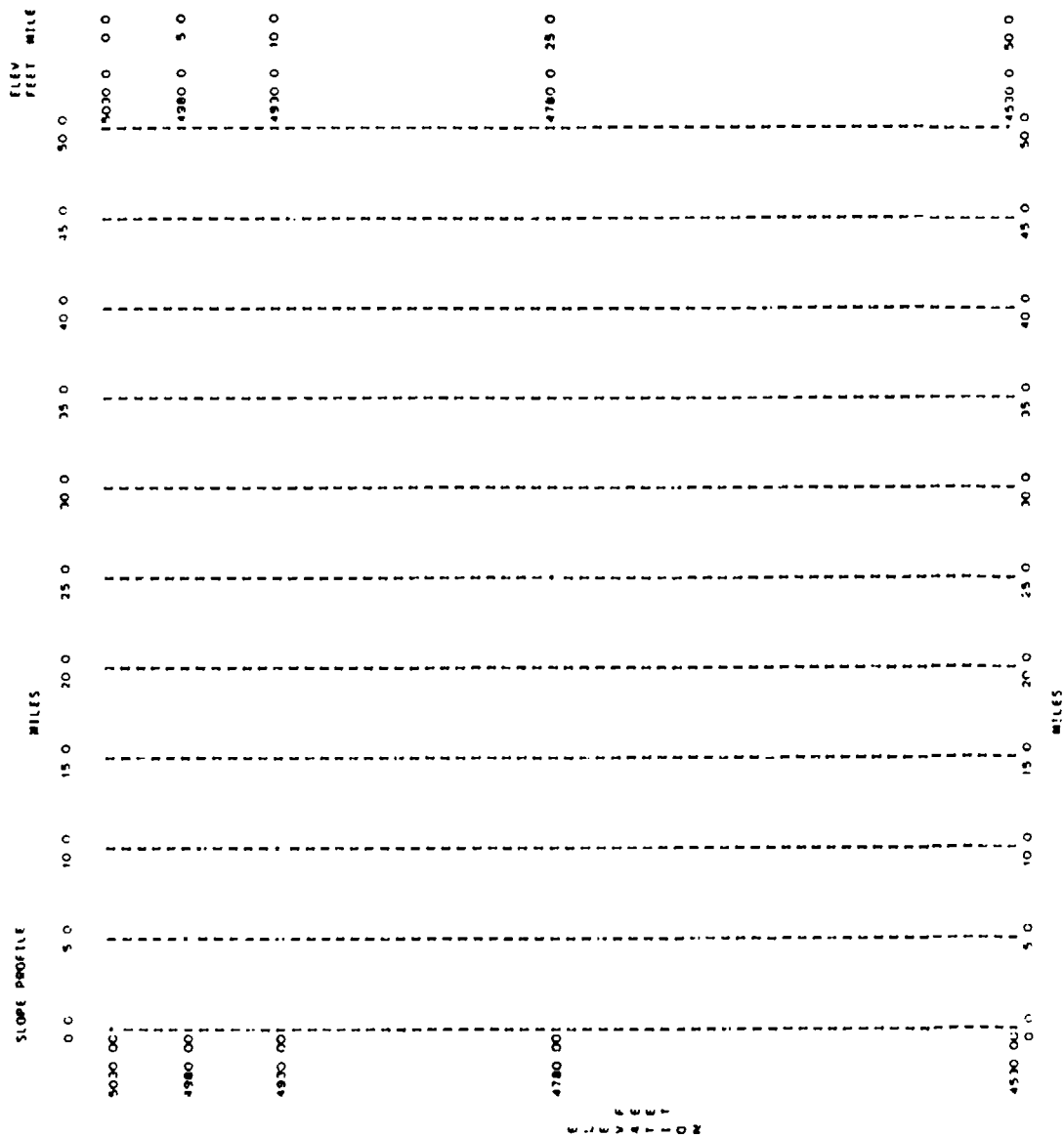
REACH NUMBER	DXM(I)	PKC(I)
1	0 200	0 0
2	0 300	0 0
3	0 600	0 0
4	0 700	0 0

DOWNSTREAM FLOW PARAMETERS FOR ALMOST PRISMATIC
BELOW SIMPLIFIED TETON

PARAMETER	UNITS	VARIABLE	VALUE
MAX DISCHARGE AT DOWNSTREAM EXTREMITY	CFS	OMAXD	0.0
MAX LATERAL OUTFLOW PRODUCING LOSSES	CFS/FT	QLL	0.0
INITIAL SIZE OF TIME STEP	HR	DTMM	0.0
INITIAL WATER SURFACE ELEVATION DOWNSTREAM	FT	YDN	0.0
SLOPE OF CHANNEL DOWNSTREAM OF DAM	FT/MI	SOM	10.00
THETA WEIGHTING FACTOR		THETA	0.0
CONVERGENCE CRITERION FOR STAGE	FT	EPSY	0.0
TIME AT WHICH DAM STARTS TO FAIL	HR	TFI	0.0

.....

 *** SUMMARY OF OUTPUT DATA ***



MESSAGE

CROSS-SECTION NO	MI	BOTTOM ELEVATION FEET	REACH NO	REACH LENGTH MILES	SLOPE FT/MI
1	0 0	5030 00			
2	5 00	4980 00	1	5 00	10 00
3	10 00	4930 00	2	5 00	10 00
4	25 00	4780 00	3	15 00	10 00
5	50 00	4530 00	4	25 00	10 00

TOTAL NUMBER OF CROSS SECTIONS (ORIGINAL+INTERPOLATED) (N) = 102 (MAXIMUM ALLOWABLE = 200)

TOTAL VOLUME IN RESERVOIR BEHIND
SIMPLIFIED TETON = 252975 5 ACRE-Feet

DEFINITION OF VARIABLES IN RESERVOIR DEPLETION TABLE

PARAMETER	UNITS	VARIABLE
TIME STEP FROM START OF ANALYSIS		I
ITERATIONS NECESSARY TO SOLVE FLOW EQUATIONS		K
ELAPSED TIME FROM START OF ANALYSIS	HRS	TTP(I)
TOTAL OUTFLOW FROM DAM	CFS	Q(I)
ELEVATION OF WATER SURFACE AT DAM	FT	H2
ELEVATION OF BOTTOM OF BREACH	FT	YB
EST DEPTH OF FLOW IMMEDIATELY DOWNSTREAM	FT	D
SUBMERGENCE COEFFICIENT		SUB
VELOCITY CORRECTION		VCOR
TOTAL VOLUME DISCHARGED FROM TIME OF BREACH AC-FT		OUTVOL
BREACH WIDTH	FT	BB
RECTANGULAR BREACH DISCHARGE COEFFICIENT		COFR
INFLOW TO RESERVOIR	CFS	QI(I)
BREACH OUTFLOW	CFS	OBRECH
SPILLWAY OUTFLOW	CFS	QSPIL

RESERVOIR DEPLETION TABLE

I	K	TRC(I)	Q(I)	H2	Y8	D	SUB	VCNR	OUTVOL	R3	COFR	Q1(I)	OBRECH	OSPIL
..	..													
1	0	0	36000	5301 70	5301 70	5041 61	1 00	1 00	0	0	1 10	3580	0	30000
2	2	0 0 0	30269	5301 68	5296 46	5041 64	1 00	1 00	49 9	10 0	3 10	3580	369	30000
3	1	0 0 0	32089	5301 66	5291 23	5041 86	1 00	1 00	101 5	20 0	3 10	3580	2089	30000
4	1	0 0 0	35756	5301 64	5286 00	5042 33	1 00	1 00	157 6	30 0	3 10	3580	5756	30000
5	1	0 0 0	41812	5301 62	5280 06	5043 05	1 00	1 00	221 7	40 0	3 10	3580	11813	30000
6	1	0 100	50626	5301 59	5275 53	5044 03	1 00	1 00	298 1	50 0	3 10	3580	20626	30000
7	1	0 120	62516	5301 56	5270 28	5045 25	1 00	1 00	391 6	60 0	3 10	3580	32516	30000
8	1	0 140	77766	5301 52	5265 06	5046 69	1 00	1 00	507 5	70 0	3 10	3580	47766	30000
9	2	0 160	96630	5301 46	5259 82	5048 31	1 00	1 00	651 7	80 0	3 10	3580	66630	30000
10	2	0 180	119338	5301 39	5254 59	5050 10	1 00	1 00	830 1	90 0	3 10	3580	89338	30000
11	2	0 200	146096	5301 31	5249 36	5052 04	1 00	1 00	1049 5	100 0	3 10	3580	116096	30000
12	2	0 220	177099	5301 21	5244 12	5053 12	1 00	1 00	1316 6	110 0	3 10	3580	147099	30000
13	2	0 240	212511	5301 09	5238 89	5056 31	1 00	1 00	1638 6	120 0	3 10	3580	182511	30000
14	2	0 260	251287	5300 95	5233 66	5058 55	1 00	1 00	2021 9	130 0	3 10	3580	222487	28800
15	2	0 280	293570	5300 78	5228 42	5060 83	1 00	1 00	2472 2	140 0	3 10	3580	267171	26400
16	2	0 300	340686	5300 58	5223 19	5063 22	1 00	1 00	2936 4	150 0	3 10	3580	316636	24000
17	2	0 320	392742	5300 36	5217 95	5065 71	1 00	1 00	3502 5	160 0	3 10	3580	371142	21600
18	2	0 340	449835	5300 10	5212 72	5068 28	1 00	1 00	4298 9	170 0	3 10	3580	430635	19200
19	2	0 360	512040	5299 80	5207 48	5070 93	1 00	1 00	5093 8	180 0	3 10	3580	495241	16800
20	2	0 380	579398	5299 47	5202 25	5073 65	1 00	1 00	5995 8	190 0	3 10	3580	564998	14400
21	2	0 400	651937	5299 09	5197 02	5076 43	1 00	1 00	7013 4	200 0	3 10	3580	639938	12000
22	2	0 420	729672	5298 67	5191 79	5079 28	1 00	1 00	8155 3	210 0	3 10	3580	720073	9600
23	2	0 440	812597	5298 19	5186 55	5082 17	1 00	1 00	9429 9	220 0	3 10	3580	805397	7200
24	2	0 460	900684	5297 65	5181 32	5085 11	1 00	1 00	10845 8	230 0	3 10	3580	895884	4800
25	2	0 480	993885	5297 05	5176 08	5088 09	1 00	1 00	12411 6	240 0	3 10	3580	991486	2400
26	2	0 500	1092130	5296 38	5170 85	5091 10	1 00	1 00	14135 5	250 0	3 10	3580	1092130	0
27	2	0 520	1197700	5295 63	5165 61	5094 21	1 00	1 00	16028 0	260 0	3 10	3580	1197700	0
28	2	0 540	1308071	5294 81	5160 38	5097 34	1 00	1 00	18098 8	270 0	3 10	3580	1308071	0
29	2	0 560	1423071	5293 89	5155 14	5100 48	1 00	1 00	20356 0	280 0	3 10	3580	1423071	0
30	2	0 580	1542495	5292 89	5149 31	5103 62	1 00	1 00	22806 9	290 0	3 10	3580	1542495	0
31	2	0 600	1666101	5291 77	5144 68	5106 76	1 00	1 00	25458 6	300 0	3 10	3580	1666101	0
32	2	0 620	1793600	5290 55	5139 45	5109 89	1 00	1 01	28317 8	310 0	3 10	3580	1793600	0
33	2	0 640	1924640	5289 20	5134 21	5113 02	1 00	1 01	31390 8	320 0	3 10	3580	1924640	0
34	2	0 660	2058804	5287 72	5128 98	5116 11	1 00	1 01	34682 9	330 0	3 10	3580	2058804	0
35	2	0 680	2195590	5286 08	5123 74	5119 18	1 00	1 01	38198 9	340 0	3 10	3580	2195590	0
36	2	0 700	2334379	5284 28	5118 51	5122 21	1 00	1 01	41942 7	350 0	3 10	3580	2334379	0
37	2	0 720	2474413	5282 29	5113 27	5125 18	1 00	1 01	45916 9	360 0	3 10	3580	2474413	0
38	2	0 740	2614247	5280 09	5108 04	5128 08	1 00	1 01	50122 8	370 0	3 10	3580	2614247	0
39	2	0 760	2754150	5277 63	5102 80	5130 89	1 00	1 01	54559 9	380 0	3 10	3580	2754150	0
40	2	0 780	2891012	5274 88	5097 57	5133 59	1 00	1 01	59225 3	390 0	3 10	3580	2891012	0
41	2	0 800	3023091	5271 77	5092 34	5136 14	1 00	1 02	64113 0	400 0	3 10	3580	3023091	0
42	2	0 820	3147082	5268 20	5087 11	5138 49	1 00	1 02	69212 2	410 0	3 10	3580	3147082	0
43	2	0 840	3257642	5264 00	5081 87	5140 55	1 00	1 02	74505 4	420 0	3 10	3580	3257642	0
44	3	0 860	3344763	5258 86	5076 64	5142 15	1 00	1 02	79961 9	430 0	3 10	3580	3344763	0
45	3	0 880	3383312	5251 95	5071 40	5142 85	1 00	1 03	85522 2	440 0	3 10	3580	3383312	0
46	3	0 900	3390948	5243 99	5066 17	5142 99	1 00	1 03	91120 7	450 0	3 10	3580	3390948	0
47	3	0 920	3434747	5237 32	5060 93	5143 78	1 00	1 03	96761 8	460 0	3 10	3580	3434747	0
48	3	0 940	3510297	5231 71	5055 70	5145 13	1 00	1 04	102501 5	470 0	3 10	3580	3510297	0
49	2	0 960	3606159	5226 73	5050 46	5146 83	1 00	1 04	113382 8	480 0	3 10	3580	3606159	0
50	2	0 980	3717316	5222 13	5045 23	5148 78	1 00	1 05	114435 2	490 0	3 10	3580	3717316	0

RESERVOIR DEPLETION TABLE

I	K	TTP(I)	O(I)	M2	YB	D	SUB	VCOR	OUTVAL	BB	CONF	Q1(I)	OBRECH	OSPIL
51	2	1.000	3841297	5217 82	5040 00	5150 91	1 00	1 05	120682 0	500 0	3 10	3580	3841297	0
52	2	1.020	3733014	5213 82	5040 00	5149 05	1 00	1 05	126941 7	500 0	3 10	3580	3733014	0
53	2	1.040	3620743	5210 21	5040 00	5147 09	1 00	1 05	133019 2	500 0	3 10	3580	3620743	0
54	2	1.060	3517451	5206 89	5040 00	5145 26	1 00	1 05	138918 5	500 0	3 10	3580	3517451	0
55	2	1.080	3422703	5203 83	5040 00	5143 56	1 00	1 05	144634 1	500 0	3 10	3580	3422703	0
56	2	1.100	3335211	5200 98	5040 00	5141 97	1 00	1 05	150239 1	500 0	3 10	3580	3335211	0
57	2	1.120	3251435	5198 23	5040 00	5140 43	1 00	1 05	155682 6	500 0	3 10	3580	3251435	0
58	2	1.140	3167079	5195 44	5040 00	5138 86	1 00	1 05	160987 1	500 0	3 10	3580	3167079	0
59	2	1.160	3080424	5192 55	5040 00	5137 23	1 00	1 06	166150 3	500 0	3 10	3580	3080424	0
60	2	1.180	2991026	5189 54	5040 00	5135 53	1 00	1 06	171168 0	500 0	3 10	3580	2991026	0
61	2	1.200	2898228	5186 39	5040 00	5133 73	1 00	1 06	176035 1	500 0	3 10	3580	2898228	0
62	2	1.220	2801121	5183 05	5040 00	5131 82	1 00	1 06	180745 3	500 0	3 10	3580	2801121	0
63	2	1.240	2698352	5179 49	5040 00	5129 77	1 00	1 06	185290 3	500 0	3 10	3580	2698352	0
64	2	1.260	2587746	5175 60	5040 00	5127 53	1 00	1 06	189658 9	500 0	3 10	3580	2587746	0
65	2	1.280	2465390	5171 24	5040 00	5124 99	1 00	1 06	193835 1	500 0	3 10	3580	2465390	0
66	2	1.300	2322756	5166 07	5040 00	5121 95	1 00	1 06	197792 2	500 0	3 10	3580	2322756	0
67	2	1.320	2131027	5158 97	5040 00	5117 74	1 00	1 06	201472 9	500 0	3 10	3580	2131027	0
68	2	1.340	191762	5145 91	5040 00	5109 85	1 00	1 06	204714 9	500 0	3 10	3580	191762	0
69	2	1.360	1533315	5135 24	5040 00	5103 38	1 00	1 06	207462 8	500 0	3 10	3580	1533315	0
70	2	1.380	1411818	5130 14	5040 00	5100 17	1 00	1 07	209896 7	500 0	3 10	3580	1411818	0
71	2	1.400	1323478	5126 29	5040 00	5097 77	1 00	1 07	212157 3	500 0	3 10	3580	1323478	0
72	2	1.420	1252744	5123 15	5040 00	5095 78	1 00	1 07	214286 4	500 0	3 10	3580	1252744	0
73	2	1.440	1193328	5120 48	5040 00	5094 09	1 00	1 07	216307 9	500 0	3 10	3580	1193328	0
74	2	1.460	1141914	5118 13	5040 00	5092 59	1 00	1 07	218237 8	500 0	3 10	3580	1141914	0
75	2	1.480	1096518	5116 03	5040 00	5091 23	1 00	1 07	220087 7	500 0	3 10	3580	1096518	0
76	2	1.500	1055840	5114 12	5040 00	5090 00	1 00	1 07	221866 5	500 0	3 10	3580	1055840	0
77	2	1.520	1018985	5112 38	5040 00	5088 87	1 00	1 07	223581 2	500 0	3 10	3580	1018985	0
78	2	1.540	985291	5110 77	5040 00	5087 82	1 00	1 07	225237 6	500 0	3 10	3580	985291	0
79	2	1.560	954267	5109 26	5040 00	5086 84	1 00	1 07	226840 5	500 0	3 10	3580	954267	0
80	2	1.580	925536	5107 86	5040 00	5085 92	1 00	1 07	228394 0	500 0	3 10	3580	925536	0
81	2	1.600	898781	5106 54	5040 00	5085 05	1 00	1 07	229901 7	500 0	3 10	3580	898781	0
82	2	1.620	873769	5105 29	5040 00	5084 23	1 00	1 07	231366 6	500 0	3 10	3580	873769	0
83	2	1.640	850298	5104 11	5040 00	5083 45	1 00	1 07	232791 4	500 0	3 10	3580	850298	0
84	2	1.660	828198	5102 98	5040 00	5082 70	1 00	1 07	234178 5	500 0	3 10	3580	828198	0
85	2	1.680	807332	5101 93	5040 00	5081 99	1 00	1 07	235530 1	500 0	3 10	3580	807332	0
86	2	1.700	787576	5100 91	5040 00	5081 31	1 00	1 07	236848 2	500 0	3 10	3580	787576	0
87	2	1.720	768791	5099 93	5040 00	5080 66	1 00	1 07	238134 4	500 0	3 10	3580	768791	0
88	2	1.740	750393	5098 97	5040 00	5080 01	1 00	1 07	239389 9	500 0	3 10	3580	750393	0
89	2	1.760	731850	5098 00	5040 00	5079 36	1 00	1 07	240614 9	500 0	3 10	3580	731850	0
90	2	1.780	713147	5097 00	5040 00	5078 68	1 00	1 07	241809 1	500 0	3 10	3580	713147	0
91	2	1.800	694260	5095 99	5040 00	5078 00	1 00	1 07	242972 2	500 0	3 10	3580	694260	0
92	2	1.820	675143	5094 95	5040 00	5077 30	1 00	1 07	244103 9	500 0	3 10	3580	675143	0
93	2	1.840	655762	5093 89	5040 00	5076 58	1 00	1 07	245203 7	500 0	3 10	3580	655762	0
94	2	1.860	636058	5092 81	5040 00	5075 84	1 00	1 07	246271 3	500 0	3 10	3580	636058	0
95	2	1.880	615965	5091 69	5040 00	5075 07	1 00	1 07	247306 0	500 0	3 10	3580	615965	0
96	2	1.900	595397	5090 53	5040 00	5074 28	1 00	1 07	248307 1	500 0	3 10	3580	595397	0
97	2	1.920	574245	5089 33	5040 00	5073 45	1 00	1 07	249273 7	500 0	3 10	3580	574245	0
98	2	1.940	552340	5088 07	5040 00	5072 57	1 00	1 07	250204 7	500 0	3 10	3580	552340	0
99	2	1.960	529456	5086 73	5040 00	5071 64	1 00	1 07	251098 7	500 0	3 10	3580	529456	0
100	2	1.980	505240	5085 30	5040 00	5070 64	1 00	1 07	251953 8	500 0	3 10	3580	505240	0

RESERVOIR DEPLETION TABLE

I	K	TTP(I)	Q(I)	N2	YB	D	SUB	VCOR	OUTVOL	BB	CONR	QI(I)	QBRECH	OSPIL
...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
101	2	2 000	479091	5083 72	5040 00	5069 54	1 00	1 07	252767 2	500 0	3 10	3580	479093	0
102	2	2 020	449847	5081 93	5040 00	5068 28	1 00	1 07	253534 9	500 0	3 10	3580	449847	0
103	3	2 012	410390	5079 44	5040 00	5066 52	1 00	1 07	254316 9	500 0	3 10	3580	410381	0
104	3	2 006	325828	5073 83	5040 00	5062 48	1 00	1 07	255053 1	500 0	3 10	3580	325829	0
105	0	2 12	293245											
106	0	2 15	263921											
107	0	2 18	237528											
108	0	2 22	213776											
109	0	2 26	192398											
110	0	2 30	173158											
111	0	2 35	155842											
112	0	2 10	140258											
113	0	2 45	126232											
114	0	2 52	113609											
115	0	2 59	102248											
116	0	2 66	92023											
117	0	2 75	82821											
118	0	2 84	74538											
119	0	2 94	67084											
120	0	3 05	60376											
121	0	3 17	54338											
122	0	3 31	48904											
123	0	3 45	44014											
124	0	3 62	39612											
125	0	3 80	35651											
126	0	3 99	32086											
127	0	4 21	30000											
128	0	4 45	30000											
129	0	4 71	30000											
130	0	5 00	30000											
131	0	5 32	30000											
132	0	5 67	30000											
133	0	6 05	30000											
134	0	6 47	30000											
135	0	6 94	30000											
136	0	7 45	30000											
137	0	8 01	30000											
138	0	8 63	30000											
139	0	9 31	30000											
140	0	10 06	30000											
141	0	10 88	30000											
142	0	11 78	30000											
143	0	12 78	30000											
144	0	13 87	30000											
145	0	15 08	30000											
146	0	16 40	30000											
147	0	17 85	30000											
148	0	19 47	30000											
149	0	21 23	30000											
150	0	23 17	30000											

RESERVOIR DEPLETION TABLE

I	K	TP(I)	Q(I)	Y8	Q	SUB	VCOR	OUTVOL	RB	COFR	Q(I)	ORRECH	OSPIL
...	..												
151	C	25 70	30000										
152	C	27 65	30000										
153	C	30 24	30000										
154	C	37 08	30000										
155	C	36 20	30000										
156	C	39 61	30000										
157	C	47 42	30000										
158	C	47 58	30000										
159	C	52 15	30000										
160	C	57 19	30000										
161	C	62 77	30000										

PARAMETER	UNITS	VARIABLE	VALUE
INITIAL FLOW	CFS	Q(1)	30000
MAX FLOW	CFS	QM	3841297
FINAL FLOW	CFS	Q(NU)	30000
TIME TO MAX FLOW	HRS	TP	1 00
NUMBER OF TIME STEPS	NNU	NNU	161
TOTAL VOLUME DISCHARGED FROM RESERVOIR	AC-FT	DISVOL	255053
NUMBER OF INTERMEDIATE STATIONS	NN(NS)	NN(NS)	102
NUMBER OF TIME STEPS	NNU	NNU	161

TIME PARAMETERS OF OUTFLOW HYDROGRAPH IMMEDIATELY DOWNSTREAM OF DAM

PARAMETER	UNITS	VARIABLE	VALUE
TIME TO FAILURE	HR	TFH	1 000
TIME TO START OF RISING LIMB OF HYDROGRAPH	HR	TFO	0 0
TIME TO PEAK	HR	TP	1 000
TIME STEP SIZE	HR	DTIME	0 050

ROUTING COMPLETED

KTIME=305 ALLOWABLE KTIME= 698 TT= 60.1

PROFILE OF CRESTS AND TIMES FOR ALMOST PRISMATIC
BELOW SIMPLIFIED TETON

RVR MILE FROM DAM	MAX ELEV (FT)	MAX FLOW (CFS)	TIME MAX FLEV(HR)	MAX VEL (FT/SEC)	MAX VEL (MI/HR)	FLOOD ELEV (FT)	TIME FLOOD ELEV (HR)
0 0	5144 62	3841297	1 000	36 89	25 15	5060 00	0 35
0 200	5142 08	3810624	1 000	36 81	25 10	5058 00	0 35
0 400	5139 53	3778548	1 000	36 72	25 04	5056 00	0 35
0 600	5137 41	3745802	1 050	36 62	24 97	5054 00	0 35
0 800	5135 37	3712995	1 050	36 53	24 90	5052 00	0 35
1 000	5133 27	3680493	1 050	36 43	24 84	5050 00	0 40
1 200	5131 10	3647526	1 050	35 89	24 47	5048 00	0 40
1 400	5128 88	3614866	1 050	35 96	24 52	5046 00	0 40
1 600	5126 61	3670030	1 050	35 02	24 15	5044 00	0 40
1 800	5124 30	3661734	1 050	36 06	24 50	5042 00	0 45
2 000	5121 95	3650454	1 050	36 09	24 60	5040 00	0 45
2 200	5119 57	3636696	1 050	36 10	24 62	5038 00	0 45
2 400	5117 18	3620850	1 100	36 12	24 62	5036 00	0 45
2 600	5115 04	3603268	1 100	36 12	24 63	5034 00	0 45
2 800	5112 85	3584311	1 100	36 13	24 63	5032 00	0 50
3 000	5110 61	3564236	1 100	36 13	24 64	5030 00	0 50
3 200	5108 30	3543324	1 100	36 15	24 65	5028 00	0 50
3 400	5105 94	3532233	1 100	35 70	24 34	5026 00	0 50
3 600	5103 51	3530280	1 100	35 86	24 45	5024 00	0 55
3 800	5101 00	3526273	1 100	36 02	24 56	5022 00	0 55
4 000	5098 40	3520383	1 100	36 20	24 68	5020 00	0 55
4 200	5095 70	3512806	1 100	36 41	24 82	5018 00	0 55
4 400	5092 87	3503687	1 100	36 66	24 99	5016 00	0 55
4 600	5089 93	3493121	1 150	36 96	25 20	5014 00	0 60
4 800	5087 01	3481248	1 150	37 33	25 45	5012 00	0 60
5 000	5083 86	3468182	1 150	37 81	25 78	5010 00	0 60
5 312	5079 87	3445417	1 150	37 60	25 63	5006 87	0 60
5 625	5075 84	3427310	1 150	36 92	25 17	5003 75	0 65
5 937	5071 77	3422973	1 150	36 81	25 10	5000 62	0 65
6 250	5067 66	3414802	1 150	36 69	25 01	4997 50	0 65
6 562	5063 58	3402940	1 200	36 55	24 92	4994 37	0 70
6 875	5059 70	3387570	1 200	36 39	24 81	4991 25	0 70
7 187	5055 73	3368912	1 200	36 23	24 70	4988 12	0 70
7 500	5051 84	3347227	1 200	36 05	24 58	4985 00	0 75
7 812	5047 87	3322020	1 200	35 40	24 14	4981 87	0 75
8 125	5043 89	3324708	1 200	35 27	24 05	4978 75	0 75
8 437	5040 17	3313737	1 250	35 11	23 94	4975 62	0 80
8 750	5036 57	3298311	1 250	34 90	23 80	4972 50	0 80
9 062	5033 03	3279253	1 250	34 60	23 59	4969 37	0 80
9 375	5029 62	3256071	1 250	34 23	23 34	4966 25	0 85
9 687	5026 50	3230693	1 300	33 11	22 58	4963 12	0 85
10 000	5023 60	3219809	1 300	32 62	22 24	4960 00	0 85
10 600	5017 05	3189635	1 300	32 76	22 34	4954 00	0 90
11 200	5010 42	3145445	1 350	32 83	22 38	4948 00	0 90
11 800	5003 92	3113607	1 350	32 35	22 06	4942 00	0 95
12 400	4997 27	3079754	1 400	32 46	22 13	4936 00	1 00
13 000	4990 80	3036148	1 400	32 58	22 21	4930 00	1 00
13 600	4984 14	3007681	1 400	32 07	21 87	4924 00	1 05

PROFILE OF CRESTS AND TIMES FOR ALMOST PRISMATIC
BELOW SIMPLIFIED TETON

RVR MILE FROM DAN	MAX ELEV (FT)	MAX FLOW (CFS)	TIME MAX ELEV(HR)	MAX VEL (FT/SEC)	MAX VEL (MI/HR)	FLOOD ELEV (FT)	TIME FLOOD ELEV (HR)
14 200	4977 70	2972363	1 450	32 24	21 98	4918 00	1 05
14 800	4971 06	2934695	1 450	31 69	21 61	4912 00	1 10
15 400	4964 58	2904541	1 500	31 88	21 73	4906 00	1 10
16 000	4957 97	2863500	1 500	31 34	21 37	4900 00	1 15
16 600	4951 44	2836193	1 550	31 53	21 50	4894 00	1 15
17 200	4944 87	2794347	1 550	31 00	21 14	4888 00	1 20
17 800	4938 28	2768873	1 600	31 19	21 27	4882 00	1 20
18 400	4931 75	2728171	1 600	31 31	21 35	4876 00	1 25
19 000	4925 10	2702737	1 600	30 87	21 05	4870 00	1 25
19 600	4918 61	2663482	1 650	30 99	21 13	4864 00	1 30
20 200	4912 00	2637355	1 650	30 56	20 83	4858 00	1 30
20 800	4905 45	2599555	1 700	30 67	20 91	4852 00	1 35
21 400	4898 88	2572475	1 700	30 25	20 52	4846 00	1 35
22 000	4892 28	2536046	1 750	30 36	20 70	4840 00	1 40
22 600	4885 80	2508543	1 750	29 97	20 43	4834 00	1 40
23 200	4879 13	2471495	1 800	30 01	20 46	4828 00	1 45
23 800	4872 72	2444419	1 800	29 67	20 23	4822 00	1 45
24 400	4866 04	2407753	1 850	29 66	20 23	4816 00	1 50
25 000	4859 62	2380099	1 850	29 34	20 00	4810 00	1 50
25 600	4851 78	2339052	1 900	29 39	20 04	4802 86	1 55
26 200	4843 97	2306231	1 900	29 03	19 79	4795 71	1 60
26 800	4836 29	2268844	1 950	28 72	19 58	4788 57	1 60
27 400	4828 46	2234036	2 000	28 75	19 60	4781 43	1 65
28 000	4820 75	2201570	2 000	28 45	19 40	4774 29	1 65
28 600	4813 07	2164259	2 050	28 14	19 19	4767 14	1 70
29 200	4805 29	2134507	2 100	28 18	19 21	4760 00	1 75
29 800	4797 64	2104310	2 100	27 93	19 04	4752 86	1 75
30 400	4789 99	2069404	2 150	27 62	18 83	4745 71	1 80
31 000	4782 27	2042948	2 200	27 67	18 87	4738 57	1 85
31 600	4774 64	2016019	2 200	27 45	18 72	4731 43	1 85
32 200	4767 04	1984779	2 250	27 16	18 52	4724 29	1 90
32 800	4759 39	1959942	2 350	27 22	18 56	4717 14	1 95
33 400	4751 79	1936344	2 350	27 03	18 43	4710 00	1 95
34 000	4744 25	1908901	2 400	26 76	18 24	4702 86	2 00
34 600	4736 66	1884306	2 451	26 80	18 28	4695 71	2 00
35 200	4729 05	1863884	2 451	26 64	18 16	4688 57	2 05
35 800	4721 55	1840129	2 503	26 40	18 00	4681 43	2 10
36 400	4714 01	1814914	2 555	25 42	18 01	4674 29	2 10
37 000	4706 40	1797301	2 608	25 27	17 91	4667 14	2 15
37 600	4698 91	1776928	2 608	25 06	17 77	4660 00	2 20
38 200	4691 42	1754157	2 661	25 77	17 57	4652 86	2 20
38 800	4683 86	1735862	2 714	25 91	17 67	4645 71	2 25
39 400	4676 35	1718493	2 714	25 73	17 54	4638 57	2 30
40 000	4668 89	1698696	2 768	25 47	17 37	4631 43	2 35
40 600	4661 37	1679164	2 823	25 56	17 43	4624 29	2 35
41 200	4653 87	1654206	2 823	25 40	17 32	4617 14	2 40
41 800	4646 40	1646643	2 878	25 16	17 16	4610 00	2 45
42 400	4638 93	1628885	2 878	24 94	17 00	4602 86	2 45

PROFILE OF CRESTS AND TIMES FOR ALMOST PRISMATIC
BELOW SIMPLIFIED TETON

RVR MILE FROM DAM	MAX ELEV (FT)	MAX FLOW (CFS)	TIME MAX ELEV(MR)	MAX VEL (FT/SEC)	MAX VEL (MI/HR)	FLOOD ELEV (FT)	TIME FLOOD ELEV (MR)
46 428	4631 49	1613311	2 934	24 81	16 92	4595 71	2 50
47 143	4624 06	1596189	2 990	24 80	16 91	4588 57	2 56
47 857	4616 50	1581998	2 990	24 61	16 78	4581 43	2 56
48 571	4608 50	1571958	3 047	24 71	16 85	4574 29	2 61
49 285	4599 54	1566259	3 047	25 49	17 38	4567 14	2 66
50 000	4583 02	1566687	2 990	30 97	21 12	4560 00	2 66

Appendix B

FLOW SIM 1 Successful Run

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.....
... PROGRAM FLOW SIM 1 ...
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.....

ANALYSIS FOR

HYPOTHETICAL PRISMATIC CHANNEL.
TETON RESERVOIR DATA

ANALYSIS PERFORMED BY

RALPH WURBS
WATERWAYS EXPERIMENT STATION
JULY 1984

PROCEDURES AND PROGRAM DEVELOPED BY

B. R. BOOINE, HYDRAULIC ENGINEER
U.S. ARMY CORPS OF ENGINEERS
1114 COMMERCE STREET
DALLAS, TEXAS 75242
PHONE (214) 767-2391 (FTS) 729-2391

DECEMBER 1983 EDITION

.....

 ... SUMMARY OF INPUT DATA ...

PARAMETER AND CONTROL CONSTANTS

PARAMETERS/CONSTANTS	UNITS	NOTATION	VALUE
SPATIAL STEP	FT	DELX	5280.00
MAXIMUM HYDRAULIC DEPTH	FT	HMAX	80.00
MANRINGS N-VALUE (CONSTANT)		CCON	0.000
SPATIAL DIMENSIONS		DIMEN	5280.00
SIMULATION TIME	HRS	YTIME	60.00
PRINT TIME INTERVAL	HRS	PTIME	0.25
TIME INTERVAL FOR BOUNDARY VALUES	HRS	RTIME	60.00
DOWNSREAM BOUNDARY CONTROL COEFFICIENT		CBOUND	0.00
RUN TIME CONTROL	HRS	TSUP	0.00
FACTOR FOR GROUND WATER FLOW		OFACF	0.000
NUMBER OF STREAMS		NU	1
NUMBER OF BARRIERS OR DAMS		KB	1
NUMBER OF EXPANSIONS		KE	0
NUMBER OF CONSTRICTIONS		KC	0
NUMBER OF LATERAL OUTFLOW LOCATIONS		LDM	0
OPTION FOR PRINTING CHANNEL DATA		IABC	0
PRINTOUT CONTROL		ISUP	0
LATERAL INFLOW INPUT OPTION		ITAPE	0
TAILWATER OPTION		ISUB	1
NUMBER OF LATERAL INFLOW LOCATIONS		LIM	0
TOTAL NUMBER OF Z OR Q NODES		MM	51
NUMBER OF RAW DATA STATIONS		ISTAN	6

CONTROL FOR DOWNSTREAM WATER LEVEL	ITT	0
OVERBANK STORAGE CONTROL	ISTOR	0
NUMBER OF RAW DATA IN VERTICAL FOR X-SEC	KDATA	3
CONTROL FOR RESERVOIR REGULATION	NREG	0
NUMBER OF RESERVOIR ELEVATIONS	KRES	0
NUMBER OF RESERVOIR STORAGE VALUES	IDATA	8
HYDROGRAPH PRINTING OPTION	IIID	0
FLOODED OR DRY BED INDICATOR	IDRY	0
NUMBER OF PLOTTING LOCATIONS	IPLOT	0
NUMBER OF DIVIDED FLOW CHANNELS	MCON	0
OPTION FOR PRINTING LAST Z AND Q VALUES	LAST	0
RATIO OPTION FOR UPSTREAM INFLOW VALUES	INFAC	0

TIME STEP (DELT) = 100.00 SEC

MAXIMUM I VALUE FOR EACH STREAM

51

TYPE OF BREACH OPTION

0

RESERVOIR, DAM AND BREACH PARAMETERS

SPILLWAY PARAMETERS - DAM NUMBER 1

SPILLWAY CREST ELEVATION *****	5301.70 FEET
DISCHARGE COEFFICIENT *****	0.00
SPILLWAY CREST WIDTH *****	0.00 FEET

RESERVOIR INITIAL CONDITIONS - DAM NUMBER 1

RESERVOIR STORAGE *****	252.200 (K AC-FT)
RESERVOIR INFLOW *****	3850.00 CFS
RESERVOIR OUTFLOW *****	30000.00 CFS

ELEVATION VS STORAGE - DAM NO. 1

RES EL (FEET)	STORAGE (K AC-FT)
5030.0	0.000
5075.0	0.750
5100.0	17.500
5150.0	51.000
5200.0	102.000
5250.0	167.000
5300.0	249.000
5320.0	286.000

DAM AND BREACH PARAMETERS - DAM NO. 1

DAM OR BARRIER LOCATION	50 (M-VALUE)
DAM OR BARRIER ELEVATION	5302. FEET
CRITICAL BREACH ELEVATION	5302. FEET
TOTAL BREACH TIME	3600. SEC
BREACH SECTION SLOPE	0.0000
WIDTH OF BOTTOM BREACH	100.0 FEET
WIDTH OF DAM	0. FEET
MINIMUM BREACH ELEVATION	5040. FEET

DATA STATION LOCATIONS IN MILES

0.0000	25.0000	40.0000	45.0000	50.0000	50.5000
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DATA STATION NUMBER 1 STATION MILE = 0.0000

HS	4530.0	4540.0	4740.0
RS	0.0	1000.0	1600.0
BSS	0.0	0.0	0.0
CHANN	0.0600	0.0600	0.0600

DATA STATION NUMBER 2 STATION MILE = 25.0000

HS	4780.0	4790.0	4990.0
RS	0.0	1000.0	1600.0
BSS	0.0	0.0	0.0
CHANN	0.0600	0.0600	0.0600

DATA STATION NUMBER 3 STATION MILE = 40.0000

HS 4930 0 4940 0 5140 0
BS 0 0 1000 0 1600 0
BSS 0 0 0 0 0 0
CMANN 0 0600 0 0600 0 0600

DATA STATION NUMBER 4 STATION MILE = 45.0000

HS 4980 0 4990 0 5190 0
BS 0 0 800 0 1400 0
BSS 0 0 0 0 0 0
CMANN 0 0600 0 0600 0 0600

DATA STATION NUMBER 5 STATION MILE = 50.0000

HS 5030 0 5040 0 5240 0
BS 0 0 800 0 1400 0
BSS 0 0 0 0 0 0
CMANN 0 0600 0 0500 0 0600

DATA STATION NUMBER 6 STATION MILE = 50.5000

HS 5035 0 5045 0 5245 0
BS 0 0 800 0 1400 0
BSS 0 0 0 0 0 0
CMANN 0 0600 0 0600 0 0600

BED ELEVATIONS

4530 00	4540 00	4550 00	4560 00	4570 00	4580 00	4590 00	4600 00	4610 00	4620 00
4630 00	4640 00	4650 00	4660 00	4670 00	4680 00	4690 00	4700 00	4710 00	4720 00
4730 00	4740 00	4750 00	4760 00	4770 00	4780 00	4790 00	4800 00	4810 00	4820 00
4930 00	4840 00	4850 00	4860 00	4870 00	4880 00	4890 00	4900 00	4910 00	4920 00
5030 00	4940 00	4950 00	4960 00	4970 00	4980 00	4990 00	5000 00	5010 00	5020 00

INITIAL WATER LEVELS

4530 00	4540 00	4550 00	4560 00	4570 00	4580 00	4590 00	4600 00	4610 00	4620 00
4630 00	4640 00	4650 00	4660 00	4670 00	4680 00	4690 00	4700 00	4710 00	4720 00
4730 00	4740 00	4750 00	4760 00	4770 00	4780 00	4790 00	4800 00	4810 00	4820 00
4830 00	4840 00	4850 00	4860 00	4870 00	4880 00	4890 00	4900 00	4910 00	4920 00
4930 00	4940 00	4950 00	4960 00	4970 00	4980 00	4990 00	5000 00	5010 00	5020 00

UPSTREAM BOUNDARY DISCHARGE IN CFS

3580 00	3580 00
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 SUMMARY OF OUTPUT DATA

RESERVOIR DEPLETION DATA FOR DAM NUMBER 1

TIME (HRS)	RES. ELEV. (FEET)	STORAGE (1000 AC-FT)	RES. INFLOW (CFS)	RES. OUTFLOW (CFS)	BREACH EL. (FEET)	EL. BELOW DAM (FEET)	OUTLET WKS. FLOW (CFS)	DAM OVERFLOW (CFS)
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DAM LOCATED AT NODE = 50 BEGAN TO BREACH AT NTIME = 2 OR HOUR = 0.056
 BREACH WIDTH = 100.00 FEET

DAM BREACHED BY UNIFORM TIME INCREMENT METHOD

NOTE *** DURING THE TIME OF DAM HEIGHT REDUCTION IN BREACH SECTION, RESERVOIR DEPLETION VALUES ARE PRINTED FOR EVERY TIME STEP

TIME (HRS)	RES. ELEV. (FEET)	STORAGE (1000 AC-FT)	RES. INFLOW (CFS)	RES. OUTFLOW (CFS)	BREACH EL. (FEET)	EL. BELOW DAM (FEET)	OUTLET WKS. FLOW (CFS)	DAM OVERFLOW (CFS)
0.06	5301.71	252.175	3580.	5880	5294.43	5020.00	0.	0.
0.08	5301.70	252.158	3580.	16631	5287.16	5020.31	0.	0.
0.11	5301.68	252.112	3580.	30554	5279.89	5020.80	0.	0.
0.14	5301.64	252.031	3580.	46993	5272.62	5021.47	0.	0.
0.17	5301.57	251.910	3580.	65571	5265.35	5027.96	0.	0.
0.19	5301.48	251.744	3580.	86036	5258.08	5030.07	0.	0.
0.22	5301.36	251.529	3580.	108199	5250.81	5032.05	0.	0.
0.25	5301.22	251.262	3580.	131899	5243.54	5034.35	0.	0.
0.28	5301.05	250.938	3580.	157016	5236.27	5036.74	0.	0.
0.31	5300.84	250.555	3580.	183446	5229.00	5039.32	0.	0.
0.33	5300.60	250.111	3580.	211072	5221.73	5041.86	0.	0.
0.36	5300.32	249.601	3580.	239814	5214.46	5044.26	0.	0.
0.39	5300.01	249.025	3580.	269617	5207.20	5046.40	0.	0.
0.42	5299.62	248.379	3580.	300387	5199.93	5050.16	0.	0.
0.44	5299.18	247.661	3580.	331861	5192.66	5052.93	0.	0.
0.47	5298.70	246.870	3580.	364181	5185.39	5055.96	0.	0.
0.50	5298.17	246.004	3580.	397233	5178.12	5058.53	0.	0.
0.53	5297.60	245.062	3580.	431010	5170.85	5060.25	0.	0.
0.56	5296.97	244.041	3580.	465450	5163.58	5061.61	0.	0.
0.58	5296.30	242.940	3580.	500491	5156.31	5063.20	0.	0.
0.61	5295.58	241.759	3580.	536134	5149.04	5064.91	0.	0.
0.64	5294.81	240.494	3580.	572280	5141.77	5066.88	0.	0.
0.67	5293.99	239.147	3580.	608937	5134.50	5068.98	0.	0.

0 63	5293 12	237 714	3580	646027	5127 23	5071 23	0	0
0 72	5292 19	236 196	3580	683563	5119 96	5073 30	0	0
0 75	5291 21	234 592	3580	721469	5112 69	5075 04	0	0
0 78	5290 18	232 900	3580	759716	5105 42	5076 65	0	0
0 81	5289 09	231 119	3580	798299	5098 15	5078 31	0	0
0 83	5287 96	229 250	3580	837168	5090 88	5080 08	0	0
0 86	5286 76	227 292	3580	876321	5083 61	5081 94	0	0
0 89	5285 52	225 262	3580	899286	5076 34	5083 81	0	0
0 92	5284 25	223 183	3580	918962	5069 07	5085 21	0	0
0 94	5282 96	221 059	3580	938698	5061 80	5086 40	0	0
0 97	5281 64	218 890	3580	958013	5054 54	5087 52	0	0
1 00	5280 29	216 677	3580	976769	5047 27	5088 64	0	0
1 25	5268 27	196 958	3580	918191	5040 00	5091 78	0	0
1 50	5257 13	178 790	3580	849267	5040 00	5090 32	0	0
1 75	5246 12	161 355	3580	786167	5040 00	5088 02	0	0
2 00	5234 22	146 493	3580	719097	5040 00	5085 15	0	0
2 25	5223 33	132 331	3580	660083	5040 00	5082 27	0	0
2 50	5213 32	119 319	3580	607563	5040 00	5079 53	0	0
2 75	5204 10	107 332	3580	560633	5040 00	5076 95	0	0
3 00	5194 40	96 288	3580	513524	5040 00	5074 45	0	0
3 25	5184 56	86 253	3580	466033	5040 00	5071 78	0	0
3 50	5175 62	77 137	3580	424493	5040 00	5069 23	0	0
3 75	5167 48	68 826	3580	387833	5040 00	5066 88	0	0
4 00	5160 03	61 230	3580	355344	5040 00	5064 72	0	0
4 25	5153 20	54 266	3580	326431	5040 00	5062 71	0	0
4 50	5145 36	47 890	3580	295239	5040 00	5060 75	0	0
4 75	5136 90	42 224	3580	261381	5040 00	5058 41	0	0
5 00	5129 40	37 200	3580	232787	5040 00	5056 17	0	0
5 25	5122 72	32 724	3580	208331	5040 00	5054 14	0	0
5 50	5116 74	26 716	3580	187226	5040 00	5052 31	0	0
5 75	5111 36	25 115	3580	168939	5040 00	5050 65	0	0
6 00	5106 52	21 867	3580	152999	5040 00	5049 14	0	0
6 25	5102 13	18 927	3580	139025	5040 00	5047 79	0	0
6 50	5098 14	16 258	3580	126736	5040 00	5046 55	0	0
6 75	5094 52	13 828	3580	115876	5040 00	5045 47	0	0
7 00	5091 21	11 609	3580	106252	5040 00	5044 37	0	0
7 25	5088 16	9 578	3580	97697	5040 00	5043 41	0	0
7 50	5085 39	7 714	3580	90049	5040 00	5042 54	0	0
7 75	5082 63	6 000	3580	83185	5040 00	5041 73	0	0
8 00	5080 48	4 420	3580	77031	5040 00	5040 98	0	0
8 25	5078 30	2 960	3580	71483	5040 29	5040 29	0	0
8 50	5076 29	1 612	3580	66155	5040 00	5039 63	0	0
8 75	5056 73	0 446	3580	29696	5040 00	5038 61	0	0
9 00	5046 75	0 279	3580	5640	5040 00	5032 54	0	0
9 25	5045 54	0 259	3580	3969	5040 00	5029 09	0	0
9 50	5045 29	0 255	3580	3661	5040 00	5027 09	0	0
10 00	5045 23	0 254	3580	3597	5040 00	5026 69	0	0
10 25	5045 22	0 254	3580	3585	5040 00	5026 69	0	0
10 50	5045 22	0 254	3580	3581	5040 00	5026 69	0	0
10 75	5045 22	0 254	3580	3581	5040 00	5026 69	0	0
11 00	5045 22	0 254	3580	3581	5040 00	5026 69	0	0
11 25	5045 22	0 254	3580	3581	5040 00	5026 69	0	0
11 50	5045 22	0 254	3580	3581	5040 00	5026 69	0	0
12 00	5045 22	0 254	3580	3581	5040 00	5026 69	0	0
12 25	5045 22	0 254	3580	3581	5040 00	5026 69	0	0
12 50	5045 22	0 254	3580	3581	5040 00	5026 69	0	0
13 00	5045 22	0 254	3580	3581	5040 00	5026 69	0	0
13 25	5045 22	0 254	3580	3581	5040 00	5026 69	0	0

59 25	5045.22	0.254	3580	3577	5010.00	5026.69	0.
59 50	5045.22	0.254	3580	3581	5040.00	5026.69	0.
59 75	5045.22	0.254	3580	3581	5040.00	5026.69	0.
60 00	5045.22	0.254	3580	3581	5040.00	5026.69	0.

MAXIMUM COMPUTED WATER SURFACE ELEVATIONS AND FLOWS

STREAM NUMBER 1

NOOF	STATION (MI)	BED ELEV (FT)	MAX W.S. ELEV(FT)	STAGE (FT)	TIME-MAX ELEV(HRS)	MAX FLOW (CFS)	MAX VEL (FT/SEC)
51	50.0	5030.00	5301.71	271.71	0.03	3580	0.00
50	49.0	5020.00	5091.80	71.80	1.22	995096	0.00
49	48.0	5010.00	5081.07	71.07	1.31	962621	17.08
48	47.0	5000.00	5070.23	70.23	1.36	931032	17.04
47	46.0	4990.00	5059.12	69.12	1.50	910190	17.07
46	45.0	4980.00	5047.21	67.21	1.53	897773	17.98
45	44.0	4970.00	5035.27	65.27	1.58	889723	19.48
44	43.0	4960.00	5023.3	63.37	1.72	880887	20.83
43	42.0	4950.00	5011.77	61.77	1.78	871822	21.52
42	41.0	4940.00	5000.46	60.46	1.92	855458	21.43
41	40.0	4930.00	4989.86	59.86	2.06	846374	21.85
40	39.0	4920.00	4979.49	59.49	2.11	834016	21.49
39	38.0	4910.00	4969.11	59.11	2.14	826702	20.71
38	37.0	4900.00	4958.72	58.72	2.31	813658	21.50
37	36.0	4890.00	4948.36	58.36	2.36	807710	21.09
36	35.0	4880.00	4938.02	58.02	2.53	791722	20.30
35	34.0	4870.00	4927.67	57.67	2.58	783749	20.34
34	33.0	4860.00	4917.34	57.34	2.72	776191	20.01
33	32.0	4850.00	4907.01	57.01	2.81	764985	20.02
32	31.0	4840.00	4896.69	56.69	2.94	759327	20.18
31	30.0	4830.00	4886.38	56.38	3.00	748290	19.94

30	29 0	4820.00	4876.07	56.07	3.14	742176.	19.71
29	28 0	4810.00	4865.77	55.77	3.22	732862.	19.67
28	27 0	4800.00	4855.48	55.48	3.33	725771.	19.23
27	26 0	4790.00	4845.19	55.19	3.42	718191.	19.30
26	25 0	4780.00	4834.91	54.91	3.53	710813.	18.95
25	24 0	4770.00	4824.63	54.63	3.61	704247	18.93
24	23 0	4760.00	4814.37	54.37	3.75	697235	18.75
23	22 0	4750.00	4804.10	54.10	3.83	690448	18.60
22	21 0	4740.00	4793.83	53.83	3.94	684439.	18.76
21	20 0	4730.00	4783.57	53.57	4.06	677363.	18.29
20	19 0	4720.00	4773.32	53.32	4.14	671259.	18.54
19	18 0	4710.00	4763.07	53.07	4.25	665715.	18.41
18	17 0	4700.00	4752.82	52.82	4.36	659206.	18.01
17	16 0	4690.00	4742.57	52.57	4.47	653535.	18.31
16	15 0	4680.00	4732.33	52.33	4.56	648092.	18.04
15	14 0	4670.00	4722.09	52.09	4.67	642071.	17.63
14	13 0	4660.00	4711.86	51.86	4.78	636472	17.94
13	12 0	4650.00	4701.63	51.63	4.89	630977.	17.90
12	11 0	4640.00	4691.40	51.40	5.00	625754.	17.20
11	10 0	4630.00	4681.17	51.17	5.08	620889.	17.60
10	9 0	4620.00	4670.95	50.95	5.19	615392.	17.66
9	8 0	4610.00	4660.73	50.73	5.31	610479.	17.56
8	7 0	4600.00	4650.51	50.51	5.42	605256	17.26
7	6 0	4590.00	4640.29	50.29	5.50	600384.	16.75
6	5 0	4580.00	4630.05	50.05	5.61	595361.	17.05
5	4 0	4570.00	4619.87	49.87	5.75	590812.	17.11
4	3 0	4560.00	4609.76	49.76	5.83	585045.	17.04
3	2 0	4550.00	4599.73	49.73	5.92	579419	16.93
2	1 0	4540.00	4589.73	49.73	5.94	576238	16.34
1	0 0	4530.00	4579.73	49.73	5.94	575028.	15.66

Appendix C

FLOW SIM 1 Unsuccessful Run

.....

 ... PROGRAM FLOW SIM 1 ...
 ...

ANALYSIS FOR

HYPOTHETICAL PRISMATIC CHANNEL
 TETON RESERVOIR DATA

ANALYSIS PERFORMED BY

RALPH WURBS
 WATERWAYS EXPERIMENT STATION
 JULY 1984

PROCEDURES AND PROGRAM DEVELOPED BY

B. R. BOONE, HYDRAULIC ENGINEER
 U. S. ARMY CORPS OF ENGINEERS
 1114 COMMERCE STREET
 DALLAS, TEXAS 75242
 PHONE (214) 767-1391 (FTS) 729-2391

DECEMBER 1981 EDITION

.....
 SUMMARY OF INPUT DATA

PARAMETER AND CONTROL CONSTANTS

PARAMETERS/CONSTANTS	UNITS	NOTATION	VALUE
SPATIAL STEP	FT	DELX	1056.00
MAXIMUM HYDRAULIC DEPTH	FT	HMAX	80.00
MANNINGS N-VALUE (CONSTANT)		CCCN	0.000
SPATIAL DIMENSIONS		DIMEN	5280.00
SIMULATION TIME	HRS	TTIME	50.00
PRINT TIME INTERVAL	HRS	PTIME	0.25
TIME INTERVAL FOR BOUNDARY VALUES	HRS	RTIME	60.00
DOWNSTREAM BOUNDARY CONTROL COEFFICIENT		CBOUND	0.00
RUN TIME CONTROL	HRS	TSUP	0.00
FACTOR FOR GROUND WATER FLOW		QFACT	0.000
NUMBER OF STREAMS		NJ	1
NUMBER OF BARRIERS OR DAMS		KB	1
NUMBER OF EXPANSIONS		KE	0
NUMBER OF CONSTRICTIONS		KC	0
NUMBER OF LATERAL OUTFLOW LOCATIONS		LOM	0
OPTION FOR PRINTING CHANNEL DATA		IABC	0
PRINTOUT CONTROL		ISUP	0
LATERAL INFLOW INPUT OPTION		ITAPE	0
TAILWATER OPTION		ISUB	1
NUMBER OF LATERAL INFLOW LOCATIONS		LIM	0
TOTAL NUMBER OF Z OR Q NODES	MM	MM	251
NUMBER OF RAW DATA STATIONS		ISTAM	6

CONTROL FOR DOWNSTREAM WATER LEVEL	ITT	0
OVERRIDE STORAGE CONTROL	ISTOR	0
NUMBER OF RAW DATA IN VERTICAL FOR X-SEC	KDATA	3
CONTROL FOR RESERVOIR REGULATION	NREG	0
NUMBER OF RESERVOIR ELEVATIONS	KRES	0
NUMBER OF RESERVOIR STORAGE VALUES	IDATA	8
HYDROGRAPH PRINTING OPTION	IHYD	0
FLOODED OR DRY BED INDICATOR	IRY	0
NUMBER OF PLOTTING LOCATIONS	IPLOT	0
NUMBER OF DIVIDED FLOW CHANNELS	MCON	0
OPTION FOR PRINTING LAST Z AND Q VALUES	LAST	0
RATIO OPTION FOR UPSTREAM INFLOW VALUES	INFAC	0

TIME STEP (DEL.T) = 20.00 SEC

MAXIMUM I VALUE FOR EACH STREAM

251

TYPE OF BREACH OPTION

0

RESERVOIR, DAM AND BREACH PARAMETERS

SPILLWAY PARAMETERS - DAM NUMBER 1	
SPILLWAY CREST ELEVATION	5301.70 FEET
DISCHARGE COEFFICIENT	0.00
SPILLWAY CREST WIDTH	0.00 FEET
RESERVOIR INITIAL CONDITIONS - DAM NUMBER 1	
RESERVOIR STORAGE	252.200 (K AC-FT)
RESERVOIR INFLOW	3850.00 CFS
RESERVOIR OUTFLOW	30000.00 CFS

ELEVATION VS STORAGE - DAM NO. 1

RES. EL. (FEET)	STORAGE (K AC-FT)
5030.0	0.000
5075.0	0.750
5100.0	17.500
5150.0	51.000
5200.0	102.000
5250.0	167.000
5300.0	249.000
5320.0	286.000

DAM AND BREACH PARAMETERS - DAM NO. 1

DAM OR BARRIER LOCATION *** 250 (M-VALUE)
 DAM OR BARRIER ELEVATION *** 5302. FEET
 CRITICAL BREACH ELEVATION ** 5302. FEET
 TOTAL BREACH TIME ***** 3600. SEC
 BREACH SECTION SLOPE ***** 0.0000
 WIDTH OF BOTTOM BREACH ***** 300.0 FEET
 WIDTH OF DAM ***** 0. FEET
 MINIMUM BREACH ELEVATION *** 5040. FEET

DATA STATION LOCATIONS IN MILES

0.0000 25.0000 40.0000 45.0000 50.0000 50.1000

DATA STATION NUMBER 1 STATION MILE = 0.0000

HS 4530.0 4540.0 4740.0
 BS 0.0 1000.0 1600.0
 BSS 0.0 0.0 0.0
 CMANN 0.0600 0.0600 0.0600

DATA STATION NUMBER 2 STATION MILE = 25.0000

HS 4780.0 4790.0 4990.0
 BS 0.0 1000.0 1600.0
 BSS 0.0 0.0 0.0
 CMANN 0.0600 0.0600 0.0600

DATA STATION NUMBER 3 STATION MILE = 40.0000

HS 4930 0 4940 0 5140 0
 BS 0 0 1000 0 1600 0
 BSS 0 0 0 0 0 0
 CMANN 0 0600 0 0600 0 0600

DATA STATION NUMBER 4 STATION MILE = 45.0000

HS 4980 0 4990 0 5190 0
 BS 0 0 800 0 1400 0
 BSS 0 0 0 0 0 0
 CMANN 0 0600 0 0600 0 0600

DATA STATION NUMBER 5 STATION MILE = 50.0000

HS 5030 0 5040 0 5240 0
 BS 0 0 800 0 1400 0
 BSS 0 0 0 0 0 0
 CMANN 0 0600 0 0600 0 0600

DATA STATION NUMBER 6 STATION MILE = 50.1000

HS 5031 0 5011 0 5241 0
 BS 0 0 800 0 1400 0
 BSS 0 0 0 0 0 0
 CMANN 0 0600 0 0600 0 0600

BED ELEVATIONS

4530 00	4532 00	4536 00	4538 00	4540 00	4542 00	4544 00	4546 00	4548 00
4550 00	4552 00	4556 00	4558 00	4560 00	4562 00	4564 00	4566 00	4568 00
4570 00	4572 00	4576 00	4578 00	4580 00	4582 00	4584 00	4586 00	4588 00
4590 00	4592 00	4596 00	4598 00	4600 00	4602 00	4604 00	4606 00	4608 00
4610 00	4612 00	4616 00	4618 00	4620 00	4622 00	4624 00	4626 00	4628 00
4630 00	4632 00	4636 00	4638 00	4640 00	4642 00	4644 00	4646 00	4648 00
4650 00	4652 00	4656 00	4658 00	4660 00	4662 00	4664 00	4666 00	4668 00
4670 00	4672 00	4676 00	4678 00	4680 00	4682 00	4684 00	4686 00	4688 00
4690 00	4692 00	4696 00	4698 00	4700 00	4702 00	4704 00	4706 00	4708 00
4710 00	4712 00	4716 00	4718 00	4720 00	4722 00	4724 00	4726 00	4728 00
4730 00	4732 00	4736 00	4738 00	4740 00	4742 00	4744 00	4746 00	4748 00

4750 00	4752 00	4754 00	4756 00	4758 00	4760 00	4762 00	4764 00	4766 00	4768 00
4770 00	4772 00	4774 00	4776 00	4778 00	4780 00	4782 00	4784 00	4786 00	4788 00
4790 00	4792 00	4794 00	4796 00	4798 00	4800 00	4802 00	4804 00	4806 00	4808 00
4810 00	4812 00	4814 00	4816 00	4818 00	4820 00	4822 00	4824 00	4826 00	4828 00
4830 00	4832 00	4834 00	4836 00	4838 00	4840 00	4842 00	4844 00	4846 00	4848 00
4850 00	4852 00	4854 00	4856 00	4858 00	4860 00	4862 00	4864 00	4866 00	4868 00
4870 00	4872 00	4874 00	4876 00	4878 00	4880 00	4882 00	4884 00	4886 00	4888 00
4890 00	4892 00	4894 00	4896 00	4898 00	4900 00	4902 00	4904 00	4906 00	4908 00
4910 00	4912 00	4914 00	4916 00	4918 00	4920 00	4922 00	4924 00	4926 00	4928 00
4930 00	4932 00	4934 00	4936 00	4938 00	4940 00	4942 00	4944 00	4946 00	4948 00
4950 00	4952 00	4954 00	4956 00	4958 00	4960 00	4962 00	4964 00	4966 00	4968 00
4970 00	4972 00	4974 00	4976 00	4978 00	4980 00	4982 00	4984 00	4986 00	4988 00
4990 00	4992 00	4994 00	4996 00	4998 00	5000 00	5002 00	5004 00	5006 00	5008 00
5010 00	5012 00	5014 00	5016 00	5018 00	5020 00	5022 00	5024 00	5026 00	5028 00

INITIAL WATER LEVELS

4530 00	4532 00	4534 00	4536 00	4538 00	4540 00	4542 00	4544 00	4546 00	4548 00
4550 00	4552 00	4554 00	4556 00	4558 00	4560 00	4562 00	4564 00	4566 00	4568 00
4570 00	4572 00	4574 00	4576 00	4578 00	4580 00	4582 00	4584 00	4586 00	4588 00
4590 00	4592 00	4594 00	4596 00	4598 00	4600 00	4602 00	4604 00	4606 00	4608 00
4610 00	4612 00	4614 00	4616 00	4618 00	4620 00	4622 00	4624 00	4626 00	4628 00
4630 00	4632 00	4634 00	4636 00	4638 00	4640 00	4642 00	4644 00	4646 00	4648 00
4650 00	4652 00	4654 00	4656 00	4658 00	4660 00	4662 00	4664 00	4666 00	4668 00
4670 00	4672 00	4674 00	4676 00	4678 00	4680 00	4682 00	4684 00	4686 00	4688 00
4690 00	4692 00	4694 00	4696 00	4698 00	4700 00	4702 00	4704 00	4706 00	4708 00
4710 00	4712 00	4714 00	4716 00	4718 00	4720 00	4722 00	4724 00	4726 00	4728 00
4730 00	4732 00	4734 00	4736 00	4738 00	4740 00	4742 00	4744 00	4746 00	4748 00
4750 00	4752 00	4754 00	4756 00	4758 00	4760 00	4762 00	4764 00	4766 00	4768 00
4770 00	4772 00	4774 00	4776 00	4778 00	4780 00	4782 00	4784 00	4786 00	4788 00
4790 00	4792 00	4794 00	4796 00	4798 00	4800 00	4802 00	4804 00	4806 00	4808 00
4810 00	4812 00	4814 00	4816 00	4818 00	4820 00	4822 00	4824 00	4826 00	4828 00
4830 00	4832 00	4834 00	4836 00	4838 00	4840 00	4842 00	4844 00	4846 00	4848 00
4850 00	4852 00	4854 00	4856 00	4858 00	4860 00	4862 00	4864 00	4866 00	4868 00
4870 00	4872 00	4874 00	4876 00	4878 00	4880 00	4882 00	4884 00	4886 00	4888 00
4890 00	4892 00	4894 00	4896 00	4898 00	4900 00	4902 00	4904 00	4906 00	4908 00
4910 00	4912 00	4914 00	4916 00	4918 00	4920 00	4922 00	4924 00	4926 00	4928 00
4930 00	4932 00	4934 00	4936 00	4938 00	4940 00	4942 00	4944 00	4946 00	4948 00
4950 00	4952 00	4954 00	4956 00	4958 00	4960 00	4962 00	4964 00	4966 00	4968 00
4970 00	4972 00	4974 00	4976 00	4978 00	4980 00	4982 00	4984 00	4986 00	4988 00
4990 00	4992 00	4994 00	4996 00	4998 00	5000 00	5002 00	5004 00	5006 00	5008 00
5010 00	5012 00	5014 00	5016 00	5018 00	5020 00	5022 00	5024 00	5026 00	5028 00

UPSTREAM BOUNDARY DISCHARGE IN CFS

3580 00 3580 00

CAUTION --- WATER LEVEL EXCEEDED SPECIFIED CHANNEL DEPTH. BANK ELEVATIONS WERE INCREASED IN VERTICAL TO OBTAIN SUFFICIENT CROSS SECTIONAL AREA FOR THE CALCULATIONS.

NOTE ---- EXECUTION OF THE PROGRAM IS TERMINATED BECAUSE OF AN INSTABILITY IN THE CALCULATIONS INPUT DATA SHOULD BE CHECKED FOR POSSIBLE ERRORS AND IF NONE ARE FOUND IT MAY BE NECESSARY TO INCREASE EITHER IMAX OR THE MANNINGS N-VALUES.

NTIME = 103 HOUR = 0.5722 M = 241

RESERVOIR DEPLETION DATA FOR DAM NUMBER 1

DAM LOCATED AT NODE = 250 BEGAN TO BREACH AT TIME = 2 OR HOUR = 0 011
BREACH WIDTH = 300 00 FEET

DAM BREACHED BY UNIFORM TIME INCREMENT METHOD

NOTE ... DURING THE TIME OF DAM HEIGHT REDUCTION IN BREACH SECTION, RESERVOIR DEPLETION VALUES ARE PRINTED FOR EVERY TIME STEP

C9

0 14	5301 30	251 420	3580	182718	5266 80	5050 96	0
0 14	5301 26	251 336	3580	194020	5265 35	5051 76	0
0 15	5301 21	251 245	3580	205516	5263 90	5052 59	0
0 16	5301 16	251 150	3580	217259	5262 44	5053 45	0
0 16	5301 11	251 049	3580	229113	5260 99	5054 33	0
0 17	5301 05	250 943	3580	241222	5259 54	5055 22	0
0 17	5301 99	250 831	3580	253462	5258 08	5056 09	0
0 18	5300 43	250 713	3580	265901	5256 63	5056 92	0
0 18	5300 86	250 589	3580	278518	5255 17	5057 70	0
0 19	5300 79	250 450	3580	291260	5253 72	5058 46	0
0 19	5300 71	250 325	3580	304207	5252 27	5059 22	0
0 20	5300 64	250 184	3580	317266	5250 81	5060 00	0
0 21	5300 56	250 037	3580	330469	5249 36	5060 82	0
0 21	5300 48	249 883	3580	343888	5247 90	5061 56	0
0 22	5300 39	249 724	3580	357407	5246 45	5062 50	0
0 22	5300 30	249 558	3580	371059	5245 00	5063 32	0
0 23	5300 21	249 386	3580	384841	5243 54	5064 09	0
0 23	5300 11	249 208	3580	398748	5242 09	5064 84	0
0 24	5300 01	249 023	3580	412820	5240 63	5065 57	0
0 24	5299 89	248 832	3580	427013	5239 18	5066 33	0
0 25	5299 77	248 634	3580	441156	5237 73	5067 17	0
0 26	5299 65	248 430	3580	455410	5236 27	5067 94	0
0 26	5299 52	248 219	3580	469815	5234 82	5068 73	0
0 27	5299 39	248 002	3580	484325	5233 36	5069 50	0
0 27	5299 25	247 778	3580	498895	5231 91	5070 23	0
0 28	5299 11	247 547	3580	513565	5230 46	5070 96	0
0 28	5298 97	247 309	3580	528331	5229 00	5071 69	0
0 29	5298 82	247 065	3580	543192	5227 55	5072 45	0
0 29	5298 66	246 813	3580	558145	5226 09	5073 23	0
0 30	5298 51	246 555	3580	573186	5224 64	5073 99	0
0 31	5298 35	246 290	3580	588315	5223 19	5074 72	0
0 31	5298 18	246 018	3580	603529	5221 73	5075 45	0
0 32	5298 01	245 739	3580	618779	5220 28	5076 17	0
0 32	5297 84	245 451	3580	634154	5218 82	5076 89	0
0 33	5297 66	245 160	3580	649608	5217 37	5077 62	0
0 33	5297 47	244 860	3580	665090	5215 92	5078 37	0
0 34	5297 29	244 552	3580	680645	5214 46	5079 11	0
0 34	5297 09	244 238	3580	696271	5213 01	5079 83	0
0 35	5296 90	243 916	3580	711966	5211 56	5080 53	0
0 36	5296 70	243 587	3580	727777	5210 10	5081 22	0
0 36	5296 49	243 251	3580	743605	5208 65	5081 92	0
0 37	5296 28	242 907	3580	759446	5207 20	5082 65	0
0 37	5296 07	242 557	3580	775327	5205 74	5083 39	0
0 38	5295 85	242 198	3580	791359	5204 29	5084 11	0
0 38	5295 63	241 832	3580	807427	5202 83	5084 78	0
0 39	5295 40	241 460	3580	823501	5201 38	5085 44	0
0 39	5295 17	241 080	3580	839629	5199 93	5086 13	0
0 40	5294 93	240 692	3580	855757	5198 47	5086 86	0
0 41	5294 69	240 297	3580	871927	5197 02	5087 58	0
0 41	5294 45	239 895	3580	888265	5195 56	5088 24	0
0 42	5294 20	239 485	3580	904539	5194 11	5088 88	0
0 42	5293 94	239 067	3580	920857	5192 66	5089 55	0
0 43	5293 68	238 642	3580	937219	5191 20	5090 29	0
0 43	5293 42	238 209	3580	953621	5189 75	5090 98	0
0 44	5293 15	237 769	3580	970066	5188 29	5091 60	0
0 44	5292 88	237 322	3580	986495	5186 84	5092 23	0
0 45	5292 60	236 867	3580	1003015	5185 39	5092 95	0
0 45	5292 32	236 404	3580	1019517	5183 93	5093 68	0
0 46	5292 03	235 934	3580	1035998	5182 48	5094 29	0
0 47	5291 74	235 456	3580	1052622	5181 02	5094 84	0
0 47	5291 44	234 970	3580	1069167	5179 57	5095 53	0

0 48	529: 14	234 47	3580	1085741	5178 12	5096 35	0
0 48	5290 84	233 976	3580	1107744	5176 66	5097 01	0
0 49	5290 53	233 468	3580	1118973	5175 21	5097 43	0
0 49	5290 21	232 952	3580	1135685	5173 75	5097 99	0
0 50	5289 89	232 428	3580	1152309	5172 30	5098 89	0
0 51	5289 57	231 897	3580	1169012	5170 85	5099 72	0
0 51	5289 24	231 358	3580	1185681	5169 39	5100 09	0
0 52	5288 91	230 811	3580	1202369	5167 94	5100 53	0
0 52	5288 57	230 257	3580	1219076	5166 48	5101 55	0
0 53	5288 23	229 695	3580	1235801	5165 03	5102 53	0
0 53	5287 88	229 125	3580	1250484	5163 58	5102 70	0
0 54	5287 53	228 548	3580	1269183	5162 12	5103 26	0
0 54	5287 17	227 963	3580	1285896	5160 67	5104 50	0
0 55	5286 81	227 370	3580	1302623	5159 22	5105 42	0
0 56	5286 44	226 770	3580	1319361	5157 76	5105 07	0
0 56	5286 07	226 112	3580	1336049	5156 31	5105 77	0
0 57	5285 70	225 546	3580	1352746	5154 86	5107 57	0

IFY2171 VS105 - END OF DATA SET. FILE U3

IFY9001 VERRM-EXECUTION TERMINATING DUE TO ERROR COUNT FOR ERROR NUMBER 217

TRACEBACK OF CALLING ROUTINES: MODULE ENTRY ADDRESS=00105428
 IFVVS105(00134708) CALLED BY IFVCOMH(00125678) AT ISN ** OFFSET (000934)
 NO ARGUMENTS PASSED TO SUBROUTINE
 IFVCOMH(00125678) CALLED BY VSCOM# (00127498) AT ISN ** OFFSET (000272)
 NO ARGUMENTS PASSED TO SUBROUTINE
 VSCOM# (00127498) CALLED BY XOUTPU (00120F00) AT ISN ** OFFSET (000C06)
 NO ARGUMENTS PASSED TO SUBROUTINE
 XOUTPU (00120F00) CALLED BY MAIN (00105428) AT ISN 14 OFFSET (00021C)
 NO ARGUMENTS PASSED TO SUBROUTINE
 MAIN (00105428) CALLED BY (OP/SYS)

MESSAGE SUMMARY MESSAGE NUMBER - COUNT

217 1

Appendix D

FLOW SIM 2 Unsuccessful Run

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... PROGRAM FLOW SIM 2 ...
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.....
.....

ANALYSIS FOR

HYPOTHETICAL PRISMATIC CHANNEL
TETON RESERVOIR DATA

ANALYSIS PERFORMED BY

RALPH WIRBS
WATERWAYS EXPERIMENT STATION
JULY 1984

PROCEDURES AND PROGRAM DEVELOPED BY

B R BODINE, HYDRAULIC ENGINEER
U S ARMY CORPS OF ENGINEERS
1114 COMMERCE STREET
DALLAS, TEXAS 75242
PHONE (214) 767-2391 (FIS) 729-2391

DECEMBER 1983 EDITION

.....
 ...
 ... SUMMARY OF INPUT DATA ...
 ...

PARAMETER AND CONTROL CONSTANTS

PARAMETERS/CONSTANTS	UNITS	NOTATION	VALUE
SPATIAL STEP	FT	DELY	1056.00
MAXIMUM HYDRAULIC DEPTH	FT	HMAX	80.00
MANNINGS N-VALUE (CONSTANT)		CCON	0.0000
SPATIAL DIMENSIONS		DIMEN	5280.00
SIMULATION TIME	HRS	TTIME	60.00
PRINT TIME INTERVAL	HRS	PTIME	0.25
TIME INTERVAL FOR BOUNDARY VALUES	HRS	RTIME	60.00
DOWNSREAM BOUNDARY CONTROL COEFFICIENT		CBOUNO	0.00
RUN TIME CONTROL	HRS	TSUP	0.00
NUMBER OF STREAMS		NJ	1
NUMBER OF BARRIERS OR DAMS		KB	1
NUMBER OF EXPANSIONS		KE	0
NUMBER OF CONSTRUCTIONS		KC	0
NUMBER OF LATERAL OUTFLOW LOCATIONS		LOM	0
OPTION FOR PRINTING CHANNEL DATA		IARC	0
PRINTOUT CONTROL		ISUP	C
LATERAL INFLOW INPUT OPTION		ITAPE	0
RAILWATER OPTION		ISUB	1
TIME FOR INCREASING TIME STEP		TCH	0.00
NUMBER OF LATERAL INFLOW LOCATIONS		LIM	0
TOTAL NUMBER OF Z OR Q NODES		MM	251
NUMBER OF RAW DATA STATIONS		ISTAM	6

CONTROL FOR DOWNSTREAM WATER LEVEL	ITT	0
OVERBANK STORAGE CONTROL	ISTOR	0
NUMBER OF RAW DATA IN VERTICAL FOR X-SEC	KDATA	3
CONTROL FOR RESERVOIR REGULATION	NREG	0
NUMBER OF RESERVOIR ELEVATIONS	KRES	0
NUMBER OF RESERVOIR STORAGE VALUES	IDATA	8
HYDROGRAPH PRINTING OPTION	IHYD	0
FLOODED OR DRY BED INDICATOR	IDRY	0
NUMBER OF PLOTTING LOCATIONS	IPLOT	0
NUMBER OF DIVIDED FLOW CHANNELS	MCON	0
ON FOR PRINTING LAST Z AND Q VALUES	LST	0
R 10 OPTION FOR UPSTREAM INFLOW VALUES	INFAC	0

TIME STEP (DELTA) = 20.00 SEC

MAXIMUM I VALUE FOR EACH STREAM

251

TYPE OF BREACH OPTION

0

RESERVOIR, DAM AND BREACH PARAMETERS

SPILLWAY PARAMETERS - DAM NUMBER 1	
SPILLWAY CREST ELEVATION	5301.70 FEET
DISCHARGE COEFFICIENT	0.00
SPILLWAY CREST WIDTH	0.00 FEET
RESERVOIR INITIAL CONDITIONS - DAM NUMBER 1	
RESERVOIR STORAGE	252.200 (K AC-FT)
RESERVOIR INFLOW	3850.00 CFS
RESERVOIR OUTFLOW	30000.00 CFS

ELEVATION VS STORAGE - DAM NO. 1

RES. FL. (FEET)	STORAGE (K AC-FT)
5030 0	0 000
5075 0	0 750
5120 0	17 500
5150 0	51 000
5200 0	102 000
5250 0	167 000
5300 0	249 000
5320 0	286 000

DAM AND BREACH PARAMETERS - DAM NO. 1

DAM OR BARRIER LOCATION	250 (M-VALUE)
DAM OR BARRIER ELEVATION	5302 FEET
CRITICAL BREACH ELEVATION	5302 FEET
TOTAL BREACH TIME	7200 SEC
BREACH SECTION SLOPE	0 0000
WIDTH OF BOTTOM BREACH	100 0 FEET
WIDTH OF DAM	0 FEET
MINIMUM BREACH ELEVATION	5040 FEET

DATA STATION LOCATIONS IN MILES

0 0000	25 0000	40 0000	45 0000	50 0000	50 5000
--------	---------	---------	---------	---------	---------

DATA STATION NUMBER 1 STATION MILE = 0 0000

HS	4530 0	4540 0	4740 0
BS	0 0	1000 0	1600 0
BSS	0 0	0 0	0 0
CHANN	0 0600	0 0600	0 0600

DATA STATION NUMBER 2 STATION MILE = 25 0000

HS	4780 0	4790 0	4990 0
BS	0 0	1000 0	1600 0
BSS	0 0	0 0	0 0
CHANN	0 0600	0 0600	0 0600

DATA STATION NUMBER 3 STATION MILE = 40.0000

HS 4930 0 4910 0 5140 0
BS 0 0 1000 0 1600 0
BSS 0 0 0 0 0 0
CMANN 0 0600 0 0600 0 0600

DATA STATION NUMBER 4 STATION MILE = 45.0000

HS 4980 0 4990 0 5190 0
BS 0 0 800 0 1400 0
BSS 0 0 0 0 0 0
CMANN 0 0600 0 0600 0 0600

DATA STATION NUMBER 5 STATION MILE = 50.0000

HS 5030 0 5040 0 5240 0
BS 0 0 800 0 1400 0
BSS 0 0 0 0 0 0
CMANN 0 0600 0 0600 0 0600

DATA STATION NUMBER 6 STATION MILE = 50.5000

HS 5035 0 5015 0 5345 0
BS 0 0 800 0 1700 0
BSS 0 0 0 0 0 0
CMANN 0 0600 0 0600 0 0600

BED ELEVATIONS

4530 00	4532 00	4514 00	4536 00	4538 00	4540 00	4542 00	4541 00	4546 00	4548 00
4550 00	4552 00	4554 00	4556 00	4558 00	4560 00	4562 00	4564 00	4566 00	4568 00
4570 00	4572 00	4574 00	4576 00	4578 00	4580 00	4582 00	4584 00	4586 00	4588 00
4590 00	4592 00	4594 00	4596 00	4598 00	4600 00	4602 00	4604 00	4606 00	4608 00
4610 00	4612 00	4614 00	4616 00	4618 00	4620 00	4622 00	4624 00	4626 00	4628 00
4630 00	4632 00	4634 00	4636 00	4638 00	4640 00	4642 00	4644 00	4646 00	4648 00
4650 00	4652 00	4654 00	4656 00	4658 00	4660 00	4662 00	4664 00	4666 00	4668 00
4670 00	4672 00	4674 00	4676 00	4678 00	4680 00	4682 00	4684 00	4686 00	4688 00
4690 00	4692 00	4694 00	4696 00	4698 00	4700 00	4702 00	4704 00	4706 00	4708 00
4710 00	4712 00	4714 00	4716 00	4718 00	4720 00	4722 00	4724 00	4726 00	4728 00
4730 00	4732 00	4734 00	4736 00	4738 00	4740 00	4742 00	4744 00	4746 00	4748 00

4750 00	4752 00	4754 00	4756 00	4758 00	4760 00	4762 00	4764 00	4766 00	4768 00
4770 00	4772 00	4774 00	4776 00	4778 00	4780 00	4782 00	4784 00	4786 00	4788 00
4790 00	4792 00	4794 00	4796 00	4798 00	4800 00	4802 00	4804 00	4806 00	4808 00
4810 00	4812 00	4814 00	4816 00	4818 00	4820 00	4822 00	4824 00	4826 00	4828 00
4830 00	4832 00	4834 00	4836 00	4838 00	4840 00	4842 00	4844 00	4846 00	4848 00
4850 00	4852 00	4854 00	4856 00	4858 00	4860 00	4862 00	4864 00	4866 00	4868 00
4870 00	4872 00	4874 00	4876 00	4878 00	4880 00	4882 00	4884 00	4886 00	4888 00
4890 00	4892 00	4894 00	4896 00	4898 00	4900 00	4902 00	4904 00	4906 00	4908 00
4910 00	4912 00	4914 00	4916 00	4918 00	4920 00	4922 00	4924 00	4926 00	4928 00
4930 00	4932 00	4934 00	4936 00	4938 00	4940 00	4942 00	4944 00	4946 00	4948 00
4950 00	4952 00	4954 00	4956 00	4958 00	4960 00	4962 00	4964 00	4966 00	4968 00
4970 00	4972 00	4974 00	4976 00	4978 00	4980 00	4982 00	4984 00	4986 00	4988 00
4990 00	4992 00	4994 00	4996 00	4998 00	5000 00	5002 00	5004 00	5006 00	5008 00
5010 00	5012 00	5014 00	5016 00	5018 00	5020 00	5022 00	5024 00	5026 00	5028 00

INITIAL WATER LEVELS

4530 00	4532 00	4534 00	4536 00	4538 00	4540 00	4542 00	4544 00	4546 00	4548 00
4550 00	4552 00	4554 00	4556 00	4558 00	4560 00	4562 00	4564 00	4566 00	4568 00
4570 00	4572 00	4574 00	4576 00	4578 00	4580 00	4582 00	4584 00	4586 00	4588 00
4590 00	4592 00	4594 00	4596 00	4598 00	4600 00	4602 00	4604 00	4606 00	4608 00
4610 00	4612 00	4614 00	4616 00	4618 00	4620 00	4622 00	4624 00	4626 00	4628 00
4630 00	4632 00	4634 00	4636 00	4638 00	4640 00	4642 00	4644 00	4646 00	4648 00
4650 00	4652 00	4654 00	4656 00	4658 00	4660 00	4662 00	4664 00	4666 00	4668 00
4670 00	4672 00	4674 00	4676 00	4678 00	4680 00	4682 00	4684 00	4686 00	4688 00
4690 00	4692 00	4694 00	4696 00	4698 00	4700 00	4702 00	4704 00	4706 00	4708 00
4710 00	4712 00	4714 00	4716 00	4718 00	4720 00	4722 00	4724 00	4726 00	4728 00
4730 00	4732 00	4734 00	4736 00	4738 00	4740 00	4742 00	4744 00	4746 00	4748 00
4750 00	4752 00	4754 00	4756 00	4758 00	4760 00	4762 00	4764 00	4766 00	4768 00
4770 00	4772 00	4774 00	4776 00	4778 00	4780 00	4782 00	4784 00	4786 00	4788 00
4790 00	4792 00	4794 00	4796 00	4798 00	4800 00	4802 00	4804 00	4806 00	4808 00
4810 00	4812 00	4814 00	4816 00	4818 00	4820 00	4822 00	4824 00	4826 00	4828 00
4830 00	4832 00	4834 00	4836 00	4838 00	4840 00	4842 00	4844 00	4846 00	4848 00
4850 00	4852 00	4854 00	4856 00	4858 00	4860 00	4862 00	4864 00	4866 00	4868 00
4870 00	4872 00	4874 00	4876 00	4878 00	4880 00	4882 00	4884 00	4886 00	4888 00
4890 00	4892 00	4894 00	4896 00	4898 00	4900 00	4902 00	4904 00	4906 00	4908 00
4910 00	4912 00	4914 00	4916 00	4918 00	4920 00	4922 00	4924 00	4926 00	4928 00
4930 00	4932 00	4934 00	4936 00	4938 00	4940 00	4942 00	4944 00	4946 00	4948 00
4950 00	4952 00	4954 00	4956 00	4958 00	4960 00	4962 00	4964 00	4966 00	4968 00
4970 00	4972 00	4974 00	4976 00	4978 00	4980 00	4982 00	4984 00	4986 00	4988 00
4990 00	4992 00	4994 00	4996 00	4998 00	5000 00	5002 00	5004 00	5006 00	5008 00
5010 00	5012 00	5014 00	5016 00	5018 00	5020 00	5022 00	5024 00	5026 00	5028 00

UPSTREAM BOUNDARY DISCHARGE IN CFS

3580 00 3580 00

NOTE ---- EXECUTION OF THE PROGRAM IS TERMINATED BECAUSE OF AN INSTABILITY IN THE CALCULATIONS
 INPUT DATA SHOULD BE CHECKED FOR POSSIBLE ERRORS AND IF NONE ARE FOUND IT MAY BE NECESSARY
 TO INCREASE EITHER TMAX OR THE MANNINGS N-VALUES
 NTIME = 2 1 HOUR = 0 1167 M = 241

.....
 ...
 ... SUMMARY OF OUTPUT DATA ...
 ...

RESERVOIR DEPLETION DATA FOR DAM NUMBER 1

TIME (HRS)	RES. ELEV (FEET)	STORAGE (1000 AC FT)	RES. INFLOW (CFS)	RES. OUTFLOW (CFS)	BREACH EL (FEET)	EL. BELOW DAM (FEET)	OUTLET WKS FLOW (CFS)	DAM OVERFLOW (CFS)
---------------	---------------------	-------------------------	----------------------	-----------------------	---------------------	-------------------------	--------------------------	-----------------------

DAM LOCATED AT NODE = 250 BEGAN TO BREACH AT NTIME = 2 OR HOUR = 0.011
 BREACH WIDTH = 100.00 FEET

DAM BREACHED BY UNIFORM TIME INCREMENT METHOD

NOTE: *** DURING THE TIME OF DAM HEIGHT REDUCTION IN BREACH SECTION, RESERVOIR DEPLETION VALUES ARE PRINTED FOR EVERY TIME STEP

TIME (HRS)	RES. ELEV (FEET)	STORAGE (1000 AC FT)	RES. INFLOW (CFS)	RES. OUTFLOW (CFS)	BREACH EL (FEET)	EL. BELOW DAM (FEET)	OUTLET WKS FLOW (CFS)	DAM OVERFLOW (CFS)
---------------	---------------------	-------------------------	----------------------	-----------------------	---------------------	-------------------------	--------------------------	-----------------------

0.01	5301.73	252.194	1790	187	5300.97	5028.00	0	0
0.02	5301.73	252.196	3580	528	5300.24	5013.79	0	0
0.03	5301.73	252.197	3580	958	5299.52	5013.79	0	0
0.04	5301.73	252.198	3580	1489	5298.79	5014.85	0	0
0.05	5301.73	252.199	3580	2081	5298.06	5019.60	0	0
0.06	5301.73	252.199	3580	2734	5297.34	5038.20	0	0
0.07	5301.73	252.199	3580	3445	5296.61	5037.50	0	0
0.08	5301.73	252.199	3580	4208	5295.88	5017.27	0	0
0.09	5301.73	252.199	3580	5021	5295.16	5037.32	0	0
0.10	5301.73	252.198	3580	5880	5294.43	5037.45	0	0
0.11	5301.73	252.196	3580	6788	5293.70	5037.60	0	0
0.12	5301.73	252.195	3580	7734	5292.97	5037.75	0	0
0.13	5301.72	252.192	3580	8719	5292.25	5037.87	0	0
0.14	5301.72	252.190	3580	9744	5291.52	5037.96	0	0
0.15	5301.72	252.186	3580	10805	5290.79	5038.03	0	0
0.16	5301.72	252.183	3580	11903	5290.07	5038.07	0	0
0.17	5301.71	252.179	3580	13035	5289.34	5038.11	0	0
0.18	5301.71	252.174	3580	14201	5288.61	5038.14	0	0
0.19	5301.71	252.169	3580	15400	5287.89	5038.18	0	0

IF 2171 VS105 - END OF DATA SET, FILE U3
 ERROR FOUND IN PROGRAM XOUTPU (OFFSET 00004E) AT ISN 52

IFV9001 VERM-EXECUTION TERMINATING DUE TO ERROR COUNT FOR ERROR NUMBER 217

TRACEBACK OF CALLING ROUTINES: MODULE ENTRY ADDRESS:00105000
IFV5105(00139148) CALLED BY IFV5000H(00132F80) AT 15N ** OFFSET (000962)
NO ARGUMENTS PASSED TO SUBROUTINE
IFV5000H(00132F80) CALLED BY VSCOM# (0012C3B8) AT 15N ** OFFSET (000272)
NO ARGUMENTS PASSED TO SUBROUTINE
VSCOM# (0012C3B8) CALLED BY XOUTPU (00125348) AT 15N ** OFFSET (00004E)
NO ARGUMENTS PASSED TO SUBROUTINE
XOUTPU (00125348) CALLED BY MAIN (00105000) AT 15N 14 OFFSET (000298)
NO ARGUMENTS PASSED TO SUBROUTINE
MAIN (00105000) CALLED BY (DP/SYS)

MESSAGE SUMMARY: MESSAGE NUMBER - COUNT

217 1

Appendix E

HEC-1 Base Run

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.....
* FLOOD HYDROGRAPH PACKAGE (HEC-1)
* FEBRUARY 1981
* REVISED 30 OCT 81
* RUN DATE 05/18/84 TIME 13:26
* .....

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.....
* U S ARMY CORPS OF ENGINEERS
* THE HYDROLOGIC ENGINEERING CENTER
* 609 SECOND STREET
* DAVIS, CALIFORNIA 95616
* (916) 440-3285 OR (FIS) 448-3285
* .....

```

```

X X XXXXXX XXXX X
X X X X X
X X X X X
XXXXXX XXXX X
X X X X X
X X X X X
X X XXXXXX XXXX
X X

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THIS PROGRAM REPLACES ALL PREVIOUS VERSIONS OF HEC-1 KNOWN AS HEC1 (JAN 73), HEC1G, HEC1DB, AND HEC1KW
 THE DEFINITIONS OF VARIABLES -RTIMP- AND -RTIOR- HAVE CHANGED FROM THOSE USED WITH THE 1973-STYLE INPUT STRUCTURE.
 THE DEFINITION OF -AMSKK- ON RM-CARD WAS CHANGED WITH REVISIONS DATED 28 SEP 81. SEE SEPTEMBER 1981 INPUT
 DESCRIPTION FOR NEW DEFINITIONS.

HEC-1 INPUT

LINE	1	2	3	4	5	6	7	8	9	10
1	ID	1								
2	ID	2								
3	ID	3								
4	ID	4								
5	ID	5								
6	KK	01	TETON DAM							
7	BA	850.								
8	Q1	3580.								
9	RS	1	ELEV	5301.7	0					
10	SV	500.	750.	17500.	51000.	102000.	167000.	249000.	286000.	
11	SE	5040.	5075.	5100.	5150.	5200.	5250.	5300.	5320.	
12	SO	3570.	3570.	3570.	3570.	3570.	3570.	3570.	3570.	
13	SI	5301.7	0.	3.08	1.5					
14	SB	5040.	500.	0.0	1.	5301.7				
15	KK	RCH1								
16	RS	4	FLOW	3580.	0					
17	RC	.040	.040	39600.	.001894	5200.				
18	RX	0.	0.	300.	700.	1100.	1400.			
19	RY	5203.5	5203.5	5202.5	5002.5	4992.5	5002.5	5202.5	5204.5	
20	KK	RCH2								
21	RS	5	FLOW	3580.	0					
22	RC	.040	.040	39600.	.001894	5030.				
23	RX	0.	0.	300.	800.	1300.	1600.			
24	RY	5129.5	5128.5	5127.5	4927.5	4917.5	4927.5	5127.5	5129.5	
25	KK	RCH3								
26	RS	7	FLOW	3580.	0					
27	RC	.040	.040	52850.	.001894	4930.				
28	RX	0.	0.	300.	800.	1300.	1600.			
29	RY	5042.	5041.	5040.	4840.	4830.	4840.	5040.	5042.	
30	KK	RCH4								
31	RS	8	FLOW	3580.	0					
32	RC	.040	.040	52800.	.001894	4830.				
33	RX	0.	0.	300.	800.	1300.	1600.			
34	RY	4942.	4941.	4940.	4740.	4730.	4740.	4940.	4942.	
35	KK	RCH5								
36	RS	13	FLOW	3580.	0					
37	RC	.040	.040	79200.	.001894	4805.				
38	RX	0.	0.	300.	800.	1200.	1600.			
39	RY	4817.	4816.	4815.	4615.	4605.	4615.	4815.	4917.	
40	ZZ									

```

.....
* FLOOD HYDROGRAPH PACKAGE (HEC-1)
* FEBRUARY 1981
* REVISED 30 OCT 81
* RUN DATE 05/18/84 TIME 13:26
*
.....
* U S ARMY CORPS OF ENGINEERS
* THE HYDROLOGIC ENGINEERING CENTER
* 609 SECOND STREET
* DAVIS, CALIFORNIA 95616
* (916) 440-3285 OR (FIS) 448-3285
*
.....

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SIMPLIFIED TETON - ALMOST PRISMATIC
WATERWAYS EXPERIMENT STATION
RALPH WURDS MARCH 1984

```

5 10 OUTPUT CONTROL VARIABLES
    IPRT 0 PRINT CONTROL
    IPLOT 0 PLOT CONTROL
    QSCAL 0 HYDROGRAPH PLOT SCALE

```

```

IT HYDROGRAPH TIME DATA
  NMIN 4 MINUTES IN COMPUTATION INTERVAL
  IDATE 1 0 STARTING DATE
  ITIME 0000 STARTING TIME
  NO 300 NUMBER OF HYDROGRAPH ORDINATES
  NODATE 1 0 ENDING DATE
  NDTIME 1956 ENDING TIME

```

```

COMPUTATION INTERVAL 0.07 HOURS
TOTAL TIME BASE 19.93 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

```

```

... ..

```

```

6 KK
    O1
    TETON DAM

```

```

9 RS STORAGE ROUTING
    NSTPS 1 NUMBER OF SUBREACHES
    ITYP ELEV TYPE OF INITIAL CONDITION
    RSVRIC 5301.70 INITIAL CONDITION
    X 0.0 WORKING R AND D COEFFICIENT

```

10 SV	STORAGE	500.0	750.0	17500.0	51000.0	102000.0	167000.0	249000.0	286000.0
11 SE	ELEVATION	5040.00	5075.00	5100.00	5150.00	5200.00	5250.00	5300.00	5320.00
12 SW	DISCHARGE	3570.	3570.	3570.	3570.	3570.	3570.	3570.	3570.
13 ST	TOP OF DAM TOPEL DAMWID COOD EXPD	5301.70 0.0 3.08 1.50	ELEVATION AT TOP OF DAM DAM WIDTH WEIR COEFFICIENT EXPONENT OF HEAD						
14 SB	BREACH DATA ELBM BRWID Z TFAIL FAILEL	5040.00 500.00 0.0 1.00 5301.70	ELEVATION AT BOTTOM OF BREACH WIDTH OF BREACH BOTTOM BREACH SIDE SLOPE TIME FOR BREACH TO DEVELOP W.S. ELEVATION TO TRIGGER FAILURE						

...

BEGIN DAM FAILURE AT 0.0 HOURS

HYDROGRAPH AT STATION 01

DA	MON	HR	MIN	ORD	STAGE	STORAGE	OUTFLOW	DA	MON	HR	MIN	ORD	STAGE	STORAGE	OUTFLOW	STAGE
1	0000	1			5301.7	252143.5	3570	1	0640	101			5040.0	500.0	3570	5040.0
1	0004	2			5301.7	252100.2	3570	1	0644	102			5040.0	500.0	3570	5040.0
1	0008	3			5301.6	251948.4	3570	1	0648	103			5040.0	500.0	3570	5040.0
1	0012	4			5301.4	251500.4	3570	1	0652	104			5040.0	500.0	3570	5040.0
1	0016	5			5300.8	250532.0	3570	1	0656	105			5040.0	500.0	3570	5040.0
1	0020	6			5299.9	248756.5	3570	1	0700	106			5040.0	500.0	3570	5040.0
1	0024	7			5298.1	245905.7	3570	1	0704	107			5040.0	500.0	3570	5040.0
1	0028	8			5295.6	241703.2	3570	1	0708	108			5040.0	500.0	3570	5040.0
1	0032	9			5292.0	235873.6	3570	1	0712	109			5040.0	500.0	3570	5040.0
1	0036	10			5287.3	228179.7	3570	1	0716	110			5040.0	500.0	3570	5040.0
1	0040	11			5281.3	218410.1	3570	1	0720	111			5040.0	500.0	3570	5040.0
1	0044	12			5274.0	206430.4	3570	1	0724	112			5040.0	500.0	3570	5040.0
1	0048	13			5265.3	192131.7	3570	1	0728	113			5040.0	500.0	3570	5040.0
1	0052	14			5255.2	175488.2	3570	1	0732	114			5040.0	500.0	3570	5040.0
1	0056	15			5242.0	156574.6	3570	1	0736	115			5040.0	500.0	3570	5040.0
1	0100	16			5226.0	135845.7	3570	1	0740	116			5040.0	500.0	3570	5040.0
1	0104	17			5210.5	115644.9	3570	1	0744	117			5040.0	500.0	3570	5040.0
1	0108	18			5196.0	97889.7	3570	1	0748	118			5040.0	500.0	3570	5040.0
1	0112	19			5180.9	82540.2	3570	1	0752	119			5040.0	500.0	3570	5040.0
1	0116	20			5167.9	69308.2	3570	1	0756	120			5040.0	500.0	3570	5040.0
1	0120	21			5156.7	57817.3	3570	1	0800	121			5040.0	500.0	3570	5040.0
1	0124	22			5145.2	47814.9	3570	1	0804	122			5040.0	500.0	3570	5040.0
1	0128	23			5132.8	39453.0	3570	1	0808	123			5040.0	500.0	3570	5040.0
1	0132	24			5122.4	32488.6	3570	1	0812	124			5040.0	500.0	3570	5040.0
1	0136	25			5113.6	26631.4	3570	1	0816	125			5040.0	500.0	3570	5040.0
1	0140	26			5106.2	21651.5	3570	1	0820	126			5040.0	500.0	3570	5040.0
1	0144	27			5099.8	17392.7	3570	1	0824	127			5040.0	500.0	3570	5040.0
1	0148	28			5094.4	13715.5	3570	1	0828	128			5040.0	500.0	3570	5040.0
1	0152	29			5089.6	10517.3	3570	1	0832	129			5040.0	500.0	3570	5040.0

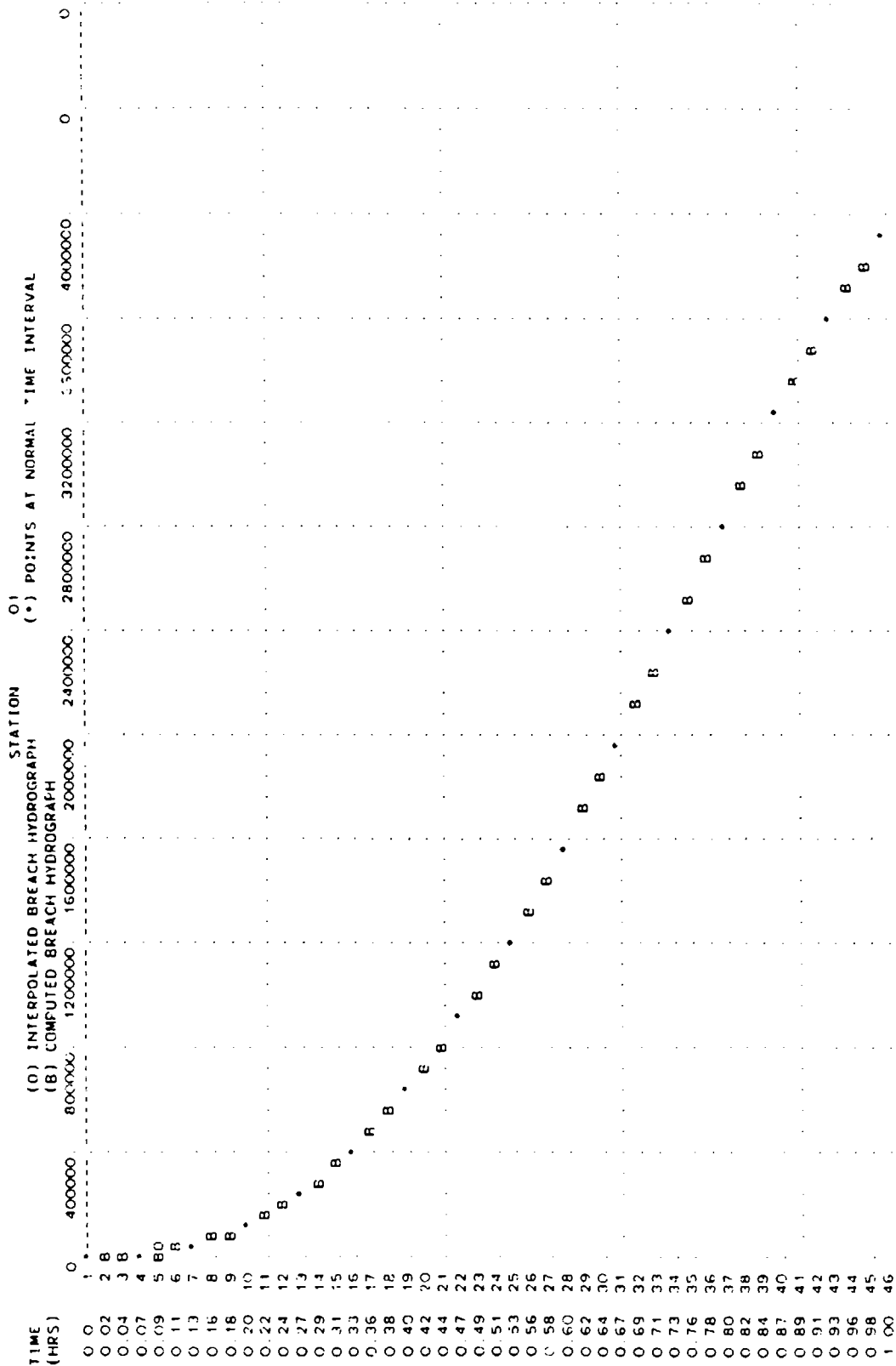
1	0156	30	474697	7719 6	5085 4 *	1	0836 130	3570	500 0	5040 0 *	1	1516 230	3570	500 0	5040 0
1	0200	31	418716	5259 4	5081 7 *	1	0840 131	3570	500 0	5040 0 *	1	1520 231	3570	500 0	5040 0
1	0204	32	371231	3084 5	5076 5 *	1	0844 132	3570	500 0	5040 0 *	1	1524 232	3570	500 0	5040 0
1	0208	33	330649	1150 4	5075 6 *	1	0848 133	3570	500 0	5040 0 *	1	1528 233	3570	500 0	5040 0
1	0212	34	3570	500 0	5040 0 *	1	0852 134	3570	500 0	5040 0 *	1	1532 234	3570	500 0	5040 0
1	0216	35	3570	500 0	5040 0 *	1	0856 135	3570	500 0	5040 0 *	1	1536 235	3570	500 0	5040 0
1	0220	36	3570	500 0	5040 0 *	1	0900 136	3570	500 0	5040 0 *	1	1540 236	3570	500 0	5040 0
1	0224	37	3570	500 0	5040 0 *	1	0904 137	3570	500 0	5040 0 *	1	1544 237	3570	500 0	5040 0
1	0228	38	3570	500 0	5040 0 *	1	0908 138	3570	500 0	5040 0 *	1	1548 238	3570	500 0	5040 0
1	0232	39	3570	500 0	5040 0 *	1	0912 139	3570	500 0	5040 0 *	1	1552 239	3570	500 0	5040 0
1	0236	40	3570	500 0	5040 0 *	1	0916 140	3570	500 0	5040 0 *	1	1556 240	3570	500 0	5040 0
1	0240	41	3570	500 0	5040 0 *	1	0920 141	3570	500 0	5040 0 *	1	1600 241	3570	500 0	5040 0
1	0244	42	3570	500 0	5040 0 *	1	0924 142	3570	500 0	5040 0 *	1	1604 242	3570	500 0	5040 0
1	0248	43	3570	500 0	5040 0 *	1	0928 143	3570	500 0	5040 0 *	1	1608 243	3570	500 0	5040 0
1	0252	44	3570	500 0	5040 0 *	1	0932 144	3570	500 0	5040 0 *	1	1612 244	3570	500 0	5040 0
1	0256	45	3570	500 0	5040 0 *	1	0936 145	3570	500 0	5040 0 *	1	1616 245	3570	500 0	5040 0
1	0300	46	3570	500 0	5040 0 *	1	0940 146	3570	500 0	5040 0 *	1	1620 246	3570	500 0	5040 0
1	0304	47	3570	500 0	5040 0 *	1	0944 147	3570	500 0	5040 0 *	1	1624 247	3570	500 0	5040 0
1	0308	48	3570	500 0	5040 0 *	1	0948 148	3570	500 0	5040 0 *	1	1628 248	3570	500 0	5040 0
1	0312	49	3570	500 0	5040 0 *	1	0952 149	3570	500 0	5040 0 *	1	1632 249	3570	500 0	5040 0
1	0316	50	3570	500 0	5040 0 *	1	0956 150	3570	500 0	5040 0 *	1	1636 250	3570	500 0	5040 0
1	0320	51	3570	500 0	5040 0 *	1	1000 151	3570	500 0	5040 0 *	1	1640 251	3570	500 0	5040 0
1	0324	52	3570	500 0	5040 0 *	1	1004 152	3570	500 0	5040 0 *	1	1644 252	3570	500 0	5040 0
1	0328	53	3570	500 0	5040 0 *	1	1008 153	3570	500 0	5040 0 *	1	1648 253	3570	500 0	5040 0
1	0332	54	3570	500 0	5040 0 *	1	1012 154	3570	500 0	5040 0 *	1	1652 254	3570	500 0	5040 0
1	0336	55	3570	500 0	5040 0 *	1	1016 155	3570	500 0	5040 0 *	1	1656 255	3570	500 0	5040 0
1	0340	56	3570	500 0	5040 0 *	1	1020 156	3570	500 0	5040 0 *	1	1700 256	3570	500 0	5040 0
1	0344	57	3570	500 0	5040 0 *	1	1024 157	3570	500 0	5040 0 *	1	1704 257	3570	500 0	5040 0
1	0348	58	3570	500 0	5040 0 *	1	1028 158	3570	500 0	5040 0 *	1	1708 258	3570	500 0	5040 0
1	0352	59	3570	500 0	5040 0 *	1	1032 159	3570	500 0	5040 0 *	1	1712 259	3570	500 0	5040 0
1	0356	60	3570	500 0	5040 0 *	1	1036 160	3570	500 0	5040 0 *	1	1716 260	3570	500 0	5040 0
1	0400	61	3570	500 0	5040 0 *	1	1040 161	3570	500 0	5040 0 *	1	1720 261	3570	500 0	5040 0
1	0404	62	3570	500 0	5040 0 *	1	1044 162	3570	500 0	5040 0 *	1	1724 262	3570	500 0	5040 0
1	0408	63	3570	500 0	5040 0 *	1	1048 163	3570	500 0	5040 0 *	1	1728 263	3570	500 0	5040 0
1	0412	64	3570	500 0	5040 0 *	1	1052 164	3570	500 0	5040 0 *	1	1732 264	3570	500 0	5040 0
1	0416	65	3570	500 0	5040 0 *	1	1056 165	3570	500 0	5040 0 *	1	1736 265	3570	500 0	5040 0
1	0420	66	3570	500 0	5040 0 *	1	1100 166	3570	500 0	5040 0 *	1	1740 266	3570	500 0	5040 0
1	0424	67	3570	500 0	5040 0 *	1	1104 167	3570	500 0	5040 0 *	1	1744 267	3570	500 0	5040 0
1	0428	68	3570	500 0	5040 0 *	1	1108 168	3570	500 0	5040 0 *	1	1748 268	3570	500 0	5040 0
1	0432	69	3570	500 0	5040 0 *	1	1112 169	3570	500 0	5040 0 *	1	1752 269	3570	500 0	5040 0
1	0436	70	3570	500 0	5040 0 *	1	1116 170	3570	500 0	5040 0 *	1	1756 270	3570	500 0	5040 0
1	0440	71	3570	500 0	5040 0 *	1	1120 171	3570	500 0	5040 0 *	1	1800 271	3570	500 0	5040 0
1	0444	72	3570	500 0	5040 0 *	1	1124 172	3570	500 0	5040 0 *	1	1804 272	3570	500 0	5040 0
1	0448	73	3570	500 0	5040 0 *	1	1128 173	3570	500 0	5040 0 *	1	1808 273	3570	500 0	5040 0
1	0452	74	3570	500 0	5040 0 *	1	1132 174	3570	500 0	5040 0 *	1	1812 274	3570	500 0	5040 0
1	0456	75	3570	500 0	5040 0 *	1	1136 175	3570	500 0	5040 0 *	1	1816 275	3570	500 0	5040 0
1	0500	76	3570	500 0	5040 0 *	1	1140 176	3570	500 0	5040 0 *	1	1820 276	3570	500 0	5040 0
1	0504	77	3570	500 0	5040 0 *	1	1144 177	3570	500 0	5040 0 *	1	1824 277	3570	500 0	5040 0
1	0508	78	3570	500 0	5040 0 *	1	1148 178	3570	500 0	5040 0 *	1	1828 278	3570	500 0	5040 0
1	0512	79	3570	500 0	5040 0 *	1	1152 179	3570	500 0	5040 0 *	1	1832 279	3570	500 0	5040 0
1	0516	80	3570	500 0	5040 0 *	1	1156 180	3570	500 0	5040 0 *	1	1836 280	3570	500 0	5040 0
1	0520	81	3570	500 0	5040 0 *	1	1200 181	3570	500 0	5040 0 *	1	1840 281	3570	500 0	5040 0
1	0524	82	3570	500 0	5040 0 *	1	1204 182	3570	500 0	5040 0 *	1	1844 282	3570	500 0	5040 0
1	0528	83	3570	500 0	5040 0 *	1	1208 183	3570	500 0	5040 0 *	1	1848 283	3570	500 0	5040 0
1	0532	84	3570	500 0	5040 0 *	1	1212 184	3570	500 0	5040 0 *	1	1852 284	3570	500 0	5040 0
1	0536	85	3570	500 0	5040 0 *	1	1216 185	3570	500 0	5040 0 *	1	1856 285	3570	500 0	5040 0
1	0540	86	3570	500 0	5040 0 *	1	1220 186	3570	500 0	5040 0 *	1	1900 286	3570	500 0	5040 0
1	0544	87	3570	500 0	5040 0 *	1	1224 187	3570	500 0	5040 0 *	1	1904 287	3570	500 0	5040 0
1	0548	88	3570	500 0	5040 0 *	1	1228 188	3570	500 0	5040 0 *	1	1908 288	3570	500 0	5040 0
1	0552	89	3570	500 0	5040 0 *	1	1232 189	3570	500 0	5040 0 *	1	1912 289	3570	500 0	5040 0
1	0556	90	3570	500 0	5040 0 *	1	1236 190	3570	500 0	5040 0 *	1	1916 290	3570	500 0	5040 0

1	0600	91	3570	500 0	5040 0 *	1	1240 191	3570	500 0	5040 0 *	1	1920 291	3570	500 0	5040 0
1	0604	92	3570	500 0	5040 0 *	1	1244 192	3570	500 0	5040 0 *	1	1924 292	3570	500 0	5040 0
1	0608	93	3570	500 0	5040 0 *	1	1248 193	3570	500 0	5040 0 *	1	1928 293	3570	500 0	5040 0
1	0612	94	3570	500 0	5040 0 *	1	1252 194	3570	500 0	5040 0 *	1	1932 294	3570	500 0	5040 0
1	0616	95	3570	500 0	5040 0 *	1	1256 195	3570	500 0	5040 0 *	1	1936 295	3570	500 0	5040 0
1	0620	96	3570	500 0	5040 0 *	1	1300 196	3570	500 0	5040 0 *	1	1940 296	3570	500 0	5040 0
1	0624	97	3570	500 0	5040 0 *	1	1304 197	3570	500 0	5040 0 *	1	1944 297	3570	500 0	5040 0
1	0628	98	3570	500 0	5040 0 *	1	1308 198	3570	500 0	5040 0 *	1	1948 298	3570	500 0	5040 0
1	0632	99	3570	500 0	5040 0 *	1	1312 199	3570	500 0	5040 0 *	1	1952 299	3570	500 0	5040 0
1	0636	100	3570	500 0	5040 0 *	1	1316 200	3570	500 0	5040 0 *	1	1956 300	3570	500 0	5040 0

PEAK OUTFLOW IS 3911197 AT TIME 1 00 HOURS

THE DAM BREACH HYDROGRAPH WAS DEVELOPED USING A TIME INTERVAL OF 0.022 HOURS DURING BREACH FORMATION
 DOWNSTREAM CALCULATIONS WILL USE A TIME INTERVAL OF 0.067 HOURS
 THIS TABLE COMPARES THE HYDROGRAPH FOR DOWNSTREAM CALCULATIONS WITH THE COMPUTED BREACH HYDROGRAPH
 INTERMEDIATE FLOWS ARE INTERPOLATED FROM END-OF-PERIOD VALUES

TIME (HOURS)	TIME FROM BEGINNING OF BREACH (HOURS)	INTERPOLATED BREACH HYDROGRAPH (CFS)	COMPUTED BREACH HYDROGRAPH (CFS)	* (CFS)	ERROR (CFS)	ACCUMULATED ERROR (CFS)	ACCUMULATED ERROR (AC-FT)
0.0	0.0	3570	3570	0	0	0	0
0.022	0.022	6059	4050	2010	2010	2010	4
0.044	0.044	8549	6281	2267	2267	4277	8
0.067	0.067	11038	11038	0	0	4277	8
0.089	0.089	22593	18893	3700	3700	7977	15
0.111	0.111	34148	30309	3840	3840	11817	22
0.133	0.133	45703	45703	0	0	11817	22
0.156	0.156	70148	65420	4727	4727	16544	30
0.178	0.178	94592	89780	4812	4812	21356	39
0.200	0.200	119037	119037	0	0	21356	39
0.222	0.222	158677	153454	5413	5413	26769	49
0.244	0.244	198697	193230	5467	5467	32236	59
0.267	0.267	238527	238527	0	0	32236	59
0.289	0.289	295217	289469	5748	5748	37984	70
0.311	0.311	351907	346168	5739	5739	43724	80
0.333	0.333	408597	408597	0	0	43724	80
0.356	0.356	482299	476601	5698	5698	49422	91
0.378	0.378	556001	550324	5677	5677	55099	101
0.400	0.400	623703	623703	0	0	55099	101
0.422	0.422	720207	714751	5456	5456	60555	111
0.444	0.444	810711	805309	5402	5402	65957	121
0.467	0.467	901215	901215	0	0	65957	121
0.489	0.489	1007197	1007197	0	0	70836	130
0.511	0.511	1113178	1108337	4841	4841	75677	139
0.533	0.533	1219160	1219160	0	0	75677	139
0.556	0.556	1328581	1334506	4075	4075	79752	146
0.578	0.578	1458003	1454046	3957	3957	83709	154
0.600	0.600	1577425	1577425	0	0	83709	154
0.622	0.622	1707569	1704451	3118	3118	86827	159
0.644	0.644	1837714	1837714	0	0	89824	165
0.667	0.667	1967859	1967859	0	0	89824	165
0.689	0.689	2105578	2105578	0	0	91827	169
0.711	0.711	2243297	2243297	0	0	92745	172
0.733	0.733	2381017	2381017	0	0	93745	172
0.756	0.756	2522862	2522862	0	0	94546	174
0.778	0.778	2654707	2654707	0	0	95192	175
0.800	0.800	2806552	2806552	0	0	95192	175
0.822	0.822	2949164	2949164	0	0	94905	174
0.844	0.844	3091777	3091777	0	0	94905	174
0.867	0.867	3234390	3234390	0	0	94493	174
0.889	0.889	3358482	3358482	0	0	94493	174
0.911	0.911	3482575	3482575	0	0	94493	174
0.933	0.933	3606668	3606668	0	0	94493	174
0.956	0.956	3708177	3708177	0	0	94493	174
0.978	0.978	3809687	3811311	-3224	-3224	58141	107
1.000	1.000	3911197	3911197	0	0	54417	100



ELEVATION 5101 68 5112 60 5123 52 5134 43 5145 35 5156 27 5167 19 5178 11 5189 02 5199 94

HYDROGRAPH AT STATION RCH1

DA MON HRMP OPD	OUTFLOW	STORAGE	STAGE	DA MON HRMN OKD	OUTFLOW	STORAGE	STAGE	DA MON HRMN OKD	OUTFLOW	STORAGE	STAGE
1	3580	153 6	4994 1	1	4846	208 0	4994 6	1	3570	153 2	4994 1
2	3580	153 7	4994 1	1	4739	203 4	4994 6	1	3570	153 2	4994 1
3	3581	153 7	4994 1	1	4641	199 2	4994 5	1	3570	153 2	4994 1
4	3588	154 0	4994 1	1	4551	195 3	4994 5	1	3570	153 2	4994 1
5	3620	155 4	4994 1	1	4467	191 8	4994 4	1	3570	153 2	4994 1
6	3732	160 2	4994 1	1	4391	188 5	4994 4	1	3570	153 2	4994 1
7	4135	177 5	4994 3	1	4321	185 4	4994 4	1	3570	153 2	4994 1
8	5418	232 5	4994 9	1	4256	182 7	4994 4	1	3570	153 2	4994 1
9	10667	457 8	4997 1	1	4197	180 1	4994 3	1	3570	153 2	4994 1
10	29379	1150 3	5003 8	1	4142	177 6	4994 3	1	3570	153 2	4994 1
11	117857	2672 3	5012 0	1	4092	175 6	4994 3	1	3570	153 2	4994 1
12	329617	5204 4	5025 2	1	4046	173 7	4994 3	1	3570	153 2	4994 1
13	722815	8493 7	5041 3	1	4004	171 9	4994 2	1	3570	153 2	4994 1
14	1235528	12031 5	5057 9	1	3966	170 2	4994 2	1	3570	153 2	4994 1
15	1808591	15397 9	5072 9	1	3930	168 7	4994 2	1	3570	153 2	4994 1
16	2368123	18396 7	5085 7	1	3898	167 3	4994 2	1	3570	153 2	4994 1
17	2870427	20912 6	5096 1	1	3869	166 0	4994 2	1	3570	153 2	4994 1
18	3235665	22670 7	5103 2	1	3842	164 9	4994 2	1	3570	153 2	4994 1
19	3382228	23347 9	5105 8	1	3817	163 8	4994 2	1	3570	153 2	4994 1
20	3296351	22951 1	5104 3	1	3795	162 9	4994 1	1	3570	153 2	4994 1
21	3064470	21857 4	5099 9	1	3774	162 0	4994 1	1	3570	153 2	4994 1
22	2775061	20448 3	5094 2	1	3756	161 2	4994 1	1	3570	153 2	4994 1
23	2477389	18961 3	5088 0	1	3739	160 5	4994 1	1	3570	153 2	4994 1
24	2195662	17505 5	5081 9	1	3723	159 8	4994 1	1	3570	153 2	4994 1
25	1934894	16097 1	5075 9	1	3709	159 2	4994 1	1	3570	153 2	4994 1
26	1694756	14767 7	5070 1	1	3696	158 6	4994 1	1	3570	153 2	4994 1
27	1484835	13530 5	5064 6	1	3684	158 1	4994 1	1	3570	153 2	4994 1
28	1247216	12403 9	5059 6	1	3674	157 7	4994 1	1	3570	153 2	4994 1
29	1139728	11396 6	5055 0	1	3664	157 3	4994 1	1	3570	153 2	4994 1
30	1022695	10488 5	5050 8	1	3655	156 9	4994 1	1	3570	153 2	4994 1
31	842936	9695 2	5047 1	1	3647	156 5	4994 1	1	3570	153 2	4994 1
32	788365	8985 4	5043 7	1	3640	156 2	4994 1	1	3570	153 2	4994 1
33	701352	8332 7	5040 6	1	3633	155 9	4994 1	1	3570	153 2	4994 1
34	624727	7757 8	5037 8	1	3627	155 7	4994 1	1	3570	153 2	4994 1
35	557371	7272 9	5035 2	1	3622	155 4	4994 1	1	3570	153 2	4994 1
36	483280	6656 0	5032 4	1	3617	155 2	4994 1	1	3570	153 2	4994 1
37	425493	6056 4	5029 4	1	3612	155 0	4994 1	1	3570	153 2	4994 1
38	360576	5482 2	5026 5	1	3608	154 9	4994 1	1	3570	153 2	4994 1
39	307013	4950 3	5023 8	1	3605	154 7	4994 1	1	3570	153 2	4994 1
40	242207	4446 5	5021 2	1	3601	154 6	4994 1	1	3570	153 2	4994 1
41	221018	3983 4	5018 9	1	3598	154 4	4994 1	1	3570	153 2	4994 1
42	186142	3591 3	5016 8	1	3596	154 3	4994 1	1	3570	153 2	4994 1
43	157893	3273 6	5015 2	1	3593	154 2	4994 1	1	3570	153 2	4994 1
44	136950	3000 7	5013 8	1	3591	154 1	4994 1	1	3570	153 2	4994 1
45	121137	2745 9	5012 4	1	3589	154 0	4994 1	1	3570	153 2	4994 1
46	107925	2501 4	5011 1	1	3587	153 9	4994 1	1	3570	153 2	4994 1
47	94661	2273 3	5009 8	1	3585	153 9	4994 1	1	3570	153 2	4994 1
48	82569	2065 3	5008 7	1	3584	153 8	4994 1	1	3570	153 2	4994 1
49	71800	1880 0	5007 7	1	3582	153 8	4994 1	1	3570	153 2	4994 1
50	62415	1718 6	5006 9	1	3581	153 7	4994 1	1	3570	153 2	4994 1

1	0320	51	54263	1580	1	5006	1	1000	151	3580	153	7	4994	1	1640	251	3570	153	2	4994	1
1	0324	52	47521	1462	4	5005	5	1004	152	3579	153	6	4994	1	1644	252	3570	153	2	4994	1
1	0328	53	41728	1362	9	5005	0	1008	153	3578	153	5	4994	1	1648	253	3570	153	2	4994	1
1	0332	54	27026	1281	8	5004	5	1012	154	3577	153	5	4994	1	1652	254	3570	153	2	4994	1
1	0336	55	33327	1218	2	5004	2	1016	155	3577	153	5	4994	1	1656	255	3570	153	2	4994	1
1	0340	56	30371	1167	3	5003	3	1020	156	3576	153	5	4994	1	1700	256	3570	153	2	4994	1
1	0344	57	27954	1125	8	5003	7	1024	157	3575	153	5	4994	1	1704	257	3570	153	2	4994	1
1	0348	58	25928	1090	9	5003	5	1028	158	3575	153	4	4994	1	1708	258	3570	153	2	4994	1
1	0352	59	24690	1059	7	5003	2	1032	159	3574	153	4	4994	1	1712	259	3570	153	2	4994	1
1	0356	60	23565	1028	6	5002	9	1036	160	3574	153	4	4994	1	1716	260	3570	153	2	4994	1
1	0360	61	23216	996	4	5002	6	1040	161	3574	153	4	4994	1	1720	261	3570	153	2	4994	1
1	0364	62	22438	963	5	5002	3	1044	162	3573	153	4	4994	1	1724	262	3570	153	2	4994	1
1	0368	63	21663	930	0	5001	9	1048	163	3573	153	3	4994	1	1728	263	3570	153	2	4994	1
1	0372	64	20884	896	3	5001	6	1052	164	3573	153	3	4994	1	1732	264	3570	153	2	4994	1
1	0376	65	20098	862	6	5001	2	1056	165	3572	153	3	4994	1	1736	265	3570	153	2	4994	1
1	0380	66	19316	829	0	5000	9	1100	166	3572	153	3	4994	1	1740	266	3570	153	2	4994	1
1	0384	67	18542	795	8	5000	6	1104	167	3572	153	3	4994	1	1744	267	3570	153	2	4994	1
1	0388	68	17779	763	1	5000	2	1108	168	3572	153	3	4994	1	1748	268	3570	153	2	4994	1
1	0392	69	17032	731	0	4999	9	1112	169	3572	153	3	4994	1	1752	269	3570	153	2	4994	1
1	0396	70	16302	699	7	4999	6	1116	170	3571	153	3	4994	1	1756	270	3570	153	2	4994	1
1	0400	71	15593	669	2	4999	3	1120	171	3571	153	3	4994	1	1800	271	3570	153	2	4994	1
1	0404	72	14905	639	7	4999	0	1124	172	3571	153	3	4994	1	1804	272	3570	153	2	4994	1
1	0408	73	14241	611	2	4998	7	1128	173	3571	153	3	4994	1	1808	273	3570	153	2	4994	1
1	0412	74	13601	583	7	4998	4	1132	174	3571	153	3	4994	1	1812	274	3570	153	2	4994	1
1	0416	75	12966	557	4	4998	2	1136	175	3571	153	3	4994	1	1816	275	3570	153	2	4994	1
1	0420	76	12398	532	1	4997	9	1140	176	3571	153	3	4994	1	1820	276	3570	153	2	4994	1
1	0424	77	11835	508	0	4997	7	1144	177	3571	153	2	4994	1	1824	277	3570	153	2	4994	1
1	0428	78	11293	484	9	4997	4	1148	178	3571	153	2	4994	1	1828	278	3570	153	2	4994	1
1	0432	79	10789	463	1	4997	2	1152	179	3571	153	2	4994	1	1832	279	3570	153	2	4994	1
1	0436	80	10305	442	3	4997	0	1156	180	3570	153	2	4994	1	1836	280	3570	153	2	4994	1
1	0440	81	9847	422	6	4996	8	1200	181	3570	153	2	4994	1	1840	281	3570	153	2	4994	1
1	0444	82	9413	404	0	4996	6	1204	182	3570	153	2	4994	1	1844	282	3570	153	2	4994	1
1	0448	83	9004	386	4	4996	4	1208	183	3570	153	2	4994	1	1848	283	3570	153	2	4994	1
1	0452	84	8613	369	9	4996	2	1212	184	3570	153	2	4994	1	1852	284	3570	153	2	4994	1
1	0456	85	8256	354	3	4996	1	1216	185	3570	153	2	4994	1	1856	285	3570	153	2	4994	1
1	0460	86	7915	339	7	4995	9	1220	186	3570	153	2	4994	1	1900	286	3570	153	2	4994	1
1	0464	87	7596	326	0	4995	8	1224	187	3570	153	2	4994	1	1904	287	3570	153	2	4994	1
1	0468	88	7237	313	2	4995	7	1228	188	3570	153	2	4994	1	1908	288	3570	153	2	4994	1
1	0472	89	7017	301	1	4995	6	1232	189	3570	153	2	4994	1	1912	289	3570	153	2	4994	1
1	0476	90	6755	289	9	4995	4	1236	190	3570	153	2	4994	1	1916	290	3570	153	2	4994	1
1	0480	91	6511	279	5	4995	3	1240	191	3570	153	2	4994	1	1920	291	3570	153	2	4994	1
1	0484	92	6284	269	7	4995	2	1244	192	3570	153	2	4994	1	1924	292	3570	153	2	4994	1
1	0488	93	6072	260	6	4995	1	1248	193	3570	153	2	4994	1	1928	293	3570	153	2	4994	1
1	0492	94	5875	252	2	4995	1	1252	194	3570	153	2	4994	1	1932	294	3570	153	2	4994	1
1	0496	95	5693	243	3	4995	0	1256	195	3570	153	2	4994	1	1936	295	3570	153	2	4994	1
1	0500	96	5523	237	0	4994	9	1300	196	3570	153	2	4994	1	1940	296	3570	153	2	4994	1
1	0504	97	5366	230	3	4994	8	1304	197	3570	153	2	4994	1	1944	297	3570	153	2	4994	1
1	0508	98	5220	224	0	4994	8	1308	198	3570	153	2	4994	1	1948	298	3570	153	2	4994	1
1	0512	99	5085	218	3	4994	7	1312	199	3570	153	2	4994	1	1952	299	3570	153	2	4994	1
1	0516	100	4961	212	9	4994	7	1316	200	3570	153	2	4994	1	1956	300	3570	153	2	4994	1

PEAK FLOW (CFS)	TIME (HR)	MAXIMUM AVERAGE FLOW 24-HR	6-HR	19.93-HR
338228	1.20	156141	510230	156141
		0.000	0.000	0.000
		257223	253006	257223
PEAK STORAGE (AC-FT)	TIME (HR)	MAXIMUM AVERAGE STORAGE 24-HR	6-HR	19.93-HR
		156141	510230	156141
		0.000	0.000	0.000
		257223	253006	257223

23348 1 20 4885 1580 1580

PEAK STAGE TIME MAXIMUM AVERAGE STAGE
(FEET) (HR) 6-HR 24-HR 72-HR
5105.84 1.20 5020.62 5002.04 5002.04 19.93-HR
5002.04

CUMULATIVE AREA = 0.0 SQ MI

.....
*
* RCH2 *
*
.....

HYDROGRAPH ROUTING DATA

21 RS STORAGE ROUTING 5 NUMBER OF SUBREACHES
NSTPS FLOW TYPE OF INITIAL CONDITION
ITYP 3580.00 INITIAL CONDITION
RSVRTC X 0.0 WORKING R AND D COEFFICIENT

22 RC NORMAL DEPTH CHANNEL ROUTING
ANL 0.040 LEFT OVERBANK N-VALUE
ANCH 0.040 MAIN CHANNEL N-VALUE
ANR 0.040 RIGHT OVERBANK N-VALUE
RLNTH 39600. REACH LENGTH
SEL 0.0019 ENERGY SLOPE
ELMAX 5030.0 MAX. ELEV. FOR STORAGE/OUTFLOW CALCULATION

CROSS-SECTION DATA
--- LEFT OVERBANK --- + --- MAIN CHANNEL --- + --- RIGHT OVERBANK ---
24 RY ELEVATION 5129.50 5128.50 5127.50 4917.50 4927.50 5127.50 5129.50
23 RY DISTANCE 0.0 0.0 0.0 300.00 800.00 1300.00 1600.00

COMPUTED STORAGE-OUTFLOW-ELEVATION DATA

STORAGE 0.0 1591.93 6219.07 11676.44 17229.32 22877.71 28621.61 34461.04 40395.98 46426.43
OUTFLOW 0.0 5850.17 39850.73 112628.44 212936.31 337673.87 484934.31 653396.44 842080.87 1050233.00
ELEVATION 4917.50 4923.42 4929.34 4935.25 4941.17 4947.09 4953.01 4958.93 4964.84 4970.76
STORAGE 52552.40 58773.89 65090.79 71503.31 78011.37 84614.94 91313.94 98108.56 104998.62 111984.19
OUTFLOW 127725.20 152265.40 178603.50 206706.20 236545.80 268097.70 301342.70 336263.50 372846.10 411077.90
ELEVATION 4976.68 4982.60 4988.52 4994.43 5000.35 5006.27 5012.19 5018.11 5024.02 5029.94

HYDROGRAPH AT STATION RCH2

DA MON HRMN ORD OUTFLOW STORAGE STAGE * DA MON HRMN ORD OUTFLOW STORAGE STAGE

0000	1	3580	194 8	4921 1	0640	101	13977	539 6	4924 8	1	1320	201	3686	200 6	4921 2
0001	2	3580	194 8	4921 1	0641	102	13390	523 6	4924 7	1	1324	202	3679	200 2	4921 2
0002	3	3580	194 8	4921 1	0642	103	12829	508 3	4924 6	1	1328	203	3673	199 9	4921 2
0003	4	3580	194 8	4921 1	0643	104	12294	493 8	4924 5	1	1332	204	3667	199 6	4921 2
0004	5	3580	194 8	4921 1	0644	105	11783	479 9	4924 4	1	1336	205	3661	199 2	4921 2
0005	6	3580	194 8	4921 1	0645	106	11298	466 7	4924 3	1	1340	206	3656	198 0	4921 2
0006	7	3580	194 8	4921 1	0646	107	10637	454 1	4924 2	1	1344	207	3651	198 7	4921 2
0007	8	3580	194 8	4921 1	0647	108	10399	442 2	4924 1	1	1348	208	3646	198 4	4921 2
0008	9	3580	194 8	4921 1	0648	109	9986	431 0	4924 0	1	1352	209	3641	198 2	4921 2
0009	10	3580	194 8	4921 1	0649	110	9596	420 3	4924 0	1	1356	210	3637	197 9	4921 2
0010	11	3580	194 8	4921 1	0650	111	9229	410 3	4924 0	1	1400	211	3630	197 7	4921 2
0011	12	3582	194 9	4921 1	0724	112	8885	401 0	4923 9	1	1404	212	3629	197 5	4921 2
0012	13	3591	195 4	4921 1	0728	113	8563	392 2	4923 8	1	1412	214	3622	197 1	4921 2
0013	14	3657	199 0	4921 2	0732	114	8263	384 1	4923 8	1	1416	215	3619	197 0	4921 2
0014	15	4297	233 8	4921 8	0736	115	7984	376 5	4923 8	1	1420	216	3616	196 8	4921 2
0015	16	11048	459 9	4924 3	0740	116	7725	369 4	4923 7	1	1424	217	3613	196 6	4921 2
0016	17	58063	1516 9	4930 8	0744	117	7486	362 9	4923 7	1	1428	218	3610	196 5	4921 1
0017	18	310487	4329 3	4945 8	0748	118	7238	357 0	4923 6	1	1432	219	3608	196 3	4921 1
0018	19	955027	8733 6	4968 1	0752	119	7067	351 5	4923 6	1	1436	220	3605	196 2	4921 1
0019	20	1824513	13193 8	4989 3	0756	120	6884	346 5	4923 6	1	1440	221	3603	196 1	4921 1
0020	21	2555145	16396 3	5003 9	0800	121	6717	342 0	4923 6	1	1444	222	3601	196 0	4921 1
0021	22	2973745	18102 9	5011 5	0804	122	6564	337 8	4923 5	1	1448	223	3599	195 9	4921 1
0022	23	3109632	18637 2	5013 8	0808	123	6428	334 1	4923 5	1	1452	224	3597	195 8	4921 1
0023	24	3048037	18397 5	5012 8	0812	124	6308	330 8	4923 5	1	1456	225	3596	195 7	4921 1
0024	25	2817082	17713 3	5009 6	0816	125	6202	328 0	4923 5	1	1500	226	3594	195 6	4921 1
0025	26	2653925	16809 7	5005 8	0820	126	6106	325 4	4923 5	1	1504	227	3592	195 5	4921 1
0026	27	2417688	15820 9	5001 3	0824	127	6020	323 0	4923 4	1	1508	228	3591	195 4	4921 1
0027	28	2185375	14816 8	4996 8	0828	128	5940	320 8	4923 4	1	1512	229	3590	195 3	4921 1
0028	29	1966026	13839 6	4992 3	0832	129	5865	318 8	4923 4	1	1516	230	3588	195 2	4921 1
0029	30	1764435	12914 5	4988 0	0836	130	5821	316 8	4923 4	1	1520	231	3587	195 1	4921 1
0030	31	1583389	12046 1	4984 0	0840	131	5783	314 7	4923 3	1	1524	232	3586	195 0	4921 1
0031	32	1419937	11234 0	4980 1	0844	132	5744	312 6	4923 3	1	1528	233	3585	195 0	4921 1
0032	33	1274163	10493 8	4976 6	0848	133	5704	310 4	4923 3	1	1532	234	3584	195 0	4921 1
0033	34	1148560	9615 9	4973 3	0852	134	5662	308 1	4923 2	1	1536	235	3583	195 0	4921 1
0034	35	1034599	9194 7	4970 3	0856	135	5619	305 8	4923 2	1	1540	236	3582	195 0	4921 1
0035	36	936597	8626 8	4967 5	0900	136	5575	303 4	4923 1	1	1544	237	3581	194 9	4921 1
0036	37	847123	8108 4	4965 0	0904	137	5531	301 0	4923 1	1	1548	238	3580	194 8	4921 1
0037	38	770806	7630 8	4962 6	0908	138	5485	298 5	4923 0	1	1552	239	3580	194 7	4921 1
0038	39	699224	7180 5	4960 4	0912	139	5440	296 0	4923 0	1	1556	240	3579	194 6	4921 1
0039	40	634302	6759 8	4958 3	0916	140	5393	293 5	4923 0	1	1600	241	3579	194 5	4921 1
0040	41	575647	6353 2	4956 2	0920	141	5346	291 0	4922 9	1	1604	242	3578	194 4	4921 1
0041	42	519510	5964 0	4954 2	0924	142	5299	288 4	4922 9	1	1608	243	3577	194 3	4921 1
0042	43	468818	5598 6	4952 4	0928	143	5252	285 8	4922 8	1	1612	244	3577	194 2	4921 1
0043	44	423494	5245 0	4950 5	0932	144	5205	283 3	4922 8	1	1616	245	3576	194 1	4921 1
0044	45	380388	4908 7	4948 8	0936	145	5158	280 7	4922 7	1	1620	246	3576	194 0	4921 1
0045	46	341198	4602 9	4947 2	0940	146	5110	278 1	4922 7	1	1624	247	3576	194 0	4921 1
0046	47	309067	4316 5	4945 7	0944	147	5064	275 6	4922 6	1	1628	248	3575	194 0	4921 1
0047	48	278681	4041 3	4944 3	0948	148	5017	273 0	4922 6	1	1632	249	3575	194 0	4921 1
0048	49	250741	3788 2	4943 0	0952	149	4971	270 5	4922 5	1	1636	250	3575	194 0	4921 1
0049	50	226135	3565 4	4941 8	0956	150	4925	268 0	4922 5	1	1640	251	3574	194 0	4921 1
0050	51	205707	3365 8	4940 7	1000	151	4880	265 6	4922 4	1	1644	252	3574	194 0	4921 1
0051	52	188463	3174 9	4939 7	1004	152	4835	263 1	4922 4	1	1648	253	3573	194 0	4921 1
0052	53	171798	2990 4	4938 7	1008	153	4791	260 7	4922 3	1	1652	254	3573	194 0	4921 1
0053	54	156208	2817 8	4937 8	1012	154	4748	258 4	4922 3	1	1656	255	3573	194 0	4921 1
0054	55	142017	2660 7	4937 0	1016	155	4705	256 1	4922 3	1	1700	256	3573	194 0	4921 1
0055	56	129580	2523 0	4936 3	1020	156	4663	253 8	4922 2	1	1704	257	3573	194 0	4921 1
0056	57	118879	2404 5	4935 6	1024	157	4622	251 6	4922 2	1	1708	258	3573	194 0	4921 1
0057	58	110075	2297 0	4935 0	1028	158	4582	249 4	4922 1	1	1712	259	3572	194 0	4921 1
0058	59	103077	2191 1	4934 5	1032	159	4543	247 2	4922 1	1	1716	260	3572	194 0	4921 1
0059	60	95873	2084 0	4933 9	1036	160	4505	245 2	4922 1	1					

1	0100	51	88808	1978 0	4933 3	1	1040 161	4467	243.1	4922 0	1	1720 261	3572	194 4	4921 1
1	0404	62	81967	1875 4	4932 8	1	1044 162	4431	241.1	4922 0	1	1724 262	3572	194 4	4921 1
1	0409	63	75479	1778 1	4932 2	1	1048 163	4395	239.2	4921 9	1	1728 263	3572	194 4	4921 1
1	0412	64	69427	1687 7	4931 7	1	1052 164	4361	237.3	4921 9	1	1732 264	3572	194 4	4921 1
1	0416	65	63936	1603 0	4931 3	1	1056 165	4328	235.5	4921 9	1	1736 265	3572	194 4	4921 1
1	0420	66	58992	1530 9	4930 9	1	1100 166	4295	233.8	4921 8	1	1740 266	3571	194 4	4921 1
1	0424	67	54645	1465 7	4930 5	1	1104 167	4264	232.0	4921 8	1	1744 267	3571	194 4	4921 1
1	0428	68	50872	1409 1	4930 2	1	1108 168	4233	230.4	4921 8	1	1748 268	3571	194 4	4921 1
1	0432	69	47639	1360 6	4930 0	1	1112 169	4204	228.8	4921 7	1	1752 269	3571	194 4	4921 1
1	0436	70	44962	1320 5	4929 7	1	1116 170	4175	227.2	4921 7	1	1756 270	3571	194 4	4921 1
1	0440	71	42772	1287 6	4929 6	1	1120 171	4148	225.7	4921 7	1	1800 271	3571	194 3	4921 1
1	0444	72	40301	1259 7	4929 4	1	1124 172	4121	224.3	4921 7	1	1804 272	3571	194 3	4921 1
1	0448	73	39501	1234 3	4929 3	1	1128 173	4095	222.9	4921 6	1	1808 273	3571	194 3	4921 1
1	0452	74	38568	1208 9	4929 1	1	1132 174	4071	221.5	4921 6	1	1812 274	3571	194 3	4921 1
1	0456	75	37591	1182 3	4928 9	1	1136 175	4047	220.3	4921 6	1	1816 275	3571	194 3	4921 1
1	0500	76	36578	1154 7	4928 8	1	1140 176	4024	219.0	4921 6	1	1820 276	3571	194 3	4921 1
1	0504	77	35539	1126 5	4928 6	1	1144 177	4002	217.8	4921 5	1	1824 277	3571	194 3	4921 1
1	0508	78	34480	1097 6	4928 4	1	1148 178	3981	216.7	4921 5	1	1828 278	3571	194 3	4921 1
1	0512	79	33410	1068 5	4928 2	1	1152 179	3961	215.6	4921 5	1	1832 279	3571	194 3	4921 1
1	0516	80	32314	1039 2	4928 0	1	1156 180	3941	214.5	4921 5	1	1836 280	3570	194 3	4921 1
1	0520	81	31259	1010 0	4927 8	1	1200 181	3923	212.5	4921 5	1	1840 281	3570	194 3	4921 1
1	0524	82	30189	980 8	4927 7	1	1204 182	3905	212.5	4921 4	1	1844 282	3570	194 3	4921 1
1	0528	83	29129	952 0	4927 5	1	1208 183	3888	211.6	4921 4	1	1848 283	3570	194 3	4921 1
1	0532	84	28082	923 5	4927 3	1	1212 184	3872	210.7	4921 4	1	1852 284	3570	194 3	4921 1
1	0536	85	27052	895 5	4927 1	1	1216 185	3856	209.9	4921 4	1	1856 285	3570	194 3	4921 1
1	0540	86	26041	867 9	4926 9	1	1220 186	3841	209.0	4921 4	1	1900 286	3570	194 3	4921 1
1	0544	87	25052	841 0	4926 8	1	1224 187	3827	208.3	4921 4	1	1904 287	3570	194 3	4921 1
1	0548	88	24086	814 7	4926 6	1	1228 188	3813	207.5	4921 4	1	1908 288	3570	194 3	4921 1
1	0552	89	23144	789 1	4926 4	1	1232 189	3800	206.8	4921 3	1	1912 289	3570	194 3	4921 1
1	0556	90	22229	764 2	4926 3	1	1236 190	3788	206.1	4921 3	1	1916 290	3570	194 3	4921 1
1	0600	91	21340	740 0	4926 1	1	1240 191	3776	205.5	4921 3	1	1920 291	3570	194 3	4921 1
1	0604	92	20478	716 5	4925 8	1	1244 192	3765	204.9	4921 3	1	1924 292	3570	194 3	4921 1
1	0608	93	19645	693 8	4925 6	1	1248 193	3754	204.3	4921 3	1	1928 293	3570	194 3	4921 1
1	0612	94	18839	671 9	4925 5	1	1252 194	3744	203.9	4921 3	1	1932 294	3570	194 3	4921 1
1	0616	95	18061	650 7	4925 5	1	1256 195	3734	203.2	4921 3	1	1936 295	3570	194 3	4921 1
1	0620	96	17311	630 3	4925 4	1	1300 196	3725	202.7	4921 3	1	1540 296	3570	194 3	4921 1
1	0624	97	16589	610 7	4925 3	1	1304 197	3716	202.3	4921 3	1	1944 297	3570	194 3	4921 1
1	0628	98	15895	591 8	4925 2	1	1308 198	3708	201.8	4921 2	1	1948 298	3570	194 3	4921 1
1	0632	99	15229	573 7	4925 0	1	1312 199	3700	201.4	4921 2	1	1952 299	3570	194 3	4921 1
1	0636	100	14589	556 3	4924 9	1	1316 200	3693	201.0	4921 2	1	1956 300	3570	194 3	4921 1

PEAK FLOW (CFS)	TIME (HR)	(CFS)	6-HR	MAXIMUM AVERAGE FLOW	19 93-HR
3109632	1 47	508561	508561	156140	156140
		(INCHES)	0.000	0.000	0.000
		(AC FT)	252179	257222	257222

PEAK STORAGE (AC-FT)	TIME (HR)	MAXIMUM AVERAGE STORAGE	19 93-HR
18637	1 47	1511	1511

PEAK STAGE (FEET)	TIME (HR)	MAXIMUM AVERAGE STAGE	19 93-HR
5013.82	1 47	4928.84	4928.84

CUMULATIVE AREA = 0.0 SQ MI

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 *
 * RCH3 *
 *
 *.....

HYDROGRAPH ROUTING DATA

26 RS STORAGE ROUTING:
 NSTPS 7 NUMBER OF SUBREACHES
 ITYP FLOW TYPE OF INITIAL CONDITION
 RSVIC 3580.00 INITIAL CONDITION
 X O O WORKING R AND D COEFFICIENT

27 RC NORMAL DEPTH CHANNEL ROUTING
 ANL O O40 LEFT OVERBANK N-VALUE
 ANCH O O40 MAIN CHANNEL N-VALUE
 ANR O O40 RIGHT OVERBANK N-VALUE
 RLPTH 52800 REACH LENGTH
 SEL O.OO19 ENERGY SLOPE
 ELMAX 4930 O MAX. ELEV. FOR STORAGE/OUTFLOW CALCULATION

CROSS-SECTION DATA
 --- LEFT OVERBANK --- + --- MAIN CHANNEL --- + --- RIGHT OVERBANK ---
 29 RY ELEVATION 5042.00 5041.00 5040.00 4840.00 4830.00 4840.00 5040.00 5042.00
 28 RX DISTANCE 0 0 0 0 0 300.00 800.00 1300.00 1600.00 1600.00

COMPUTED STORAGE-OUTFLOW-ELEVATION DATA

STORAGE 0 0 1677.92 6695.56 13133.76 19672.63 26312.17 33052.39 39893.28 46834.85 53877.10
 OUTFLOW 0 0 4276.11 27959.46 85150.44 165283.44 265626.25 38452.19 520827.50 673696.87 842473.56
 ELEVATION 4830.00 4835.26 4840.52 4845.79 4851.05 4856.31 4861.57 4866.83 4872.09 4877.36

STORAGE 61020.02 68263.56 75607.87 83052.75 90598.37 98244.69 105991.56 113839.25 121787.62 129836.50
 OUTFLOW 1076637.501225763.001439494.001667537.001909637.002165584.002435191.002718303.003014778.003324500.00
 ELEVATION 4882.62 4887.88 4893.14 4898.40 4903.66 4908.93 4914.19 4919.45 4924.71 4929.97

HYDROGRAPH AT STATION RCH3

DA	MON	HRMN	ORD	OUTFLOW	STORAGE	STAGE	DA	MON	HRMN	ORD	OUTFLOW	STORAGE	STAGE
1	0000	1	3580.	200.7	4834.4	1	1320	201	4565.	248.5	4835.3		
1	0004	2	3580.	200.7	4834.4	1	1324	202	4536.	247.6	4835.2		
1	0008	3	3580.	200.7	4834.4	1	1328	203	4508.	246.7	4835.3		
1	0012	4	3580.	200.7	4834.4	1	1332	204	4482.	245.9	4835.3		
1	0016	5	3580.	200.7	4834.4	1	1336	205	4458.	245.2	4835.3		
1	0020	6	3580.	200.7	4834.4	1	1340	206	4435.	244.5	4835.3		
1	0024	7	3580.	200.7	4834.4	1	1344	207	4414.	243.9	4835.3		
1	0028	8	3580.	200.7	4834.4	1	1348	208	4394.	243.3	4835.3		
1	0032	9	3580.	200.7	4834.4	1	1352	209	4376.	242.7	4835.3		

1	0036	10	3580	200 7	4834 4	1	0716 11C	27353	955 3	4840 5	1	1356 210	4359	242 2	4835 3
1	0040	11	3580	200 7	4834 4	1	0720 111	27710	949 9	4840 5	1	1400 211	4343	241 7	4835 3
1	0044	12	3580	200 7	4834 4	1	0724 112	27502	942 7	4830 4	1	1404 212	4329	241 3	4835 3
1	0048	13	3580	200 7	4834 4	1	0728 113	27211	934 8	4840 4	1	1408 213	4316	240 9	4835 3
1	0052	14	3580	200 7	4834 4	1	0732 114	26955	926 1	4840 3	1	1412 214	4304	240 6	4835 3
1	0056	15	3580	200 7	4834 4	1	0736 115	26647	916 8	4840 2	1	1416 215	4293	240 2	4835 3
1	0100	16	3580	200 7	4834 4	1	0740 116	26315	906 7	4840 2	1	1420 216	4282	239 9	4835 3
1	0104	17	3580	200 7	4834 4	1	0744 117	25961	896 0	4840 1	1	1424 217	4274	239 6	4835 3
1	0108	18	3580	200 7	4834 4	1	0748 118	25587	884 7	4840 0	1	1428 218	4268	239 2	4835 2
1	0112	19	3580	200 7	4834 4	1	0752 119	25133	872 8	4839 9	1	1432 219	4261	238 9	4835 2
1	0116	20	3580	200 7	4834 4	1	0756 120	24779	860 3	4839 8	1	1436 220	4255	238 5	4835 2
1	0120	21	3585	200 7	4834 4	1	0800 121	24319	847 2	4839 7	1	1440 221	4248	238 1	4835 2
1	0124	22	3662	205 3	4834 5	1	0804 122	23903	833 7	4839 6	1	1444 222	4241	237 7	4835 2
1	0128	23	4986	261 2	4835 4	1	0808 123	23413	819 8	4839 5	1	1448 223	4234	237 3	4835 2
1	0132	24	22756	799 0	4839 4	1	0812 124	22969	805 5	4839 4	1	1452 224	4226	236 9	4835 2
1	0136	25	189833	3042 4	4852 3	1	0816 125	22485	790 8	4839 3	1	1456 225	4218	236 5	4835 2
1	0140	26	805045	7473 6	4876 2	1	0820 126	21931	775 9	4839 2	1	1500 226	4210	236 0	4835 2
1	0144	27	1739219	12183 8	4900 0	1	0824 127	21490	760 7	4839 1	1	1504 227	4202	235 5	4835 2
1	0148	28	2431037	15124 6	4914 1	1	0828 128	20983	745 3	4839 0	1	1508 228	4193	235 1	4835 2
1	0152	29	2702550	16200 4	4919 2	1	0832 129	20470	729 8	4838 9	1	1512 229	4185	234 6	4835 1
1	0156	30	2703513	16204 2	4919 2	1	0836 130	19355	714 3	4838 7	1	1516 230	4176	234 1	4835 1
1	0200	31	2582407	15724 6	4916 9	1	0840 131	19419	698 6	4838 6	1	1520 231	4167	233 6	4835 1
1	0204	32	2412940	15050 3	4913 7	1	0844 132	18923	683 0	4838 5	1	1524 232	4157	233 0	4835 1
1	0208	33	2232115	14308 1	4910 2	1	0848 133	18408	667 4	4838 4	1	1528 233	4148	232 5	4835 1
1	0212	34	2052620	13552 8	4906 6	1	0852 134	17897	651 9	4838 3	1	1532 234	4138	232 0	4835 1
1	0216	35	1882005	12819 6	4903 1	1	0856 135	17389	636 6	4838 2	1	1536 235	4128	231 4	4835 1
1	0220	36	1724590	12118 7	4899 6	1	0900 136	16887	621 4	4838 1	1	1540 236	4119	230 9	4835 1
1	0224	37	1579127	11452 3	4896 4	1	0904 137	16332	606 4	4838 0	1	1544 237	4109	230 3	4835 1
1	0228	38	1445858	10830 3	4893 3	1	0908 138	15905	591 7	4837 8	1	1548 238	4099	229 8	4835 0
1	0232	39	1326901	10248 4	4890 4	1	0912 139	15426	577 2	4837 7	1	1552 239	4089	229 2	4835 0
1	0236	40	1217156	9707 2	4887 6	1	0916 140	14957	563 0	4837 6	1	1556 240	4078	228 6	4835 0
1	0240	41	1120379	9204 3	4885 1	1	0920 141	14498	549 1	4837 5	1	1600 241	4068	228 0	4835 0
1	0244	42	1030511	8737 3	4882 7	1	0924 142	14050	535 5	4837 4	1	1604 242	4058	227 5	4835 0
1	0248	43	951874	8302 9	4880 5	1	0928 143	13614	522 3	4837 3	1	1608 243	4048	227 5	4835 0
1	0252	44	877976	7893 4	4878 4	1	0932 144	13190	509 5	4837 2	1	1612 244	4037	226 3	4835 0
1	0256	45	811529	7512 3	4876 4	1	0936 145	12719	497 1	4837 1	1	1616 245	4027	225 7	4835 0
1	0300	46	750736	7143 9	4874 5	1	0940 146	12381	485 0	4837 1	1	1620 246	4017	225 2	4834 9
1	0304	47	693801	6810 5	4872 7	1	0944 147	11937	473 4	4837 0	1	1624 247	4007	224 6	4834 9
1	0308	48	643077	6492 0	4871 0	1	0948 148	11626	462 2	4836 9	1	1628 248	3996	224 0	4834 9
1	0312	49	595573	6183 9	4869 4	1	0952 149	11269	451 4	4836 8	1	1632 249	3986	223 5	4834 9
1	0316	50	550678	5892 7	4867 9	1	0956 150	10926	441 0	4836 7	1	1636 250	3976	222 9	4834 9
1	0320	51	510069	5621 9	4866 4	1	1000 151	10596	431 0	4836 7	1	1640 251	3966	222 3	4834 9
1	0324	52	473677	5361 0	4865 0	1	1004 152	10280	421 4	4836 6	1	1644 252	3956	221 8	4834 9
1	0328	53	438392	5108 0	4863 6	1	1008 153	9978	412 3	4836 5	1	1648 253	3946	221 2	4834 9
1	0332	54	405721	4873 8	4862 4	1	1012 154	9689	403 5	4836 5	1	1652 254	3936	220 7	4834 8
1	0336	55	376693	4658 4	4861 2	1	1016 155	9414	395 2	4836 4	1	1656 255	3927	220 1	4834 8
1	0340	56	351020	4450 4	4860 1	1	1020 156	9151	387 2	4836 3	1	1700 256	3917	219 6	4834 8
1	0344	57	325991	4247 7	4859 0	1	1024 157	8901	379 7	4836 3	1	1704 257	3907	219 0	4834 8
1	0348	58	302423	4055 9	4857 9	1	1028 158	8663	372 5	4836 2	1	1708 258	3898	218 5	4834 8
1	0352	59	281087	3884 1	4857 0	1	1032 159	8436	365 6	4836 2	1	1712 259	3889	218 0	4834 8
1	0356	60	262331	3727 7	4856 1	1	1036 160	8221	359 1	4836 1	1	1716 260	3880	217 5	4834 8
1	0400	61	246309	3576 3	4855 3	1	1040 161	8017	352 9	4836 1	1	1720 261	3871	217 0	4834 8
1	0404	62	230390	3425 8	4854 5	1	1044 162	7824	347 1	4836 0	1	1724 262	3862	216 5	4834 7
1	0408	63	215025	3280 6	4853 7	1	1048 163	7640	341 5	4836 0	1	1728 263	3853	216 0	4834 7
1	0412	64	200615	3144 4	4852 9	1	1052 164	7466	336 3	4836 0	1	1732 264	3844	215 5	4834 7
1	0416	65	187429	3019 7	4852 2	1	1056 165	7301	331 3	4835 9	1	1736 265	3836	215 0	4834 7
1	0420	66	175771	2909 5	4851 6	1	1100 166	7145	326 5	4835 9	1	1740 266	3828	214 6	4834 7
1	0424	67	165471	2812 2	4851 1	1	1104 167	6997	322 1	4835 9	1	1744 267	3820	214 1	4834 7
1	0428	68	157353	2717 9	4850 5	1	1108 168	6857	317 8	4835 8	1	1748 268	3812	213 7	4834 7
1	0432	69	149100	2621 7	4850 0	1	1112 169	6724	313 8	4835 8	1	1752 269	3804	213 2	4834 7
1	0436	70	140827	2525 3	4849 4	1	1116 170	6597	310 0	4835 8	1	1756 270	3796	212 8	4834 7

1	0440	71	132686	2430.3	4835.7	1	1120	171	6477	306.3	4835.7	1	1800	271	3789	212.4	4834.7
1	0444	72	124818	2338.7	4848.4	1	1124	172	6364	302.9	4835.7	1	1804	272	3782	212.0	4834.7
1	0448	73	117347	2251.6	4847.9	1	1128	173	6256	299.6	4835.7	1	1808	273	3774	211.6	4834.6
1	0452	74	110374	2170.3	4847.4	1	1132	174	6153	296.5	4835.7	1	1812	274	3768	211.2	4834.6
1	0456	75	103985	2095.8	4847.0	1	1136	175	6055	293.5	4835.7	1	1816	275	3761	210.8	4834.6
1	0500	76	98228	2028.7	4846.6	1	1140	176	5962	290.7	4835.6	1	1820	276	3754	210.4	4834.6
1	0504	77	93169	1969.7	4846.3	1	1144	177	5873	289.0	4835.6	1	1824	277	3748	210.1	4834.6
1	0508	78	88793	1918.7	4846.0	1	1148	178	5788	285.5	4835.6	1	1828	278	3741	209.7	4834.6
1	0512	79	84953	1873.1	4845.8	1	1152	179	5707	283.0	4835.6	1	1832	279	3735	209.4	4834.6
1	0516	80	82153	1828.1	4845.5	1	1156	180	5629	280.6	4835.6	1	1836	280	3729	209.1	4834.6
1	0520	81	79228	1781.0	4845.2	1	1200	181	5555	278.4	4835.5	1	1840	281	3723	208.7	4834.6
1	0524	82	76221	1732.6	4845.0	1	1204	182	5482	276.2	4835.5	1	1844	282	3718	208.4	4834.6
1	0528	83	73174	1683.7	4844.7	1	1208	183	5415	274.2	4835.5	1	1848	283	3712	208.1	4834.6
1	0532	84	70127	1634.6	4844.4	1	1212	184	5349	272.2	4835.5	1	1852	284	3707	207.8	4834.6
1	0536	85	67114	1586.2	4844.1	1	1216	185	5286	270.3	4835.5	1	1856	285	3702	207.5	4834.6
1	0540	86	64166	1538.8	4843.9	1	1220	186	5226	268.4	4835.5	1	1900	286	3697	207.2	4834.5
1	0544	87	61306	1492.8	4843.6	1	1224	187	5168	266.7	4835.5	1	1904	287	3692	207.0	4834.5
1	0548	88	58552	1448.5	4843.3	1	1228	188	5112	265.0	4835.4	1	1908	288	3687	206.7	4834.5
1	0552	89	55917	1406.1	4843.1	1	1232	189	5058	263.4	4835.4	1	1912	289	3683	206.4	4834.5
1	0556	90	53409	1365.8	4842.9	1	1236	190	5006	261.8	4835.4	1	1916	290	3678	206.2	4834.5
1	0600	91	51032	1327.6	4842.6	1	1240	191	4957	260.3	4835.4	1	1920	291	3674	206.0	4834.5
1	0604	92	48788	1291.5	4842.4	1	1244	192	4909	258.9	4835.4	1	1924	292	3670	205.7	4834.5
1	0608	93	46673	1257.5	4842.2	1	1248	193	4864	257.5	4835.4	1	1928	293	3666	205.5	4834.5
1	0612	94	44686	1225.5	4842.1	1	1252	194	4820	256.2	4835.4	1	1932	294	3662	205.3	4834.5
1	0616	95	42824	1195.6	4841.9	1	1256	195	4778	254.9	4835.4	1	1936	295	3658	205.1	4834.5
1	0620	96	41083	1167.6	4841.7	1	1300	196	4738	253.7	4835.4	1	1940	296	3655	204.9	4834.5
1	0624	97	39461	1141.5	4841.6	1	1304	197	4700	252.5	4835.4	1	1944	297	3651	204.7	4834.5
1	0628	98	37956	1117.3	4841.4	1	1308	198	4664	251.4	4835.3	1	1948	298	3648	204.5	4834.5
1	0632	99	36564	1094.9	4841.3	1	1312	199	4629	250.4	4835.3	1	1952	299	3645	204.1	4834.5
1	0636	100	35284	1074.3	4841.2	1	1316	200	4596	249.4	4835.3	1	1956	300	3641	204.1	4834.5

PEAK FLOW (CFS)	TIME (HR)	MAXIMUM AVERAGE FLOW 24-HR	72-HR	19.93-HR
2703513	1.93	156137	156137	156137
		0.000	0.000	0.000
		(INCHES)		
		(AC-FT)	257217	257217

PEAK STORAGE (AC-FT)	TIME (HR)	MAXIMUM AVERAGE STORAGE 24-HR	72-HR	19.93-HR
16204	1.93	1591	1591	1591

PEAK STAGE (FEET)	TIME (HR)	MAXIMUM AVERAGE STAGE 24-HR	72-HR	19.93-HR
4919.17	1.93	4859.79	4842.79	4842.79

CUMULATIVE AREA = 0.0 SQ MI

30 KK
RCH4

HYDROGRAPH ROUTING DATA

31 RS STORAGE ROUTING
 NSTPS 8 NUMBER OF SUBREACHES
 ITYP FLOW TYPE OF INITIAL CONDITION
 R5URIC 3580.00 INITIAL CONDITION
 X 0.0 WORKING R AND C COEFFICIENT

32 RC NORMAL DEPTH CHANNEL ROUTING
 AP/L 0.040 LEFT OVERBANK N-VALUE
 ANCH 0.040 MAIN CHANNEL N-VALUE
 ANR 0.040 RIGHT OVERBANK N-VALUE
 RLNTH 52800. REACH LENGTH
 SEL 0.0019 ENERGY SLOPE
 ELMAX 4830.0 MAX. ELEV. FOR STORAGE/OUTFLOW CALCULATION

CROSS-SECTION DATA
 --- LEFT OVERBANK --- MAIN CHANNEL --- RIGHT OVERBANK ---
 ELEVATION 4942.00 4941.00 4940.00 4730.00 4740.00 4740.00 4940.00 4942.00
 DISTANCE 0.0 0.0 0.0 300.00 800.00 1300.00 1600.00

COMPUTED STORAGE-OUTFLOW-ELEVATION DATA

STORAGE 0.0 1677.92 6695.56 13133.76 19672.63 26312.17 33052.39 39893.28 46834.85 53877.10
 OUTFLOW 0.0 4276.11 27959.46 85150.44 165283.44 265626.25 384522.19 520827.50 673696.87 842473.56
 ELEVATION 4730.00 4735.26 4740.52 4745.79 4751.05 4756.31 4761.57 4766.83 4772.09 4777.36

STORAGE 61020.02 68263.56 75607.87 83052.75 90598.37 98244.69 105991.56 113839.25 121787.62 129836.50
 OUTFLOW 1026637.50 1225763.00 1439494.00 1667537.00 1909637.00 2165584.00 2435191.00 2718303.00 30324500.00
 ELEVATION 4782.62 4787.88 4793.14 4798.40 4803.66 4808.93 4814.19 4819.45 4824.71 4829.97

HYDROGRAPH AT STATION RCH4

DA	MON	HR	MIN	ORD	STAGE	STORAGE	OUTFLOW	STAGE	STORAGE	OUTFLOW	STAGE	STORAGE	OUTFLOW	STAGE
1	0000	1	3580	175.6	4734.4	1	0640	101	76751	1523.5	4745.0	1	1320	201
1	0004	2	3580	175.6	4734.4	1	0644	102	74552	1492.6	4744.8	1	1324	202
1	0008	3	3580	175.6	4734.4	1	0648	103	72292	1460.8	4744.6	1	1328	203
1	0012	4	3580	175.6	4734.4	1	0652	104	69990	1428.4	4744.4	1	1332	204
1	0016	5	3580	175.6	4734.4	1	0656	105	67664	1395.7	4744.2	1	1336	205
1	0020	6	3580	175.6	4734.4	1	0700	106	65332	1362.8	4744.0	1	1340	206
1	0024	7	3580	175.6	4734.4	1	0704	107	63011	1330.2	4743.7	1	1344	207
1	0028	8	3580	175.6	4734.4	1	0708	108	60715	1297.9	4743.5	1	1348	208
1	0032	9	3580	175.6	4734.4	1	0712	109	58458	1266.1	4743.3	1	1352	209
1	0036	10	3580	175.6	4734.4	1	0716	110	56253	1235.1	4743.1	1	1356	210
1	0040	11	3580	175.6	4734.4	1	0720	111	54109	1204.9	4742.9	1	1400	211
1	0044	12	3580	175.6	4734.4	1	0724	112	52035	1175.7	4742.7	1	1404	212
1	0048	13	3580	175.6	4734.4	1	0728	113	50038	1147.6	4742.6	1	1408	213
1	0052	14	3580	175.6	4734.4	1	0732	114	48126	1120.7	4742.4	1	1412	214
1	0056	15	3580	175.6	4734.4	1	0736	115	46302	1095.1	4742.2	1	1416	215
1	0100	16	3580	175.6	4734.4	1	0740	116	44570	1070.7	4742.1	1	1420	216
1	0104	17	3580	175.6	4734.4	1	0744	117	42933	1047.6	4741.9	1	1424	217
1	0108	18	3580	175.6	4734.4	1	0748	118	41393	1026.0	4741.8	1	1428	218
1	0112	19	3580	175.6	4734.4	1	0752	119	39949	1005.7	4741.6	1	1432	219
1	0116	20	3580	175.6	4734.4	1	0756	120	38611	985.7	4741.5	1	1436	220
1	0120	21	3580	175.6	4734.4	1	0760	121	37273	966.1	4741.4	1	1440	221
1	0124	22	3580	175.6	4734.4	1	0764	122	35935	946.7	4741.3	1	1444	222
1	0128	23	3580	175.6	4734.4	1	0768	123	34597	927.3	4741.2	1	1448	223
1	0132	24	3580	175.6	4734.4	1	0772	124	33259	907.9	4741.1	1	1452	224
1	0136	25	3580	175.6	4734.4	1	0776	125	31921	888.5	4741.0	1	1456	225
1	0140	26	3580	175.6	4734.4	1	0780	126	30583	869.1	4740.9	1	1460	226
1	0144	27	3580	175.6	4734.4	1	0784	127	29245	849.7	4740.8	1	1464	227
1	0148	28	3580	175.6	4734.4	1	0788	128	27907	830.3	4740.7	1	1468	228
1	0152	29	3580	175.6	4734.4	1	0792	129	26569	810.9	4740.6	1	1472	229
1	0156	30	3580	175.6	4734.4	1	0796	130	25231	791.5	4740.5	1	1476	230
1	0200	31	3580	175.6	4734.4	1	0800	131	23893	772.1	4740.4	1	1480	231
1	0204	32	3580	175.6	4734.4	1	0804	132	22555	752.7	4740.3	1	1484	232
1	0208	33	3580	175.6	4734.4	1	0808	133	21217	733.3	4740.2	1	1488	233
1	0212	34	3580	175.6	4734.4	1	0812	134	19879	713.9	4740.1	1	1492	234
1	0216	35	3580	175.6	4734.4	1	0816	135	18541	694.5	4740.0	1	1496	235
1	0220	36	3580	175.6	4734.4	1	0820	136	17203	675.1	4739.9	1	1500	236
1	0224	37	3580	175.6	4734.4	1	0824	137	15865	655.7	4739.8	1	1504	237
1	0228	38	3580	175.6	4734.4	1	0828	138	14527	636.3	4739.7	1	1508	238
1	0232	39	3580	175.6	4734.4	1	0832	139	13189	616.9	4739.6	1	1512	239
1	0236	40	3580	175.6	4734.4	1	0836	140	11851	597.5	4739.5	1	1516	240
1	0240	41	3580	175.6	4734.4	1	0840	141	10513	578.1	4739.4	1	1520	241
1	0244	42	3580	175.6	4734.4	1	0844	142	9175	558.7	4739.3	1	1524	242
1	0248	43	3580	175.6	4734.4	1	0848	143	7837	539.3	4739.2	1	1528	243
1	0252	44	3580	175.6	4734.4	1	0852	144	6499	519.9	4739.1	1	1532	244
1	0256	45	3580	175.6	4734.4	1	0856	145	5161	500.5	4739.0	1	1536	245
1	0300	46	3580	175.6	4734.4	1	0860	146	3823	481.1	4738.9	1	1540	246
1	0304	47	3580	175.6	4734.4	1	0864	147	2485	461.7	4738.8	1	1544	247
1	0308	48	3580	175.6	4734.4	1	0868	148	1147	442.3	4738.7	1	1548	248
1	0312	49	3580	175.6	4734.4	1	0872	149	0	422.9	4738.6	1	1552	249
1	0316	50	3580	175.6	4734.4	1	0876	150	0	403.5	4738.5	1	1556	250

0116	20	3580	175 6	4734 4	1	0756	120	38604	986 7	4741 5	1	1436	220	5917	253 2	4735 6
0120	21	3560	175 6	4734 4	1	0800	121	37354	963 1	4741 4	1	1440	221	5828	250 8	4735 6
0124	22	3580	175 6	4734 4	1	0804	122	36200	952 9	4741 3	1	1444	222	5743	244 6	4735 6
0128	23	3580	175 6	4734 4	1	0808	123	35139	938 0	4741 2	1	1448	223	5661	246 4	4735 6
0132	24	3580	175 6	4734 4	1	0812	124	34163	924 3	4741 1	1	1452	224	5583	244 4	4735 6
0136	25	3580	175 6	4734 4	1	0816	125	33287	911 9	4741 0	1	1456	225	5509	242 4	4735 5
0140	26	3580	175 6	4734 4	1	0820	126	32489	900 7	4740 9	1	1500	226	5438	240 5	4735 5
0144	27	3580	175 6	4734 4	1	0824	127	31772	890 6	4740 8	1	1504	227	5370	238 7	4735 5
0148	28	3581	175 6	4734 4	1	0828	128	31132	881 6	4740 8	1	1508	228	5305	237 0	4735 5
0152	29	3593	175 6	4734 4	1	0832	129	30564	873 6	4740 8	1	1512	229	5241	235 4	4735 5
0156	30	3856	189 1	4734 7	1	0836	130	30061	866 6	4740 7	1	1516	230	5185	233 8	4735 5
0200	31	9353	344 3	4736 4	1	0840	131	29625	850 4	4740 7	1	1520	231	5128	232 8	4735 4
0204	32	70585	1336 8	4744 4	1	0844	132	29247	835 1	4740 6	1	1524	232	5075	230 9	4735 4
0208	33	454194	4568 6	4764 3	1	0848	133	28921	820 5	4740 6	1	1528	233	5024	229 5	4735 4
0212	34	1288713	8803 3	4789 4	1	0852	134	28641	806 5	4740 5	1	1532	234	4975	228 3	4735 4
0216	35	2033411	11787 0	4806 2	1	0856	135	28407	843 2	4740 6	1	1536	235	4929	227 0	4735 4
0220	36	2334384	12886 9	4812 2	1	0900	136	28215	840 5	4740 5	1	1540	236	4885	225 9	4735 4
0224	37	2343930	12921 2	4812 4	1	0904	137	28043	838 2	4740 5	1	1544	237	4843	224 8	4735 4
0228	38	2240763	12550 6	4810 4	1	0908	138	27923	836 0	4740 5	1	1548	238	4804	223 7	4735 4
0232	39	2104414	12052 2	4807 7	1	0912	139	27831	833 6	4740 5	1	1552	239	4766	222 7	4735 4
0236	40	1942651	11522 8	4804 8	1	0916	140	27728	830 8	4740 5	1	1556	240	4730	221 8	4735 4
0240	41	1825170	10995 7	4801 8	1	0920	141	27612	827 7	4740 4	1	1600	241	4696	220 9	4735 4
0244	42	1694798	10487 8	4799 0	1	0924	142	27482	824 3	4740 4	1	1604	242	4664	220 0	4735 3
0248	43	1574521	10002 0	4796 3	1	0928	143	27339	820 5	4740 4	1	1608	243	4634	219 2	4735 3
0252	44	1461885	9542 4	4793 7	1	0932	144	27183	816 4	4740 3	1	1612	244	4605	218 5	4735 3
0256	45	1359809	9108 7	4791 2	1	0936	145	27012	811 9	4740 3	1	1616	245	4579	217 7	4735 3
0300	46	1264571	8699 6	4788 8	1	0940	146	26827	806 9	4740 3	1	1620	246	4553	217 1	4735 3
0304	47	1178302	8317 1	4786 6	1	0944	147	26627	801 7	4740 2	1	1624	247	4529	216 4	4735 3
0308	48	1098661	7955 0	4784 5	1	0948	148	26414	796 0	4740 2	1	1628	248	4507	215 9	4735 3
0312	49	1024609	7617 7	4782 6	1	0952	149	26185	790 0	4740 2	1	1632	249	4486	215 3	4735 3
0316	50	958967	7299 4	4780 7	1	0956	150	25943	783 5	4740 1	1	1636	250	4466	214 8	4735 3
0320	51	895788	6993 1	4778 9	1	1000	151	25685	776 7	4740 0	1	1640	251	4448	214 3	4735 3
0324	52	837918	6710 9	4777 2	1	1004	152	25415	769 6	4740 0	1	1644	252	4431	213 8	4735 3
0328	53	786631	6443 4	4775 6	1	1008	153	25132	762 1	4739 9	1	1648	253	4415	213 4	4735 3
0332	54	736593	6182 4	4774 1	1	1012	154	24836	754 2	4739 8	1	1652	254	4400	213 0	4735 3
0336	55	689976	5939 3	4772 6	1	1016	155	24527	745 0	4739 8	1	1656	255	4386	212 6	4735 3
0340	56	648506	5711 4	4771 2	1	1020	156	24205	737 5	4739 7	1	1700	256	4373	212 3	4735 3
0344	57	609293	5488 8	4769 9	1	1024	157	23873	728 7	4739 6	1	1704	257	4361	212 0	4735 3
0348	58	571443	5273 9	4768 6	1	1028	158	23529	719 6	4739 5	1	1708	258	4350	211 7	4735 3
0352	59	536451	5075 3	4767 4	1	1032	159	23175	710 2	4739 5	1	1712	259	4340	211 4	4735 3
0400	61	476501	4890 3	4766 2	1	1036	160	22812	700 6	4739 4	1	1716	260	4331	211 2	4735 3
0404	62	437994	4529 7	4764 0	1	1040	161	22441	690 8	4739 3	1	1720	261	4322	211 0	4735 3
0408	63	420973	4360 2	4762 0	1	1044	162	22081	680 7	4739 2	1	1724	262	4315	210 8	4735 3
0412	64	396397	4206 0	4762 0	1	1048	163	21674	670 5	4739 1	1	1728	263	4307	210 6	4735 3
0416	65	374939	4063 6	4761 1	1	1052	164	21281	660 1	4739 0	1	1732	264	4301	210 4	4735 3
0420	66	35063	3922 8	4760 3	1	1056	165	20883	649 5	4738 9	1	1736	265	4295	210 2	4735 3
0424	67	335209	3782 1	4759 4	1	1100	166	20480	638 9	4738 8	1	1740	266	4290	210 0	4735 3
0428	68	316000	3646 0	4758 5	1	1104	167	20074	628 1	4738 7	1	1744	267	4285	210 0	4735 3
0432	69	297993	3518 4	4757 7	1	1108	168	19654	617 3	4738 6	1	1748	268	4281	209 8	4735 3
0436	70	281642	3402 5	4757 0	1	1112	169	19253	606 4	4738 5	1	1752	269	4277	209 6	4735 3
0440	71	267067	3299 2	4756 4	1	1116	170	18841	595 4	4738 4	1	1756	270	4271	209 5	4735 3
0444	72	254945	3200 7	4755 7	1	1120	171	18428	584 5	4738 4	1	1900	271	4272	209 5	4735 3
0448	73	242754	3099 8	4755 1	1	1124	172	18015	573 6	4738 3	1	1804	272	4269	209 4	4735 2
0452	74	230494	2998 4	4754 5	1	1128	173	17604	562 7	4738 2	1	1808	273	4266	209 2	4735 2
0456	75	218460	2898 9	4753 8	1	1132	174	17195	551 9	4738 1	1	1812	274	4263	209 1	4735 2
0500	76	206921	2803 5	4753 2	1	1136	175	16789	541 1	4738 0	1	1816	275	4260	208 9	4735 2
0504	77	196102	2714 0	4752 7	1	1140	176	16386	530 4	4737 9	1	1820	276	4257	208 8	4735 2
0508	78	186186	2632 0	4752 1	1	1144	177	15987	519 9	4737 8	1	1824	277	4253	208 6	4735 2
0512	79	177286	2558 3	4751 7	1	1148	178	15592	509 4	4737 7	1	1828	278	4250	208 4	4735 2
0516	80	169501	2494 0	4751 3	1	1152	179	15203	499 1	4737 6	1	1832	279	4246	208 3	4735 2
						1156	180	14820	489 0	4737 6	1	1836	280	4242	208 1	4735 2

1	05:00	81	162948.	2435.3	4750.9	1	1200	181	14443.	479.0	4737.5	1	1840	281	4238.	207.9	4735.2
1	05:24	82	157096.	2375.6	4750.5	1	1204	182	14072.	469.2	4737.4	1	1844	282	4233.	207.6	4735.2
1	05:28	83	150965.	2313.0	4750.1	1	1208	183	13709.	459.5	4737.4	1	1848	283	4229.	207.4	4735.2
1	05:32	84	144665.	2248.8	4749.7	1	1212	184	13353.	450.1	4737.3	1	1852	284	4224.	207.2	4735.2
1	05:36	85	138306.	2183.9	4749.3	1	1216	185	13005.	440.9	4737.2	1	1856	285	4220.	207.0	4735.2
1	05:40	86	131990.	2119.5	4748.9	1	1220	186	12665.	431.9	4737.1	1	1900	286	4215.	206.7	4735.2
1	05:44	87	125815.	2056.5	4748.5	1	1224	187	12333.	423.1	4737.1	1	1504	287	4210.	206.5	4735.2
1	05:48	88	119868.	1995.8	4748.1	1	1228	188	12010.	414.6	4737.0	1	1908	288	4204.	206.2	4735.2
1	05:52	89	114224.	1938.3	4747.7	1	1232	189	11696.	406.2	4736.9	1	1912	289	4199.	206.0	4735.2
1	05:56	90	108944.	1884.4	4747.3	1	1236	190	11390.	398.1	4736.8	1	1916	290	4194.	205.7	4735.2
1	06:00	91	104076.	1834.8	4747.0	1	1240	191	11094.	390.3	4736.8	1	1920	291	4188.	205.4	4735.2
1	06:04	92	99653.	1789.7	4746.7	1	1244	192	10806.	382.7	4736.7	1	1924	292	4182.	205.1	4735.1
1	06:08	93	95700.	1749.3	4746.5	1	1248	193	10527.	375.3	4736.6	1	1928	293	4176.	204.8	4735.1
1	06:12	94	92220.	1713.8	4746.2	1	1252	194	10257.	368.1	4736.6	1	1932	294	4170.	204.5	4735.1
1	06:16	95	89220.	1683.2	4746.1	1	1256	195	9996.	361.2	4736.5	1	1936	295	4164.	204.2	4735.1
1	06:20	96	86654.	1657.1	4745.9	1	1300	196	9744.	354.6	4736.5	1	1940	296	4157.	203.9	4735.1
1	06:24	97	84535.	1633.1	4745.7	1	1304	197	9501.	348.1	4736.4	1	1944	297	4151.	203.6	4735.1
1	06:28	98	82778.	1608.3	4745.6	1	1308	198	9266.	341.9	4736.4	1	1948	298	4144.	203.3	4735.1
1	06:32	99	80882.	1581.7	4745.4	1	1312	199	9040.	335.9	4736.3	1	1952	299	4138.	203.0	4735.1
1	06:36	100	78867.	1553.3	4745.2	1	1316	200	8822.	330.1	4736.3	1	1956	300	4131.	202.6	4735.1

PEAK FLOW (CFS)	TIME (HR)	(CFS)	6-HR	MAXIMUM AVERAGE FLOW	19.93-HR
234930.	2.40	(INCHES)	492666	24-HR	156061.
		(AC-FT)	244297.	72-HR	156061.
					0.000
					257091.

PEAK STORAGE (AC-FT)	TIME (HR)	6-HR	MAXIMUM AVERAGE STORAGE	19.93-HR
12921.	2.40	4109.	24-HR	1506.
			72-HR	1506.

PEAK STAGE (FEET)	TIME (HR)	6-HR	MAXIMUM AVERAGE STAGE	19.93-HR
4812.41	2.40	4760.80	24-HR	4743.82
			72-HR	4743.82

CUMULATIVE AREA = 0.0 SQ MI

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 . RCH5
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HYDROGRAPH ROUTING DATA

35 KK	STORAGE ROUTING	13	NUMBER OF SUBREACHES
	NSIPS	FLOW	TYPE OF INITIAL CONDITION
	ITVP	3580.00	INITIAL CONDITION
	RSVRIC	0.00	WORKING R AND D COEFFICIENT
	X		
36 RS	NORMAL DEPTH CHANNEL ROUTING		
	ANL	0.040	LEFT OVERBANK N-VALUE
37 RC			

1	0140	25	3580	98 9	4606 3	1	0820	126	80191	1342 1	4619 5	1	1500	226	21320	589 1	4613 0
1	0144	27	3580	98 9	4606 3	1	0824	127	77570	1313 5	4619 3	1	1504	227	21020	590 8	4612 9
1	0148	28	3580	98 9	4606 3	1	0828	128	72507	1285 8	4619 1	1	1508	228	20715	572 4	4612 8
1	0152	29	3580	98 9	4606 3	1	0832	129	72557	1258 6	4618 9	1	1512	229	20408	563 9	4612 7
1	0156	30	3580	98 9	4606 3	1	0836	130	70153	1232 6	4618 8	1	1516	230	20097	555 3	4612 6
1	0200	31	3580	98 9	4606 3	1	0840	131	67811	1207 1	4618 6	1	1520	231	19783	546 6	4612 4
1	0204	32	3580	98 9	4606 3	1	0844	132	65530	1182 2	4618 4	1	1524	232	19468	537 9	4612 3
1	0208	33	3580	98 9	4606 3	1	0848	133	63308	1158 0	4618 2	1	1528	233	19150	529 1	4612 2
1	0212	34	3580	98 9	4606 3	1	0852	134	61144	1134 4	4618 1	1	1532	234	18831	520 3	4612 1
1	0216	35	3580	98 9	4606 3	1	0856	135	59041	1111 5	4617 9	1	1536	235	18510	511 5	4612 0
1	0220	36	3580	98 9	4606 3	1	0900	136	56989	1089 2	4617 7	1	1540	236	18189	502 6	4611 8
1	0224	37	3580	98 9	4606 3	1	0904	137	55021	1067 6	4617 6	1	1544	237	17868	493 7	4611 7
1	0228	38	3580	98 9	4606 3	1	0908	138	53100	1046 8	4617 4	1	1548	238	17547	484 9	4611 6
1	0232	39	3580	98 9	4606 3	1	0912	139	51267	1026 7	4617 3	1	1552	239	17226	476 0	4611 5
1	0236	40	3586	99 1	4606 3	1	0916	140	49495	1007 4	4617 2	1	1556	240	16906	467 1	4611 4
1	0240	41	3651	100 9	4606 4	1	0920	141	47797	988 9	4617 0	1	1600	241	16587	458 3	4611 2
1	0244	42	4103	121 7	4606 7	1	0924	142	46175	971 2	4616 9	1	1604	242	16269	449 5	4611 1
1	0248	43	12183	353 2	4609 8	1	0928	143	44630	954 3	4616 8	1	1608	243	15954	440 8	4611 0
1	0252	44	102748	1520 0	4621 3	1	0932	144	43164	938 4	4616 7	1	1612	244	15610	432 2	4610 9
1	0256	45	507746	4491 4	4641 1	1	0936	145	41778	923 2	4616 6	1	1616	245	15329	423 6	4610 8
1	0300	46	1209285	7785 4	4662 3	1	0940	146	40472	909 0	4616 5	1	1620	246	15071	415 1	4610 7
1	0304	47	1705837	9703 9	4674 1	1	0944	147	39246	895 6	4616 4	1	1624	247	14716	406 6	4610 5
1	0308	48	1656496	10258 1	4677 5	1	0948	148	38089	883 1	4616 3	1	1628	248	14411	398 3	4610 4
1	0312	49	1838164	10190 7	4677 1	1	0952	149	37031	871 5	4616 2	1	1632	249	14116	390 0	4610 3
1	0316	50	1759727	3902 1	4675 3	1	0956	150	36039	860 7	4616 1	1	1636	250	13821	381 9	4610 2
1	0320	51	1662406	9544 1	4673 1	1	1000	151	35123	850 7	4616 1	1	1640	251	13531	373 9	4610 1
1	0324	52	1563416	9179 9	4670 9	1	1004	152	34281	841 5	4616 0	1	1644	252	13244	366 0	4610 0
1	0328	53	1472121	8844 0	4668 9	1	1008	153	33508	823 1	4615 9	1	1648	253	12963	358 2	4609 9
1	0332	54	1393667	8537 1	4667 0	1	1012	154	32804	825 4	4615 9	1	1652	254	12685	350 5	4609 8
1	0336	55	1318614	8231 1	4665 1	1	1016	155	32165	818 4	4615 8	1	1656	255	12413	343 0	4609 7
1	0340	56	1242207	7919 6	4663 1	1	1020	156	31589	812 1	4615 8	1	1700	256	12145	335 6	4609 6
1	0344	57	1168480	7619 1	4661 2	1	1024	157	31071	806 5	4615 8	1	1704	257	11883	328 3	4609 5
1	0348	58	1100850	7343 3	4659 5	1	1028	158	30609	801 5	4615 7	1	1708	258	11626	321 2	4609 4
1	0352	59	1041976	7103 3	4658 0	1	1032	159	30199	797 0	4615 7	1	1712	259	11374	314 3	4609 3
1	0356	60	993118	6885 3	4656 6	1	1036	160	29838	793 0	4615 7	1	1716	260	11127	307 5	4609 2
1	0400	61	945146	6662 8	4655 2	1	1040	161	29527	789 6	4615 6	1	1720	261	10886	300 8	4609 1
1	0404	62	895395	6432 1	4653 7	1	1044	162	29248	786 6	4615 6	1	1724	262	10650	294 3	4609 0
1	0408	63	845833	6202 3	4652 2	1	1048	163	29011	784 0	4615 6	1	1728	263	10419	287 9	4608 9
1	0412	64	799286	5981 8	4650 8	1	1052	164	28809	781 8	4615 6	1	1732	264	10195	281 7	4608 8
1	0416	65	754381	5778 2	4649 5	1	1056	165	28638	780 0	4615 6	1	1736	265	9975	275 6	4608 8
1	0420	66	715466	5597 7	4648 3	1	1100	166	28494	778 4	4615 6	1	1740	266	9762	269 7	4608 7
1	0424	67	682479	5444 7	4647 4	1	1104	167	28375	777 1	4615 6	1	1744	267	9554	264 0	4608 6
1	0428	68	655835	5305 8	4646 4	1	1108	168	28276	776 0	4615 5	1	1748	268	9351	258 4	4608 5
1	0432	69	629364	5160 2	4645 5	1	1112	169	28196	775 1	4615 5	1	1752	269	9154	252 9	4608 4
1	0436	70	601099	5004 8	4644 4	1	1116	170	28132	774 4	4615 5	1	1756	270	8963	247 7	4608 4
1	0440	71	571878	4844 1	4643 4	1	1120	171	28081	773 9	4615 5	1	1800	271	8777	242 5	4608 3
1	0444	72	542506	4682 5	4642 3	1	1124	172	28031	773 5	4615 5	1	1804	272	8596	237 5	4608 2
1	0448	73	513729	4524 3	4641 3	1	1128	173	28011	773 1	4615 5	1	1808	273	8421	232 7	4608 2
1	0452	74	486225	4373 0	4640 3	1	1132	174	27988	772 9	4615 5	1	1812	274	8251	228 0	4608 1
1	0456	75	450622	4212 2	4639 3	1	1136	175	27971	772 7	4615 5	1	1816	275	8087	223 4	4608 0
1	0500	76	437470	4104 9	4638 5	1	1140	176	27958	772 5	4615 5	1	1820	276	7927	219 0	4608 0
1	0504	77	417193	3993 4	4637 8	1	1144	177	27952	772 3	4615 5	1	1824	277	7773	214 8	4607 9
1	0508	78	400003	3888 9	4637 1	1	1148	178	27944	772 1	4615 5	1	1828	278	7624	210 7	4607 9
1	0512	79	386069	3822 2	4636 6	1	1152	179	27934	771 9	4615 5	1	1832	279	7479	206 7	4607 8
1	0516	80	375620	3751 1	4636 1	1	1156	180	27922	771 5	4615 5	1	1836	280	7340	202 8	4607 8
1	0520	81	364332	3671 6	4635 6	1	1200	181	27908	771 1	4615 5	1	1840	281	7205	199 1	4607 7
1	0524	82	351939	3501 3	4635 0	1	1204	182	27892	770 7	4615 5	1	1844	282	7075	195 5	4607 7
1	0528	83	338735	3391 3	4634 4	1	1208	183	27873	770 2	4615 5	1	1848	283	6949	192 0	4607 6
1	0532	84	325012	3394 7	4633 7	1	1212	184	27850	769 6	4615 5	1	1852	284	6828	188 7	4607 6
1	0536	85	311036	3296 3	4633 0	1	1216	185	27832	768 8	4615 5	1	1856	285	6711	185 4	4607 5
1	0540	86	297040	3197 7	4632 4	1	1220	186	27756	768 0	4615 5	1	1900	286	6590	182 3	4607 5

1	0544	87	283216	3100.4	4631.7	1	1224	187	27763	767.1	4615.4	1	1904	287	6491.	179.3	4607.4
1	0548	88	269719	3005.3	4631.1	1	1228	188	27726	766.1	4615.4	1	1908	288	6386	176.5	4607.4
1	0552	89	256677	2913.5	4630.4	1	1232	189	27685	765.0	4615.4	1	1912	289	6286	173.7	4607.4
1	0556	90	244196	2825.6	4629.8	1	1236	190	27638	763.7	4615.4	1	1916	290	6189	171.0	4607.3
1	0600	91	232373	2742.3	4629.3	1	1240	191	27587	762.3	4615.4	1	1920	291	6097	168.5	4607.3
1	0604	92	221000	2664.4	4628.7	1	1244	192	27531	760.7	4615.4	1	1924	292	6007	166.0	4607.3
1	0608	93	211067	2592.3	4628.2	1	1248	193	27468	759.0	4615.3	1	1928	293	5922	163.6	4607.2
1	0612	94	201755	2526.7	4627.8	1	1252	194	27400	757.1	4615.3	1	1932	294	5840	161.4	4607.2
1	0616	95	192435	2468.2	4627.4	1	1256	195	27326	755.1	4615.3	1	1936	295	5761	159.2	4607.2
1	0620	96	183151	2416.9	4627.0	1	1300	196	27245	752.8	4615.3	1	1940	296	5685	157.1	4607.1
1	0624	97	173922	2373.0	4626.7	1	1304	197	27158	750.4	4615.2	1	1944	297	5613	155.1	4607.1
1	0628	98	174743	2336.5	4626.5	1	1308	198	27064	747.8	4615.2	1	1948	298	5543	153.2	4607.1
1	0632	99	170553	2307.0	4626.3	1	1312	199	26962	745.0	461	1	1952	299	5477	151.3	4607.1
1	0636	100	167309	2284.2	4626.1	1	1316	200	26854	742.0	46	1	1956	300	5413	149.6	4607.0

PEAK FLOW (CFS)	TIME (HR)	MAXIMUM AVERAGE FLOW 24-HR 72-HR
1856496	3.13	155855 155855
		0.000 0.000
		256753 256753

PEAK STORAGE (AC-FT)	TIME (HR)	MAXIMUM AVERAGE STORAGE 24-HR 72-HR
10258	3.13	1501 1501

PEAK STAGE (FEET)	TIME (HR)	MAXIMUM AVERAGE STAGE 24-HR 72-HR
4677.47	3.13	4618.85 4618.85

CUMULATIVE AREA = 0.0 SQ MI

OPERATION	STATION	PEAK FLOW	TIME OF PEAK	AVERAGE FLOW FOR MAXIMUM PERIOD	24-HOUR	72-HOUR	BASEIN AREA	MAXIMUM STAGE	TIME OF MAX STAGE
ROUTED TO	O1	3911197.	1.00	510454.	156142.	156142.	0.0	5301.70	0.02
ROUTED TO	RCH1	3382228.	1.20	510230.	156141.	156141	0	5105.84	1.20
ROUTED TO	RCH2	3109632.	1.47	508561.	156140.	156140.	0.0	5013.82	1.47
ROUTED TO	RCH3	2703513	1.93	502006.	156137.	156137.	0.0	4919.17	1.93
ROUTED TO	RCH4	2343930.	2.40	492666.	156061.	156061.	0.0	4812.41	2.40
ROUTED TO	RCH5	1856496.	3.13	474495.	155855.	155855	0.0	4677.47	3.13

PLAN 1	ELEVATION STORAGE OUTFLOW	INITIAL VALUE 5301.70 252144 3570	SPILLWAY CREST 5301.70 252144 3570	TOP OF DAM 5301.70 252144 3570	RATIO OF PMF	MAXIMUM RESERVOIR W.S.ELEV	MAXIMUM DEPTH OVER DAM	MAXIMUM STORAGE AC-FT	MAXIMUM OUTFLOW CFS	DURATION OVER TOP HOURS	TIME OF MAX OUTFLOW HOURS	TIME OF FAILURE HOURS
1.00	5301.70	0.0	252144	3911197	0.0	1.00	0.0	0.0	0.0	0.0	0.0	0.0

... NORMAL END OF HEC-1 ...

Appendix F

SMPDBK Manual Computations

Manual Version of SMPDBK
Hypothetical Prismatic Channel Case Study
Summary of Calculations

Reference: Jonathan N. Wetmore and Danny L. Fread, "The NWS Simplified Dam-Break Model Executive Brief."

INPUT DATA

$A_s = 1940$ acres

$H = 5301.7 - 5040 =$ feet

$B_r = 500$ feet

$t_f = 1.0$ hour

$Q_o = 3,580$ cfs

$Vol = 251,300$ ac - ft = 1.09466×10^{10} ft³

<u>mile 0.0</u>		
<u>elev</u>	<u>: depth</u>	<u>: topwidth</u>
5030	0	0
5040	10	800
5240	210	1400

<u>mile 10.0</u>		
<u>elev</u>	<u>: depth</u>	<u>: topwidth</u>
4930	0	0
4940	10	1000
5140	210	1600

<u>mile 50.0</u>		
<u>elev</u>	<u>: depth</u>	<u>: topwidth</u>
4530	0	0
4540	10	1000
4740	210	1600

<u>mile 5.0</u>		
<u>elev</u>	<u>: depth</u>	<u>: topwidth</u>
4980	0	0
4990	10	800
5190	210	1400

<u>mile 25.0</u>		
<u>elev</u>	<u>: depth</u>	<u>: topwidth</u>
4780	0	0
4790	10	1000
4990	210	1600

CHANNEL DESCRIPTION

$$m = \frac{\sum((\log h_i)(\log B_i)) - \frac{(\sum \log h_i)(\sum \log B_i)}{I}}{\sum (\log h_i)^2 - \frac{(\sum \log h_i)^2}{I}}$$

$$\log k = \frac{\sum \log B_i}{I} - m \frac{\sum \log h_i}{I}$$

For Miles 0 to 5

$$m = \frac{10.209 - \frac{(3.322)(6.049)}{2}}{6.393 - \frac{(3.322)^2}{2}} = 0.18467$$

$$\log k = \frac{6.049}{2} - 0.18466 \frac{3.322}{2} = 2.7177$$

$$k = 522$$

$$B = kh^m = 522 h^{0.1847}$$

For Miles 10 to 50

$$B = 675 h^{0.1577}$$

MAXIMUM BREACH OUTFLOW (Q_{bmax})

$$C = \frac{23.4 As}{B_r} = \frac{23.4 (1940)}{500} = 90.792$$

$$Q_{bmax} = Q_o = 3.1 Br \left[\frac{C}{t_f + \frac{C}{\sqrt{H}}} \right]^3$$

$$= 3,590 + 3.1(500) \left[\frac{90.792}{1.0 + \frac{90.792}{\sqrt{261.7}}} \right]^3 = 4,016,000 \text{ cfs}$$

$$a = \frac{1.49}{n} S^{0.05} \frac{k}{(m+1)^{5/3}} = \frac{1.49}{0.04} \left[\frac{10}{5280} \right]^{0.5} \left[\frac{522}{(.1847+1)^{5/3}} \right] = 638.2$$

$$b = m + 5/3 = 0.1847 + 5/3 = 1.851$$

$$h_{max} = \left[\frac{Q_{bmax}}{a} \right]^{1/b} = \left[\frac{4,016,000}{638.2} \right]^{1/1.851} = 112.7 \text{ ft}$$

Check for Submergence

$$h_{weir} = \left[\frac{C}{t_f + \frac{C}{\sqrt{H}}} \right]^2 = \left[\frac{90.792}{1.0 + \frac{90.792}{\sqrt{261.7}}} \right]^2 = 188.5$$

$$\frac{h_{max}}{h_{weir}} = \frac{112.7}{188.5} = .59 < 0.67$$

Submergence correction not required.

DOWNSTREAM ROUTING

mile	5	10	25	50
X	26,400	52,800	132,000	264,000
FC	0.605	0.605	0.606	0.607
V*	1.326	1.324	1.319	1.310
XC	73,809	72,700	69,500	64,000
X/XC	0.358	0.726	1.899	4,124
QP/Q _{max}	0.922	0.851	0.704	0.537
QP	3,703	3,418	2,827	2,157

Mile : Peak Discharge (cfs)

0	4,016,000
5	3,703,000
10	3,418,000
25	2,827,000
50	2,157,000
