Texas Utilities Services Inc.
Comanche Peak Steam Electric Station
1980-1982 Units 1 and 2
CPSES SSI Dam
Design Calculation Checks

SAFE SHUTDOWN IMPOUNDMENT DAM

DESIGN CALCULATIONS AND CALCULATIONS CHECK

BY
FREESE AND NICHOLS
CONSULTING ENGINEERS

FOR
TEXAS UTILITIES SERVICES, INC.
COMANCHE PEAK STEAM ELECTRIC STATION
CPSES 1980-1982
UNITS 1 AND 2
SSI DAM

VOLUME NO. 2

MEMORANDUM:

TO: R. A. Thompson, III
Project Engineer

FROM: Ronnie M. Lemons
Design Engineer

RE: Independent Review of Calculations
Texas Utilities Services, Inc., - SSI Dam

DATE: August 22, 1974.

In accordance with the Freese and Nichols Quality Assurance Program, Paragraph 4.3.5 and Appendix C, Section 4.3, 5.12, 5.14, and 6.3, I have checked all design calculations. I vertified the applicability of the engineering principles and concepts to the design and verified the accuracy of the calculations.

I have no comments and found no needed corrections. I found the results of all calculations in good shape.

Ronnie M Lemons

cc: R. S. Gooch, Project Manager

MEMORANDUM

TO: Ronnie M. Lemons, Design Engineer

FROM: R. A. Thompson, III, Project Engineer

RE: TUSI Engineering Analysis

July 29, 1974

Transmitted herewith is Freese and Nichols Design Input Document for design of the Sahfe Shutdown Impoundment (SSI) at the Comanche Peak Steam Electric Station (CPSES) for your use in review of the design calculations.

Paragraph 4.3.5 of Freese and Nichols Quality Assurance Program requires the independent "review for accuracy and technical adequacy and conformance with the Design Input Document." A copy of this paragraph is attached for your information.

Should you determine the need for additional calculations not contained in previous analysis, you are to so note in your written review comments. If the performance of these calculations fall within your field of competence, you are to perform them and submit them to the Project Engineer for review.

This review is to be submitted to the Project Engineer on or before August 12, 1974, in order for the project to stay on schedule.

cc: R. S. Gooch, Project Manager

R. A. Thompson

INTRODUCTION

The following is a guide to information on the design calculations:

Volume 1 - Design Calculations

Volume 2 - Independent Review of Design Calculations

Volume 3 - Computer Runs for SSI Dam Spillway for the Independent Review

The hydrologic and hydraulic design considerations for the SSI Dam are affected by the hydrologic and hydraulic design considerations for the SCR. In short, the water levels in the SSI Dam Reservoir are affected by the water levels in the SCR. For this reason the hydrologic and hydraulic design considerations for the SCR are included with these design calculations for the SSI Dam.

The calculations for the two reservoirs were identified by the use of the following page numbering system:

1.5.A Page 3 of 4

2.5.B Page 3 of 4

1.5 Page 3 of 4

1. Refers to Volume 1 (Design Calculations)
2. Refers to Volume 2 (Independent Review)
5. Refers to section number within the volume
A. Refers to the calculations on the SCR
B. Refers to the calculations on the SSI Dam

No letter - Refers to calculations that have no seperation between the SSI and SCR.

In some sections of the early calculations the SSI Dam is referred to as the Mini-Dam. If this notation appears, it has been crossed through and changed to SSI Dam.

In most cases the independent review consisted of completely reworking all calculations in similar or simplified methods. The independent review calculations are in Volume No. 2. When a section in that Volume is blank it means that a detailed check on the original calculations was performed and may be found in that section in Volume No. 1. The independent reviewer has initialed all design calculations as being checked. That does not necessarily mean a detailed check was performed on that design calculation but means that the end result compares with the result obtained by the independent review.

All symbols and abbreviations used are ones which are in common usage. The source of formulae or equations are listed in the introduction to each section or within the text of each section.

As finally designed, the SSI spillway had 3:1 side slopes instead of 2:1 as shown in the calculations. This gives an added factor of safety as the area of flow for a particular depth is somewhat larger.

Client TUSI Date: 8-17-74

Project Safe Shutdown Impoundment By: ~~BML~~

Title: Squaw Creek Reservoir - Basin Characteristics ✓ RML

Approved _____ Project Engineer

The basin characteristics were determined from U.S.G.S. quads with a scale of 1" ≈ 2000' and a 10' contour interval. (Quads are on accompanying large sheets). The following basin characteristics are used:

Sub-drainage Basin	A (mi^2)	L (mi.)	L_{CA} (mi)
Panther Branch	3.47	4.15	2.05
Lollar Branch	5.52	5.17	2.74
Panter Branch	9.53	7.46	4.51
Squaw Creek	24.62	13.57	6.89
SA-1	2.37	3.27	1.59
SA-2	1.72	2.37	1.35
Million Branch	2.66	3.39	2.00
Small Drainage areas	9.13	0.468	0.252

$A^{(Area)}$ - is determined from quad sheets with planimeter work and calculations on 2.1 page 3 to 5 of 5.

L - length of drainage area - measured from quad sheets

L_{CA} - length from centroid of drainage area to outlet - measured from quad sheets.

Title: Typical Stream Lengths in Small Drainage Areas Adjoining Squaw Creek Reservoir

Date: 12/17/77

By: TAK

✓ PHL

Straight Line Length Along Shore (feet)

5100	2800
3800	8700
1800	4700
3100	4100
3100	2700
3100	4000
1500	8400
1500	3000
3100	2400
1900	4000
2900	2400
3300	1900
2500	2800
600	1600
2500	3100
	3200
	1600
	1500
	102900 ft ✓

Measured Area

9.13 sq.mi.

$$\frac{9.13 \text{ sq.mi.} \times (5{,}280 \text{ ft})^2}{102{,}900 \text{ ft}} = 2473.6 \text{ feet}$$

or 0.468 mi.

Avg Ratio of L/Lc on larger drainage areas = 1.86

$$L_c = \frac{0.468}{1.86} = 0.252$$

T.U.S.I. - Safe Shutdown Impoundment

Title: Squaw Creek Reservoir Watershed Areas

Project Engineer

Date: 12/14/73

By: TAR

✓ RMC

Watershed Area	Measured Size (mi^2)	Adjusted Size (mi^2)
Reservoir Surface	4.92	4.98 (1)
Small Drainage Areas Adjoining Reservoir	9.07	9.13 (3)
Panther Branch	3.53	3.57 (2)
Leo Nar Branch	5.48	5.52 (3)
Panther Branch	9.47	9.53 (3)
Squaw Creek	24.46	24.62 (2)
SA-1	2.35	2.37 (3)
SA-2	1.71	1.72 (3)
Million Branch	2.64	2.66 (3)
	63.63	64.00

(1) From published report @ Elev 775 3220 + 40 = 3,128 ac or 4.98 sq. mi.

(2) From response to NEC Question 2.8

(3) Measured Size $\times \frac{(64.0 - 4.98 - 3.47)}{(63.63 - 4.92 - 3.53)}$ = Measured Size $\times \frac{55.55}{55.18}$ = Measured Size $\times 1.006705$

T.U.S.I. - Safe Shutdown Impoundment Project Engineer

PLANIMETER COMPUTATIONS

Project Squaw Creek Reservoir Date 12/14/73

Map Identification USGS Quad 1:24,000 [illegible]; Tolar, 1961; Granbury, 1961

Planimeter Name A. Ott Number 72954 Arm Setting —

Contour Elev. or Area No.		Planimeter Reading	Differences	Av. Diff.	Constant (1)	Area
						15,000 × 15,000 / 5280 × 5280 = 8.070764 sq mi
	3	89422	15530	15531 p.u.		
	2	73892	15,532			
	1	58360			8.070764 sq. mi. / 15,531 p.u.	= 0.000519655 sq mi./p.u.
	3					
	2					
	1					
Drainage Area	3	215469	73,275	73266	0.000519655	38.07
Total [illegible] including reservoir	2	142194	73,256			
	1	68938				63.8[illegible] sq. [illegible]
Drainage Area on Pelham, Tolar Granbury Quads	3	110666	49,552	49,551	0.000519655	25.75
	2	61114	49,550			
	1	11564				
Reservoir Surface Area @ 775.0 ft.	3	30495	9471	9,470	0.000519655	4.92 sq mi 3149.[illegible]
	2	21024	9,469			
	1	11555				
	3			Published [illegible] Table		
	2			@ Elev 775	Area =	3,228
	1			Mini-dam	Area =	− 40
						3,188 ac.
	3					
	2					
	1					
	3					
	2					
	1					

(1) For determination of Planimeter Constant, see Sheet 4 of 5

Planimeter Constant this work: One unit= 0.000519655 ~~Ac. Sq. ft.~~ Sq. mi.

Planimetered by: TAR Checked by: [illegible] Sheet ___ of ___

SWF-18-8 Page ___

I.U.S.L. - Safe Shutdown Impoundment **Project Engineer**

PLANIMETER COMPUTATIONS

Project Squaw Creek Reservoir Date 12/14/73

Map Identification USGS Quad 1:24,000 Nemo, 1961; Paluxy, 1961; Mill City, 1961; Toler, 1961; Glen Rose, 1961

Planimeter Name A OH Number 72954 Arm Setting —

Contour Elev. or Area No.		Planimeter Reading	Computations: Differences	Av. Diff.	Constant (1)	Area
Surrounding Small Drainage Areas	3	65417	17,461	17,461	0.000519655	9.07 sq. mi
	2	47956	17,461			
	1	30,495				
Panther Branch Main-Dam	3	81057	6,799	6,796	0.000519655	3.53 sq. mi.
	2	74258	6,793			
	1	67465				
Loller Branch	3	44050	10,552	10,550.5	0.000519655	5.48 sq. mi
	2	33498	10,549			
	1	22949				
Powder Branch	3	101754	18,212	18,218.5	0.000519655	9.47 sq. mi
	2	83542	18,225			
	1	65317				
Squaw Creek	3	144525	47,079	47,075.5	0.000519655	24.46 sq. mi.
	2	97446	47,072			
	1	50374				
SA-1	3	51303	4535	4530.5	0.000519655	2.35 sq. mi.
	2	46768	4526			
	1	42242				
SA-2	3	54135	3300	3,300.0	0.000519655	1.71 sq. mi.
	2	51435	3,300			
	1	48135				
Mullins Branch	3	67645	5075	5075.5	0.000519655	2.64 sq. mi.
	2	67570	5076			
	1	57494				

(1) For determination of Planimeter Constant, see Sheet 4 of 5

Planimeter Constant this work: One unit = 0.000519655 ~~Acs Sq. I.D.~~ Sq. mi. 58.71 +4.92 63.63

Planimetered by: TAR Checked by: PHV Sheet ___ of ___

SWF-18-B Page ___

21 pages of 5

Client TUSI Date: 8-17-74

Project Safe Shutdown Impoundment By: ~~RME~~

Title: PROBABLE MAXIMUM PRECIPITATION ✓ RMV

Approved
Project Engineer

The probable maximum precipitation is determined for the 64 mi² drainage area at Squaw Creek. From the curve determined the rainfall for each one-half hour increment is found, then these are placed in a pattern that will apprpximate the arrangement that will give the most runoff from the unit graph.

The P.M.P. curve for 64 mi² is determined.

Storm Duration	Total Rain (inches)	Ratio To 6hr. Rain	Precipitation (inches)
1 hr.		.49	12.5
2		.64	16.3
3		.76	19.4
4		.84	21.5
5		.92	23.5
6	25.5		25.5
12	31.3		31.3
24	34.7		34.7
48	39.1		39.1

Total Rain - from 2.A. page 2 of 6 which was checked by D.D.H.

Ratio - from 2.2. page 3 of 5 which is a page zeroxed from Design of Small Dams, 2ND Ed.

Precip. - from total rain and ratio.

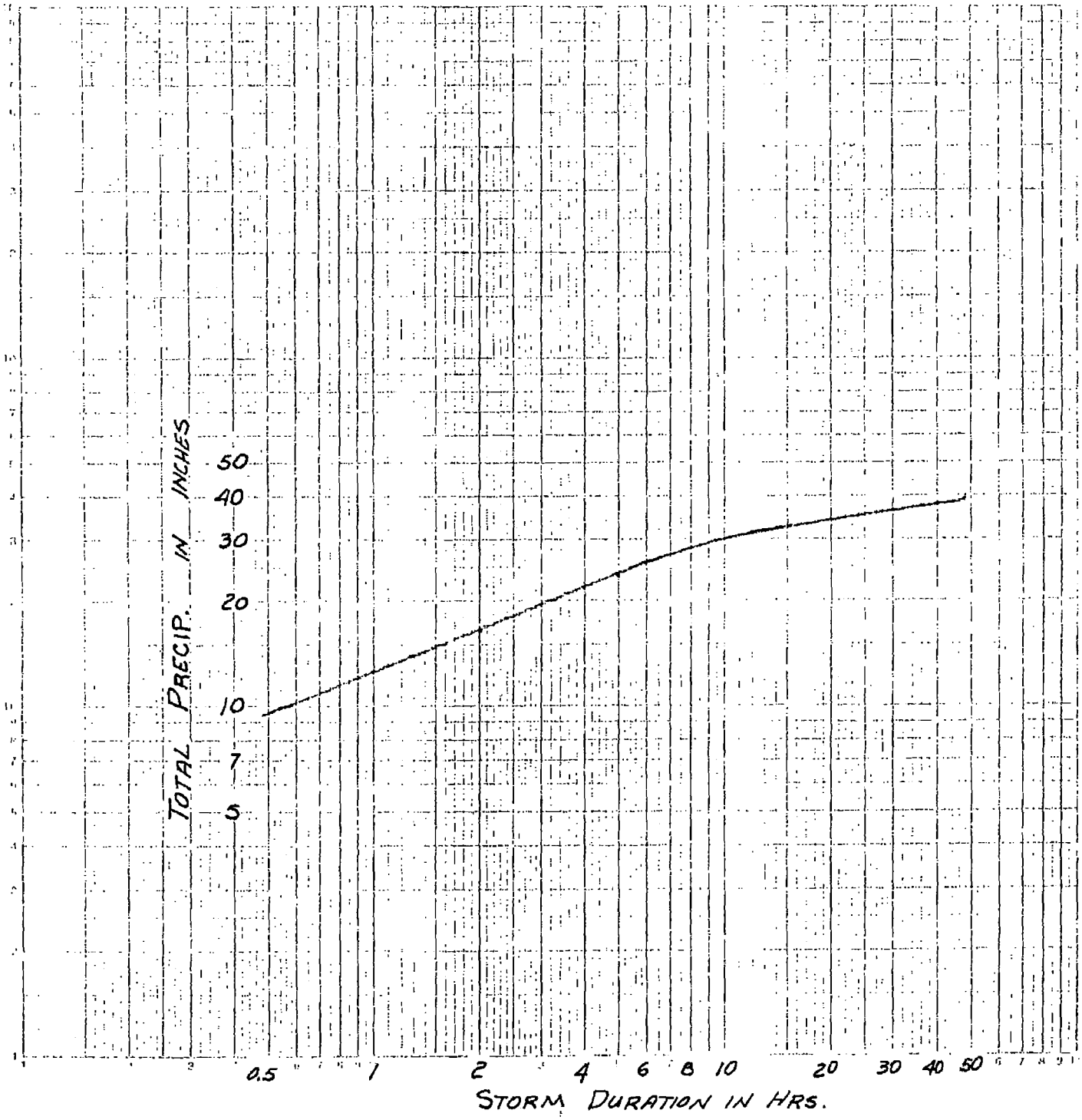
These values are plotted on 2.2. page 2 of 6 for further use on 2.2. page 4 of 6.

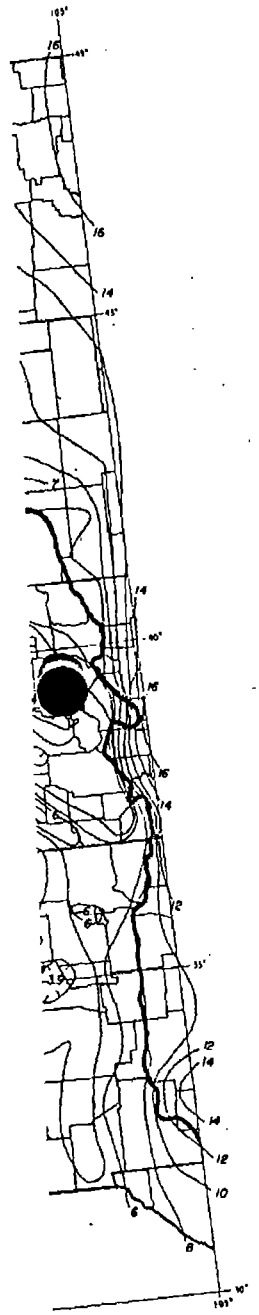
S.S.I. - Safe Shutdown Impoundment

Project Engineer

PROBABLE MAXIMUM PRECIPITATION
on 64 mi²

8-17-74
RMC





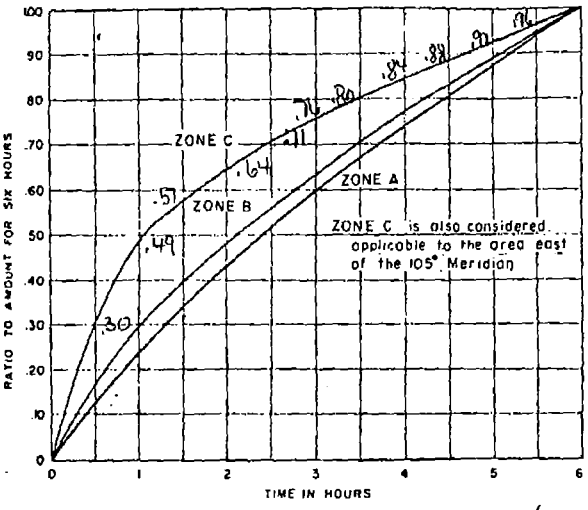


Figure 18. Distribution of 6-hour rainfall for area west of 105° meridian. See figure 17 for area included within each zone. 288–D–2758.

(2) *Generalized charts for the United States west of 105° meridian.*—Separate charts of probable maximum precipitation are presented for general-type storms which cover relatively large areas of rainfall, and for thunderstorm rainfall having limited areal coverage.

a. *General-type storm.*—Figure 17 probable maximum 6-hour point gener storm values for areas of the United west of the 105° meridian. This chart is on the results of approximately 330 storm analyses prepared by the Bure Reclamation for specific drainage basins of the 105° meridian, as well as considera numerous design storm analyses made b Special Studies and Hydrometeorol Branches of the National Weather Se The variable topography of this part o United States greatly influences the stor tential and permits only limited transpo of storms. These point storm values ca applied to areas up to 1,000 square miles b of the curves presented on figure 19. T hour general-type storm values can be exte for longer duration periods by multiplyin 6-hour value by the appropriate factor s in table 1. Values for duration of less th hours can be obtained from the appro curve of figure 18.

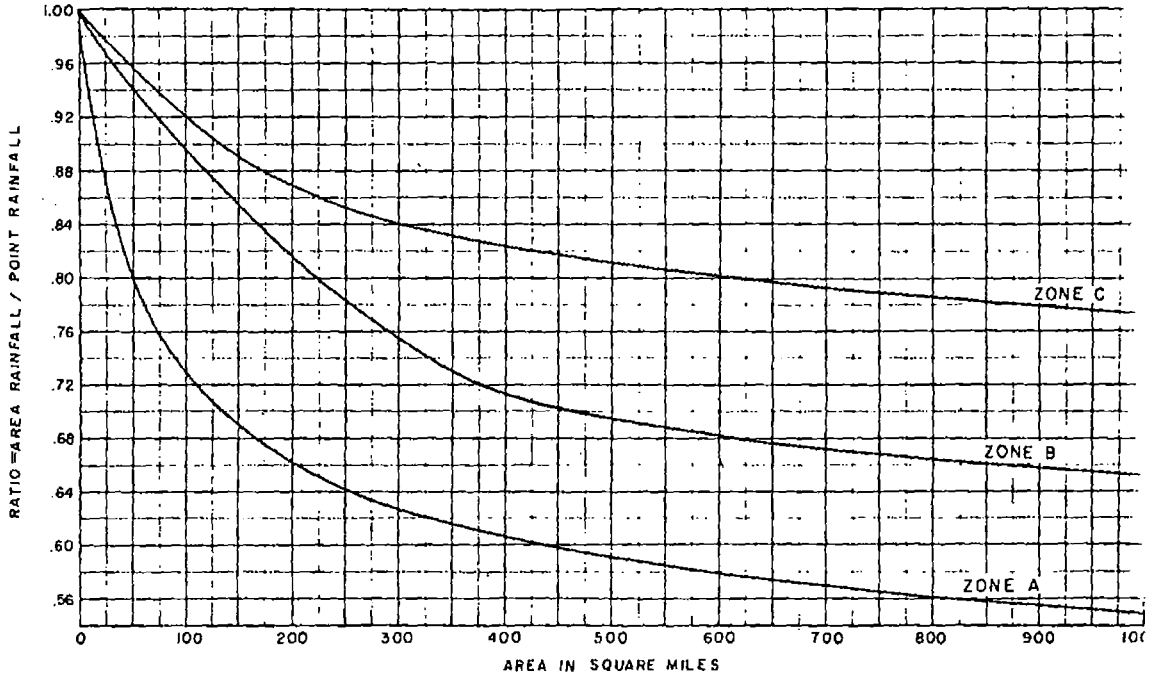


Figure 19. General storm: conversion ratio from 6-hour point rainfall to 6-hour area rainfall for area west of 105° meridio 288–D–2759.

2756, 288–D–2757.

Shutdown Impoundment

Project Engineer

P.M.P
8-17-74
RML

Z.A. page 3 of 6

T.U.S.I. - Safe Shutdown Impoundment

Project Engineer

Title: SQUAW CREEK RESERVOIR: PROBABLE MAXIMUM PRECIPITATION

Date: 12/19/73

By: TAR

✓ RMC

Time (hrs)	Rainfall (inches)	Diff (inches)	Time (hrs)	Rainfall (inches)	Diff (inches)	Time (hrs)	Rainfall (inches)	Diff (inches)	Time (hrs)	Rainfall (inches)	Diff (inches)
0.5	7.7	4.8	12.5	31.6	3	24.5	34.9	1	36.5	37.3	1
1.0	12.5	2.0	13.0	31.9	2	25.0	35.0	1	37.0	37.4	1
1.5	14.5	1.8	13.5	32.1	2	25.5	35.1	1	37.5	37.5	1
2.0	16.3	1.8	14.0	32.3	2	26.0	35.2	1	38.0	37.6	1
2.5	18.1	1.3	14.5	32.5	2	26.5	35.3	1	38.5	37.7	1
3.0	19.4	1.1	15.0	32.7	2	27.0	35.4	1	39.0	37.8	1
3.5	20.5	1.0	15.5	32.9	2	27.5	35.5	1	39.5	37.9	1
4.0	21.5	1.0	16.0	33.1	2	28.0	35.6	1	40.0	38.0	1
4.5	22.5	1.0	16.5	33.2	1	28.5	35.7	1	40.5	38.1	1
5.0	23.5	1.0	17.0	33.4	1	29.0	35.8	1	41.0	38.2	1
5.5	24.5	1.0	17.5	33.5	1	29.5	35.9	1	41.5	38.3	1
6.0	25.5	.8	18.0	33.6	1	30.0	36.0	1	42.0	38.40	1
6.5	26.3	.7	18.5	33.7	1	30.5	36.1	1	42.5	38.50	1
7.0	27.0	.6	19.0	33.8	1	31.0	36.2	1	43.0	38.60	.05
7.5	27.6	.5	19.5	33.9	1	31.5	36.3	1	43.5	38.65	.05
8.0	28.1	.5	20.0	34.0	1	32.0	36.4	1	44.0	38.70	.05
8.5	28.6	.4	20.5	34.1	1	32.5	36.5	1	44.5	38.75	.05
9.0	29.0	.4	21.0	34.2	1	33.0	36.6	1	45.0	38.80	.05
9.5	29.4	.4	21.5	34.3	1	33.5	36.7	1	45.5	38.85	.05
10.0	29.8	.4	22.0	34.4	1	34.0	36.8	1	46.0	38.90	.05
10.5	30.2	.4	22.5	34.5	1	34.5	36.9	1	46.5	38.95	.05
11.0	30.6	.4	23.0	34.6	1	35.0	37.0	1	47.0	39.00	.05
11.5	31.0	.3	23.5	34.7	1	35.5	37.1	1	47.5	39.05	.05
12.0	31.3	.3	24.0	34.8	1	36.0	37.2	1	48.0	39.1	

Rainfall - from 2.2 page 2 of 5 for column labeled time

Diff. - rainfall rates subtracted from each other

Freese AND Nichols CONSULTING ENGINEERS

T.U.S.I. - Safe Shutdown Impoundment

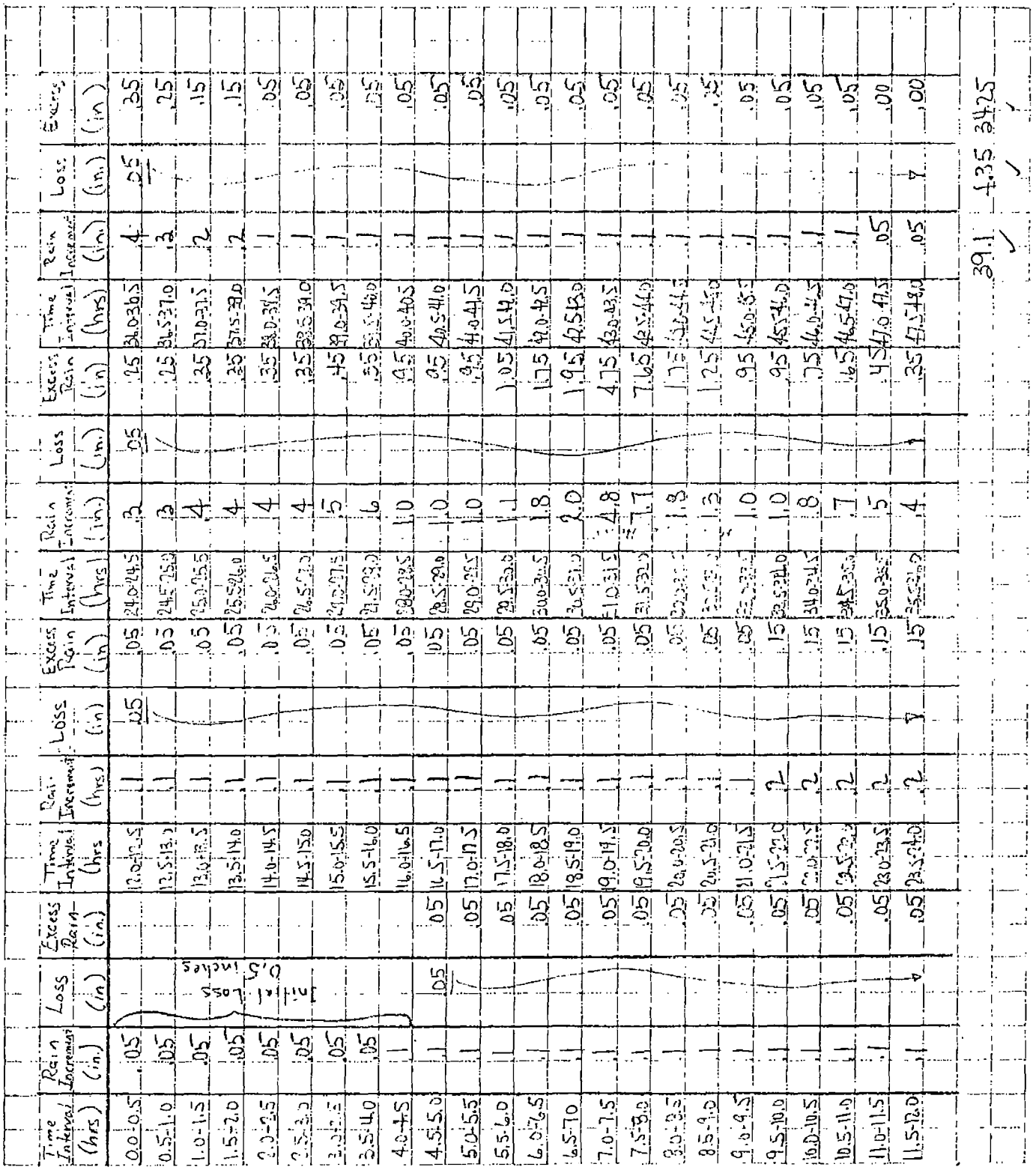
Project Engineer

Title : SQUAW CREEK RESERVOIR:
CRITICAL RAINFALL ARRANGEMENT

Date : 12/19/92

By : TAR

✓ RML



Time Interval (hrs)	Rain Increment (in.)	Loss (in.)	Excess Rain (in.)	Time Interval (hrs)	Rain Increment (in.)	Loss (in.)	Excess Rain (in.)	Time Interval (hrs)	Rain Increment (in.)	Loss (in.)	Excess Rain (in.)
0.0-0.5	.05	.05		12.0-12.5	1	.05	.05	24.0-24.5	.3		.25
0.5-1.0	.05			12.5-13.0	1		.05	24.5-25.0	.3		.25
1.0-1.5	.05			13.0-13.5	1		.05	25.0-25.5	.4		.35
1.5-2.0	.05			13.5-14.0	1		.05	25.5-26.0	.4		.35
2.0-2.5	.05			14.0-14.5	1		.05	26.0-26.5	.4		.35
2.5-3.0	.05			14.5-15.0	1		.05	26.5-27.0	.4		.35
3.0-3.5	.05			15.0-15.5	1		.05	27.0-27.5	.5		.45
3.5-4.0	.05			15.5-16.0	1		.05	27.5-28.0	.6		.55
4.0-4.5	.1			16.0-16.5	1		.05	28.0-28.5	1.0		.95
4.5-5.0	.1	.05	.05	16.5-17.0	1		.05	28.5-29.0	1.0		.95
5.0-5.5	.1		.05	17.0-17.5	1		.05	29.0-29.5	1.0		.95
5.5-6.0	.1		.05	17.5-18.0	1		.05	29.5-30.0	1.1		1.05
6.0-6.5	.1		.05	18.0-18.5	1		.05	30.0-30.5	1.8		1.75
6.5-7.0	.1		.05	18.5-19.0	1		.05	30.5-31.0	2.0		1.95
7.0-7.5	.1		.05	19.0-19.5	1		.05	31.0-31.5	4.8		4.75
7.5-8.0	.1		.05	19.5-20.0	1		.05	31.5-32.0	7.7		7.65
8.0-8.5	.1		.05	20.0-20.5	1		.05	32.0-32.5	1.8		1.75
8.5-9.0	.1		.05	20.5-21.0	1		.05	32.5-33.0	1.3		1.25
9.0-9.5	.1		.05	21.0-21.5	1		.05	33.0-33.5	1.0		.95
9.5-10.0	.1		.05	21.5-22.0	2		.15	33.5-34.0	1.0		.95
10.0-10.5	.1		.05	22.0-22.5	2		.15	34.0-34.5	.8		.75
10.5-11.0	.1		.05	22.5-23.0	2		.15	34.5-35.0	.7		.65
11.0-11.5	.1		.05	23.0-23.5	2		.15	35.0-35.5	.5		.45
11.5-12.0	.1		.05	23.5-24.0	2		.15	35.5-36.0	.4		.35

39.1 4.35 3425 ✓ ✓

Freese AND Nichols CONSULTING ENGINEERS

Client TUSI

Project Safe Shutdown Impoundment

Title: P.M.P. Arrangement

Date: 8-17-74

By: ~~RML~~

✓ RML

Approved

Project Engineer

The arrangement of rainfall on 2.2. page 5 of 6 is the arrangement which will approximate maximum runoff.

Rain Increment - from 2.2. page 4 of 6 in a rearranged form.

Loss - 0.5" initial loss
0.1" loss per hr. (0.05" loss per ½-hr.)
these come from 2,3, page 1 of 1

Excess - Rain Increment minus Loss

Freese and Nichols CONSULTING ENGINEERS

Client TUSI

Date: 6-17-74

Project Safe Shutdown Impoundment

By: RML

Title: Precipitation Losses

✓

Approved

Project Engineer

The losses as described on 1.3, page 1 of 1 appear to be conservative compared to the information on the Paluxy River. I, therefore, feel they are O.K.

initial loss - 0.5"
loss - 0.1"/hr.

Freese and Nichols CONSULTING ENGINEERS

Client TUSI

Date: 8-19-74

Project Safe Shutdown Impoundment

By: RML

Title: Squaw Creek Reservoir Watershed Unit-graph Variation

✓ FHL

Approved _____ Project Engineer

A synthetic unit graph for the entire SCR watershed including Panther Branch above the SSI was determined using p. 10 of EM 1110-2-1405. The unit graph for each sub-drainage area was determined using a log-normal distribution based on a program developed by John A. Constant of the Fort Worth District of the Corps of Engineers. A second set of unit graph for the upper 30.7 mi.^{2} of the drainage area was developed by increasing the peak of the unit graph by 30% to account for nonlinearity (ref: p. 15 of EM 1110-2-1405). The first set of unit-graphs are combined as on 2.4, page 17 of 19. This combined unit-graph is to have other than the maximum six hours of rainfall applied to it. The unit-graphs with the increased peaks are combined with the unit graphs from the sub-drainage basins that were not increased to give the total unit-graph which is to have the maximum six hours of rainfall applied to it. The unit-graph for Panther Branch above the SSI is prepared in the same method but is not combined with any other unit-graphs.

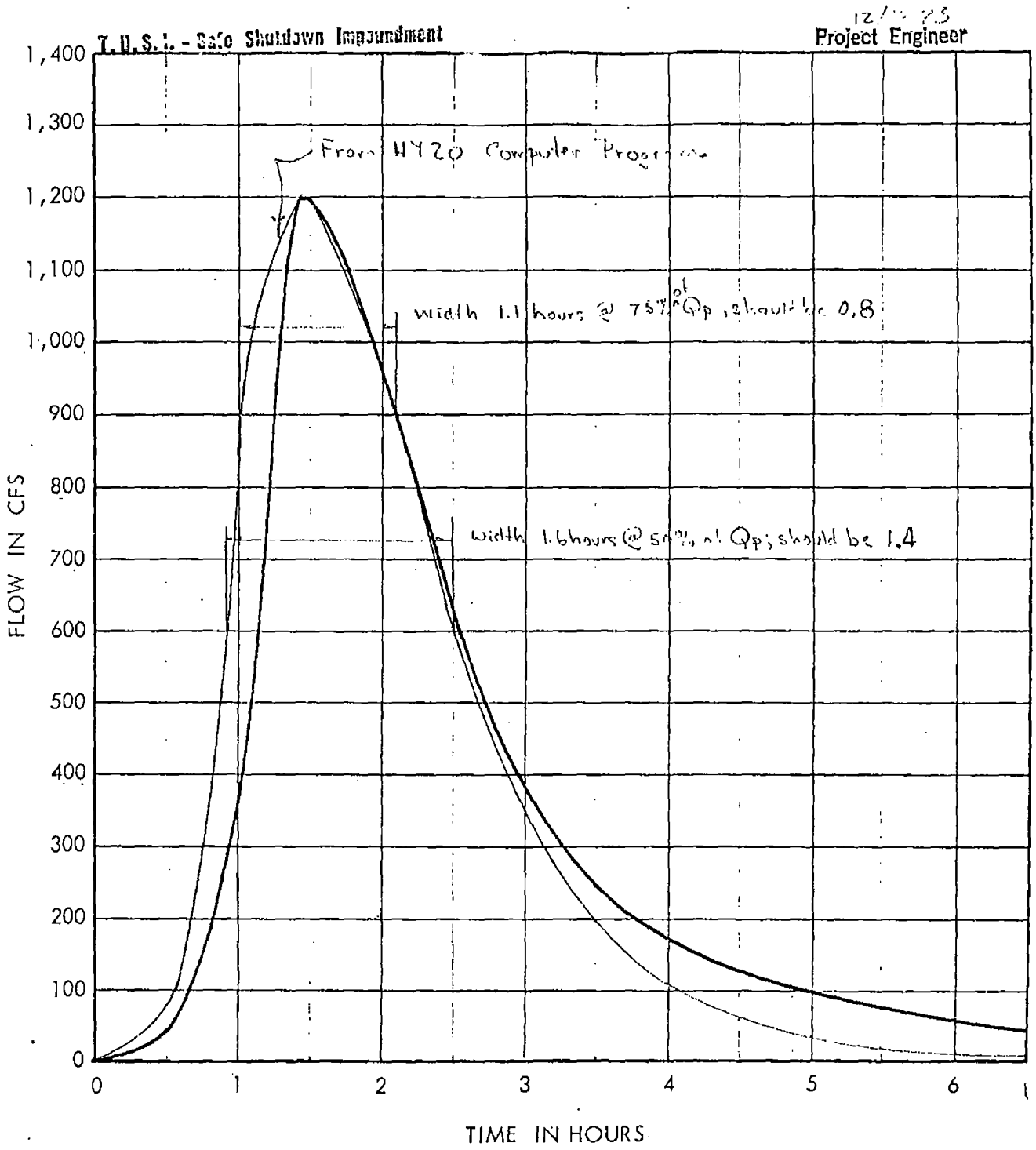
T.U.S.I. - Safe Shutdown Impoundment | **Project Engineer**

Title: Squaw Creek Reservoir Watershed
Unit Hydrograph Times and Flow

Date: 12/14/73
By: TAR
✓ RMc

	Small Drainage Area Near the Reservoir	Panther Branch	Little Branch	Panter Branch	Squaw Creek	SA-1	SA-2	Million Branch
1. A (Sq. Mi.)	9.13	3.47	5.52	9.53	24.62	2.37	1.72	2.66
2. L (Mi.)	.469[1]	4.15	5.17	7.46	13.57	3.27	2.37	3.39
3. L_{CA} (Mi.)	.352[1]	2.05	2.74	4.51	6.88	1.59	1.35	2.00
4. $(L L_{CA})^{.3}$	.527	1.90	2.21	2.87	3.90	1.64	1.42	1.78
5. C_t	.6	.6	1.1	1.1	1.1	.6	.6	.6
6. $t_p = C_t (L L_{CA})^{.3}$ (hrs)	.32	1.14	2.43	3.16	4.29	.98	.85	1.07
7. $t_r = t_p / 5.5$ (hrs)	.06	.21	.44	.58	.78	.18	.16	.20
8. t_R (hrs)	.5	.5	.5	.5	.5	.5	.5	.5
9. $t_{pR} = t_p + .25(t_R - t_r)$	.43	1.21	2.45	3.14	4.22	1.06	.94	1.15
10. $t_{pR} + .5 t_R$	.68	1.46	2.70	3.39	4.47	1.31	1.19	1.40
11. C_p 640	420	420	[illegible]	440	440	420	420	420
12. $Q_{pR} = \frac{C_p 640 \times A}{t_{pR}}$ (cfs)	8,920	1,200	990	1,340	2570	940	770	970
13. $Q_{pR} \times 1.30$ *	—	—	1,290	1,740	3340	—	—	—

* For maximum 6 hours of rainfall excess, unit hydrograph peak increased 30% on upper 39.11 sq mi. ([illegible])



COMANCHE PEAK S.E.S. NUCLEAR PLANT UNITS 1 and 2
SAFE SHUTDOWN IMPOUNDMENT UNIT HYDROGRAPH
FIGURE 2.4.3.7-2

SQUAW CREEK RESERVOIR

"SUBAREA UNIT HYDROGRAPHS"

T.N.S.I. - Safe Shutdown Impoundment

Project Engineer

FREESE, NICHOLS AND ENDRESS

Date 12/17/75 By T.A.B.

Page 1 Of 2

```
    5    10   15   20   25   30   35   40   45   50   55   60   65   70   75   80
110
SQUAW CREEK RESERVOIR
0.5 - HR UNIT HYDROGRAPH FOR
SMALL DRAINAGE AREAS ADJOINING RESERVOIR
          .5          .43          .5          8920          91.13          0
SQUAW CREEK RESERVOIR
0.5 - HR UNIT HYDROGRAPH FOR OTHER THAN MAX 6-HRS
OF RAIN FOR LOLLAR BRANCH DRAINAGE AREA
          .5          2.45          .5          4900          5.52          0
SQUAW CREEK RESERVOIR
0.5 - HR UNIT HYDROGRAPH FOR MAX 6-HRS OF RAIN
FOR LOLLAR BRANCH DRAINAGE AREA
          .5          2.45          .5          12900          5.52          0
SQUAW CREEK RESERVOIR
0.5 - HR UNIT HYDROGRAPH FOR OTHER THAN MAX 6-HRS
OF RAIN FOR PANTER BRANCH DRAINAGE AREA
          .5          2.14          .51          13640          9.53          0
SQUAW CREEK RESERVOIR
0.5 - HR UNIT HYDROGRAPH FOR MAX 6-HRS OF RAIN
FOR PANTER BRANCH DRAINAGE AREA
          .5          3.14          .5          17140          9.53          0
SQUAW CREEK RESERVOIR
0.5 - HR UNIT HYDROGRAPH FOR OTHER THAN MAX 6-HRS
OF RAIN FOR SQUAW CREEK DRAINAGE AREA
          .5          4.22          .5          25770          24.62          0
```

SQUAW CREEK RESERVOIR

SUBAREA UNIT HYDROGRAPHS

T.U.S.I. - Safe Shutdown Impoundment

FREESE, NICHOLS AND ENDRESS

Date 12/17/73 By TAR

Page 3 Of 3

Project Engineer

SQUAW CREEK RESERVOIR
0.5 - HR UNIT HYDROGRAPH FOR MAX 6-HRS OF RAIN
FOR SQUAW CREEK DRAINAGE AREA
.5 4.22 .5 3240 24.62 0
SQUAW CREEK RESERVOIR
0.5 - HR UNIT HYDROGRAPH FOR
SA-1 DRAINAGE AREA
.5 1.06 .5 940 2.37 0
SQUAW CREEK RESERVOIR
0.5 - HR UNIT HYDROGRAPH FOR
SA-2 DRAINAGE AREA
.5 .91 .5 770 1.72 0
SQUAW CREEK RESERVOIR
0.5 - HR UNIT HYDROGRAPH FOR
MILLION BRANCH DRAINAGE AREA
.5 1.15 .5 970 2.60 0
SQUAW CREEK RESERVOIR
0.5 - HR UNIT HYDROGRAPH FOR
FAINTHEED BRANCH (MINI-DAM) DRAINAGE AREA
.5 1.21 .5 1200 3.47 0

Project Engineer

T.U.S.I. - Cole Shadows Impoundment

SUGAR CREEK RESERVOIR
.5 - HR UNIT HYDROGRAPH FOR
SMALL DRAINAGE AREAS ADJOINING RESERVOIR

DT = 0.500 TMQ = 0.680 QMAX = 8920. A = 9.130
TIME TO HALF VOLUME = 0.775704

SIGMA =0.15759466

NO OF HRS	INST FLOW
0.500	6229.
1.000	5070.
1.500	828.
2.000	107.
2.500	14.
3.000	2.
3.500	0.
SUM =	12254.
VOLUME =	510. AF

JFM

2.4. Page 5 of 19

SQUAW CREEK RESERVOIR
S - HR UNIT HYDROGRAPH FOR OTHER THAN MAX. 6 HRS.
OF RAIN FOR LOLLAR BRANCH DRAINAGE AREA

DT = 0.500 TMQ = 2.700 QMAX = 990. A = 5.520
TIME TO HALF VOLUME = 3.383489

SIGMA =0.20630391

NO OF HRS	INST FLOW
0.500	2.
1.000	111.
1.500	460.
2.000	811.
2.500	977.
3.000	966.
3.500	853.
4.000	703.
4.500	555.
5.000	427.
5.500	322.
6.000	241.
6.500	179.
7.000	132.
7.500	98.
8.000	72.
8.500	54.
9.000	40.
9.500	30.
10.000	22.
10.500	17.
11.000	13.
11.500	9.
12.000	7.
12.500	5.
13.000	4.
13.500	3.
14.000	2.
14.500	2.
15.000	1.
SUM =	7134.
VOLUME =	297. AF

SQUAW CREEK RESERVOIR
5 - HR UNIT HYDROGRAPH FOR MAX 6 HRS OF RAIN
FOR LOLLAR BRANCH DRAINAGE AREA

DT = 0.500 TMQ = 2.700 QMAX = 1290. A = 5.520
TIME TO HALF VOLUME = 3.110725

SIGMA =0.16490192

NO OF HRS	INST FLOW
0.500	0.
1.000	42.
1.500	389.
2.000	944.
2.500	1264.
3.000	1241.
3.500	1021.
4.000	755.
4.500	522.
5.000	346.
5.500	223.
6.000	141.
6.500	89.
7.000	55.
7.500	35.
8.000	22.
8.500	13.
9.000	8.
9.500	5.
10.000	3.
10.500	2.
11.000	1.
SUM =	7132.

VOLUME = 297. AF

T.U.S.I. - Safe Shutdown Impoundment

Project Engineer
/ PMV

SQUAW CREEK RESERVOIR
.5 - HR UNIT HYDROGRAPH FOR OTHER THAN MAX 6 HRS.
OF RAIN FOR PANTER BRANCH DRAINAGE AREA

DT = 0.500 TMW = 3.390 QMAX = 1340. A = 9.530
TIME TO HALF VOLUME = 4.273200

SIGMA =0.20897331

NO OF HRS	INST FLOW
0.500	0.
1.000	54.
1.500	319.
2.000	734.
2.500	1097.
3.000	1297.
3.500	1337.
4.000	1263.
4.500	1127.
5.000	967.
5.500	808.
6.000	663.
6.500	536.
7.000	430.
7.500	343.
8.000	273.
8.500	216.
9.000	171.
9.500	135.
10.000	107.
10.500	85.
11.000	67.
11.500	53.
12.000	43.
12.500	34.
13.000	27.
13.500	22.
14.000	17.
14.500	14.
15.000	11.
15.500	9.
16.000	7.
16.500	6.
17.000	5.
17.500	4.
18.000	3.
18.500	3.
19.000	2.
19.500	2.
20.000	1.

SUM = 12312.

VOLUME = 513. AF

T.U.S.I. - Safe Shutdown Impoundment

Project Engineer
VFM

SQUAW CREEK RESERVOIR
SCS - HR UNIT HYDROGRAPH FOR MAX 6 HRS OF RAIN
FOR PANTER BRANCH DRAINAGE AREA

DT = 0.500 TMQ = 3.390 QMAX = 1740. A = 9.530
TIME TO HALF VOLUME = 3.935052

SIGMA =0.16769292

NO OF HRS	INST FLOW
0.500	0.
1.000	12.
1.500	187.
2.000	684.
2.500	1275.
3.000	1655.
3.500	1734.
4.000	1587.
4.500	1329.
5.000	1048.
5.500	793.
6.000	583.
6.500	420.
7.000	298.
7.500	210.
8.000	147.
8.500	102.
9.000	71.
9.500	49.
10.000	34.
10.500	24.
11.000	17.
11.500	12.
12.000	8.
12.500	6.
13.000	4.
13.500	3.
14.000	2.
14.500	1.
SUM =	12310.

VOLUME = 512. AF

SQUAW CREEK RESERVOIR
.5 - HR. UNIT HYDROGRAPH FOR OTHER THAN MAX 6 HRS
OF RAIN FOR SQUAW CREEK DRAINAGE AREA

DT = 0.500 TMQ = 4.470 QMAX = 2570. A = 24.620
TIME TO HALF VOLUME = 5.680539

SIGMA =0.21260821

NO OF HRS	INST FLOW
0.500	0.
1.000	24.
1.500	214.
2.000	666.
2.500	1270.
3.000	1844.
3.500	2268.
4.000	2504.
4.500	2569.
5.000	2503.
5.500	2349.
6.000	2144.
6.500	1918.
7.000	1689.
7.500	1470.
8.000	1267.
8.500	1085.
9.000	925.
9.500	785.
10.000	664.
10.500	561.
11.000	473.
11.500	399.
12.000	336.
12.500	283.
13.000	238.
13.500	201.
14.000	169.
14.500	143.
15.000	121.
15.500	102.
16.000	86.
16.500	73.
17.000	62.
17.500	53.
18.000	45.
18.500	38.
19.000	33.
19.500	28.
20.000	24.
20.500	20.
21.000	17.
21.500	15.
22.000	13.
22.500	11.
23.000	10.

T.O.S.I. - Safe Shutdown Impoundment

Project Engineer
F.M.L

SQUAW CREEK RESERVOIR
6 - HR UNIT HYDROGRAPH FOR MAX 6 HRS OF RAIN
FOR SQUAW CREEK DRAINAGE AREA

DT = 0.500 TMQ = 4.470 QMAX = 3340. A = 24.620
TIME TO HALF VOLUME = 5.216764

SIGMA =0.17069981

NO OF HRS	INST FLOW
0.500	0.
1.000	2.
1.500	70.
2.000	412.
2.500	1120.
3.000	1996.
3.500	2751.
4.000	3209.
4.500	3339.
5.000	3207.
5.500	2906.
6.000	2523.
6.500	2121.
7.000	1741.
7.500	1404.
8.000	1116.
8.500	877.
9.000	684.
9.500	531.
10.000	410.
10.500	315.
11.000	242.
11.500	186.
12.000	142.
12.500	109.
13.000	84.
13.500	64.
14.000	49.
14.500	38.
15.000	29.
15.500	22.
16.000	17.
16.500	13.
17.000	10.
17.500	8.
18.000	6.
18.500	5.
19.000	4.
19.500	3.
20.000	2.
20.500	2.
21.000	1.
SUM =	31791.

VOLUME = 1784. AF

2.1 Case 12 a

SQUAW CREEK RESERVOIR
.5 - HR UNIT HYDROGRAPH FOR
SA-1 DRAINAGE AREA

DT = 0.500 TMQ = 1.310 QMAX = 940. A = 2.370
TIME TO HALF VOLUME = 1.601490

SIGMA =0.19466253

NO OF HRS	INST FLOW
0.500	93.
1.000	784.
1.500	898.
2.000	602.
2.500	332.
3.000	170.
3.500	85.
4.000	42.
4.500	21.
5.000	11.
5.500	6.
6.000	3.
6.500	2.
7.000	1.
SUM =	3056.
VOLUME =	127. AF

Project Engineer

JPML

SQUAW CREEK RESERVOIR
.5 - HR UNIT HYDROGRAPH FOR
SA-2 DRAINAGE AREA

DT = 0.500 TMQ = 1.190 QMAX = 770. A = 1.720
TIME TO HALF VOLUME = 1.442885

SIGMA =0.19064087

NO OF HRS	INST FLOW
0.500	109.
1.000	712.
1.500	670.
2.000	382.
2.500	184.
3.000	84.
3.500	38.
4.000	17.
4.500	8.
5.000	4.
5.500	2.
6.000	1.
SUM =	2216.
VOLUME =	92. AF

Project Engineer

QUAW CREEK RESERVOIR
5 - HR UNIT HYDROGRAPH FOR
MILLION BRANCH DRAINAGE AREA

DT = 0.500 TMQ = 1.400 QMAX = 970. A = 2.660
TIME TO HALF VOLUME = 1.721747

SIGMA =0.19752884

NO OF HRS	INST FLOW
0.500	75.
1.000	738.
1.500	959.
2.000	713.
2.500	430.
3.000	238.
3.500	127.
4.000	68.
4.500	36.
5.000	19.
5.500	11.
6.000	6.
6.500	3.
7.000	2.
7.500	1.
SUM =	3433.

VOLUME = 143. AF

Project Engineer

SQUAW CREEK RESERVOIR
5 - HR UNIT HYDROGRAPH FOR
PANTHER BRANCH (MINI-DAM) DRAINAGE AREA
SSI

DT = 0.500 TMQ = 1.460 QMAX = 1200. A = 3.470
TIME TO HALF VOLUME = 1.802430

SIGMA =0.19935008

NO OF HRS	INST FLOW
0.500	79.
1.000	854.
1.500	1190.
2.000	940.
2.500	604.
3.000	350.
3.500	196.
4.000	108.
4.500	59.
5.000	33.
5.500	18.
6.000	10.
6.500	6.
7.000	4.
7.500	2.
8.000	1.
SUM =	4478.
VOLUME =	186. AF

2d. Page 16 of 1

12-18-73

T. U. S. I. - Safe ... Impoundment

SQUAW CREEK RESERVOIR - COMPOSITE Project/Engineer (0.5 Hr) TEU72120

UNIT HYDROGRAPH - OTHER THAN MAX 6 HOURS OF RAIN TAR RMC

	1	2	3	4	5
Number of Hours	Small Drainage Areas Adjoining Reservoir	Lollar Branch	Panter Branch	Squaw Creek	SA-1	SA-2	Million Branch
1	0.5	6229	2	10	0	93	109	15
2	1.0	5070	111	54	24	184	712	738
3	1.5	828	460	319	214	898	670	959
4	2.0	107	811	734	666	602	382	713
5	2.5	14	977	1091	1270	332	184	430
6	3.0	2	966	1297	1844	170	84	238
7	3.5	0	853	1337	2268	85	38	127
8	4.0		703	1263	2504	42	17	68
9	4.5		555	1121	2569	21	8	36
10	5.0	12250	427	967	2503	11	4	19
11	5.5	✓	322	808	2349	6	2	11
12	6.0		241	663	2144	3	1	6
13	6.5		179	536	1918	2		3
14	7.0		132	430	1689	11	2211	2
15	7.5		98	343	1470			1
16	8.0		72	273	1267	3050		
17	8.5		54	216	1085			3426
18	9.0		40	171	925			
19	9.5		30	135	785			
20	10.0		22	107	664			
21	10.5		17	85	561			
22	11.0		13	67	473			
23	11.5		9	53	399			
24	12.0		7	43	336			
25	12.5		5	34	283			
26	13.0		4	27	238			
27	13.5		3	22	201			
28	14.0		2	17	169			
29	14.5		2	14	143			
30	15.0		1	11	121			
31	15.5			9	102			
32	16.0			7	86			
33	16.5		7118	6	73			
34	17.0		✓	5	62			
35	17.5			4	53			
36	18.0			3	45			
37	18.5			3	38			
38	19.0			2	33			
39	19.5			2	28			
40	20.0			1	24			
				12797				

6 Total	7	8	9 Number of Hours	10 Squaw Creek	11 Total	12	13
4508			20.5	20	20		
7493			21.0	17	17		
4348			21.5	15	15		
4015			22.0	13	13		
4304			22.5	11	11		
4601			23.0	10	10		
4708			23.5	8	8		
4597			24.0	7	7		
4316			24.5	6	6		
3931			25.0	5	5		
3498			25.5	5	5		
3058			26.0	4	4		
2632			26.5	3	3		
2254			27.0	3	3		
1912			27.5	3	3		
1612			28.0	2	2		
1355			28.5	2	2		
1136			29.0	2	2		
950			29.5	2	2		
793			30.0	1	1		
663							
555				317.65			
461							
386					72,112 ✓		
322							
269							
226							
188							
159							
133							
111							
93							
79							
67							
57							
48							
41							
35							
30							
25							

$$\frac{72{,}112\ \text{cfs} \times 1.9835\ \frac{\text{ac-ft/day}}{\text{cfs}} \times \frac{1\ \text{day}}{48\ \text{hr}} \times \frac{12\ \text{in}}{\text{ft}}}{33.55\ \text{sq mi} \times 640\ \frac{\text{ac}}{\text{sq mi}}} = 1.005809\ \text{in.}$$ ✓

Project Engineer

SQUAW CREEK RESERVOIR – COMPOSITE 0.5-HR UNIT HYDROGRAPH – MAX 6 HRS OF RAIN

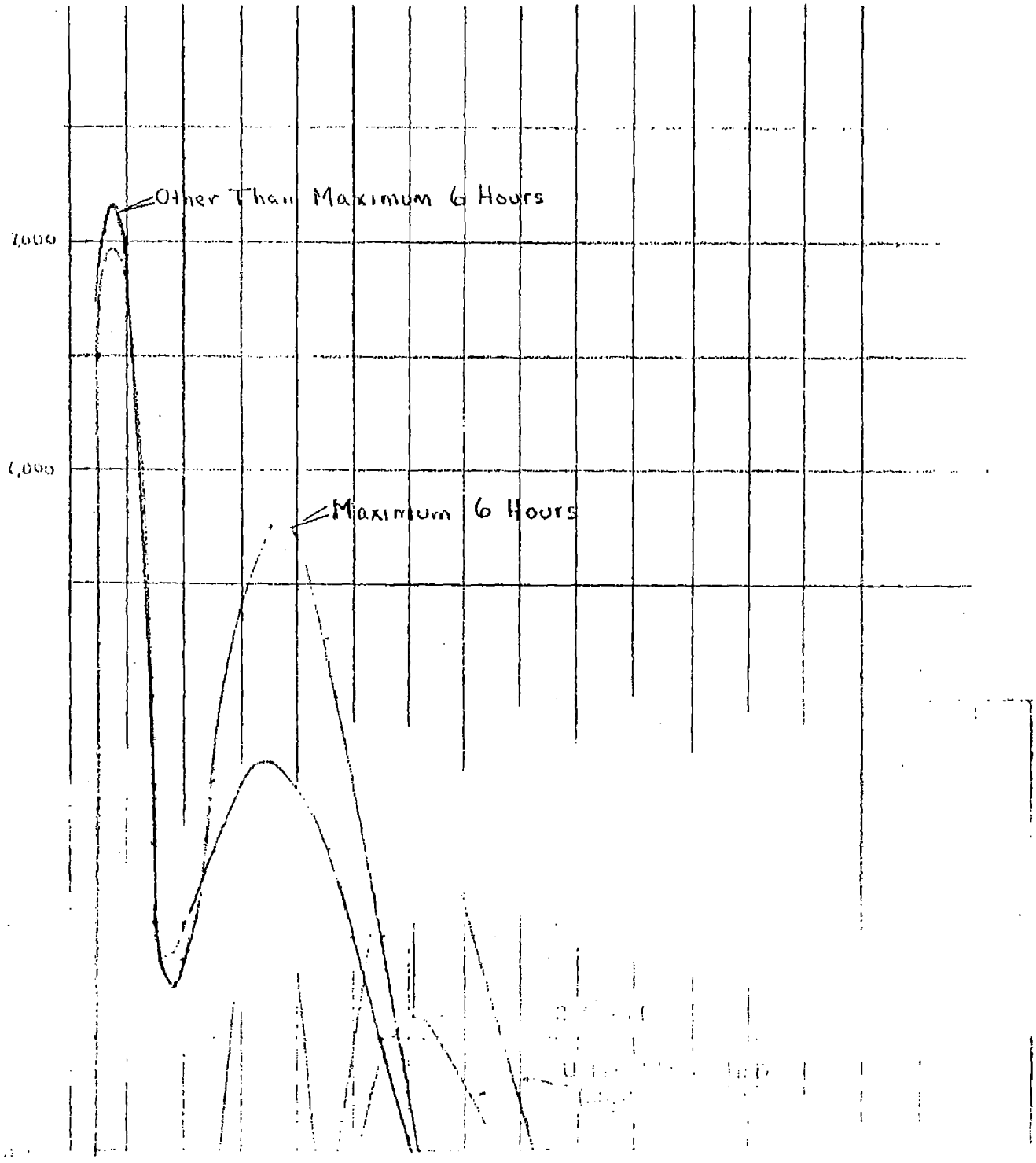
TJJ 12/20

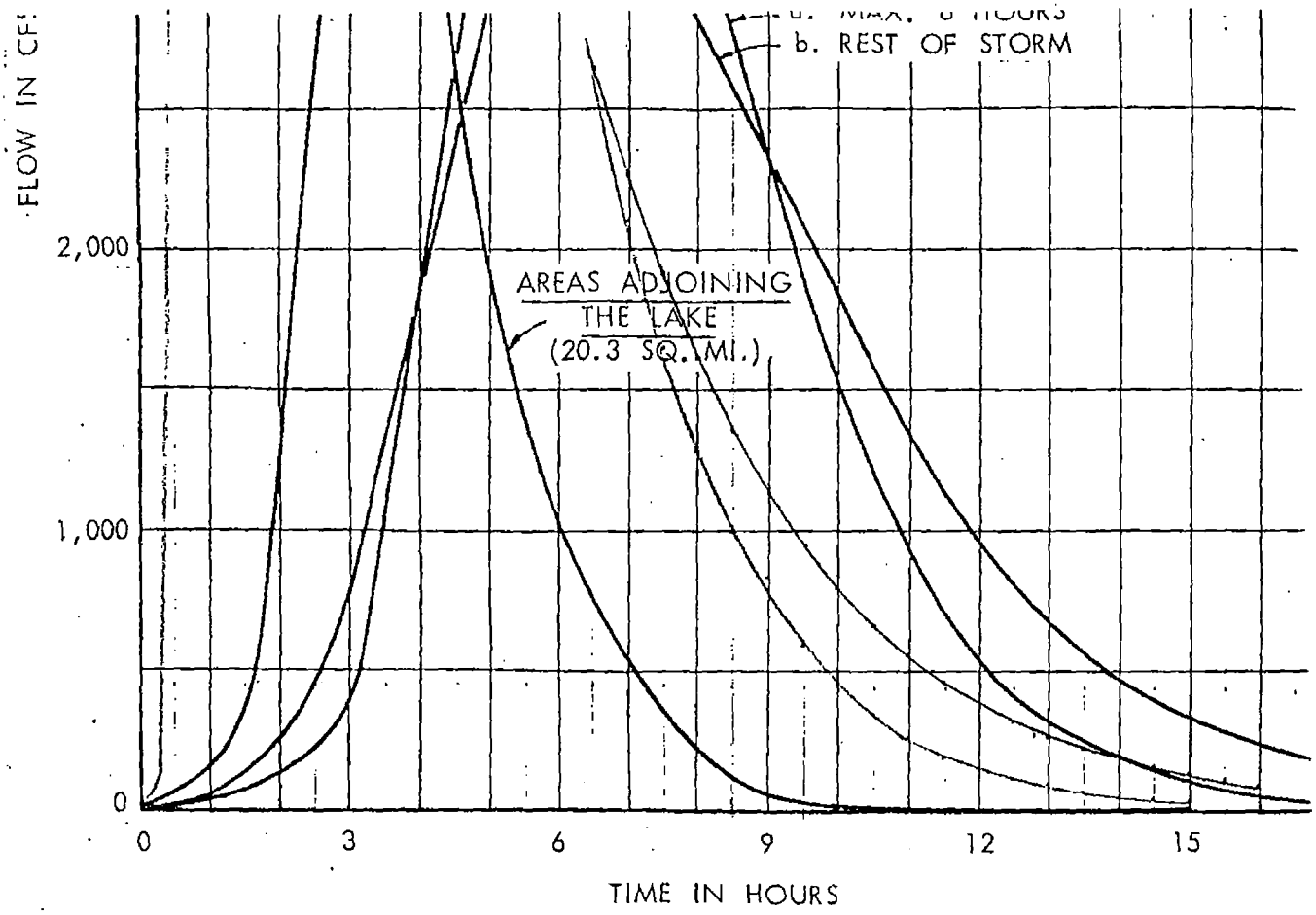
TAR 12/21

Number of Hours	Small Drainage Areas Adjoining Reservoir	Lollar Branch	1 Porter Branch	2 Squaw Creek	3 SA-1	4 SA-2	5 Million Branch
0.5	6229	0	0	0	93	109	75
1.0	5070	42	12	2	784	712	738
1.5	828	389	187	70	818	670	959
2.0	107	944	684	412	602	382	713
2.5	14	1764	1275	1120	332	184	430
3.0	2	1241	1655	1996	170	84	238
3.5	0	1021	1734	2751	85	38	127
4.0		755	1587	3209	42	17	68
4.5		522	1329	3339	21	8	36
5.0	12250	346	1048	3201	11	4	19
5.5		223	793	2906	6	2	11
6.0		141	583	2523	3	1	6
6.5		89	420	2121	2		3
7.0		55	298	1741	1	2211	2
7.5		35	210	1404			1
8.0		22	147	1116	3050		
8.5		13	102	877			34426
9.0		8	71	684			
9.5		5	49	531			
10.0		3	34	410			
10.5		2	24	315			
11.0		1	17	242			
11.5			12	186			
12.0			8	142			
12.5		7121	6	107			
13.0			4	84			
13.5			3	64			
14.0			2	49			
14.5			1	38			
15.0				29			
15.5				22			
16.0			12295	17			
16.5				12			
17.0				10			
17.5				8			
18.0				6			
18.5				5			
19.0				4			
19.5				3			
20.0				2			

6	7	8	9	10	11	12	13
Total			Number of Hours	Squaw Creek	Total		
6506			20.5	2	2		
7360			21.0	1	1		
4001							
3844				3177.0	7241.23 ✓	✓	
4619							
5386							
5756							
5678							
5255							
4637							
3941							
3257							
2635							
2097			7241.23 cfs/sq.mi.	× 1.9835	× 1 day/48.5 hr	× 12 in/ft	= 1.00596 in. ✓
1650			149.55 sq.mi.	× 48.4 sq.mi.			
1285							
992							
763							
585							
447							
341							
260							
198							
150							
115							
88							
67							
51							
39							
29							
22							
17							
13							
10							
8							
6							
5							
4							
3							
2							

[illegible] Project Engineer
/RML





COMANCHE PEAK S.E.S.
NUCLEAR PLANT
UNITS 1 and 2

SQUAW CREEK WATERSHED
UNIT HYDROGRAPHS

FIGURE 2.4.3.3.3-1

Client TUSI

Project Safe Shutdown Impoundment

Title: Probable Max. Flood Hydrographs

Date: 8-21-74

By: ~~RML~~

✓ RML

Approved _____ Project Engineer

The probable maximum flood hydrograph is developed by applying the probable maximum precipitation from E.2. page 5 of 6 to the unit graphs. The precipitation is applied to three different unit graphs. One is the unit graph for other than the maximum six hours of rain. The second is for the maximum six hours of rainfall and the third is for the mini-dam drainage area which has no correction for nonlinearity. To get the total flood hydrograph the other than max. six hours and max. six hours are combined with the lagged inflow from the SSI (mini-dam.) This is done in the "Flood Routing" section. In this section the precipitation is applied to the unit graph and reservoir surface to get the average inflow for each ½-hour interval. This is done by a computer program which works similar to the example on p. 80 of Introduction to Hydrology by Viessman, Harbaugh, and Knapp. The computer program also applies the rain to the reservoir surface then goes through the mechanics of getting the average inflow.

HYDROGRAPH AND MASS CURVE PROGRAM

Date: 8-20-
By: RML
Page: of

CONTROL CARD

Squaw Creek Reservoir - Other than Max Str.

	Type of Unit Hydrograph (Hours)	Number of Rainfall Values	Number of Unit Hydrograph Ordinate Values	Surface Area of Reservoir at Normal Level	Control Number
Cols:	1 2 3 4 5	6 7 8 9 10	11 12 13 14 15	16 17 18 19 20 21 22 23 24 25	80
	.5	9 6	6 2	3 8 0 6	1

For more conservative results assume W.S. at max. reservoir elev. for area on which to apply rainfall.

Max W.S. = 799.0 Area 3878 Ac - Total
72 AC SSI
3806 Ac SCR

HYDROGRAPH AND MASS CURVE PROGRAM

Date: 5-80
By: RML
Page: ___ of ___

Project Engineer

Squaw Creek Reservoir (From 2.2, page 5 of 6)

RAINFALL DATA - OTHER THAN MAX 6 HOURS

T.U.S.I. - Safe Shutdown Impoundment

Cols	Rainfall 7	8	9	10	Losses 18	19	20	Excess 27	28	29	30
1				5			5				0
2				5			5				0
3				5			5				0
4				5			5				0
5				5			5				0
6				5			5				0
7				5			5				0
8				5			5				0
9			1	0		1	0				0
10			1	0			5				5
11			1	0			5				5
12			1	0			5				5
13			1	0			5				5
14			1	0			5				5
15			1	0			5				5
16			1	0			5				5
17			1	0			5				5
18			1	0			5				5
19			1	0			5				5
20			1	0			5				5
21			1	0			5				5
22			1	0			5				5
23			1	0			5				5
24			1	0			5				5
25			1	0			5				5
26			1	0			5				5
27			1	0			5				5
28			1	0			5				5
29			1	0			5				5
30			1	0			5				5
31			1	0			5				5
32			1	0			5				5
33			1	0			5				5
34			1	0			5				5
35			1	0			5				5
36			1	0			5				5

Cols	Rainfall 7	8	9	10	Losses 18	19	20	Excess 27	28	29	30
37			1	0			5				5
38			1	0			5				5
39			1	0			5				5
40			1	0			5				5
41			1	0			5				5
42			1	0			5				5
43			1	0			5				5
44			2	0			5			1	5
45			2	0			5			1	5
46			2	0			5			1	5
47			2	0			5			1	5
48			2	0			5			1	5
49			3	0			5			2	5
50			3	0			5			2	5
51			4	0			5			3	5
52			4	0			5			3	5
53			4	0			5			3	5
54			4	0			5			3	5
55			5	0			5			4	5
56			6	0			5			5	5
57				0			0				0
58				0			0				0
59				0			0				0
60				0			0				0
61				0			0				0
62				0			0				0
63				0			0				0
64				0			0				0
65				0			0				0
66				0			0				0
67				0			0				0
68				0			0				0
69			8	0			5			7	5
70			7	0			5			6	5
71			5	0			5			5	5
72			4	0			5			3	5

25 pane 3 of 15

Squaw Peak Reservoir (from 2.2, page 5 of 6) By: RML

RAINFALL DATA – OTHER THAN MAX 6 HOURS Page: ___ of ___

T.V.S.I. - Safe Shutdown Impoundment Project Engineer

	Rainfall				Losses			Excess			
Cols	7	8	9	10	18	19	20	27	28	29	30
1			4	0			5			3	5
2			3	0			5			2	5
3			2	0			5			1	5
4			2	0			5			1	5
5			1	0			5				5
6			1	0			5				5
7			1	0			5				5
8			1	0			5				5
9			1	0			5				5
10			1	0			5				5
11			1	0			5				5
12			1	0			5				5
13			1	0			5				5
14			1	0			5				5
15			1	0			5				5
16			1	0			5				5
17			1	0			5				5
18			1	0			5				5
19			1	0			5				5
20			1	0			5				5
21			1	0			5				5
22			1	0			5				5
23				5			5				0
24				5			5				0
25											
26											
27											
28											
29											
30											
31											
32											
33											
34											
35											
36											

	Rainfall				Losses			Excess			
Cols	7	8	9	10	18	19	20	27	28	29	30
37											
38											
39											
40											
41											
42											
43											
44											
45											
46											
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65											
66											
67											
68											
69											
70											
71											
72											

2.5. page 4 of 6

HYDROGRAPH AND MASS CURVE PROGRAM — Date: 8/20/

SQUAW CREEK RESERVOIR — OTHER THAN MAX 24 HOURS / By: RMC

UNIT HYDROGRAPH ORDINATES (from 2.4. page 7 of 19) Page: ___ of ___

T. U. S. I. - Safe Shutdown Impoundment

Project Enginee

Cols:	Ordinates 6	7	8	9	10
1					0
2		6	5	0	8
3		7	4	9	3
4		4	3	4	8
5		4	0	1	5
6		4	3	0	4
7		4	6	0	1
8		4	7	0	8
9		4	5	9	7
10		4	3	1	6
11		3	9	3	1
12		3	4	9	8
13		3	0	5	8
14		2	6	3	8
15		2	2	5	4
16		1	9	1	2
17		1	6	1	2
18		1	3	5	5
19		1	1	3	6
20			9	5	0
21			7	9	3
22			6	6	3
23			5	5	2
24			4	6	1
25			3	8	6
26			3	2	2
27			2	6	9
28			2	2	6
29			1	8	8
30			1	5	9
31			1	3	3
32			1	1	1
33				9	3
34				7	9
35				6	7
36				5	7

Cols:	Ordinates 6	7	8	9	10
37				4	8
38				4	1
39				3	5
40				3	0
41				2	5
42				2	0
43				1	7
44				1	5
45				1	3
46				1	1
47				1	0
48					8
49					7
50					6
51					5
52					5
53					4
54					3
55					3
56					3
57					2
58					2
59					2
60					2
61					1
62					0
63					
64					
65					
66					
67					
68					
69					
70					
71					
72					

Cols:	Ordinates 6	7	8	9	10
73					
74					
75					
76					
77					
78					
79					
80					
81					
82					
83					
84					
85					
86					
87					
88					
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107					
108					

Note: Last value must be Zero (0).

HYDROGRAPH AND MASS CURVE PROGRAM

Date: 8-20-
By: AML
Page: of

CONTROL CARD = SCR - Max. Ghrs. of Rain

	Type of Unit Hydrograph (Hours)	Number of Rainfall Values	Number of Unit Hydrograph Ordinate Values	Surface Area of Reservoir at Normal Level	Control Number
Cols:	1 2 3 4 5	6 7 8 9 10	11 12 13 14 15	16 17 18 19 20 21 22 23 24 25	80
	5	6 8	4 4	3 8 0 6	1

HYDROGRAPH AND MASS CURVE PROGRAM — Date: 8-20
By: RM
Page: — of —

RAINFALL DATA — SCP. Max. 6hrs. of Rain (from 2.2. page 5 of 6)

	Rainfall				Losses			Excess			
Cols	7	8	9	10	18	19	20	27	28	29	30
1				0			0				0
2											
3											
4											
5											
6											
7											
8											
9											
10											
11											
12											
13											
14											
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28											
29											
30											
31											
32											
33											
34											
35											
36				0			0				0

	Rainfall				Losses			Excess			
Cols	7	8	9	10	18	19	20	27	28	29	30
37				0			0				0
38											
39											
40											
41											
42											
43											
44											
45											
46											
47											
48											
49											
50											
51											
52											
53											
54											
55											
56				0			0				0
57		1	0	0			5			9	5
58		1	0	0			5			9	5
59		1	0	0						9	5
60		1	1	0					1	0	5
61		1	8	0					1	7	5
62		2	0	0					1	9	5
63		4	8	0					4	7	5
64		7	7	0					7	6	5
65		1	8	0					1	7	5
66		1	3	0					1	2	5
67		1	0	0						9	5
68		1	0	0			5			9	5
69				0							
70											
71											
72											

Squaw Creek Reservoir - Max 6 Hours (From 3-4 page 13 of 19) By: RML

Page: 1 of

Project Engin

Unit Hydrograph Ordinates - CFS

I.U.S.I. - Safe Shutdown Impoundment

Cols:	Ordinates 6	7	8	9	10
1					0
2		6	5	0	6
3		7	3	6	0
4		4	0	0	1
5		3	8	4	4
6		4	6	1	9
7		5	3	8	6
8		5	7	5	6
9		5	6	7	8
10		5	2	5	5
11		4	6	3	5
12		3	9	4	1
13		3	2	5	7
14		2	6	3	5
15		2	0	9	7
16		1	6	5	0
17		1	2	8	5
18			9	9	2
19			7	6	3
20			5	8	5
21			4	4	7
22			3	4	1
23			2	6	0
24			1	9	8
25			1	5	0
26			1	1	5
27				8	8
28				6	7
29				5	1
30				3	9
31				2	9
32				2	2
33				1	7
34				1	3
35				1	0
36					8

Cols:	Ordinates 6	7	8	9	10
37					6
38					5
39					4
40					3
41					2
42					2
43					1
44					0
45					
46					
47					
48					
49					
50					
51					
52					
53					
54					
55					
56					
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59					
60					
61					
62					
63					
64					
65					
66					
67					
68					
69					
70					
71					
72					

Cols:	Ordinates 6	7	8	9	10
73					
74					
75					
76					
77					
78					
79					
80					
81					
82					
83					
84					
85					
86					
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Note: Last value must be Zero (0).

HYDROGRAPH AND MASS CURVE PROGRAM

Date: 8-29-7
By: RML
Page: ___ of ___

CONTROL CARD - SSI - Inflow Hydrograph

	Type of Unit Hydrograph (Hours)				Number of Rainfall Values				Number of Unit Hydrograph Ordinate Values				Surface Area of Reservoir at Normal Level								Control Number
Cols:	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25		80
					5				9	6				1	8									7	2		1

HYDROGRAPH AND MASS CURVE PROGRAM

Date: 8-20-
By: RML
Page: ___ of ___

RAINFALL DATA

SSI inflow hydrograph (from 2.2. page 5 of 6)

	Rainfall				Losses			Excess			
Cols	7	8	9	10	18	19	20	27	28	29	30
1				5			5				0
2				5			5				
3				5			5				
4				5			5				
5				5			5				
6				5			5				
7				5			5				
8				5			5				
9			1	0		1	0				0
10			1	0			5				5
11			1	0			5				
12			1	0							
13			1	0							
14			1	0							
15			1	0							
16			1	0							
17			1	0							
18			1	0							
19			1	0							
20			1	0							
21			1	0							
22			1	0							
23			1	0							
24			1	0							
25			1	0							
26			1	0							
27			1	0							
28			1	0							
29			1	0							
30			1	0							
31			1	0							
32			1	0							
33			1	0							
34			1	0							
35			1	0							
36			1	0			5				5

	Rainfall				Losses			Excess			
Cols	7	8	9	10	18	19	20	21	28	29	30
37			1	0			5				5
38			1	0							5
39			1	0							5
40			1	0							5
41			1	0							5
42			1	0							5
43			1	0							5
44			2	0						1	5
45			2	0							
46			2	0							
47			2	0							
48			2	0						1	5
49			3	0						2	5
50			3	0						2	5
51			4	0						3	5
52			4	0						3	5
53			4	0						3	5
54			4	0						3	5
55			5	0						4	5
56			6	0						5	5
57		1	0	0						9	5
58		1	0	0						9	5
59		1	0	0						9	5
60		1	1	0					1	0	5
61		1	8	0					1	7	5
62		2	0	0					1	9	5
63		4	8	0					4	7	5
64		7	7	0					7	6	5
65		1	8	0					1	7	5
66		1	3	0					1	2	5
67		1	0	0						9	5
68		1	0	0						9	5
69			8	0						7	5
70			7	0						6	5
71			5	0						5	5
72			4	0			5			3	5

HYDROGRAPH AND MASS CURVE PROGRAM –

Date: 8-20-
✓ By: RML
Page: ___ of ___

RAINFALL DATA – SSI – Inflow hydrograph (from T. Jane Stark)

Cols	Rainfall 7	8	9	10	Losses 18	19	20	Excess 27	28	29	30
1			4	0			5			3	5
2			3	0						2	5
3			2	0						1	5
4			2	0						1	5
5			1	0							5
6											
7											
8											
9											
10											
11											
12											
13											
14											
15											
16											
17											
18											
19											
20											
21											
22			1	0							5
23				5							0
24				5			5				0
25											
26											
27											
28											
29											
30											
31											
32											
33											
34											
35											
36											

Cols	Rainfall 7	8	9	10	Losses 18	19	20	Excess 27	28	29	30
37											
38											
39											
40											
41											
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43											
44											
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46											
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69											
70											
71											
72											

HYDROGRAPH AND MASS CURVE PROGRAM -

Date: 8-90
By: RML
Page: 1 of

UNIT HYDROGRAPH ORDINATES - SSI - Inflow

(From 2.4 page 16 of 19)

Cols:	Ordinates 6	7	8	9	10
1					0
2				7	9
3			6	5	4
4		1	1	9	8
5			9	4	8
6			6	0	4
7			3	5	0
8			1	9	6
9			1	0	8
10				5	9
11				3	3
12				1	8
13				1	0
14					6
15					4
16					2
17					1
18					0
19					
20					
21					
22					
23					
24					
25					
26					
27					
28					
29					
30					
31					
32					
33					
34					
35					
36					

Cols:	Ordinates 6	7	8	9	10
37					
38					
39					
40					
41					
42					
43					
44					
45					
46					
47					
48					
49					
50					
51					
52					
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59					
60					
61					
62					
63					
64					
65					
66					
67					
68					
69					
70					
71					
72					

Cols:	Ordinates 6	7	8	9	10
73					
74					
75					
76					
77					
78					
79					
80					
81					
82					
83					
84					
85					
86					
87					
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Note: Last value must be Zero (0).

T.V.S.I. - Safe Shutdown Impoundment

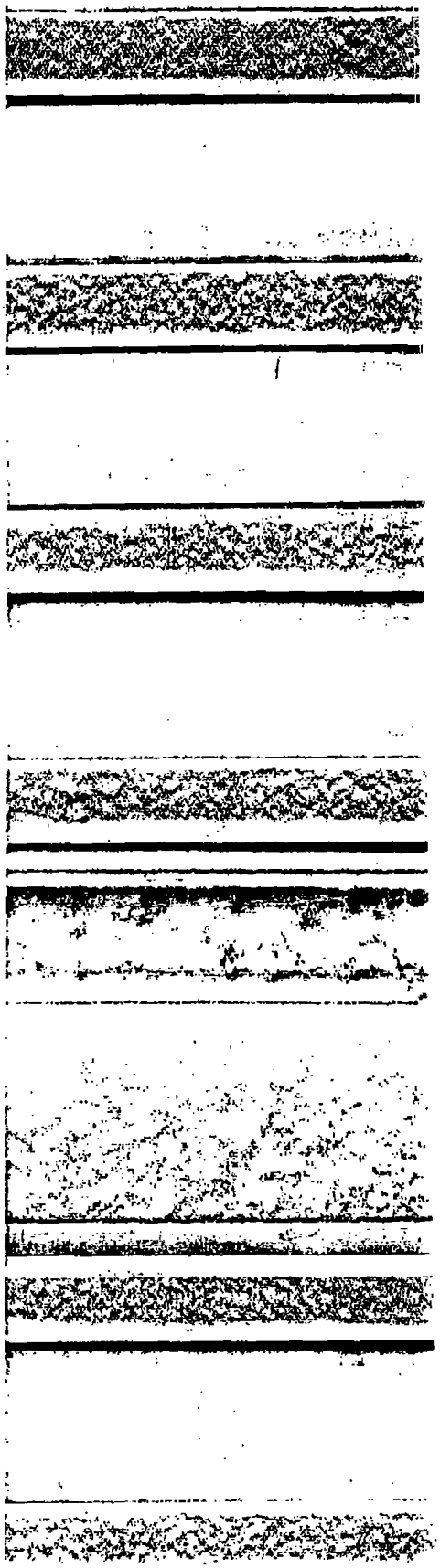
Project Engineer

✓ RML

SCR - PROBABLE MAXIMUM FLOOD
OTHER THAN MAXIMUM SIX HOURS OF RAINFALL
8-20-74 RML

HOURS	RAIN (IN.)	INFIL (IN)	EXCESS (IN)	UNIT HYDROGRAPH (CFS)	INFLOW HYDROGRAPH (CFS)	INFLOW MASS INCREMENT (AC-FT)	CURV CUMULAT (AC-FT
0.00	0.05	0.05	0.00	0.	0.	0.	
0.50	0.05	0.05	0.00	6508.	0.	0.	
1.00	0.05	0.05	0.00	7493.	0.	0.	
1.50	0.05	0.05	0.00	4348.	0.	0.	
2.00	0.05	0.05	0.00	4015.	0.	0.	
2.50	0.05	0.05	0.00	4304.	0.	0.	
3.00	0.05	0.05	0.00	4601.	0.	0.	
3.50	0.05	0.05	0.00	4708.	0.	0.	
4.00	0.10	0.10	0.00	4597.	0.	0.	
4.50	0.10	0.05	0.05	4316.	0.	0.	
5.00	0.10	0.05	0.05	3931.	325.	6.	
5.50	0.10	0.05	0.05	3498.	700.	21.	
6.00	0.10	0.05	0.05	3058.	917.	33.	
6.50	0.10	0.05	0.05	2638.	1118.	42.	1
7.00	0.10	0.05	0.05	2254.	1333.	50.	1
7.50	0.10	0.05	0.05	1912.	1563.	59.	2
8.00	0.10	0.05	0.05	1612.	1798.	69.	2
8.50	0.10	0.05	0.05	1355.	2028.	79.	2
9.00	0.10	0.05	0.05	1136.	2244.	88.	3
9.50	0.10	0.05	0.05	950.	2441.	96.	3
10.00	0.10	0.05	0.05	793.	2615.	104.	4
10.50	0.10	0.05	0.05	663.	2768.	111.	4
11.00	0.10	0.05	0.05	553.	2900.	117.	4
11.50	0.10	0.05	0.05	461.	3013.	122.	1
12.00	0.10	0.05	0.05	386.	3109.	126.	1
12.50	0.10	0.05	0.05	322.	3189.	130.	1
13.00	0.10	0.05	0.05	269.	3257.	133.	1
13.50	0.10	0.05	0.05	226.	3314.	135.	1
14.00	0.10	0.05	0.05	188.	3361.	137.	1
14.50	0.10	0.05	0.05	159.	3401.	139.	1
15.00	0.10	0.05	0.05	133.	3434.	141.	1
15.50	0.10	0.05	0.05	111.	3462.	142.	2
16.00	0.10	0.05	0.05	93.	3485.	143.	2
16.50	0.10	0.05	0.05	93.	3504.	144.	2
17.00	0.10	0.05	0.05	79.	3520.	145.	2
17.50	0.10	0.05	0.05	67.	3534.	145.	2
18.00	0.10	0.05	0.05	57.	3545.	146.	2
18.50	0.10	0.05	0.05	48.	3554.	146.	2
19.00	0.10	0.05	0.05	41.	3562.	147.	3
19.50	0.10	0.05	0.05	35.	3569.	147.	3
20.00	0.10	0.05	0.05	30.	3574.	147.	3
20.50	0.10	0.05	0.05	25.	3579.	147.	3
21.00	0.10	0.05	0.05	20.	3584.	148.	3
21.50	0.20	0.05	0.15	17.	3588.	148.	3
22.00	0.20	0.05	0.15	15.	4242.	161.	4
22.50	0.20	0.05	0.15	13.	4994.	190.	4
23.00	0.20	0.05	0.15	11.	5431.	215.	4
23.50	0.20	0.05	0.15	10.	5835.	232.	4
24.00	0.30	0.05	0.25	8.	6267.	250.	4
24.50	0.30	0.05	0.25	7.	7379.	281.	5

RAIN ON RESERVOIR (AC-FT)	TOTAL MASS CURVE INCREMENT (AC-FT)	CUMULATIVE (AC-FT)	HOURS
0.	0.00	0.	0.00
15.	15.85	15.	0.50
15.	15.85	31.	1.00
15.	15.85	47.	1.50
15.	15.85	63.	2.00
15.	15.85	79.	2.50
15.	15.85	95.	3.00
15.	15.85	111.	3.50
15.	15.85	126.	4.00
31.	31.71	158.	4.50
31.	38.43	197.	5.00
31.	52.90	249.	5.50
31.	65.13	315.	6.00
31.	73.77	388.	6.50
31.	82.57	471.	7.00
31.	91.56	562.	7.50
31.	101.18	663.	8.00
31.	110.79	774.	8.50
31.	120.00	894.	9.00
31.	128.52	1023.	9.50
31.	136.20	1159.	10.00
31.	142.97	1302.	10.50
31.	148.85	1451.	11.00
31.	153.91	1605.	11.50
31.	158.21	1763.	12.00
31.	161.86	1925.	12.50
31.	164.92	2090.	13.00
31.	167.49	2257.	13.50
31.	169.65	2427.	14.00
31.	171.45	2598.	14.50
31.	172.95	2771.	15.00
31.	174.21	2946.	15.50
31.	175.25	3121.	16.00
31.	176.13	3297.	16.50
31.	176.86	3474.	17.00
31.	177.47	3651.	17.50
31.	177.98	3829.	18.00
31.	178.41	4008.	18.50
31.	178.77	4186.	19.00
31.	179.07	4365.	19.50
31.	179.32	4545.	20.00
31.	179.53	4724.	20.50
31.	179.73	4904.	21.00
31.	179.90	5084.	21.50
63.	225.22	5309.	22.00
63.	254.27	5563.	22.50
63.	278.85	5842.	23.00
63.	296.22	6139.	23.50
63.	313.48	6452.	24.00
95.	377.11	6829.	24.50



SCR - PROBABLE MAXIMUM FLOOD
OTHER THAN MAXIMUM SIX HOURS OF RAINFALL
8-20-74 RML

HOURS	RAIN (IN)	INFIL (IN)	EXCESS (IN)	UNIT HYDROGRAPH (CFS)	INFLOW HYDROGRAPH (CFS)	INFLOW INCREMENT (AC-FT)	MASS CURV CUMULAT (AC-FT
25.00	0.40	0.05	0.35	6.	8601.	330.	55
25.50	0.40	0.05	0.35	5.	10147.	387.	58
26.00	0.40	0.05	0.35	5.	11750.	452.	63
26.50	0.40	0.05	0.35	4.	12989.	510.	68
27.00	0.50	0.05	0.45	3.	14201.	561.	74
27.50	0.60	0.05	0.55	3.	16060.	625.	80
28.00	0.00	0.00	0.00	3.	18644.	717.	87
28.50	0.00	0.00	0.00	2.	17377.	744.	95
29.00	0.00	0.00	0.00	2.	15136.	671.	101
29.50	0.00	0.00	0.00	2.	14520.	612.	107
30.00	0.00	0.00	0.00	2.	14036.	590.	113
30.50	0.00	0.00	0.00	1.	13328.	565.	119
31.00	0.00	0.00	0.00	0.	12354.	530.	124
31.50	0.00	0.00	0.00	0.	11190.	486.	129
32.00	0.00	0.00	0.00	0.	9940.	436.	134
32.50	0.00	0.00	0.00	0.	8691.	384.	137
33.00	0.00	0.00	0.00	0.	7506.	334.	141
33.50	0.00	0.00	0.00	0.	6420.	287.	144
34.00	0.80	0.05	0.75	0.	5453.	245.	146
34.50	0.70	0.05	0.65	0.	9488.	309.	149
35.00	0.50	0.05	0.55	0.	13727.	479.	154
35.50	0.40	0.05	0.35	0.	14964.	592.	160
36.00	0.40	0.05	0.35	0.	14962.	618.	166
36.50	0.30	0.05	0.25	0.	15410.	627.	172
37.00	0.20	0.05	0.15	0.	16134.	651.	179.
37.50	0.20	0.05	0.15	0.	16259.	669.	186
38.00	0.10	0.05	0.05	0.	16471.	676.	192
38.50	0.10	0.05	0.05	0.	16154.	674.	199
39.00	0.10	0.05	0.05	0.	15507.	654.	206
39.50	0.10	0.05	0.05	0.	14911.	628.	212.
40.00	0.10	0.05	0.05	0.	14141.	600.	218.
40.50	0.10	0.05	0.05	0.	13213.	565.	224
41.00	0.10	0.05	0.05	0.	12197.	525.	229
41.50	0.10	0.05	0.05	0.	11164.	482.	234
42.00	0.10	0.05	0.05	0.	10169.	440.	238
42.50	0.10	0.05	0.05	0.	9245.	401.	242
43.00	0.10	0.05	0.05	0.	8414.	364.	246
43.50	0.10	0.05	0.05	0.	7683.	332.	249
44.00	0.10	0.05	0.05	0.	7050.	304.	252
44.50	0.10	0.05	0.05	0.	6500.	279.	255
45.00	0.10	0.05	0.05	0.	6032.	258.	257
45.50	0.10	0.05	0.05	0.	5636.	241.	260
46.00	0.10	0.05	0.05	0.	5304.	226.	262
46.50	0.10	0.05	0.05	0.	5025.	213.	264
47.00	0.05	0.05	0.00	0.	4792.	202.	266
47.50	0.05	0.05	0.00	0.	4272.	187.	266
48.00	0.00	0.00	0.00	0.	3734.	165.	270
48.50	0.00	0.00	0.00	0.	3381.	147.	271
49.00	0.00	0.00	0.00	0.	3068.	133.	273
49.50	0.00	0.00	0.00	0.	2759.	120.	274

RAIN ON RESERVOIR (AC-FT)	TOTAL MASS INCREMENT (AC-FT)	CURVE CUMULATIVE (AC-FT)	HOURS
95.	425.33	7255.	25.00
126.	514.23	7769.	25.50
126.	578.89	8348.	26.00
126.	637.62	8985.	26.50
126.	688.68	9674.	27.00
158.	783.83	10458.	27.50
190.	907.34	11365.	28.00
0.	744.25	12109.	28.50
0.	671.78	12781.	29.00
0.	612.75	13394.	29.50
0.	590.03	13984.	30.00
0.	565.40	14549.	30.50
0.	530.64	15080.	31.00
0.	486.48	15566.	31.50
0.	436.59	16003.	32.00
0.	384.95	16388.	32.50
0.	334.66	16723.	33.00
0.	287.75	17010.	33.50
0.	245.34	17256.	34.00
253.	562.45	17818.	34.50
222.	701.68	18520.	35.00
158.	751.39	19271.	35.50
126.	745.20	20017.	36.00
126.	754.41	20771.	36.50
95.	746.92	21518.	37.00
63.	732.75	22251.	37.50
63.	739.71	22990.	38.00
31.	705.82	23696.	38.50
31.	685.90	24382.	39.00
31.	660.23	25042.	39.50
31.	631.99	25674.	40.00
31.	596.90	26271.	40.50
31.	556.75	26828.	41.00
31.	514.42	27342.	41.50
31.	472.50	27815.	42.00
31.	432.84	28248.	42.50
31.	396.59	28644.	43.00
31.	364.32	29009.	43.50
31.	336.15	29345.	44.00
31.	311.71	29656.	44.50
31.	290.68	29947.	45.00
31.	272.83	30220.	45.50
31.	257.77	30478.	46.00
31.	245.14	30723.	46.50
31.	234.56	30957.	47.00
15.	203.14	31161.	47.50
15.	181.28	31342.	48.00
0.	147.03	31489.	48.50
0.	133.28	31622.	49.00
0.	120.43	31743.	49.50

SCR - PROBABLE MAXIMUM FLOOD
OTHER THAN MAXIMUM SIX HOURS OF RAINFALL
8-20-74 RML

HOURS	RAIN (IN)	INFIL (IN)	EXCESS (IN)	UNIT HYDROGRAPH (CFS)	INFLOW HYDROGRAPH (CFS)	INFLOW MASS CI INCREMENT (AC-FT)	CUMUL (AC-	
50.00	0.00	0.00	0.00	0.	2450.	107.		2
50.50	0.00	0.00	0.00	0.	2160.	95.		2
51.00	0.00	0.00	0.00	0.	1884.	83.		2
51.50	0.00	0.00	0.00	0.	1628.	72.		2
52.00	0.00	0.00	0.00	0.	1395.	62.		2
52.50	0.00	0.00	0.00	0.	1189.	53.		2
53.00	0.00	0.00	0.00	0.	1010.	45.		2
53.50	0.00	0.00	0.00	0.	854.	38.		2
54.00	0.00	0.00	0.00	0.	721.	32.		2
54.50	0.00	0.00	0.00	0.	606.	27.		2
55.00	0.00	0.00	0.00	0.	509.	23.		2
55.50	0.00	0.00	0.00	0.	427.	19.		2
56.00	0.00	0.00	0.00	0.	358.	16.		2
56.50	0.00	0.00	0.00	0.	301.	13.		2
57.00	0.00	0.00	0.00	0.	253.	11.		2
57.50	0.00	0.00	0.00	0.	213.	9.		2
58.00	0.00	0.00	0.00	0.	179.	8.		2
58.50	0.00	0.00	0.00	0.	151.	6.		2
59.00	0.00	0.00	0.00	0.	128.	5.		2
59.50	0.00	0.00	0.00	0.	109.	4.		2
60.00	0.00	0.00	0.00	0.	93.	4.		2
60.50	0.00	0.00	0.00	0.	79.	3.		2
61.00	0.00	0.00	0.00	0.	68.	3.		2
61.50	0.00	0.00	0.00	0.	58.	2.		2
62.00	0.00	0.00	0.00	0.	50.	2.		2
62.50	0.00	0.00	0.00	0.	43.	1.		2
63.00	0.00	0.00	0.00	0.	38.	1.		2
63.50	0.00	0.00	0.00	0.	32.	1.		2
64.00	0.00	0.00	0.00	0.	28.	1.		2
64.50	0.00	0.00	0.00	0.	24.	1.		2
65.00	0.00	0.00	0.00	0.	19.	0.		2
65.50	0.00	0.00	0.00	0.	16.	0.		2
66.00	0.00	0.00	0.00	0.	13.	0.		2
66.50	0.00	0.00	0.00	0.	10.	0.		2
67.00	0.00	0.00	0.00	0.	8.	0.		2
67.50	0.00	0.00	0.00	0.	7.	0.		2
68.00	0.00	0.00	0.00	0.	6.	0.		2
68.50	0.00	0.00	0.00	0.	5.	0.		2
69.00	0.00	0.00	0.00	0.	4.	0.		2
69.50	0.00	0.00	0.00	0.	3.	0.		2
70.00	0.00	0.00	0.00	0.	3.	0.		2
70.50	0.00	0.00	0.00	0.	2.	0.		2
71.00	0.00	0.00	0.00	0.	2.	0.		2
71.50	0.00	0.00	0.00	0.	1.	0.		2
72.00	0.00	0.00	0.00	0.	1.	0.		2
72.50	0.00	0.00	0.00	0.	1.	0.		2
73.00	0.00	0.00	0.00	0.	1.	0.		2
73.50	0.00	0.00	0.00	0.	0.	0.		2
74.00	0.00	0.00	0.00	0.	0.	0.		2
74.50	0.00	0.00	0.00	0.	0.	0.		2

VE	RAIN ON RESERVOIR (AC-FT)	TOTAL MASS INCREMENT (AC-FT)	CURVE CUMULATIVE (AC-FT)	HOURS
7.	0.	107.65	31850.	50.00
2.	0.	95.27	31946.	50.50
6.	0.	83.57	32029.	51.00
8.	0.	72.57	32102.	51.50
1.	0.	62.46	32164.	52.00
4.	0.	53.41	32218.	52.50
0.	0.	45.45	32263.	53.00
8.	0.	38.52	32302.	53.50
1.	0.	32.55	32334.	54.00
8.	0.	27.44	32362.	54.50
1.	0.	23.06	32385.	55.00
1.	0.	19.35	32404.	55.50
7.	0.	16.23	32420.	56.00
0.	0.	13.63	32434.	56.50
2.	0.	11.47	32445.	57.00
2.	0.	9.66	32455.	57.50
0.	0.	8.13	32463.	58.00
5.	0.	6.85	32470.	58.50
[redacted]	0.	5.79	32476.	59.00
7.	0.	4.91	32481.	59.50
1.	0.	4.19	32485.	60.00
5.	0.	3.58	32488.	60.50
8.	0.	3.06	32491.	61.00
1.	0.	2.61	32494.	61.50
3.	0.	2.26	32496.	62.00
5.	0.	1.95	32498.	62.50
7.	0.	1.69	32500.	63.00
8.	0.	1.46	32501.	63.50
9.	0.	1.26	32503.	64.00
0.	0.	1.08	32504.	64.50
1.	0.	0.90	32505.	65.00
2.	0.	0.73	32505.	65.50
3.	0.	0.60	32506.	66.00
3.	0.	0.49	32507.	66.50
3.	0.	0.40	32507.	67.00
4.	0.	0.33	32507.	67.50
4.	0.	0.27	32508.	68.00
4.	0.	0.23	32508.	68.50
5.	0.	0.19	32508.	69.00
5.	0.	0.16	32508.	69.50
5.	0.	0.14	32508.	70.00
5.	0.	0.11	32508.	70.50
5.	0.	0.10	32508.	71.00
[redacted]	0.	0.00	32509.	71.50
[redacted]	0.	0.07	32509.	72.00
5.	0.	0.06	32509.	72.50
5.	0.	0.05	32509.	73.00
5.	0.	0.04	32509.	73.50
5.	0.	0.03	32509.	74.00
5.	0.	0.02	32509.	74.50

SCR - PROBABLE MAXIMUM FLOOD
OTHER THAN MAXIMUM SIX HOURS OF RAINFALL
6-20-74 RML

HOURS	RAIN (IN)	INFIL (IN)	EXCESS (IN)	UNIT HYDROGRAPH (CFS)	INFLOW HYDROGRAPH (CFS)	INFLOW MASS CURVE INCREMENT (AC-FT)	INFLOW MASS CURVE CUMULAT (AC-FT)
75.00	0.00	0.00	0.00	0.	0.	0.	281
75.50	0.00	0.00	0.00	0.	0.	0.	281
76.00	0.00	0.00	0.00	0.	0.	0.	281
76.50	0.00	0.00	0.00	0.	0.	0.	281
77.00	0.00	0.00	0.00	0.	0.	0.	281
77.50	0.00	0.00	0.00	0.	0.	0.	281
78.00	0.00	0.00	0.00	0.	0.	0.	281

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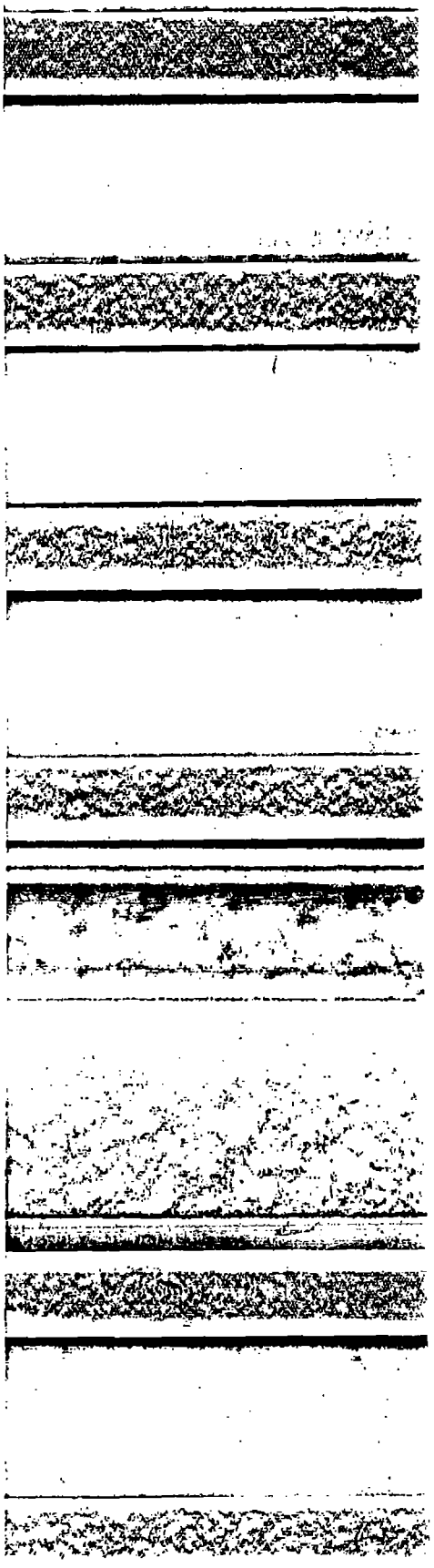
RAIN ON RESERVOIR (AC-FT)	TOTAL MASS CURVE INCREMENT (AC-FT)	CUMULATIVE (AC-FT)	HOURS
0.	0.02	32509.	75.00
0.	0.01	32509.	75.50
0.	0.01	32509.	76.00
0.	0.00	32509.	76.50
0.	0.00	32509.	77.00
0.	0.00	32509.	77.50
0.	0.00	32509.	78.00

SCR - PROBABLE MAXIMUM FLOOD
MAXIMUM SIX HOURS OF RAINFALL
8-20-74

HOURS	RAIN (IN)	INFIL (IN)	EXCESS (IN)	UNIT HYDROGRAPH (CFS)	INFLOW HYDROGRAPH (CFS)	INFLOW MASS CURVE INCREMENT (AC-FT)	INFLOW MASS CURVE CUMULATI (AC-FT)
0.00	0.00	0.00	0.00	0.	0.	0.	
0.50	0.00	0.00	0.00	6506.	0.	0.	
1.00	0.00	0.00	0.00	7360.	0.	0.	
1.50	0.00	0.00	0.00	4001.	0.	0.	
2.00	0.00	0.00	0.00	3844.	0.	0.	
2.50	0.00	0.00	0.00	4619.	0.	0.	
3.00	0.00	0.00	0.00	5386.	0.	0.	
3.50	0.00	0.00	0.00	5756.	0.	0.	
4.00	0.00	0.00	0.00	5678.	0.	0.	
4.50	0.00	0.00	0.00	5255.	0.	0.	
5.00	0.00	0.00	0.00	4635.	0.	0.	
5.50	0.00	0.00	0.00	3941.	0.	0.	
6.00	0.00	0.00	0.00	3257.	0.	0.	
6.50	0.00	0.00	0.00	2635.	0.	0.	
7.00	0.00	0.00	0.00	2097.	0.	0.	
7.50	0.00	0.00	0.00	1650.	0.	0.	
8.00	0.00	0.00	0.00	1285.	0.	0.	
8.50	0.00	0.00	0.00	992.	0.	0.	
9.00	0.00	0.00	0.00	763.	0.	0.	
9.50	0.00	0.00	0.00	585.	0.	0.	
10.00	0.00	0.00	0.00	447.	0.	0.	
10.50	0.00	0.00	0.00	341.	0.	0.	
11.00	0.00	0.00	0.00	260.	0.	0.	
11.50	0.00	0.00	0.00	198.	0.	0.	
12.00	0.00	0.00	0.00	150.	0.	0.	
12.50	0.00	0.00	0.00	115.	0.	0.	
13.00	0.00	0.00	0.00	88.	0.	0.	
13.50	0.00	0.00	0.00	67.	0.	0.	
14.00	0.00	0.00	0.00	51.	0.	0.	
14.50	0.00	0.00	0.00	39.	0.	0.	
15.00	0.00	0.00	0.00	29.	0.	0.	
15.50	0.00	0.00	0.00	22.	0.	0.	
16.00	0.00	0.00	0.00	17.	0.	0.	
16.50	0.00	0.00	0.00	13.	0.	0.	
17.00	0.00	0.00	0.00	10.	0.	0.	
17.50	0.00	0.00	0.00	8.	0.	0.	
18.00	0.00	0.00	0.00	6.	0.	0.	
18.50	0.00	0.00	0.00	5.	0.	0.	
19.00	0.00	0.00	0.00	4.	0.	0.	
19.50	0.00	0.00	0.00	3.	0.	0.	
20.00	0.00	0.00	0.00	2.	0.	0.	
20.50	0.00	0.00	0.00	2.	0.	0.	
21.00	0.00	0.00	0.00	1.	0.	0.	
21.50	0.00	0.00	0.00	0.	0.	0.	
22.00	0.00	0.00	0.00	0.	0.	0.	
22.50	0.00	0.00	0.00	0.	0.	0.	
23.00	0.00	0.00	0.00	0.	0.	0.	
23.50	0.00	0.00	0.00	0.	0.	0.	
24.00	0.00	0.00	0.00	0.	0.	0.	
24.50	0.00	0.00	0.00	0.	0.	0.	

RAIN ON RESERVOIR (AC-FT)	TOTAL MASS CURVE INCREMENT (AC-FT)	CUMULATIVE (AC-FT)	HOURS
0.	0.00	0.	0.00
0.	0.00	0.	0.50
0.	0.00	0.	1.00
0.	0.00	0.	1.50
0.	0.00	0.	2.00
0.	0.00	0.	2.50
0.	0.00	0.	3.00
0.	0.00	0.	3.50
0.	0.00	0.	4.00
0.	0.00	0.	4.50
0.	0.00	0.	5.00
0.	0.00	0.	5.50
0.	0.00	0.	6.00
0.	0.00	0.	6.50
0.	0.00	0.	7.00
0.	0.00	0.	7.50
0.	0.00	0.	8.00
0.	0.00	0.	8.50
0.	0.00	0.	9.00
0.	0.00	0.	9.50
0.	0.00	0.	10.00
0.	0.00	0.	10.50
0.	0.00	0.	11.00
0.	0.00	0.	11.50
0.	0.00	0.	12.00
0.	0.00	0.	12.50
0.	0.00	0.	13.00
0.	0.00	0.	13.50
0.	0.00	0.	14.00
0.	0.00	0.	14.50
0.	0.00	0.	15.00
0.	0.00	0.	15.50
0.	0.00	0.	16.00
0.	0.00	0.	16.50
0.	0.00	0.	17.00
0.	0.00	0.	17.50
0.	0.00	0.	18.00
0.	0.00	0.	18.50
0.	0.00	0.	19.00
0.	0.00	0.	19.50
0.	0.00	0.	20.00
0.	0.00	0.	20.50
0.	0.00	0.	21.00
0.	0.00	0.	21.50
0.	0.00	0.	22.00
0.	0.00	0.	22.50
0.	0.00	0.	23.00
0.	0.00	0.	23.50
0.	0.00	0.	24.00
0.	0.00	0.	24.50



SCR - PROBABLE MAXIMUM FLOOD
MAXIMUM SIX HOURS OF RAINFALL
8-20-74

HOURS	RAIN (IN)	INFIL (IN)	EXCESS (IN)	UNIT HYDROGRAPH (CFS)	INFLOW HYDROGRAPH (CFS)	INFLOW MASS CURVE INCREMENT (AC-FT)	INFLOW MASS CURVE CUMULATIV (AC-FT)
25.00	0.00	0.00	0.00	0.	0.	0.	
25.50	0.00	0.00	0.00	0.	0.	0.	
26.00	0.00	0.00	0.00	0.	0.	0.	
26.50	0.00	0.00	0.00	0.	0.	0.	
27.00	0.00	0.00	0.00	0.	0.	0.	
27.50	0.00	0.00	0.00	0.	0.	0.	
28.00	1.00	0.05	0.95	0.	0.	0.	
28.50	1.00	0.05	0.95	0.	6180.	127.	12
29.00	1.00	0.05	0.95	0.	13172.	399.	52
29.50	1.10	0.05	1.05	0.	16973.	622.	115
30.00	1.80	0.05	1.75	0.	21276.	790.	194
30.50	2.00	0.05	1.95	0.	30954.	1079.	301
31.00	4.80	0.05	4.75	0.	42924.	1526.	454
31.50	7.70	0.05	7.65	0.	71266.	2359.	690
32.00	1.80	0.05	1.75	0.	120088.	3953.	1085
32.50	1.30	0.05	1.25	0.	123783.	5038.	1589
33.00	1.00	0.05	0.95	0.	109145.	4812.	2071
33.50	1.00	0.05	0.95	0.	113406.	4598.	2530
34.00	0.00	0.00	0.00	0.	123739.	4899.	3020
34.50	0.00	0.00	0.00	0.	126701.	5174.	3536
35.00	0.00	0.00	0.00	0.	123741.	5174.	4055
35.50	0.00	0.00	0.00	0.	118661.	5008.	4556
36.00	0.00	0.00	0.00	0.	109785.	4720.	5028
36.50	0.00	0.00	0.00	0.	97951.	4292.	5457
37.00	0.00	0.00	0.00	0.	84590.	3771.	5834
37.50	0.00	0.00	0.00	0.	71058.	3215.	6156
38.00	0.00	0.00	0.00	0.	58353.	2673.	6423
38.50	0.00	0.00	0.00	0.	47056.	2177.	6641
39.00	0.00	0.00	0.00	0.	37407.	1745.	6816
39.50	0.00	0.00	0.00	0.	29388.	1380.	6954
40.00	0.00	0.00	0.00	0.	22878.	1079.	7062
40.50	0.00	0.00	0.00	0.	17698.	838.	7146
41.00	0.00	0.00	0.00	0.	13625.	647.	7210
41.50	0.00	0.00	0.00	0.	10447.	497.	7260
42.00	0.00	0.00	0.00	0.	7989.	380.	7298
42.50	0.00	0.00	0.00	0.	6100.	291.	7327
43.00	0.00	0.00	0.00	0.	4650.	222.	7349
43.50	0.00	0.00	0.00	0.	3541.	169.	7366.
44.00	0.00	0.00	0.00	0.	2704.	129.	7379
44.50	0.00	0.00	0.00	0.	2062.	98.	7389
45.00	0.00	0.00	0.00	0.	1571.	75.	7397
45.50	0.00	0.00	0.00	0.	1196.	57.	7402
46.00	0.00	0.00	0.00	0.	911.	43.	7407
46.50	0.00	0.00	0.00	0.	690.	33.	7410
47.00	0.00	0.00	0.00	0.	526.	25.	7413
47.50	0.00	0.00	0.00	0.	403.	19.	7414
48.00	0.00	0.00	0.00	0.	308.	14.	7416
48.50	0.00	0.00	0.00	0.	238.	11.	7417
49.00	0.00	0.00	0.00	0.	185.	8.	7418
49.50	0.00	0.00	0.00	0.	142.	6.	7419

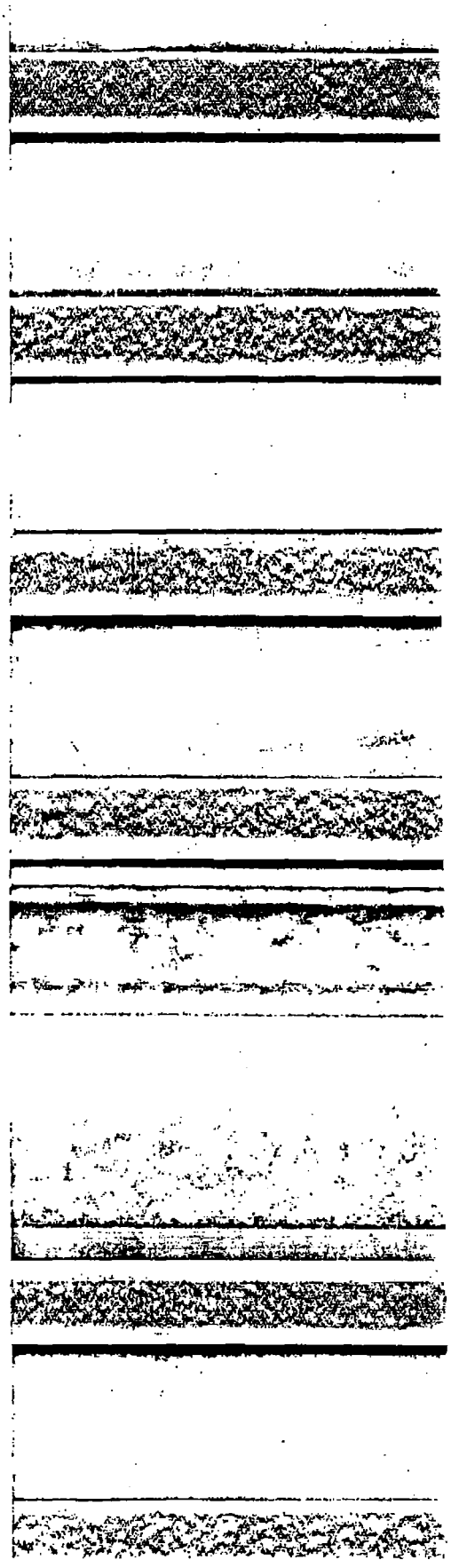
VE TIVE T)	RAIN ON RESERVOIR (AC-FT)	TOTAL MASS CURVE INCREMENT (AC-FT)	 CUMULATIVE (AC-FT)	HOURS
0.	0.	0.00	0.	25.00
0.	0.	0.00	0.	25.50
0.	0.	0.00	0.	26.00
0.	0.	0.00	0.	26.50
0.	0.	0.00	0.	27.00
0.	0.	0.00	0.	27.50
0.	0.	0.00	0.	28.00
127.	317.	444.86	444.	28.50
527.	317.	717.03	1161.	29.00
150.	317.	940.03	2101.	29.50
940.	348.	1139.17	3241.	30.00
819.	570.	1650.05	4891.	30.50
546.	634.	2160.77	7051.	31.00
905.	1522.	3881.74	10933.	31.50
659.	2442.	6395.86	17329.	32.00
498.	570.	5609.64	22939.	32.50
710.	412.	5224.95	28164.	33.00
508.	317.	4915.40	33079.	33.50
208.	317.	5216.94	38296.	34.00
[illegible]	0.	5174.47	43470.	34.50
57.	0.	5174.52	48645.	35.00
66.	0.	5008.39	53653.	35.50
86.	0.	4720.02	58373.	36.00
78.	0.	4292.12	62666.	36.50
49.	0.	3771.56	66437.	37.00
65.	0.	3215.91	69653.	37.50
39.	0.	2673.82	72327.	38.00
17.	0.	2177.91	74505.	38.50
62.	0.	1745.14	76250.	39.00
42.	0.	1380.09	77630.	39.50
22.	0.	1079.90	78710.	40.00
61.	0.	838.38	79548.	40.50
08.	0.	647.20	80195.	41.00
05.	0.	497.37	80693.	41.50
36.	0.	380.93	81074.	42.00
77.	0.	291.12	81365.	42.50
99.	0.	222.13	81587.	43.00
69.	0.	169.26	81756.	43.50
98.	0.	129.04	81885.	44.00
96.	0.	98.49	81984.	44.50
71.	0.	75.08	82059.	45.00
28.	0.	57.18	82116.	45.50
72.	0.	43.55	82160.	46.00
05.	0.	33.08	82193.	46.50
[illegible]	0.	25.12	82218.	47.00
[illegible]	0.	19.20	82237.	47.50
54.	0.	14.70	82252.	48.00
75.	0.	11.30	82263.	48.50
14.	0.	8.74	82272.	49.00
11.	0.	6.77	82278.	49.50

SCR - PROBABLE MAXIMUM FLOOD
MAXIMUM SIX HOURS OF RAINFALL
8-20-74

HOURS	RAIN (IN)	INFIL (IN)	EXCESS (IN)	UNIT HYDROGRAPH (CFS)	INFLOW HYDROGRAPH (CFS)	INFLOW MASS CURV INCREMENT (AC-FT)	CUMULAT (AC-FT
50.00	0.00	0.00	0.00	0.	111.	5.	741
50.50	0.00	0.00	0.00	0.	86.	4.	742
51.00	0.00	0.00	0.00	0.	64.	3.	742
51.50	0.00	0.00	0.00	0.	47.	2.	742
52.00	0.00	0.00	0.00	0.	35.	1.	742
52.50	0.00	0.00	0.00	0.	20.	1.	742
53.00	0.00	0.00	0.00	0.	9.	0.	742
53.50	0.00	0.00	0.00	0.	5.	0.	742
54.00	0.00	0.00	0.00	0.	2.	0.	742
54.50	0.00	0.00	0.00	0.	0.	0.	742
55.00	0.00	0.00	0.00	0.	0.	0.	742

// XEQ UHAHG

RAIN ON RESERVOIR (AC-FT)	TOTAL MASS INCREMENT (AC-FT)	CURVE CUMULATIVE (AC-FT)	HOURS
0.	5.26	82284.	50.00
0.	4.10	82288.	50.50
0.	3.12	82291.	51.00
0.	2.31	82293.	51.50
0.	1.72	82295.	52.00
0.	1.16	82296.	52.50
0.	0.60	82297.	53.00
0.	0.29	82297.	53.50
0.	0.16	82297.	54.00
0.	0.07	82297.	54.50
0.	0.01	82297.	55.00



S.S.I. - Safe Shutdown Impoundment

Project Engineer
/RML

SSI - PROBABLE MAXIMUM FLOOD
FOR ENTIRE RAINFALL PERIOD
8-20-74 RML

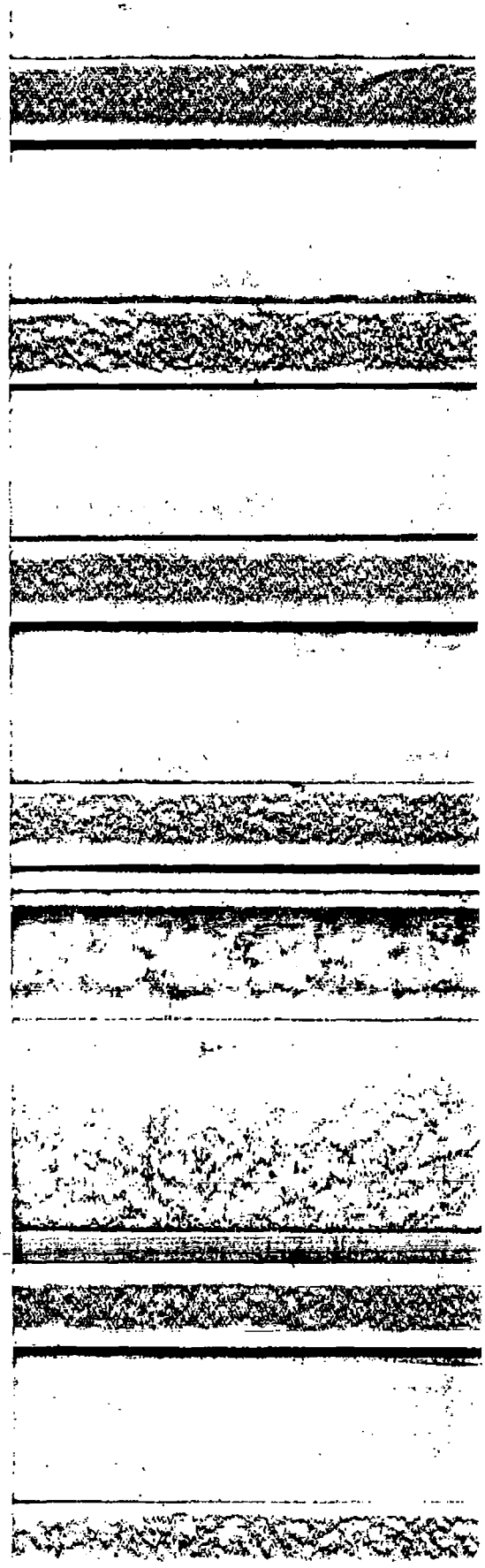
HOURS	RAIN (IN)	INFIL (IN)	EXCESS (IN)	UNIT HYDROGRAPH (CFS)	INFLOW HYDROGRAPH (CFS)	INFLOW MASS CURVE INCREMENT (AC-FT)	INFLOW MASS CURVE CUMULATIVE (AC-FT)
0.00	0.05	0.05	0.00	0.	0.	0.	0.
0.50	0.05	0.05	0.00	79.	0.	0.	0.
1.00	0.05	0.05	0.00	854.	0.	0.	0.
1.50	0.05	0.05	0.00	1198.	0.	0.	0.
2.00	0.05	0.05	0.00	948.	0.	0.	0.
2.50	0.05	0.05	0.00	604.	0.	0.	0.
3.00	0.05	0.05	0.00	350.	0.	0.	0.
3.50	0.05	0.05	0.00	196.	0.	0.	0.
4.00	0.10	0.10	0.00	108.	0.	0.	0.
4.50	0.10	0.05	0.05	59.	0.	0.	0.
5.00	0.10	0.05	0.05	33.	3.	0.	0.
5.50	0.10	0.05	0.05	18.	46.	1.	1.
6.00	0.10	0.05	0.05	10.	106.	3.	4.
6.50	0.10	0.05	0.05	6.	153.	5.	9.
7.00	0.10	0.05	0.05	4.	184.	6.	16.
7.50	0.10	0.05	0.05	2.	201.	7.	24.
8.00	0.10	0.05	0.05	1.	211.	8.	33.
8.50	0.10	0.05	0.05	0.	216.	8.	42.
9.00	0.10	0.05	0.05	0.	219.	9.	51.
9.50	0.10	0.05	0.05	0.	221.	9.	60.
10.00	0.10	0.05	0.05	0.	222.	9.	69.
10.50	0.10	0.05	0.05	0.	222.	9.	78.
11.00	0.10	0.05	0.05	0.	223.	9.	87.
11.50	0.10	0.05	0.05	0.	223.	9.	96.
12.00	0.10	0.05	0.05	0.	223.	9.	106.
12.50	0.10	0.05	0.05	0.	223.	9.	115.
13.00	0.10	0.05	0.05	0.	223.	9.	124.
13.50	0.10	0.05	0.05	0.	223.	9.	133.
14.00	0.10	0.05	0.05	0.	223.	9.	143.
14.50	0.10	0.05	0.05	0.	223.	9.	152.
15.00	0.10	0.05	0.05	0.	223.	9.	161.
15.50	0.10	0.05	0.05	0.	223.	9.	170.
16.00	0.10	0.05	0.05	0.	223.	9.	180.
16.50	0.10	0.05	0.05	0.	223.	9.	189.
17.00	0.10	0.05	0.05	0.	223.	9.	198.
17.50	0.10	0.05	0.05	0.	223.	9.	207.
18.00	0.10	0.05	0.05	0.	223.	9.	217.
18.50	0.10	0.05	0.05	0.	223.	9.	226.
19.00	0.10	0.05	0.05	0.	223.	9.	235.
19.50	0.10	0.05	0.05	0.	223.	9.	244.
20.00	0.10	0.05	0.05	0.	223.	9.	253.
20.50	0.10	0.05	0.05	0.	223.	9.	263.
21.00	0.10	0.05	0.05	0.	223.	9.	272.
21.50	0.20	0.05	0.15	0.	223.	9.	281.
22.00	0.20	0.05	0.15	0.	231.	9.	291.
22.50	0.20	0.05	0.15	0.	316.	11.	302.
23.00	0.20	0.05	0.15	0.	436.	15.	317.
23.50	0.20	0.05	0.15	0.	531.	20.	337
24.00	0.30	0.05	0.25	0.	591.	23.	361
24.50	0.30	0.05	0.25	0.	634.	25.	386

E	RAIN ON RESERVOIR (AC-FT)	TOTAL MASS CURVE INCREMENT (AC-FT)	CUMULATIVE (AC-FT)	HOURS
.	0.	0.00	0.	0.00
.	0.	0.30	0.	0.50
.	0.	0.30	0.	1.00
.	0.	0.30	0.	1.50
.	0.	0.30	1.	2.00
.	0.	0.30	1.	2.50
.	0.	0.30	1.	3.00
.	0.	0.30	2.	3.50
.	0.	0.30	2.	4.00
.	0.	0.60	2.	4.50
.	0.	0.68	3.	5.00
.	0.	1.64	5.	5.50
.	0.	3.76	9.	6.00
.	0.	5.98	15.	6.50
.	0.	7.58	22.	7.00
.	0.	8.57	31.	7.50
.	0.	9.13	40.	8.00
.	0.	9.44	49.	8.50
.	0.	9.62	59.	9.00
.	0.	9.71	69.	9.50
.	0.	9.76	78.	10.00
.	0.	9.79	88.	10.50
.	0.	9.81	98.	11.00
.	0.	9.82	108.	11.50
.	0.	9.83	118.	12.00
.	0.	9.83	128.	12.50
.	0.	9.83	137.	13.00
.	0.	9.83	147.	13.50
.	0.	9.83	157.	14.00
.	0.	9.83	167.	14.50
.	0.	9.83	177.	15.00
.	0.	9.83	187.	15.50
.	0.	9.83	196.	16.00
.	0.	9.83	206.	16.50
.	0.	9.83	216.	17.00
.	0.	9.83	226.	17.50
.	0.	9.83	236.	18.00
.	0.	9.83	246.	18.50
.	0.	9.83	255.	19.00
.	0.	9.83	265.	19.50
.	0.	9.83	275.	20.00
.	0.	9.83	285.	20.50
.	0.	9.83	295.	21.00
.	0.	9.83	305.	21.50
.	1.	10.59	315.	22.00
.	1.	12.52	328.	22.50
.	1.	16.76	344.	23.00
.	1.	21.20	366.	23.50
.	1.	24.40	390.	24.00
.	1.	27.14	417.	24.50

SS1 - PROBABLE MAXIMUM FLOOD
FOR ENTIRE RAINFALL PERIOD
8-20-74 RML

HOURS	RAIN (IN)	INFIL (IN)	EXCESS (IN)	UNIT HYDROGRAPH (CFS)	INFLOW HYDROGRAPH (CFS)	INFLOW MASS CURVE INCREMENT (AC-FT)	INFLOW MASS CURVE CUMULATIV (AC-FT)
25.00	0.40	0.05	0.35	0.	739.	28.	41
25.50	0.40	0.05	0.35	0.	878.	33.	44
26.00	0.40	0.05	0.35	0.	1064.	40.	48
26.50	0.40	0.05	0.35	0.	1247.	47.	53
27.00	0.50	0.05	0.45	0.	1379.	54.	59
27.50	0.60	0.05	0.55	0.	1468.	58.	64
28.00	1.00	0.05	0.95	0.	1607.	63.	71
28.50	1.00	0.05	0.95	0.	1870.	71.	78
29.00	1.00	0.05	0.95	0.	2441.	89.	87
29.50	1.10	0.05	1.05	0.	3083.	114.	98
30.00	1.80	0.05	1.75	0.	3570.	137.	112
30.50	2.00	0.05	1.95	0.	4009.	156.	128
31.00	4.80	0.05	4.75	0.	4914.	184.	146
31.50	7.70	0.05	7.65	0.	6336.	232.	169
32.00	1.80	0.05	1.75	0.	9972.	336.	203
32.50	1.30	0.05	1.25	0.	16014.	536.	257
33.00	1.00	0.05	0.95	0.	17466.	691.	326
33.50	1.00	0.05	0.95	0.	14614.	662.	392
34.00	0.80	0.05	0.75	0.	11023.	529.	445
34.50	0.70	0.05	0.65	0.	8243.	398.	485
35.00	0.50	0.05	0.55	0.	6322.	300.	515
35.50	0.40	0.05	0.35	0.	4976.	233.	538
36.00	0.40	0.05	0.35	0.	4000.	185.	557
36.50	0.30	0.05	0.25	0.	3186.	148.	572
37.00	0.20	0.05	0.15	0.	2541.	118.	584
37.50	0.20	0.05	0.15	0.	2031.	94.	593
38.00	0.10	0.05	0.05	0.	1581.	74.	601
38.50	0.10	0.05	0.05	0.	1218.	57.	606
39.00	0.10	0.05	0.05	0.	894.	43.	611
39.50	0.10	0.05	0.05	0.	631.	31.	614
40.00	0.10	0.05	0.05	0.	455.	22.	616
40.50	0.10	0.05	0.05	0.	353.	16.	618
41.00	0.10	0.05	0.05	0.	295.	13.	619
41.50	0.10	0.05	0.05	0.	262.	11.	620
42.00	0.10	0.05	0.05	0.	244.	10.	621
42.50	0.10	0.05	0.05	0.	235.	9.	622
43.00	0.10	0.05	0.05	0.	229.	9.	623
43.50	0.10	0.05	0.05	0.	226.	9.	624
44.00	0.10	0.05	0.05	0.	225.	9.	625
44.50	0.10	0.05	0.05	0.	224.	9.	626
45.00	0.10	0.05	0.05	0.	223.	9.	627
45.50	0.10	0.05	0.05	0.	223.	9.	628
46.00	0.10	0.05	0.05	0.	223.	9.	629
46.50	0.10	0.05	0.05	0.	223.	9.	630
47.00	0.05	0.05	0.00	0.	223.	9.	631
47.50	0.05	0.05	0.00	0.	219.	9.	632
48.00	0.00	0.00	0.00	0.	176.	8.	632
48.50	0.00	0.00	0.00	0.	116.	6.	633
49.00	0.00	0.00	0.00	0.	69.	3.	633
49.50	0.00	0.00	0.00	0.	39.	2.	634

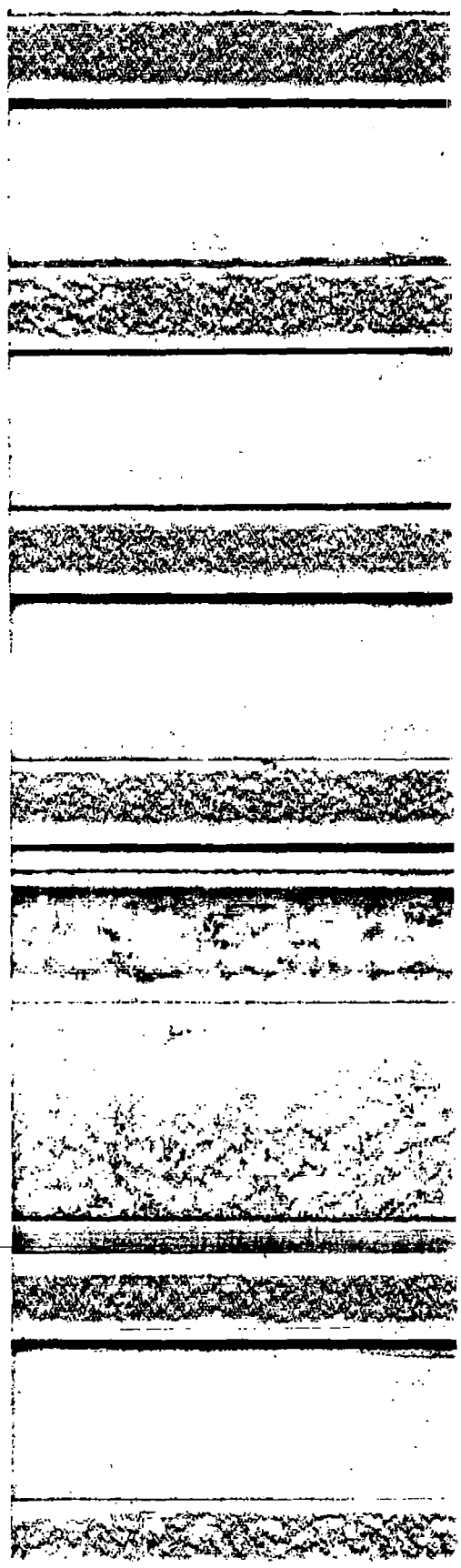
RAIN ON RESERVOIR (AC-FT)	TOTAL MASS CURVE INCREMENT (AC-FT)	CUMULATIVE (AC-FT)	HOURS
1.	30.19	447.	25.00
2.	35.82	483.	25.50
2.	42.53	526.	26.00
2.	50.17	576.	26.50
2.	56.68	633.	27.00
3.	61.83	694.	27.50
3.	67.16	762.	28.00
6.	77.87	839.	28.50
6.	95.09	935.	29.00
6.	120.14	1055.	29.50
6.	144.07	1199.	30.00
10.	167.40	1366.	30.50
12.	196.38	1563.	31.00
28.	261.25	1824.	31.50
46.	383.16	2207.	32.00
10.	547.72	2755.	32.50
7.	699.54	3454.	33.00
6.	668.82	4123.	33.50
6.	535.70	4659.	34.00
4.	402.87	5062.	34.50
4.	305.15	5367.	35.00
3.	236.46	5603.	35.50
2.	187.89	5791.	36.00
2.	150.90	5942.	36.50
1.	120.15	6062.	37.00
1.	95.69	6158.	37.50
1.	75.85	6234.	38.00
0.	58.44	6292.	38.50
0.	44.25	6337.	39.00
0.	32.13	6369.	39.50
0.	23.07	6392.	40.00
0.	17.30	6409.	40.50
0.	13.99	6423.	41.00
0.	12.12	6435.	41.50
0.	11.09	6446.	42.00
0.	10.52	6457.	42.50
0.	10.20	6467.	43.00
0.	10.03	6477.	43.50
0.	9.93	6487.	44.00
0.	9.88	6497.	44.50
0.	9.85	6507.	45.00
0.	9.84	6517.	45.50
0.	9.83	6526.	46.00
0.	9.83	6536.	46.50
0.	9.83	6546.	47.00
0.	9.45	6555.	47.50
0.	8.49	6564.	48.00
0.	6.07	6570.	48.50
0.	3.85	6574.	49.00
0.	2.25	6576.	49.50



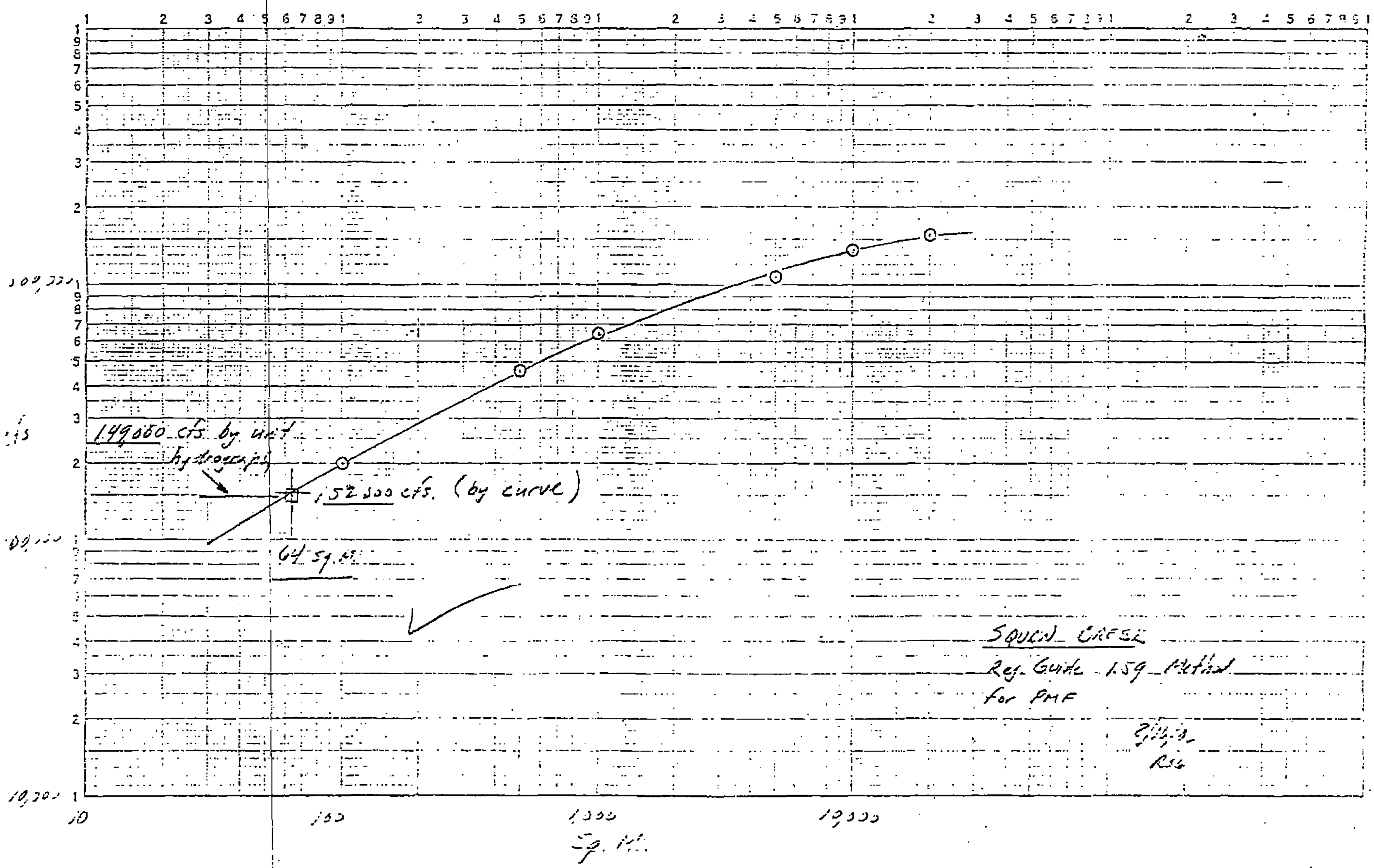
SSI - PROBABLE MAXIMUM FLOOD
FOR ENTIRE RAINFALL PERIOD
8-20-74 RML

HOURS	RAIN (IN)	INFIL (IN)	EXCESS (IN)	UNIT HYDROGRAPH (CFS)	INFLOW HYDROGRAPH (CFS)	INFLOW MASS CURVE INCREMENT (AC-FT)	INFLOW MASS CURVE CUMULATIVE (AC-FT)
50.00	0.00	0.00	0.00	0.	21.	1.	6343
50.50	0.00	0.00	0.00	0.	12.	0.	6344
51.00	0.00	0.00	0.00	0.	6.	0.	6344
51.50	0.00	0.00	0.00	0.	3.	0.	6344
52.00	0.00	0.00	0.00	0.	2.	0.	6344
52.50	0.00	0.00	0.00	0.	1.	0.	6344
53.00	0.00	0.00	0.00	0.	0.	0.	6344
53.50	0.00	0.00	0.00	0.	0.	0.	6344
54.00	0.00	0.00	0.00	0.	0.	0.	6344
54.50	0.00	0.00	0.00	0.	0.	0.	6344
55.00	0.00	0.00	0.00	0.	0.	0.	6344
55.50	0.00	0.00	0.00	0.	0.	0.	6344
56.00	0.00	0.00	0.00	0.	0.	0.	6344

RAIN ON RESERVOIR (AC-FT)	TOTAL MASS CURVE INCREMENT (AC-FT)	CUMULATIVE (AC-FT)	HOURS
0.	1.26	6577.	50.00
0.	0.70	6578.	50.50
0.	0.38	6579.	51.00
0.	0.21	6579.	51.50
0.	0.11	6579.	52.00
0.	0.06	6579.	52.50
0.	0.03	6579.	53.00
0.	0.02	6579.	53.50
0.	0.01	6579.	54.00
0.	0.00	6579.	54.50
0.	0.00	6579.	55.00
0.	0.00	6579.	55.50
0.	0.00	6579.	56.00



KEUFFEL & ESSER CO.



1057

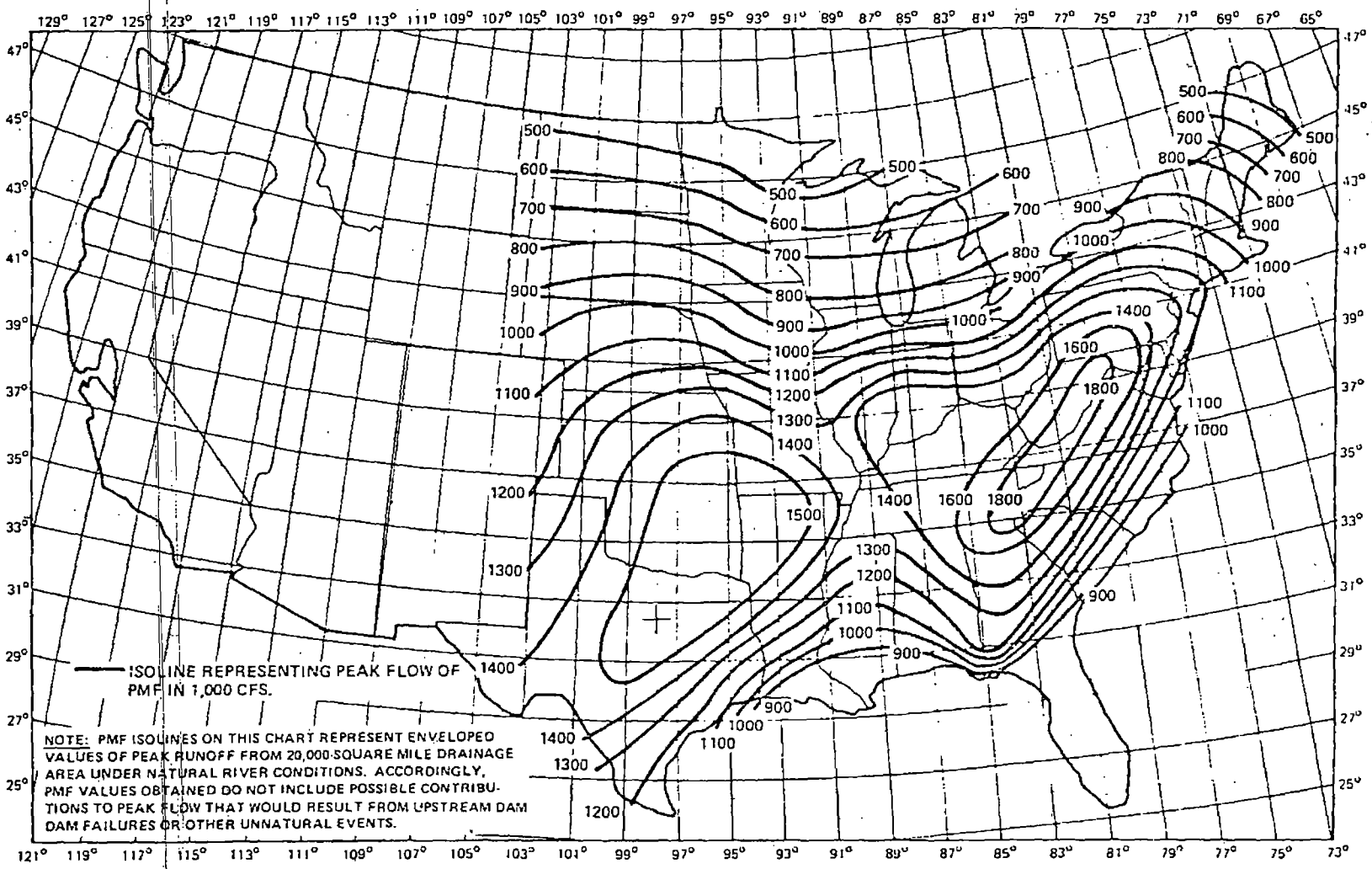


FIGURE 8.7 PROBABLE MAXIMUM FLOOD (ENVELOPING PMF ISOLINES) FOR 20,000 SQUARE MILES

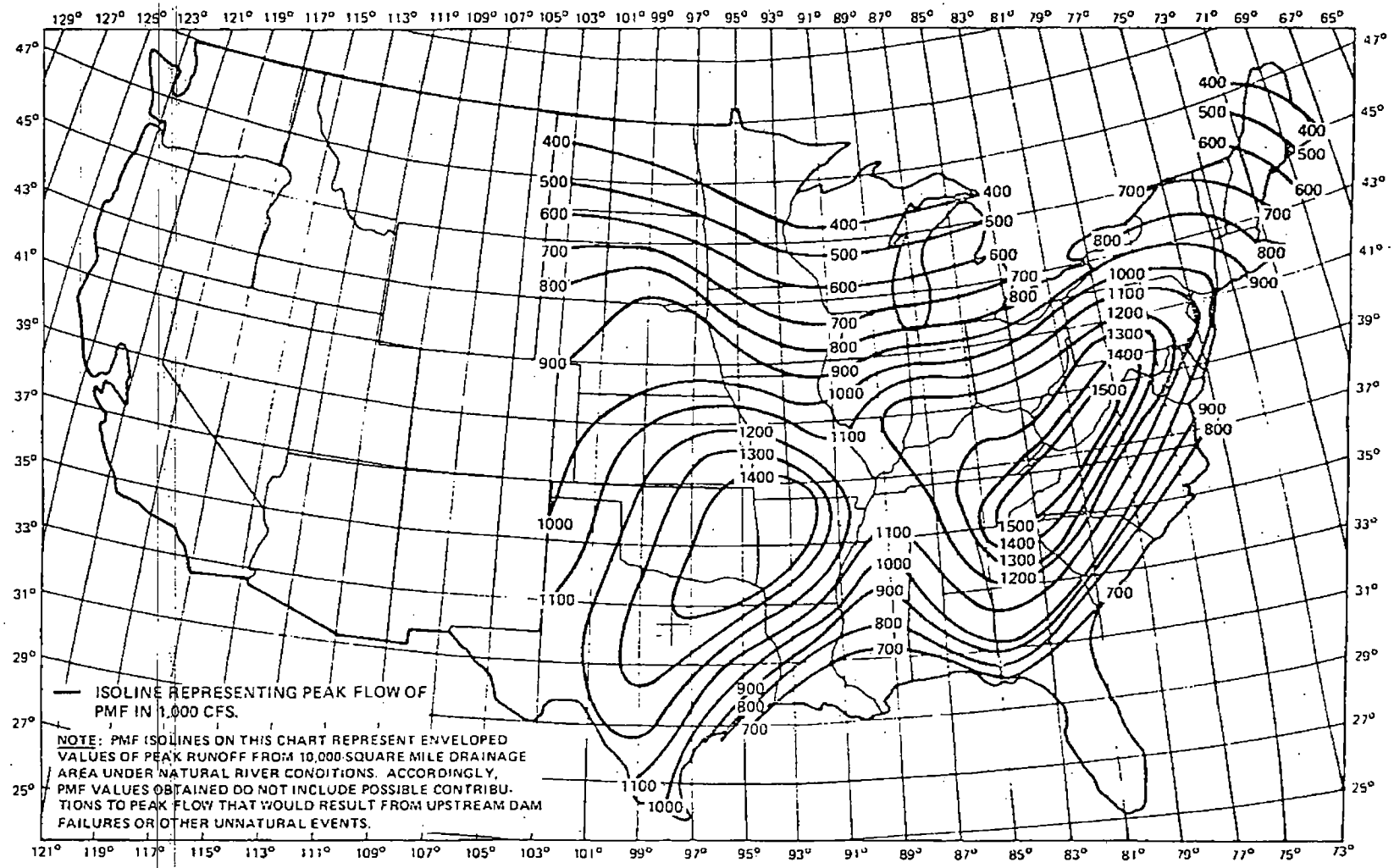


FIGURE B.6 PROBABLE MAXIMUM FLOOD (ENVELOPING PMF ISOLINES) FOR 10,000 SQUARE MILES

1.59-33

3 of 7

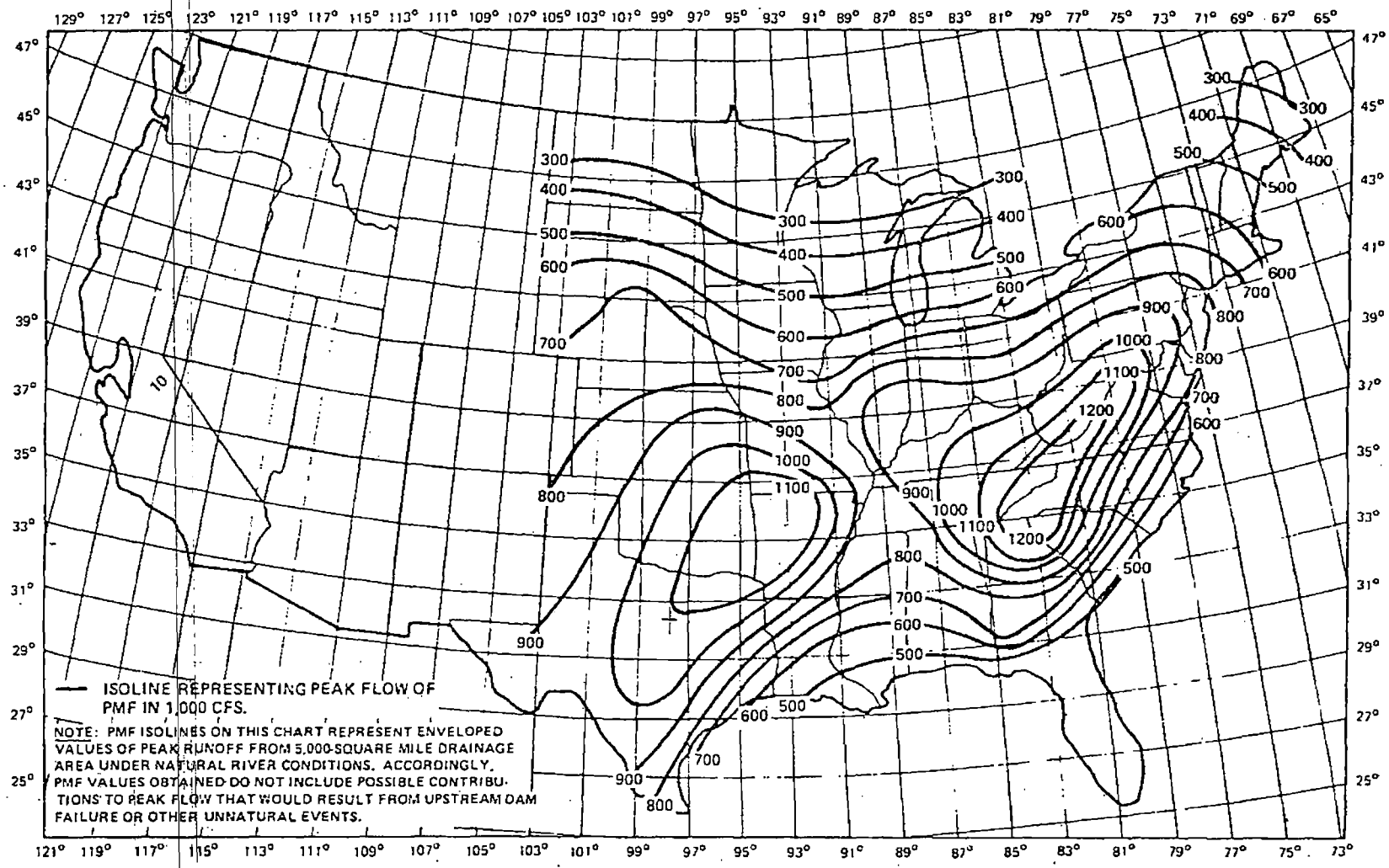


FIGURE 8.5 PROBABLE MAXIMUM FLOOD (ENVELOPING PMF ISOLINES) FOR 5,000 SQUARE MILES

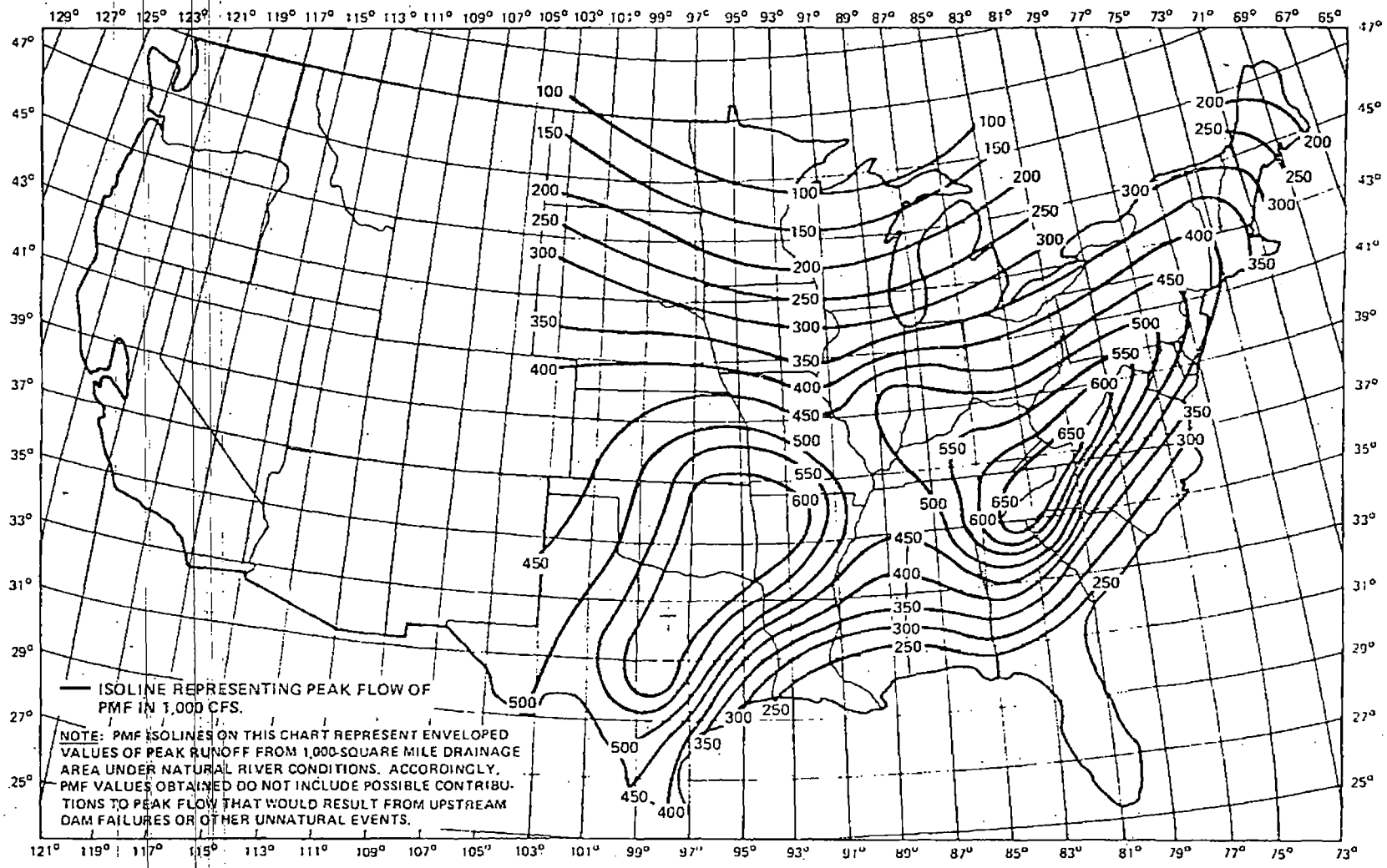


FIGURE B.4 PROBABLE MAXIMUM FLOOD (ENVELOPING PMF ISOLINES) FOR 1,000 SQUARE MILES

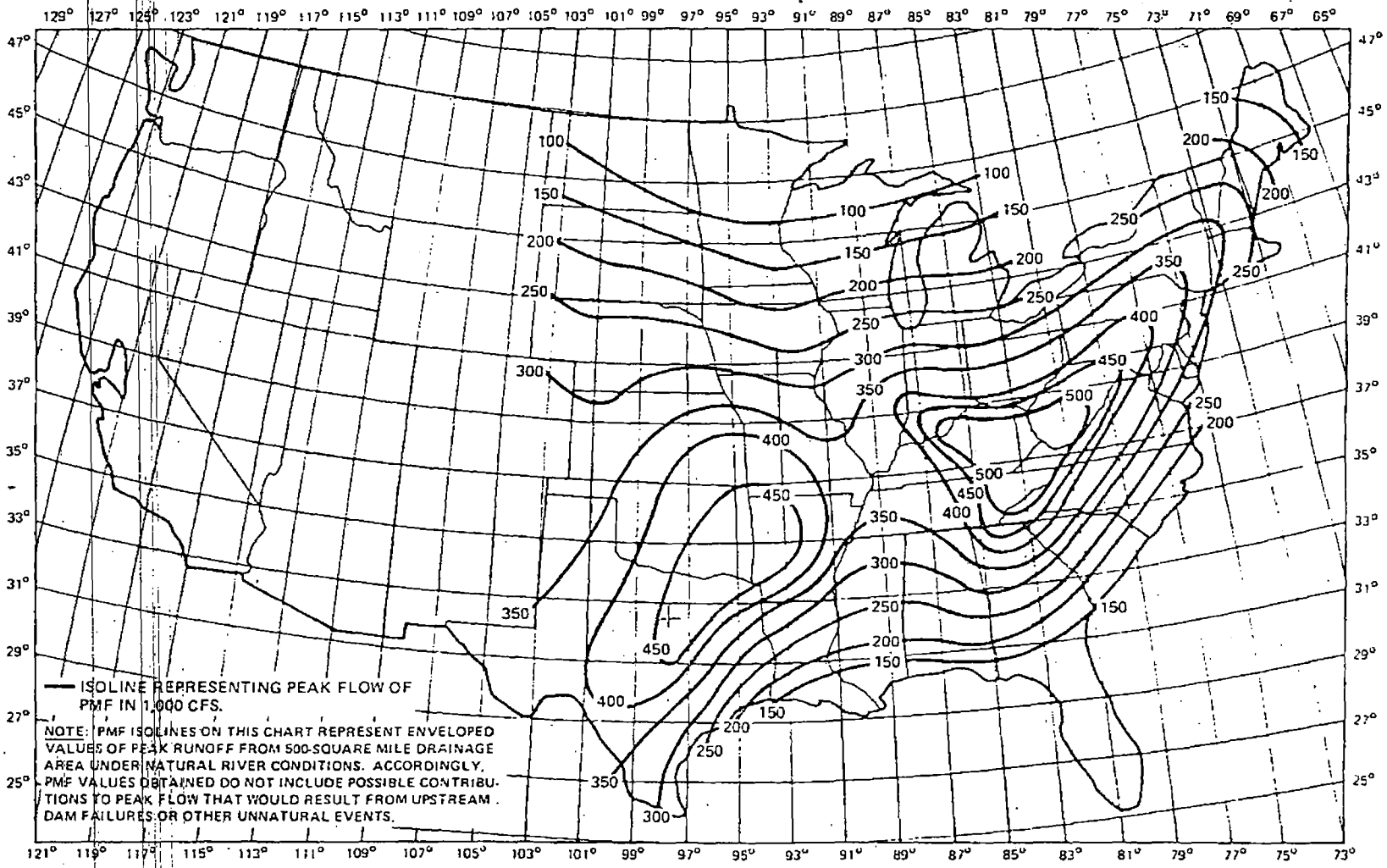


FIGURE B.3 PROBABLE MAXIMUM FLOOD (ENVELOPING PMF ISOLINES) FOR 500 SQUARE MILES

1-59-30

6 of 7

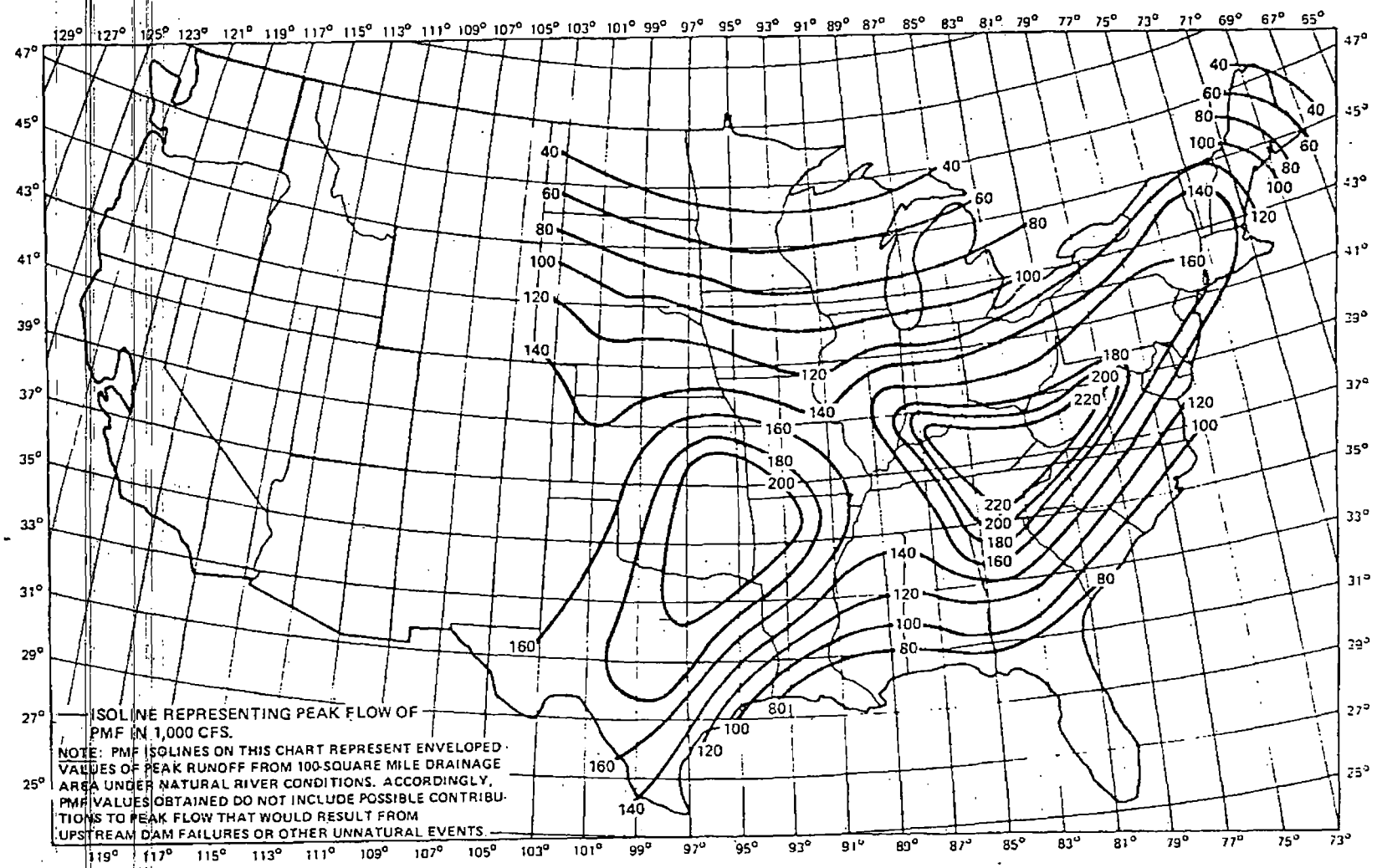


FIGURE B.2 PROBABLE MAXIMUM FLOOD (ENVELOPING PMF ISOLINES) FOR 100 SQUARE MILES

1.59-29

7 of 7

Client TUSI

Project Safe Shutdown Impoundment

Title: Area-Capacity Check.

Date: 8-19-74

By: ~~BME~~

✓ RML

Approved _____ Project Engineer

This review of the area-capacity relationship for the SCR and SSI was performed to check those relationship that would effect the flood routings. The area at elevations 770, 780, and 790 were planimetered, then compared to the original planimeter work. The capacity above elev. 775 are the only ones that will effect the flood routings so the capacity at elev. 770 was assumed correct and then the capacity to elev. 790 was checked. The capacity check was performed on the original capacity sheets in 6.A. page 6&7 of 8 and 6.A. page 5 of 7.

The area check at the different elevations for the two reservoirs are on the accompanying pages. All agree very well with the original work.

T.U.S.I. - Safe Shutdown Impoundment PLANIMETER COMPUTATIONS Project Engineer

Client: _____

Project: Squaw Creek Reservoir (CHECK) Date: 8-13-74

Drawing Number: USGS Quad sheet 1"=2000' Subject: _____

Planimeter Make: A. Ott Serial Number: 72454 Arm Setting: 100

Contour Elev. or Area No.		Planimeter Reading	Differences	Computations Av. Diff.	Constant (1)	Area
Constant				~~Area Measured: 101.9284 ac.~~		
	3	09200	3329	3328 Units	: 1 unit =	0.33110829 Ac.
	2	05871	3327			
	1	02544				
Elev 770	3	18407	9203	9201	Ac. 0.33110829	3046.53 ac
	2	09204	9199			
	1	00005				
Elev 780	3	39198	10390	10395	"	3441.87 ac.
	2	28808	10400			
	1	18408				
Elev 790	3	62697	11744	11750		3890.52 ac
	2	50953	11756			
	1	39197				
	3					
	2					
	1					
	3					
	2					
	1					
	3					
	2					
	1					
	3					
	2					
	1					

(1) For determination of Planimeter Constant, see Sheet Chart

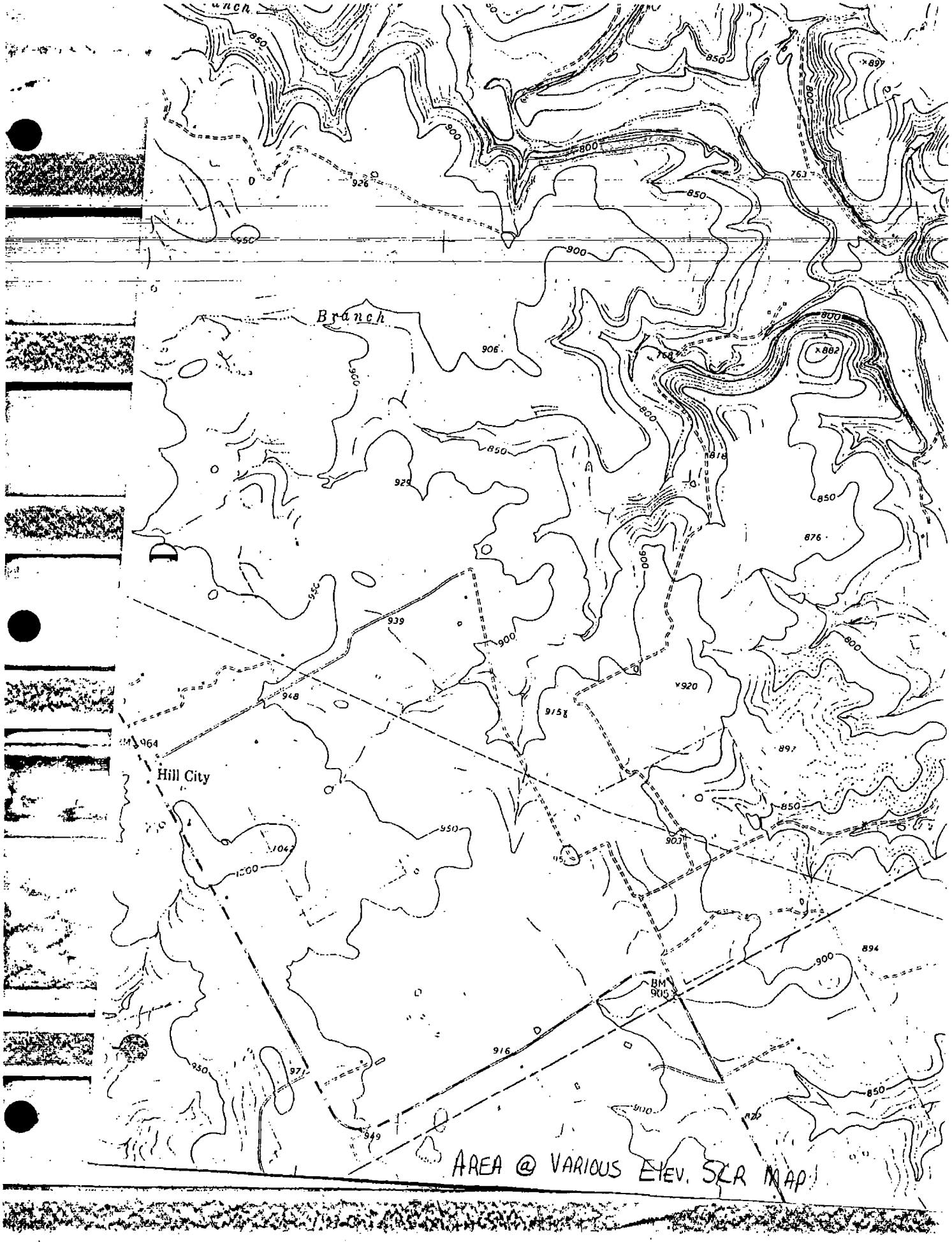
Planimeter Constant this work: One unit = 0.33110829 Ac. ~~Sq. ft.~~ ~~Sq. mi.~~

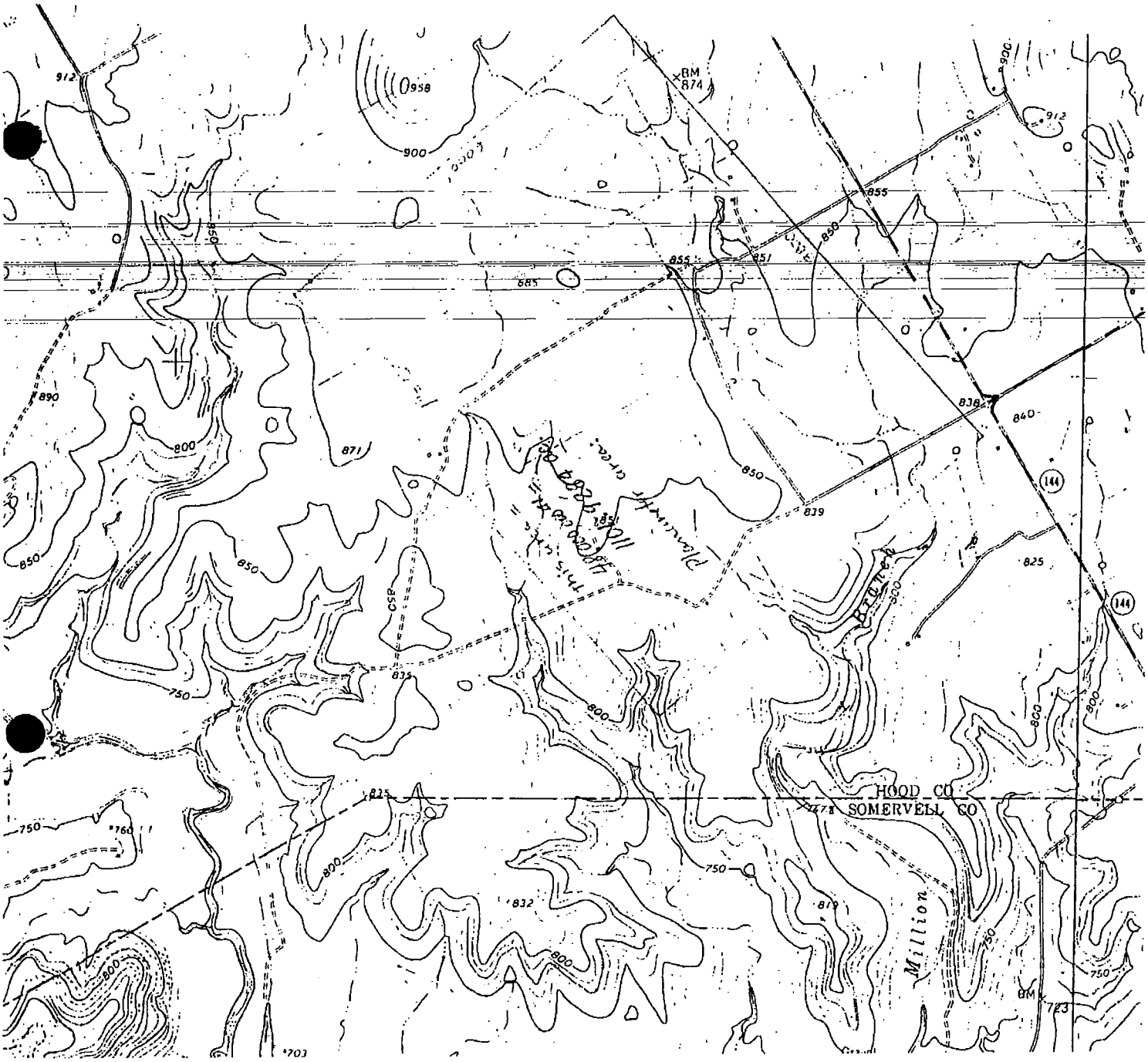
Freese and Nichols CONSULTING ENGINEERS

Planimeter by: J.W.R. Checked: RML Sheet ____ of ____

Approved: _____ Page _____

Project Engineer


Branch
Hill City
AREA @ VARIOUS ELEV. SCR MAP


HOOD CO
SOMERVELL CO
Million
BM 874
BM 723
144
144

T.U.S.I. - Safe Shutdown Impoundment PLANIMETER COMPUTATIONS Project Engineer

Client: TUST

Project: SSI DAM - Area/capacity - CHECK Date: 8-12-74

Drawing Number: Traced from 1"=600' by Limbaugh Subject:

Planimeter Make: KE Serial Number: 15957 Arm Setting: 35.0

Contour Elev. or Area No.		Planimeter Reading	Computations: Differences	Av. Diff.	Constant (1)	Area
Constant			Area = 10 ^{AH} = 3,600,000 ^{AI} = 82.6446 ac.			
	3	4104	586	587 units	1 unit =	0.14079153 ac.
	2	3518	588			
	1	2930				
Elev 770	3	0939	225	226	0.14079153	31.82 ac
	2	0714	227			
	1	0487				
Elev 780	3	1676	361	360	"	50.68 ac
	2	1315	359			
	1	0956				
Elev 790	3	2736	523	521	"	73.35 ac.
	2	2213	519			
	1	1694				
	3					
	2					
	1					
	3					
	2					
	1					
	3					
	2					
	1					
	3					
	2					
	1					

(1) For determination of Planimeter Constant, see Sheet ____ of ____

Planimeter Constant this work: One unit= _____ Ac. Sq. ft. Sq. mi.

Freese and Nichols CONSULTING ENGINEERS

Planimeter by: J.W.R. Checked: RWL Sheet ____ of ____

Approved: _____ Page _____

Project Engineer

T.U.S.I. - Safe Shutdown Impoundment

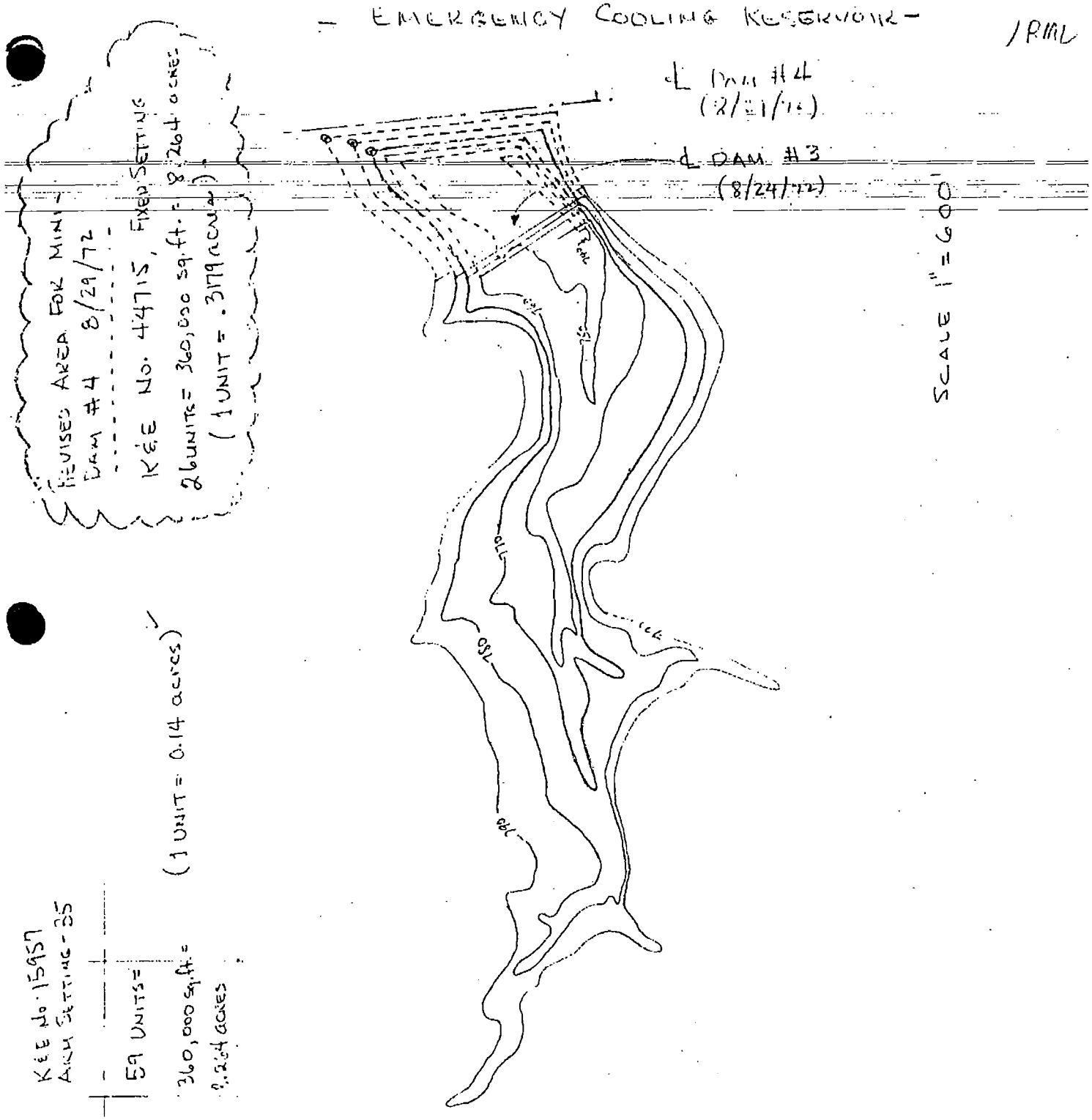
COMANCHE PEAK RESERVOIR PROJECT

Project Engineer

ICU 120.
5/24/72
JDW

- EMERGENCY COOLING RESERVOIR -

/RML



Areas @ Various Elev. - SSI map.
8-13-74
RML

2 plus 5 of 5

Client TUSI Date: 8-19-74

Project Safe Shutdown Impourdment By: ~~RMZ~~

Title: Squaw Creek Reservoir ✓ RML

Discharge Rating 100' ogee. Approved _____ Project Engineer

The final plans for SCR contains two spillways. One is a 100' ungated concrete ogee spillway at elevation 775. The second is a 2200' long emergency spillway in a rock cut. The discharge rating curve computations are extracted from the final hydraulic design of the 100' long ogee. The notes are fairly easy to follow so I will not attempt to further explain them.

The rating curve for the emergency spillway is determined using the basic principles discussed on 2.7.B. page 3 and 4 of 18. The main difference is the downstream effect. The emercency spillway drops very rapidly at the end into another small creek. The water surface must go through critical depth at the end of the spillway before entering the steep slope into the adjacent creek. For this reason, assuming normal depth of flow some 600' from the rapid depth will be close to correct. It might even be conservative as the water surface might not have reached normal depth by that point. The water surface in the emergency spillway is calculated over the crest (@ sta 4100 to 4+5 back into the reservoir. An entrance loss of 0.1 times the velocity head is assumed and the reservoir water surface required is calculated. The water surface profiles through the emergency spillway are determined using a computer program that performs the mathematics described in 2.7.E. page 3 and 4 of 18.

Title: SQUAW CREEK RESERVOIR
DISCHARGE RATING 100' ogee

Date: 9-27-13

By: RMS

✓

To compute head loss in approach channel

first compute approximate velocity head

$$V_{approximate} = Q/A_{approximate}$$

$$= Q/(100 + He + 12)(He + 12)$$

$$h_{a\ approx.} = V^2_{approximate}/2g = \frac{Q^2}{[(100 + He + 12)(He + 12)]^2 2g}$$

then compute actual water depths and apply to head loss eqns

$$Y = P + He - h_a = 12 + He - h_a$$

$$A = (b + zY)Y = (100 + Y)(Y)$$

$$R = (100+Y)(Y)/b + 2\sqrt{2}Y = (100+Y)Y/100 + 2\sqrt{2}Y$$

$$V = Q/A \quad \& \quad S_f = h_f/L = h_f/450 \quad \& \quad V = \frac{1.486}{n} R^{2/3} S^{1/2}$$

assume $n = 0.035$ (p. 57 Table IV, EM 1110-2-1603) for smooth & uniform Rock channels

$$V = \frac{1.486}{0.035} R^{2/3} \left(\frac{h_f}{450}\right)^{1/2}$$

$$h_f = \frac{450\, V_a^2 (0.035)^2}{(1.486)^2 R^{4/3}} = \frac{0.24964\, V_a^2}{R^{4/3}}$$

Total head loss is head loss in approach channel plus entrance loss ($0.1\ V^2/2g$)

$$h_L = h_f + 0.1\ V^2/2g$$

$$h_L = \frac{0.24964}{R^{4/3}} V^2 + 0.00551\, V^2$$

Project Engineer

Title: SQUAW CREEK RESERVOIR
DISCHARGE RATING 100' ogee

Date: 9-27-73
By: RML
✓ [illegible]

H_e	H_e/H_d	C_w	C^*	K_a°	L	Q	h_a	Y	A	V	h_L	Reservoir Elev.
1	0.076	3.17	3.17	0.170	99.66	316						776.0
2	.141	3.25	3.25	.169	99.32	913						777.0
3	.211	3.33	3.33	.168	98.99	1713						778.0
4	.282	3.40	3.40	.167	98.66	2684						779.0
5	.352	3.47	3.47	.164	98.30	3816	0.057	16.9	1976	1.93	0.035	780.0
6	.423	3.53	3.53	.161	98.07	5088	0.089	17.9	2110	2.41	0.052	781.1
7	.493	3.60	3.60	.159	97.77	6519						782.1
8	.563	3.66	3.66	.155	97.52	8076						783.1
9	.634	3.73	3.731	.151	97.28	9797	.231	20.8	2513	3.90	0.12	784.1
10	.704	3.79	3.79	.147	97.06	11633	.292	21.7	2641	4.40	0.146	785.1
11	.775	3.85	3.85	.142	96.88	13,608						786.2
12	.845	3.89	3.89	.130	96.74	15,643	.429	23.6	2917	5.36	0.20	787.2
13	.915	3.94	3.94	.122	96.67	17,853	0.507	24.5	3050	5.85	0.231	788.2
14	.986	3.98	3.98	.120	96.64	20,148	0.587	25.4	3185	6.33	0.27	789.3
15	1.056	4.00	4.00	.112	96.64	22,457	0.667	26.3	3322	6.76	0.29	790.3

C_w - plate #31 EM 1110-2-1603

$^*C = C_w \times C_i/C_w$, $C_i/C_w = 1.001$

Δ h_a 0.27 = .3 assumed, O.K

Not all values of H_e computed through, not req'd to establish Res. Elev.

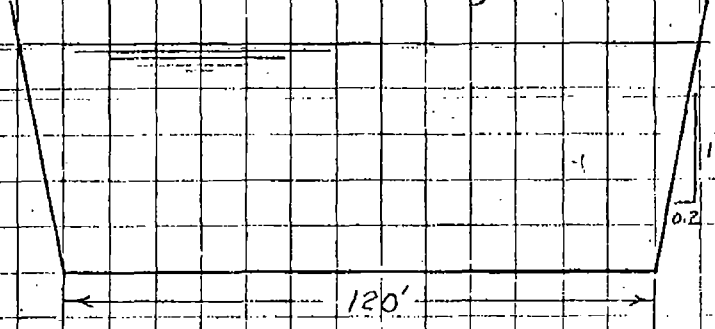
$^\circ K_a$ from EM, pt CXVI chapter 3 Pl 14

Project Engineer

Title: SQUAW CREEK RESERVOIR
DISCHARGE RATING - 100' ogee

Date: 10-10-73
By: RML
✓ [illegible]

The approach channel configuration was changed as shown below. The new rating curve is calculated to compare.



To compute head loss in approach channel

first compute approximate velocity head

$$V_{approximate} = Q/A_{approximate}$$

$$Q/[120 + 0.2(H_c + 12)](H_c + 12)$$

$$h_{a\ approximate} = V_{app}^2/2g = \frac{Q^2}{\{[120 + 0.2(H_c + 12)](H_c + 12)\}^2 \cdot 2g}$$

Then compute actual water depth and apply to head loss eq.

$$Y = P + H_c - h_a = 12 + H_c - h_a$$

$$A = (b + ZY)Y = [120 + 0.2Y]Y$$

$$R = (120 + 0.2Y)Y / 120 + 2\sqrt{1.04}\,Y$$

$$V = Q/A$$

$$S_f = h_f/L = h_f/500$$

$$V = 1.486/n\ R^{2/3} S^{1/2}$$

$$n = 0.035$$

$$h_f = \frac{500\, V_a^2 (0.035)^2}{(1.49)^2 R^{4/3}}$$

$$h_f = 0.27589 \frac{V_a^2}{R^{4/3}}$$

T.U.S.I. - Safe Shutdown Impoundment

Project Engineer

Title: SQUAW CREEK RESERVOIR
DISCHARGE RATING - 100' ogee

Date: 10-10-73

By: RML

✓ VLC

Total head loss is head loss in approach channel plus entrance loss $(0.1 V^2/2g)$

$$h_L = h_f + 0.1 \frac{V^2}{2g}$$

$$h_L = \left[\frac{0.0015 n^2}{R^{4/3}} + 0.001554 \right] V^2$$

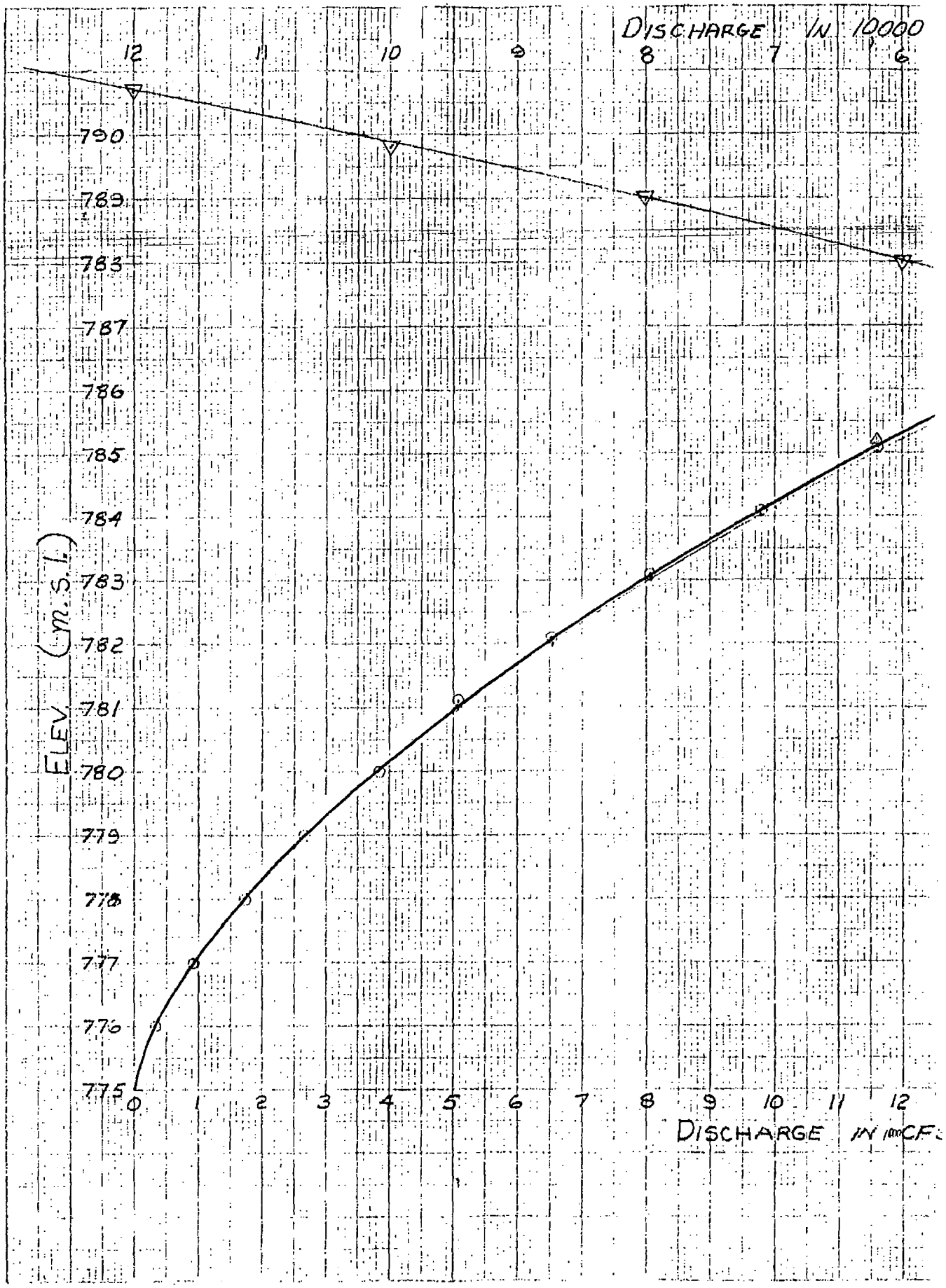
H_e	Q	h_a approx.	Y	A	V	h_L	Reservoir Elev.	El EGL @ Crest
1	316						776	776
2	913						777	777
3	1713						778	778
4	2684						779	779
5	3816 V	0.105'	16.9'	2085.12	1.83'	0.034'	780.1'	780
6	5088'	0.08'	17.9'	2212.08	2.30'	0.05'	781.1'	781
7	6579						782.1	782
8	8076						783.1	783
9	9797	.21'	20.8'	2582.52	3.79'	0.12'	784.1'	784
10	11633	0.28'	21.7'	2698.74	4.31'	0.15'	785.2'	785
11	13608						786.2	786
12	15643	0.42'	23.6'	2943.36	5.31'	0.21'	787.2'	787
13	17853	.50'	24.5'	3060.05	5.83'	0.25'	788.3'	788
14	20148						789.3	789
15	22,457	0.68'	26.3'	3294.1	6.82'	.32'	790.3'	790

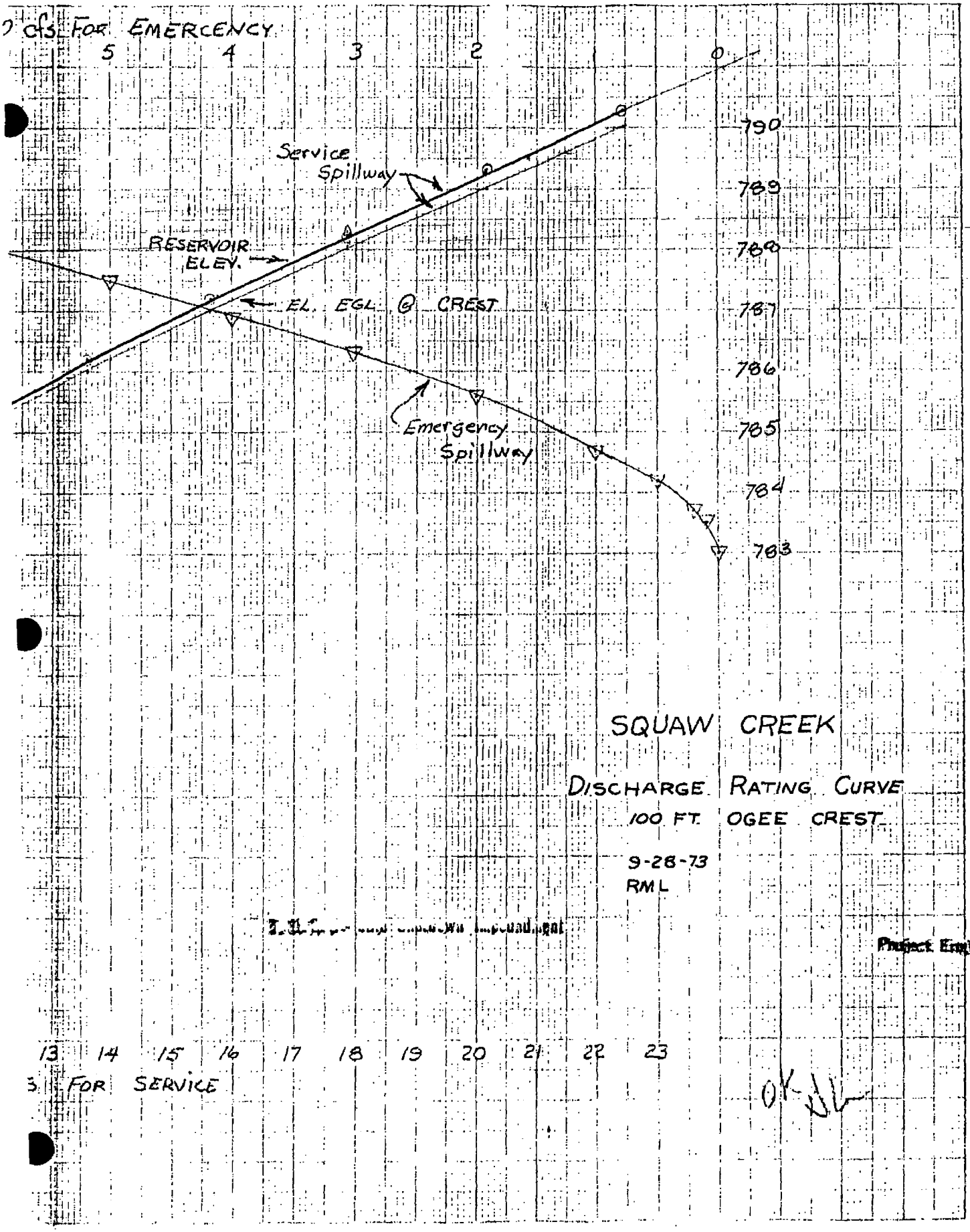
Only two points were different from original values & these were only by 0.1 ft, so no change was made in rating curve.

Title: SQUAW CREEK RESERVOIR
DISCHARGE RATING 100' ogee

Project Engineer
Date: 6-12-74
By: RML
✓

The approach channel walls had a slope of 4V:1H in the final design with a 120' wide bottom. The design tested for comparison was for a 5V:1H therefore there will be some difference but not much. The difference will be that the head loss in approach with a 4V:1H wall will be somewhat smaller than 5V:1H. The difference being small and conservative, I did not redo calculations.


DISCHARGE IN 10000
12
11
10
9
8
7
6
790
789
788
787
786
785
784
783
782
781
780
779
778
777
776
775
ELEV. (m.s.l.)
0
1
2
3
4
5
6
7
8
9
10
11
12
DISCHARGE IN 1000 CFS



SQUAW CREEK

DISCHARGE RATING CURVE

100 FT. OGEE CREST

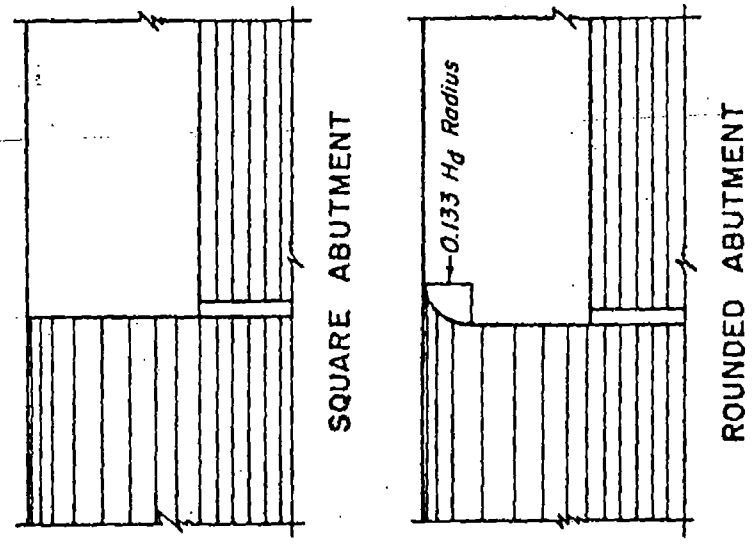
9-28-73

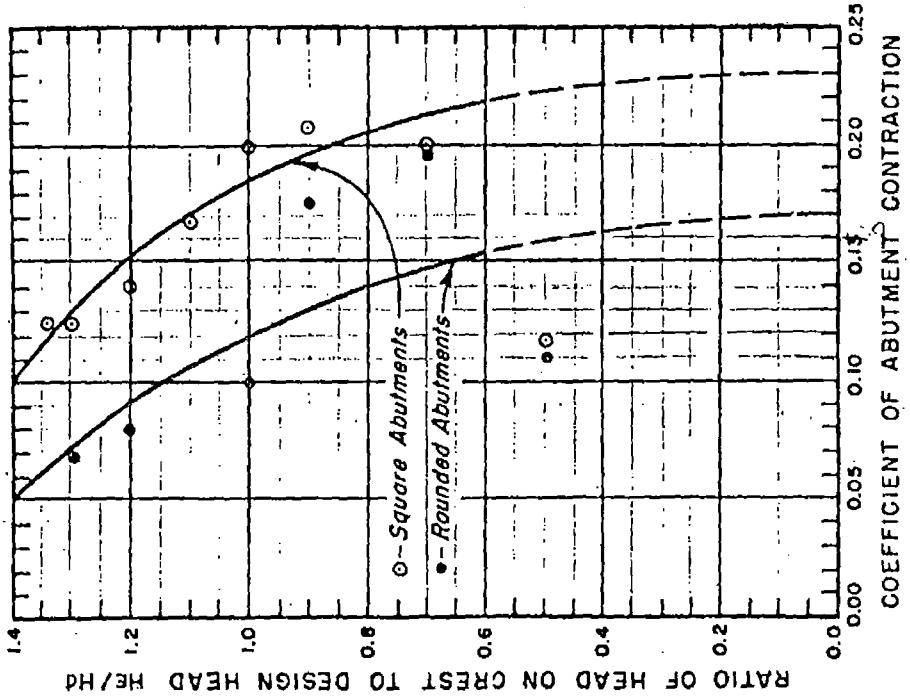
RML

Project Engineer

OK-JL

27 A Page 8 of 26

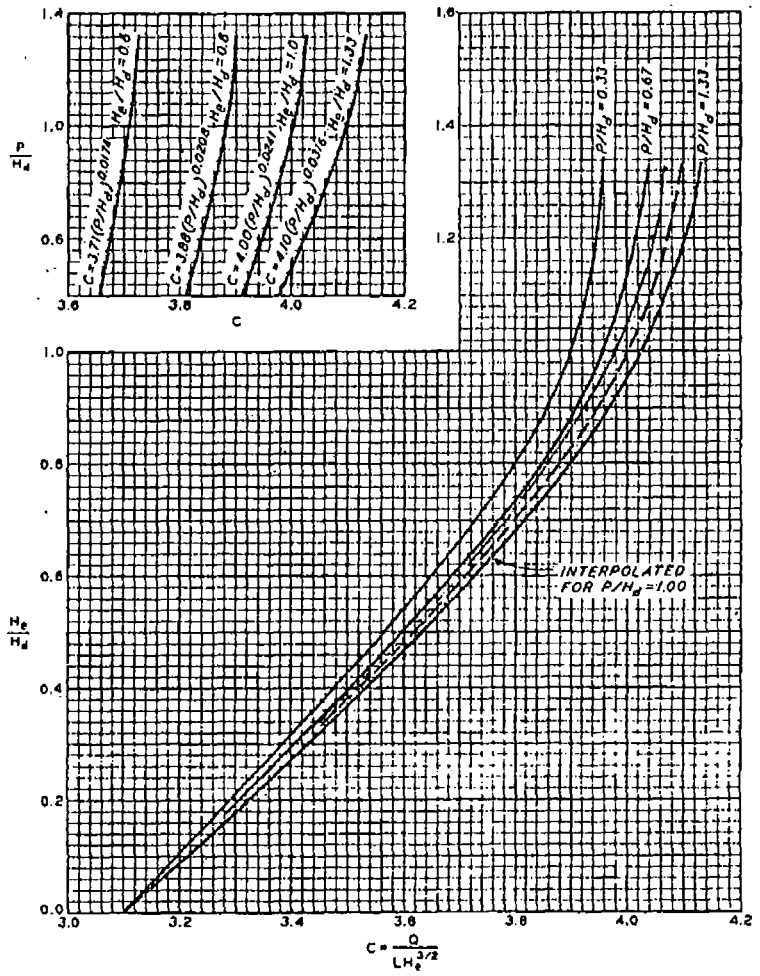


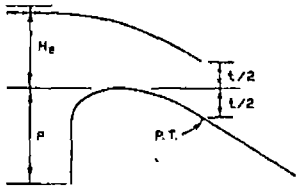


VARIATION OF ABUTMENT CONTRACTION COEFFICIENTS WITH ABUTMENT SHAPE

RMV

T.U.S.I. - Safe Shutdown Impoundment Project Engineer

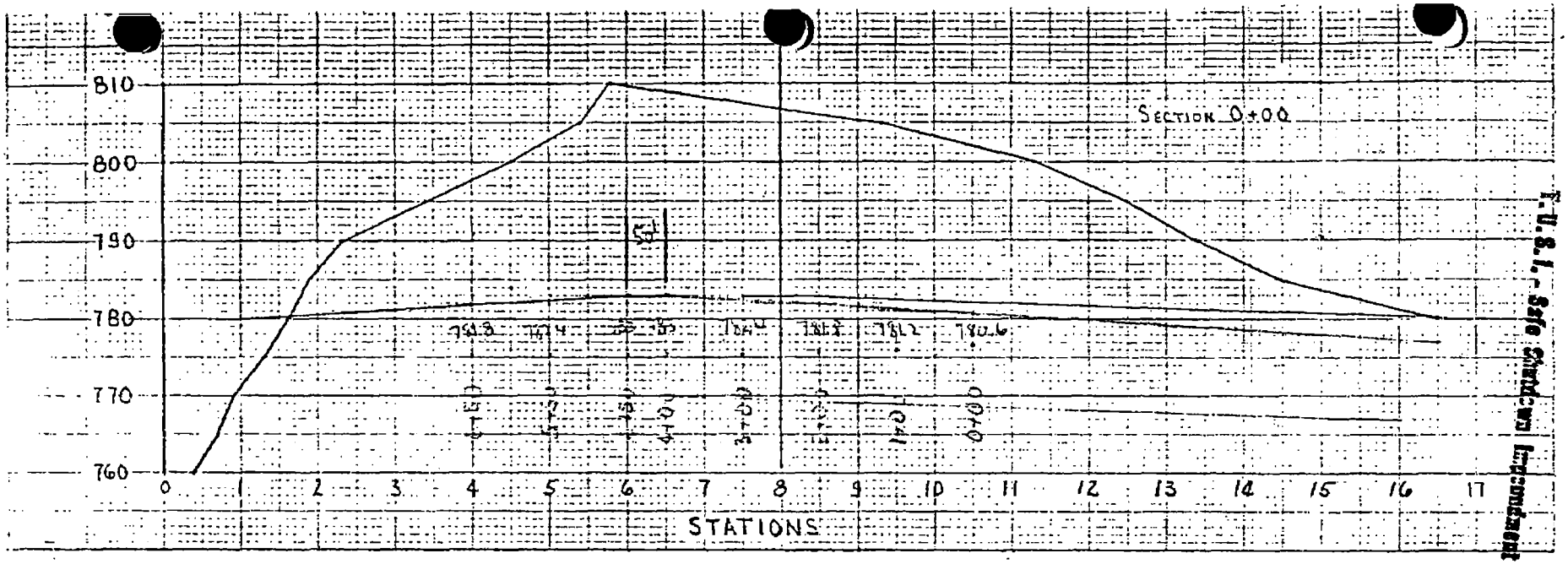


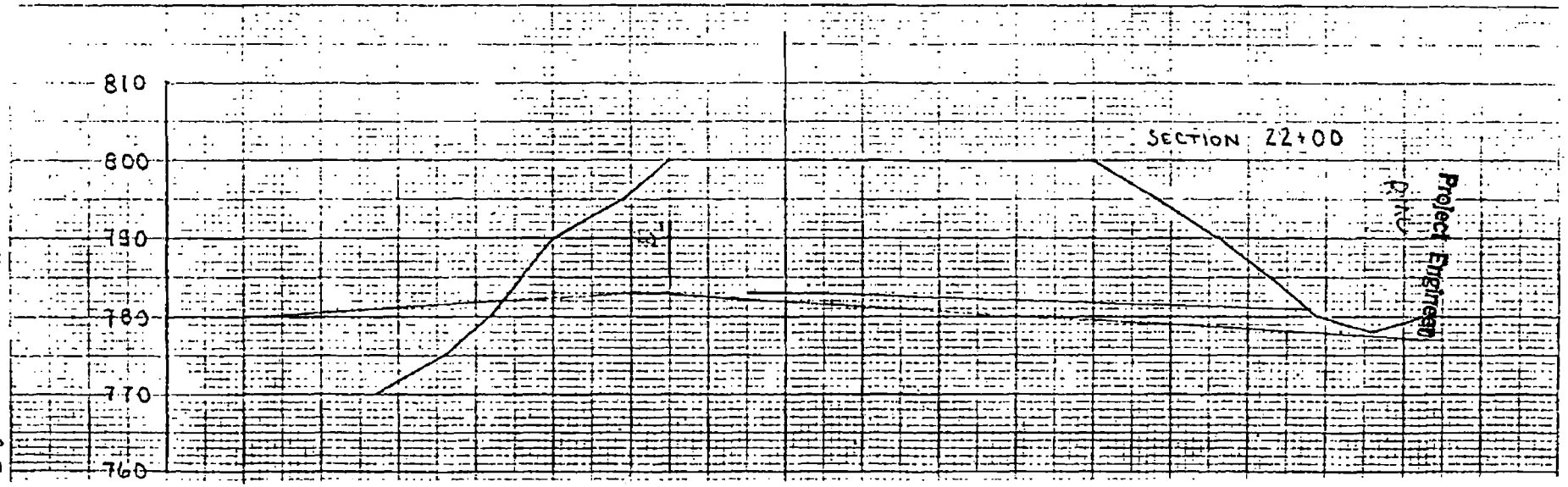


DEFINITION SKETCH

LOW OGEE CREST
DISCHARGE COEFFICIENT
VERTICAL UPSTREAM FACE

Plate 31


SECTION 0+00
810
800
790
780
770
760
0
1
2
3
4
5
6
7
8
9
10
11
12
13
14
15
16
17
STATIONS
T.U.S.I. - Site Simulation Impoundment


SECTION 22+00
810
800
790
780
770
760
Project Engineer

T.U.S.I. - Safe Shutdown Impoundment

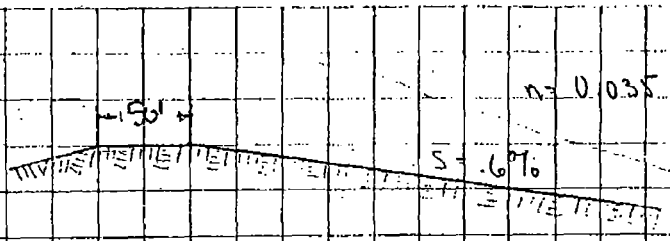
Title: SQUAW CREEK RESERVOIR
EMERGENCY SPILLWAY RATING
2,200 FEET WIDE @ ELEV. 783 ±

Project Engineer

Date: 1/10/74

By: TAR

✓ EHL



Compute normal depth on slope.
Neglect area gained due to sloping sides as y increases.
Use R = y throughout.

$$Q = \frac{1.486}{n} AR^{2/3} S^{1/2} = \frac{1.486}{0.035} \times 2200y \times y^{2/3} \times \sqrt{.006} = 7,235.21\, y^{5/3}$$

Q (cfs)	$y^{5/3}$	y (ft)	A $(ft)^2$	V (ft/sec)	$V^2/2g$	$0.1\ V^2/2g$	Stage	$TF = \sqrt{\frac{V^2/2g}{D} \times 2}$
10000	1.3818	0.305	671	1.490	0.034	0.003	0.342	0.472
20000	2.764	0.462	1016	1.969	0.060	0.006	0.528	0.510
50000	6.911	0.801	1.762	2.838	0.125	0.013	0.939	0.559
100000	13.822	1.214	2,671	3.744	0.218	0.022	1.454	0.599
200000	27.644	1.840	4.048	4.941	0.379	0.038	2.257	0.642
300000	41.466	2.347	5,163	5.811	0.524	0.052	2.923	0.669
400000	55.288	2.790	6,138	6.517	0.659	0.066	3.515	0.687
500000	69.111	3.190	7,018	7.125	0.788	0.079	4.057	0.703
600000	82.933	3.558	7,828	7.665	0.912	0.091	4.561	0.716
800000	110.57	4.228	9,302	8.600	1.148	0.115	5.491	0.737
1000000	138.21	4.834	10,635	9.403	1.373	0.137	6.344	0.754
1200000	165.86	5.393	11,865	10.114	1.588	0.159	7.140	0.767

T.U.S.I. - Tate Snowdown Incorporated — Project Engineer — Date: 1/11/74

By: TAR

JRM

BACK WATER CALCULATIONS PROGRAM "KKWT2"

RIVER SECTION CARDS - TYPE 2

All Cards: Punch 2 in Col 80

RSTA(K)			SSTA(I,K)			SELEV(I,K)				XN(I,K)	
5 6 7 8	9	10	15 16	17 18	19 20	25 26	27	28	29 30	37 38	39 40
		0			0	7	9	5	6 0		3 5
		0			45	7	8	0	6		
		0		22	45	7	8	0	6		
		0		22	90	7	9	5	6		
	100				0	7	9	6	2		3 5
	100				45	7	8	1	2		
				22	45	7	8	1	2		
				22	90	7	9	6	2		
	200				0	7	9	6	8		3 5
					45	7	8	1	8		
				22	45	7	8	1	8		
				22	90	7	9	6	8		
	300				0	7	9	7	4		3 5
					45	7	8	2	4		
				22	45	7	8	2	4		
				22	90	7	9	7	4		
	400				0	7	9	8	0		3 5
					45	7	8	3	0		
				22	45	7	8	3	0		
				22	90	7	9	8	0		
	450				0	7	9	8	0		3 5
					45	7	8	3	0		
				22	45	7	8	3	0		
				22	90	7	9	8	0		
	500				0	7	9	7	4		3 5
					45	7	8	2	4		
				22	45	7	8	2	4		
				22	90	7	9	7	4		
	600				0	7	9	6	8		3 5
					45	7	8	1	8		
				22	45	7	8	1	8		
				22	90	7	9	6	8		

T.U.S.I. - Safe Shutdown Impoundment
BACKWATER CALCULATIONS PROGRAM ~ PBKWT2 Project Engineer: By: TAR

CONTROL INFORMATION ~ TYPE 2

All Cards: Punch 3 in Col. 80

												ELEV1			
3	4	5	6	7	8	9	10	14	15	16	17	18	19	20	
				1	0	0	0			7	8	0	.	9	
				2	0	0	0			7	8	1	.	1	
				5	0	0	0			7	8	1	.	4	
			1	0	0	0	0			7	8	1	.	8	
			2	0	0	0	0			7	8	2	.	4	
			3	0	0	0	0			7	8	2	.	9	
			4	0	0	0	0			7	8	3	.	4	
			5	0	0	0	0			7	8	3	.	8	
			6	0	0	0	0			7	8	4	.	2	
			8	0	0	0	0			7	8	4	.	8	
		1	0	0	0	0	0			7	8	5	.	4	
		1	2	0	0	0	0			7	8	6	.	0	

D.T.A. Page 13 of 2

T.U.S.L. - Safe Shutdown Impoundment

Project Engineer

SQUAW CREEK RESERVOIR EMERGENCY SPILLWAY

JANUARY 11, 1974 TAR

DISCHARGE IS 1000.000 CUBIC FEET/SECOND

RIVER STATION (FEET)	SURFACE ELEV (FEET)	CROSS SECTION AREA (SQ FT)	CONVEY-ANCE K	VELOCITY HEAD (FEET)	FRICTION SLOPE	ALPHA
0.	780.9	660.	12558.	0.0356	0.006340	1.000
100.	781.5	660.	12558.	0.0356	0.006340	1.000
200.	782.0	735.	15020.	0.0287	0.004432	1.000
300.	782.6	615.	11162.	0.0410	0.008025	1.000
400.	783.2	858.	19458.	0.0210	0.002641	1.000
450.	783.4	755.	15733.	0.0271	0.004039	1.000
500.	783.5	2433.	110250.	0.0026	0.000082	1.000
600.	783.5	3819.	233450.	0.0010	0.000018	0.999

T.U.S.I. - Safe Shutdown Impoundment

Project Engineer

SQUAW CREEK RESERVOIR EMERGENCY SPILLWAY

JANUARY 11, 1974 TAR

DISCHARGE IS 2000.000 CUBIC FEET/SECOND

RIVER STATION (FEET)	SURFACE ELEV (FEET)	CROSS SECTION AREA (SQ FT)	CONVEY-ANCE K	VELOCITY HEAD (FEET)	FRICTION SLOPE	ALPHA
0.	781.1	1100.	29426.	0.0512	0.004619	1.000
100.	781.7	880.	20286.	0.0801	0.009719	1.000
200.	782.4	1294.	38567.	0.0370	0.002689	1.000
300.	782.8	994.	24835.	0.0628	0.006485	1.000
400.	783.4	1066.	27925.	0.0545	0.005129	1.000
450.	783.6	1483.	48349.	0.0282	0.001711	1.000
500.	783.7	2800.	139340.	0.0079	0.000206	1.000
600.	783.7	4277.	281850.	0.0033	0.000050	0.999

T.U.S.I. - Safe Shutdown Impoundment

Project Engineer

SQUAW CREEK RESERVOIR EMERGENCY SPILLWAY

JANUARY 11, 1974 TAR

JRML

DISCHARGE IS 5000.000 CUBIC FEET/SECOND

RIVER STATION (FEET)	SURFACE ELEV (FEET)	CROSS SECTION AREA (SQ FT)	CONVEY-ANCE K	VELOCITY HEAD (FEET)	FRICTION SLOPE	ALPHA
0.	781.4	1761.	64414.	0.1250	0.006025	1.000
100.	782.0	1761.	64414.	0.1250	0.006025	1.000
200.	782.6	1767.	64753.	0.1242	0.005962	0.999
300.	783.1	1767.	64775.	0.1242	0.005958	1.000
400.	783.7	1759.	64247.	0.1254	0.006056	1.000
450.	784.0	2199.	93169.	0.0802	0.002880	1.000
500.	784.2	3896.	241350.	0.0255	0.000429	1.000
600.	784.2	5306.	403387.	0.0137	0.000153	0.999

T.U.S.I. - [illegible]

Project Engineer

SQUAW CREEK RESERVOIR EMERGENCY SPILLWAY

JANUARY 11, 1974 TAR

JRM

DISCHARGE IS 10000.000 CUBIC FEET/SECOND

RIVER STATION (FEET)	SURFACE ELEV (FEET)	CROSS SECTION AREA (SQ FT)	CONVEY-ANCE K	VELOCITY HEAD (FEET)	FRICTION SLOPE	ALPHA
0.	781.8	2644.	126627.	0.2220	0.006236	1.000
100.	782.4	2644.	126627.	0.2220	0.006236	1.000
200.	783.0	2696.	130815.	0.2135	0.005843	1.000
300.	783.6	2724.	133055.	0.2092	0.005648	0.999
400.	784.1	2677.	129293.	0.2165	0.005981	1.000
450.	784.4	3062.	161648.	0.1655	0.003826	0.999
500.	784.7	5043.	370704.	0.0610	0.000727	1.000
600.	784.7	6413.	552669.	0.0377	0.000327	1.000

[illegible]

Project Engineer

JRML

SQUAW CREEK RESERVOIR EMERGENCY SPILLWAY

JANUARY 11, 1974 TAR

DISCHARGE IS 20000.000 CUBIC FEET/SECOND

RIVER STATION (FEET)	SURFACE ELEV (FEET)	CROSS SECTION AREA (SQ FT)	CONVEY-ANCE K	VELOCITY HEAD (FEET)	FRICTION SLOPE	ALPHA
0.	782.4	3969.	248947.	0.3941	0.006454	1.000
100.	783.0	3969.	248947.	0.3941	0.006454	1.000
200.	783.6	4070.	259509.	0.3749	0.005939	1.000
300.	784.2	4156.	268694.	0.3595	0.005540	1.000
400.	784.8	4132.	266168.	0.3636	0.005646	1.000
450.	785.1	4697.	329327.	0.2815	0.003688	0.999
500.	785.4	6503.	565586.	0.1468	0.001250	1.000
600.	785.5	8186.	828810.	0.0926	0.000582	1.000

TAR 01-19 A26

T.U.S.I. - Safe Shutdown Impoundment

Project Engineer

SQUAW CREEK RESERVOIR EMERGENCY SPILLWAY

JANUARY 11, 1974 TAR

DISCHARGE IS 30000.000 CUBIC FEET/SECOND

RIVER STATION (FEET)	SURFACE ELEV (FEET)	CROSS SECTION AREA (SQ FT)	CONVEY-ANCE K	VELOCITY HEAD (FEET)	FRICTION SLOPE	ALPHA
0.	782.9	5075.	374637.	0.5424	0.006412	1.000
100.	783.5	5075.	374637.	0.5424	0.006412	1.000
200.	784.1	5167.	385905.	0.5234	0.006043	0.999
300.	784.7	5259.	397459.	0.5051	0.005697	0.999
400.	785.3	5271.	398928.	0.5029	0.005655	1.000
450.	785.6	5869.	476896.	0.4057	0.003957	1.000
500.	786.0	7949.	789301.	0.2211	0.001444	1.000
600.	786.1	9549.	1070044.	0.1532	0.000786	1.000

T.U.S.I. - Safe Shutdown Impoundment

Project Engineer

SQUAW CREEK RESERVOIR EMERGENCY SPILLWAY

/ RHL

JANUARY 11, 1974 TAR

DISCHARGE IS 40000.000 CUBIC FEET/SECOND

RIVER STATION (FEET)	SURFACE ELEV (FEET)	CROSS SECTION AREA (SQ FT)	CONVEY-ANCE K	VELOCITY HEAD (FEET)	FRICTION SLOPE	ALPHA
0.	783.4	6183.	520084.	0.6497	0.005915	0.999
100.	783.9	6183.	520084.	0.6497	0.005915	0.999
200.	784.5	6164.	517461.	0.6537	0.005975	1.000
300.	785.1	6143.	514547.	0.6582	0.006043	1.000
400.	785.7	6135.	513458.	0.6598	0.006068	1.000
450.	786.1	6809.	610504.	0.5357	0.004292	1.000
500.	786.5	8994.	968795.	0.3071	0.001704	1.000
600.	786.7	10950.	1342701.	0.2071	0.000887	1.000

T.U.S.I. - Safe Shutdown Impoundment

Project Engineer

SQUAW CREEK RESERVOIR EMERGENCY SPILLWAY

JANUARY 11, 1974 TAR

DISCHARGE IS 50000.000 CUBIC FEET/SECOND

RIVER STATION (FEET)	SURFACE ELEV (FEET)	CROSS SECTION AREA (SQ FT)	CONVEY-ANCE K	VELOCITY HEAD (FEET)	FRICTION SLOPE	ALPHA
0.	783.8	7070.	649815.	0.7764	0.005920	1.000
100.	784.3	7070.	649815.	0.7764	0.005920	1.000
200.	784.9	7053.	647126.	0.7803	0.005969	1.000
300.	785.5	7032.	643960.	0.7849	0.006028	1.000
400.	786.1	7021.	642376.	0.7873	0.006058	1.000
450.	786.5	7692.	747396.	0.6560	0.004475	1.000
500.	787.0	10126.	1179461.	0.3785	0.001797	0.999
600.	787.2	11987.	1559843.	0.2701	0.001027	1.000

T.U.S.I. - Safe Shutdown Impoundment

Project Engineer

SQUAW CREEK RESERVOIR EMERGENCY SPILLWAY

JANUARY 11, 1974 TAR

/RML

DISCHARGE IS 60000.000 CUBIC FEET/SECOND

RIVER STATION (FEET)	SURFACE ELEV (FEET)	CROSS SECTION AREA (SQ FT)	CONVEY-ANCE K	VELOCITY HEAD (FEET)	FRICTION SLOPE	ALPHA
0.	784.2	7958.	790875.	0.8824	0.005755	0.999
100.	784.7	7958.	790875.	0.8824	0.005755	0.999
200.	785.3	7904.	781937.	0.8946	0.005887	1.000
300.	785.9	7837.	771026.	0.9099	0.006055	1.000
400.	786.5	7797.	764473.	0.9193	0.006159	1.000
450.	786.9	8689.	915016.	0.7402	0.004299	1.000
500.	787.4	11006.	1354125.	0.4614	0.001963	1.000
600.	787.6	12871.	1754974.	0.3373	0.001168	0.999

TAR Page 22 of 26

T.U.S.I. - Safe Shutdown Impoundment

Project Engineer

SQUAW CREEK RESERVOIR EMERGENCY SPILLWAY

JANUARY 11, 1974 TAR

JRML

DISCHARGE IS 80000.000 CUBIC FEET/SECOND

RIVER STATION (FEET)	SURFACE ELEV (FEET)	CROSS SECTION AREA (SQ FT)	CONVEY-ANCE K	VELOCITY HEAD (FEET)	FRICTION SLOPE	ALPHA
0.	784.8	9292.	1022777.	1.1507	0.006118	0.999
100.	785.4	9292.	1022777.	1.1507	0.006118	0.999
200.	786.0	9319.	1027580.	1.1442	0.006061	1.000
300.	786.6	9353.	1033872.	1.1358	0.005987	1.000
400.	787.2	9377.	1038290.	1.1300	0.005936	0.999
450.	787.6	10272.	1207763.	0.9417	0.004387	1.000
500.	788.1	12607.	1695722.	0.6252	0.002225	0.999
600.	788.5	14803.	2212054.	0.4534	0.001307	0.999

T.U.S.I. - Safe Shutdown Impoundment

Project Engineer

J RIM

SQUAW CREEK RESERVOIR EMERGENCY SPILLWAY

JANUARY 11, 1974 TAR

DISCHARGE IS 100000.000 CUBIC FEET/SECOND

RIVER STATION (FEET)	SURFACE ELEV (FEET)	CROSS SECTION AREA (SQ FT)	CONVEY-ANCE K	VELOCITY HEAD (FEET)	FRICTION SLOPE	ALPHA
0.	785.4	10629.	1277997.	1.3744	0.006122	1.000
100.	786.0	10629.	1277997.	1.3744	0.006122	1.000
200.	786.6	10656.	1283450.	1.3673	0.006070	1.000
300.	787.2	10693.	1290896.	1.3578	0.006000	1.000
400.	787.8	10722.	1296740.	1.3504	0.005946	0.999
450.	788.3	11625.	1482619.	1.1488	0.004549	0.999
500.	788.8	14227.	2071307.	0.7671	0.002330	1.000
600.	789.2	16364.	2610887.	0.5798	0.001466	1.000

T.U.S.I. - Safe Shutdown Impoundment

SQUAW CREEK RESERVOIR EMERGENCY SPILLWAY

JANUARY 11, 1974 TAR

Project Engineer

J PMC

DISCHARGE IS 120000.000 CUBIC FEET/SECOND

RIVER STATION (FEET)	SURFACE ELEV (FEET)	CROSS SECTION AREA (SQ FT)	CONVEY-ANCE K	VELOCITY HEAD (FEET)	FRICTION SLOPE	ALPHA
0.	786.0	11967.	1555536.	1.5612	0.005951	1.000
100.	786.5	11967.	1555536.	1.5612	0.005951	1.000
200.	787.1	11956.	1553189.	1.5640	0.005969	1.000
300.	787.7	11941.	1549909.	1.5680	0.005994	1.000
400.	788.3	11928.	1547118.	1.5715	0.006016	1.000
450.	788.8	12815.	1742255.	1.3615	0.004743	0.999
500.	789.4	15678.	2432315.	0.9096	0.002434	1.000
600.	789.9	17994.	3054185.	0.6905	0.001543	1.000

Title: SQUAW CREEK RESERVOIR
EMERGENCY SPILLWAY
DISCHARGE CHARACTERISTICS

Project Engineer

Date: 1/14/74

By: IAR

✓ PNL

DISCHARGE (cfs)	CHANNEL W.S.E. (ft)	VELOCITY HEAD (ft)	ENTRANCE LOSS (ft)	RESERVOIR W.S.E. (ft)
1,000	783.5	0.0010	0.0001	783.5
2,000	783.7	0.0033	0.0003	783.7
5,000	784.2	0.0137	0.0014	784.2
10,000	784.7	0.0377	0.0038	784.7
20,000	785.5	0.0926	0.0093	785.6
30,000	786.1	0.1532	0.0153	786.3
40,000	786.7	0.2071	0.0207	786.9
50,000	787.2	0.2701	0.0270	787.5
60,000	787.6	0.3373	0.0337	788.0
80,000	788.5	0.4534	0.0453	789.0
100,000	789.2	0.5798	0.0580	789.8
120,000	789.9	0.6905	0.0691	790.7

Results plotted on 2.7.B. Page 8 of 26

FREESE AND NICHOLS
CONSULTING ENGINEERS
811 LAMAR ST. FORT WORTH, TEXAS 76102

DATE 8/11/76

MEMORANDUM

TO R. A. Thompson, III

PROJECT Independent Review of Calculations
Texas Utilities Services Inc.-SSI Dam

FROM Charlie M. Moore

The SSI spillway channel has been slightly redesigned from that of 1973-74 (Section 1.7.B). This necessitated an independent review of design calculations in accordance with the Freese and Nichols Quality Assurance Program, Paragraph 4.3.5 and Appendix C.

I checked all design calculations and found them to be accurate and reliable. I verify the applicability of the engineering principles and concepts to the design and the accuracy of the computations.

I have no comments and found no needed corrections to be made.

Charlie M. Moore

From the desk of -
ROBERT S. GOOCH

7/9/76

TUSI SSI DAM

Bob:

Here is the set of calculations on SSI flood routing to reflect the wider spillway channel. They represent a revision to the Design Calculations and as such require an independent review. I wondered if Charlie Moore might be able to do that. If not, Tony Reid is probably the only person in the office competent to do it. What is your preference ? Note that they also will need your initials as sign that you concur with the work. The new calculations should eventually go into the notebook.

O.K. C Moore 8/11/76

Title: TUSI
SAFE SHUTDOWN IMPOUNDMENT

Date: 7/7/76
By: TRS
✓ CMM 8/11/76

The SSI Spillway channel has been slightly redesigned from that of 1973-74 (Section 1.7.B).

The changes were:

1. A sill with elevation of 769.5 FT is now located at station 4+00. The canal slopes downward toward SCR and SSI at S = 0.003. The previous design used a sill of 769.5 FT around station 1+95 (at the SSI entrance of the canal) and sloped S=0.003 toward SCR. The model used in the current calculations assumes the canal slopes downward toward SCR from the sill and → upward toward SSI from the sill with S = 0.003. This is slightly conservative.
2. The other change is that the side slopes were changed from 1:2 to 1:3. The bottom width remained at 40 feet.

The results were:

The maximum water level in the SSI for the routing of the maximum probable flood, changed from 791.8 FT to 790.5 FT

✓ CMM ✓ CMM

Freese AND Nichols CONSULTING ENGINEERS

Title: TUSI
SAFE SHUTDOWN IMPOUNDMENT
SPILLWAY RATING

Date: 24 MAY 1976
By: TDS
✓ GCW
cmm. 8/11/76

A. PROFILE

Reference: From drawing "Safe shutdown Impoundment Dam; Excavation Plan," Sheet 5 of 41, CCR No. 3; Sheet 8 of 41, CAR No 1.

STATION	ELEVATION FT-msl NATURAL GRND	Bottom of Spillway
0+00	760.8	—
0+40	762.0	—
0+85	764.0	—
1+10	766.0	—
1+52	768.0	—
→ 1+65	768.8	768.8
1+80	770.0	—
2+02	772.0	—
2+23	774.0	—
2+38	776.0	—
2+45	778.0	—
2+58	780.0	—
2+77	782.0	—
2+97	784.0	—
3+12	786.0	—
3+28	788.0	—
3+42	790.0	—
3+59	792.0	—
3+72	794.0	—
3+85	796.0	—
4+00	798.0	769.5
4+09	800.0	—
4+25	802.0	—
4+95	802.0	—
5+09	800.0	—
5+18	798.0	—
5+30	796.0	—

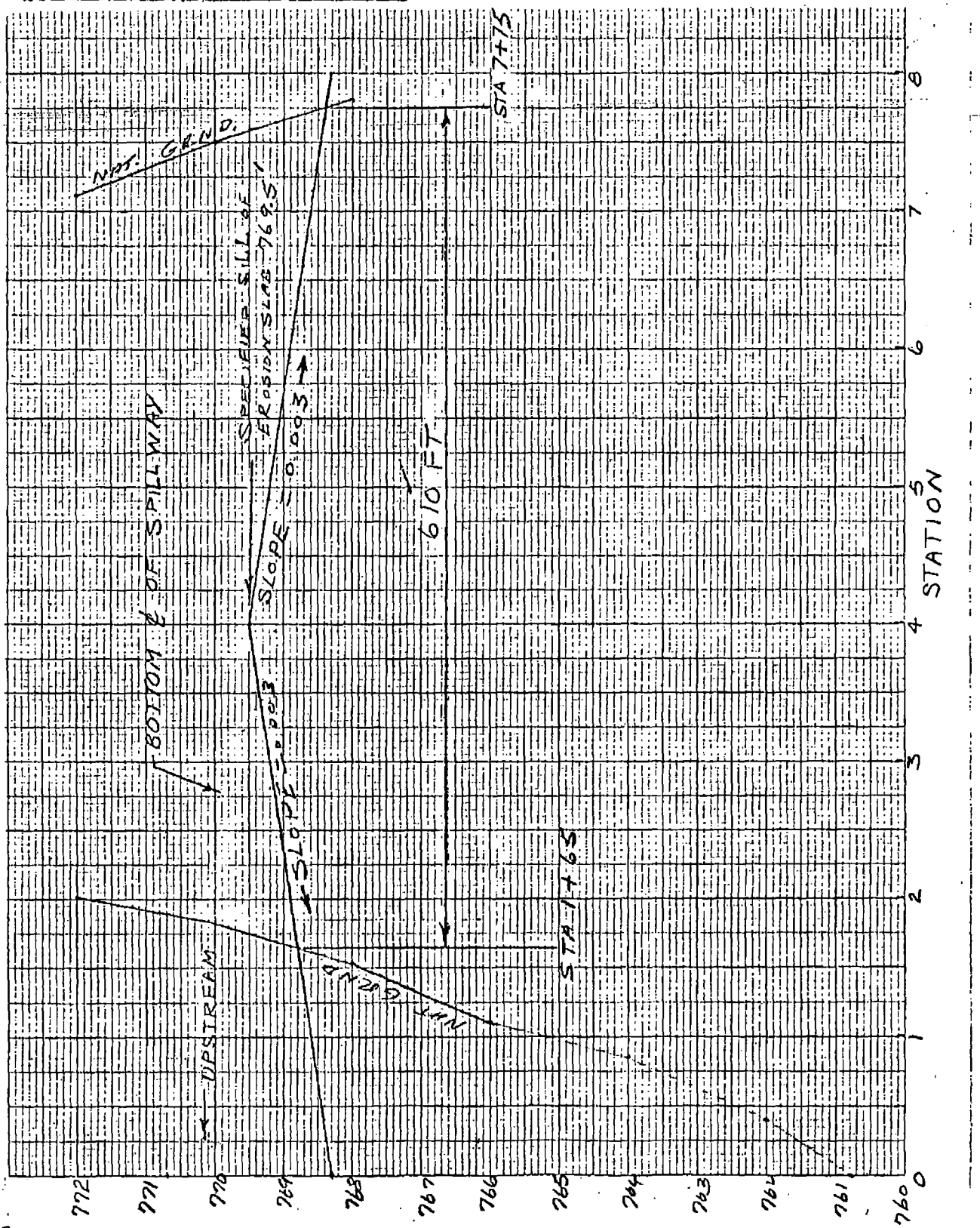
Title : TUSI
SAFE SHUTDOWN IMPOUNDMENT
SPILLWAY RATING

Date : 25 MAY 1926
By : JRS
✓ GEW
CMM

STATION	NATURAL GROUND	BOTTOM & SPILLWAY
5+38	794.0	—
5+52	792.0	—
5+62	790.0	—
5+85	788.0	—
6+00	786.0	—
6+15	784.0	—
6+29	782.0	—
6+50	780.0	—
6+66	778.0	—
6+78	776.0	—
6+87	774.0	—
7+00	772.0	—
7+49	770.0	—
→ 7+75	768.4	768.4 L
7+79	768.0	
7+83	766.0	

Title : TUSI
SAFE - SHUTDOWN IMPOUNDMENT
SPILLWAY RATING

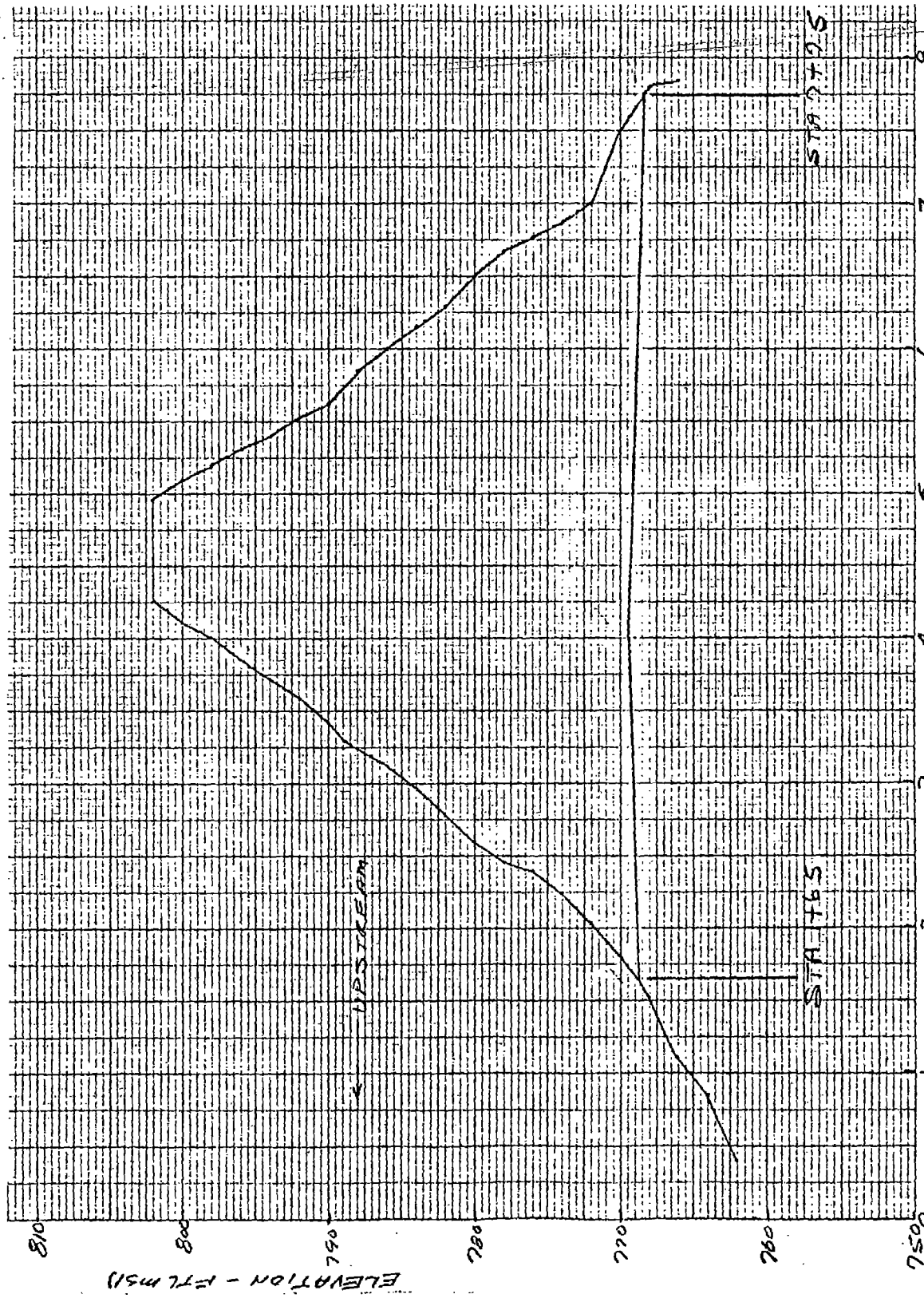
Date : 24 MAY 1996
By : JRS
✓ GEW



Freese AND Nichols CONSULTING ENGINEERS

Title : TUSI
SAFE SHUTDOWN IMPOUNDMENT
SPILLWAY RATING

Date : 25 MAY 1
By : TRS
✓ GEW / CMM



Freese AND Nichols CONSULTING ENGINEERS

Title: TUSI
SAFE SHUTDOWN IMPOUNDMENT
SPILLWAY RATING

Date: 25 MAY 1996
By: JRS
✓ GEN CMM

B. FLOWS THROUGH CHANNEL (Main lake below downstream S.H.)

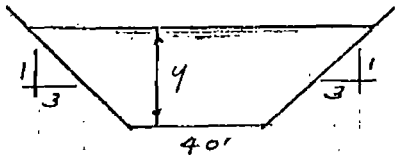
$$Q = \frac{1.486}{n} a r^{2/3} S^{1/2}$$

$n = 0.04$

$S = 0.003$

$S^{1/2} = 0.05477$

$Q = 2.035\, a r^{2/3}$



$a = 40y + 3y^2$

$r = a/p = a/(40 + 6.325y)$

y (FT)	a (FT²)	P (FT)	R (FT)	$R^{2/3}$	Q (CFS)	V (FPS)
5	275	71.63	3.839	2.453	1,372.8	4.992
6	348	77.95	4.464	2.712	1,920.6	5.519
7	427	84.28	5.066	2.951	2,564.3	6.005
8	512	90.60	5.651	3.174	3,307.1	6.459
9	603	96.93	6.221	3.385	4,153.8	6.889
10	700	103.25	6.780	3.585	5,106.8	7.295
11	803	109.58	7.328	3.775	6,168.7	7.682
12	912	115.90	7.869	3.959	7,347.6	8.057
13	1,027	122.23	8.402	4.136	8,644.0	8.417
14	1,148	128.55	8.930	4.307	10,061.9	8.765
15	1,275	134.88	9.453	4.474	11,608.4	9.105
16	1,408	141.20	9.972	4.636	13,283.4	9.434
17	1,547	147.53	10.486	4.795	15,095.4	9.758
18	1,692	153.85	10.998	4.949	17,040.5	10.071
19	1,843	160.18	11.506	5.101	19,131.3	10.381
20	2,000	166.50	12.012	5.249	21,363.4	10.682
21	2,163	172.83	12.515	5.395	23,747.2	10.979

Title : TUSI

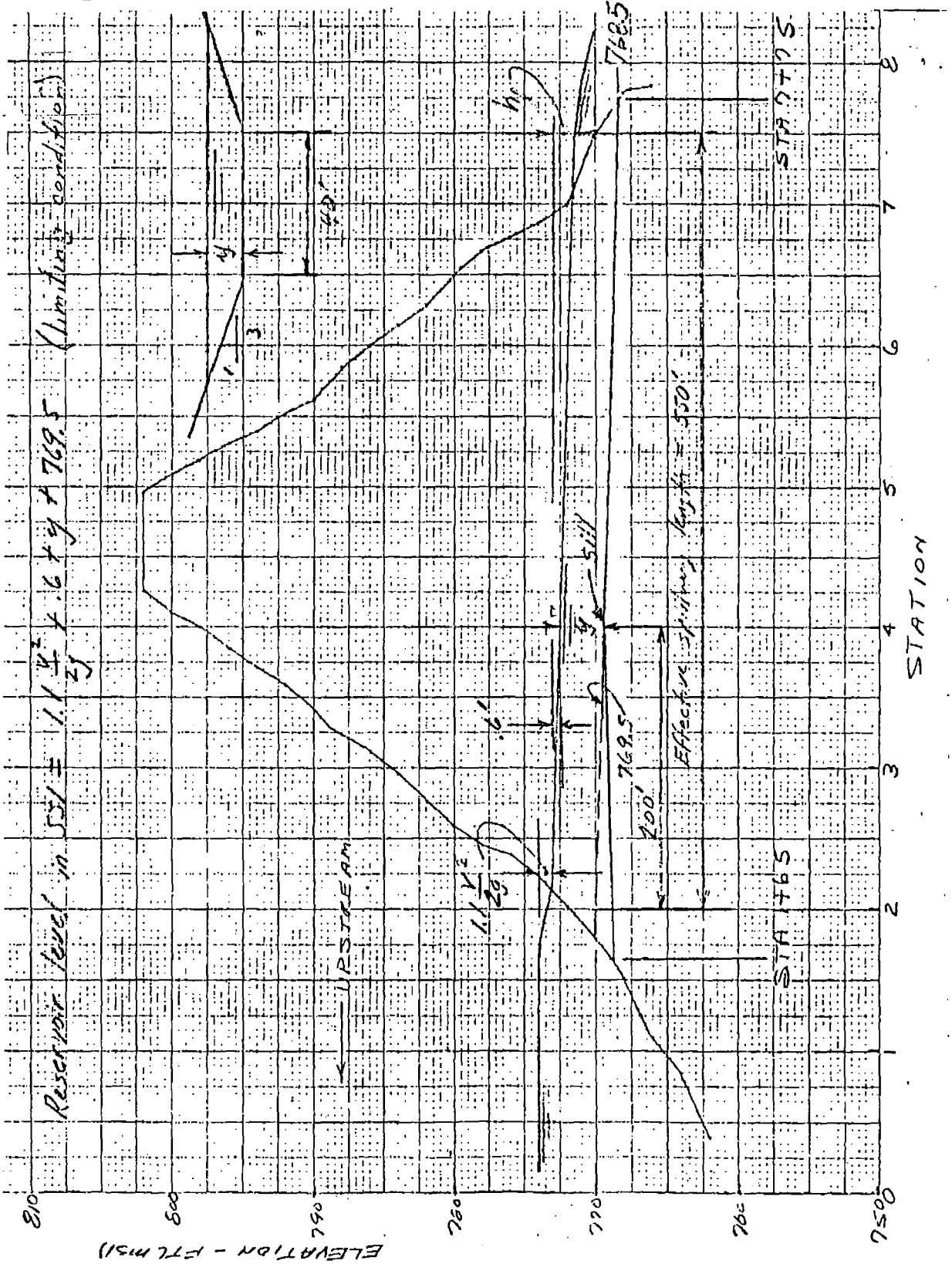
SAFE SHUTDOWN IMPOUNDMENT

SPILLWAY RATING

Date : 25 MAY 1976

By : TRS/RSG

✓ GEW Cmm



Freese AND Nichols CONSULTING ENGINEERS

Title: TUSI
SAFE SHUTDOWN IMPOUNDMENT
SPILLWAY RATING
Limiting Flow Condition

Date: 25 MAY 1776
By: TDS
✓ GEW cmm

C. Reservoir Level in SSI

$$L = 1.1 \frac{V^2}{2g} + 0.6 + y + 769.5$$

y (FT)	V (FT/SEC)	V^2 (FT²/SEC²)	$\frac{1.1V^2}{2g}$	L
5	4.792	24.920	0.424	775.52
6	5.519	30.459	0.518	776.62
7	6.005	36.060	0.613	777.77
8	6.459	41.719	0.709	778.81
9	6.889	47.458	0.807	779.91
10	7.295	53.217	0.905	781.00
11	7.682	59.013	1.003	782.10
12	8.057	64.915	1.104	783.20
13	8.417	70.846	1.204	784.36
14	8.765	76.825	1.306	785.41
15	9.105	82.901	1.409	786.51
16	9.434	89.000	1.513	787.61
17	9.758	95.219	1.618	788.72
18	10.071	101.425	1.724	789.82
19	10.381	107.765	1.832	790.93
20	10.682	114.105	1.940	792.04
21	10.979	120.538	2.049	793.15

Title: TUSI
SAFE SHUTDOWN IMPOUNDMENT
SPILLWAY RATING

Date: 26 MAY
By: TJRS
✓ SFW

Main Lake Level	② Q (CFS)	③ y_2 = ①-768.5 (ft)	④ $V_2^2/2g$ (ft)	⑤ H_2 = ③+④ (ft)	⑥ y_1 (ft)	⑦ $V_1^2/2g$ (ft)	⑧ H_1=1.7+⑥+⑦	⑨ H_f = ⑧-⑤ (ft)	⑩ $(0.631/AR^{2/3})$ (X10⁴) @STA 2	⑪ @STA 1	⑫ $(0.631Q/AR^{2/3})^2$ @STA 2	⑬ @STA 1	⑭ h_f = ½(⑫+⑬)(ft)	⑮ SSI level = 768.5+⑧+0.1×⑦
787	15,000	18.5	1.120	19.620	17.89	1.245	20.835	1.215	0.211	.764 .762	1.137	1.312 1.306	1.225 1.222	789.5 OK
786	5,000	17.5	0.148	17.648	15.95	0.198	17.848	0.200	0.800	0.991	0.160	0.236	0.198 ✓	786.4 ✓
786	10,000	17.5	0.593	18.093	~~16.3~~ 16.41	~~0.737~~ 0.745	~~18.749~~ 18.835	~~0.656~~ 0.742	~~0.800~~ 0.800	~~.918~~ 0.917	~~0.640~~ 0.640	~~0.841~~ 0.841	~~0.951~~ 0.740 ✓	787.4
786	15,000	17.5	1.334	18.834	~~17.02~~ 17.21	~~1.456~~ 1.406	~~20.176~~ 20.316	~~1.342~~ 1.482	~~0.800~~ 0.800	~~0.848~~ .828	~~1.440~~ 1.440	~~1.618~~ 1.543	~~1.529~~ 1.491 ✓	789.0
785	5,000	16.5	0.178	16.676	14.98	0.240	16.920	0.242	.905	1.11	0.205	0.308	0.257 ✓	785.4
785	10,000	16.5	0.712	17.212	~~15.54~~ 15.59	~~0.858~~ 0.850	~~18.098~~ 18.140	~~0.886~~ 0.928	~~0.905~~ 0.905	~~1.036~~ 1.021	~~0.819~~ 0.819	~~1.057~~ 1.042	~~0.938~~ 0.931 ✓	786.2
784	5,000	15.5	0.216	15.716	~~14.01~~ 14.06	~~0.294~~ 0.291	~~16.004~~ 16.051	~~0.288~~ 0.335	~~1.034~~ 1.034	~~1.274~~ 1.265	~~0.267~~ 0.267	~~0.406~~ 0.400	~~0.336~~ 0.334 ✓	784.6 ✓
784	10,000	15.5	0.864	16.364	~~14.79~~ 14.85	~~0.998~~ 0.987	~~17.488~~ 17.537	~~1.124~~ 1.173	~~1.034~~ 1.034	~~1.139~~ 1.130	~~1.069~~ 1.069	~~1.277~~ 1.277	~~1.183~~ 1.173 ✓	786.1
783	4,000	14.5	0.170	14.67	~~13.75~~ ~~12.96~~ 13.04	~~0.199~~ ~~0.238~~ 0.233	~~15.649~~ ~~14.953~~ 14.973	~~0.979~~ ~~[illegible]~~ 0.303	1.186 ~~1.186~~ 1.186	~~1.323~~ ~~1.415~~ 1.473	~~0.225~~ ~~0.225~~ 0.225	~~0.250~~ ~~0.355~~ 0.347	0.253 ~~0.292~~ 0.286 ✓	783.5
783	9,000	14.5	0.858	15.358	~~[illegible]~~ 13.94	~~[illegible]~~ 0.967	~~17.215~~ 16.607	~~1.57~~ 1.249	~~1.186~~ 1.181	~~1.15~~ 1.287	~~1.139~~	~~1.052~~	~~1.111~~	

Freese and Nichols
CONSULTING ENGINEERS

Title: TUSI
SAFE SHUTDOWN IMPOUNDMENT
SPILLWAY RATING

Date: 26 MAY
By: TRS
✓ SEW

Main Lake Level	② Q (CFS)	③ y_2 = ①-768.5 (ft)	④ $V_2^2/2g$ (ft)	⑤ H_2 = ③+④ (ft)	⑥ y_1 (ft)	⑦ $V_1^2/2g$ (ft)	⑧ H_1=1.7 +⑥+⑦	⑨ H_f = ⑧-⑤ (ft)	⑩ $(0.631/AR^{2/3})$ $(\times 10^4)$ @STA 2	⑪ @STA 1	⑫ $(0.631Q/AR^{2/3})^2$ @STA 2	⑬ @STA 1	⑭ h_f = ½(⑫+⑬) (ft)	⑮ SSI level = 768.5+⑧+0.1×⑦
789	5,000	20.5	0.092	20.59	~~20.0~~	~~0.097~~	~~21.80~~	~~1.210~~	~~0.570~~	~~0.601~~	~~0.081~~	~~0.0906~~	~~0.086~~	
					~~19.5~~	~~0.105~~	~~21.3~~	~~0.710~~	~~0.570~~	~~0.634~~	~~0.081~~	~~0.100~~	~~0.091~~	
					~~19.1~~	~~0.113~~	~~20.9~~	~~0.31~~	~~0.570~~	~~0.665~~	~~0.081~~	~~0.111~~	~~0.096~~	
					~~18.9~~	~~0.116~~	~~20.716~~	~~0.126~~	~~0.570~~	~~.678~~	~~0.081~~	~~0.115~~	~~0.098~~	
					18.87	0.117	20.657	0.097	0.570	.651	0.081	0.116	0.098 ✓	789.2 ✓OK
789	10,000	20.5	0.359	20.859	~~20.0~~	~~0.364~~	~~22.09~~	~~1.230~~	~~0.570~~	~~0.601~~	~~0.325~~	~~0.361~~	~~0.343~~	
					19.10	0.450	21.25	0.391	0.570	.665	0.325	0.442	0.383 ✓	789.8
789	19,000	20.5	1.300	21.800	~~19.53~~	~~1.511~~	~~22.744~~	~~0.944~~	~~0.570~~	~~.633~~	~~1.173~~	~~1.446~~	~~1.310~~	
					~~19.60~~	~~1.500~~	~~22.80~~	~~1.005~~	~~0.570~~	~~0.628~~	~~1.173~~	~~1.423~~	~~1.300~~	
					~~19.85~~	~~1.432~~	~~22.987~~	~~1.189~~	~~0.570~~	~~0.610~~	~~1.173~~	~~1.343~~	~~1.258~~	
					~~19.9~~	~~1.425~~	~~23.03~~	~~1.225~~	~~0.570~~	~~0.608~~	~~1.173~~	~~1.334~~	~~1.254~~	
					19.95	1.420	23.050	1.250	0.570	0.606	1.173	1.326	1.249 ✓	791.7
788	5000	19.5	0.105	19.605	17.89	0.138	19.728	0.123	0.6351	.762	0.101	0.145	0.123 ✓	788.2
788	10,000	19.5	0.421	19.921	18.18	0.526	20.406	0.485	0.6351	.737	0.403	0.543	0.473 ✓	789.0
788	15,000	19.5	0.948	20.448	~~18.92~~	~~1.043~~	~~21.663~~	~~1.215~~	~~0.641~~	~~0.697~~	~~0.724~~	~~1.031~~	~~0.998~~	
					18.68	1.088	21.468	1.020	0.6351	0.697	0.908	1.093	1.001 ✓	790.1 ok
787	5,000	18.5	.124	18.624	~~17.00~~	~~0.162~~	~~18.86~~	~~0.236~~	~~0.711~~	~~0.850~~	~~0.127~~	~~0.181~~	~~0.154~~	
					16.92	0.165	18.785	0.161	0.711	0.859	0.126	0.184	0.155 ✓	787.3
787	10,000	18.5	0.498	18.998	17.28	0.617	19.597	0.599	0.711	0.824	0.506	0.676	0.591 ✓	---

Freese and Nichols CONSULTING ENGINEERS

Freese and Nichols CONSULTING ENGINEERS

Title: TUSI

SAFE SHUTDOWN IMPOUNDMENT

SPILLWAY RATING

Date: 26 Aug

By: TRS / JEW

Main Lake Level	② Q (CFS)	③ y_2 = ①-7685 (ft)	④ $V_2^2/2g$ (ft)	⑤ H_2 = ③+④ (ft)	⑥ y_1 (ft)	⑦ $V_1^2/2g$ (ft)	⑧ H_1 = ⑥+⑦	⑨ H_2 = ②-⑤ (ft)	⑩ $(0.631/A R^{2/3})$ (X 10^4) @STA 2	⑪ @STA 1	⑫ $(0.631 g/A R^{2/3})$ @STA 2	⑬ @STA 1	⑭ h_2 = ½(⑩+⑬) (ft)	⑮ SSI level = 768.5 + ⑧ + 0.1×⑭
778	1,000	9.5	0.031	9.537	~~9.45~~	~~0.546~~	~~10.496~~	~~0.959~~	~~2.977~~	~~3.268~~	~~0.009~~	~~0.1601~~	~~0.0942~~	
					~~788~~	~~0.0614~~	~~9.661~~	~~0.105~~	~~=.99~~	~~4.001~~	~~3.077~~	~~0.105~~	~~0.123~~	
					7.9	0.0614	9.661	0.124	2.781	3.981	0.077	0.1584	0.118	✓ 778.2
778	3,000	9.5	0.330	9.830	~~8.87~~	~~0.400~~	~~10.994~~	~~1.139~~	~~2.777~~	~~3.176~~	~~0.570~~	~~0.409~~	~~0.802~~	
					~~3.54~~	~~3.446~~	~~10.666~~	~~0.~~	~~2.799~~	~~3.767~~	~~0.094~~	~~1.057~~	~~0.895~~	
					8.55	0.444	10.694	0.864	2.781	3.420	0.696	1.053	0.874	✓ 779.2
777	3,000	8.5	0.20	8.700	~~7.90~~	~~0.363~~	~~9.662~~	~~0.96~~	~~3.452~~	~~4.176~~	~~0.497~~	~~0.655~~	~~0.559~~	
					~~7.43~~	~~0.290~~	~~9.420~~	~~0.720~~	~~3.452~~	~~4.~~	~~0.402~~	~~0.497~~	~~0.637~~	
					~~7.20~~	~~0.315~~	~~9.215~~	~~0.515~~	~~3.452~~	~~4.289~~	~~0.477~~	~~0.598~~	~~0.538~~	
					~~7.24~~	~~0.311~~	~~9.251~~	~~.551~~	~~3.452~~	~~4.091~~	~~0.299~~	~~0.282~~	~~0.619~~	
					7.36	0.298	9.354	0.658	3.452	4.549	0.471	0.836	0.652	✓ 777.9
776	2,000	7.5	0.282	7.782	~~6.45~~	~~0.423~~	~~8.573~~	~~0.791~~	~~4.373~~	~~5.~~	~~0.765~~	~~1.36~~	~~1.066~~	
					~~6.72~~	~~0.351~~	~~8.801~~	~~1.019~~	~~4.373~~	~~5.~~	~~0.765~~	~~1.17~~	~~0.969~~	
					6.68	0.386	8.766	0.984	4.591	5.423	0.771	1.198	0.985	✓ 777.3
777	3,000	8.5	0.450	8.950	~~7.66~~	~~0.523~~	~~10.183~~	~~1.333~~	~~3.452~~	~~3.231~~	~~1.072~~	~~1.321~~	~~1.197~~	
					~~7.71~~	~~0.545~~	~~10.168~~	~~1.218~~	~~3.452~~	~~3.156~~	~~1.072~~	~~1.410~~	~~1.241~~	
					7.94	0.544	10.184	1.234	3.452	3.934	1.072	1393	1.232	✓ 778.7
778	4,000	9.5	0.586	10.086	~~7.97~~	~~0.957~~	~~10.624~~	~~0.543~~	~~2.781~~	~~3.916~~	~~1.259~~	~~2.451~~	~~1.611~~	
					~~9.13~~	~~0.677~~	~~11.457~~	~~1.401~~	~~2.781~~	~~3.019~~	~~1.237~~	~~1.458~~	~~1.348~~	
					9.09	0.665	11.455	1.369	2.781	3.037	1.237	1.476	1.356	✓ 780.0

Freese AND Nichols CONSULTING ENGINEERS

Title: TUST

SAFE SHUTDOWN IMPOUNDMENT

SPILLWAY RATING

Date: 26 MAY 1926

By: TDRS

V SEEN CMMN

Main Lake Level	② Q (CFS)	③ y_2 = ①-7625 (FT)	④ $V_2^2/2g$ (FT)	⑤ H_2 = ③+④ (FT)	⑥ y_1 (FT)	⑦ $V_1^2/2g$ (FT)	⑧ H_1=1.7 +⑥+⑦	⑨ H_F = ⑧-⑤ (FT)	⑩ $(0.631/AR^{2/3})$ (X10⁴) @STA 2	⑪ @STA 1	⑫ $(a^{6310}/AR^{2/3})$ @STA 2	⑬ @STA 1	⑭ h_F = ½(⑨+⑬) (FT)	⑮ SSI level = 768.5+③+0.1×①
780	6,000	11.5	0.764	12.264	~~11.09~~	~~0.719~~	~~13.609~~	~~1.345~~	~~1.903~~	~~2.057~~	~~1.302~~	~~1.513~~	~~1.407~~	
					11.12	0.840	13.660	1.399	1.902	2.035	1.302	1.491	1.396	782.2
781	7,000	12.5	0.810	13.310	~~12.4~~	~~0.834~~	~~14.234~~	~~1.614~~	~~1.638~~	~~1.825~~	~~1.269~~	~~1.214~~	~~1.280~~	
					~~12.1~~	~~0.843~~	~~14.693~~	~~1.383~~	~~1.605~~	~~1.767~~	~~1.09~~	~~1.446~~	~~1.350~~	
					12.08	0.897	14.677	1.367	1.608	1.725	1.267	1.458	1.363	783.3
782	9,000	13.5	1.064	14.564	~~13.75~~	~~1.008~~	~~16.458~~	~~1.894~~	~~1.375~~	~~1.325~~	~~1.531~~	~~1.422~~	~~1.495~~	
					13.33	1.107	16.137	1.573	1.375	1.411	1.531	1.613	1.572	784.7
783	11,000	14.5	1.281	15.781	~~14.54~~	~~1.258~~	~~17.548~~	~~1.761~~	~~1.186~~	~~1.172~~	~~1.702~~	~~1.602~~	~~1.682~~	
					14.51	1.279	17.489	1.708	1.186	1.185	1.702	1.699	1.701	786.12
784	13,000	15.50	1.244	16.744	15.33	1.287	18.317	1.573	1.032	1.057	1.534	1.609	1.571	786.95
785	13,000	16.50	1.203	17.703	~~16.31~~	~~1.345~~	~~19.258~~	~~1.555~~	~~0.906~~	~~0.941~~	~~1.387~~	~~1.459~~	~~1.423~~	
					16.17	1.290	19.160	1.457	0.906	0.946	1.387	1.512	1.450	787.79
787	18,000	18.50	1.611	20.111	18.50	~~1.611~~	~~21.511~~	~~1.700~~	~~0.911~~	~~0.711~~	~~1.633~~	~~1.634~~	~~1.638~~	
					18.44	1.628	21.763	1.657	0.711	0.716	1.668	1.661	1.650	790.43
788	20,000	19.50	1.653	21.183	~~19.50~~	~~1.653~~	~~22.853~~	~~1.7~~	~~0.636~~	~~0.636~~	~~1.610~~	~~1.610~~	~~1.610~~	
					19.42	1.7001	22.820	1.637	.6351	.6402	1.6139	1.6804	1.627	791.49
789	22,000	20.50	1.735	22.235	~~20.50~~	~~1.735~~	~~23.735~~	~~1.700~~	~~.5699~~	~~.5641~~	~~1.573~~	~~1.574~~	~~1.573~~	
					~~20.10~~	~~1.749~~	~~23.849~~	~~1.714~~	~~.5603~~	~~.596~~	~~1.571~~	~~1.713~~	~~1.643~~	
					20.35	1.777	23.827	1.592	.5699	.5798	1.572	1.624	1.599	792.60

Title: TUSI
SAFE SHUTDOWN IMPOUNDMENT
SPILLWAY RATING

Date: 26 MAY 1
By: TRS
✓ SEW ck

① Main Lake Level	② Q (CFS)	③ y_2 = ①-768.5 (ft)	④ $V_2^2/2g$ (ft)	⑤ H_2 = ③+④ (ft)	⑥ y_1 (ft)	⑦ $V_1^2/2g$ (ft)	⑧ H_1 = 1.7 + ⑥ + ⑦	⑨ H_f = ⑧ - ⑤ (ft)	⑩ $(0.631/AR^{2/3})$ (x10⁴) @STA 2	⑪ $(0.631/AR^{2/3})$ (x10⁴) @STA 1	⑫ $(0.631Q/AR^{2/3})$ @STA 2	⑬ $(0.631Q/AR^{2/3})$ @STA 1	⑭ h_f = ½(⑫+⑬) (ft)	⑮ SSI level = 768.5 + ⑧ + 0.1×⑦
786	16,000	17.5	1.517	19.017	~~19.5~~	~~1.515~~	~~20.915~~	~~1.70?~~	~~[illegible]~~	~~[illegible]~~	~~1.635~~	~~1.6??~~	~~1.65?~~	
					17.44	1.534	20.674	1.657	.880	.886	1.638	1.663	1.651	✓ 789.33
785	14,000	16.5	1.395	17.895	~~16.5~~	~~1.395~~	~~19.595~~	~~1.700~~	~~0.906~~	~~0.9??~~	~~1.609~~	~~1.6??~~	~~1.6??~~	
					16.4	1.422	19.522	1.627	0.906	0.917	1.609	1.648	1.629	✓ 788.16
781	8,000	12.5	1.058	13.558	~~12.13~~	~~1.070~~	~~15.20?~~	~~1.6??~~	~~1.608~~	~~1.6??~~	~~1.655~~	~~1.69?~~	~~1.674~~	
					12.45	1.092	15.222	1.664	1.608	1.622	1.655	1.684	1.669	783.83
788	21,000	19.50	1.856	21.356	~~19.46~~	~~1.869~~	~~23.029~~	~~1.673~~	~~0.636~~	~~0.636~~	~~1.784~~	~~1.795~~	~~1.79?~~	
					~~19.57~~	~~1.835~~	~~23.105~~	~~1.749~~	~~0.63?~~	~~0.630~~	~~1.75?~~	~~1.750~~	~~1.767~~	
					19.58	1.833	23.113	1.757	0.635	0.649	1.778	1.745	1.761	✓ 791.79
784	13,000	15.5	1.459	16.959	~~15.5~~	~~1.459~~	~~18.859~~	~~1.700~~	~~1.033~~	~~1.033~~	~~1.803~~	~~1.8??~~	~~1.803~~	
					15.6	1.431	18.731	1.772	1.033	1.015	1.803	1.741	1.772	✓ 787.37
779	6,000	10.5	0.994	11.494	~~10.12~~	~~1.103~~	~~12.223~~	~~1.429~~	~~2.291~~	~~2.156~~	~~1.892~~	~~2.171~~	~~2.031~~	
					~~10.74~~	~~0.933~~	~~13.3??~~	~~1.859~~	~~2.291~~	~~2.189~~	~~1.8??~~	~~1.725~~	~~1.808~~	
					10.67	0.955	13.35?	1.834	2.291	2.230	1.890	1.790	1.840	✓ 781.92 ck
778	5,000	9.5	0.916	10.416	~~9.97~~	~~0.714~~	~~12.40?~~	~~2.4??~~	~~2.161~~	~~2.521~~	~~1.933~~	~~1.58?~~	~~1.75?~~	
					~~9.73~~	~~0.557~~	~~12.287~~	~~1.871~~	~~2.781~~	~~2.0??~~	~~1.933~~	~~1.703~~	~~[illegible]~~	
					9.70	0.865	12.165	1.849	2.781	2.673	1.933	1.786	1.860	✓ 780.85
777	4,000	8.5	0.801	9.301	~~8.9~~	~~0.904~~	~~11.344~~	~~2.003~~	~~3.452~~	~~3.15?~~	~~1.907~~	~~1.901~~	~~1.907~~	
					8.59	0.778	11.068	1.767	3.452	3.383	1.907	1.831	1.869	✓
					8.67	0.759	11.129	1.828	3.452	3.37?	1.?			

Freese AND Nichols CONSULTING ENGINEERS

Freese and Nichols CONSULTING ENGINEERS

Title: TUSI — SLUICE SHUTDOWN IMPOUNDMENT — SPILLWAY RATING

Date: 26 MAY 1926

By: TRS

V — STEW Comm

Main Lake Level	② Q (CFS)	③ y_2 = ①−768.5 (ft)	④ $V_2^2/2g$ (ft)	⑤ H_2 = ③+④ (ft)	⑥ y_1 (ft)	⑦ $V_1^2/2g$ (ft)	⑧ H_1=1.7 +⑥+⑦	⑨ H_E = ⑧−⑤ (ft)	⑩ $(0.631/A R^{2/3})$ (X10^4) @STA 2	⑪ (X10^4) @STA 1	⑫ $(0.631 g/A R^{2/3})$ @STA 2	⑬ @STA 1	⑭ h_E = ½(⑩+⑪) (ft)		⑮ SSI level = 765.5+⑧+0.1×①
782	4,000	13.5	0.210	13.710	~~12.14~~	~~0.189~~	~~14.129~~	~~0.419~~	~~1.396~~	~~1.904~~	~~0.303~~	~~0.465~~	~~0.361~~		
					12.10	0.252	14.092	0.382	1.375	1.719	0.303	0.473	0388	✓	782.6
782	7,000	13.5	0.644	14.144	~~13.4~~	~~0.540~~	~~16.190~~	~~2.044~~	~~1.393~~	~~1.275~~	~~0.928~~	~~0.852~~	~~0.875~~		
					~~12.96~~	~~0.719~~	~~15.339~~	~~1.243~~	~~1.376~~	~~1.495~~	~~0.908~~	~~1.095~~	~~1.012~~		
					12.73	0.769	15.199	1.053	1.375	1.550	0.926	1.177	1.052	✓	783.8
781	2,500	12.5	0.104	12.604	~~10.98~~	~~0.160~~	~~12.640~~	~~0.036~~	~~1.606~~	~~2.169~~	~~0.162~~	~~0.294~~	~~0.228~~		
					10.97	0.152	12.822	0.215	1.606	2.093	0.162	0.274	0.218	✓	781.3
781	5,000	12.5	0.414	12.914	~~11.82~~	~~0.488~~	~~14.008~~	~~1.094~~	~~1.606~~	~~1.820~~	~~0.646~~	~~0.814~~	~~0.728~~		
					11.46	0.535	13.695	0.781	1.608	1.919	0.646	0.921	0.783	✓	782.2
780	2,000	11.5	0.085	11.585	~~9.83~~	~~0.131~~	~~11.711~~	~~0.126~~	~~1.593~~	~~2.377~~	~~0.145~~	~~0.265~~	~~0.205~~		
					~~10.08~~	~~0.114~~	~~11.894~~	~~0.309~~	~~1.702~~	~~2.317~~	~~0.146~~	~~0.244~~	~~0.180~~		
					9.96	0.128	11.788	0.203	1.902	2.532	0.145	0256	0.201	✓	780.3
780	5,000	11.5	0.529	12.029	~~11.16~~	~~0.505~~	~~13.434~~	~~1.405~~	~~1.702~~	~~2.015~~	~~0.904~~	~~1.035~~	~~0.965~~		
					10.72	0.649	13.069	1.040	1.902	2.192	0.904	1.201	1.053	✓	781.6
779	2,000	10.5	0.110	10.61	~~9.06~~	~~0.155~~	~~10.975~~	~~0.378~~	~~2.253~~	~~3.047~~	~~0.255~~	~~0.391~~	~~0.320~~		
					9.03	0.169	10.899	0.289	2.283	3.074	0.208	0.397	0.293	✓	779.4
779	5000	10.5	0.689	11.189	~~10.63~~	~~0.606~~	~~12.946~~	~~1.057~~	~~2.283~~	~~2.232~~	~~1.303~~	~~1.545~~	~~1.424~~		
					~~10.10~~	~~0.991~~	~~12.571~~	~~1.362~~	~~2.283~~	~~2.467~~	~~1.303~~	~~1.524~~	~~1.413~~		
					10.13	0.764	12.594	1.405	2.283	2.451	1.383	1.502	1.402	✓	781.2

Freese AND Nichols CONSULTING ENGINEERS

Title: TUSI

SAFE SHUTDOWN EMBANKMENT

SPILLWAY RATING

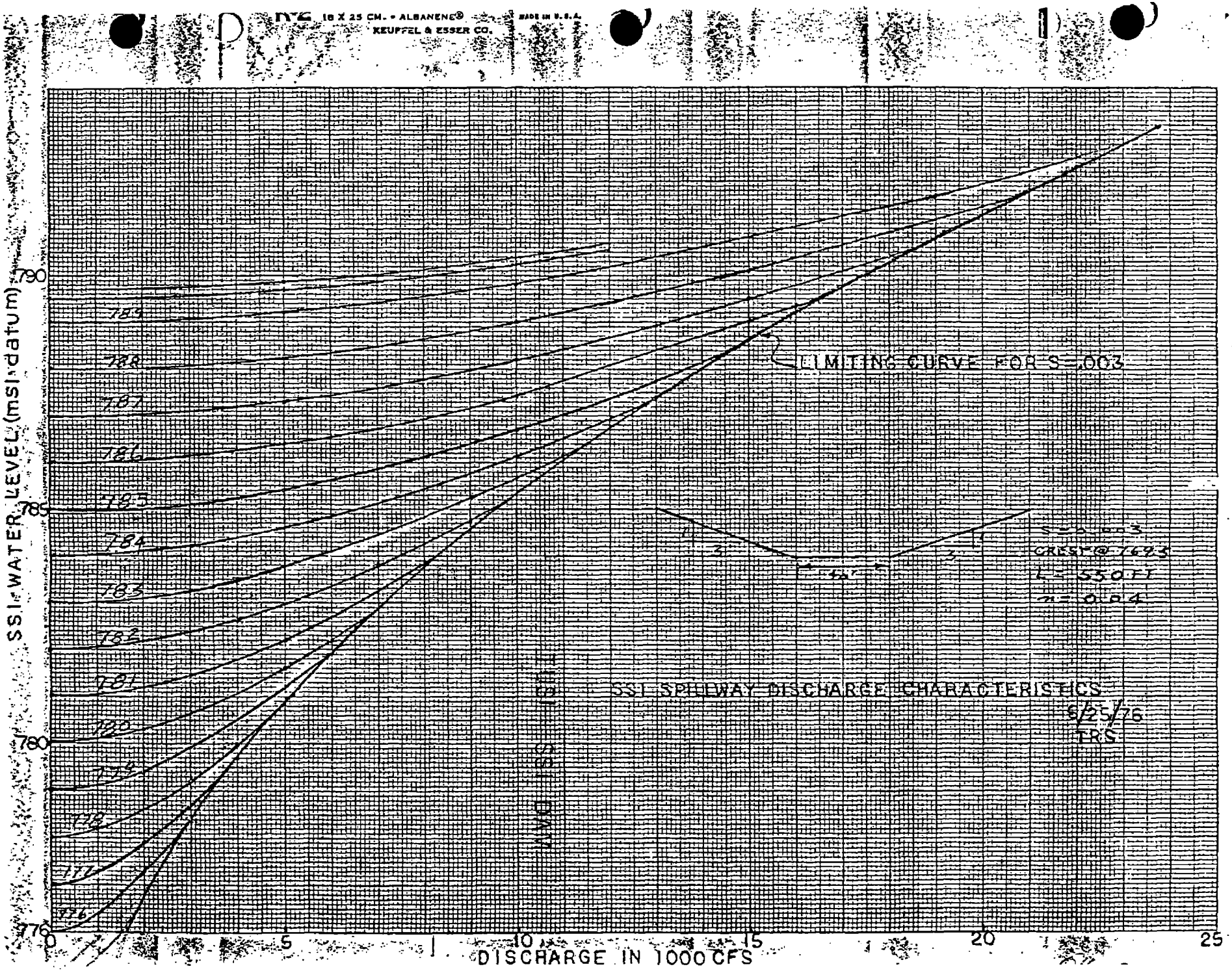
Date: 26 March 15

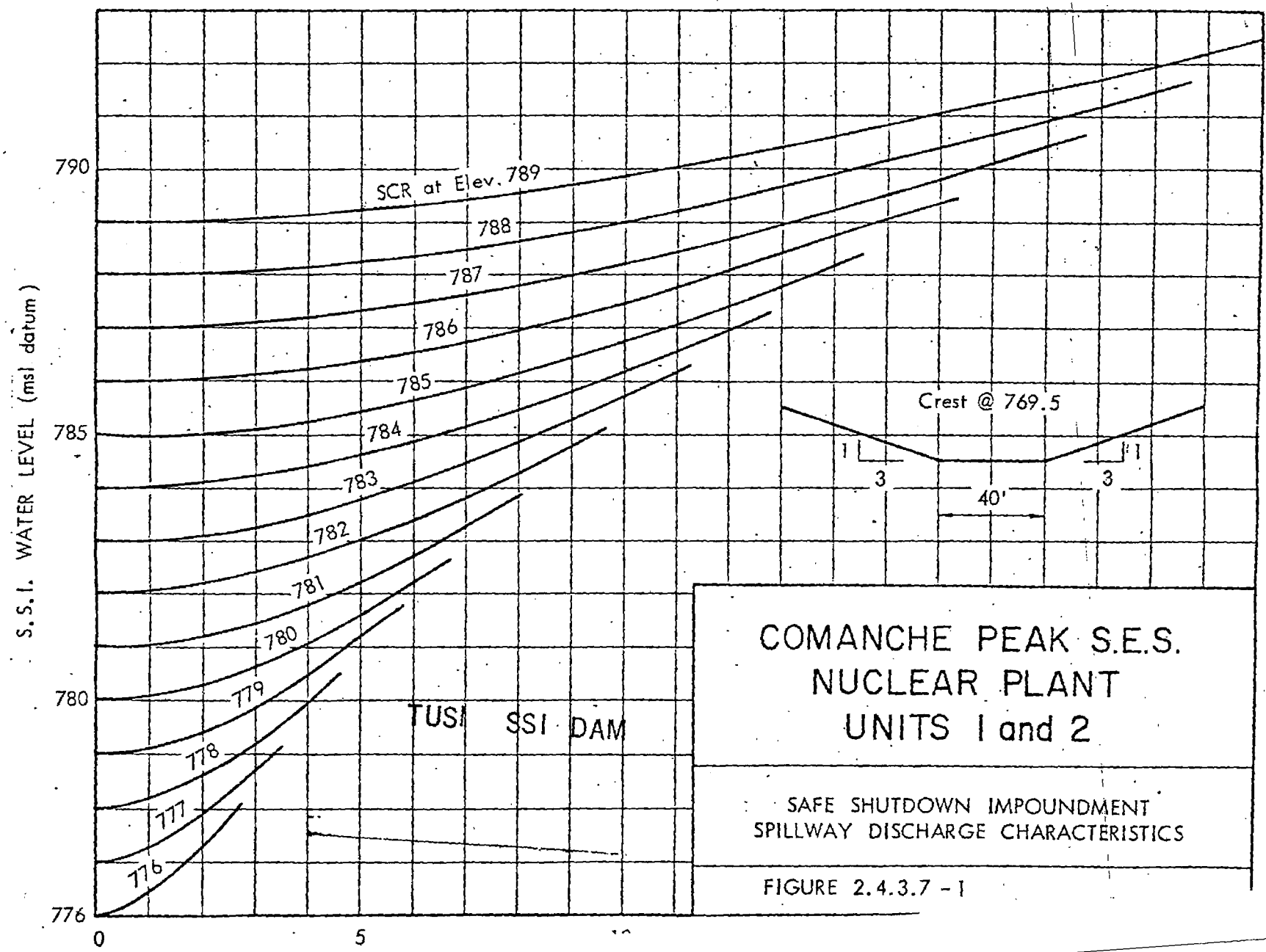
By: TRS

V

SEW Em

① Main Lake Level	② Q (CFS)	③ y_2 = ①-768.5 (FT)	④ $V_2^2/2g$ (FT)	⑤ H_2 = ③+④ (FT)	⑥ y_1 (FT)	⑦ $V_1^2/2g$ (FT)	⑧ H_1=1.7 +⑥+⑦	⑨ H_F = ②-⑤ (FT)	⑩ $\left(0.631/AR^{2/3}\right)$ (X10^4) @STA 2	⑪ (X10^4) @STA 1	⑫ $\left(0.631\beta/AR^{2/3}\right)$ @STA 2	⑬ @STA 1	⑭ h_F = ½(⑩+⑪) (13) (FT)	⑮ SSI level = 768.5+⑧+0.1×①
776	3,000	7.5	0.625	8.125	7.26	0.643	9.653	1.518	4.388	4.664	1.733	1.958	1.845	
					9.58	0.319	9.897	1.162	4.383	4.246	1.133	1.603	1.618	
					7.51	0.633	9.643	1.908	4.35	4.370	1.933	1.923	1.928	
					7.53	0.630	9.660	1.725	4.391	4.364	1.235	1.214	1.225	778.42
789.5	5000	21.0	0.029	21.029	21.2	0.002	22.902	1.897	0.541	0.520	0.0232	0.0701	0.0716	
					19.37	0.1075	21.178	0.095	0.541	0.645	0.0932	0.104	0.0856	789.69
789.5	12,000	21.0	0.448	21.478	21.37	0.445	23.515	2.044	0.544	0.522	0.441	0.374	0.407	
					19.73	0.581	22.014	0.514	0.541	0.584	0.441	0.491	0.456	
					19.64	0.59	21.930	0.454	0.541	0.626	0.441	0.564	0.493	
					19.68	0.589	21.969	0.491	0.541	0.624	0.441	0.561	0.491	790.53
789.7	5000	21.2	0.080	21.280	19.57	0.104	21.374	0.694	.530	.630	.0702	.0992	0.0847	789.88
789.7	12,000	21.2	0.464	21.664	19.88	0.590	22.150	0.486	.530	.609	0.404	0.534	0.469	
					19.86	0.572	22.132	0.468	.530	.611	0.404	0.538	0.471	790.69

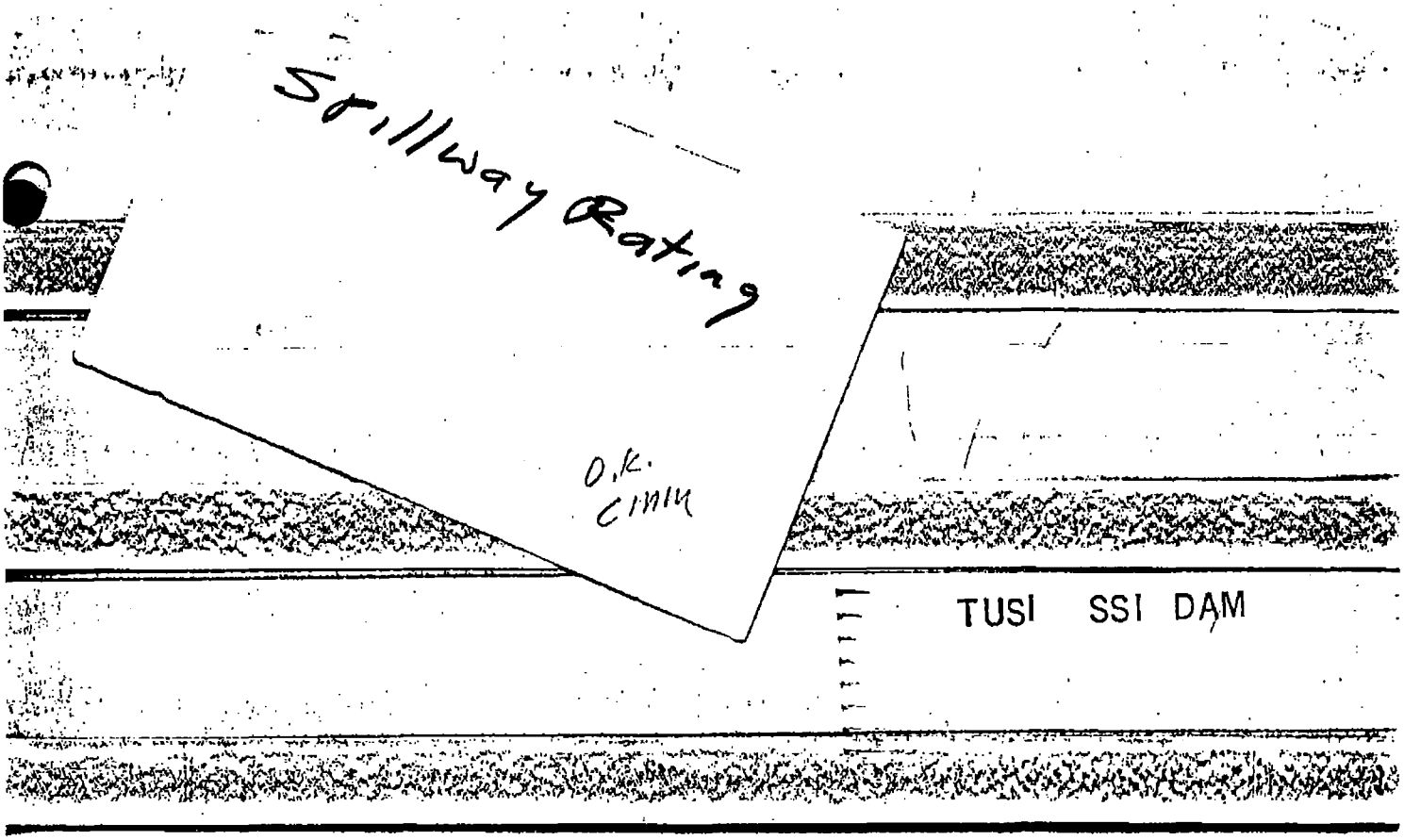




COMANCHE PEAK S.E.S.
NUCLEAR PLANT
UNITS 1 and 2

SAFE SHUTDOWN IMPOUNDMENT
SPILLWAY DISCHARGE CHARACTERISTICS

FIGURE 2.4.3.7 - 1


Spillway Rating
O.K.
C IMIN
TUSI SSI DAM

Title: TUSI
SAFE SHUTDOWN IMPOUNDMENT
SPILLWAY RATING

Date: 23 JUNE 1976
By: TRS
✓ SEAL Cmm
8-11-76

$P = 40 + 6.32\sqrt{y}$; $a = 40y + 3y^2$ hf. (for 3 slopes)

Depth (ft)	Area (ft²)	P (ft)	R	$R^{2/3}$	$a R^{2/3}$	$\frac{0.631}{a R^{2/3}}$
19.5	1921 ✓	163.3	11.76 ✓	5.172	9935 ✓	6.351×10^{-5} OK
19.42	1908	162.8	11.72	5.164	9853	6.404×10^{-5}
20.60	2081	169.7	12.26	5.321	11,073	5.699×10^{-5}
20.10	2016	167.1	12.06	5.263	10,610	5.947×10^{-5}
20.04	2006	166.8	12.03	5.255	10,542	5.986×10^{-5}
17.50	1,619	150.7	10.74	4.872	7888	8.00×10^{-5}
17.44	1,610	150.3	10.71	4.863	7,828	8.06×10^{-5}
16.5	1,477	144.4	10.23	4.716	6,966	9.06×10^{-5}
16.4	1,463	143.7	10.18	4.701	6878	9.17×10^{-5}
12.50	969	119.1	8.136	4.048	3923	16.08×10^{-5}
12.43	961	118.6	8.103	4.037	3880	16.26×10^{-5}
12.45	963	118.7	8.113	4.040	3891	16.22×10^{-5}
19.46	1914	163.1	11.73	5.168	9892	6.378×10^{-5}
19.57	1932	163.7	11.80	5.188	10,023	6.30×10^{-5}
19.68	1933	163.8	11.800	5.187	10,026	6.296×10^{-5}
15.5	1341	138.9	9.717	4.557	6111	10.326×10^{-5}
14.88	1259	134.12	9.387	4.453	5606	11.256×10^{-5}
15.6	1354	138.7	9.833	4.593	6219	10.15×10^{-5}
10.5	750	106.68	7.03	3.672	2754	22.91×10^{-5}
10.12	712	104.00	6.844	3.606	2569	24.56×10^{-5}
10.72	774	107.8	7.18	3.724	2882	21.91×10^{-5}
10.67	768	107.3	7.16	3.703	2829	22.14×10^{-5}
9.5	651	100.1	6.50	3.485	2268	27.82×10^{-5}
9.99	699	103.2	6.77	3.581	2503	25.21×10^{-5}
9.73	673	101.5	6.63	3.531	2376	26.56×10^{-5}
9.70	670.0 OK	101.4	6.61	3.524	2361 OK	26.73×10^{-5} OK
8.5	557	93.8	5.94	3.282	1828	34.52×10^{-5}
8.19	594	96.3	6.168	3.365	1999	31.56×10^{-5}
8.59	565	94.3	5.992	3.301	1865	33.83×10^{-5}
7.50	469	87.4	5.368	3.064	1437	43.91×10^{-5}
7.26	449	85.9	5.229	3.014	1353	46.64×10^{-5}
7.58	476	87.9	5.415	3.085	1468	42.98×10^{-5}
7.51	470	87.5	5.37	3.068	1,442	43.76×10^{-5}
7.53	471	87.6	5377	3.071	1446	43.64×10^{-5}

Freese AND Nichols CONSULTING ENGINEERS

Title: JUSI
SAFE SHUTDOWN IMPOUNDMENT
SPILLWAY RATING

Date: 26 May 1976
By: JRS
✓ SEW CMM

$P = 40 + 6.325y$; $a = 40y + 3y^2$

Depth (ft)	area (ft²)	P (ft)	R	$R^{2/3}$	$ar^{2/3}$	$\frac{0.631}{ar^{2/3}}$
20.5	2081.	169.66	12.26	5.32	11,071	6.699E-5 ✓
20.0	2000	166.50	12.01	5.25	10,500	6.009E-5 ✓
~~19.5~~	~~1921~~	~~163.34~~	~~11.76~~	~~5.18~~	~~9,951~~	~~6.344E-5~~
19.1	1,858	160.81	11.55	5.11	9,494	6.646E-5
19.4	1,905	162.7	11.71	5.16	9,830	6.42E-5 ✓
19.34	1,896	162.33	11.68	5.15	9,764	6.46E-5 ✓
19.61	1,938	164.03	11.81	5.19	10,058	6.27E-5 ✓
19.57	1,932	163.78	11.80	5.19	10,027	6.29E-5 ✓
20.17	2,027	167.58	12.10	5.27	10,682	5.91E-5 ✓
19.80	1,968	165.24	11.91	5.22	10,273	6.14E-5 ✓
19.60	1934	163.97	11.81	5.19	10,048	6.28E-5 ✓
19.30	1889	162.07	11.66	5.15	9,728	6.49E-5 ✓
19.25	1,882	161.76	11.63	5.14	9,673	6.52E-5 ✓
18.20	1,722	155.12	11.10	4.98	8,576	7.36E-5 ✓
18.12	1,710	154.61	11.06	4.97	8,499	7.42E-5 ✓
18.49	1,765	156.96	11.25	5.02	8,860	7.12E-5 ✓
18.40	1,751	156.38	11.20	5.01	8,773	7.19E-5 ✓
18.71	1,799	158.34	11.36	5.06	9,103	6.93E-5 ✓
18.76	1,806	158.66	11.38	5.06	9138	6.91E-5 ✓
18.50	1,767	157.01	11.25	5.02	8,870	7.11E-5 ✓
17.00	1,547	147.53	10.49	4.80	7,426	8.50E-5 ✓
17.15	1,568	148.47	10.56	4.82	7,558	8.35E-5 ✓
17.43	1609	150.24	10.71	4.86	7,820	8.07E-5 ✓
17.45	1,612	150.37	10.72	4.87	7850	8.04E-5 ✓
→ 17.76	1,657	152.33	10.88	4.91 ✓	8,136 ✓	7.76E-5 ✓
18.9	1,828	159.54	11.46	5.09	9,305	6.78E-5 ✓
18.87	1823	159.35	11.44	5.08	9261	6.81E-5 ✓
19.53	1925	163.53	11.77	5.18	9971	6.33E-5 ✓
19.85	1976	165.55	11.94	5.23	10,334	6.10E-5 ✓
19.90	1984	165.87	11.96	5.23	10,376	6.08E-5 ✓
19.73	1956	164.84	11.89	5.21	10,217	6.18E-5 ✓
17.89	1676	153.15	10.95	4.94	8279	7.62E-5 ✓
18.18	1719	154.99	11.09	4.98	8560	7.37E-5 ✓

Freese AND Nichols CONSULTING ENGINEERS

Title: TUSI
SAFE SHUTDOWN IMPOUNDMENT
SPILLWAY RATING

Date: 22 JUNE 1976
By: TRS
✓ SEN CMM

$A = 40Y + 3Y^2$; $P = 40 + 6.325Y$

Q (CFS)	Depth (ft)	AREA (ft^2)	Velocity (FPS)	$V^2/2g$	
2,000	7.5	469	4.264	0.282	✓
2,000	6.45	383	5.222	0.423	✓
2,000	6.72	404	4.950	0.381	✓
2,000	6.68	401	4.9875	0.386	✓
3,000	8.5	557	5.386	0.450	✓
3,000	8.06	517	5.803	0.523	✓
3,000	7.92	505	5.941	0.548	✓
3,000	7.94	507	5.917	0.544	✓
4,000	7.97	509	7.858	0.959	✓
4,000	9.50	651	6.144	0.586	✓
4,000	9.13	615	6.504	0.657	✓
4,000	9.09	611	6.547	0.665	✓
6,000	11.5	857	7.001	0.761	✓
6,000	11.09	812	7.389	0.848	✓
6,000	11.12	816	7.353	0.840	✓
7,000	12.5	969	7.224	0.810	✓
7,000	12.4	957	7.284	0.831	✓
7,000	12.1	923	7.584	0.893	✓
7,000	11.9	900.8	7.771	0.938	✓
7,000	12.08	921.0	7.600	0.897	✓
9,000	13.50	1087	8.280	1.064	✓
9,000	13.75	1117	8.057	1.008	✓
9,000	13.33	1066	8.443	1.107	✓
9,000	13.37	1071	8.403	1.097	✓
11,000	14.50	1211 ✓OK	9,083 ✓OK	1,281 ✓OK	CMM
11,000	14.59	1222	9,001	1,258	✓
11,000	14.51	1212	9,076	1,279	✓
12,000	15.50	1341	8,949	1,244	✓
12,000	15.33	1318	9,105	1,287	✓
13,000	16.50	1477	8,802	1,203	✓
13,000	16.31	1450	8,964	1,268	✓
13,000	16.17	1431	9,085	(1,281)	✓

Title: TUSI
SAFE SHUTDOWN IMPOUNDMENT
SPILLWAY RATING

Date: 26 MAY 1976
By: JRS
✓ SEW CMM

$Q = 4.0y + 3y^2$

VELOCITY CALCULATIONS FOR Q's and Depths

Q(CFS)	Depth(FT)	Area(SF)	Velocity(FPS)	$V^2/2g$
5,000	20.5	2,081	2.403	0.090
5,000	10.0	700	7.143	0.793
5,000	20.0	2,000	7.500	0.097
5,000	19.5	1921	2.603	0.105
5,000	19.1	1858	2.691	0.113
10,000	19.4	1905	5.249	0.428
10,000	19.34	1896	5.274	0.432
15,000	20.5	2081	7.208	0.808
15,000	20.0	2,000	7.500	0.874
15,000	19.61	1,938	7.740	0.931
15,000	19.57	1,932	7.764	0.937
19,000	20.50	2,081	9.130	(1.300)
19,000	20.17	2,047	9.373	1.367
19,000	20.0	2,000	9.500	1.403
19,000	19.80	1,968	9.65	1.447
19,000	19.60	1,936	9.81	(1.500)
19,000	19.3	1,889	10.06	1.572
19,000	19.25	1,882	10.10	1.584
19,000	19.34	1,896	10.02	1.561
5,000	18.20	1,722	2.904	0.131
5,000	18.12	1,710	2.924	0.133
10,000	18.49	1,765	5.664	0.499
10,000	19.5	1,921	5.21	0.421
10,000	18.40	1,751	5.71	0.507
17,000	19.5	1921	8.85	1.217
17,000	18.40	1,751	9.71	(1.465)
17,000	18.71	1,799	9.45	1.388
17,000	18.76	1,806	9.41	1.377
5,000	18.50	1,767	2.830	0.124
5,000	17.00	1547	3.232	0.162
5,000	17.15	1,568	3.189	0.158

Freese AND Nichols CONSULTING ENGINEERS

Title : TUSI
SAFE SHUTDOWN IMPOUNDMENT
SPILLWAY RATING

Date: 27 MAY 1976
By: TRS
✓ SEW CMM

$a = 40y + 3y^2$

Q (CFS)	Depth (Ft)	Area (Ft²)	Velocity (FPS)	V²/2g	
10,000	17.43	1609	6.215	0.600	✓
10,000	18.50	1,767	5.659	0.498	✓
10,000	17.45	1,612	6,203	0.598	✓
15,000	18.5	1,769	8,489	1.12	✓
15,000	17.76	1,657	9.053	1.274	✓
5,000	17.5	1,619	3.088	0.148	✓
5,000	18.9	1,828	2.735	0.116	✓
5,000	18.83	1,817	2.752	0.118	✓
5,000	18.87	1,823	2.74	0.117	✓
10,000	19.1	1,858	5.382	0.450	✓
19,000	19.53	1,925	9.87	(1.514)	✓
19,000	19.57	1932	9.83	1.503	✓
19,000	19.85	1976	9.62	1.437	✓
19,000	19.70	1984	9.58	1.425	✓
19,000	19.53	1588	9.557	(1.420)	✓
5,000	17.89	1676	2.983	0.138	✓
10,000	19.5	1921	5.206	0.44	✓
10,000	18.18	1719	5.817	0.526	✓
15,000	18.92	1831	8.192	1.043	✓
15,000	19.50	1921	7.808	0.948	✓
15,000	18.68	1793	8.366	(1.088)	✓
5,000	16.92	1536	3.255	0.165	✓
5,000	17.28	1587	3.151	0.154	✓
5,000	17.27	1588	3.149	0.154	✓
10,000	17.28	1587	6.302	0.617	✓
10,000	17.29	1587	6.300	0.617	✓
15,000	17.89	1676	8.950	1.245	✓
5,000	15.95	1401	3.569	0.198	✓
10,000	17.50	1619	6.1766	0.593	✓
10,000	16.31	1,450	6.894	0.739	✓
10,000	16.41	1,464	6.831	0.725	✓

Freese AND Nichols CONSULTING ENGINEERS

Title: TUSI
SAFE SHUTDOWN IMPOUNDMENT
SPILLWAY RATING

Date: 28 MAY 1996
By: TRS
✓ SCH Cmm

Q(CFS)	Depth (ft)	Area (ft²)	Velocity (FPS)	V²/2g	
15,000	17.5	1619	9.265	1.334	✓
15,000	17.02	1550	9.677	1.456	✓
15,000	17.21	1577	9.512	1.406	✓
5,000	16.50	1477	3.385	0.178	✓
5,000	14.98	1272	3.931	0.240	✓
10,000	15.54	1346	7.429	0.858	✓
10,000	15.59	1352	7.396	0.850	✓
5,000	15.50	1341	3.7285	0.2160	✓
5,000	14.01	1149	4.352	0.294	✓
5,000	14.06	1155	4.329	0.291	✓
10,000	15.50	1341	7.457	0.864	✓
10,000	13.26	1058	9.452	1.388	✓
10,000	14.79	1248	8.013	0.998	✓
10,000	14.85	1255	7.968	(0.982)	✓
4,000	14.5	1211	3.303	0.170	✓
4,000	13.75	1117	3.581	0.199	✓
4,000	12.96	1022	3.914	0.238	✓
4,000	13.04	1032	3.878	0.233	✓
9,000	14.5	1211	7.432	0.858	✓
9,000	14.69	1235	7.288	0.825	✓
9,000	14.03	1152	7.813	0.949	✓
9,000	14.06	1155	7.792	(0.944)	✓
4,000	13.5	1087	3.680	0.210	✓
4,000	12.14	928	4.310	0.289	✓
4,000	14.10	923	4.334	0.292	✓
7,000	13.9	1136	6.162	0.590	✓
7,000	13.5	1086	6.446	(0.646)	✓
7,000	12.96	1022	6.849	0.729	✓
7,000	12.73	995	7.035	0.769	✓
2,500	10.78	780	3.205	0.160	✓
2,500	12.50	969	2.583	0.104	✓
2,700	10.97	800	3.125	0.152	✓
9,000	13.94	1141	7.891	0.967	✓

Title: TUST
SAFE SHUTDOWN IMPOUNDMENT
SPILLWAY RATING

Date: 28 MAY 19
By: TDS
✓ SEAL C

Q (cfs)	Depth (ft)	Area (ft²)	Velocity (fps)	V²/2g	
5000	11.82	892	5.605	0.488	
5000	11.46	852	5.869	0.53	
2,000	9.88	688	2.907	0.131	
2,000	11.50	857	2.334	0.08	
2,000	10.08	708	2.714	0.12	
2,000	9.76	696	2.874	0.128	
5,000	11.5	857	5,834	0.529	
5,000	11.16	820	6.098	0.578	
5,000	10.72	774	6.460	0.649	
2,000	9.06	609	3.284	0.168	
2,000	10.5	751	2.663	0.110	
2,000	9.03	606	3,300	0.169	
5,000	10.63	764	6.545	0.666	
5,000	10.5	751	6.658	0.689	
5,000	10.1	710	7.042	0.771	
5,000	10.13	713	7,013	0.764	
1,000	9,5	651	1.536	0.037	
1,000	8.75	580	1.724	0.046	
1,000	7.88	501	1.996	0.0619	
1,000	7.90	503	1.988	0.0614	
3,000	8.87	591	5.0761	0400	✓
3,000	8.54	560	5.357	0.446	✓
3,000	8.55	561	5.348	0.444	✓
2000	8.50	557	3.591	0.200	✓
2000	7.70	486	4.115	0,263	✓
2000	7.43	463	4,320	0.290	✓
2000	7.20	444	4.505	0.315	✓
2000	7.24	447	4.474	0.31	✓
2,000	7.36	457	4.376	0.298	✓
5,000	12.50	969	5.161	0.414	✓
22,000	20.35	2056	10.698	1.777	✓
10,000	16.50	1477	6.772	0.712	✓
10,000	20.50	2081	4.8060	0.359	✓

Freese and Nichols CONSULTING ENGINEERS

Title: TUST
SAFE SHUTDOWN IMPOUNDMENT
SPILLWAY RATING

Date: 23 JUNE 1976
By: TRS
✓ SEW CMM

$A = 40y + 3y^2$; $P = 40 + 6.325y$

Q(CFS)	Depth (ft)	Area (ft²)	Q/A Velocity (FPS)	$V^2/2g$	$g = 32.2$
18,000	18.5	1767	10.1867	1.611	✓
18,000	18.44	1758	10.239	1.628	✓
20,000	19.50	1921	10.411	1.6831	✓
20,000	19.42	1908	10.482	1.706	✓
22,000	20.50	2081	10.572	1.735	✓
22,000	20.10	2016	10.913	1.849	✓
22,000	20.04	2006	10.967	1.868	✓
16,000	17.5	1,619	9.883	1.517	✓
16,000	17.44	1610	9.938	1.534	✓
14,000	16.5	1,477	9.479	1.395	✓
14,000	16.4	1,463	9,569	1,422	✓
8,000	12.50	969	8.2559	1.058	✓
8,000	12.43	961	8.3246	1.076	✓
8,000	12.45	963	8.307	1.072	✓
21,000	19.5	1921	10.952	1.856	✓
21,000	19.46	1914	10.9712	1.869	✓
21,000	19.57	1932	10.870	1,835	✓
21,000	19.58	1933	10.864	1.833	✓
13,000	15.50	1341	9.694	1.459	✓
13,000	14.88	1259	10.324	1.656	✓
13,000	15.6	1354	9,601	1,431	✓
6,000	10.50	750	8.07	0.994	✓
6,000	10.12	712	8.427	1.103	✓
6,000	10.72	774	7.752	0.933	✓
6,000	10.67	764	7.853	0.958	✓
5,000	9.5	651	7,680	0.916	✓
5,000	9.99	699	7,152	0.794	✓
6,000	10,24	724	8.287	1.064	✓
5,000	9.73	675	7,429	0,857	✓
5,000	9.70	670	7,463	0,865	✓
4,000	8.5	557	7,181	0,801	✓
4,000	8.9	594	6.734	0.704	✓

Freese AND Nichols CONSULTING ENGINEERS

Title: TUSI
SAFE SHUTDOWN IMPOUNDMENT
SPILLWAY RATING

Date: 24 JUNE 1976
By: TRS
✓ SEW Cmm

Q (CFS)	Depth (FT)	Area (SQ FT)	Velocity (FPS)	$V^2/2g$	
4,000	8.59	565	7.079	0.778	✓
3,000	7.50	469	6.400	0.635	✓
3,000	7.26	449	6.682	(0.693)	✓
3,000	7.58	476	6.303	0.617	✓
3,000	7.51	470	6.383	0.633	✓
3,000	7.53	471	6.369	0.630	✓
4,000	8.67	572	6.993	0.759	✓
3,000	9.50	651	9.610	0.330	✓
5,000	21.0	2163	2.3116	0.0529	
5,000	21.2	2200	2.272	0.0802	
5,000	19.37	1900	2.632	0.1075	
12,000	21.00	2163	5.548	0.478	
12,000	21.37	2224	5.396	0.452	
12,000	19.73	1957	6.132	0.584	
12,000	19.64	1943	6.174	0.592	
12,000	19.68	1949	6.157	0.589	
5,000	21.20	2196	2.278	0.080	
5,000	19.57	1932	2.588	0.1040	
12,000	19.88	1981	6.058	0.570	
12,000	21.2	2196	5.464	0.464	
12,000	19.86	1978	6.067	0.572	

Title: TVSI
SAFE SHUTDOWN IMPOUNDMENT
SPILLWAY RATING

Date: 27 MAY 19
By: TRS
✓ SEW

$P = 40 + 6.325y$ $a = 40y + 3y$

Depth (ft)	Area (ft)	P (ft)	R	$R^{2/3}$	$aR^{2/3}$	$\frac{0.63}{aR}$
18.92	1831	159.67	11.47	5.09	9320	6.77C
18.68	1793	158.15	11.33	5.05	9055	6.97C
16.92	1536	147.02	10.45	4.78	7342	8.59C
17.28	1587	149.30	10.63	4.84	7681	8.22C
17.29	1588	149.36	10.63	4.84	7686	8.21C
17.89	1676	153.15	10.94	4.93	8263	7.64C
17.5	1619	150.69	10.74	4.87	7885	8.00C
15.95	1401	140.57	9.97	4.64	6501	9.74C
16.31	1450	143.16	10.13	4.69	6801	9.28C
16.41	1464	143.79	10.18	4.70	6881	9.17C
17.02	1550	147.65	10.50	4.80	7440	8.48C
17.21	1577	148.85	10.59	4.83	7617	8.28C
16.5	1477	144.36	10.23	4.72	6971	9.05C
14.98	1272	134.75	9.44	4.47	5686	11.10C
15.54	1346	138.29	9.73	4.54	6138	10.28C
15.59	1352	138.61	9.75	4.57	6179	10.21C
15.5	1341	138.04	9.71	4.55	6101	10.34C
14.01	1149	128.61	8.93	4.31	4952	12.74C
14.06	1155	128.93	8.96	4.32	4990	12.65C
15.51	1341	135.04	9.71	4.55	6102	10.34C
13.26	1058	123.87	8.54	4.18	4426	14.24C
14.79	1248	133.55	9.34	4.44	5541	11.39C
14.85	1255	133.93	9.37	4.45	5585	11.30C
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
13.75	1117	126.97	8.80	4.27	4770	13.25C
12.96	1022	121.99	8.38	4.13	4221	14.95C
13.04	1034	122.48	8.43	4.15	4283	14.73C
14.69	1235	132.91	9.29	4.42	5459	11.56C
14.03	1152	128.93	8.95	4.31	4965	12.71C
13.5	1087	125.39	8.67	4.22	4587	13.76C
12.14	968	116.79	7.95	3.99	3863	17.04C
12.10	923	116.53	7.92	3.97	3683	17.20C
13.9	1136	127.92	8.88	4.29	4873	12.95C
13.94	1141	128.17	8.90	4.30	4901	[illegible]

Freese AND Nichols CONSULTING ENGINEERS

Title: TUSI
SAFE SHUTDOWN IMPOUNDMENT
SPILLWAY RATING

Date: 27 MAY 1926
By: JRC
✓ SEW Cmm

Depth (ft)	Area (sq ft)	P (ft)	(A/P) or	$R^{2/3}$	$aR^{2/3}$	$\frac{0.631}{aR^{2/3}}$
12.75	995	120.52	8.26	4.09	4070	15.506-5
10.78	780	108.18	7.21	3.73	2909	21.696-5
12.5	969	119.06	8.14	4.05	3924	16.086-5
10.97	800	109.39	7.31	3.77	3014	20.936-5
11.82	892	114.76	7.77	3.95	3506	(1800(-5)
11.46	852	112.48	7.57	3.86	3289	19.196-5
11.50	857	112.74	7.60	3.87	3317	19.026-5
9.88	688	102.49	6.71	3.56	2449	25.776-5
10.08	708	103.8	7.10	3.70	2727	23.776-5
9.96	696	103.00	6.76	3.58	2492	25.346-5
11.16	820.	110.59	7.41	3.80	3116	20.256-5
11.50	857	112.74	7.60	3.87	3317	19.026-5
10.72	774	107.80	7.18	3.72	2879	21.926-5
9.06	609	97.3	6.25	3.40	2071	30.526-5
10.5	751	106.4	7.06	3.68	2764	22.836-5
9.03	606	97.1	6.24	3.39	2054	30.726-5
10.63	764	107.63	7.12	3.70	2827	22.326-5
10.10	710	103.9	6.83	3.60	2556	24.696-5
10.13	713	104.07	6.85	3.61	2574	24.516-5
9.5	651	100.08	6.50	3.50	2268	27.816-5
8.75	580	95.34	6.08	3.33	1931	32.686-5
7.88	501	89.84	5.577	3.147	1577	40.016-5
7.90	503	90.0	5.588	3.151	1585	39.816-5
8.87	591	96.10	6.150	3.359	1985	31.816-5
8.54	560	94.02	5.956	3.288	1841	34.276-5
8.55	561	94.08	5.963	3.290	1845	34.206-5
8.50	557	93.76	5.941	3.282	1828	34.526-5
7.70	486	88.70	5.479	3.110	1511	41.766-5
7.43	463	87.0	5.324	3.054	1414	44.626-5
7.2	444	85.5	5.193	3.003	1334	47.446-5
7.24	447	85.79	5.210	3.007	1344	46.976-5
7.36	457	86.55	5.280	3.034	1387	45.546-5
8.67	572	94.84	6.031	3.313	1895	33.296-5

Freese AND Nichols CONSULTING ENGINEERS

Title: TUSI
SAFE SHUTDOWN IMPOUNDMENT
SPILLWAY RATING

Date: 4 JUNE 26
By: TRS
✓ SEW Chma

$A = 40y + 3y^2$; $P = 40 + 6.325y$

Depth (FT)	Area (SF)	P (ft)	R	$R^{2/3}$	$aR^{2/3}$	$\frac{0.631}{aR^{2/3}}$
~~2.50~~	~~4.69~~	~~89~~	~~5.39~~	~~3.076~~	~~1443~~	~~43.728(-5~~
6.45	383	81	4.73	2.819	1080	58.43(-5 ✓
6.72	404	82.5	4.90	2.886	1166	54.12(-5 ✓
6.68	401	82.3	4.87	2875	1153	54.73(-5 ✓
8.5	557	93.8	5.938	3.281	1828	34.52(-5 ✓
8.06	517	91.0	5.681	3.185	1647	38.31(-5 ✓
7.92	505	90.1	5.605	3.157	1594	39.58(-5 ✓
7.94	507	90.2	5.620	3.163	1604	39.34(-5
9.5	651	100.1	6.503	3.486	2269	27.81(-5 ✓
7.97	509	90.4	5.631	3.167	1612	39.16(-5 ✓
9.13	615	97.7	6.295	3.411	2098	30.10(-5
9.09	611	97.5	6.267	3.401	2078	30.37(-5 ✓
11.50	857	112.7	7.604	3.870	3317	19.02(-5 ✓
11.09	812	110.1	7.375	3.791	3078	20.50(-5 ✓
11.12	816	110.3	7.398	3.800	3101	20.35(-5 ✓
12.5	969	119.1	8.136	4.048	3923	16.08(-5 ✓
12.4	961 (157)	118.4	8.117	4.042	3884	16.37(-5
12.1	923	116.5	7.92	3.976	3670	17.19(-5 ✓
12.08	921	116.4	7.91	3.973	3,659	17.25(-5 ✓
13.50	1087 ✓	125.4	8.67	4.223	4,590	13.75(-5 ✓
13.75	1117	127.0	8.80	4.265	4,764	13.25(-5 ✓
13.33	1066	124.3	8.58	4.194	4471	14.11(-5 ✓
13.37	1071	124.5	8.60	4.201	4499	14.03(-5 ✓
14.50	1211	131.7	9.195	4.392	5319	11.86(-5 ✓
14.59	1222	132.3	9.237	4.406	5384	11.72(-5 ✓
14.51	1212	131.8	9.196	4.393	5324	11.85(-5 ✓
15.50	1341	138.0	9.717	4.557	6111	10.32(-5 ✓
15.33	1318	137.0	9.620	4.527	5967	10.57(-5 ✓
16.50	1477	144.4	10.229	4.716	6966	9.06(-5 ✓
16.31	1450	143.2	10.126	4.684	6792	9.29(-5 ✓
16.17	1431	142.3	10.056	4.662	6671	9.46(-5 ✓
18.5	1767	157.0	11.255	5.026	8881	7.11(-5 ✓
18.44	1758	156.6	11.23	5.019	8823	7.16(-5 ✓
20.35	2056	168.7	12.18	5.296	10,887	5.796(-5 ✓

Title: TUSI
SAFE SHUTDOWN IMPOUNDMENT
SPILLWAY RATING

Date: 1 JULY 1976
By: TRS
✓ C.M.M.

Depth (ft)	Area (ft^2)	P (ft)	R	$R^{2/3}$	$a R^{2/3}$	$\frac{0.631}{a R^{2/3}}$
21.0	2163	172.8	12.52	5.391	11,662	5.411E-5
21.2	2200	174.1	12.636	5.425	11,935	5.289E-5
19.37	1900	162.5	11.69	5.151	9787	6.447E-5
21.37	2224	175.2	12.69	5.440	12,099	5.215E-5
19.73	1957	164.77	11.88	5.206	10,189	6.193E-5
19.64	1943	164.22	11.83	5.192	10,088	6.255E-5
19.68	1949	164.48	11.84	5.195	10114	6.239E-5
21.2	2196	174.09	12.61	5.418	11,897	5.304E-5
19.57	1932	163.78	11.80	5.183	10,014	6.301E-5
19.88	1981	165.74	11.95	5.227	10354	6.094E-5
19.86	1978	165.61	11.94	5.224	10,334	6.106E-5

Freese and Nichols CONSULTING ENGINEERS

FREESE AND NICHOLS
CONSULTING ENGINEERS
811 LAMAR ST. FORT WORTH, TEXAS 76102

DATE 8/11/76

MEMORANDUM

TO R. A. Thompson, III

PROJECT Independent Review of Calculations
Texas Utilities Services Inc.-SSI Dam

FROM Charlie M. Moore

The SSI spillway channel has been slightly redesigned from that of 1973-74 (Section 1.7.B). This necessitated an independent review of design calculations in accordance with the Freese and Nichols Quality Assurance Program, Paragraph 4.3.5 and Appendix C.

I checked all design calculations and found them to be accurate and reliable. I verify the applicability of the engineering principles and concepts to the design and the accuracy of the computations.

I have no comments and found no needed corrections to be made.

Charlie M. Moore

From the desk of
ROBERT S. GOOCH

7/9/76

Bob:

ere is the set of calculations on SSI flood routing to reflect the wider spillway channel. They represent a revision to the Design Calculations and as such require an independent review. I wondered if Charlie Moore might be able to do that. If not, Tony Reid is probably the only person in the office competent to do it. What is your preference ? Note that they also will need your initials as sign that you concur with the work. The new calculations should eventually go into the notebook.

O.K. CMmoore 8/11/76

Title: TUSI
SAFE SHUTDOWN IMPOUNDMENT

Date: 7/7/76
By: JRS
✓ CMM 8/4/76
DJ

The SSI spillway channel has been slightly redesigned from that of 1973-74 (Section 1.7.B).

The changes were:

1. A sill with elevation of 769.5 FT is now located at station 4+00. The canal slopes downward toward SCR and SSI at S = 0.003. The previous design used a sill of 769.5 FT around station 1+95 (at the SSI entrance of the canal) and sloped S=0.003 toward SCR. The model used in the current calculations assumes the canal slopes downward toward SCR from the sill and upward toward SSI from the sill with S = 0.003. This is slightly conservative.

2. The other change is that the side slopes were changed from 1:2 to 1:3. The bottom width remained at 40 feet.

The results were:

The maximum water level in the SSI for the routing of the maximum probable flood changed from 791.8 FT to 790.5 FT

✓ CMM

Freese AND Nichols CONSULTING ENGINEERS

Flood Routing

O.K.
CMM
8/11/76

TUSI SSI DAM

Title: SSI - DAM FLOOD ROUTING — TUSI SSI DAM

Date: 25 JUNE 1976

By: TRS

✓ CMM

Main Lake Level	Time (Hours)	Σ In (Ac-ft)	SSI Elev	SSI Content (Ac-ft)	Outflow Inst. (CFS)	Outflow Avg. (CFS)	Outflow Avg x ΔT x 0.826 (Ac-ft)	Σ out (Ac-ft)	Σ In − Σ out (Ac-ft)	Σ Δ cont (Ac-ft)
775.0	0.0	0	775.0	558	0	0	0	0	0	0
776.0	15.1 (6.3)	206	776.03	600	270	135	168	168	38	42
777.0	21.4 (4.4)	411	777.05	643	350	310	161	329	82	85
778.0	25.8 (2.3)	597	778.04	693	380	365	133	462	135	135
779.0	28.1 (1.4)	870	779.36	755	1893	1136	216	678	192	197
780.0	29.5 (1.0)	1,270	780.92	835	3641	2767	320	998	272	277
781.0	30.5 (0.60)	1,659	782.00	887	4519	4080	337	1335	324	329
782.0	31.1 (0.60)	1,957	783.00	945	5080	4799	238	1573	384	387
783.0	31.6 (0.40)	2,277	784.38	1020	6784	5932	245	1818	459	462
784.0	32.0 (0.40)	2,598	785.56	1090	8410	7597	251	2069	529	534
785.0	32.4 (0.60)	3,024	787.15	1187	11,400	9,905	327	2396	627	629
786.0	33.0 (0.65)	3,936	790.10	1385	17,625	14,510	719	3115	821	827
787.0	33.65 (0.70)	4,929	790.40	1406	18,253	17,936	763	4078	851	848
788.0	34.35 (0.65)	5,715	789.28	1333	11,690	14,926	863	4941	774	775
789.0	35.0 (.65)	6,233	789.46	1345	7249	9427	506	5447	786	787
789.5	35.65	6,587	789.70	1357	5200	6225	334	5,781	806	799

Freese and Nichols CONSULTING ENGINEERS

Title: SSI - DAM FLOOD ROUTING

Date: 25 JUNE 1976

By: TRS

✓ CMM

Main Lake Level	Time (Hours)	Σ In (Ac-ft)	SST Elev	SST Content (Ac-ft)	Outflow Inst. (CFS)	Outflow Avg. (CFS)	Outflow Avg x ΔT x 0.8264 (Ac-ft)	Σ Out (Ac-ft)	Σ In − Σ Out (Ac-ft)	Σ ΔCont (Ac-ft)
789.7	36.4 (1.8)	6871	789.80	1370	4,100	4650	288	6069	802	812
789.0	38.2 (1.4)	7259	789.0+	1310	1,900	3,000	446	6515	744	752
788.0	39.6 (1.4)	7369	788.0+	1245	1,050	1,475	171	6686	683	687
787.0	41.0 (1.8)	7422	787.0+	1178	900	975	113	6799	623	620
786.0	42.6 (1.8)	7445	786.0+	1116	600	750	99	6898	547	558
785.0	44.8	7474	785.0+	1060	400	500	74	6972	502	502

TUSI SSI DAM

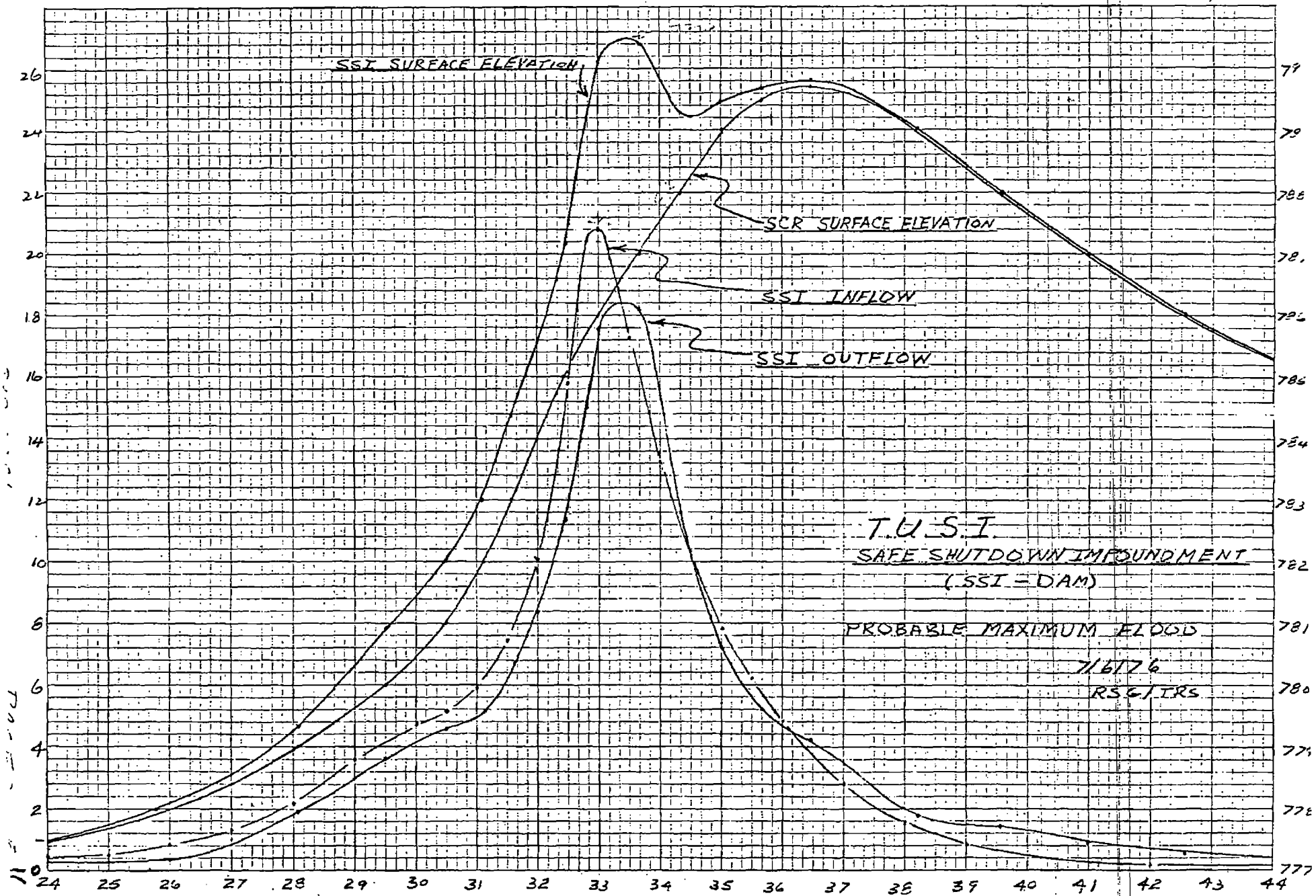


TABLE 2.4.3.7-1

SAFE SHUTDOWN IMPOUNDMENT PROBABLE MAXIMUM FLOOD

Time in Hours	Incremental Rainfall (Inches)	Incremental Rainfall Excess (Inches)	Inflow to SSI (cfs)	SSI Surface Elevation	SSI Spillway Flow (cfs)
3	.5	.0	0	775.0	0
6	.5	.2	111	775.3	60
9	.6	.3	200	775.5	130
12	.7	.4	285	775.7	200
15	.8	.5	354	776.0	270
18	.8	.5	368	776.5	320
21	.9	.6	431	777.0	350
24	.9	.6	442	777.5	370
25	.6	.5	504	777.8	380
26	.8	.7	851	778.1	380
27	1.2	1.1	1,311	778.6	830
28	2.2	2.1	2,103	779.3	1,900
29	2.6	2.5	3,586	780.3	3,000
30	2.9	2.8	4,683	781.5	4,200
30-1/2	2.4	2.35	5,151	782.1	4,600
31	2.6	2.55	5,883	782.9	4,900
31-1/2	5.9	5.85	7,451	784.2	6,200
32	9.3	9.25	10,079	785.5	8,400
32-1/2	1.6	1.55	15,828	787.5	11,600
33	1.5	1.45	20,849	790.1	17,600
33-1/2	1.0	.95	17,310	790.5	18,400
34	.9	.85	13,321	789.8	15,400
34-1/2	.7	.65	10,124	789.2	10,200
35	.4	.35	7,783	789.5	7,200
35-1/2	.3	.25	6,107	789.7	5,600
36	.2	.15	4,787	789.8	4,600
37	.2	.1	2,832	789.7	3,500
38	.2	.1	1,538	789.2	2,000
39	.2	.1	838	788.5	1,500
42	.5	.2	178	786.4	600
45	.5	.2	145	784.9	300
48	.5	.2	146	783.9	100
51	.0	.0	28	783.3	100
54	.0	.0	3	782.9	100
	44.9	39.9			

TUSI SSI DAM

✓ CMM

Client T.U.S.I. Date: 8-10-74

Project SSI @ Commanche Peak By:

Title: INDEPENDENT CHECK OF WIND AND WAVE ACTION ✓ RML

Approved _____ Project Engineer

INDEPENDENT CHECK OF WAVE HEIGHTS

From a visual observation it is obvious that the SCR dam will be subject to much worse wave action than the SSI, so it is studied. The effective fetch is determined and the wind and wave action is studied for the wind in coincident with the probable maximum flood and the probable maximum wind. (ref: Corps of Engineers, ETL 1110-2-8, 1 Aug. 1966)

I. The effective fetch is determined using several different allignments on the accompanying figure. The radians which give the largest fetch are drawn onto the figure. The computations sheets are also attached to this sheet.

Effective Fetch = 8600 ft. (1.6 mi.)

II. The wave action for a 40 mph wind in coincident with the maximum water level is studied. ref: ETL 1110-2-8 p. 32

1. Wind Tide Estimate
   a. Fetch $F = 2Fe = 2(1.6) = 3.2$ mi.
   b. Average depth is estimated from quad sheets to be $D = 90'$
   c. Wind tide rise (s) from Exhibit 7 p. 29
      $S < 0.1'$ so ignore

Client TUSI Date: 8-10-74

Project SSI at Commanche Peak By:

Title: INDEPENDENT CHECK OF WIND and WAVE ACTION ✓ RML

Approved _____ Project Engineer

2. Deep Water Wave Characteristics

a. Effective Fetch : $F_e = 1.6$ mi.

b. Ratio of over-water winds to over-land winds.
interpolated from Section 5.C. p. 4a.
ratio = 1.18

c. Average over-water winds @ 25' above water
$V = (1.18)(40) = 47$ mph

d. Minimum wind duration required to produce wave - from Exhibit 3 p. 21
25 min.

e. Significant Wave Height (H_s)
from Exhibit 3, p. 21
$H_s = 2.6'$

f. Wave period (T_s) from Exhibit 4, p. 22
$T_s = 3.0$ sec

g. Length of Significant Wave (L_s)
$L_s = 5.12\, T_s^2 = 5.12\,(3)^2$
$L_s = 46.1$ ft.

h. Wave steepness (H_s/L_s)
$H_s/L_s = 2.6/46.1 = 0.056$

i. Maximum wave (H_{max})
$H_{max} = 1.67\, H_s = 4.3'$

j. Wave steepness (H_{max}/L_s)
$H_{max}/L_s = 0.093$

k. Relative Runup (R/H_s)
for riprap face with 2H:1V slope
from Exhibit 8, p. 30.
$R/H_s \approx 1.0$ for H_{max}

l. Runup (R)
$R = (1.0)(4.3) = 4.3'$ for H_{max}

Client TUSI Date: 8-10-74

Project SSI at Commanche Peak By:

Title: INDEPENDENT CHECK of WIND and WAVE ACTION ✓ RML

Approved _____ Project Engineer

3. Wave Runup on Embankment

a. Maximum reservoir elevation	≈ 790
b. Wind Tide Rise	≈ 0
c. Runup	4.3'
d. Minimum Top of Embankment	El. 794.3

III The wave action for a probable maximum wind (80 mph) in coincident with normal water level. The effective fetch is somewhat smaller than the Fe in II. 2. a. but it is still used because this will be conservative

1. Wind Tide Estimate
   a. Fetch (F)
      $F = 2Fe = 3.2$ mi.
   b. Average depth is estimated to be
      $D = 75'$
   c. Wind Tide rise (s) from Exhibit 7 p. 29.
      $S = 0.14'$ use 0.2' to be conservative

2. Deep Water Wave Characteristics
   a. Effective Fetch: $Fe = 1.6$ mi.
   b. Ratio of over-water winds to over-land winds interpolated from Section 5.C. page 4. a. (ETL 1110-
      ratio = 1.18
   c. Average over-water winds @ 25' above water
      $V = (1.18)(80) = 94$ mph

   d. Minimum wind duration required to produce wave - from Exhibit 3 p. 21
      18 min.

Client TUSI Date: 8-10-74

Project SSI at Commanche Peak By:

Title: INDEPENDENT CHECK of WIND and WAVE ACTION ✓ RML

Approved _____ Project Engineer

e. Significant Wave Height (H_s)
from Exhibit 3, p.21
H_s = 5.3'

f. Wave period (T_s) from Exhibit 9, p.22
T_s = 4.1 sec

g. Length of Significant Wave (L_s)
$L_s = 5.12\ T_s^2 = (5.12)(4.1)^2$
L_s = 86.1 ft.

h. Wave steepness
H_s/L_s = 5.3/86.1 = 0.062

i. Maximum wave (H_{max})
H_{max} = 1.67 H_s = 8.9'

j. Wave steepness (H_{max}/L_s)
H_{max}/L_s = 0.103

K. Relative Runup (R/H_s)
for riprap face with 2H:1V slope
from Exhibit 8 p.30.
$R/H_s \approx 0.9$ for H_{max}

l. Runup (R)
R = (0.9)(8.9) = 8.0' for H_{max}

3. Wave Runup on Embankment

a.	Reservoir Elev.	≈ 775.0
b.	Wind Tide Rise	.2
c.	Runup	8.0
d.	Minimum Top of Embankment -	El. 783.2

For protection from wind and waves the elevation of the top of SCR dam must be 794.3. It is 796 so is O.K. Since this structure has the worst wave action, all other structures should be very safe if above this elev.

Freese AND Nichols CONSULTING ENGINEERS

2.9. Page 4 Of 7

Client TUSI Date: 8-10-74

Project SSI at Commanche Peak By: I

Title: INDEPENDENT CHECK OF WIND and WAVE ACTION ✓ RML

Approved _____ Project Engineer

EFFECTIVE FETCH COMPUTATION SHEET

(ref: Corps of Engineers, ETL 1110-2-8, 1 Aug. 1966)

RADIAN NUMBER	ANGLE FROM CENTRAL RADIAN	COSINE OF ANGLE	COSINE SQUARED	LENGTH OF RADIAN IN FEET	LENGTH x (COSINE)^2
1	42°	0.743	0.552	6200	3422
2	36°	.809	.655	8000	5240
3	30°	.866	.750	9000	6750
4	24°	.914	.835	7300	6096
5	18°	.951	.905	7200	6516
6	12°	.978	.957	8400	8039
7	6°	.995	.989	19000	18791
8	0°	1.000	1.000	18700	18700
9	6°	.995	.989	12600	12461
10	12°	.978	.957	8100	7752
11	18°	.951	.905	4500	4073
12	24°	.914	.835	4500	3758
13	30°	.866	.750	4600	3450
14	36°	.809	.655	10500	6878
15	42°	.743	.552	7800	4306
		13.512			116,232

Effective Fetch = $\frac{116232}{13.512}$ = 8602 ft

Client TUSI Date: 8-10-74

Project SSI at Commanche Peak By:

Title: INDEPENDENT CHECK OF WIND and WAVE ACTION ✓ RML

Approved _____ Project Engineer

EFFECTIVE FETCH COMPUTATION SHEET

(ref: Corps of Engineers, ETL 1110-2-8, 1 Aug. 1966)

RADIAN NUMBER	ANGLE FROM CENTRAL RADIAN	COSINE OF ANGLE	COSINE SQUARED	LENGTH OF RADIAN IN FEET	LENGTH x (COSINE)^2
1	42°	0.743	0.552	5600	3091
2	36°	.809	.655	5100	3341
3	30°	.866	.750	7800	5850
4	24°	.914	.835	8900	7432
5	18°	.951	.905	7200	6516
6	12°	.978	.957	7300	6986
7	6°	.995	.989	8400	8308
8	0°	1.000	1.000	19500	19500
9	6°	.995	.989	18700	18494
10	12°	.978	.957	12500	11963
11	16°	.951	.905	8000	7240
12	24°	.914	.835	7600	6346
13	30°	.866	.750	4400	3300
14	36°	.809	.655	4400	2882
15	42°	.743	.552	6000	3312
		13.512			114561

Effective Fetch = $\frac{114561}{13.512}$ = 8478 ft.

Client TUSI Date: 8-19-74

Project Safe Shutdown Impoundment By: ~~RML~~

Title: Flood Evaluation ✓ RML

P.M. Flood & 40 mph winds Approved

Project Engineer

The wind and wave effects for the SCR dam are obviously more severe than those for the SSI, so if they are used for analysis of the SSI the analysis will be conservative.

: From Independent Review

	SCR	SSI
Max. Water Level	790.1	790.8
Wind Tide *	~0.0	~0.0
Runup *	4.3	4.3
Req'd Top of Dam	794.4	795.1

Both are less than the El. 796 used so the El. of 796 is found safe by this independent review.

* from 2.9. page 3 of 7

Client TUSI

Project Safe Shutdown Impoundment

Title: Probable Maximum Winds

Date: 8-19-74

By: ~~RMZ~~

✓ RMC

Approved _____ Project Engineer

The design using the winds with a return period of 200 years is considered a good design. The work in P.S.A.R. 2.3.1.3.7 and Table 2.3.1-7 indicate extreme winds of 81 mph for 30' above the ground. In the original calculations by this office the winds were found to be smaller for the 200 year event. Therefore, the use of 80 mph for design is plenty safe.

: From Independent Review
Wave from Winds with 200 year recurrence interval

	SCR	SSI
Water level	775.0	775.0
Wind tide	.2 *	.2 *
Run up	8.0 *	8.0 *
Req'd top of dam	783.2	783.2

* from 2.9. page 4 of 7

The use of the wind tide and wave effects from the SCR dam will be larger than those obtained for the SSI so the results will be conservative. The results obtained are less than 796, so the El. of top of dams of 796 is conservative.

FREESE AND NICHOLS
CONSULTING ENGINEERS

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W. ERNEST CLEMENT
ELVIN C. COPELAND
ALBERT H. ULLRICH

October 4, 1974

FNT-1022

Mr. Robert Caudle, P.E.
Project Manager - Nuclear Plants
Texas Utilities Services Inc.
1506 Commerce Street
Dallas, Texas 75201

Re: Potential tornado effect on SSI

Dear Mr. Caudle:

At the ACRS subcommittee meeting of September 18, 1974, Mr. Myer Bender asked whether a tornado would cause serious sloshing in the Safe Shutdown Impoundment. Pursuant to his suggestion (see page 75 of the transcript), I have subsequently checked into the matter in greater detail.

A tornado at ground level, if passing across the impoundment, would tend to pick up water and form a waterspout. We have derived the probable volume of water entrainment per foot of travel for a design basis tornado assumed to be moving directly across the SSI. The resulting volume picked up by the funnel, using what we consider to be conservative assumptions, is less than the volume of water per foot of width in a typical 4' wave. We therefore conclude that there would be no significant problem of reservoir sloshing due to the tornado.

Yours very truly,

FREESE AND NICHOLS

By _____
Robert S. Gooch, P.E.

RSG:jd

Check + Calculations

TELEPHONE 817 336-7161 811 LAMAR STREET FORT WORTH, TEXAS 76102

7.11.B Page 18 of 4

Project Engineer

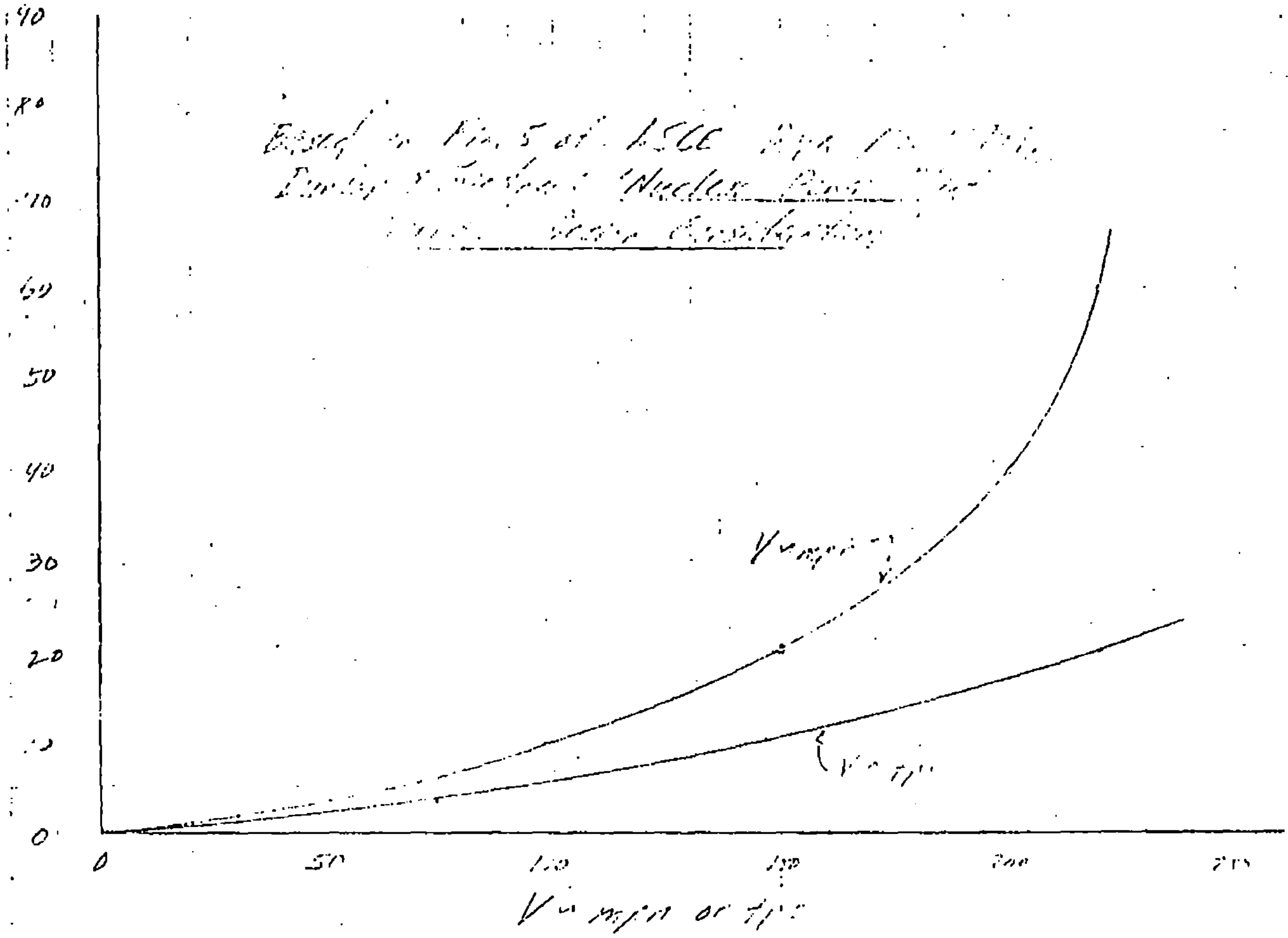
Title: Velocity [illegible] Basin [illegible]

[illegible]

Date: [illegible]

By: [illegible]

✓ [illegible]



Velocity [illegible] in first [illegible] ≈ 30 fps

Ave. [illegible] ≈ 15 fps

$\frac{p}{\gamma} + z + [illegible] = C$ $\frac{dp}{ds} + \gamma\frac{dz}{ds} [illegible] = 0$

$\frac{dp}{ds} \approx - [illegible] \approx -.0024 \times .5 \times 30 \approx -.036$ [illegible]

([illegible])

For [illegible] gradient [illegible] twenty times the [illegible] in the first [illegible] or .216 [illegible]

T. U. S. I. - Safe Shutdown Impoundment

Title: [illegible]

Project En[illegible]

Date: [illegible]

By: [illegible]

✓: RJML

Basic [illegible]:

1. Assume [illegible] the water [illegible] is [illegible] psf/ft.

2. Use design [illegible] with [illegible] slope.

3. [illegible] 20 [illegible] in diameter. [illegible] diameter [illegible]

4. [illegible] water [illegible] of the [illegible]. Assume [illegible] of the [illegible]

Using Bernoulli['s] [illegible] for zone [illegible] water surface:

$$\frac{p}{\gamma} + z + \frac{v^2}{2g} = \frac{p}{\gamma} + z + \frac{v^2}{2g}$$

$$\frac{\Delta p}{\gamma} = \frac{1}{10} + v^2/2g$$

$$v^2 = \left(\frac{21.6/10}{[illegible]} - \frac{1}{10}\right) 64.4 = [illegible]$$

$v =$ [illegible]

Volume [illegible]

$Q/$[illegible] $=$ [illegible] $x .25 x 1.57) \div$ [illegible] $=$ [illegible] cubic ft. per [illegible]

Freese and Nichols Consulting Engineers

T.U.S.I. - Safe Shutdown Impoundment

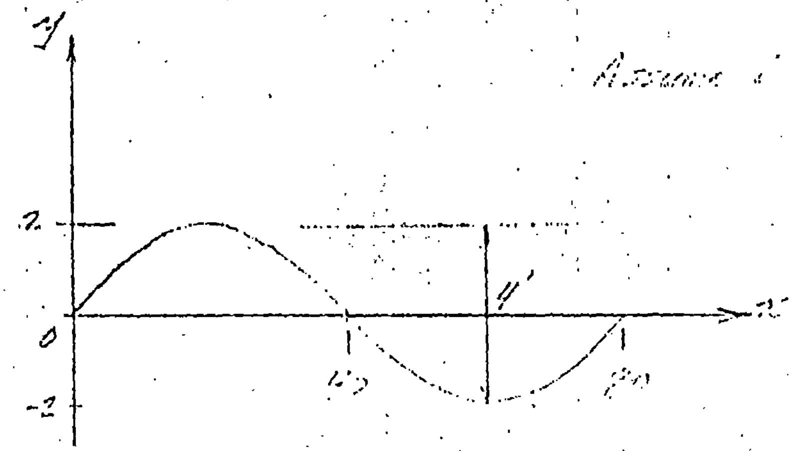
Project Engineer

Title: [illegible]

Date: [illegible]

By: [illegible]

✓ RHL



Assume [illegible] = 80'

$$y = a \sin\left(\frac{\pi}{L}x\right) = 2 \times \sin\left(\frac{\pi}{40}x\right)$$

For a unit width of wave:

$$Volume = 2\int_0^{40} \sin\left(\frac{\pi}{40}x\right)dx$$

$$= 2\left[-\frac{40}{\pi}\cos\left(\frac{\pi}{40}x\right)\right]_0^{40}$$

$$= \frac{80}{\pi}\left[-\cos\pi + \cos 0\right]$$

$$= \frac{160}{\pi} = \underline{50.9} \text{ cu ft/ft}$$

Freese and Nichols Consulting Engineers

Client TUSI Date: 8-19-74

Project Safe Shutdown Impoundment By: ~~RME~~

Title: Rock in Rockfill ✓ RML

Approved _____ Project Engineer

The design of rockfill is such that it may protect against wave action. The following information is assumed:

spherical or cubical rock

The following information is given:

H_s = 2.6' - significant wave height (II.2.e. or 2.9. page 2 of 7

G_s = 2.3 (γ = 145 pcf) from preliminary soils investig.

slope of embankment - 1V : 2H

The thickness of riprap is computed using EM 1110-2-2300 page 5-19, Fig. 5-6, 1 Mar 1971 by the Corps of Engineers

① cot α = 2

② & ⑥ G_s = 2.3

④ Wave height, H = 2.6'

Using the figure the riprap thickness is 18". The use of 24" is therefore conservative. This thickness is 1.5 times the max. diameter of the gradation size rock.

The gradation is based upon ETL 1110-2-120 page 8. The specific weight = 145 #/ft³ and T = $D_{100\,max}$ = 1.5 D_{100} = 24"

Freese AND Nichols CONSULTING ENGINEERS

2.12. Page 1 Of 3

Client TUSJ

Project Safe Shut Down Impoundment

Title: Rock in Rockfill

Date: 8-19-74

By:

✓ RMC

Approved

Project Engineer

% Lighter by Weight	Limits of Stone Wt. (lbs.)
100	607-243
50	180-121
15	90-39

The rock as designed is conservative since the thickness is greater than the thickness which I got. The gradation is based on this thickness so is O.K. also.

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2.12. Page 2 Of 3

TUSI
Safe Shutdown Impoundment
Rock in Rockfill

EXAMPLE:

GIVEN: ① EMBANKMENT SLOPE, COT $\alpha = 3$
② , ⑥ SPECIFIC GRAVITY OF ROCK, G = 2.6
④ WAVE HEIGHT, H = 4 FT

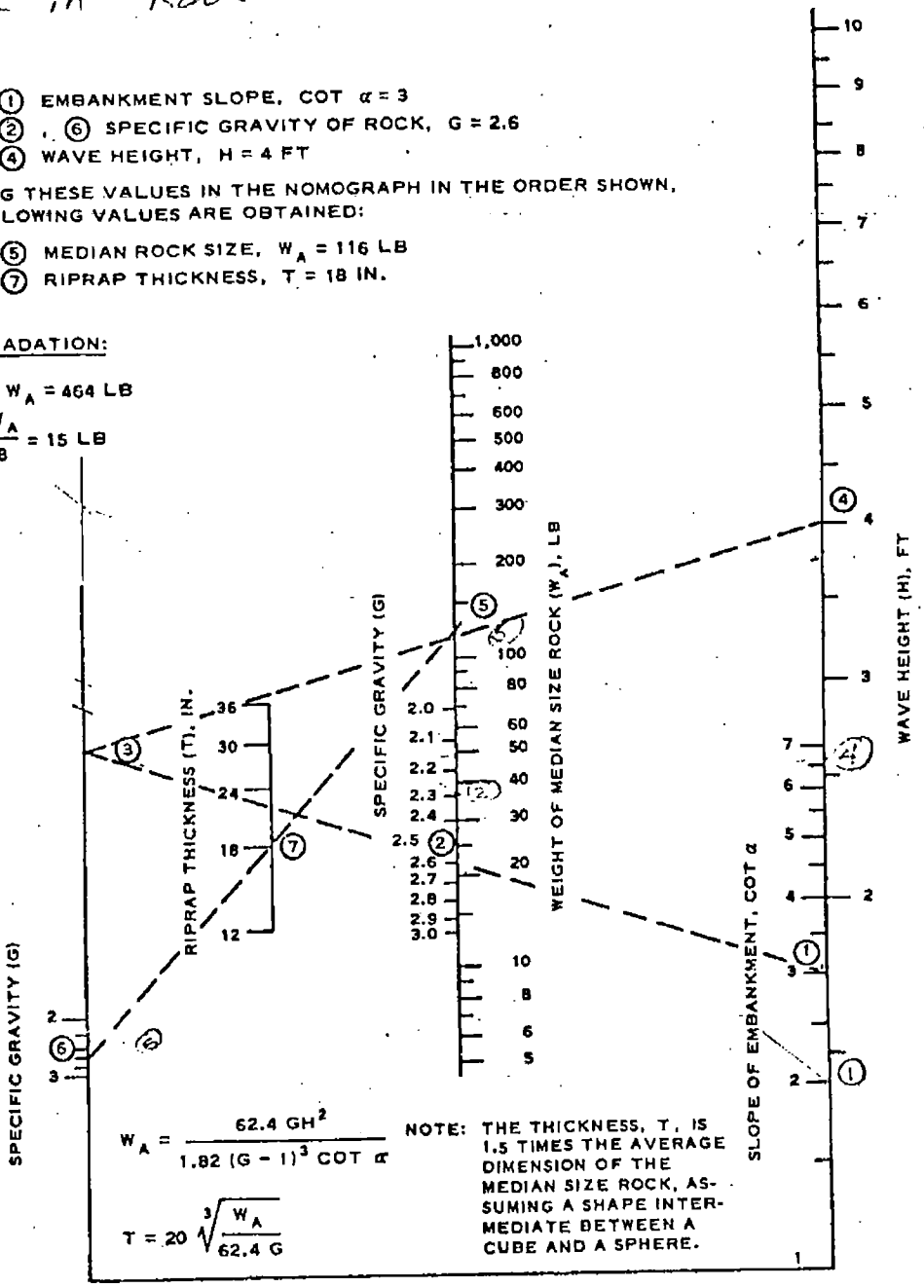
ENTERING THESE VALUES IN THE NOMOGRAPH IN THE ORDER SHOWN, THE FOLLOWING VALUES ARE OBTAINED:

⑤ MEDIAN ROCK SIZE, W_A = 116 LB
⑦ RIPRAP THICKNESS, T = 18 IN.

RIPRAP GRADATION:

$W_{MAX} = 4\ W_A = 464$ LB

$W_{MIN} = \frac{W_A}{8} = 15$ LB



$$W_A = \frac{62.4\ GH^2}{1.82\ (G-1)^3\ \cot \alpha}$$

$$T = 20 \sqrt[3]{\frac{W_A}{62.4\ G}}$$

NOTE: THE THICKNESS, T, IS 1.5 TIMES THE AVERAGE DIMENSION OF THE MEDIAN SIZE ROCK, ASSUMING A SHAPE INTERMEDIATE BETWEEN A CUBE AND A SPHERE.

Fig. 5-6. Slope protection nomograph for dumped riprap for earth dams

✓ RML

Client TUSI Date: 9-9-74

Project Safe Shutdown Impoundment By:

Title: Spillway Slab - Velocity Head Uplift Pressure ✓ RML

Approved _____ Project Engineer

The maximum possible uplift on the bottom of the spillway slab due to the force of the flowing water will be the difference in water levels between the SSI reservoir and over the spillway slab. For this to occur the head loss in the flow under the slab would have to be zero which is impossible. Using the difference in water surfaces is therefore conservative.

The maximum water level and discharge is:

Max. WL in SSI @ El. 790.8
WL in SCR @ El. 787.3
Q_{max} = 15600 cfs
} from 2.8, page 10 of 11,

The difference in water levels between the SSI and above the spillway slab will be the term $h_v + 0.1 h_v$ as calculated by the computer runs in Volume #3. The following information was obtained from Volume #3

Q = 15000 cfs
SCR El. 787.0
$h_v + 0.1 h_v$ = 2.3

SCR El. 788.0
$h_v + 0.1 h_v$ = 2.1

Q = 20,000 cfs
SCR El. 787.0
$h_v + 0.1 h_v$ = 3.5

SCR El. 788.0
$h_v + 0.1 h_v$ = 3.3

Client TUSI Date: 9-9-74

Project Safe Shutdown Impoundment By:

Title: Spillway Slab ✓ RML

Velocity Head Uplift Pressure Approved

Project Engineer

Interpolation between the two water levels in the SCR will give

$Q = 15{,}000$ cfs	$Q = 20{,}000$ cfs
SCR El. 787.3	SCR El. 787.3
$h_v + 0.1 h_v = 2.1'$	$h_v + 0.1 h_v = 3.4'$

Interpolating between the two discharges will give

$Q = 15{,}600$
SCR El. 787.3
$h_v + 0.1 h_v = 2.2'$

Therefore the use of the velocity head uplift of 3' is conservative.

Title: SQUAW CREEK RESERVOIR 10 YEAR Flood. CHECK CALCULATIONS

Date: 11/5/76

By: TRS

✓

- SQUAW CREEK RESERVOIR

Separate calculations indicate a maximum water surface level of 778.27 FT (msl) for a 10 yr flood. This is 0.17 FT (2 inches) higher than Runder's calculation. — Satisfactory Agreement

- SSI

Separate calculations indicate a maximum water surface level of 777.8 FT (msl) for a 10 yr rain on the SSI Watershed. This is 0.1 FT (1.2 inches) higher than Runder's calculation — Satisfactory Agreement

Tom R. Strayhorn

Freese AND Nichols CONSULTING ENGINEERS

CHECK CALCULATIONS

Title: SQUAW CREEK RESERVOIR. EFFECT OF ADDING RAINFALL ON LAKE.

Date: 11/3/76

By: TRS

✓

Lake Area = 5.7 mi²

TIME	ΔRF	Δ Ac-FT	I CFS (AVG)	CFS (INST.)
0	0	0	0	0
3	0.89	271	1.5 1093	2594
6	3.34	1015	4.5 4094	2330
9	0.46	140	7.5 565	466
12	0.30	91	10.5 367	307
15	0.20	61	13.5 246	246
18	0.20	61	16.5 246	246
21	0.20	61	19.5 246	184
24	0.10	30	21.5 121	61

1. The "Kunder" hydrograph is reduced 6% and ...
2. The CFS (INST) on the lake is placed on page 3 and a new total hydrograph is determined.
3. The new hydrograph is routed on page 4 giving a peak of 778.27 or 0.17 FT (2 inches) above the Kunder Routing.
4. —

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Title: SQUAW CREEK - 10-YR FLOOD (Check Calculation - TR55) Date: 8-12-76 By: RHR

DA = 58.3 Sq. Mi ✓

TIME	UNIT GRAPH	0.39	PER 30%	0.16	TOTAL	0.95*
0	0	0			0	0
3	4759	1856	0		1856	1763
6	4651	1814	14467	0	16281	15467
9	2379	928	14134	761	15828	15037
12	934	364	7232	744	8340	7923
15	325	127	2839	381	3347	3180
18	110	43	988	149	1180	1121
21	38	15	344	52	411	390
24	13	5	115	18	138	131
27	5	2	40	6	48	46
30	2	1	15	2	18	17
33	1	0	6	1	7	7
	0	0	3	0	3	3
			0	0	0	0
TOTAL	13217				47457	- 3462

58.4 x 53.3 x 3.59 x 41.033 = 45,093

58.4 x 53.3 x 1.00 x 41.33 + 12560 - 3462 =

*NOTE: UNIT GRAPH 5% STORMS ✓

Title: SQUAW CREEK (Check Calculation - TDRs)

Date: 11/4/76

By: TRS

✓

From page 1

Unit hydrograph for drainage area

Time	Q CFS	(From page 4) Q CFS (on Lake)	TOTAL HYDROGRAPH (CFS)
0	0	0	0
3	1763	2594	4357
6	15,467	2330	17,797
9	15,037	466	15,503
12	7,923	307	8,230
15	3,180	246	3,426
18	1,121	246	1,367
21	390	184	574
24	131	61	192
27	46	61	107
30	17	61	78
33	7	61	68
36	3	61	64
39	0	61	61

Title: SQUAW CREEK (Check Calculation) S.C. Routing of 10 year Storm

Date: 11/4/76
By: TRS
✓

$N = V/\Delta t + O/2$ (O above 775) $\quad \Delta t = 3$ hr

Time	Inflow I (CFS)	$\bar{I}$	N CFS	ΔN	Outflow O CFS	Elevation
0	0		0		0	775.0
		2179		2179		
3	4357		2,179		25	775.13
		11,077		11,052		
6	17,797		13,231		288	775.95
		16,650		16,362		
9	15,503		29,593		1025	777.13
		11,867		10,842		
12	8,230		40,435		1700	777.95
		5,828		4128		
15	3,426		44,563		1950	778.22
		2,447		497		
18	1307		45,060		2010	778.27
		821		-1189		
21	574		43,871		1925	778.18
		383		-1542		
24	192		42,329		1800	778.07
		150		-1650		
27	107		40,679			
		93				
30	78					
		73				
33	68					
		66				
36	64					
		63				
39	61					

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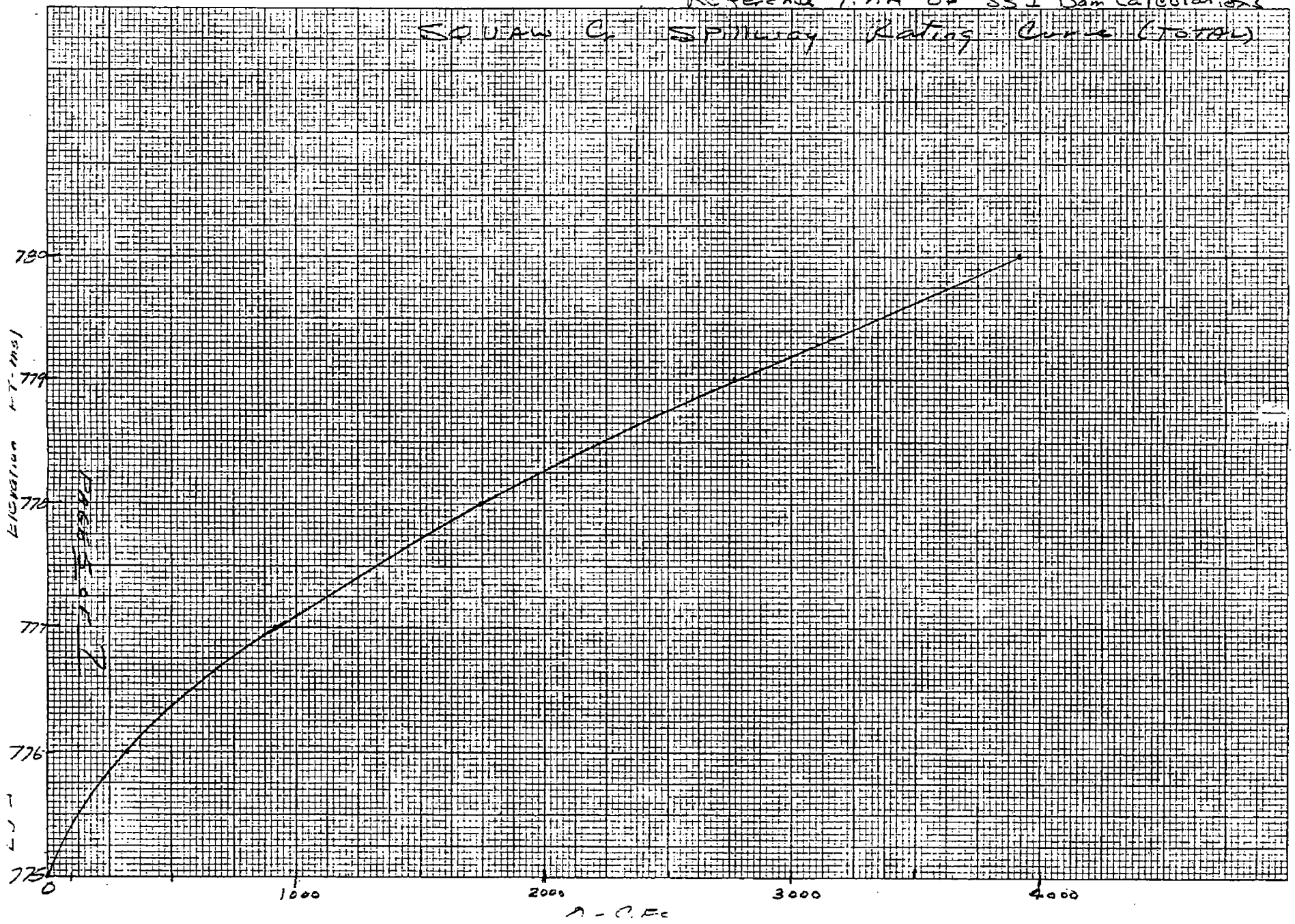
Reference 1.7.A OF SSI Dam Calculations

SQUAW C. SPillway Rating Curve (TOTAL)



Title: Squaw Cr. Reservoir (Check Calculations)

Date: 11/5/76

By: TRS

✓

Lake Area above minimum = 38.9 Acres

D.A. ≈ 3.55 Sq. miles

Time	Runoff N.G. CFS	T	CFS (AVG)	CFS (INST)	TOTAL HYDROGRAPH
0	0	0	0	0	0
0.5	0	.25	7.8	7.8	7.8
1.0	0	.75	7.8	7.8	7.8
1.5	0	1.25	7.8	7.8	7.8
2.0	0	1.75	7.8	7.8	7.8
2.5	0	2.25	7.8	9.8	9.8
3.0	4	2.75	11.8	13.8	17.8
3.5	42	3.25	15.7	15.7	57.7
4.0	180	3.75	15.7	30.6	210.6
4.5	351	4.25	45.5	96.0	447.0
5.0	666	4.75	176.4	103.0	769.0
5.5	1716	5.25	29.0	24.3	17403
6.0	3439	5.75	19.6	10.0	3449.0
6.5	3013	6.25		10.0	3023.0
7.0	2212	6.75		10.0	2222.0
7.5	1427	7.25		10.0	1437.0
8.0	930	7.75		10.0	940.0
8.5	627	8.25		10.0	637.0
9.0	440	8.75		10	350
9.5	324	9.25		10	334
10.0	220			10	230
10.5	43			10	53
11.0	15			10	25
					15,953.4

½ SF

7,991.7 ft³

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Title: SQUAW Creek (Check Calculations) SSI Routing of 10 Yr. Storm

Date: 11/5/76

By: TDS

✓

CONSTANT SQUAW CREEK LAKE LEVEL (775.2 ft.

Time	Inflow I (CFS)	$\bar{I}$	N CFS	ΔN $\bar{I}-O$	Outflow O CFS	Elevation
0	0		0		0	775.2
		3.9		3.9		
0.5	7.8		3.9		0	775.2
		7.8		7.8		
1.0	7.8		11.7		7.8	775.21
		7.8		0		
1.5	7.8		11.7		7.8	775.21
		7.8		0		
2.0	7.8		11.7		7.8	775.21
		8.8		1		
2.5	9.8		12.7		9	775.22
		13.8		4.8		
3.0	17.8		17.5		12	775.23
		37.8		25.8		
3.5	57.7		43.3		30	775.26
		134.2		104.2		
4.0	210.6		147.5		120	775.3
		329		209		
4.5	447.0		357		300	775.42
		608		308		
5.0	769.0		665		570	775.60
		1255		685		
5.5	1740.2		1350		1180	776.05
		2595		1888		
6.0	3449.0		3238		2180	777.2
		3236		1056		
6.5	3023.0		4294		2620	777.8
		2623		3		
7.0	2222.0		4297		2622	777.8
		1830		-792		
7.5	1437.0		3507		2250	777.3
		1189		-1061		
8.0	940.0		2446		1830	776.7

Freese and Nichols CONSULTING ENGINEERS

MEMORANDUM

T.U.S.I. - [illegible] Impoundme

TO: R. A. Thompson, III

FROM: Tom Strayhorn

T.U.S.I. - Safe Shutd[illegible] Impoundmen

RE: SSI Sedimentation Check

DATE: September 1, 1978

In accordance with Appendix C of the Quality Assurance procedures report, this memo is hereby submitted.

The results of Mr. Charlie Moore's calculations on the SSI sedimentation were reviewed. The check calculations varied slightly from the original calculations but not significantly.

Tom Strayhorn

TRS:pp

RJS 11/8

Title: CHECK ON INCREASING SSI SEDIMENTATION FROM 30 YEARS TO 40 YEARS. TEU 72120-32 Date: 8-29-78 By: TRStrayhorn ✓

References: See Attachments No. 1 & 2

PROJECT ENGINEER: R. A. Thompson III

CALCULATION PREPARER: C. Moore T.U.S.I. - Safe Shutdown Impoundmen

INDEPENDENT REVIEWER: T.R. Strayhorn

CLIENT: TEXAS ELECTRIC UTILITIES

Drainage Area Above SSI = 3.47 Sq. Miles

County: Sommerville
SOIL AREA: West Cross Timbers ✓

CHECK ON 40 year sediment: This was accomplished by an independent calculation. For 40 years Mr Moore gets 91 Ac-Ft of sediment.

Method I Reference Attachment No. 2.

Using a SCS structure whose drainage area adjoins the SSI drainage area we use the SCS calculated sediment for Structure 24 to estimate that for the SSI

$$*\text{Sediment}(SSI, 40\text{ yrs}) = 272\text{ AF}\left(\frac{3.47}{6.29}\right)^{0.8}\left(\frac{40\text{ yrs}}{100\text{ yrs}}\right)$$
$$= 272 \times 0.62 \times .4$$
$$= 68 \text{ Acre-feet}$$

* Reference 1 page 4-2

Freese AND Nichols CONSULTING ENGINEERS

Title: CHECK ON INCREASING SSI SEDIMENTATION FROM 30 TO 40 YRS

Date: 8/31/78

By: T.R. Strayhorn ✓

Method II Reference 1

Dep. Sediment = $R K (LS) C P X \left(\frac{2000}{D}\right) X (DR) X (RTE) X A X Y \frac{1}{43,560}$ IN (AF)

R = Rainfall factor = 270

K = Soil-erodibility factor = 0.32

LS = Slope effect factor = 0.65

C = Cropping management factor = (1) 0.450 Open - No Ground Cover; (2) 0.013 Open - 80% Grass; (3) 0.087 Trees - 60% Cover

P = Erosion-Control Practice factor = 1.0

DR = Delivery Ratio = 0.35 (Figure 4, page 4-4)

RTE = Reservoir Trapping Efficiency = 0.90

Y = Years (40); D = Density of dry mtl. (110 lbs/ft³), A = Area (222.1 Ac).

Estimated Land Use: 20% cultivated, 20% trees, 60% pasture

$\bar{I} = 0.2 \times 45 + 0.2 \times 0.013 + 0.6 \times 0.087$

$\bar{C} = 0.09 + 0.0026 + 0.0522 = 0.1448$

Deposited Sediment = $270 \times 0.32 \times 0.65 \times 0.1448 \times 1.0 \times 0.35 \times 0.90 \times 40 \times \frac{2000}{110} \times \frac{2221}{43560}$

= 95 Acre-Feet

This value is about 4% greater than C. Moore's value of 91 AF.

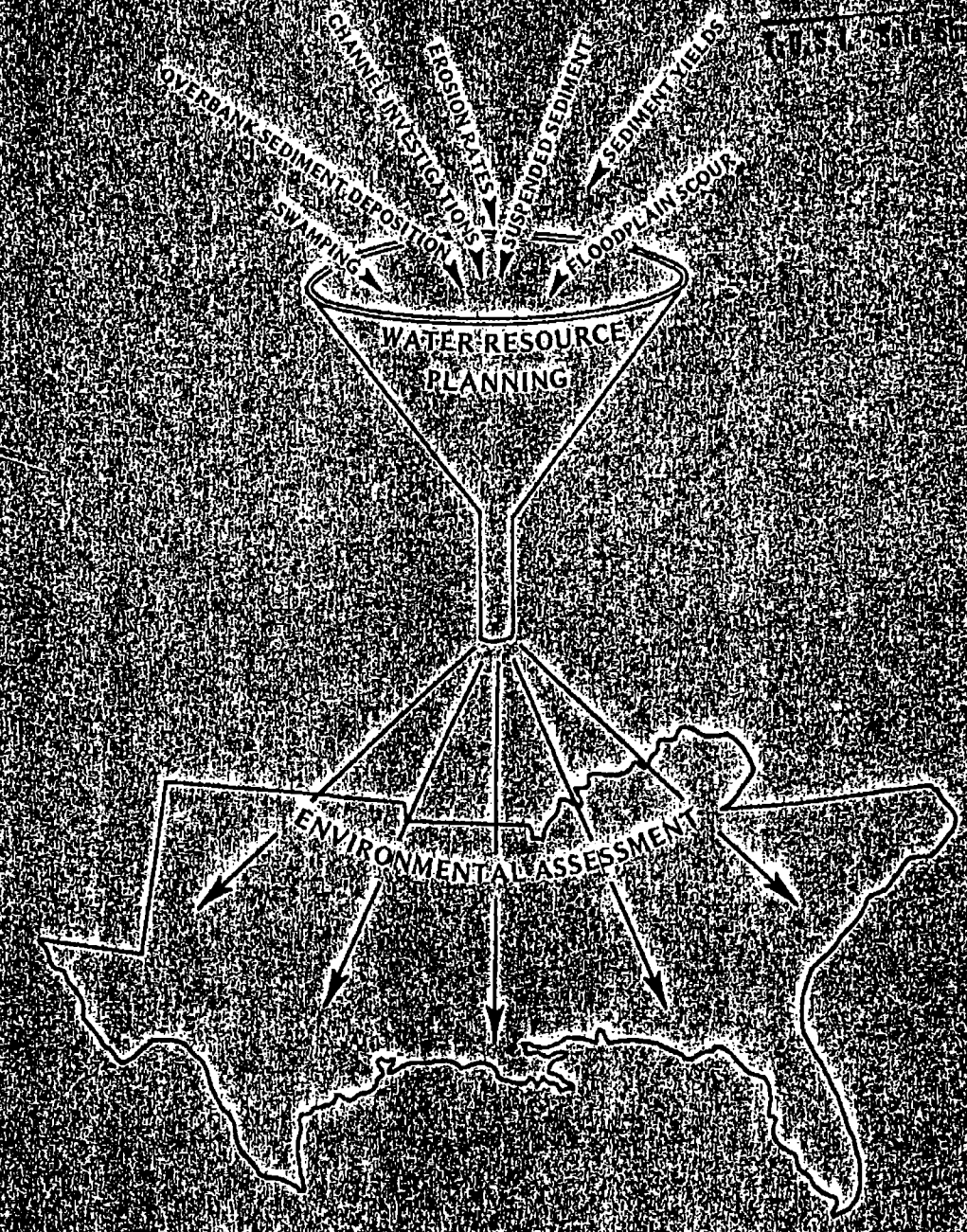
CONCLUSIONS: The sedimentation value of 91 AF for 40 years is satisfactory. If during the next 40 years the drainage Area land is well managed the sedimentation could be less than 91 AF, whereas if there are increases in Construction and/or cultivation the 40 year sediment deposition could well exceed 91 AF.

ATTACHMENT
No. 1
(Reference 1)

GUIDE TO SEDIMENTATION INVESTIGATIONS

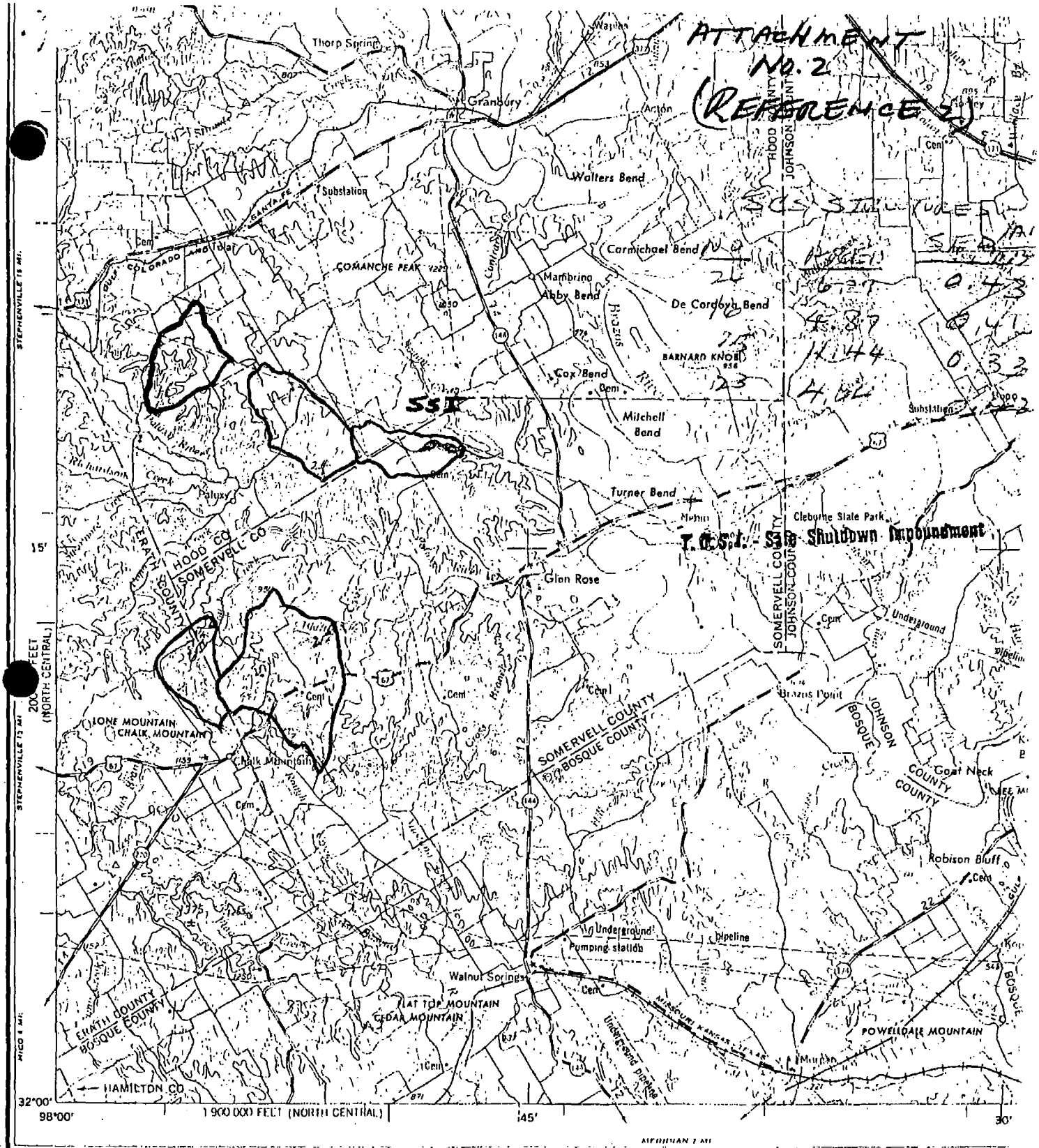
TECHNICAL GUIDE 12
SOUTH TECHNICAL SERVICE CENTER AREA

T.G.S.I. Sedimentation Investigations



U.S. DEPARTMENT OF AGRICULTURE · SOIL CONSERVATION SERVICE
ENGINEERING AND WATERSHED PLANNING UNIT
FORT WORTH, TEXAS
JUNE 1976

PAGE 3 of 11



PAGE 4 OF 11

Prepared by the Army Map Service (AJEE), Corps of Engineers, U.S. Army, Washington, D.C. Compiled in 1954 by photogrammetric methods. Horizontal and vertical control by USGS and USC&GS. Aerial photography 1952-53. Photography field annotated 1954. Limited revision by U.S. Geological Survey 1963

Areas covered by dashed light-blue pattern are to be submerged by Iron Bridge Dam. Spillway elevation 438 feet

100,000-foot grid based on Texas coordinate system, north central and central zones

10,000-meter Universal Transverse Mercator grid ticks, zone 14, shown

LEGEND

ROAD DATA 1954 PARTIALL

POPULATED PLACES

Over 500,000 LOS ANGELES
100,000 to 500,000 OMAHA
25,000 to 100,000 GALVESTON
5,000 to 25,000 Laramie
1,000 to 5,000 Grand Coulee
Less than 1,000 Sun Valley

RAILROADS

Single track Double or Multiple

TABLE 3 - STRUCTURAL DATA - STRUCTURES WITH PLANNED STORAGE CAPACITY
Paluxy River Watershed, Texas

Item	Unit	Structure Number 1	2	3	4	5	6	7	8	9
Class of Structure		a	a	a	a	a	a	b	a	a
Drainage Area	Sq. Mi.	3.90	3.06	2.40	2.11	4.34	4.84	11.94	2.02	3.04
Controlled	Sq. Mi.	-	-	-	-	-	-	-	-	-
Curve No. (1-Day)(AMC II)		74	75	75	75	75	75	75	75	75
TC	Hrs.	1.44	1.74	1.50	1.50	2.40	1.94	3.70	1.07	1.57
Elevation Top of Dam	Ft.	1239.3	1229.3	1233.1	1194.5	1182.0	1192.8	1073.7	1101.2	1168.9
Elevation Crest Emergency Spillway	Ft.	1234.0	1224.0	1227.5	1189.0	1177.0	1187.0	1066.3	1098.0	1163.0
Elevation Crest Principal Spillway	Ft.	1215.5	1205.8	1212.2	1173.2	1158.1	1167.8	1047.2	1082.3	1147.7
Elevation Crest Lowest Ungated Outlet	Ft.	1215.5	1205.8	1212.2	1173.2	1158.1	1167.8	1044.8	1082.3	1147.7
Maximum Height of Dam	Ft.	51	46	50	42	60	54	50	40	45
Volume of Fill	Cu.Yds.	120,300	169,700	107,600	120,400	182,800	196,000	462,100	104,000	105,900
Total Capacity	Ac. Ft.	1,040	806	545	473	1,128	1,211	3,566	711	709
Sediment Pool (Lowest Ungated Outlet)	Ac. Ft.	137	102	93	74	153	150	200	71	146
Sediment Submerged 100 Years	Ac. Ft.	137	102	93	74	153	150	376	71	146
Sediment Aerated	Ac. Ft.	23	18	17	13	18	23	51	9	18
Irrigation Water Supply	Ac. Ft.	-	-	-	-	-	-	-	-	-
Municipal Water Supply Pool	Ac. Ft.	-	-	-	-	-	-	-	-	-
Retarding Pool	Ac. Ft.	880	686	435	386	957	1,038	3,139	631	545
Surface Area										
Sediment Pool (Lowest Ungated Outlet)	Acres	24	20	16	15	25	24	58	13	20
Sediment Pool (Principal Spwy. Crest)	Acres	24	20	16	15	25	24	81	13	20
Irrigation Water Supply	Acres	-	-	-	-	-	-	-	-	-
Municipal Water Supply	Acres	-	-	-	-	-	-	-	-	-
Retarding Pool	Acres	79	60	45	35	83	88	258	74	54
Principal Spillway										
Rainfall Volume (Areal)(1-Day)	In.	8.45	8.10	6.40	7.50	8.20	7.80	8.22	10.70	7.40
Rainfall Volume (Areal)(10-Day)	In.	13.60	13.50	12.10	12.20	13.30	12.70	13.55	17.20	12.00
Runoff Volume (10-Day)	In.	6.81	6.93	6.00	6.15	6.66	6.17	6.28	10.35	5.76
Capacity (Maximum)	C.F.S.	75	75	76	72	81	75	192	73	72
Frequency Operation - Emer. Spillway	% Chance	1.9	2.0	3.9	3.8	2.2	2.9	2.0	0.4	4.0
Size of Conduit	In.	24	24	24	24	24	24	36	24	24
Emergency Spillway										
Rainfall Volume (ESH)(Areal)	In.	6.70	6.70	6.70	6.70	6.70	6.70	9.31	6.70	6.70
Runoff Volume (ESH)	In.	3.78	3.88	3.88	3.88	3.88	3.88	6.23	3.88	3.88
Type		Veg.	Veg.	Veg.	Veg.	Veg.	Veg.	Veg.	Veg.	Veg.
Bottom Width	Ft.	120	100	80	80	160	130	350	100	100
Velocity of Flow (V_e)	Ft./Sec.	0	0	0	0	0	0	5.6	0	0
Slope of Exit Channel	Ft./Ft.	0.140	0.071	0.071	0.093	0.059	0.140	0.024	0.027	0.082
Maximum Water Surface Elev.	Ft.	-	-	-	-	-	-	1068.1	-	-
Freeboard										
Rainfall Volume (FH)(Areal)	In.	13.80	13.80	13.80	13.80	13.80	13.80	20.59	13.80	13.80
Runoff Volume (FH)	In.	10.33	10.47	10.47	10.47	10.47	10.47	17.07	10.47	10.47
Maximum Water Surface Elevation	Ft.	1039.3	1029.3	1233.1	1194.5	1182.0	1192.8	1073.7	1101.2	1168.9
Capacity Equivalents										
Sediment Volume	In.	.77	.74	.86	.77	.74	.67	.67	.74	1.01
Water Supply	In.	-	-	-	-	-	-	-	-	-
Retarding Volume	In.	4.23	4.20	3.40	3.43	4.13	4.02	4.93	5.86	3.36
		0.41	0.31	0.46	0.41	0.39	0.36	0.34	0.394	0.54

T. U. S. I. - Safe Shutdown Impoundment

TABLE 3 - STRUCTURAL DATA - STRUCTURES WITH PLANNED STORAGE CAPACITY - continued
Paluxy River Watershed, Texas

Item	Unit	Structure Number 10	11	12	13	14	15	16	17	18
Class of Structure		a	a	a	a	a	a	a	a	b
Drainage Area	Sq. Mi.	2.01	1.39	4.51	12.00	3.91	12.31	4.87	20.61	23.61
Controlled	Sq. Mi.	-	-	-	-	-	-	-	-	20.61
Curve No. (1-Day)(AMC II)		75	75	76	75	75	75	75	75	75
TC	Hrs.	1.17	.84	2.00	3.06	1.57	3.90	1.65	3.85	5.48
Elevation Top of Dam	Ft.	1091.7	1017.1	1111.8	998.6	996.5	925.0	873.3	1069.4	904.7
Elevation Crest Emergency Spillway	Ft.	1086.5	1012.5	1106.0	992.0	991.0	918.0	867.0	1059.0	893.5
Elevation Crest Principal Spillway	Ft.	1073.7	997.9	1088.1	974.1	975.4	897.2	850.0	1035.2	871.3
Elevation Crest Lowest Ungated Outlet	Ft.	1073.7	997.9	1088.1	971.8	975.4	896.9	850.0	1035.2	864.7
Maximum Height of Dam	Ft.	39	40	46	54	42	53	50	74	66
Volume of Fill	Cu. Yds.	73,900	63,300	136,700	277,100	134,800	227,300	221,400	444,000	533,500
Total Capacity	Ac. Ft.	438	294	1,155	2,798	967	2,468	1,408	5,200	6,011
Sediment Pool (Lowest Ungated Outlet)	Ac. Ft.	65	42	111	200	113	200	-	-	200
Sediment Submerged 100 Years	Ac. Ft.	65	42	111	307	113	217	200	681	736
Sediment Aerated	Ac. Ft.	8	3	12	26	8	19	23	77	61
Irrigation Water Supply	Ac. Ft.	-	-	-	-	-	-	96	326	-
Municipal Water Supply	Ac. Ft.	-	-	-	-	-	-	-	-	-
Retarding Pool	Ac. Ft.	365	249	1,032	2,465	846	2,232	1,089	4,116	5,214
Surface Area										
Sediment Pool (Lowest Ungated Outlet)	Acres	14	8	25	36	20	42	-	-	53
Sediment Pool (Principal Spwy. Crest)	Acres	14	8	25	54	20	43	-	-	112
Irrigation Water Supply	Acres	-	-	-	-	-	-	39	103	-
Municipal Water Supply	Acres	-	-	-	-	-	-	-	-	-
Retarding Pool	Acres	45	29	100	235	99	186	93	267	378
Principal Spillway										
Rainfall Volume (Areal)(1-Day)	In.	7.40	7.60	7.95	8.20	8.00	7.60	7.90	7.80	8.50
Rainfall Volume (Areal)(10-Day)	In.	12.00	12.40	12.90	13.20	13.00	12.40	12.80	13.00	14.00
Runoff Volume (10-Day)	In.	6.01	6.46	6.64	6.03	6.46	5.47	6.24	5.68	6.32
Capacity (Maximum)	C.F.S.	69	70	73	202	73	200	73	218	545
Frequency Operation - Emer. Spillway	% Chance	4.0	3.4	2.6	2.3	2.5	3.4	2.7	2.4	1.4
Size of Conduit	In.	24	24	24	36	24	36	24	36	1/ 48x48
Emergency Spillway										
Rainfall Volume (ESH)(Areal)	In.	6.70	6.70	6.70	6.63	6.70	6.60	6.70	6.45	8.31
Runoff Volume (ESH)	In.	3.88	3.88	3.99	3.82	3.88	3.79	3.88	3.67	5.32
Type		Veg.	Veg.	Veg.	Veg.	Veg.	Veg.	Veg.	Veg.	Veg.
Bottom Width	Ft.	70	80	100	200	100	200	100	300	400
Velocity of Flow (V_e)	Ft./Sec.	0	0	0	0	0	2.4	0	0	8.2
Slope of Exit Channel	Ft./Ft.	0.059	0.079	0.095	0.049	0.079	0.039	0.114	0.060	0.050
Maximum Water Surface Elevation	Ft.	-	-	-	-	-	918.5	-	-	896.0
Freeboard										
Rainfall Volume (FH)(Areal)	In.	13.80	13.80	13.80	13.66	13.80	13.59	13.80	18.20	18.20
Runoff Volume (FH)	In.	10.47	10.47	10.62	10.34	10.47	10.27	10.47	14.73	14.73
Maximum Water Surface Elevation	Ft.	1091.7	1017.1	1111.8	998.6	996.5	925.0	873.3	1069.4	904.7
Capacity Equivalents										
Sediment Volume	In.	.68	.61	.51	.52	.58	.36	.86	.69	.65
Water Supply Volume	In.	-	-	-	-	-	-	.37	.30	-
Retarding Volume	In.	3.40	3.36	4.29	3.85	4.06	3.40	4.19	3.74	4.25
		0.36	0.22	0.27	0.26	0.51	0.19	0.46	0.37	0.37

1/ Dimensions of a square or rectangular conduit.

T. U. S. I. - Safe Shutdown Impoundment

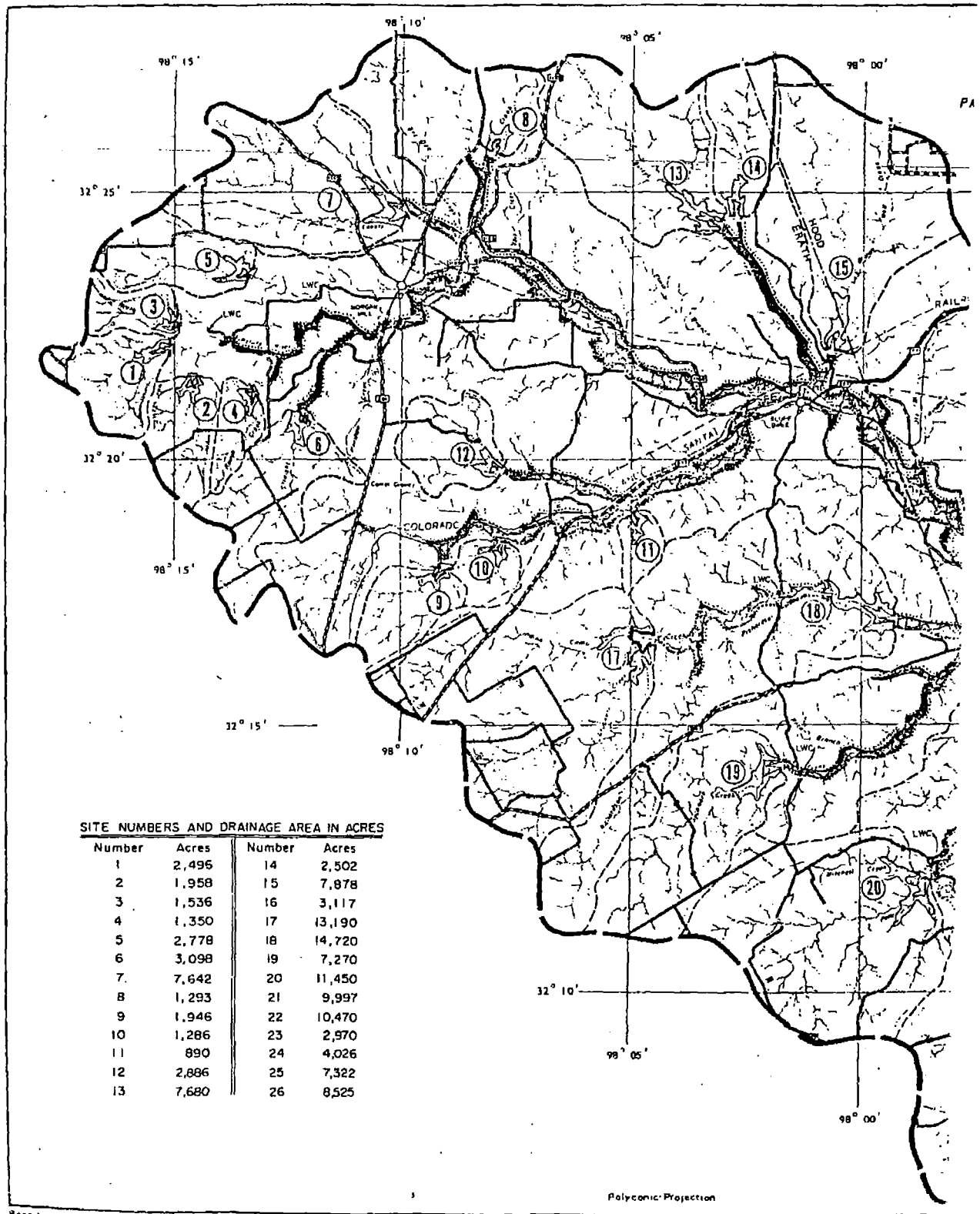
PAGE 6 OF 11

TABLE 3 - STRUCTURAL DATA - STRUCTURES WITH PLANNED STORAGE CAPACITY - Continued
Paluxy River Watershed, Texas

Item	Unit	Structure Number 19	20	21	22	23	24	25	26	Total
Class of Structure		a	a	a	a	a	a	a	c	
Drainage Area	Sq. Mi.	11.36	17.89	15.62	16.36	4.64	6.29	11.44	13.32	219.18
Controlled	Sq. Mi.	-	-	-	33.51	-	-	-	-	
Curve No. (1-Day)(AMC II)		77	76	79	75	77	75	76	77	
TC	Hrs.	3.10	3.23	2.86	4.37	2.20	1.92	2.72	2.73	
Elevation Top of Dam	Ft.	1049.8	985.7	1036.2	806.7	970.0	856.7	845.7	778.4	
Elevation Crest Emergency Spillway	Ft.	1042.5	977.0	1028.0	800.5	964.5	850.5	838.5	765.8	
Elevation Crest Principal Spillway	Ft.	1016.5	947.5	997.0	783.5	939.2	831.7	813.0	741.5	
Elevation Crest Lowest Ungated Outlet	Ft.	1015.4	940.8	990.2	779.8	939.2	830.4	809.6	741.5	
Maximum Height of Dam	Ft.	62	72	72	56	57	54	61	80	
Volume of Fill	Cu. Yds.	298,100	376,400	395,850	270,900	197,200	185,600	342,100	609,900	6,356,850
Total Capacity	Ac. Ft.	2,811	4,446	4,324	4,136	1,292	1,617	3,148	4,756	57,458
Sediment Pool (Lowest Ungated Outlet)	Ac. Ft.	200	200	200	200	181	200	200	-	3,438
Sediment Submerged 100 Years	Ac. Ft.	236	534	517	506	181	245	342	341	6,676
Sediment Aerated	Ac. Ft.	31	48	41	44	15	27	30	21	684
Irrigation Water Supply	Ac. Ft.	-	-	-	-	-	-	-	-	422
Municipal Water Supply	Ac. Ft.	-	-	-	-	-	-	-	700	700
Retarding Pool	Ac. Ft.	2,544	3,864	3,766	3,586	1,096	1,345	2,776	3,694	48,976
Surface Area										
Sediment Pool (Lowest Ungated Outlet)	Acres	34	36	35	70	22	31	36	-	677
Sediment Pool (Principal Spwy. Crest)	Acres	38	65	56	105	22	35	49	-	884
Irrigation Water Supply	Acres	-	-	-	-	-	-	-	-	142
Municipal Water Supply	Acres	-	-	-	-	-	-	-	85	85
Retarding Pool	Acres	172	220	209	331	71	125	181	229	3,746
Principal Spillway										
Rainfall Volume (Areal)(1-Day)	In.	7.90	8.00	8.20	8.08	8.15	7.60	8.40	9.38	
Rainfall Volume (Areal)(10-Day)	In.	12.80	13.20	13.50	13.46	13.20	12.50	13.70	15.25	
Runoff Volume (10-Day)	In.	6.19	6.16	6.97	6.10	7.02	5.86	6.71	7.92	
Capacity (Maximum)	C.F.S.	133	215	214	610	79	74	131	215	
Frequency Operation - Emer. Spillway	% Chance	2.8	2.3	1.9	2.0	2.4	3.2	1.9	1.0	
Size of Conduit	In.	30	36	36	1/ 48x54	24	24	30	36	
Emergency Spillway										
Rainfall Volume (ESH)(Areal)	In.	6.63	6.53	6.60	9.22	6.70	6.70	6.63	12.84	
Runoff Volume (ESH)	In.	4.03	3.84	4.22	6.15	4.09	3.88	3.93	9.85	
Type		Veg.	Veg.	Veg.	Veg.	Veg.	Veg.	Veg.	Veg.	
Bottom Width	Ft.	200	250	250	500	160	150	200	400	
Velocity of Flow (V_e)	Ft./Sec.	0	0	0	6.8	0	0	0	10.0	
Slope of Exit Channel	Ft./Ft.	0.114	0.074	0.127	0.040	0.139	0.058	0.056	0.023	
Maximum Water Surface Elev.	Ft.	-	-	-	802.6	-	-	-	770.8	
Freeboard										
Rainfall Volume (FH)(Areal)	In.	13.76	14.19	14.19	14.19	13.80	13.80	13.67	30.08	
Runoff Volume (FH)	In.	10.73	11.00	11.43	10.85	10.77	10.47	10.49	26.77	
Maximum Water Surface Elevation	Ft.	1049.8	985.7	1036.2	806.7	970.0	856.7	845.7	778.4	
Capacity Equivalents										
Sediment Volume	In.	.44	.61	.67	.63	.79	.81	.61	.51	
Water Supply Volume	In.	-	-	-	-	-	-	-	.98	
Retarding Volume	In.	4.20	4.05	4.52	4.11	4.43	4.01	4.55	5.20	

1/ Dimensions of a square or rectangular conduit.

PAGE 2 OF 11



SITE NUMBERS AND DRAINAGE AREA IN ACRES

Number	Acres	Number	Acres
1	2,496	14	2,502
2	1,958	15	7,878
3	1,536	16	3,117
4	1,350	17	13,190
5	2,778	18	14,720
6	3,098	19	7,270
7	7,642	20	11,450
8	1,293	21	9,997
9	1,946	22	10,470
10	1,286	23	2,970
11	890	24	4,026
12	2,886	25	7,322
13	7,680	26	8,525

Polyconic Projection

Base from General Highway Map — Rev. 1967 — Reproduction permission granted U.S. Department of Agriculture, Soil Conservation Service, Fort Worth, Texas.

Shutdown Impoundment

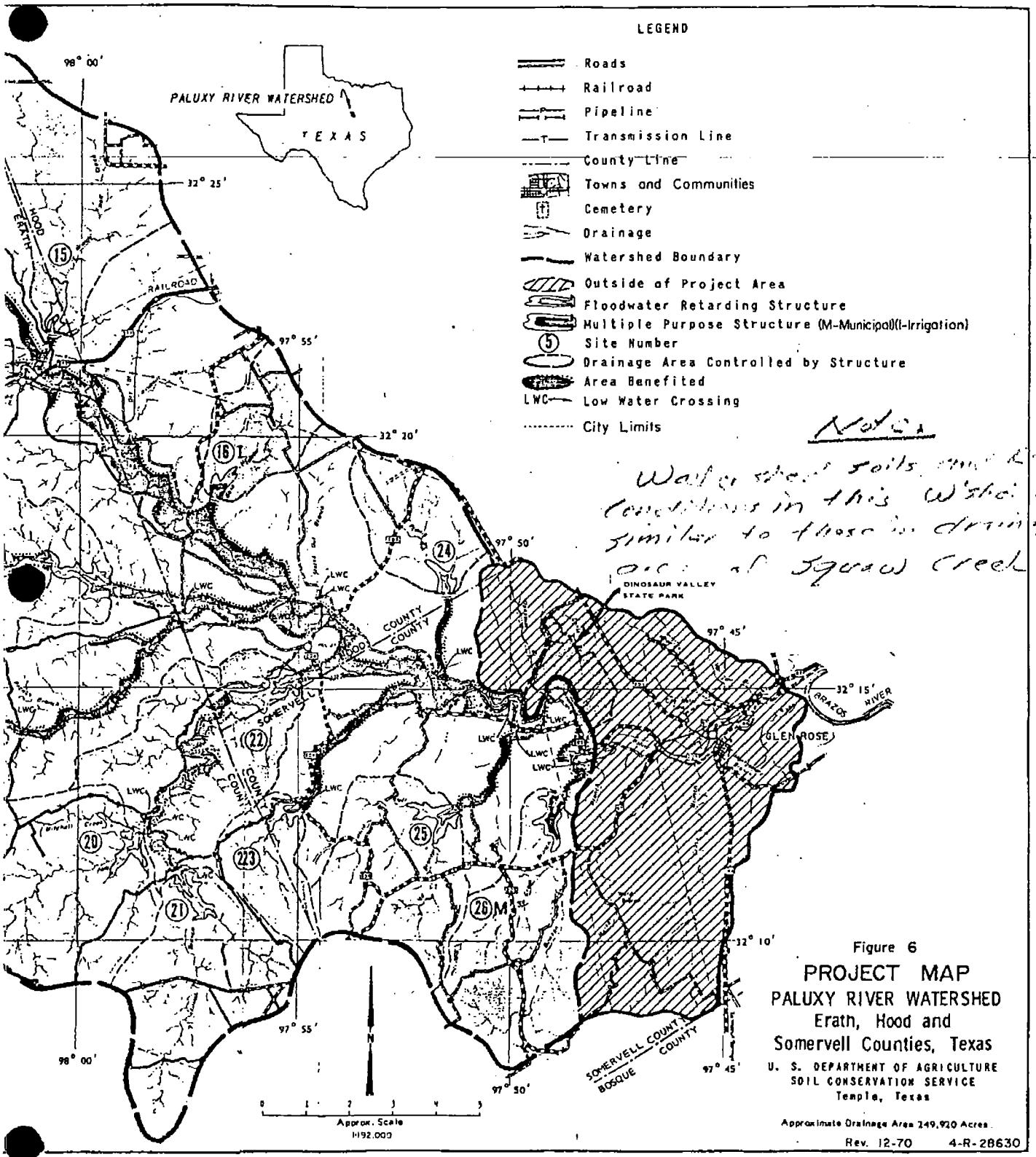


Figure 6

PROJECT MAP

PALUXY RIVER WATERSHED

Erath, Hood and Somervell Counties, Texas

U. S. DEPARTMENT OF AGRICULTURE
SOIL CONSERVATION SERVICE
Temple, Texas

Approximate Drainage Area 249,920 Acres

Rev. 12-70 4-R-28630

Rev. 11-69 4-R-20625

Taken From SCS Work Plan Watershed Protection & Flood Prevention Paluxy River W.S.

12/3/9/

Title: CHECK ON DISTRIBUTION OF 91 AF OF SEDIMENT IN RESERVOIR TEUTZLO

Date: 9/1/78

By: TRS

✓

CHECK BY SEPARATE CALCULATION METHOD: EQUAL AREA REDUCTION UP TO SPILLWAY CREST 770 and tapered "0" at 775.

ORIGINAL CONTENTS AT 775' = 558 AF

DEPTH ~ 774 − 744 = 30

91 − 8 = 83

ΔArea = 83/30 = 2.8 Acres as an estimate to check Mr. C. Moore's Areas.

Page 10 Shows a comparison of my estimated areas and Mr. Moores.

Page 11 Show a comparison of Mr. Moores numerical integration for the capacity and the check integration.

Conclusions: The sediment distributation shape Throughout the SSI is satisfactory. The numerical integration Vary's slightly.

T.U.S.I. - Safe Shutdown Impact 9/11/78

CHECK ON SEDIMENTATION DISTRIBUTION TRS

40 YEAR SEDIMENT TEU 72120 RJ 9/6

	1	2	3	4	5
Elevation (FT-msl)	ORIGINAL AREA Ac	CHECK-EST AREA Ac	C. Moore Calculation Ac		
744	2.8	0	0		
745	3.4	0.6	0.5		
746	4.0	1.2	1.1		
747	4.6	1.8	1.7		
748	5.2	2.4	2.3		
749	5.9	3.0	3.0		
750	6.6	3.8	3.7		
751	7.4	3.8	4.5		
752	8.2	5.4	5.3		
753	9.1	6.3	6.2		
754	10.0	7.2	7.1		
755	11.0	8.2	8.1		
756	12.1	9.3	9.2		
757	13.2	10.4	10.3		
758	14.3	11.5	11.4		
759	15.5	12.7	12.6		
760	16.7	13.9	13.8		
761	17.9	15.1	15.0		
762	19.2	16.4	16.3		
763	20.5	17.7	17.6		
764	21.8	19.0	18.9		
765	23.2	20.4	20.3		
766	24.7	21.9	21.8		
767	26.7	23.9	23.8		
768	27.7	24.9	24.8		
769	29.2	26.4	26.3		
770	30.8	28.0	27.9		
771	32.5	30.8	30.5		
772	34.3	32.7	32.1		
773	36.1	34.1	35.4		
774	37.9	37.5	37.8		
775	39.8	39.8	39.8		
AREA UNCHANGED			ABOVE 775'		

DEVO - Blue 8805 - Green

LITHO. IN U.S.A.

Table 1

Predicted Area and Capacity Characteristics of the Safe Shutdown Impoundment After Forty Years of Sedimentation

Elev.	0	1	2	3	4	5	6	7	8	9	
740					0	0.5	1.1	1.7	2.3	3.0	Acres
					0	0.3 ✓	1 ✓	2 ✓	4 ✓	~~6~~ 7 ✓	Ac-Ft
750	3.7	4.5	5.3	6.2	7.1	8.1	9.2	10.3	11.4	12.6	Acres
	~~9~~ 10	~~13.7~~ 14	~~18.0~~ 19	~~24~~ 25	~~30~~ 32	~~38~~ 40	~~46~~ 49	~~56~~ 59	~~67~~ 70	~~79~~ 82	Ac-Ft
760	13.8	15.0	16.3	17.6	18.9	20.3	21.8	23.3	24.8	26.3	Acres
	~~92~~ 95	~~107~~ 1?9	~~122~~ 125	~~139~~ 142	~~157~~ 160	~~177~~ 180	~~198~~ 201	~~220~~ 224 ✓	~~244~~ 248	~~270~~ 274 ✓	Ac-Ft
770	27.9	30.5	33.1	35.4	37.8	39.8	41.7	43.6	45.6	47.6	Acres
	~~297~~ 301 ✓	~~325~~ 330 ✓	~~357~~ 362 ✓	~~391~~ 396	~~428~~ 433	~~467~~ 472 ✓	~~508~~ 513	~~550~~ 556	~~595~~ 601	~~642~~ 648 ✓	Ac-Ft
780	49.7	51.8	53.9	56.0	58.1	60.3	62.5	64.8	67.1	69.4	Acres
	~~690~~ 697 ✓	~~741~~ 748 ✓	~~794~~ 801 ✓	~~849~~ 856 ✓	~~906~~ 913 ✓	~~965~~ 972 ✓	~~1027~~ 1033	~~1090~~ 1097 ✓	~~1156~~ 1163 ✓	~~1225~~ 1231	Ac-Ft
790	71.7										Acres
	~~1295~~ 1302										Ac-Ft

$\Delta V = \left(\frac{A_i + A_{i+1}}{2}\right)$ rounded to nearest AF.

TABLE PREPARED BY [illegible] 8-78

CHECK ON NUMERICAL CORRECTION OF AREAS & CAPACITY

9/11/78
TRS
12/9/78

T.U.S.I. - Safe Shutdown Impoundment

Client TUSI

Project SSI at Commanche Peak

Title: Spillway Rating Independent Check

Date: 8-10-74

By: I

✓ RML

Approved _____ Project Engineer

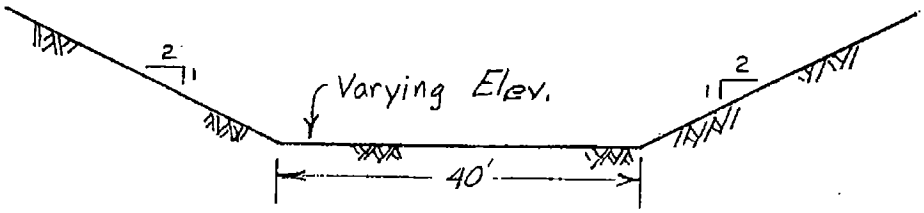
This independent check of the design calculations for the rating curve for the spillway between the SSI and SCR was performed to prove the accuracy of the design curves. The main problem in determining the rating curve is that the downstream conditions effect the upstream discharge. The basis for this approach was taken from p. 299, Chapter 11 of Chow's Open Channel Hydraulics on constant downstream depth. The approach will be:

(1) Define the discharge channel (length, physical characteristics)
(2) Determine the method of approach of calculating the discharge.
(3) Actual computations
(4) Plotting of results and comparing to original work.

(1.) DISCHARGE CHANNEL

a. for centerline profile see the attached page.

b. A typical cross section:



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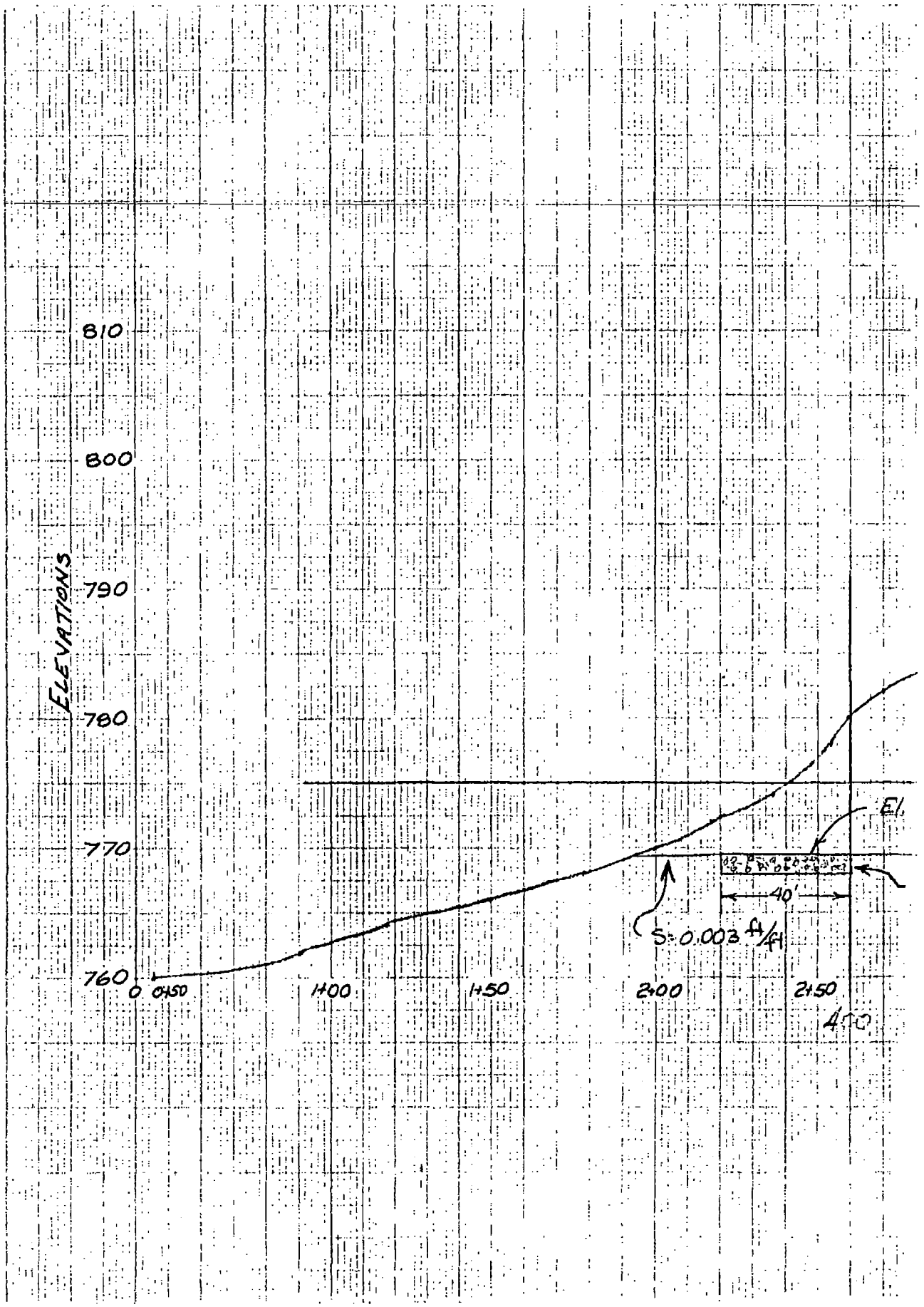
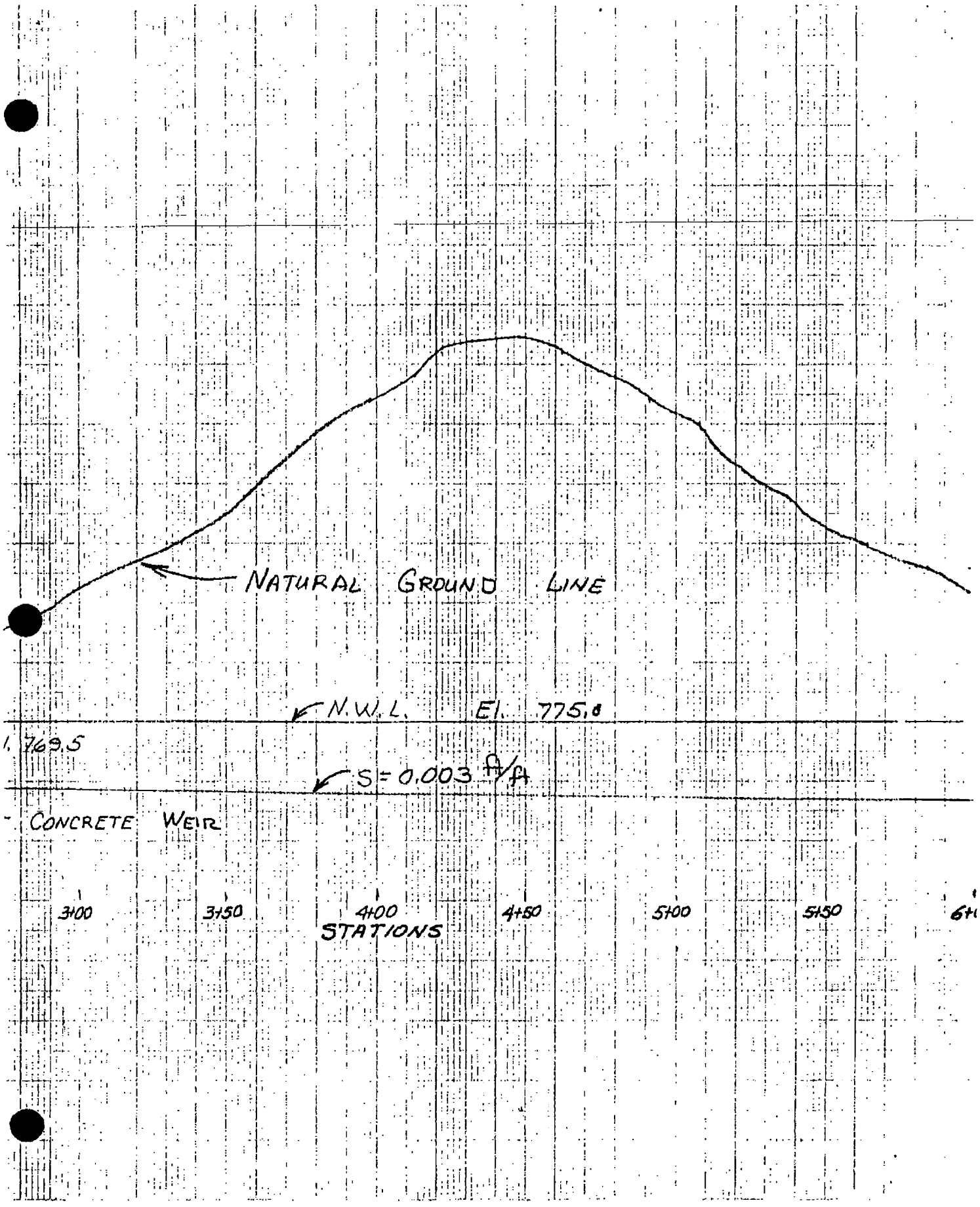

ELEVATIONS
810
800
790
780
770
760
0
0+50
1+00
1+50
2+00
2+50
3+10
40'
S=0.003 ft/ft


NATURAL GROUND LINE
N.W.L. El. 775.0
S = 0.003 ft/ft
CONCRETE WEIR
3+00
3+50
4+00
4+50
5+00
5+50
STATIONS

TUSI

SSI @ Commanche Peak

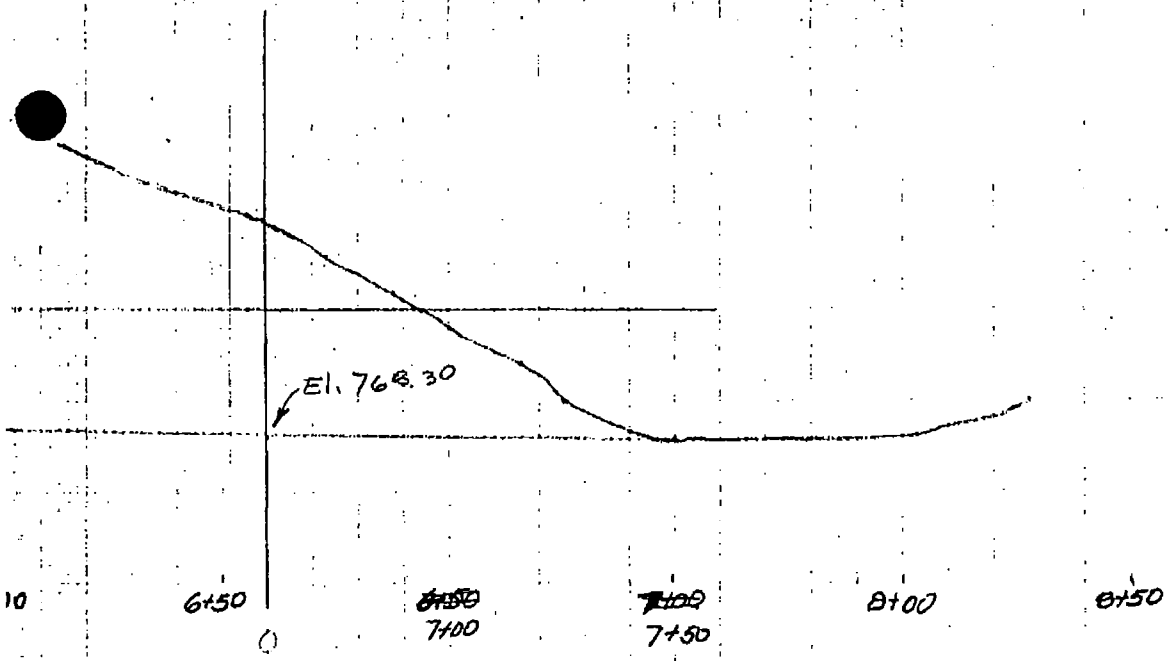
Spillway Rating -
Independent Check

8-10-74

✓ RML

T.U.S.I. - Safe Shutdown Impoundment

Project Engineer



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Client TUSI Date: 8-10-74

Project SSI at Commanche Peak By:

Title: Spillway Rating - Independent Check ✓ RML

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(2.) APPROACH.

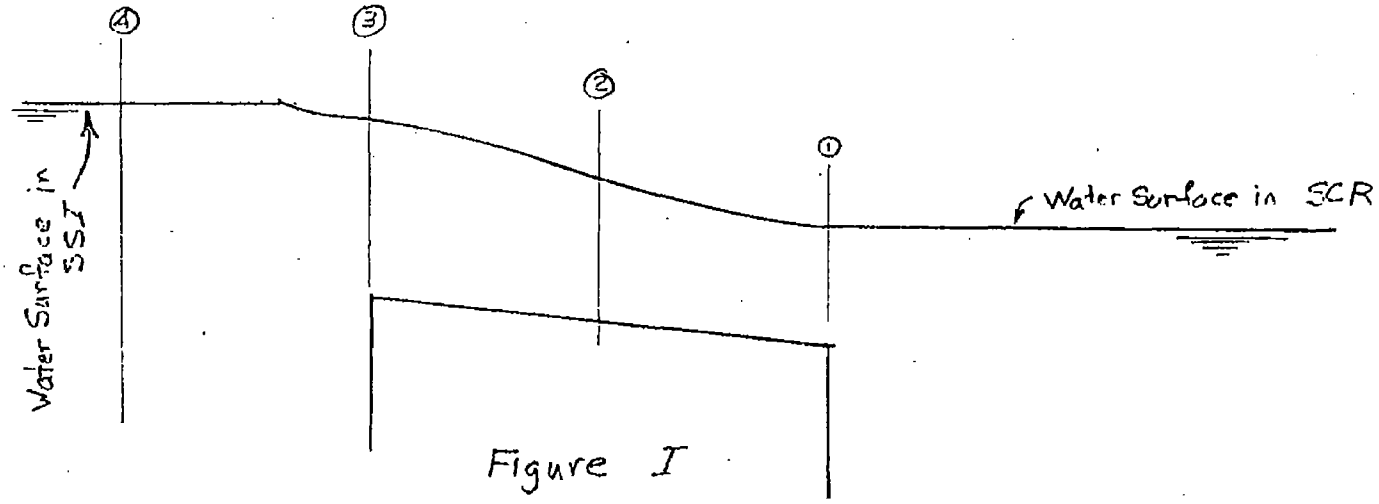

Figure I

a. Bernoulli's Eqn is used to analyze the water surface profiles between the two reservoirs
ref: Chows Open Channel Hydraulics p 265

$$z_1 + Y_1 + \frac{\alpha_1 V_1^2}{2g} = z_2 + Y_2 + \frac{\alpha_2 V_2^2}{2g} + h_f$$

I. h_f is analyzed by using Mannings Eqn

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

$n = 0.040$ for a canal

$$S_f = \left[\frac{Qn}{1.49 A R^{2/3}}\right]^2 = \frac{h_f}{\Delta L_{1-2}}$$

The value of S_f at 1 and 2 will be different so as an approximation S_f is assumed to be the average of the two sections

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2.7.B. Page 3 Of 18

Therefore:

$$h_f = \Delta L_{1-2}\left(\frac{S_{f1} + S_{f2}}{2}\right)$$

II. The value of α is analyzed using a method described in Open Channel Flow by Henderson p. 144-148.

III. This gives the water surface at point 2. The water surface at point 3 is analyze in a similar method using points 2 and 3. The results become more accurate as the sections between 1 and 3 are taken closer together. The water surface at point 3 is determined by the use of a computer program using the above theory as a basis. On the program more cross sections are taken (7 sections) to get more accurate results. The location of the sections are shown on the center line profile referred to in (1.) a. See accompanying sheets for computer results.

b. The water surface in the SSI is also determined using Bernoulli's Eqn.

$$H_4 = Z_3 + Y_3 + \frac{\alpha_3 V_3^2}{2g} + h_e$$

h_e is the entrance losses. It is assumed that $h_e = 0.1\frac{\alpha_3 V_3^2}{2g}$

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Project SSI @ Commanche Peak By:

Title: Spillway Rating - Independent Check ✓ RML

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Therefore:

$$H_4 = Z_3 + Y_3 + (1.1)\frac{\alpha_3 V_3^2}{2g}$$

H_4 = Water Surface Elev at 3 + $(1.1)\frac{\alpha_3 V_3^2}{2g}$

The computer printout of the results contains the Water surface Elev. at 3 and the velocity head ($\frac{\alpha_3 V_3^2}{2g}$). The value of H_4 is then determined on each printout for the results on that printout. See the results referred to in (2) a. III.

The water surface in the SSI is determined for varying discharges and varying water surface elev. in the SCR using the above described methods. The results thus obtained could be 0.1 foot off because of truncation. This still exceeds the accuracy of the actual results. The distance between ① and ③ in Figure I is an estimated average distance which will vary with the water surface elevations. The estimate is made using the profile referred to in (1.) a.

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It should be noted at this time that the minimum depth of flow at the SCR end of the canal is critical depth no matter what the depth of the SCR. The critical depth is therefore calculated for various discharges and is used as a minimum level at the SCR end for computations.

ref: Chow's Open Channel Hydraulics p. 64

$$Q = Z\sqrt{g} = \frac{[(b+zY)Y]^{1.5}}{[b+2zY]^{0.5}}\sqrt{g}$$

(3) COMPUTATIONS:

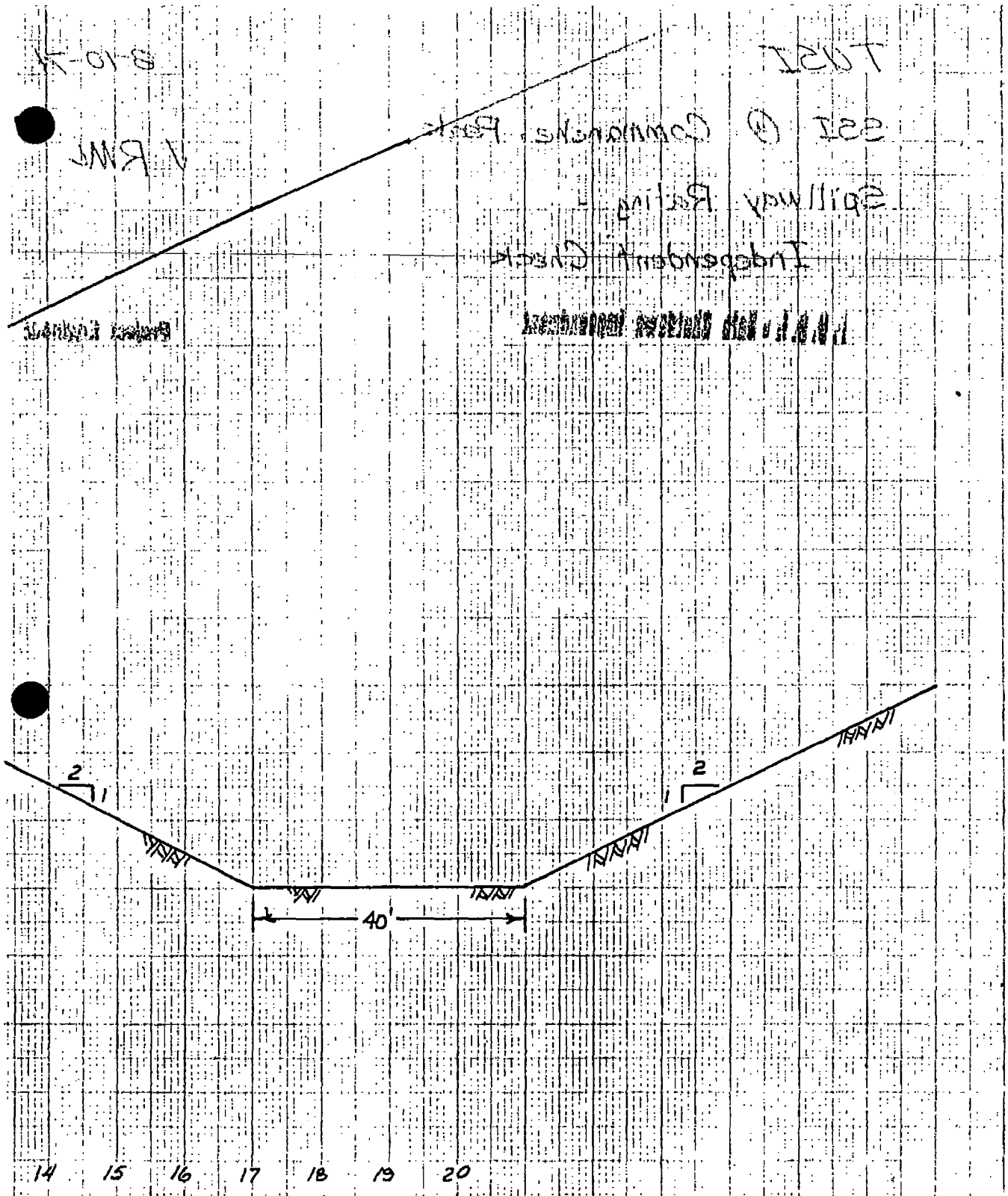
a. Critical depth

$$Q = \frac{[(b+zY)Y]^{1.5}}{[b+2zY]^{0.5}}\sqrt{g}$$

$b = 40'$, $z = 2$, & $g = 32.1725$

$$Q = \frac{[(40+2Y)Y]^{1.5}}{[40+4Y]^{0.5}}\sqrt{32.1725}$$

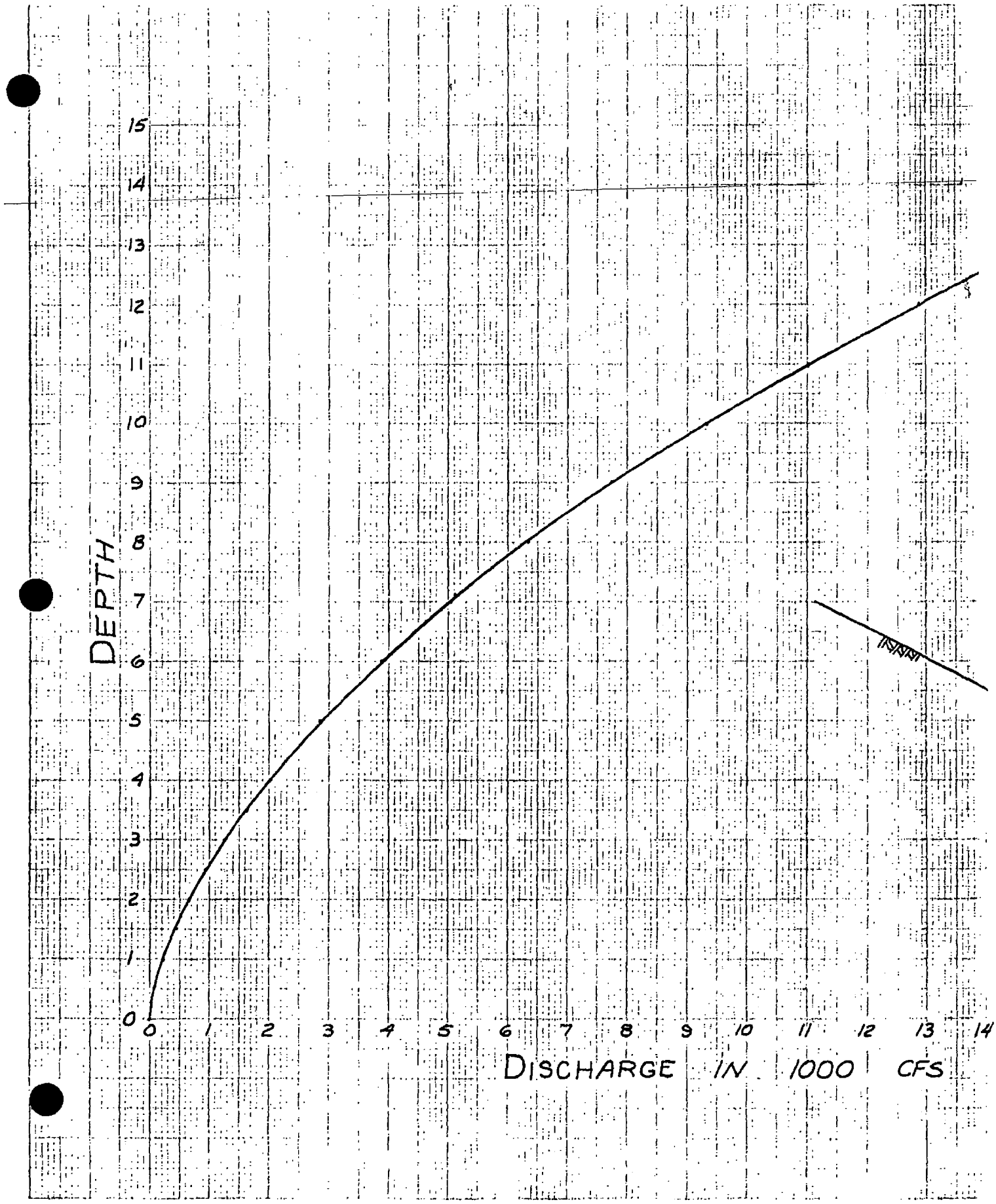
Y_c	Q_c	Y_c	Q_c	Y_c	Q_c
0.5	81	4.0	2017	10.0	9320
1.0	233	5.0	2895	11.0	11022
1.5	433	6.0	3907	12.0	12869
2.0	676	7.0	5055	13.0	14862
2.5	957	8.0	6339	14.0	17004
3.0	1275	9.0	7760	15.0	19299



CRITICAL DEPTH FOR VARIOUS DISCHARGES

8-9-74 RML

TEU 72120


DEPTH
0
1
2
3
4
5
6
7
8
9
10
11
12
13
14
15
0
1
2
3
4
5
6
7
8
9
10
11
12
13
14
DISCHARGE IN 1000 CFS

Client TUSI Date: 8-10-74

Project SSI @ Commanche Peak By:

Title: Spillway Rating - Independent Check ✓ RML

Approved _____ Project Engineer

These results are plotted on the following graph.

b. Preparation of computer input cards

SSI Spillway Station	Computer Station	Elev. Channel Bottom	Bottom Width
6+60	0+00	768.30	40'
6+10	0+50	768.45	
5+60	1+00	768.60	
4+60	2+00	768.90	
3+60	3+00	769.20	
2+60	4+00	769.50	40'

The side slope are 2H:1V and a Manning's n of 0.040 is used. The preparation of the card is shown on the attached page.

W.S. Elev SCR	Y_c	Q_c	Range of Q
790	21.7	>20,000	1000 to 20,000
789	20.7	>20,000	1000 to 20,000
788	19.7	>20,000	1000 to 20,000
787	18.7	>20,000	1000 to 20,000
786	17.7	>20,000	1000 to 20,000
785	16.7	>20,000	500 to 20,000
784	15.7	>20,000	500 to 20,000
783	14.7	18,500	500 to 18500

Client TUSI Date: 8-10-74

Project SSI @ Commanche Peak By:

Title: Spillway Rating - Independent Check ✓ RML

Approved Project Engineer

W.S. Elev. SCR	Y_c	Q_c	RANGE OF Q
782	13.7	16300	500 to 16300
781	12.7	14200	500 to 14200
780	11.7	12300	500 to 12300
779	10.7	10500	500 to 10500
778	9.7	8800	500 to 8800
777	8.7	7200	500 to 7200
776	7.7	5900	500 to 5900
775	6.7	4600	500 to 4600

c. The actual computer run with the results are on sheet #17. For actual computer runs see accompanying notebook, "Computer Runs".

(4) The results as obtained are plotted on the accompanying graph and compared to the original.

The graph obtained is very similar to the original. The maximum variation is in the order of 0.1' to 0.2' so no change in the original is justified.

RML

Project Engineer

T.U.S.I. - Safe Shutdown Impoundment

All Cards : Punch 2 in Col 80

RSTA(M)	SSTA(I,M)	SELEV(I,M)	XTVL(I,M)
5 6 7 8 9 10	15 16 17 18 19 20	25 26 27 28 29 30	35 36 37 38 39 40
0	0	818.30	040
0	100	768.30	
0	140	768.30	
0	240	818.30	
50	0	818.45	
50	100	768.45	
50	140	768.45	
50	240	818.45	
100	0	818.60	
100	100	768.60	
100	140	768.60	
100	240	818.60	
200	0	818.90	
200	100	768.90	
200	140	768.90	
200	240	818.90	
300	0	819.20	
300	100	769.20	
300	140	769.20	
300	240	819.20	
400	0	819.50	
400	100	769.50	
400	140	769.50	
400	240	819.50	040

OBSOLETE

Date: 5-20-74

BACKWATER CALCULATIONS PROGRAM - BKWT2 — By: RML

T.U.S.I. - Safe Shutdown Impoundment

Project Engineer

CONTROL INFORMATION - TYPE 2

All Cards: Punch 2 in Col. 80

	Q							ELEV1						
3	4	5	6	7	8	9	10	14	15	16	17	18	19	20
			2	0	0	0						7	9	0
			1	5	0	0	0							
			1	2	0	0	0							
			1	0	0	0	0							
				8	0	0	0							
				6	0	0	0							
				4	0	0	0							
				2	0	0	0							
				1	0	0	0					7	9	0
			2	0	0	0	0					7	8	9
			1	5	0	0	0							
			1	2	0	0	0							
			1	0	0	0	0							
				8	0	0	0							
				6	0	0	0							
				4	0	0	0							
				2	0	0	0							
				1	0	0	0					7	8	9
			2	0	0	0	0					7	8	8
			1	5	0	0	0							
			1	2	0	0	0							
			1	0	0	0	0							
				8	0	0	0							
				6	0	0	0							
				4	0	0	0							
				2	0	0	0							
				1	0	0	0					7	8	8

OBSOLETE

BACKWATER CALCULATIONS PROGRAM ~ BKWT2

By: RML

T.U.S.I. - Safe Shutdown Impoundment

Project Engineer

CONTROL INFORMATION ~ TYPE 3

All Cards: Punch 3 in Col. 80

			Q								ELEV1			
3	4	5	6	7	8	9	10	14	15	16	17	18	19	20
			2	0	0	0	0					7	8	7
			1	5	0	0	0							
			1	2	0	0	0							
			1	0	0	0	0							
				8	0	0	0							
				6	0	0	0							
				4	0	0	0							
				2	0	0	0							
				1	0	0	0					7	8	7
			2	0	0	0	0					7	8	6
			1	5	0	0	0							
			1	2	0	0	0							
			1	0	0	0	0							
				8	0	0	0							
				6	0	0	0							
				4	0	0	0							
				2	0	0	0							
				1	6	0	0					7	8	6
			2	0	0	0	0					7	8	5
			1	5	0	0	0							
			1	2	0	0	0							
			1	0	0	0	0							
				8	0	0	0							
				6	0	0	0							
				4	0	0	0							
				2	0	0	0							
				1	0	0	0							
					5	0	0					7	8	5

OBSOLETE

BACKWATER CALCULATIONS PROGRAM - BRKWT2

Date: 8-10-76
By: RMC

Control U.S.I. - Safe Shutdown Impoundment TYPE 2

Project Engineer

All Cards: Punch 3 in Col. 80

①										ELEV1				
3	4	5	6	7	8	9	10	14	15	16	17	18	19	20
			2	0	0	0	0					7	8	4
			1	5	0	0	0							
			1	2	0	0	0							
			1	0	0	0	0							
				8	0	0	0							
				6	0	0	0							
				4	0	0	0							
				2	0	0	0							
				1	0	0	0							
					5	0	0					7	8	4
			1	8	5	0	0					7	8	3
			1	5	0	0	0							
			1	2	0	0	0							
			1	0	0	0	0							
				8	0	0	0							
				6	0	0	0							
				4	0	0	0							
				2	0	0	0							
				1	0	0	0							
					5	0	0					7	8	3
			1	6	3	0	0					7	8	2
			1	5	0	0	0							
			1	2	0	0	0							
			1	0	0	0	0							
				8	0	0	0							
				6	0	0	0							
				4	0	0	0							
				2	0	0	0							
				1	0	0	0							
					5	0	0					7	8	2

OBSOLETE

Date: 8-10-14

By: RML

Project Engineer

T.U.S.I. - Safe Shutdown Impoundment

CONTROL ILLUMINATION - TYPE 3

All Cards: Punch 3 in Col. 80

				⌀				ELEV							
3	4	5	6	7	8	9	10	14	15	16	17	18	19	20	
												7	8	1	
			1	4	2	0	0								
			1	2	0	0	0								
			1	0	0	0	0								
				8	0	0	0								
				6	0	0	0								
				4	0	0	0								
				2	0	0	0								
				1	0	0	0								
					5	0	0					7	8	1	
												7	8	0	
			1	2	3	0	0								
			1	2	0	0	0								
			1	0	0	0	0								
				8	0	0	0								
				6	0	0	0								
				4	0	0	0								
				2	0	0	0								
				1	0	0	0								
					5	0	0					7	8	0	
												7	7	9	
			1	0	5	0	0								
			1	0	0	0	0								
				8	0	0	0								
				6	0	0	0								
				4	0	0	0								
				2	0	0	0								
				1	0	0	0								
					5	0	0					7	7	9	

OBSOLETE

Date: 5-10-79

BACKWATER CALCULATIONS PROGRAM - BKWT2

By: RML

Project Engineer

T.U.S.I. - Safe Shadeway Impoundment

CONTROL INFORMATION - TYPE 2

All Cards: Punch 2 in Col. 80

1										ELEV1									
3	4	5	6	7	8	9	10	14	15	16	17	18	19	20					
												7	7	8					
				8	8	0	0												
				8	0	0	0												
				6	0	0	0												
				4	0	0	0												
				2	0	0	0												
				1	0	0	0												
					5	0	0					7	7	8					
												7	7	7					
				7	2	0	0												
				6	0	0	0												
				4	0	0	0												
				2	0	0	0												
				1	0	0	0												
					5	0	0					7	7	7					
												7	7	6					
				5	9	0	0												
				4	0	0	0												
				2	0	0	0												
				1	0	0	0												
					5	0	0					7	7	6					

OBSOLETE

TUSL - SSL @ Comanche Peak

BACKWATER CALCULATIONS PROGRAM ~ BKWT2

Date: 8-10-74

By: RML

T.U.S.L. - Safe Shutdown Impoundment

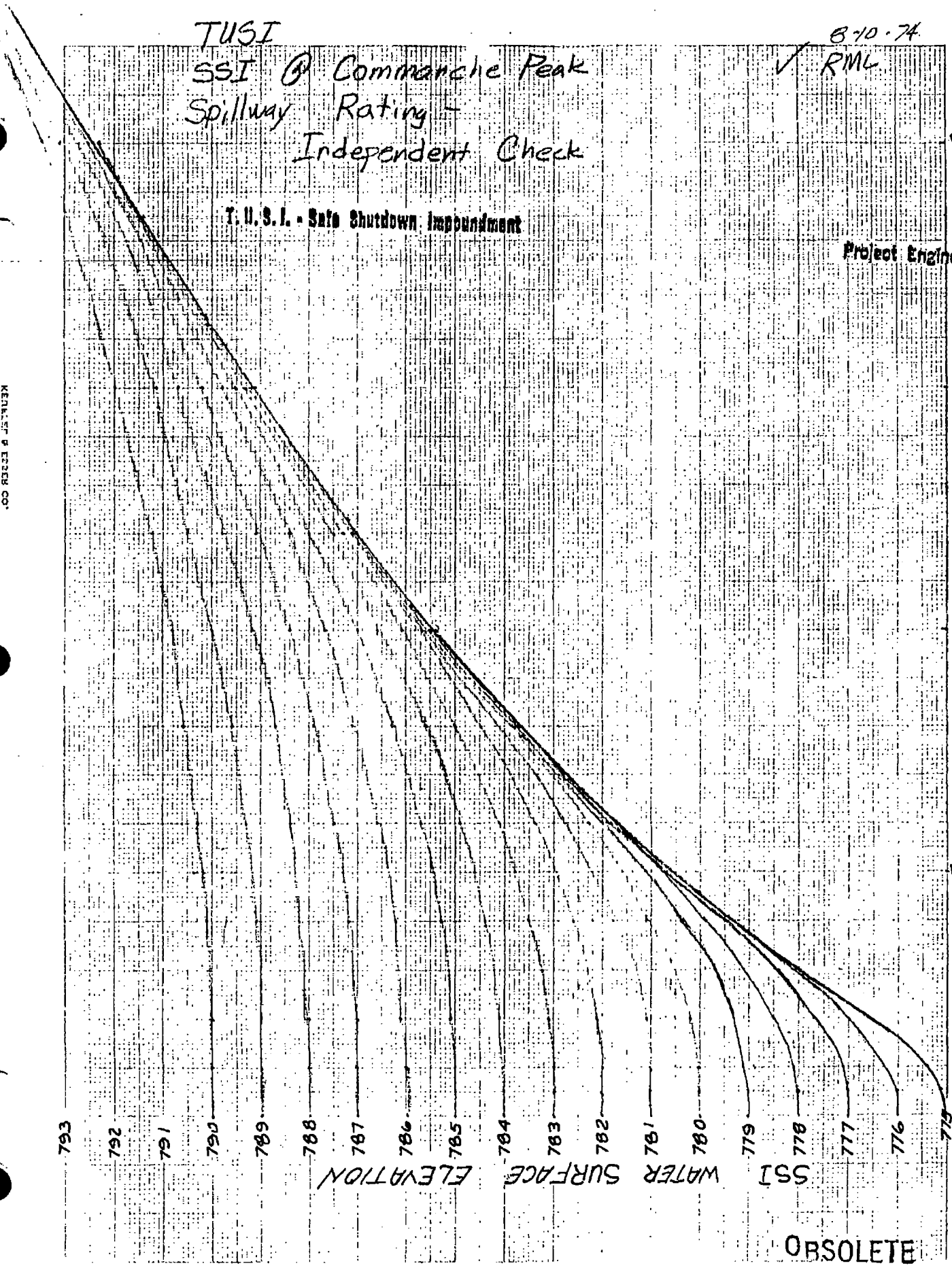
CONTROL INFORMATION ~ TYPE 3

Project Engineer

All Cards: Punch 3 in Col. 80

Q								ELEV1						
3	4	5	6	7	8	9	10	14	15	16	17	18	19	20
												7	7	5
				4	6	0	0							
				4	0	0	0							
				2	0	0	0							
				1	0	0	0							
					5	0	0					7	7	5

OBSOLETE


TUSI
SSI @ Commanche Peak
Spillway Rating -
Independent Check
8-10-74
RML
T. U. S. I. - Safe Shutdown Impoundment
Project Engineer
SSI WATER SURFACE ELEVATION
793
792
791
790
789
788
787
786
785
784
783
782
781
780
779
778
777
776
775
0
5
10
15
20
OBSOLETE

Client TUSI

Date: 8-19-74

Project Safe Shutdown Impoundment

By: ~~RML~~

Title: Discharge Rating - SSI

✓ RMN

Approved

Project Engineer

This rating curve compares very close to that derived in 7.B. page 15 of 15. The use of normal depth as the minimum reservoir elevation is somewhat conservative because for low water levels in the SCR combined with high discharges could result in critical depth at the SCR end of the discharge channel. For short lengths this critical depth does not have enough length to reach normal depth so lower SSI reservoir elevations could produce greater discharges

Freese AND Nichols CONSULTING ENGINEERS

OBSOLETE

Client TUSI Date: 8-21-74

Project Safe Shutdown Impoundment By: FML

Title: Reservoir Routing ✓ RMV

Approved _____
Project Engineer

The probable maximum floods were routed through the two reservoirs to determine the maximum water levels. The method of routing used the basic theory that for a period of time inflow is equal to outflow plus the change in storage during the interval. Since the outflow from the SSI depends on both the water levels in the SCR and SSI the routing of the SCR must be performed first. The average inflow for the maximum six hours of precipitation (2.5. page 14 of 15) is combined with inflow from other than the maximum six hours of precipitation (2.5. page 13 of 15). These are combined with an estimate of the outflow from the SSI. The outflow from the SSI is assumed to be the inflow. This flood is routed through the SCR using a computer program. The discharge and capacity must also be put into the program. These results are used to route the flood through the SSI. The revised outflow from the SSI is then compined with the other SCR inflow and routed through the SCR. The difference in the two flood routings in the SCR are very small so all results are assumed O.K.

The routing of the flood through the SSI is performed by a hand crank method. The inflow comes from 2.5. page 15 of 15. The discharge rating is from 2.7.B. page 17 of 18 and the capacity - elevation relationship from 6.B. page 7 of 7 is used.

Client TUSI

Date: 8-20-74

Project Safe Shutdown Impoundment

By: ~~RMAL~~

Title: SCR & SSI Reservoir Routing

✓ RMV

Approved _____ Project Engineer

The actual storage and discharge for various elev. are determined.

Elev. (msl.)	S_{TOTAL}	S_{SSI}	O_S	O_E	S_{SCR}	O_{SCR}
775	151047	558	0		150489	0
776	154293	599	316		153694	316
777	157576	642	913		156934	913
778	160895	686	1713		160209	1713
779	164252	733	2684		163519	2684
780	167648	781	3816		166867	3816
781	171083	832	5050		170251	5050
782	174,559	865	6430		173674	6430
783	178,077	940	7950	0	177137	7950
784	181,638	997	9630	3700	180641	13330
785	185,244	1056	11450	12900	184188	24350
786	188,897	1118	13300	25500	187,779	38800
787	192,599	1181	15300	41300	191,418	56600
788	196351	1247	17400	59200	195,104	76600
789	200,153	1316	19650	79500	198,837	99150
790	204,005	1386	21850	102100	202,619	123950
791	208,000*	1445	24100*	126500*	206,555	150,600
792		1510				

S_{TOTAL} - Total storage in SCR & SSI from 6.A. page 6 & 7 of 8.

S_{SSI} - Storage in SSI from 6.B. page 5 of 8. (Extropolated from 6.B. page 8 of 8 above El. 790.0)

O_S - Discharge from 100' ogee on SCR from 2.7.A page 8 of 26

O_E - Discharge from 2200 emergency spillway on SCR from 2.7.A page 8 of 26

S_{SCR} - Storage in SCR $S_{SCR} = S_{TOTAL} - S_{SSI}$

O_{SCR} - Discharge from SCR $O_{SCR} = O_S + O_E$

* extrapolated

Freese AND Nichols CONSULTING ENGINEERS

OBSOLETE

2.B. Page 2 Of 17

Date: 8-21-74
By: RML

T.U.S.I. - Safe Shutdown Impoundment

Project Engineer

RESERVOIR ROUTING PROGRAM

CONTROL CARD

TIME INTERVAL (hrs.)	NO. OF INFLOW CARDS	NO. OF ELEVATION-CAPACITY - DISCHARGE CARDS
.5	1	17

STARTING WATER SURFACE (ft. M.S.L.)	STARTING CAPACITY (Ac-Ft.)	MINIMUM WATER SURFACE (ft. M.S.L.)
775	150489	775

MINIMUM CAPACITY (Ac.-Ft.)
150489

OBSOLETE

DATE: 8-21-74
BY: RMC

Project Engineer

S.S.I. - Safe Shutdown Impoundment

RESERVOIR ROUTING PROGRAM

INFLOW CARD

AFA (Ac-FA)										BFA (Ac.-Ft.)										CFA (Ac. - Ft.)									
1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30

From 2.5. Page 13 of 15

From 2.5. Page 14 of 15

From 2.5. Page 15 of 15

OBSOLETE

DATE: 8-21-74
BY: RML

Project Engineer

T.U.S.I. - Safe Shutdown Impoundment

RESERVOIR ROUTING PROGRAM

ELEVATION - CAPACITY - DISCHARGE CARD

	ELEVATION (ft. MSL)										CAPACITY (Ac. - Ft.)										DISCHARGE (cfs)									
	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30
1								7	7	5					1	5	0	4	8	9										0
2								7	7	6					1	5	3	6	9	4								3	1	6
3								7	7	7					1	5	6	9	3	4								9	1	3
4								7	7	8					1	6	0	2	0	9							1	7	1	3
5								7	7	9					1	6	3	5	1	9							2	6	8	4
6								7	8	0					1	6	6	8	6	7							3	6	1	6
7								7	8	1					1	7	0	2	5	1							5	0	5	0
8								7	8	2					1	7	3	6	7	4							6	4	3	0
9								7	8	3					1	7	7	1	3	7							7	9	5	0
10								7	8	4					1	8	0	6	4	1						1	3	3	3	0
11								7	8	5					1	8	4	1	8	8						2	4	3	5	0
12								7	8	6					1	8	7	7	7	9						3	8	8	0	0
13								7	8	7					1	9	1	4	1	8						5	6	6	0	0
14								7	8	8					1	9	5	1	0	4						7	6	6	0	0
15								7	8	9					1	9	8	8	3	7						9	9	1	5	0
16								7	9	0					2	0	2	6	1	9					1	2	3	9	5	0
17								7	9	1					1	5	0	6	0	0					2	0	6	5	5	5

OBSOLETE

T.U.S.I. - Safe Shutdown Impoundment **Project Engineer**

SCR - RESERVOIR WATER SURFACE ELEVATIONS
PROBABLE MAXIMUM FLOOD
8-20-74 RML

/ RML

TIME (HR)	AVERAGE INFLOW (CFS)	(AC-FT)	AVERAGE OUTFLOW (CFS)	(AC-FT)	STO INC (AC-FT)	TOT STO ELEV	RES.
0.00	0.	0.	0.	0.	0.	150489.	775.00
0.50	389.	16.	0.	0.	16.	150505.	775.00
1.00	389.	16.	0.	0.	16.	150521.	775.00
1.50	389.	16.	2.	0.	16.	150537.	775.01
2.00	389.	16.	3.	0.	15.	150553.	775.01
2.50	389.	16.	4.	0.	15.	150569.	775.01
3.00	389.	16.	6.	0.	15.	150584.	775.02
3.50	389.	16.	8.	0.	15.	150600.	775.02
4.00	389.	16.	10.	0.	15.	150616.	775.03
4.50	781.	32.	12.	0.	31.	150648.	775.04
5.00	946.	39.	14.	0.	38.	150686.	775.05
5.50	1318.	54.	19.	0.	53.	150740.	775.07
6.00	1667.	68.	25.	1.	67.	150808.	775.09
6.50	1931.	79.	33.	1.	78.	150886.	775.11
7.00	2179.	90.	40.	1.	88.	150974.	775.14
7.50	2424.	100.	49.	2.	98.	151073.	775.17
8.00	2669.	110.	60.	2.	107.	151180.	775.21
8.50	2908.	120.	72.	2.	117.	151298.	775.24
9.00	3136.	129.	84.	3.	126.	151424.	775.28
9.50	3340.	138.	97.	4.	134.	151558.	775.32
10.00	3533.	146.	110.	4.	141.	151699.	775.37
10.50	3547.	146.	124.	5.	141.	151841.	775.41
11.00	3840.	158.	138.	5.	152.	151994.	775.46
11.50	3961.	163.	154.	6.	157.	152151.	775.51
12.00	4065.	168.	169.	7.	160.	152312.	775.56
12.50	4152.	171.	185.	7.	163.	152476.	775.61
13.00	4227.	174.	201.	8.	166.	152642.	775.66
13.50	4290.	177.	218.	9.	168.	152811.	775.71
14.00	4341.	179.	234.	9.	169.	152980.	775.76
14.50	4385.	181.	251.	10.	170.	153151.	775.82
15.00	4421.	182.	268.	11.	171.	153323.	775.87
15.50	4452.	184.	285.	11.	172.	153495.	775.93
16.00	4477.	185.	302.	12.	172.	153667.	775.98
16.50	4498.	185.	324.	13.	172.	153840.	776.03
17.00	4516.	186.	354.	14.	172.	154012.	776.09
17.50	4532.	187.	385.	15.	171.	154183.	776.14
18.00	4544.	187.	417.	17.	170.	154354.	776.19
18.50	4554.	188.	448.	18.	169.	154523.	776.24
19.00	4564.	188.	480.	19.	168.	154692.	776.30
19.50	4571.	188.	511.	21.	167.	154860.	776.35
20.00	4576.	189.	541.	22.	166.	155027.	776.40
20.50	4581.	189.	572.	23.	165.	155192.	776.45
21.00	4585.	189.	603.	24.	164.	155357.	776.50
21.50	4590.	189.	633.	26.	163.	155520.	776.55
22.00	5706.	235.	667.	27.	208.	155729.	776.61
22.50	6456.	266.	708.	29.	237.	155966.	776.69
23.00	7153.	295.	756.	31.	264.	156231.	776.77
23.50	7681.	317.	806.	33.	284.	156515.	776.86
24.00	8177.	337.	860.	35.	302.	156817.	776.95
24.50	9781.	404.	927.	38.	365.	157183.	777.06

OBSOLETE 28 sheet 4 of 17

F.U.S.I. - Safe Shutdown Impoundment

Project Engineer

SCR - RESERVOIR WATER SURFACE ELEVATIONS
PROBABLE MAXIMUM FLOOD
8-20-74 RMI

TIME (HR)	AVERAGE INFLOW (CFS)	(AC-FT)	AVERAGE OUTFLOW (CFS)	(AC-FT)	STO INC (AC-FT)	TOT STO ELEV	RES.
25.00	11023.	455.	1010.	42.	413.	157596.	777.19
25.50	13309.	550.	1129.	46.	503.	158100.	777.34
26.00	15037.	621.	1201.	52.	569.	158669.	777.52
26.50	16644.	687.	1409.	58.	629.	159299.	777.71
27.00	18038.	745.	1568.	64.	680.	159979.	777.92
27.50	20463.	845.	1758.	72.	772.	160752.	778.15
28.00	23582.	974.	1995.	82.	892.	161644.	778.42
28.50	30661.	1267.	2299.	95.	1171.	162816.	778.78
29.00	35910.	1483.	2688.	111.	1372.	164189.	779.19
29.50	40484.	1672.	3163.	130.	1542.	165731.	779.65
30.00	45333.	1873.	3721.	153.	1719.	167451.	780.16
30.50	57663.	2382.	4419.	182.	2200.	169651.	780.81
31.00	69884.	2887.	5347.	220.	2666.	172318.	781.59
31.50	112031.	4629.	6802.	281.	4348.	176666.	782.85
32.00	174619.	7215.	14600.	603.	6612.	183278.	784.73
32.50	158323.	6542.	31855.	1316.	5225.	188504.	786.19
33.00	151472.	6259.	52512.	2169.	4089.	192593.	787.30
33.50	142102.	5872.	70921.	2930.	2941.	195535.	788.10
34.00	145149.	5997.	86404.	3570.	2427.	197962.	788.76
34.50	148583.	6139.	100045.	4134.	2005.	199968.	789.28
35.00	149589.	6181.	111521.	4608.	1573.	201541.	789.70
35.50	145110.	5996.	120120.	4963.	1032.	202574.	789.98
36.00	136805.	5653.	125155.	5171.	481.	203055.	790.10
36.50	125777.	5197.	126773.	5238.	-41.	203014.	790.10
37.00	112256.	4638.	124999.	5165.	-526.	202487.	789.97
37.50	97874.	4044.	120248.	4968.	-924.	201563.	789.73
38.00	84441.	3489.	113307.	4682.	-1192.	200370.	789.41
38.50	71198.	2942.	104800.	4330.	-1388.	198981.	789.04
39.00	59899.	2475.	95749.	3956.	-1481.	197500.	788.64
39.50	50152.	2072.	86682.	3581.	-1509.	195991.	788.24
40.00	41987.	1735.	77827.	3216.	-1481.	194509.	787.84
40.50	35152.	1452.	69660.	2878.	-1425.	193084.	787.45
41.00	29475.	1218.	62126.	2567.	-1349.	191734.	787.09
41.50	24778.	1023.	55285.	2284.	-1260.	190474.	786.74
42.00	20920.	864.	49243.	2034.	-1170.	189303.	786.42
42.50	17772.	734.	43746.	1807.	-1073.	188230.	786.13
43.00	15219.	628.	38938.	1609.	-980.	187250.	785.85
43.50	13155.	543.	34945.	1444.	-900.	186349.	785.60
44.00	11497.	475.	31467.	1300.	-825.	185524.	785.37
44.50	10166.	420.	28293.	1169.	-749.	184775.	785.16
45.00	9089.	375.	25479.	1052.	-677.	184098.	784.98
45.50	8223.	339.	23213.	959.	-619.	183479.	784.80
46.00	7531.	311.	21359.	882.	-571.	182907.	784.64
46.50	6969.	288.	19649.	811.	-523.	182383.	784.49
47.00	6521.	269.	18085.	747.	-477.	181905.	784.36
47.50	5607.	231.	16630.	687.	-455.	181450.	784.23
48.00	4948.	204.	15256.	630.	-425.	181024.	784.11
48.50	3970.	164.	13955.	576.	-412.	180612.	783.99
49.00	3528.	145.	13019.	537.	-392.	180219.	783.88
49.50	3131.	129.	12424.	513.	-384.	179835.	783.77

T.U.S.I. - Safe Shutdown Impoundment

Project Engineer

SCR - RESERVOIR WATER SURFACE ELEVATIONS
PROBABLE MAXIMUM FLOOD
6-20-74 RM

TIME (HR)	AVERAGE INFLOW (CFS)	(AC-FT)	AVERAGE OUTFLOW (CFS)	(AC-FT)	STO INC (AC-FT)	TOT STO ELEV	RES.
50.00	2763.	114.	11840.	489.	-375.	179460.	783.66
50.50	2422.	100.	11271.	465.	-365.	179095.	783.56
51.00	2107.	87.	10716.	442.	-355.	178739.	783.46
51.50	1817.	75.	10177.	420.	-345.	178393.	783.36
52.00	1556.	64.	9654.	398.	-334.	178059.	783.26
52.50	1323.	54.	9148.	378.	-323.	177735.	783.17
53.00	1113.	46.	8659.	357.	-311.	177424.	783.08
53.50	938.	38.	8189.	338.	-299.	177124.	783.00
54.00	793.	32.	7891.	326.	-293.	176831.	782.91
54.50	665.	27.	7759.	320.	-293.	176538.	782.83
55.00	559.	23.	7631.	315.	-292.	176245.	782.74
55.50	469.	19.	7503.	310.	-290.	175955.	782.66
56.00	392.	16.	7376.	304.	-288.	175666.	782.58
56.50	329.	13.	7250.	299.	-285.	175380.	782.49
57.00	278.	11.	7125.	294.	-282.	175097.	782.41
57.50	234.	9.	7001.	289.	-279.	174818.	782.33
58.00	196.	8.	6879.	284.	-276.	174541.	782.25
58.50	164.	6.	6758.	279.	-272.	174269.	782.17
59.00	140.	5.	6640.	274.	-268.	174000.	782.09
59.50	118.	4.	6526.	269.	-264.	173736.	782.02
60.00	101.	4.	6414.	265.	-260.	173475.	781.94
60.50	87.	3.	6308.	260.	-257.	173218.	781.87
61.00	75.	3.	6205.	256.	-253.	172964.	781.79
61.50	62.	2.	6103.	252.	-249.	172715.	781.72
62.00	55.	2.	6007.	248.	-245.	172469.	781.65
62.50	48.	2.	5909.	244.	-242.	172227.	781.58
63.00	41.	1.	5812.	240.	-238.	171988.	781.51
63.50	36.	1.	5716.	236.	-234.	171753.	781.44
64.00	31.	1.	5622.	232.	-231.	171522.	781.38
64.50	26.	1.	5529.	228.	-227.	171295.	781.31
65.00	21.	0.	5438.	224.	-223.	171071.	781.24
65.50	16.	0.	5348.	221.	-220.	170851.	781.18
66.00	14.	0.	5260.	217.	-216.	170634.	781.12
66.50	12.	0.	5173.	213.	-213.	170421.	781.05
67.00	9.	0.	5088.	210.	-209.	170211.	780.99
67.50	7.	0.	5003.	206.	-206.	170004.	780.93
68.00	7.	0.	4933.	203.	-203.	169801.	780.87
68.50	4.	0.	4859.	200.	-200.	169600.	780.81
69.00	4.	0.	4786.	197.	-197.	169402.	780.75
69.50	4.	0.	4715.	194.	-194.	169208.	780.69
70.00	2.	0.	4644.	191.	-191.	169016.	780.64
70.50	2.	0.	4575.	189.	-188.	168827.	780.58
71.00	2.	0.	4506.	186.	-186.	168641.	780.53
71.50	2.	0.	4439.	183.	-183.	168457.	780.47
72.00	2.	0.	4372.	180.	-180.	168277.	780.42
72.50	2.	0.	4307.	177.	-177.	168099.	780.37
73.00	2.	0.	4242.	175.	-175.	167924.	780.31
73.50	0.	0.	4178.	172.	-172.	167751.	780.26
74.00	0.	0.	4116.	170.	-170.	167581.	780.21
74.50	0.	0.	4054.	167.	-167.	167413.	780.16

OBSOLETE

U.S.I. - Safe Shutdown Impoundment **Project Engineer**

SCR - RESERVOIR WATER SURFACE ELEVATIONS
PROBABLE MAXIMUM FLOOD
8-20-74 RML

TIME (HR)	AVERAGE INFLOW (CFS)	(AC-FT)	AVERAGE OUTFLOW (CFS)	(AC-FT)	STO INC (AC-FT)	TOT STO ELEV	RES.
75.00	0.	0.	3993.	165.	-165.	167248.	780.11
75.50	0.	0.	3934.	162.	-162.	167086.	780.07
76.00	0.	0.	3875.	160.	-160.	166926.	780.02
76.50	0.	0.	3817.	157.	-157.	166768.	779.97
77.00	0.	0.	3763.	155.	-155.	166612.	779.93
77.50	0.	0.	3711.	153.	-153.	166459.	779.88
78.00	0.	0.	3659.	151.	-151.	166308.	779.83
78.50	0.	0.	3609.	149.	-149.	166159.	779.79
79.00	0.	0.	3558.	147.	-147.	166012.	779.75
79.50	0.	0.	3509.	145.	-145.	165867.	779.70
80.00	0.	0.	3460.	143.	-143.	165724.	779.66
80.50	0.	0.	3412.	141.	-141.	165583.	779.62
81.00	0.	0.	3365.	139.	-139.	165444.	779.58
81.50	0.	0.	3318.	137.	-137.	165306.	779.53
82.00	0.	0.	3272.	135.	-135.	165171.	779.49
82.50	0.	0.	3226.	133.	-133.	165038.	779.45
83.00	0.	0.	3181.	131.	-131.	164906.	779.42
83.50	0.	0.	3137.	129.	-129.	164777.	779.38
84.00	0.	0.	3093.	127.	-127.	164649.	779.34
84.50	0.	0.	3050.	126.	-126.	164523.	779.30
85.00	0.	0.	3008.	124.	-124.	164399.	779.26
85.50	0.	0.	2966.	122.	-122.	164276.	779.23
86.00	0.	0.	2925.	120.	-120.	164155.	779.19
86.50	0.	0.	2884.	119.	-119.	164036.	779.15
87.00	0.	0.	2847.	117.	-117.	163918.	779.12
87.50	0.	0.	2808.	116.	-116.	163802.	779.09
88.00	0.	0.	2769.	114.	-114.	163688.	779.06
88.50	0.	0.	2730.	112.	-112.	163575.	779.02
89.00	0.	0.	2693.	111.	-111.	163464.	778.99
89.50	0.	0.	2659.	109.	-109.	163354.	778.95
90.00	0.	0.	2626.	108.	-108.	163245.	778.92
90.50	0.	0.	2595.	107.	-107.	163138.	778.89
91.00	0.	0.	2563.	105.	-105.	163032.	778.86
91.50	0.	0.	2532.	104.	-104.	162927.	778.82
92.00	0.	0.	2502.	103.	-103.	162824.	778.79
92.50	0.	0.	2474.	102.	-102.	162722.	778.76
93.00	0.	0.	2442.	100.	-100.	162621.	778.73
93.50	0.	0.	2412.	99.	-99.	162521.	778.70
94.00	0.	0.	2385.	98.	-98.	162422.	778.67
94.50	0.	0.	2357.	97.	-97.	162325.	778.64
95.00	0.	0.	2329.	96.	-96.	162229.	778.61
95.50	0.	0.	2300.	95.	-95.	162134.	778.59
96.00	0.	0.	2273.	93.	-93.	162040.	778.56
96.50	0.	0.	2245.	92.	-92.	161947.	778.53
97.00	0.	0.	2218.	91.	-91.	161855.	778.50
97.50	0.	0.	2191.	90.	-90.	161765.	778.47
98.00	0.	0.	2165.	89.	-89.	161675.	778.45
98.50	0.	0.	2138.	88.	-88.	161587.	778.42
99.00	0.	0.	2113.	87.	-87.	161500.	778.39
99.50	0.	0.	2087.	86.	-86.	161413.	778.37

OBSOLETE

L. B. & L. - Safe Shutdown Impoundment

Project Engineer

Date: 8-21-74

By: RML

Flood - Routing - SSI

	TIME (hrs)	1 W.S. S.C.R.	2 Avg. Inflow (Ac-Ft.)	3 W.S. S.S.I.	4 Storage (Ac.-Ft.)	5 Outflow (cfs)
1	0	775.00		775.0	560	0
2	1	775.00	0.6	775.0	560	7
3	2	775.01	.6	775.0	560	7
4	3	775.02	.6	775.0	560	7
5	4	775.03	.6	775.0	560	7
6	5	775.05	1.3	775.0	560	21
7	6	775.09	5.4	775.1	560	
8	7	775.14	13.6	775.1	560	
9	8	775.21	17.7	775.2	570	
10	9	775.28	19.1	175.3	575	
11	10	775.37	19.5	775.4	570	
12	11	775.46	19.6	775.5	580	
13	12	775.56	19.6	775.6	585	
14	13	775.66	19.7	775.7	590	
15	14	775.76	19.7	775.8	595	
16	15	775.87	19.7	775.9	600	
17	16	775.98	19.7	776.0	603	
18	17	776.09	19.7	776.1	605	
19	18	776.19	19.7	776.2	610	
20	19	776.30	19.7	776.3	615	
21	20	776.40	19.7	776.4	620	178
22	21	776.50	19.7	776.5	625	178
23	22	776.61	20.4	776.6	630	195
24	23	776.77	29.3	776.8	635	353
25	24	776.95	45.6	777.0	645	469
26	25	777.19	57.3	777.2	655	676
27	26	777.52	78.4	777.6	675	700
28	27	777.92	106.8	778.1	693	1500
29	28	778.42	129.0	778.4	710	1200
30	29	779.19	173.0	779.5	760	1800
31	30	780.16	264.2	780.7	820	3000
32	31	781.59	363.8	782.2	900	4000
33	32	784.73	644.4	785.7	1100	6700
34	33	787.30	1247.3	790.8	1430	15600
35	34	788.76	1201.5	790.7	1425	13700
36	35	789.70	708.0	789.8	1370	4700
37	36	790.10	424.4	790.4	1405	4800
38	37	789.97	271.0	790.0	1380	2300
39	38	789.41	171.5	789.4	1340	2800
40	39	788.61	102.1	788.6	1290	900
	40	787.81	55.7	787.8	1230	1800

6	7	8	9	10	11	12	13
[redacted]FLOW (AC.-FT.)	OUTFLOW - INFLOW (AC.-FT.)	NEW CAPACITY (AC.-FT.)	COMPUTED SSI EL.				
		560					
6	0	560					
6	0	560					
5	0	560					
5	0	560					
13	0	560					
5.4	0	560					
13.6	0	560					
12.2	5	565					
14.1	5	570					
14.5	5	575					
14.6	5	580					
14.6	5	585					
14.7	5	590					
14.7	5	595					
14.7	5	600					
14.7	3	603					
[redacted]7	2	605					
14.7	5	610					
14.7	5	615					
14.7	5	620					
14.7	5	625					
15.4	5	630					
24.3	5	635					
35.6	10	645					
47.3	10	655					
56.9	21.5	676					
90.9	16.9	692					
111.6	17.4	709					
224.0	49.0	758					
98.3	65.9	824					
89.3	74.5	899					
72.1	202.3	1101					
21.5	325.8	1427	use 1430				
10.7	-6.2	1424					
60.3	-52.3	1372	use 1370				
[redacted]6	31.8	1404					
95.0	-24	1380					
11.5	-40	1340					
52.7	-50	1290					
15.2	-60	1230					

W.S.-S.S.I. - Assumed Water Surface for SSI

Storage in SSI for W.S.-S.S.I.

Outflow - Discharge obtained using W.S. SCR & W.S.-S.S.I. and 72 hours previous

Average Outflow - Average of outflow from this hour and previous hour

New Capacity - Capacity from previous hour + Outflow + Inflow

W.S. - SCR - Water Surface on SCR at that time (From 29 page 6 to 9 of 17)

Avg. Inflow - Average inflow for the time period (From 25 page 15 of 15)

The average inflows are added to get the hourly period.

Client TUSI

Project Safe Shutdown Impoundment

Title: Mass Curve for Outflow - SSI

Date: 8-21-74

By: RML

✓

Approved

Project Engineer

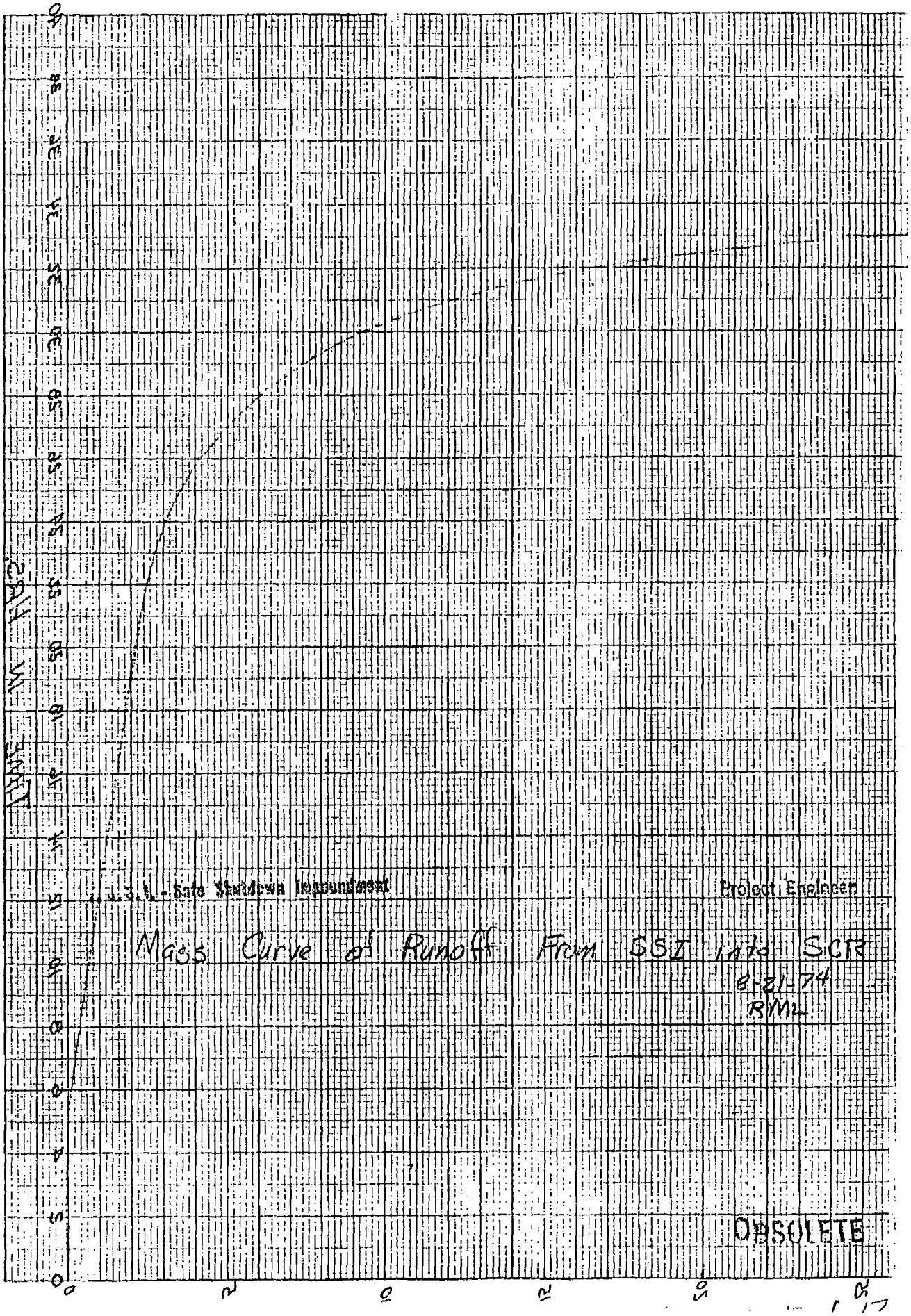
Time (hr.)	Outflow Avg. (Ac-Ft)	Outflow Cumulative (Ac-Ft)	Time (hr)	Outflow Avg. (Ac-Ft)	Outflow Cumulative (Ac-Ft)
0					
1	0.6	0.6	21	14.7	230.0
2	.6	1.2	22	15.4	245.4
3	.6	1.8	23	24.3	269.7
4	.6	2.4	24	35.6	305.3
5	1.3	3.7	25	47.3	352.6
6	5.4	9.1	26	56.9	409.5
7	13.6	22.7	27	90.9	500.4
8	12.2	34.9	28	111.6	612.0
9	14.1	49.0	29	124.0	736.0
10	14.5	63.5	30	198.3	934.3
11	14.6	78.1	31	289.3	1223.6
12	14.6	92.7	32	442.1	1665.7
13	14.7	107.4	33	921.5	2587.2
14	14.7	122.1	34	1210.7	3797.9
15	14.7	136.8	35	760.3	4558.2
16	16.7	153.5	36	392.6	4950.8
17	17.7	171.2	37	295.0	5245.8
18	14.7	185.9	38	211.5	5457.3
19	14.7	200.6	39	152.7	5610.0
20	14.7	215.3	40	115.2	5725.2

The average outflow is from E.B. page 10 of 17 and added to get cumulative. This is plotted on E.B. page 12 of 17 so that the half hour increments can be determined.

Freese AND Nichols CONSULTING ENGINEERS

OBSOLETE

E.B. Page 11 Of 17


Mass Curve of Runoff From SSE into SCR
6-21-74
RMH
OBSOLETE

30
34
40
42
50
52

Client TUSI

Date: 8-21-74

Project Safe Shutdown Impoundment

By: RML

Title: Mass Curve for Outflow - SSI

✓ RML

Approved

Project Engineer

Time	Outflow		Time	Outflow	
(hr.)	Cumulative (Ac-Ft)	Avg. (Ac-Ft)	(hr.)	Cumulative (Ac-Ft)	Avg. (Ac-Ft)
0					
.5	0.3	0.3	10.5	70.8	7.3
1.0	0.6	0.3	11.0	78.1	7.3
1.5	0.9	.3	11.5	85.4	7.3
2.0	1.2	.3	12.0	92.7	7.3
2.5	1.5	.3	12.5	100.0	7.3
3.0	1.8	.3	13.0	107.4	7.4
3.5	1.9	.3	13.5	114.8	7.4
4.0	2.4	.3	14.0	122.1	7.3
4.5	2.9	.5	14.5	129.4	7.3
5.0	3.7	.8	15.0	136.8	7.4
5.5	5.8	2.1	15.5	145.1	8.3
6.0	9.1	3.3	16.0	153.5	8.4
6.5	14.6	5.5	16.5	162.2	8.7
7.0	22.7	8.1	17.0	171.2	9.0
7.5	29.2	6.5	17.5	178.6	7.4
8.0	34.9	5.7	18.0	185.9	7.3
8.5	41.7	6.8	18.5	193.2	7.3
9.0	49.0	7.3	19.0	200.6	7.4
9.5	56.3	7.3	19.5	208.0	7.4
10.0	62.5	7.2	20.0	215.3	7.3

These values for half hour increments are obtained from 2.8. page 11 & 12 of 17.

Freese AND Nichols CONSULTING ENGINEERS

OBSOLETE

2.9 Page 13 Of 17

Client TUSI

Project Safe Shutdown Impoundment

Title: Outflow from SSI

Date: 8-21-74

By: RML

✓ RML

Approved _____ Project Engineer

Time (hrs.)	Outflow Cumulative (Ac.-Ft.)	Outflow Avg. (Ac.-Ft.)	Time (hrs)	Outflow Cumulative (Ac-Ft)	Outflow Avg. (Ac-Ft)
20.5	222.6	7.3	30.5	1069.3	135.0
21.0	230.0	7.4	31.0	1223.6	154.3
21.5	237.7	7.7	31.5	1410.0	186.4
22.0	245.4	7.7	32.0	1665.7	255.7
22.5	255.4	10.0	32.5	2030.0	364.3
23.0	269.7	14.3	33.0	2587.2	557.2
23.5	286.0	16.3	33.5	3320.0	732.8
24.0	305.3	19.3	34.0	3797.9	477.9
24.5	328.3	23.0	34.5	4220	422.1
25.0	352.6	24.3	35.0	4558.2	338.2
25.5	379.6	27.0	35.5	4800	241.8
26.0	409.5	29.9	36.0	4950.8	150.8
26.5	4500	40.5	36.5	5100.8	150.0
27.0	500.4	50.4	37.0	5245.8	145.0
27.5	554.4	54.0	37.5	5360	114.2
28.0	612.0	57.6	38.0	5457.3	97.3
28.5	671	59.0	38.5	5538.3	81.0
29.0	736.0	65.0	39.0	5610.0	71.7
29.5	821.0	85.0	39.5	5670.0	60.0
30.0	934.3	113.3	40.0	5715.2	39.2

Freese AND Nichols CONSULTING ENGINEERS

OBSOLETE

2.13. Page 14 Of 17

T.U.S.I. - Safe Shutdown Impoundment **Project Engineer**

SCR - RESERVOIR WATER SURFACE ELEVATIONS
PROBABLE MAXIMUM FLOOD
8-20-74 RNL

JPWL

This inflow is the same as that on 2.8. page 4 of 17 except the inflow from the SSI (CFA) comes from 2.8. page 15 of 17

TIME (HR)	AVERAGE INFLOW (CFS)	(AC-FT)	AVERAGE OUTFLOW (CFS)	(AC-FT)	STO INC (AC-FT)	TOT STO	RES. ELEV
0.00	0.	0.	0.	0.	0.	150489.	775.00
0.50	389.	16.	0.	0.	16.	150505.	775.00
1.00	389.	16.	0.	0.	16.	150521.	775.00
1.50	389.	16.	2.	0.	16.	150537.	775.01
2.00	389.	16.	3.	0.	15.	150553.	775.01
2.50	389.	16.	4.	0.	15.	150569.	775.01
3.00	389.	16.	6.	0.	15.	150584.	775.02
3.50	389.	16.	8.	0.	15.	150600.	775.02
4.00	389.	16.	10.	0.	15.	150616.	775.03
4.50	779.	32.	12.	0.	31.	150648.	775.04
5.00	948.	39.	14.	0.	38.	150686.	775.05
5.50	1331.	55.	19.	0.	54.	150740.	775.07
6.00	1655.	68.	26.	1.	67.	150808.	775.09
6.50	1919.	79.	32.	1.	77.	150886.	775.11
7.00	2190.	90.	40.	1.	88.	150974.	775.14
7.50	2374.	98.	49.	2.	96.	151070.	775.17
8.00	2586.	106.	60.	2.	104.	151175.	775.20
8.50	2845.	117.	71.	2.	114.	151289.	775.24
9.00	3080.	127.	83.	3.	123.	151413.	775.28
9.50	3286.	135.	95.	3.	131.	151545.	775.32
10.00	3470.	143.	109.	4.	138.	151684.	775.36
10.50	3487.	144.	122.	5.	139.	151823.	775.41
11.00	3780.	156.	136.	5.	150.	151974.	775.45
11.50	3901.	161.	151.	6.	154.	152129.	775.50
12.00	4005.	165.	167.	6.	158.	152287.	775.55
12.50	4092.	169.	183.	7.	161.	152449.	775.60
13.00	4169.	172.	199.	8.	164.	152613.	775.65
13.50	4232.	174.	215.	8.	166.	152779.	775.70
14.00	4280.	176.	231.	9.	167.	152946.	775.75
14.50	4324.	178.	248.	10.	168.	153115.	775.81
15.00	4363.	180.	264.	10.	169.	153284.	775.86
15.50	4416.	182.	281.	11.	170.	153455.	775.91
16.00	4443.	183.	298.	12.	171.	153626.	775.97
16.50	4472.	184.	318.	13.	171.	153798.	776.02
17.00	4498.	185.	346.	14.	171.	153969.	776.07
17.50	4474.	184.	377.	15.	169.	154138.	776.12
18.00	4484.	185.	409.	16.	168.	154307.	776.18
18.50	4493.	185.	440.	18.	167.	154474.	776.23
19.00	4506.	186.	470.	19.	166.	154641.	776.28
19.50	4513.	186.	501.	20.	165.	154807.	776.33
20.00	4515.	186.	532.	21.	164.	154972.	776.38
20.50	4520.	186.	562.	23.	163.	155135.	776.43
21.00	4527.	187.	592.	24.	162.	155298.	776.48
21.50	4539.	187.	622.	25.	161.	155460.	776.53
22.00	5636.	232.	655.	27.	205.	155665.	776.59
22.50	6396.	264.	696.	28.	235.	155901.	776.67
23.00	7093.	293.	743.	30.	262.	156163.	776.75
23.50	7562.	312.	793.	32.	279.	156443.	776.84
24.00	8053.	332.	846.	34.	297.	156741.	776.93
24.50	9682.	400.	911.	37.	362.	157103.	777.04

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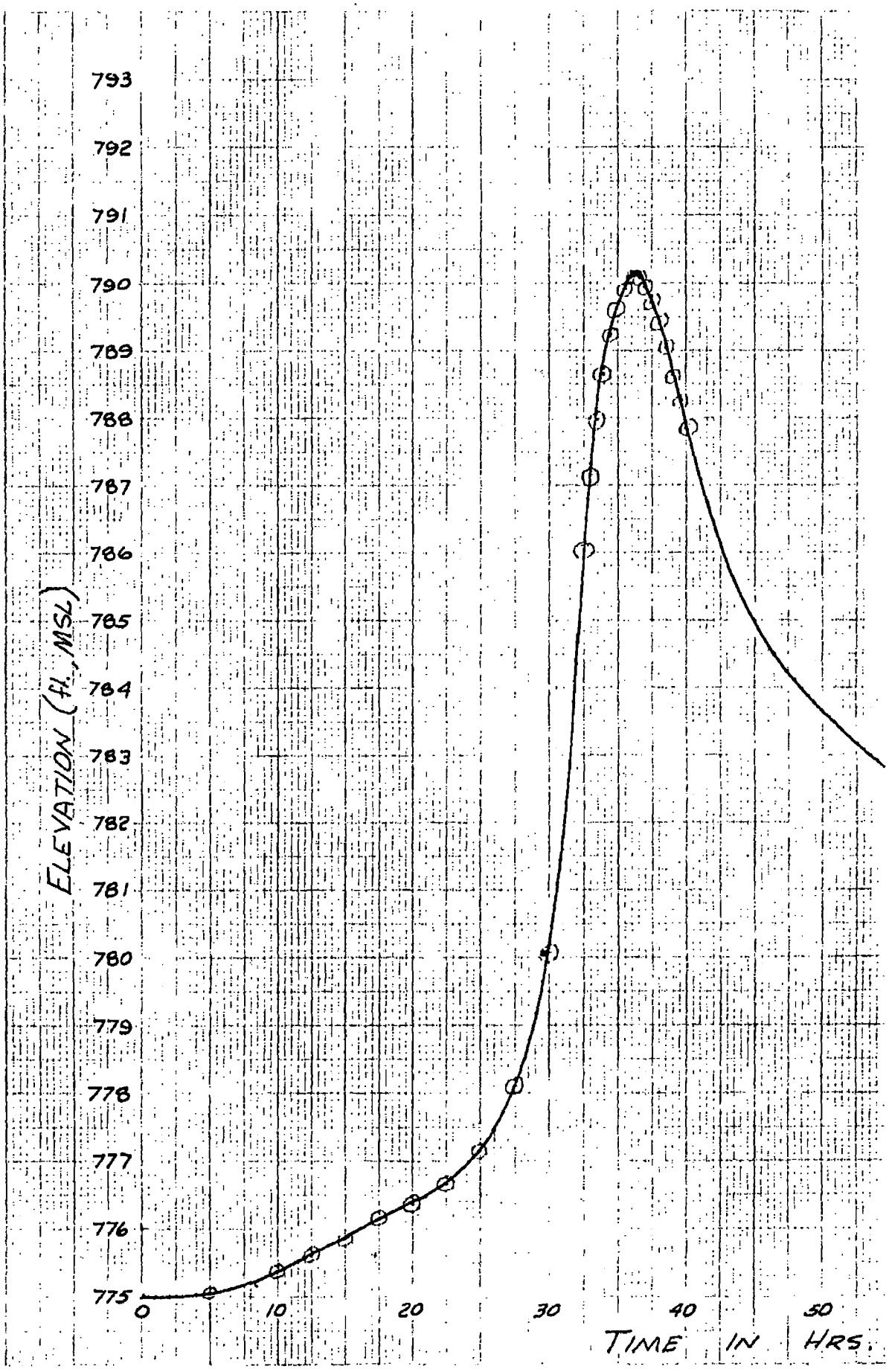
T.U.S.I. - Safe Shutdown Impoundment

SCR - RESERVOIR WATER SURFACE ELEVATIONS
PROBABLE MAXIMUM FLOOD
6-20-74 RML

Project Engineer
RML

TIME (HR)	AVERAGE INFLOW (CFS)	(AC-FT)	AVERAGE OUTFLOW (CFS)	(AC-FT)	STO INC (AC-FT)	TOT STO ELEV	RES.
25.00	10880.	449.	998.	41.	408.	157512.	777.16
25.50	13097.	541.	1107.	45.	495.	158007.	777.31
26.00	14732.	608.	1237.	51.	557.	158565.	777.49
26.50	16010.	678.	1382.	57.	620.	159146.	777.68
27.00	17886.	739.	1540.	63.	675.	159861.	777.88
27.50	20274.	837.	1725.	71.	766.	160628.	778.11
28.00	23350.	964.	1957.	80.	883.	161512.	778.38
28.50	30204.	1248.	2257.	93.	1154.	162666.	778.73
29.00	35181.	1453.	2636.	108.	1344.	164011.	779.14
29.50	39634.	1637.	3098.	128.	1509.	165521.	779.59
30.00	44588.	1842.	3643.	150.	1691.	167213.	780.09
30.50	56879.	2350.	4327.	178.	2171.	169385.	780.73
31.00	68865.	2845.	5237.	216.	2629.	172014.	781.50
31.50	110221.	4554.	6659.	275.	4279.	176293.	782.74
32.00	171534.	7088.	13794.	570.	6518.	182811.	784.60
32.50	153885.	6356.	29751.	1229.	5129.	187941.	786.03
33.00	148028.	6116.	49550.	2047.	4069.	192010.	787.15
33.50	143651.	5936.	60112.	2814.	3121.	195132.	788.00
34.00	143750.	5940.	84075.	3474.	2465.	197596.	788.66
34.50	149047.	6159.	98071.	4052.	2106.	199704.	789.21
35.00	150388.	6214.	110082.	4548.	1665.	201370.	789.66
35.50	145238.	6001.	119138.	4923.	1078.	202448.	789.94
36.00	135907.	5616.	124308.	5136.	479.	202927.	790.07
36.50	125755.	5196.	125907.	5202.	-6.	202921.	790.07
37.00	112856.	4663.	124413.	5141.	-477.	202444.	789.95
37.50	98322.	4062.	120037.	4960.	-897.	201546.	789.72
38.00	84961.	3510.	113269.	4680.	-1169.	200376.	789.41
38.50	71745.	2964.	104901.	4334.	-1370.	199006.	789.05
39.00	60565.	2502.	95960.	3965.	-1462.	197544.	788.66
39.50	50827.	2100.	86990.	3594.	-1494.	196049.	788.26
40.00	42763.	1767.	78208.	3231.	-1464.	194585.	787.86
40.50	0.	0.	66473.	2746.	-2746.	191838.	787.12
41.00	0.	0.	53477.	2209.	-2209.	189628.	786.51
41.50	0.	0.	43536.	1799.	-1799.	187829.	786.01
42.00	0.	0.	36128.	1492.	-1492.	186336.	785.60
42.50	0.	0.	30577.	1263.	-1263.	185073.	785.25
43.00	0.	0.	25936.	1071.	-1071.	184001.	784.95
43.50	0.	0.	22405.	925.	-925.	183075.	784.69
44.00	0.	0.	19695.	813.	-813.	182261.	784.46
44.50	0.	0.	17311.	715.	-715.	181546.	784.26
45.00	0.	0.	15242.	629.	-629.	180916.	784.08
45.50	0.	0.	13613.	562.	-562.	180353.	783.92
46.00	0.	0.	12540.	518.	-518.	179835.	783.77
46.50	0.	0.	11766.	486.	-486.	179349.	783.63
47.00	0.	0.	11040.	456.	-456.	178893.	783.50
47.50	0.	0.	10358.	428.	-428.	178465.	783.38
48.00	0.	0.	9719.	401.	-401.	178063.	783.27
48.50	0.	0.	9119.	376.	-376.	177686.	783.16
49.00	0.	0.	8556.	353.	-353.	177333.	783.06
49.50	0.	0.	8031.	331.	-331.	176998.	782.96

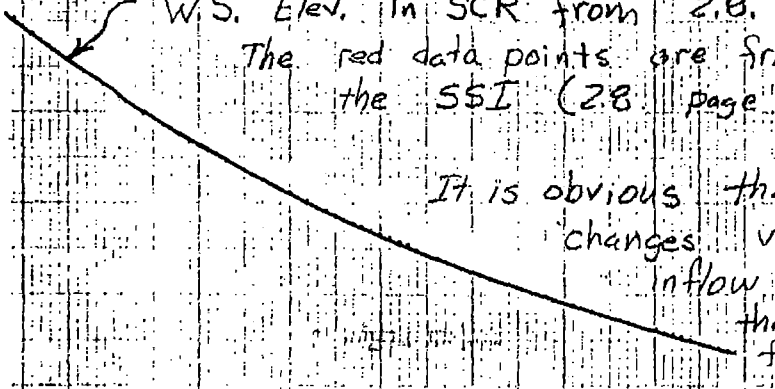
OBSOLETE


793
792
791
790
789
788
787
786
785
784
783
782
781
780
779
778
777
776
775
ELEVATION (Ft., MSL)
0
10
20
30
40
50
TIME IN HRS.

W.S. Elev. in SCR from 2.8. page 6 to 9 of 17

The red data points are from the routed outflow from the SSI (2.8 page 15 & 16 of 17)

It is obvious that the W.S. Elev. in the SCR changes very little no matter if the inflow from the SSI drainage area or the outflow routed through the reservoi from the SSI is used.



0 70 80 90 100