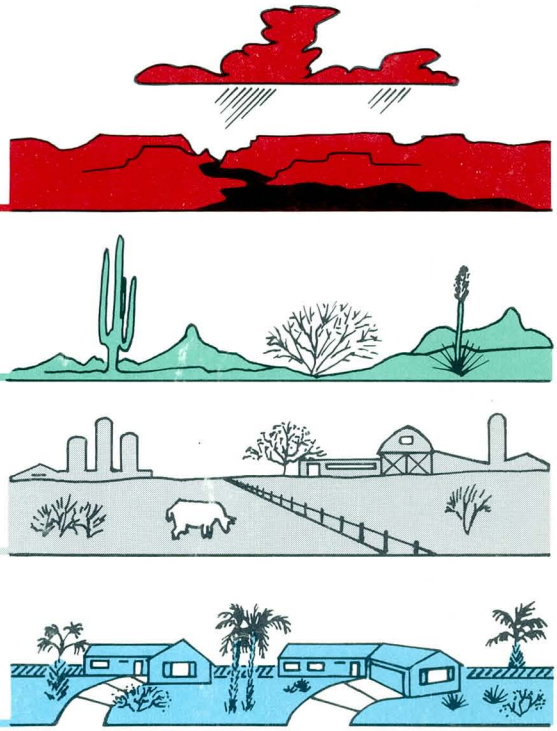

FLOOD CONTROL DISTRICT OF MARICOPA COUNTY

0 Watershed modeling - Schematic
0 Input data
10-day routing
0 Summary Tables
down Check
ary of results, Phase II

SADDLEBACK FRS
DESIGN VOL I

FLOOD CONTROL DISTRICT

JDB NO 3043-000

SADDLEBACK FLOODWATER RETARDING STRUCTURE

HARQUAHALA VALLEY WATERSHED

ENGINEERING DOCUMENTATION: PHASE II

PART I

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TABLE OF CONTENTS

Toups Corp.

SECTION

I. Narrative, References

II. Site Information

1. List of Maps

III. Hydraulics and Hydrology

Saddleback FRS:

Subdrainage areas and runoff curve numbers
Precipitation, data - General
- Emergency Spillway
- Principal Spillway

Concentration times

Area-Capacity and Stage-Discharge Curves
- G.R.A. Dike (C.A.P.)
-SADFRS (Basin #1 + Basin #2)
-SADFRS (Basin #1 Only)
-SADFRS (Basin #2 Only)

Hydrology computations

-FH, ESH, 100-Yr., 50-Yr., 10-Yr. storms III
-PSH- 10 day
-TR-20 Watershed modeling - Schematic
-TR-20 Input data
-PSH 10-day routing
-TR-20 Summary Tables
-Drawdown Check
-Summary of results, Phase II

SADDLEBACK FRS DESIGN VOL I

SADDLEBACK FLOODWATER RETARDING STRUCTURE

TABLE OF CONTENTS (CON'T.)

III. Hydraulics and Hydrology (Continued)
Saddleback FRS:

Structure Hydraulics

-SAF Basin-Principal Spillway
-Buckeye-Salome Road Ramp
-Drainage Channel - Backwater Analysis
(HEC-2 Computer results)

IV. Structural Design

Saddleback FRS Principal Spillway

Box Conduit

SAF Basin and Wingwalls

Inlet - Wingwall and Apron

Vegetative maintenance conduits - FRS

Riser inlet stability analysis - FRS

Joint extensibility requirements

V. Environmental Design & Quantities

VI. Land Rights Design and Quantities

1. Buckeye - Salome Road Crossing
Plan View
Quantities
2. AT & T Cable Relocation
3. Right-of-Way

VII. Summary - Quantities and Cost Estimates

PART II

BID SCHEDULE AND SPECIFICATIONS

PART I

INTRODUCTION

The Harquahala Watershed, located approximately seventy miles west of Phoenix, Arizona, is composed of three major structural works that either singly or in combination provide floodplain protection to the area. The purpose of this report is to describe the general features of the Saddleback Flood Retarding Structure and Diversion in accordance with the Harquahala Valley Watershed Work Plan Supplement Number 1 and the Environmental Impact Statement.

This report describes the engineering design procedures, criteria and selections used to develop the hydrological design, structural components and estimated cost for the construction of this structure.

SITE DEVELOPMENT

The site location, description of topography, land uses both present and future, existing cultural features and socio-economic disposition have been described in the work plan supplement and the environmental impact statement and will, therefore, not be discussed further in this report.

Horizontal alignment along the FRS centerline axis remains unchanged with reference to the alignment previously set by the Soil Conservation Service with the exception of the south structure leg which parallels Courthouse Road (Sta. 0+00 to Sta. 9+33). This section was moved approximately 125 feet further north to mitigate potential construction conflicts with Courthouse Road as well as reducing visual and asthetic problems that would result if the structure were immediately adjacent to the road right-of-way.

The Granite Reef Aqueduct intercepts storm runoff from over 54.7 square miles of watershed, a portion of which would have contributed directly to the Saddleback FRS. The flood control dike upstream and adjacent to the aqueduct is approximately twenty feet high and has a detention capacity of 7,500 acre feet at the top dike elevation. Flow is released downstream from the dike through five ungated conduit overchutes. The Saddleback FRS is effected by only one of the overchutes (G.R.A. Reach 6 Sta. 243+00) immediately east and adjacent to Burnt Mountain.

The drainage area within the watershed was computed on USGS 7-1/2 minute quadrangles using standard planimetering procedures to determine individual sub-areas (Map No. 1) precipitation values were obtained from isopluvial maps published by the National Oceanic and Atmospheric Administration, "Precipitation-Frequency Atlas of the Western United States", Volume VIII for the State of Arizona. The values obtained compared favorably to the values used in the Work Supplement Plan. Probable maximum precipitation values were referenced from the publication by Riedel and Hansen, "Probable Maximum Thunderstorm Precipitation Estimates Southwest States".

The area-capacity curve for the Saddleback FRS was re-evaluated using the 1" = 100' scale topographic map. The new area-capacity curve did not include any storage available in borrow or drain channel area.

The Saddleback FRS alignment and location allows for adequate water impoundments without threat of inundation on Interstate Highway 10. Elevation on the eastbound roadbed along Interstate 10 at its lowest point, which could have been affected from impoundments, is at elevation 1195.5

Top of dam elevation has been set at 1193.0 from Sta. 300+00 to Sta. 171+37 and 1194.0 from Sta. 171+37 to 272+70 while principal spillway crest elevation is 1176.9. The maximum water surface that will be reached from the passage of the 100 year, 10 day storm will be to elevation 1190.1. A freeboard of some 1.5 feet remains, therefore, between maximum water surface and the lowest point on the Interstate Highway.

The Saddleback Diversion, which receives a maximum controlled release of 1120 cfs from the flood retarding structure, extends approximately 4.7 miles to the south and discharges into Centennial Wash, a natural drainage. There are seven subareas within the watershed on the western slope of Saddleback Mountain which drains into the Saddleback Diversion. The drainage area along with a schematic of the TR-20 computer modeling showing area, curve number, time of concentration, concentration points, length of reach and routing co-efficients is delineated on Map Number 1. The results obtained in the hydrology design compared favorably with hydrologic data over the same area previously furnished by the Soil Conservation Service.

PRINCIPAL SPILLWAY

The principal spillway for the Saddleback FRS will be a dual purpose structure that will allow discharge under conditions of normal operations as well as that of an emergency spillway. As a result the structure will not have an open chute over the crest of the embankment.

Routing through the 10' x 8' spillway was based upon the Principal Spillway and Freeboard hydrographs. The spillway will be ungated and incorporate a straight drop inlet.

Anti-seep collars, joints, wingwalls, etc. are designed using SCS criteria. The designs for the outlet spilling basin is based upon "Hydraulic Design of Energy Dissipators for Culverts and Channels", NEH 14.

REFERENCES

S.C.S. NATIONAL ENGINEERING HANDBOOKS

Section 2	"Standards for Conservation Practices"
Section 3	Sedimentation
Section 4	Hydrology
Section 5	"Hydraulics"
Section 11	"Drop Spillways"
Section 14	"Chute Spillways"
Section 16	"Drainage of Agricultural Land"

S.C.S. TECHNICAL RELEASES

TR #12	"Sediment Storage Requirements for Reservoir"
TR #20	"Computer Program for Project Formulation - Hydrology"
TR #29	"Hydraulics of Two Way Covered Risers"
TR #30	"Structural Design of Standard Covered Risers"
TR #39	"Hydraulics of Broad Crested Spillways"
TR #46	"Gated Outlet Appurtanances, Earth Dams"
TR #48	"Dams 2"
TR #54	"SAF Stiling Basins"
TR #59	"Hydraulic Design of Riprap Gradient Control Structures"
TR #60	"Earth Dams and Reservoirs"

S.C.S. ENGINEERING MEMORADA (CRITERIA)

EM # 7 (Rev. 2)	Dated 04/02/73	"Preparation of Engineering Designs and Construction Drawings and Specifications"
EM #27 (Rev. 2)	Dated 06/01/76	"Dams"
EM #35 (Rev. 6)	Dated 04/02/73	"Specifications for Construction Contracts for FP, WP or RC&D Projects"
EM #39 (Rev.)	Dated 01/27/60	"Standard Format for Engineering Notes"
EM #50	Dated 05/16/63	
Supp. #1	Dated 11/23/65	
Supp. #2	Dated 02/01/66	
Supp. #3	Dated 09/12/66	
Supp. #4	Dated 10/05/66	
Supp. #5	Dated 06/02/67	
EM #66	Dated 06/21/73	"Guidelines for Minimizing Soil Erosion and Water and Air Pollution During Construction."

Other

"Computation Standards for Engineering Work", S.C.S. TSC Unit, Portland, Oregon, August, 1969.

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Design Note 8, "Entrance Head Losses in Drop Inlet Spillways"

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Runoff Curve Numbers for Semiarid Range and Forest Conditions by Woodward, Paper #73-209 ASAE

Harquahala Watershed - Workplan by Wall 09/25/64

Granite Reef Aqueduct, Specs. No. DC-7268, Bureau of Reclamation, 1977

Saddleback F.R.S. Engineering Documentation (Work Plan)

S.C.S. Materials Testing by Sergent, Hauskins & Beckwith Report #2

S.C.S. Materials Testing by Sergent, Hauskins & Beckwith Report #3

Preliminary Geologic Investigation Report Harquahala Valley Watershed by P.F. Pedone, March, 1978

Sedimentation; WS-PL-566, Harquahala Valley Watershed Basic Data

Preliminary Geologic Investigation of Saddleback F.R.S., Arizona Water Commission 8, 7, and Supplement 12, 74

Environmental Impact Statement: Harquahala Valley Watershed, March, 1977

Cracking of Dams in Arizona

Bid Schedule, Spookhill Dam and Floodway

STRUCTURAL DATA

SADDLEBACK FLOODWATER RETARDING STRUCTURE

Harquahala Valley Watershed, Arizona

Item	Unit	Saddleback FRS
Class of Structure		a
Drainage Area (Uncontrolled)	Sq. Mi.	22.26
Average Curve Number (1-day AMC II)		83
Elevation Top of Dam	M.S.L. NGVD 1929	1193
Elevation Crest Emergency Spillway	M.S.L. NGVD 1929	1190.1 3/
Elevation Crest Principal Spillway	M.S.L. NGVD 1929	1177.1
Maximum Height of Dam	Ft.	20.8
Volume of Fill	Cu. Yd.	360000
Length	Mi.	5.02
Maximum Bottom Width	Ft.	111 2/
Top Width	Ft.	12.0
Upstream Slope Z:1		3
Downstream Slope Z:1		2
Total Capacity 1/	AF	3620
Sediment (50 Year)	AF	120 5/
Retarding	AF	3500
Surface Area		
Sediment Pool	Ac.	60 7/
Retarding Pool 1/	Ac.	760
Principal Spillway Design		
Rainfall Volume (Areal, 1-Day)	In.	4.03
Rainfall Volume (Areal, 10-Day)	In.	5.59
Runoff Volume (10-Day)	In.	3.27
Capacity	C.F.S.	1100
Frequency Operation-Emergency Spillway	%	No Spillway
Dimensions of Conduit	Ft.	1 - 10' x 8' x 65'
Tailwater Elevation	M.S.L. NGVD 1929	1179.4 5.68 + 1173.5
Type of Outlet		SAF
Drawdown Time	Days	6
Emergency Spillway Design		
Rainfall Volume (ESH, Areal)	In.	3.22
Runoff Volume (ESH)	In.	1.85 8/
Storm Duration	Hours	6
Type		No Spillway
Bottom Width	Ft.	-
Velocity of Flow (Ve)	F.P.S.	-
Slope of Exit Channel	Ft./Ft.	-
Maximum Reservoir Water Surface Elevation	M.S.L. NGVD 1929	1189.0 3/
Side Slopes Z:1		-
Maximum Outflow from ESH Routing	C.F.S.	1028 6/
Freeboard Design		
Rainfall Volume (FH, Areal)	In.	6.86
Runoff Volume (FH)	In.	5.23 8/
Storm Duration	Hours	6
Maximum Reservoir Water Surface Elevation	M.S.L. NGVD 1929	1193 4/
Maximum Outflow from FH Routing	C.F.S.	1300
Capacity Equivalents		
Sediment Volume	In.	.09751
Retarding Volume	In.	2.19 8/

1/ At crest of emergency spillway.

2/ Includes berm width.

3/ No emergency spillway. Elevation shown is that attained by routing of emergency spillway hydrograph.

4/ No emergency spillway. Elevation shown is that attained by routing of freeboard spillway hydrograph.

5/ This includes 80 AF in Basin #1, 30 AF in Basin #2, and 10 AF in area between basins.

6/ Outflow through principal spillway.

7/ Includes 55 ac. of nondraining areas.

8/ Does not include runoff from Harquahala or Granite Reef Aqueduct.

TABLE I

STRUCTURAL DATA

SADDLEBACK FLOODWATER RETARDING STRUCTURE

Item	Unit	Data
Drainage Area (Uncontrolled)	Sq. Mi.	22.26
Storm Protection Frequency	Yr.	100.00
Total Length	Mi.	5.02
Maximum Height	Ft.	20.80
Average Height	Ft.	9.00
Top Width	Ft.	12.00
Maximum Bottom Width	Ft.	111.00
Average Bottom Width	Ft.	57.00
Side Slopes, Z:1	Ft./Ft.	
Upstream		3.00
Downstream		2.00
Storage Capacity	Ac.-Ft.	
Floodwater Retarding		3500.00
Sediment (50 Year)		120.00
Total		3620.00
Principal Spillway 1/		
Reservoir Drawdown Time	Days	6.00
Maximum Release Rate	C.F.S.	1100.00

1/ - For 100-year storm protection frequency.

2/ - Required minimum capacity - emergency spillway fig. 7-1, TR-60

LIST OF MAPS

1. DRAINAGE AREA MAP Nº 1

   SCALE : 1" = 2000'

2. RIGHT OF WAY ACQUISITION MAP Nº 2

   SCALE : 1" = 1000'

NOTE :

MAPS LISTED ABOVE ARE UNDER SEPARATE COVER.

SECTION III : HYDRAULICS AND HYDROLOGY

Saddleback FRS :

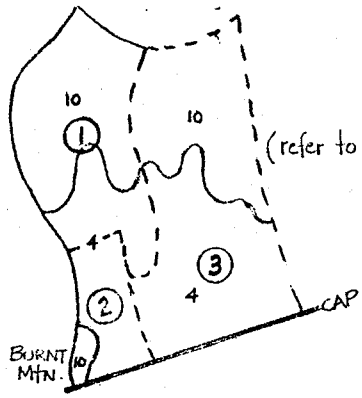
Subdrainage areas and runoff curve numbers III. 1. 1
Precipitation data - General III. 2. 1
- Emergency Spillway 2.2
- Principal Spillway 2.4
Concentration times III. 3. 1
Area-Capacity and Stage-Discharge Curves III. 4. 1
- G.R.A. Dike (C.A.P.) 4.2
- SADFRS (Basin #1 + Basin #2) 4.12
- SADFRS (Basin #1 only) 4.12
- SADFRS (Basin #2 only) 4.19

Hydrology computations
- FH, ESH, 100-Yr, 50-Yr, 10-Yr storms III. 5. 1
- PSH- 10 day 5.2
- TR-20 Watershed Modeling - Schematic 5.7
- TR-20 Input data 5.8
- PSH- 10day routing 5.14
- TR-20 Summary Tables 5.16
- Draw Down Check 5.21
- Summary of results, phase II 5.22

Structure Hydraulics
- SAF Basin - Principal Spillway III 6.2
- Buckeye - Salome Road Ramp 6.8
- Drain. channel Backwater Analysis (HEC-2 Computer Results) 6.17

JOB NO. 3043-000
2/22/78

Determine : Effect of CAP on hydrology



(refer to 7½' quad for detailed areas)

1 → drainage area designation

[1] 4 → Rillito - Gunsight - Anal Association

[1] 10 → Chirioni - Gachado - Rock Outcrop Association

Major Soil	Hydrologic Group	[2] CN_{6hr}
4	C with 20% cover density	88
10	D with 10% cover density	92

2. ref : Hydrologic Design for Highway Drainage - Arizona Highway Dept. & NEH-4
1. ref : General Soil Map - Maricopa County, Arizona - SCS 1973

1. Compute drainage area size using planimeter on 7½' quad :

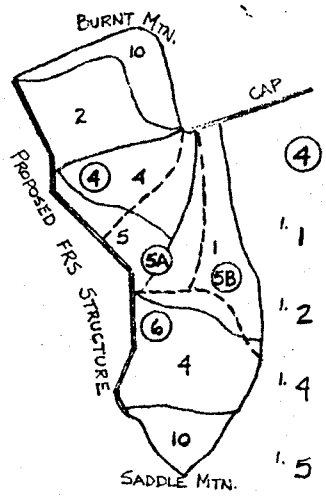
2. Determine weighted CN :

planimeter constant : $K = \frac{(2000)^2}{(5280)^2} = 0.1438$ sq.mi./read.

AREA	READING (sq.in.)	CALCULATED AREA (sq.mi.)	WEIGHTED CN_{6hr}
2.	39.41	× K = 5.65	80% (88) + 20% (92) = 88.8 ~ 89
1.	111.58	× K = 16.01	30% (88) + 70% (92) = 90.8 ~ 91
3.	121.47 + 108.98 = 230.45	× K = 33.07	60% (88) + 40% (92) = 89.6 ~ 90

JOB NO. 3043 - 000
3/6/78

Determine : Runoff fm. areas downstream of CAP



(refer to 7½' quad for detailed areas)

(4) → drainage area designation

1. 1 → Gilman - Estrella - Avondale Association

1. 2 → Antho - Valencia Association

1. 4 → Rillito - Gunsight - Final Association

1. 5 → Mohall - Laveen Association

1. 10 → Chirioni - Gachado - Rock Outcrop Association

MAJOR SOIL	HYDROLOGIC GROUP	2. CN_{6hr}
1	B with 20% cover density	83
2	B with 20% cover density	83
4	C with 20% cover density	88
5	B with 20% cover density	83
10	D with 10% cover density	92

AREA 4 :

Wtd. $CN_{6hr.}$ = 88(0.25) + 92(0.25) + 83(0.50) = 86.5 ~ 87

AREA 5A :

Wtd. $CN_{6hr.}$ = 83(0.30) + 88(0.35) + 83(0.35) = 84.75 ~ 85

AREA 5B :

Wtd. $CN_{6hr.}$ = 83(1.00) = 83

AREA 6 :

Wtd. $CN_{6hr.}$ = 83(0.15) + 92(0.15) + 88(0.70) = 87.85 ~ 88

Wtd. CN_{6hr} (Areas 4, 5A, 5B, 6) = $(7.19 \times 87 + 5.24 \times 85 + 4.51 \times 83 + 5.30 \times 88) \frac{1}{22.24}$ = 86

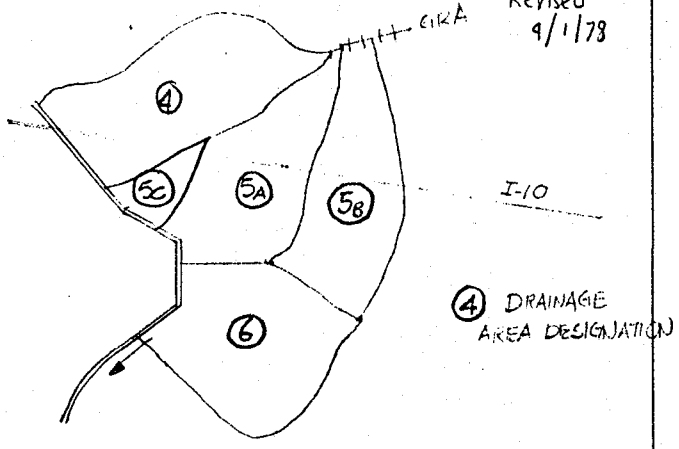
1. ref : General Soil Map - Maricopa County, Arizona - SCS 1973
2. ref : Hydrologic Design for Highway Drainage - Arizona Highway Dept. & NEH - 4

Revised 9/1/78

Saddleback F.R.S.

Drainage Areas below G.R.A.

(from $7\frac{1}{2}'$ QUAD)



D.A. DESIGNATION	PLANIMETER READING (SQ. IN)	AREA IN SQ. MI. (SQ. IN X K)
4	48.1	6.9
5A	30.1	4.32
5B	31.46	4.51
5C	14.40	2.07
6	36.92	4.46

Area = 22.26 mi^2

(K) PLANIMETER CONSTANT = $(\text{SQ. IN.})\left(2000 \times 2000 \frac{\text{SQ FT}}{\text{SQ IN}}\right)\left(\frac{1}{5280 \times 5280} \frac{\text{SQ MI}}{\text{SQ FT}}\right)$

= .1435

Precip. values for PSH & 50 YR. - 24 storm :

1.) 100 YR. - 24 hr precip. = 4.15"

1.) 50 YR - 24 hr. precip = 3.68"

D.A. Designation	A mi²	1.) Reduction Factor	Precip. in.	2.) CN 24-hr
1	16.01			89
2	5.65			87
3	33.07			88
north basin	54.73	0.95	3.94 (100) 3.50 (50)	
4	6.9			84
5_A	4.32			82
5_B	4.51			80
5_C	2.07			83
6	5.30			85
south basin	22.24	0.97	4.03 (100) 3.57 (50)	

1.) NOAA ATLAS 2 VOL. VIII

2.) see sht. # III.1.5

Revised 9/1/78

RUNOFF CURVE NUMBERS

Runoff CN 6hr were derived using NEH SEC. 4 & ADOT MANUAL as shown on sht III.1.2

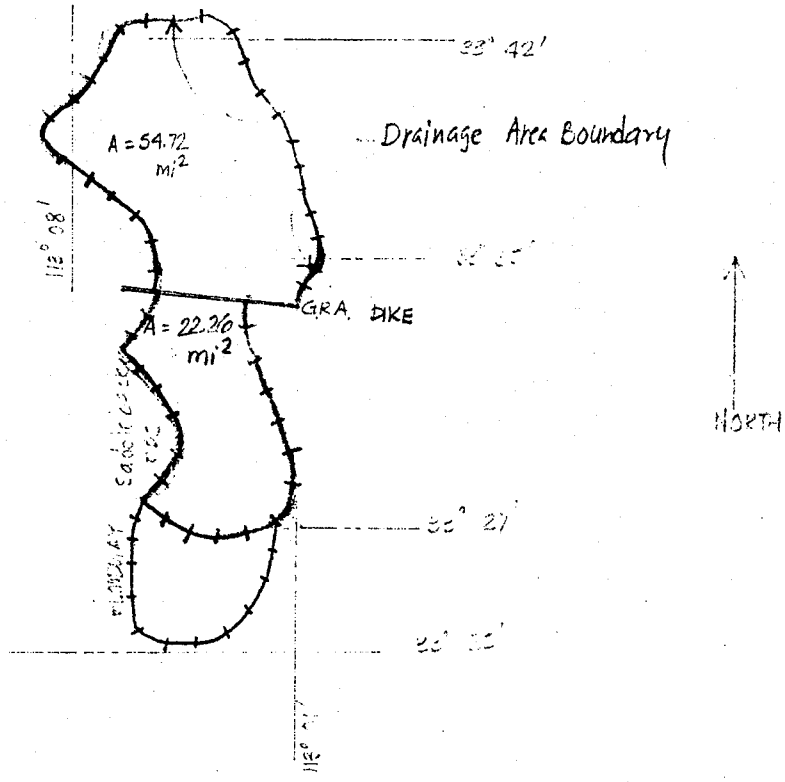
* Figure 4 'Woodward paper no. 73-209 ASAE

D.A Designation	A mi^2	CN- 1 hr*	CN 6 hr		CN 24 hr*			
1	16.01	94	91	Wtd. CN. 90.2	89	Wtd. CN 88.2		Wtd. CN 85.56
2	5.65	92	89		87			
3	33.07	93	90		88			
4	6.9	91	87	Wtd. CN. 86	84	Wtd. CN 83.0		
5A	4.32	89	85		82			
5B	4.51	87	83		80			
5C	2.07	90	86		83			
6	4.47	91	88		85			

2/21/78
ACP
Revised 10/78

EMERGENCY SPILLWAY DESIGN

PRECIPITATION: "Probable Maximum Thunderstorm Precipitation Estimates - Continental United States" (Hydro Data) Aug. 1973 was used to derive design precip. values.



(1) 1-hr, 1 sq. mi Thunderstorm PMP = 11.6" (Fig. 23)

(2) 6-hr PMP in percent of 1-hr PMP (Fig. 24) = 135 % (Type 'B')

(3) 6-hr total precip = 135 (11.6) = 15.66"

(4) Reduce precip for Drainage Area (Fig. 26)

Reduction factor = 0.83 (for D.A = 22.27)

{ Red. Factor = .725 (D.A. = 54.73)
Ave. precip = .725 X 15.66
= 11.35" }

Ave. precip = 0.83 X 15.66 = 13"

(5) Class b Freeboard Hydrograph (FH) precip data
(from Earth Dams & Reservoirs TR 60 Pg 2-9)

$= P_{100} + 0.4 (PMP - P_{100})$

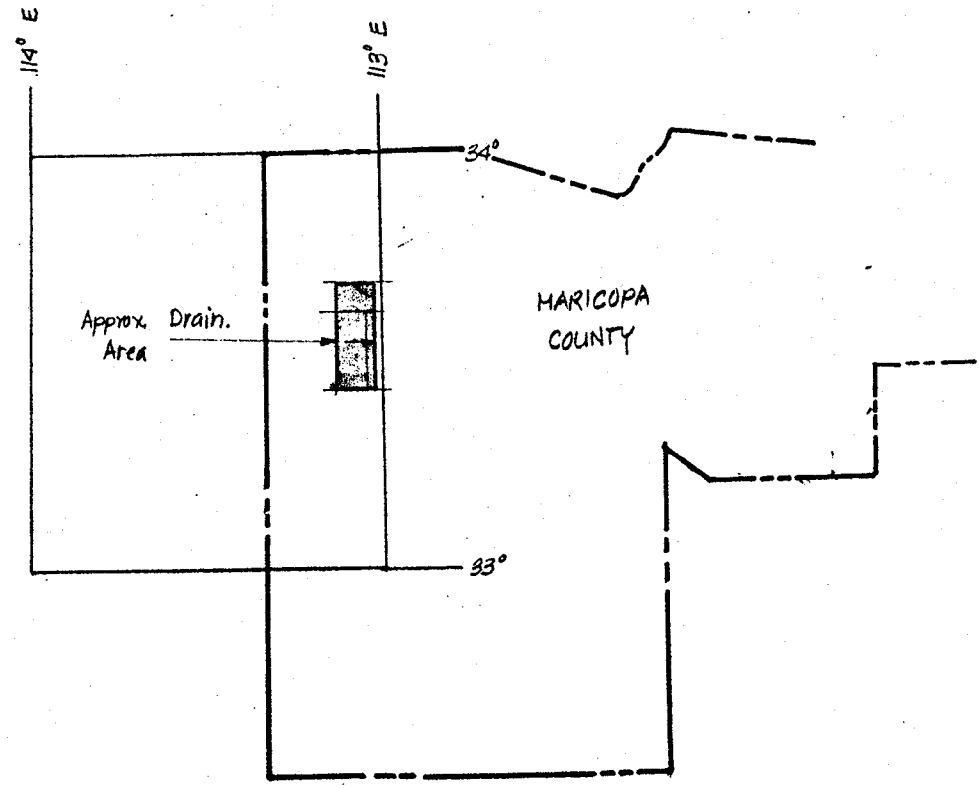
P_{100} = 3.33" 6-HR DURATION (from NOAA ATLAS VOL VII)

$= 3.33 + 0.4 (15.66 - 3.33)$

{ Area Above CAP
8.26 }

$= 8.26"$

PRECIPITATION DATA



SCALE: 1" = 31.85' ML.

Fig. 23

NOAA ATLAS 2 VOL VIII

FREQ.	PRECIP. (IN) 6 Hr.	24 Hr
2-Yr	1.25	1.5
5-Yr		2.12
10-Yr		2.58
25-Yr		3.10
50-Yr	2.95	3.65 – 3.70
100-Yr	3.33-3.5	4.15

Revised 10/78

(6) Ave. Precip. = 0.83 × 8.26 = 6.86" F.H. {CAP. .725 × 8.26 = 6"}

(7) Class b ESH = P_{100} + 0.12 (PMP − P_{100})

= 3.33 + 0.12 (15.66 − 3.33) = 4.81"

(8) Ave. Precip = (0.83)(4.81)

= 3.99" ESH. {CAP .725 × 4.81 = 3.49"}

Explanation.

{ } → for area north of CAP Dike

SUMMARY FH, ESH PRECIP.

	UNCONTROLLED AREA SADFRS	UNCONTROLLED AREA CAP-DIKE
FH. Precip	6.86"	6.00"
runoff for CN: 86	4.9"	4.41"
ESH Precip	3.99"	3.49"
runoff for CN = 86	2.54"	2.09"

PRINCIPAL SPILLWAY DESIGN

The PSH was generated from a Qdirect card in DAMS 2 Program with runoff adjusted for transmission loss. The PSH development is shown on sht. 3.3-2

on WSDATA card – QRF of 32.03 was included to account for the following-

(1) Harquahala baseflow of 500 cfs

(2) Controlled release from GRA Basin. equivalent to 240 cfs Baseflow based on the following assumption:

Volume on divert subroutine CP 11,[1] $= \dfrac{10.95(\text{sq.mi}) \times 5280^2(\text{ft}^2/\text{sq.mi}) \times 2.46(\text{in}) \times \frac{1}{12}(\frac{\text{ft}}{\text{in}})}{3(\text{days}) \times 24(\frac{\text{hrs}}{\text{days}}) \times 3600(\frac{\text{sec}}{\text{hr}})}$

$= 241.4$ cfs

EMERGENCY SPILLWAY DESIGN

Design precipitation was obtained from the publication "Probable Maximum Thunderstorm Precipitation Estimates, Southwest States" (see sht. 3.4-1)

Drainage parameters like drainage subareas, curve numbers, time of concentrations etc are shown on sht. 3.4-2

Schematic for TR-20 run, Input data listing, summary outputs are on sheets 3.5-1

The proposed Granite Reef Aqueduct dike (Structure 1 on TR-20) would have a significant effect on the design of SADFRS. Several alternates were tried to best model this dike. In all these alternates freeboard Hydrograph overtopped GRA dike. This matter was discussed with the Bureau of Reclamation and it was decided that the portion of dike draining to SADFRS be raised by one foot. The Final TR-20 routing did consider this one foot raised elevation of dike.

Saddleback FRS is designed to store the entire freeboard hydrograph, and therefore has only a Principal Spillway. Class b freeboard hydrograph generated by TR-20 was used as input to DAMS 2 to determine the required top of dam elevation.

The freeboard hydrograph did include a baseflow of 500 cfs from harquahala FRS

1] Ref: TR-20 Summary table 1, 100-Yr 24 hr storm (Alt. No. 3) CP 11, Drain. Area = 10.95 sq.mi, Runoff = 2.46"

3/7/78
ACP
Revised 10/78

PRINCIPAL SPILLWAY

D.A 22.26 mi²
Tc 1.61 (III.3.4.)
structure class b
Design storm Freq. 100-Yr

Pa 7.52 in Buckeye
Ta 69° F Buckeye

$C_i = \frac{100 \times 7.52}{69^2} = 0.158$

	1 DAY		10 DAY	
Point P	4.15"	(NOAA)	5.67" *	(Tech. note PO-6)
Aerial Corr.	x .9660		x .985	
Aerial P	4.01"		5.59"	
CN	83 **		83	(Table 21-2 Sec. 4, Point P<6")
Gross Q	2.30"		3.71"	
Channel loss factor	0.88		0.88	(Attacht 2) when $C_i < 1$ (Sec. 4 Table 21-3)
Net Q	2.02"		3.27"	

10-Day precip (P.O.-6 Tech. note) *

1. 2-Yr 6-hr = 1.25 (NOAA - Vol III)
   2 Yr 24-hr = 1.50

2 Region 7 (Fig B-1)

3 2 Yr 1 hr = $-0.011 + 0.942 \frac{(2\text{-Yr } 6\text{hr})^2}{2\text{-Yr } 24\text{ hr}}$ (Table B-1)

$= -0.011 + .942 \frac{(1.25)^2}{1.50} = 0.97$

4. 2 Yr 10-day = 2.3" (Fig B-2)

5 $\frac{100\text{-Yr 10-day}}{2\text{ Yr 10-day}} = 2.8$ (Fig B-3)

6 100 Yr 10 Day = 2.8 x 2.3 = 6.44

7 annual series : 0.88 x 6.44 = 5.67"

** Wtd CN_{6hr} = 80, using Fig 4 Woodward '73 CN_{1day} = 84

Chapter 21-2
Sec 4

C.A.P. Principal Spillway

D.A.: 54.73 sq.m

Tc: (1.52+1.19*) = 2.71 hr

* $T_t = \frac{L}{V \times 3600} = \frac{21500}{5 \times 3600}$ = 1.19 hr

Structure class: b

Design Storm Freq.: 100-Yr

Pa = 7.52" Buckeye

Ta: 69° "

$C_i = \frac{100 \times 7.52}{69^2} = 0.158$

	1 DAY	10 DAY	
Point P	4.15	5.67	(T. Note P.O. 6)
Aerial Correction	0.947	0.973	(")
Aerial P	3.93	5.52	
CN **	88	88	(table 21-2, Sec. 4)
Gross Q	2.66	4.17	
channel loss Factor	0.85	0.85	(Attachment 2.)
Net Q	2.26" ←	3.54" ←	

10-Day precip (P.O. 6 - Tech. note) *

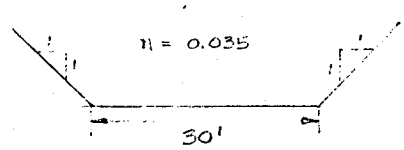
1. 2-Yr 6 Hr = 1.3 (NOAA-Vol VIII)
   2 Yr 24 Hr = 1.53
2. Region 7
3. 2 Yr 1 hr precip = $-.011 + 0.942 \frac{(2\text{-Yr } 6\text{ hr})^2}{2\text{-Yr} \cdot 24\text{ hr}}$ = 1.03 (table B-1)
4. 2 Yr 10 day = 2.3" (fig B-2)
5. Ratio $\frac{100\text{ Yr-10 day}}{2\text{ Yr-10 day}}$ = 2.8 (Fig B-3)
6. 100 Yr-10 day = 2.8 × 2.3 = 6.44"
7. annual serial: 0.88 × 6.44 = 5.67"

** Wtd. CN_{6hr} = 90, using fig 4 woodward '73 CN_{1day} = 88

3. Compute T_c for given drainage areas :

PROCEDURE :

1. assume ave. section :



2. assume bank-full conditions @ d = 2.0'

3. break each area into reaches with uniform slope (@ 200' contour intervals)

4. solve Manning's for velocity using d = 2.0'
ave. vel. over reach :

$$vel_{AVE.} = \frac{1.486}{0.035} R^{2/3} S_f^{1/2}$$

5. compute T_c of reach : $\frac{\text{reach length}}{vel_{AVE}} \times \frac{1}{3600} = T_c$ (hrs.)

6. ΣT_c (reach) = T_c of total drainage area

note : reach$_1$ = elev. 2400 - elev. 2200
reach$_2$ = elev. 2200 - elev. 2000
reach$_3$ = elev. 2000 - elev 1800
reach$_4$ = elev 1800 - elev. 1600
reach$_5$ = elev. 1600 - elev. 1400

AREA	Length (ft.)	S_f (%)	Vel. (fps)	T_c (hrs.)	ΣT_c (hrs.)
1					
reach$_1$	5210	3.84	12.29	0.12	
reach$_2$	7810	2.56	10.03	0.22	
reach$_3$	12,500	1.60	7.93	0.44	
reach$_4$	17,700	1.13	6.67	0.74	
					1.52
2					
reach$_4$	14,000	1.43	7.49	0.52	
reach$_5$	17,700	1.13	6.67	0.74	
					1.26
3					
reach$_1$	5200	3.85	12.30	0.12	
reach$_2$	5210	3.84	12.29	0.12	
reach$_3$	9900	2.02	8.91	0.31	
reach$_4$	13,000	1.54	7.78	0.46	
reach$_5$	17,200	1.16	6.76	0.71	
					1.72

Calcs. for TABLE (pg.):

AREA ①

reach 1 : length = 5210' $S_f = \frac{200}{5210} = 0.03839$

@ d = 2' : Vel = 12.29 fps (786.29 cfs)

$T_c = \frac{5210}{12.29} \times \frac{1}{3600} = 0.12$ hrs.

reach 2 : length = 7810' $S_f = \frac{200}{7810} = 0.02561$

@ d = 2' : Vel. = 10.03 fps (642.21 cfs)

$T_c = \frac{7810}{10.03} \times \frac{1}{3600} = 0.22$ hrs.

reach 3 : length = 12,500' $S_f = \frac{200}{12500} = 0.016$

@ d = 2' : Vel. = 7.93 fps (507.63 cfs)

$T_c = \frac{12500}{7.93} \times \frac{1}{3600} = 0.44$ hrs.

reach 4 : length = 17,700' $S_f = \frac{200}{17700} = 0.0113$

@ d = 2' : Vel. = 6.67 fps (426.60 cfs)

$T_c = \frac{17700}{6.67} \times \frac{1}{3600} = 0.74$ hrs.

$\Sigma T_c = 0.12 + 0.22 + 0.44 + 0.74 = \underline{1.52 \text{ hrs.}}$

AREA ②

reach 4 : length = 14,000' $S_f = \frac{200}{14000} = 0.01429$

@ d = 2' : Vel. = 7.49 fps (479.67 cfs)

$T_c = \frac{14000}{7.49} \times \frac{1}{3600} = 0.52$ hrs.

reach 5 : length = 17,700' $S_f = \frac{200}{17700} = 0.01130$

@ d = 2' : Vel. = 6.67 fps (426.60 cfs)

$T_c = \frac{17700}{6.67} \times \frac{1}{3600} = 0.74$ hrs.

$\Sigma T_c = 0.52 + 0.74 = \underline{1.26 \text{ hrs.}}$

AREA ③

reach 1 : length = 5200' $S_f = \frac{200}{5200} = 0.03846$

@ d = 2' : Vel. = 12.30 fps (787.05 cfs)

$T_c = \frac{5200}{12.30} \times \frac{1}{3600} = 0.12$ hrs.

reach 2 : length = 5210' $S_f = \frac{200}{5210} = 0.0384$

@ d = 2' : Vel. = 12.29 fps (786.29 cfs)

$T_c = \frac{5210}{12.29} \times \frac{1}{3600} = 0.12$ hrs.

reach 3 : length = 9900' $S_f = \frac{200}{9900} = 0.0202$

@ d = 2' : Vel. = 8.91 fps (570.41 cfs)

$T_c = \frac{9900}{8.91} \times \frac{1}{3600} = 0.31$ hrs.

reach 4 : length = 13,000' $S_f = \frac{200}{13000} = 0.01538$

@ d = 2' : Vel. = 7.78 fps (497.77 cfs)

$T_c = \frac{13000}{7.78} \times \frac{1}{3600} = 0.46$ hrs.

reach 5 : length = 17,200' $S_f = \frac{200}{17200} = 0.01163$

@ d = 2' : Vel. = 6.76 fps (432.75 cfs)

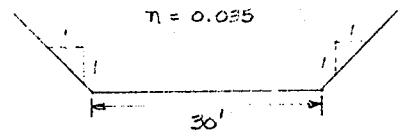
$T_c = \frac{17200}{6.76} \times \frac{1}{3600} = 0.71$ hrs.

$\Sigma T_c = 0.12 + 0.12 + 0.31 + 0.46 + 0.71 = \underline{\underline{1.72 \text{ hrs.}}}$

Compute T_c for given drainage areas:

PROCEDURE:

1. assume ave. section:



2. assume "bank-full" conditions @ d = 1.0' above elev. 1300 & d = 2.0' below elev. 1300

3. break each area into reaches with uniform slope

4. solve Manning's for velocity using d = 2.0' or d = 1.0'
   ave. vel. over reach:
   $$Vel_{AVE} = \frac{1.486}{0.035} R^{2/3} s_f^{1/2}$$

5. compute T_c of reach: $\frac{\text{reach length}}{Vel._{AVE.}} \times \frac{1}{3600} = T_c$ (hrs.)

6. $\Sigma T_{c(reach)}$ = T_c of total drainage area

note: AREA 4 → reach$_1$ = elev. 2294 - elev. 1180

AREA 5A → reach$_1$ = elev. 1300 - elev. 1180
reach$_2$ = elev. 1180 - elev. 1300

AREA 5B → reach$_1$ = elev. 1300 - elev. 1180
reach$_2$ = elev. 1175 - elev. 1300

AREA 6 → reach$_1$ = elev. 1400 - elev. 1600
reach$_2$ = elev. 1300 - elev. 1400
reach$_3$ = elev. 1175 - elev. 1300

AREA	LENGTH (ft.)	S_f (%)	Vel. (fps)	T_c (hrs.)	ΣT_c (hrs.)
4					
reach$_1$	22000	5.0	5.00 (assumed) ave.	1.2	1.2
5A					
reach$_1$	8200	0.98	6.19	0.37	
reach$_2$	14,200	0.85	5.76	0.68	
					1.05
5B					
reach$_1$	8000	1.00	6.27	0.35	
reach$_2$	21,600	0.58	4.77	1.26	
					1.61
6					
reach$_1$	1600	12.50	14.45	0.03	
reach$_2$	3000	3.33	7.46	0.11	
reach$_3$	14,000	0.89	5.93	0.66	
					0.80

Calcs. for TABLE (pg.

AREA 4

reach 1 : Length = 22000' $S_f = \frac{2294-1180}{22000} = .05$

Assume Ave. velocity = 5 fps

$T_c = \frac{22000}{5 \times 3600} = 1.2$ hr

AREA 5A

reach 1 : length = 8200' $S_f = \frac{1380-1500}{8200} = 0.00976$

* @ d = 2' : Vel. = 6.19 fps (396 cfs)

$T_c = \frac{8200}{6.19} \times \frac{1}{3600} = 0.37$ hrs.

reach 2 : length = 14200' $S_f = \frac{1300-1180}{14200} = 0.00845$

@ d = 2' : Vel. = 5.76 fps (367 cfs)

$T_c = \frac{14200}{5.76} \times \frac{1}{3600} = 0.68$ hrs.

$\Sigma T_c = 0.37 + 0.68 = 1.05$ hrs.

9/4/78

AREA 5C

Length = 12500' $S_f = \frac{1308-1190}{12500} = .0094$

@ d = 1', vel. = 4 fps

$T_c = \frac{12500}{4 \times 3600} = 0.87$ hr

AREA 5B

reach 1 : length = 8000' $S_f = \frac{1380 - 1300}{8000} = 0.010$

* @ d = 2' : Vel. = 6.27 fps (401 cfs)

$T_c = \frac{8000}{6.27} \times \frac{1}{3600} = 0.35$ hrs.

reach 2 : length = 21,600' $S_f = \frac{1300 - 1175}{21600} = 0.00579$

@ d = 2' : Vel. = 4.77 fps (305 cfs)

$T_c = \frac{21600}{4.77} \times \frac{1}{3600} = 1.26$ hrs.

$\Sigma T_c = 0.35 + 1.26 = \underline{1.61 \text{ hrs.}}$

AREA 6

reach 1 : length = 1600' $S_f = \frac{1600 - 1400}{1600} = 0.1250$

@ d = 1' : Vel. = 14.45 fps (448 cfs)

$T_c = \frac{1600}{14.45} \times \frac{1}{3600} = 0.03$ hrs.

reach 2 : length = 3000' $S_f = \frac{1400 - 1300}{3000} = 0.0333$

@ d = 1' : Vel. = 7.46 fps (231 cfs)

$T_c = \frac{3000}{7.46} \times \frac{1}{3600} = 0.11$ hrs.

reach 3 : length = 14,000' $S_f = \frac{1300 - 1175}{14000} = 0.00893$

@ d = 2' : Vel. = 5.93 fps (379 cfs)

$T_c = \frac{14000}{5.93} \times \frac{1}{3600} = 0.66$ hrs.

$\Sigma T_c = 0.03 + 0.11 + 0.66 = \underline{0.80 \text{ hrs.}}$

* d = 2.0' was used on this reach because of flat slopes

STRUCTURE NO. 1 GRA DIKE[1] (see sht. for location)
(C.A.P.)

Procedure

1. Determine storage volume behind GRA dike for Basin a, b using conventional planimetric method, using 1" = 200' topo maps & U.S.G.S. Quad map.[2]

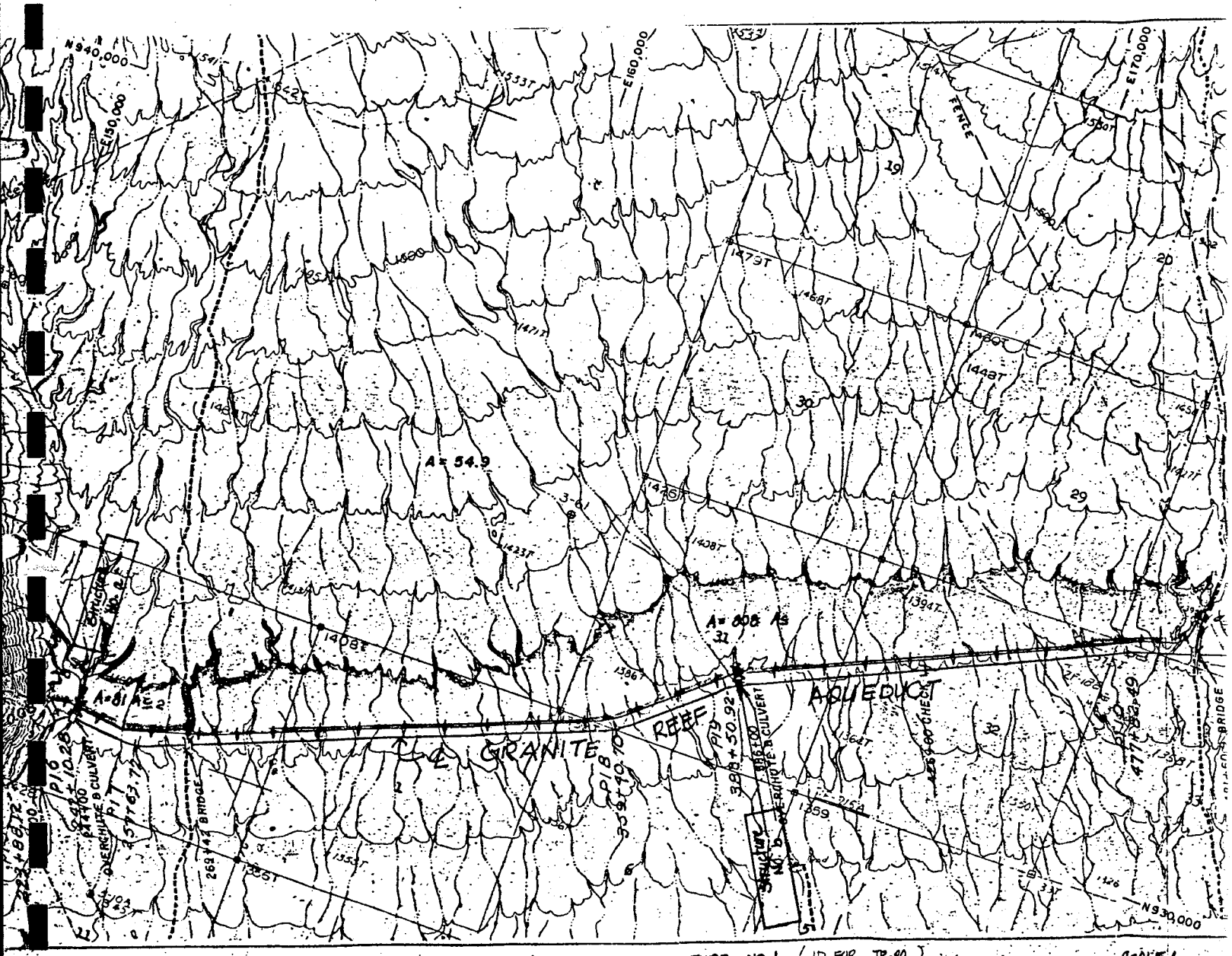
2. Establish stage vs outflow relation for the drainage structures - 72" overchutes. (see sht. III.4.5)

3. Determine dike overtopping using weir flow eqn. (Sec. 4-NEH) (See sht. III.4.10)

4. Prepare tabulation of data to be used in TR-20 watershed modeling (see sht. III.4.11)

2] 100-Yr sediment volume = 2600 AcFt (Bureau of Rec.) This volume was not considered in the design since it would reduce the inflow volume to SADFRS.

1] Bureau of Recl. Specs No. DC-7268



STRUCTURE NO. 1 (ID. FOR TR-90)

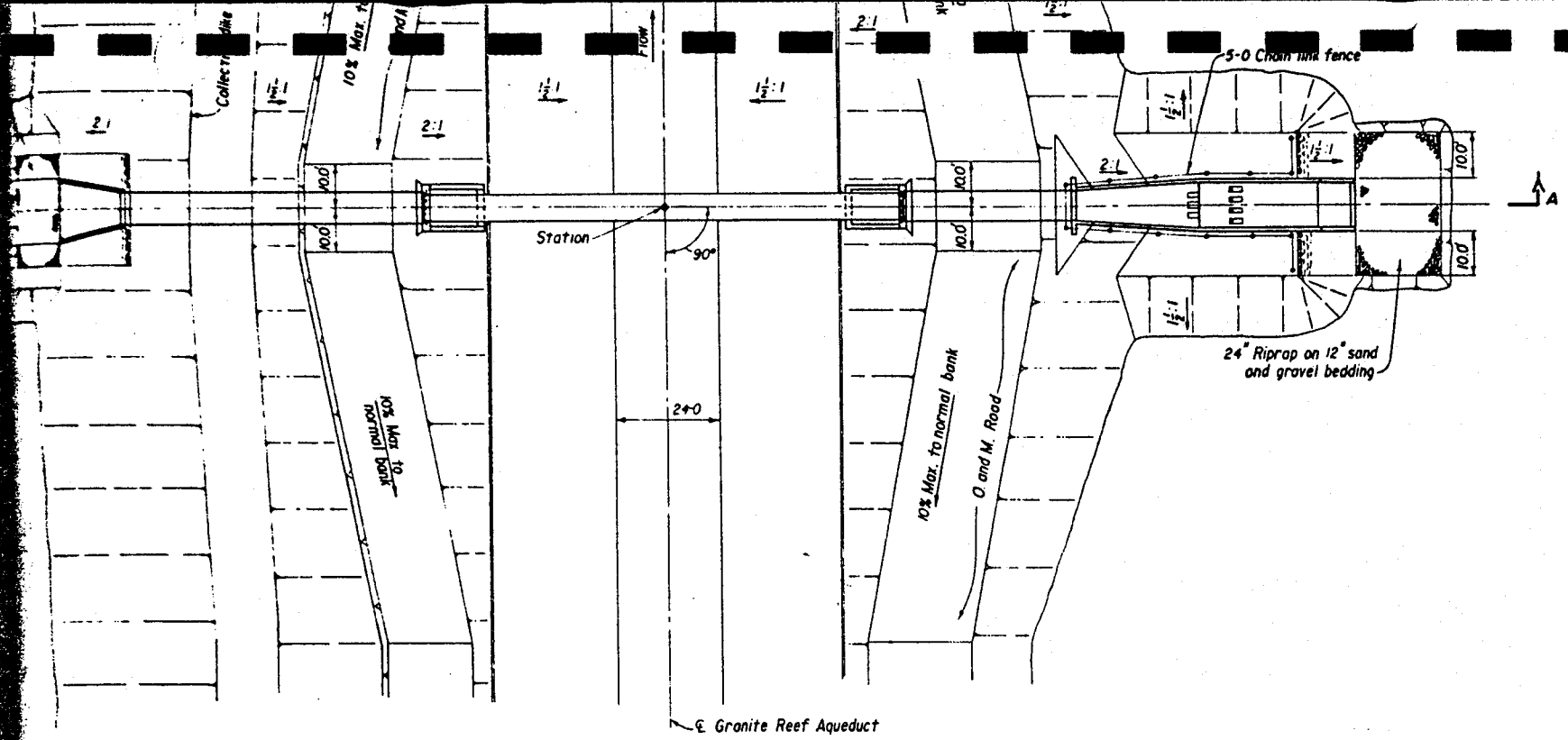
SCALE: 1" = 3000'

SADDLEBACK FRS

STORAGE AREA - BEHIND GRA DIKE

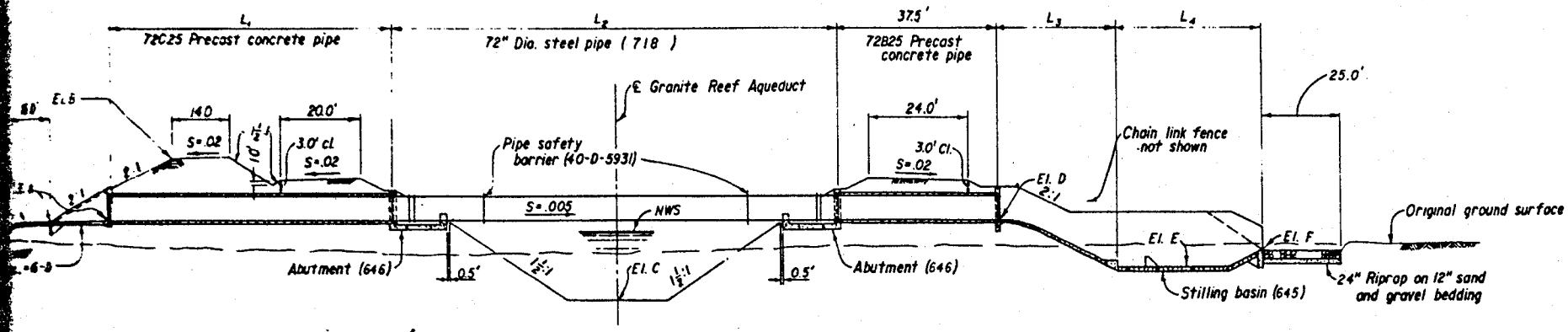
Feb. 78

461+50	1379.71	1398.0
5.	1379.11	1397.0
5.	1378.74	1397.0
644+50	1378.25	1397.0



TYPICAL PLAN

20 0 20 40 60
SCALE OF FEET



SECTION A-A

GRANITE REEF AQUEDUCT
344-D-642 "Basin G"

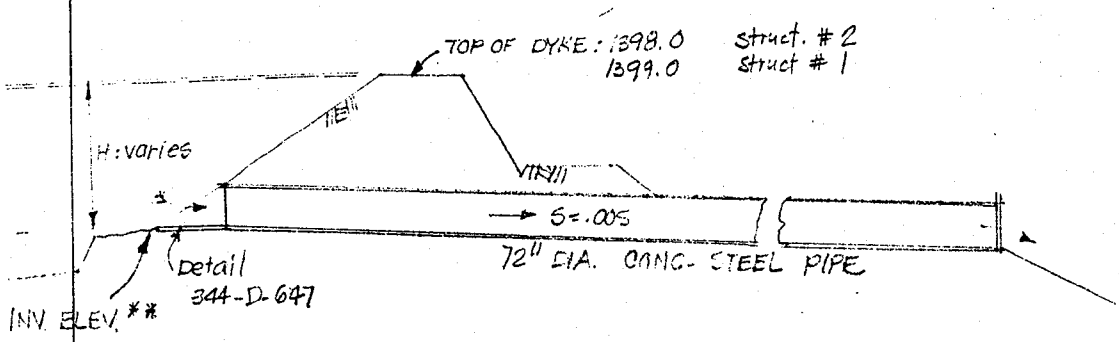
HCP
6/24/78
Revised 8/13/78

Granite Reef Aqueduct. Reach 6 (Ref: Specifications No. DC-1268)

To establish Stage Vs Outflow relation for the drainage structures (72"Φ PIPES) located at the stations

243+00	**	1381.5
[illegible]		1381.22
342+65		1380.73
387+00		1380.78
461+50		1379.71

Typical section from Fancl-42, 344-D-643 (See sht. III.4.4)



HEAD (Ft)	H/D	OUTFLOW (Q) CFS*
0	0	0
2	.33	35
4	.67	105
6	1.00	195
8	1.33	280
10	1.67	340
12	2.00	400
14	2.33	440
16	2.67	480
18	3.00	520
20	3.33	560
22	3.67	600

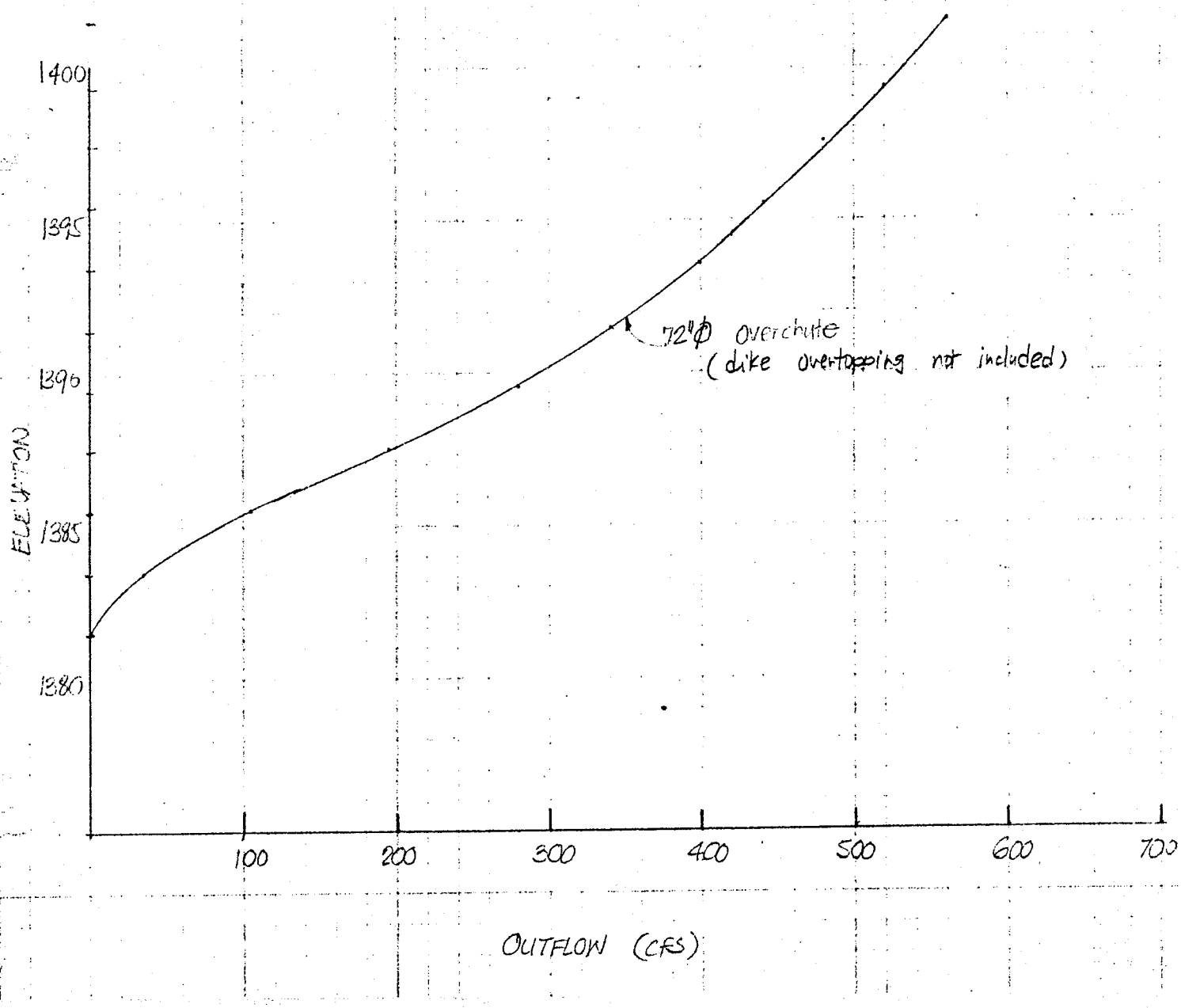
* Ref: Culvert Charts, Hydraulic Circular No. 5 B.P.R.
Entrance type- Square Edge with headwall.

STAGE x DISCHARGE

Stn 240+00 to 269+42

structure No. a

head (ft)	Elev.	outflow cfs
0	1381.5	0
2	83.5	25
4	85.5	105
6	87.5	195
8	89.5	280
10	91.5	340
12	93.5	400
14	95.5	440
16	97.5	480
18	99.5	520
20	1401.5	560

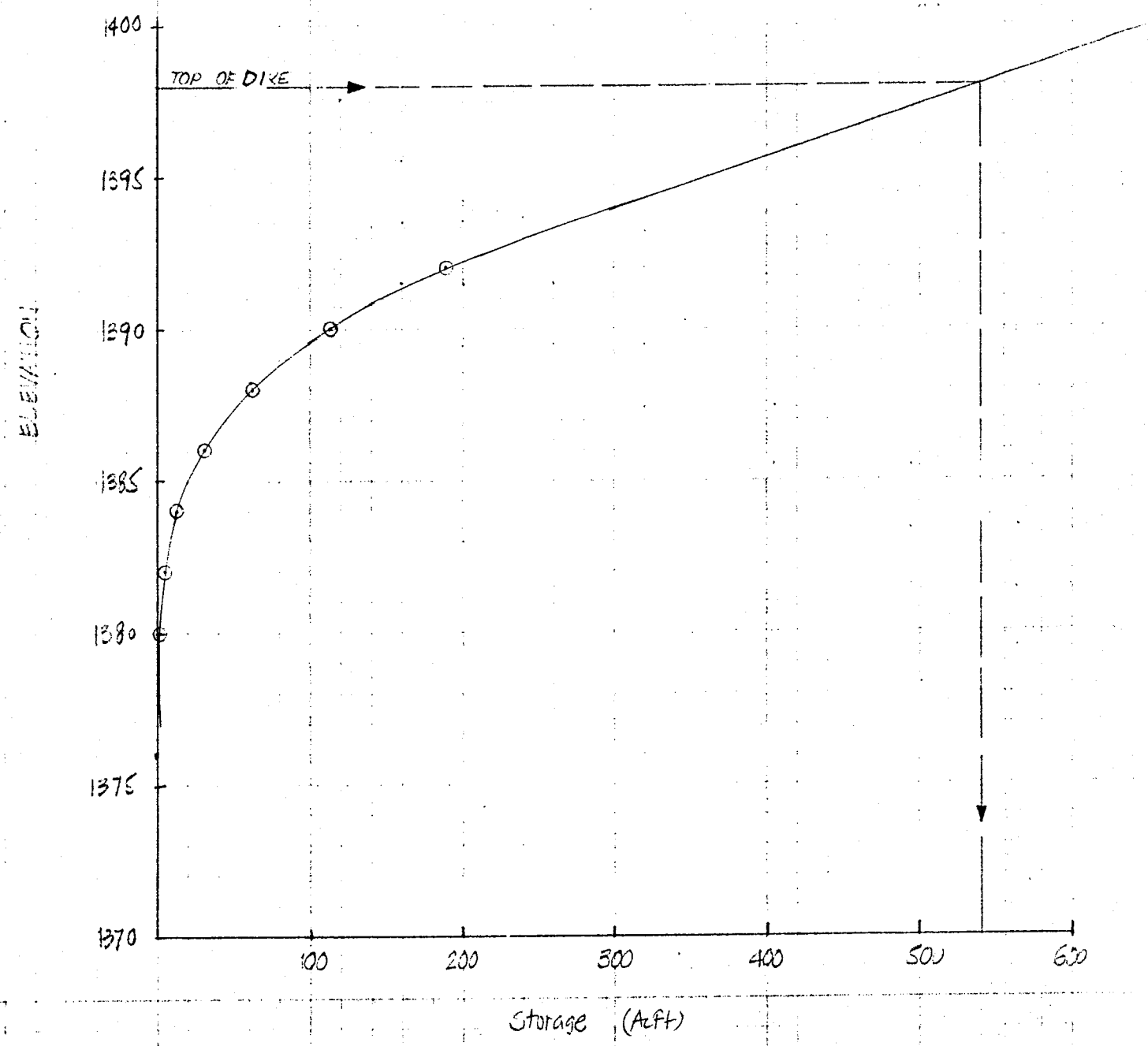


Ad
2/22/78

ELEVATION x STORAGE (Granite Reef Aqueduct) Reach 6

sta 240+00 to 269+42

Structure No a



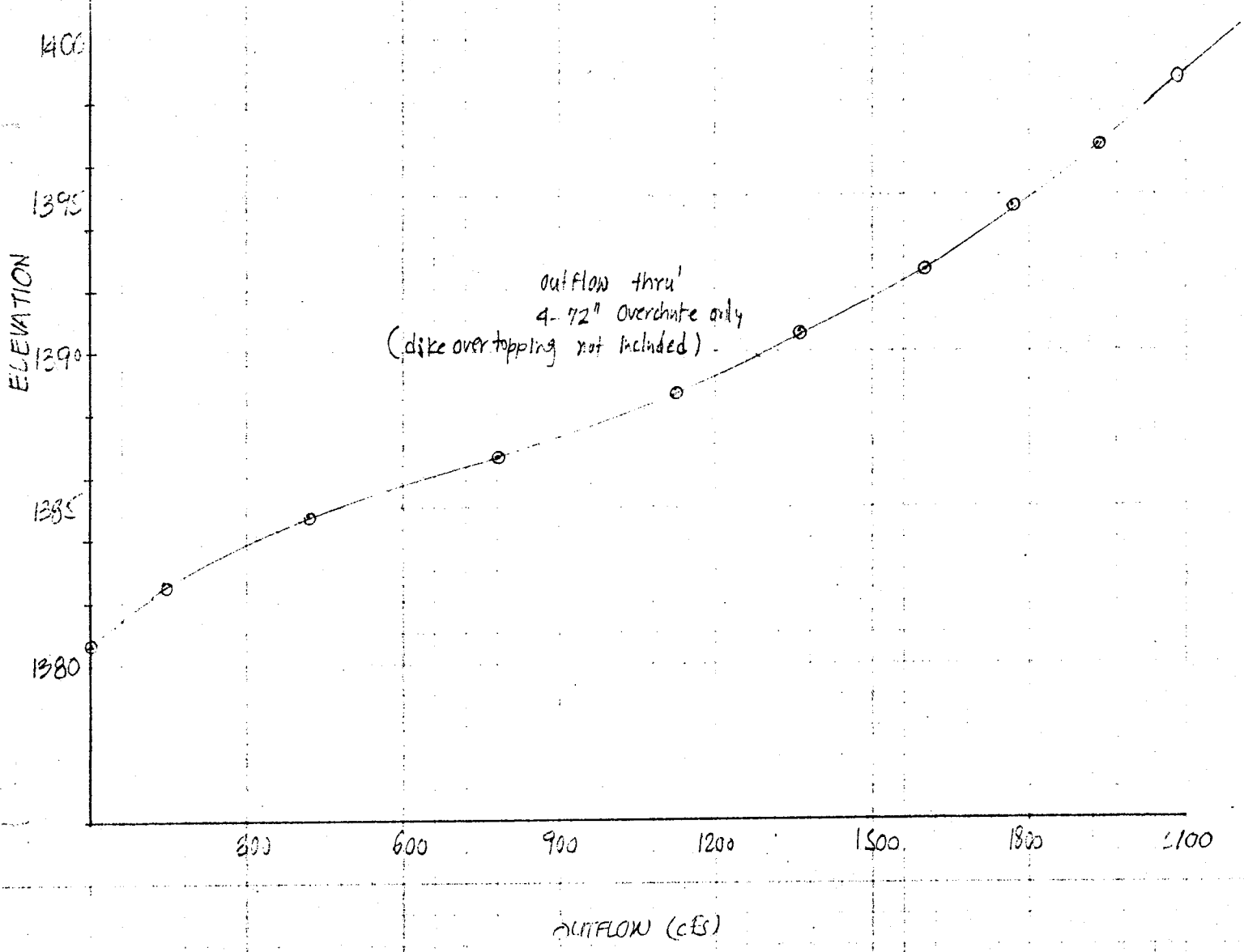
Revised
9/14/78

* average of 4- inverts

STAGE Vs DISCHARGE

Stn. 296+42 to 482+00
Structure No. b

Head in (ft)	Elev.	Outflow (cfs): 1-72"ϕ	Outflow (cfs): 4-72"ϕ
0	1380.6*	0	0
2	1382.6	35	140
4	1384.6	105	420
6	1386.6	195	780
8	1388.6	280	1120
10	1390.6	340	1360
12	1392.6	400	1600
14	1394.6	440	1760
16	1396.6	480	1920
18	1398.6	520	2080
20	1400.6	560	2240

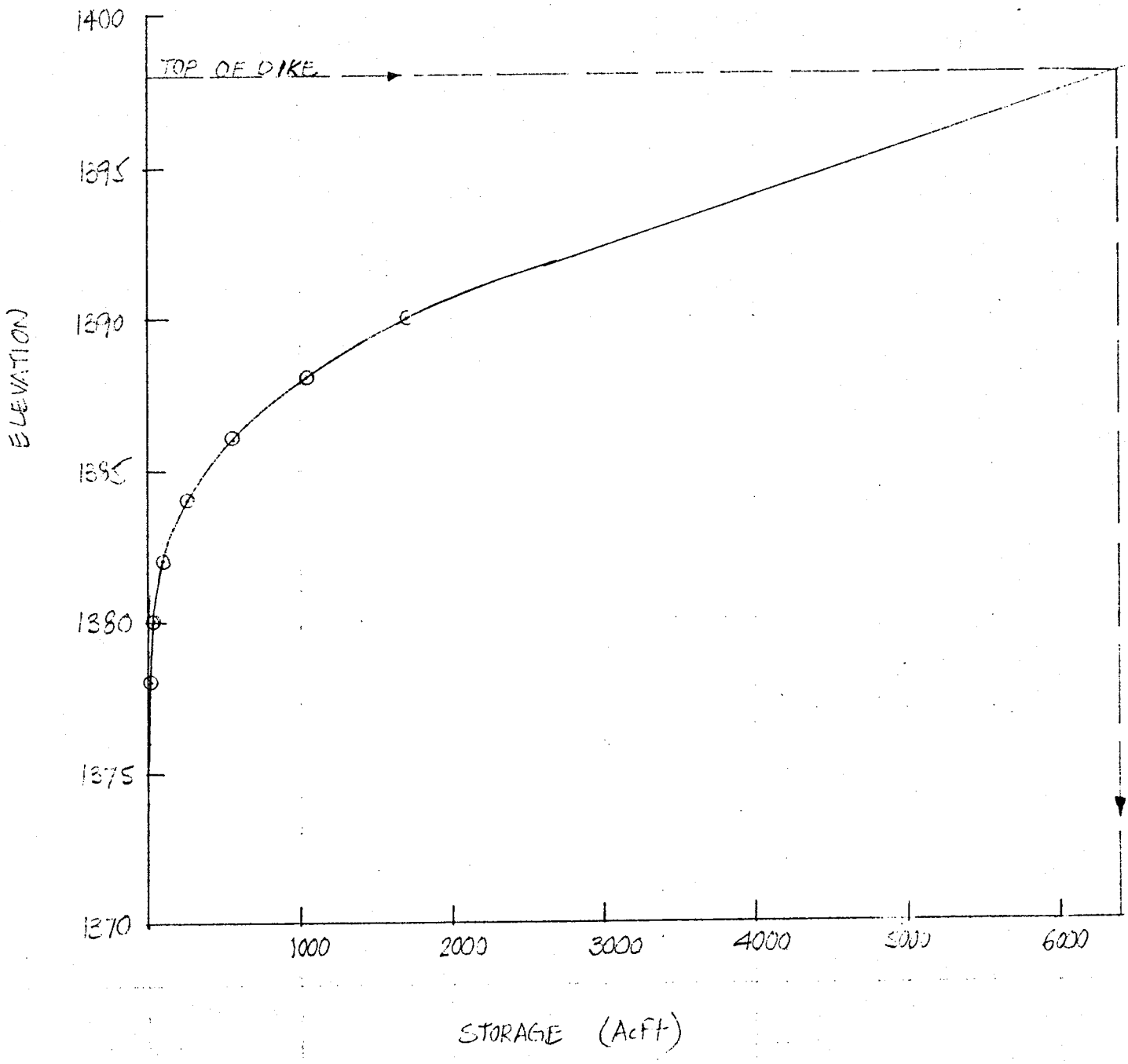


HCP
2/24/78

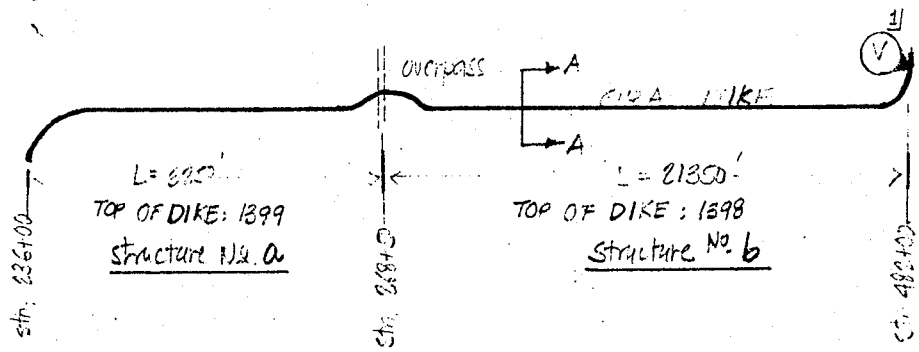
ELEVATION vs STORAGE (Granite Reef Aqueduct)
Reach 6

Stn. 269+42 to 482+00

Structure No. b



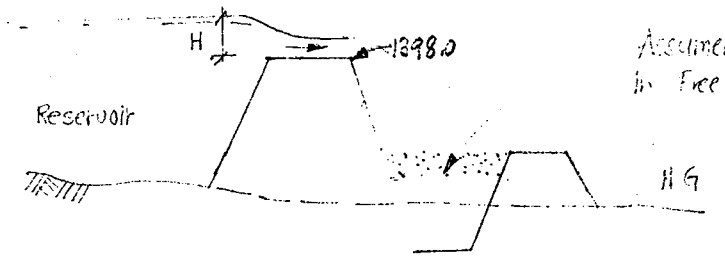
Dike overtopping



Assume weir flow conditions.

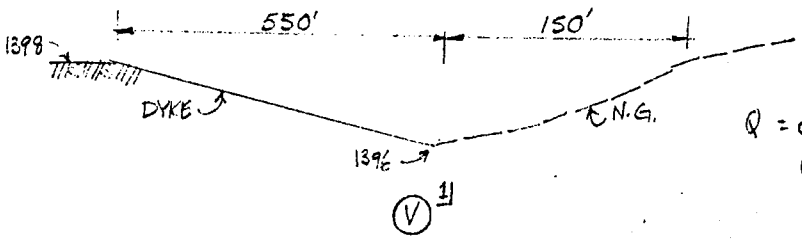
$Q = CLH^{3/2}$ 2] $C = 2.63$ (King's handbook - broad crested weir)

Elev	H (ft)	V-notch @ sta 1]	Structure No b Dike	(cfs) Total outflow
1396.0	0	0	0	0
1398.0	0	2600	0	2600
1398.25	.25	3450	7020	10470
1398.50	.5	4360	19850	24210
1398.75	.75	5340	36470	41810
1399.00	1.00	6370	56150	62520



Assumed storage volume in freeboard is insignificant

SEC. A-A



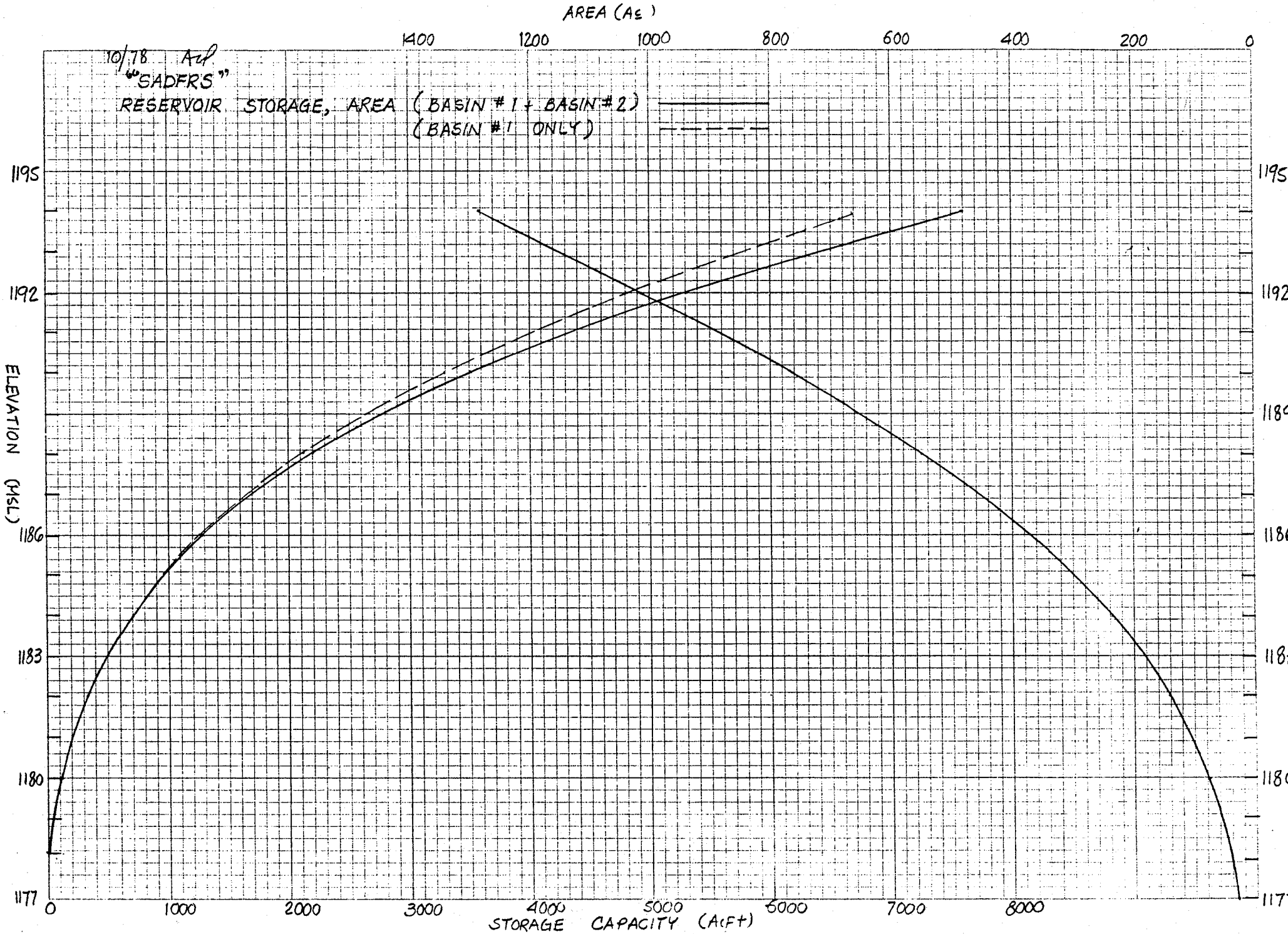
$Q = CAH^{1/2}$
(section 4, 14.46)

1] GRA SPECS. REACH 6 344-330-1411
2] Eqn. gives more conservative outflow conditions than that in NEH-4

INPUT TO TR-20 - Structure NO. 1 (GRA DIKE)

Elev.	Discharge (cfs)					Flow Area (ft²)		Storage (AcFt)		
	Struct. a 72" PIPE	Struct. b 4-72" PIPES	+ DIKE O.T.	= total	Total	Struct. a	Struct. b	Struct. a	Struct. b	Total
1380.0	0	0	0	0	0	0	0	2	48	50
1381.5	–	60	0	60	60	–	10.64	2	63	65
1382.0	5	100	0	105	105	1.06	19.66	3.8	101.5	105.3
1384.0	50	320	0	370	370	11.28	66.6	8.3	263	271.3
1386.0	125	640	0	765	765	22.74	107.2	16.4	573.6	590.0
1388.0	220	1020	0	1240	1240	28.27	113.1	31.3	1070	1101.3
1390.0	300	1300	0	1600	1600	28.27	113.1	51.7	1763.8	1815.5
1392.0	360	1530	0	1890	1890	28.27	113.1	73.6	2913.4	2987.0
1394.0	410	1720	0	2130	2130	28.27	113.1	300	4000	4300.0
1396.0	450	1890	0	2340	2340	28.27	113.1	420	5200	5570.
1398.0	495	2030	2600	4630	5125	28.27	812	540	6400	6940
1398.25	500	2045	10470	12515	13015	28.27	6324	555	6525	7080
1398.5	505	2065	24210	26275	26780	28.27	11837	570	6650	7220
1398.75	510	2080	41810	43890	44400	28.27	17350	585	6775	7360
1399.0	515	2100	62520	64620	65135	28.27	22862	600	6900	7500

K+E 10 T[redacted]NCH[redacted]G INC[redacted] 703[redacted]
KEUFFEL & ESSER CO. MADE IN U.S.A.



8/10
J.C, J.B, AP

FRS. Storage Comps.

ELEV.	BASIN Nº 1 Ac ft (1)	BASIN Nº 1 Ac ft (2)	BASIN Nº 1 AREA (Ac) (3)	BASIN Nº 2 Ac ft (4)	BASIN Nº 2 Ac ft (5)	BASIN Nº 2 AREA (Ac) (6)	Σ VOL* (Ac ft) (2)+(5)	Σ A* (Ac) (3)+(6)
1172	0		0	0				0
74	1.2		1.2	0				1.2
76	17.7		15.7	0				15.7
78	72.3		38.9	0			0	38.9
78.13	80.0*	0						
80	188.1	108.1	76.9	0			108.1	76.9
82	407.3	327.3	142.2	0		0	327.3	142.2
84	779.9	699.7	230.4	6.2	0	6.2	699.7	236.6
85.7				30.0	0			
86	1357.5	1277.5	347.3	34.4	4.4	22.1	1281.9	369.4
88	2205.9	2125.9	501.1	103.9	73.9	47.4	2199.8	548.5
90	3375.5	3295.5	668.5	248.7	218.7	97.4	3514.2	765.9
92	4889.7	4809.7	845.6	512.4	482.4	166.3	5292.1	1011.9
94	6765.2	6685.2	1029.9	930.4	900.4	251.7	7585.6	1281.6

*[Combine #1 + #2]

BASIN Nº 1 — BASIN - NORTH OF COURTHOUSE RD.
Nº 2 — " " " BUCKEYE-SALOME RD.

Col. (2) = Col (1) - 80 Ac ft ← sedi. storage Basin #1

Col. (5) = Col. (4) - 30 Ac ft. ← sedi storage Basin #2

Checked 10/5/78

JOB Nº 3043-000

SADDLEBACK

STORAGE POND

BASIN NO. 1

LOCATION: STA 0+00 TO [illegible]

ELEVATION ①	PLANIMETER READING	SQ.IN. ②	AREA. ACRES	AVE. AREA.	DEPTH FT.	VOLUME AcFt.	ACCUM. VOL. AcF
1172 1174	0.68	1.36	1.2	.6	2	1.2	1.2
1175	4.35	8.70	8.0	4.6	1	4.6	5.9
1176	8.57	17.14	15.7	11.9	1	11.9	17.7
1178	21.16	42.32	38.9	27.3	2	54.6	72.3
1180	41.89	83.78	76.9	57.9	2	115.8	188.1
1182	77.43	154.86	142.2	109.6	2	219.1	407.3
1184	125.45	250.90	230.4	186.3	2	372.6	779.9
86	189.12	378.20	347.3	288.8	2	577.7	1357.5
88	272.84	545.68	501.1	424.2	2	848.4	2205.9
90	364.01	728.02	668.5	584.8	2	1169.6	3375.5
92	460.43	920.86	845.6	757.1	2	1514.1	4889.7
94	560.80	1121.60	1029.9	937.8	2	1875.5	6765.2

* EL. 1175 PARTLY ESTIMATED

checked 10/5/78

JOB Nº

3043-000

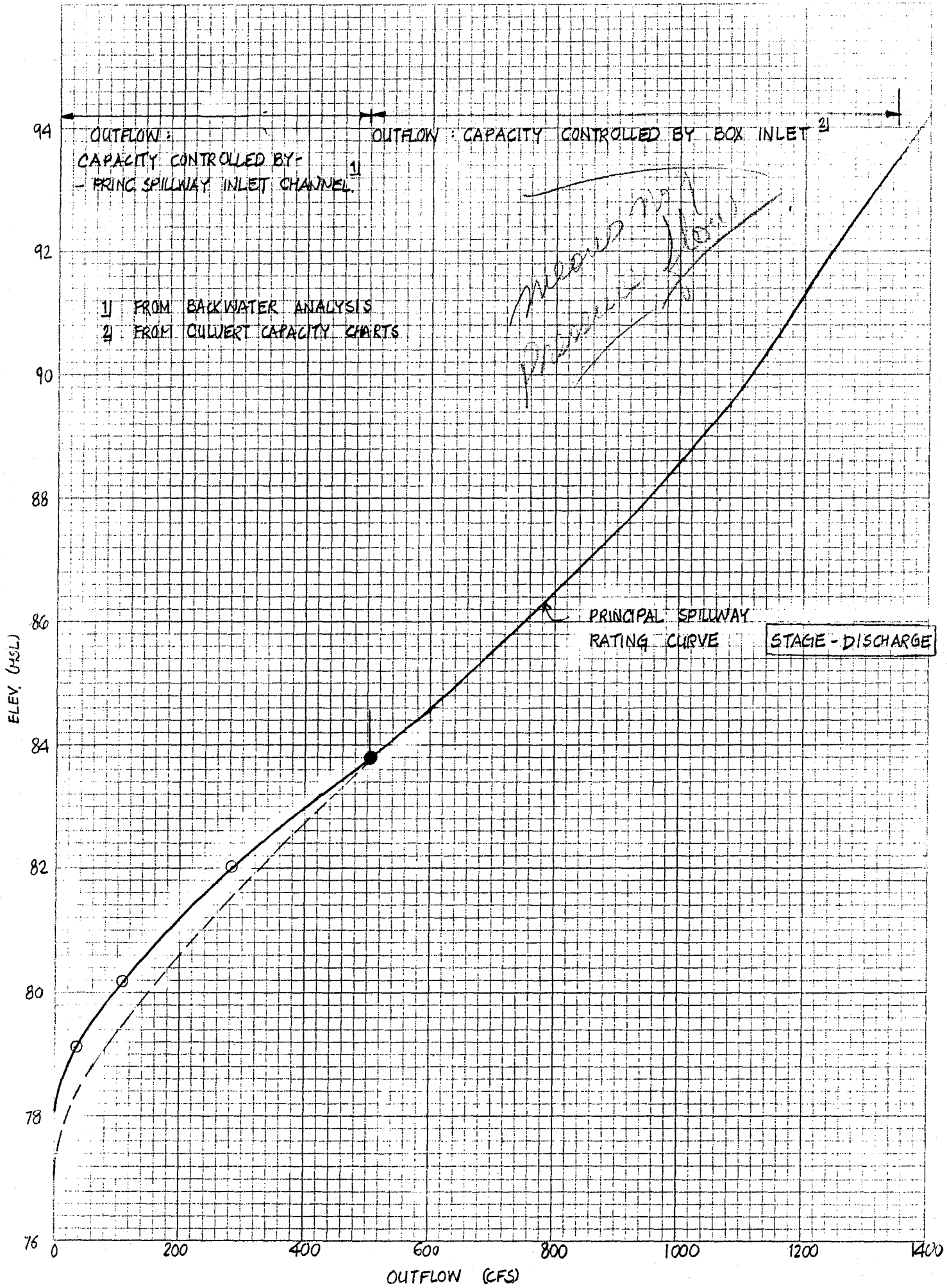
SADDLEBACK

STORAGE POND | BASIN NO. 2

LOCATION: BUCKEYE SALOME RD TO STA 7724--

ELEVATION	PLANIMETER READING	SQ.IN.	AREA. ACRES	AVE. AREA.	DEPTH FT.	VOLUME Ac Ft.	ACCUM. VOL. Ac
1182		0					0
1184	3.36	6.72	6.17	3.08	2	.617	6.2
86	12.03	24.06	22.09	14.13	2	2.826	34.4
88	25.80	51.60	47.38	34.74	2	6.947	103.9
90	53.03	106.06	97.39	72.39	2	14.477	248.7
92	90.57	181.14	166.34	131.86	2	26.373	512.4
1194	123.55	274.10	251.70	209.02	2	41.803	930.4

Checked 10/5/78 (JB)


OUTFLOW:
CAPACITY CONTROLLED BY-
- PRINC SPILLWAY INLET CHANNEL 1
OUTFLOW : CAPACITY CONTROLLED BY BOX INLET 2
1 FROM BACKWATER ANALYSIS
2 FROM CULVERT CAPACITY CHARTS
PRINCIPAL SPILLWAY
RATING CURVE
STAGE - DISCHARGE
ELEV. (MSL)
94
92
90
88
86
84
82
80
78
76
0
200
400
600
800
1000
1200
1400
OUTFLOW (CFS)

STAGE VS DISCHARGE CURVE : PRINCIPAL SPILLWAY

PROJECT: SADFRS

DESIGNER: A-P

DATE: 10/78

HYDROLOGIC AND CHANNEL INFORMATION

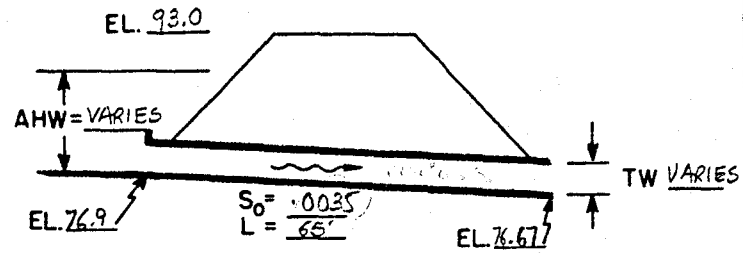
Q_1 = VARIES TW_1 = VARIES

Q_2 = _____ TW_2 = _____

(Q_1 = DESIGN DISCHARGE , SAY Q_{25}
Q_2 = CHECK DISCHARGE , SAY Q_{50} OR Q_{100})

SKETCH

STATION : _____



MEAN STREAM VELOCITY = _____

MAX. STREAM VELOCITY = _____

ELEV.	CULVERT DESCRIPTION (ENTRANCE TYPE)	Q	SIZE	HEADWATER COMPUTATION: INLET CONT. HW/D	INLET CONT. HW	OUTLET CONTROL HW=H+h₀−LS₀: K_e	H	d_c	$\frac{d_c+D}{2}$	TW	h_o	LS_o	HW	CONTROLLING HW	OUTLET VELOCITY	COST	COMMENTS
	R.C. TWIN BOX Wing Flare = 75°		10×8														
76.1	Square edge at crown																
77.1		0		0	0								N/A	0.0			
78.1		30 ‖		.13	1.0								"	1.0			
79.5		110		.3	2.4			-					"	2.4			INLET CONTROL
81.5		280		.55	4.4			-					"	4.4			"
83.5		480		.8	6.4			-					"	6.4			"
85.5		700		1.05	8.4	.4	1.8	5.3	6.65		6.65	.23	8.22	8.4			"
87.5		900		1.3	10.4		3.0	6.6	7.3		7.3	"	10.07	10.4			"
89.5		1080		1.55	12.4		4.4	7.2	7.6		7.6	"	11.77	12.4			"
91.5		1210		1.8	14.4		5.5	7.7	7.85		7.85	"	13.12	14.4			"
93.5		1350		2.05	16.4		6.7	8.0	8.0		8.0	"	14.47	16.4			"

check

SUMMARY & RECOMMENDATIONS:

REF : 1. SEC. 4 CHPT. 14 , CULVERTS
2. HEC. 5

‖ Assumed weir flow - $Q = CLH^{3/2}$
$= 3 \times 10 \times 1^{3/2} = 30$ cfs

PROJECT: SADFRS

DESIGNER: AcP

BACKWATER ANALYSIS

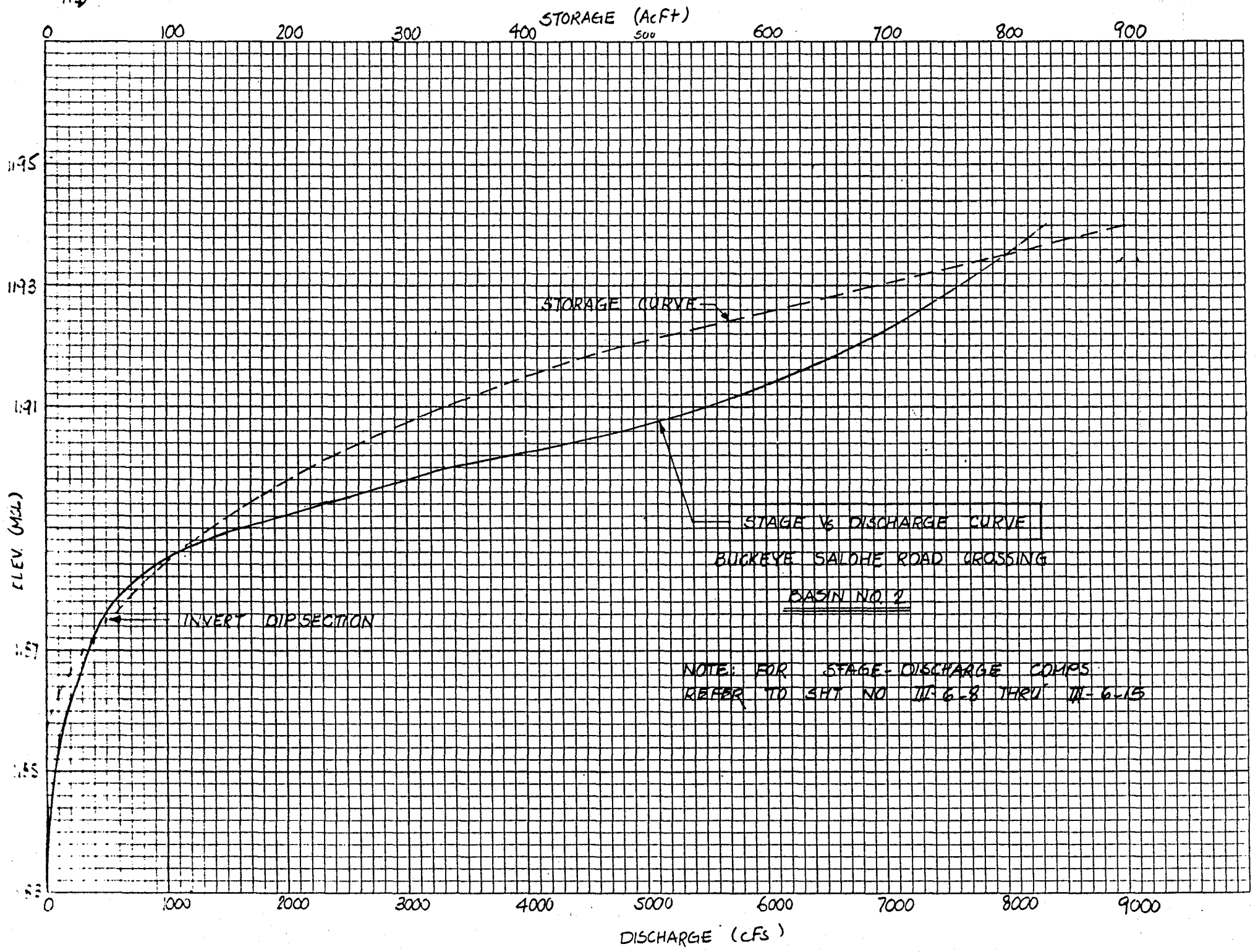
DATE: 10/11/78

CROSS SECTION	STO. A Side Slope Z:1	STO. B Bot. Width (ft.)	STO. C Length (ft.)	STO. D Discharge (cfs)	STO. E F.L. Elev. (ft.)	STO. O Manning's "n"	STO. 1 Depth (ft.)	COMMENTS	VEL. (Fps)	CALCULATED WATER SURFACE ELEVATION
20	.01	40	0	30 110 280	77.1	.032	1.0 2.4 4.4	AT BEGINING STN. INLET CHA	.75 1.14 1.59	78.1 * 79.5 * 81.5 *
50	3	40	50	30 110 280	77.11	.03			.7 .97 1.19	78.11 79.51 81.52
300	3	40	250	30 110 280	77.21	.03			.72 1.0 1.21	78.17 79.55 81.55
1300	3	40	1000	30 110 280	77.49	.03			.75 1.06 1.27	78.42 79.72 81.67
2300	3	40	1000	30 110 280	77.80	.03			.77 1.12 1.34	78.71 79.92 81.81
3300	3	40	1000	30 110 280	78.1	.03			.77 1.16 1.39	79.01 80.16 81.97

* KNOWN FROM CULVERT CAPACITY CHARTS

K+E 10 X 10 TO THE INCH • 7 X 10 INCHES KEUFFEL & ESSER CO. MADE IN U.S.A.

46 0703



GENERAL PROCEDURE FOR FLOOD HYDROGRAPH (freeboard, Emergency Spillway, 100-Yr 1 day, 50-Yr 1 day, & 10-Yr 1 day) COMPUTATIONS AND RESERVOIR ROUTING

1 Drainage Parameters: Subareas, Curve Numbers & time of conc. etc are shown on sht.

2. Design Precipitation

FH (see sht. III.2.3)
ESH (")
100-Yr 1 day (see sht. III.2.1)
50-Yr 1 day (")
10-Yr 1 day (")

3. ROUTING PROCEDURE

a. Compute flood hydrograph at CAP Dike
b. Route Flood Hydrograph thru' CAP structures
c. Split routed flow and divert 20% flow into saddleback FRS
d. Compute flood hydrograph at Basin No. 2 (Basin north of Buckeye-Salome Road) & add baseflow from Harquahala FRS
e. Route flood hydrograph thru' Buckeye-Salome Road culvert and dip section
f. Compute flood hydrograph from uncontrolled watershed draining to Basin No 1 (Basin north of Courthouse Road)
g. Combine routed flow from step c and step e and add uncontrolled flow from step f.
h. Route combine hydrograph from step g thru' Principal Spillway

4. Schematic for TR-20 run (see sht. III.5.7)

5. TR-20 computer input data listing and output summary Tables

PRINCIPAL SPILLWAY DESIGN

In the phase I design DAMS-2 computer program was used (1) to develop spillway rating curve for drop inlet type spillway (2) to develop 10-day principal spillway Hydrograph and (3) to perform reservoir routing & to check drawdown time.

On WSDATA card - QRF of 32.03 was included to account for -

1. Base flow from Harquahala FRS = 500 cfs
2. Controlled release from GRA Basin equivalent to 240 cfs base flow.

For final design, due to certain limitations of DAMS-2, the following procedure was used for PSH computations. The methodology was discussed with Engineering Staff - WTSC and SCS Phoenix office personnel.

Procedure :

1. Develop stage-Discharge curve for principal spillway based on inlet condition (Ref. NEH 4, chap 14)

2. PSH Computations & Routing

   a. Develope PSH inflow at CAP-Dike (NEH 4, chap. 21)
   b. Route PSH-CAP thru' CAP structures using TR-20
   c. Split routed flow and divert 20% flow into Saddleback FRS using TR-20
   d. Develop PSH inflow at SADFRS from uncontrolled watershed (22.26 sq.mi)
   e. Combine flows from steps c and d and add 500 cfs baseflow to combined hydrograph using TR-20
   f. Route combined hydrograph from step e thru' Principal Spillway. (Spillway rating curve from step 1) by utilizing TR-20

   e check drawdown time

3. Compare the results of this analysis with Phase I analysis

to develop PSH. - Area above CAP

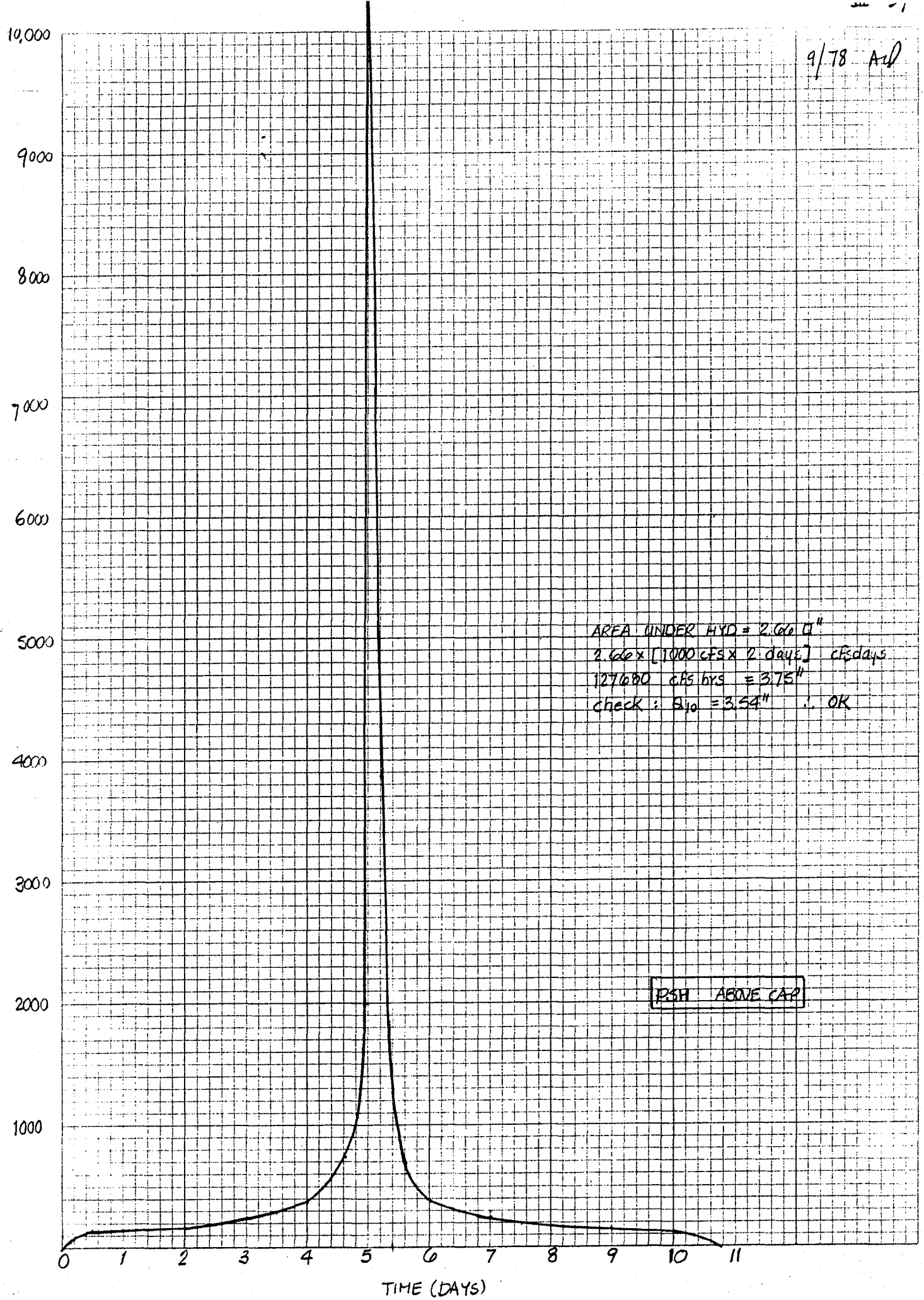
(Sec. 4. - 21.) (one day & ten day point precip)

$Q_1/Q_{10} = 2.26/3.54 = 0.638$, A = 54.73 sq. mi

For $T_c = 2.71$, & $Q_1/Q_{10} = 0.638$, Serial No. of PSH, PSMC from Table 21-9 = 13

Time, days (1)	cfs / A Q_{10} (2)	PSH (3) = (2) × A × Q_{10}
0	0	0
.2	.345	64
.5	.661	123
1.	.741	138
2	.906	169
3	1.2	224
3.5	1.462	273
4	1.986	371
4.3	2.802	523
4.6	3.961	740
4.8	5.881	1098
4.9	8.682	1621
5.	56.24	10500
5.1	42.862	8002
5.2	20.664	3858
5.3	10.89	2033
5.4	6.744	1259
5.5	4.686	875
5.6	3.438	642
5.7	2.871	536
5.8	2.618	489
6.	2.113	394
6.5	1.656	309
7.	1.325	247
7.5	1.09	202
8	.915	171
9	.719	134
10	.582	109
10.1	.086	16
10.7	0	0

PRINCIPLE SPILLWAY HYDROGRAPH



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ACP 10/78
(ucked DEN)

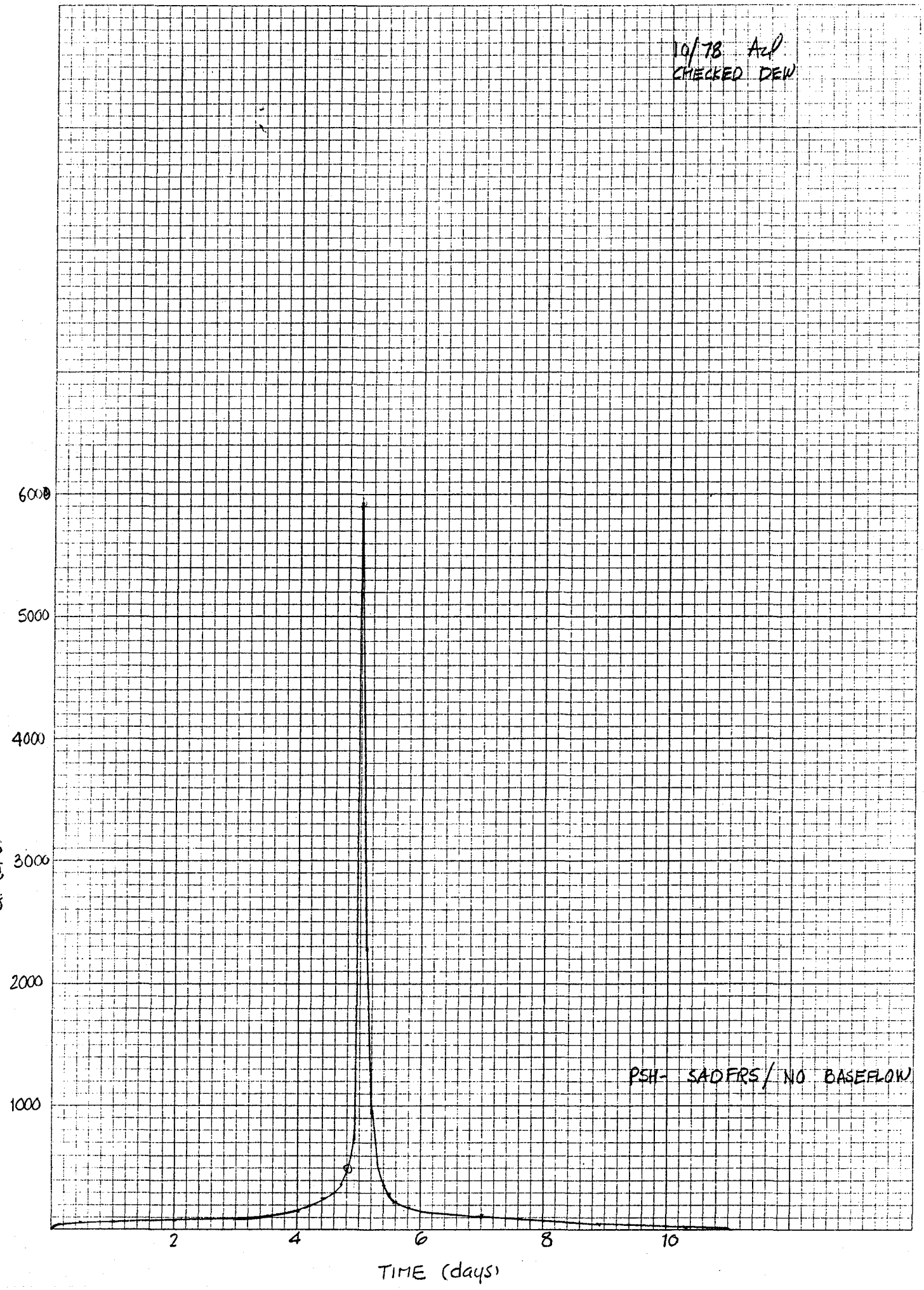
to develop PSH - Area above FRS

(section 4- 21.):

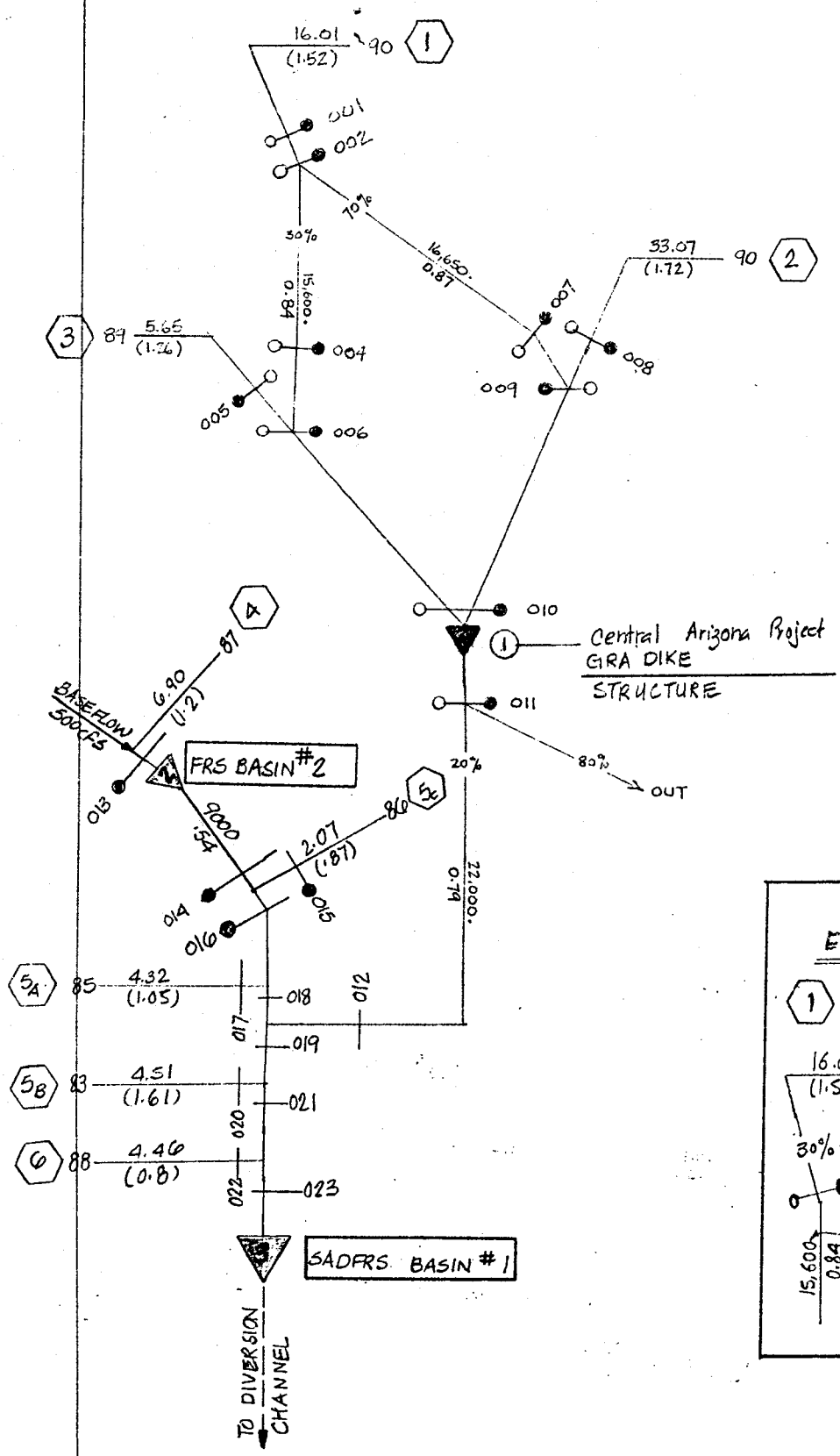
$Q_1/Q_{10} = 2.02/3.27 = 0.618$ Q_1 1 day point precip
Q_{10} 10 day point precip

For $T_c = 1.61$, & $Q_1/Q_{10} = 0.618$, Serial No of PSH from Table 21-9 : 5

Time	CFS / A. Q_{10}	PSH (from 22.26 mi²)	BASEFLOW from Harquahala	PSH input TR-20
0	0	0	500	500
.1	.528	38	"	538
.5	.671	49	"	549
1.	.754	55	"	555
2.	.922	67	"	567
3.	1.225	89	500	589
3.5	1.482	108	"	608
4.	2.014	147	"	647
4.2	2.808	204	"	704
4.4	3.374	246	"	746
4.6	4.154	302	500	802
4.7	4.96	361	"	862
4.8	6.567	478	"	978
4.9	10.131	737	"	1237
5.0	81.384	5924	"	6424
5.1	31.367	2283	500	2783
5.2	12.872	937	"	1437
5.3	7.15	520	"	1020
5.4	5.069	369	"	869
5.5	4.112	299	"	799
5.6	2.998	218	500	718
5.8	2.554	186	"	686
6.	2.028	148	"	648
6.5	1.678	122	"	622
7.0	1.342	98	"	598
8.0	.924	67	500	567
9.	.727	53	"	553
10.	.587	43	"	543
10.1	.022	2	"	502
10.3	0	0	"	500


10/78 AZP
CHECKED DEW
PSH- SADFRS / NO BASEFLOW
6000
5000
4000
3000
2000
1000
Q. (cfs)
2
4
6
8
10
TIME (days)

JOB. NO. 3043 - 000
3/8/78
Revised 10/78



EXPLANATION

1 Drainage Area Designation

16.01 ← Area (sq mi)
90 ← curve no.
(1.52) ← Time of Conc. (hr)
30% ← percent split flow
001 ← Concen. point (cross section)
15,600 ← reach length (ft)
0.84 ← routing Coeff. "c"

1/ BASE FLOW FROM HARQUAHALA : GIVEN 500cfs (Max.)

EXECUTIVE CONTROL CARD OPERATION LIST

LISTING OF DATA IN CORE

SADFRS & DIVERSION - TR 20 INPUT DATA

```
    0  SADDLEBACK FRS - ESH,FH,PSH

                        VELOCITY INCREMENT
    1 CTABLE                     .2000

    8                0.0000      .0800      .1800      .2500      .3200
    8                 .3700      .4100      .4500      .4900      .5100
    8                 .5400      .5700      .5900      .6100      .6300
    8                 .6500      .6600      .6700      .6900      .7000
    8                 .7100      .7200      .7300      .7400      .7500
    8                 .7600      .7700      .7700      .7800      .7900
    8                 .7900      .8000      .8100      .8100      .8200
    8                 .8200      .8300      .8300      .8400      .8400
    8                 .8400      .8500      .8500      .8600      .8600
    8                 .8600      .8600      .8700      .8700      .8700
    8                 .8800      .8800      .8800      .8900      .8900
    8                 .8900      .8900      .8900      .8900      .9000
    8                 .9000      .9000      .9000      .9000      .9100
    8                 .9100      .9100      .9100      .9100      .9100
    8                 .9200      .9200      .9200      .9200      .9200
    8                 .9200      .9200      .9200      .9300      .9300
    9 ENDTBL

            XSECTN NO.       DRAINAGE AREA
    2 XSECTN     2               1.0000

                          ELEVATION   DISCHARGE    END AREA
    8                     1580.0000      0.0000      0.0000
    8                     1582.0000    200.0000    800.0000
    8                     1584.0000    400.0000   2400.0000
    8                     1586.0000    600.0000   4800.0000
    9 ENDTBL

            XSECTN NO.       DRAINAGE AREA
    2 XSECTN     3               1.0000

                          ELEVATION   DISCHARGE    END AREA
    8                     1580.0000      0.0000      0.0000
    8                     1582.0000    467.0000   1868.0000
    8                     1584.0000    933.0000   5598.0000
    8                     1586.0000   1311.0000  10488.0000
    9 ENDTBL

            XSECTN NO.       DRAINAGE AREA
    2 XSECTN    11               1.0000

                          ELEVATION   DISCHARGE    END AREA
    8                     1380.6000      0.0000      0.0000
    8                     1382.0000      5.0000      1.0600

    8                     1384.0000     50.0000     11.2800
    8                     1386.0000    125.0000     22.7400
    8                     1388.0000    220.0000     28.2700
    8                     1390.0000    300.0000     28.2700
    8                     1392.0000    360.0000     28.2700
    8                     1394.0000    410.0000     28.2700
    8                     1396.0000    450.0000     28.2700
    8                     1398.0000    495.0000     28.2700
    8                     1398.2500    500.0000     28.2700
    8                     1398.5000    505.0000     28.2700
    8                     1398.7500    510.0000     28.2700
    8                     1399.0000    515.0000     28.2700
    9 ENDTBL
```

```
          XSECTN NO.        DRAINAGE AREA
2 XSECTN     12                 1.0000

                            ELEVATION   DISCHARGE    END AREA
8                           1380.6000      0.0000      0.0000
8                           1381.5000     60.0000     10.6400
8                           1382.0000    100.0000     19.6600
8                           1384.0000    320.0000     66.6000
8                           1386.0000    640.0000    107.2100
8                           1388.0000   1020.0000    113.1000
8                           1390.0000   1300.0000    113.1000
8                           1392.0000   1530.0000    113.1000
8                           1394.0000   1720.0000    113.1000
8                           1396.0000   1890.0000    113.1000
8                           1398.0000   4630.0000    812.0000
8                           1398.2500  12515.0000   6324.0000
8                           1398.5000  26275.0000  11837.0000
8                           1398.7500  43890.0000  17350.0000
8                           1399.0000  64620.0000  22862.0000
9 ENDTBL

          XSECTN NO.        DRAINAGE AREA
2 XSECTN     51                 1.0000

                            ELEVATION   DISCHARGE    END AREA
8                           1380.6000      0.0000      0.0000
8                           1382.0000      5.0000      1.0600
8                           1384.0000     50.0000     11.2800
8                           1386.0000    125.0000     22.7400
8                           1388.0000    220.0000     28.2700
8                           1390.0000    300.0000     28.2700
8                           1392.0000    360.0000     28.2700
8                           1394.0000    410.0000     28.2700
8                           1396.0000    450.0000     28.2700
8                           1398.0000    495.0000     28.2700
8                           1398.2500    500.0000     28.2700
8                           1398.5000    505.0000     28.2700
8                           1398.7500    510.0000     28.2700
8                           1399.0000    515.0000     28.2700
9 ENDTBL

          XSECTN NO.        DRAINAGE AREA
2 XSECTN     52                 1.0000

                            ELEVATION   DISCHARGE    END AREA
8                           1380.6000      0.0000      0.0000

8                           1381.5000     60.0000     10.6400
8                           1382.0000    100.0000     19.6600
8                           1384.0000    320.0000     66.6000
8                           1386.0000    640.0000    107.2100
8                           1388.0000   1020.0000    113.1000
8                           1390.0000   1300.0000    113.1000
8                           1392.0000   1530.0000    113.1000
8                           1394.0000   1720.0000    113.1000
8                           1396.0000   1890.0000    113.1000
8                           1398.0000   4630.0000    812.0000
8                           1398.2500  12515.0000   6324.0000
8                           1398.5000  26275.0000  11837.0000
8                           1398.7500  43890.0000  17350.0000
8                           1399.0000  64620.0000  22862.0000
9 ENDTBL
```

STRUCT NO.

3 STRUCT 1

	ELEVATION	DISCHARGE	STORAGE
8	1380.6000	0.0000	50.0000
8	1381.5000	60.0000	65.0000
8	1382.0000	105.0000	105.3000
8	1384.0000	370.0000	271.3000
8	1386.0000	765.0000	590.0000
8	1388.0000	1240.0000	1101.3000
8	1390.0000	1600.0000	1815.5000
8	1392.0000	1890.0000	2987.0000
8	1394.0000	2130.0000	4300.0000
8	1396.0000	2340.0000	5570.0000
8	1398.0000	5125.0000	6940.0000
8	1398.2500	13015.0000	7080.0000
8	1398.5000	26780.0000	7220.0000
8	1398.7500	44400.0000	7360.0000
8	1399.0000	65135.0000	7500.0000

9 ENDTBL

STRUCT NO.

3 STRUCT 2

	ELEVATION	DISCHARGE	STORAGE
8	1185.7000	0.0000	0.0000
8	1186.0000	100.0000	4.4000
8	1188.0000	700.0000	73.9000
8	1190.0000	3300.0000	218.7000
8	1192.0000	6800.0000	482.4000
8	1194.0000	8500.0000	900.4000

9 ENDTBL

STRUCT NO.

3 STRUCT 3

	ELEVATION	DISCHARGE	STORAGE
8	1178.1000	0.0000	0.0000
8	1179.5000	60.0000	108.1000
8	1181.5000	230.0000	327.3000
8	1183.5000	470.0000	699.7000
8	1185.5000	700.0000	1277.5000
8	1187.5000	900.0000	2125.9000
8	1189.5000	1080.0000	3295.5000
8	1191.5000	1210.0000	4809.7000
8	1193.5000	1350.0000	6685.2000

9 ENDTBL

STRUCT NO.

3 STRUCT 4

	ELEVATION	DISCHARGE	STORAGE
8	1380.6000	0.0000	50.0000
8	1381.5000	60.0000	65.0000
8	1382.0000	105.0000	105.3000
8	1384.0000	370.0000	271.3000
8	1386.0000	765.0000	590.0000
8	1388.0000	1240.0000	1101.3000
8	1390.0000	1600.0000	1815.5000
8	1392.0000	1890.0000	2987.0000
8	1394.0000	2130.0000	4300.0000
8	1396.0000	2340.0000	5570.0000
8	1398.0000	5125.0000	6940.0000
8	1398.2500	13015.0000	7080.0000
8	1398.5000	26780.0000	7220.0000
8	1398.7500	44400.0000	7360.0000
8	1399.0000	65135.0000	7500.0000

9 ENDTBL

```
          STRUCT NO.
3 STRUCT        5

                          ELEVATION   DISCHARGE     STORAGE
8                         1178.1000      0.0000      0.0000
8                         1179.5000     60.0000    108.1000
8                         1181.5000    230.0000    327.3000
8                         1183.5000    470.0000    699.7000
8                         1185.5000    700.0000   1281.9000
8                         1187.5000    900.0000   2199.8000
8                         1189.5000   1080.0000   3514.2000
8                         1191.5000   1210.0000   5292.1000
8                         1193.5000   1350.0000   7585.6000
9 ENDTBL

                    TIME INCREMENT
4 DINHYD

8                 0.0000      .0300       .1000       .1900       .3100
8                  .4700      .6600       .8200       .9300       .9900
8                 1.0000      .9900       .9300       .8600       .7800
8                  .6800      .5600       .4600       .3900       .3300
8                  .2800      .2410       .2070       .1740       .1470
8                  .1260      .1070       .0910       .0770       .0660
8                  .0550      .0470       .0400       .0340       .0290
8                  .0250      .0210       .0180       .0150       .0130
8                  .0110      .0090       .0080       .0070       .0060
8                  .0050      .0040       .0030       .0020       .0010
8                 0.0000     0.0000      0.0000      0.0000      0.0000
9 ENDTBL

  COMPUTED PEAK K FACTOR =  484.00

                    TIME INCREMENT
5 RAINFL 1                   .5000


8                 0.0000      .0050       .0110       .0160       .0220
8                  .0280      .0350       .0410       .0480       .0560
8                  .0630      .0710       .0800       .0890       .0980
8                  .1090      .1200       .1330       .1470       .1630
8                  .1810      .2040       .2350       .2830       .6630
8                  .7350      .7720       .7990       .8200       .8380
8                  .8540      .8680       .8800       .8910       .9020
8                  .9120      .9210       .9290       .9370       .9450
8                  .9520      .9590       .9650       .9720       .9780
8                  .9840      .9890       .9950      1.0000      1.0000
9 ENDTBL

                    TIME INCREMENT
5 RAINFL 2                   .0200

8                 0.0000      .0080       .0162       .0246       .0333
8                  .0425      .0524       .0630       .0743       .0863
8                  .0990      .1124       .1265       .1420       .1600
8                  .1800      .2050       .2550       .3450       .4370
8                  .5300      .6030       .6330       .6600       .6840
8                  .7050      .7240       .7420       .7590       .7750
8                  .7900      .8043       .8180       .8312       .8439
8                  .8561      .8678       .8790       .8898       .9002
8                  .9103      .9201       .9297       .9391       .9483
8                  .9573      .9661       .9747       .9832       .9916
8                 1.0000     1.0000      1.0000      1.0000      1.0000
9 ENDTBL
```

STANDARD CONTROL INSTRUCTIONS

"EGH & FH ROUTING"

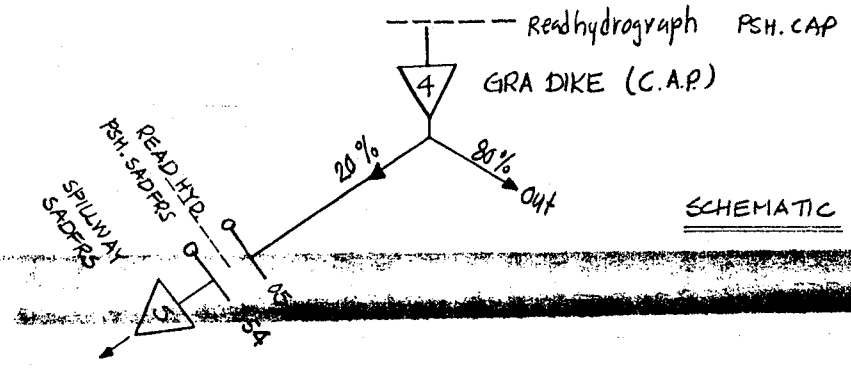
```
6 RUNOFF 1  1       6     16.0100     91.0000     1.52001 0 0 1 0 1
6 DIVERT 6  2   6 1 2      0.0000       .3000     3.00001 0 0 1 0 1
6 REACH  3  4   1   5  15600.0000       .8400     0.00001 0 0 1 0 1
6 RUNOFF 1  5       6      5.6510     89.0000     1.26001 0 0 1 0 1
6 ADDHYD 4  6   5 6 1                                   1 0 0 1 0 1
6 REACH  3  7   2   5  16650.0000       .8700     0.00001 0 0 1 0 1
6 RUNOFF 1  8       6     33.0700     90.0000     1.72001 0 0 1 0 1
6 ADDHYD 4  9   5 6 7                                   1 0 0 1 0 1
6 ADDHYD 4 10   7 1 2                                   1 0 0 1 0 1
6 RESVOR 2      1 2 7   1380.6000                       0 0 0 0 0 1
6 DIVERT 6 11   7 1 2      0.0000       .2000    12.00000 0 0 0 0 1
6 REACH  3 12   1   3  22000.0000       .7900     0.00001 0 0 1 0 1
6 RUNOFF 1 13       6      6.9000     87.0000     1.20001 0 0 1 0 1
6 REACH  3 13   6   1     10.0000       .8700     0.00000 0 0 0 0 1
6 RESVOR 2      2 1 6   1185.7000                       1 1 1 1 0 1
6 REACH  3 14   6   1   9000.0000       .6000     0.00000 0 0 0 0 1
6 RUNOFF 1 15       6      2.0700     86.0000      .87000 0 0 0 0 1
6 ADDHYD 4 16   1 6 7                                   1 1 1 1 0 1
6 RUNOFF 1 17       1      4.3200     85.0000     1.05000 0 0 0 0 1
6 ADDHYD 4 18   1 3 4                                   0 0 0 0 0 1
6 ADDHYD 4 19   4 7 3                                   0 0 0 0 0 1
6 RUNOFF 1 20       4      4.5100     83.0000     1.61000 0 0 0 0 1
6 ADDHYD 4 21   3 4 6                                   0 0 0 0 0 1
6 RUNOFF 1 22       5      4.4600     88.0000      .80000 0 0 0 0 1
6 ADDHYD 4 23   5 6 1                                   0 0 0 0 0 1
6 RESVOR 2      3 1 5   1178.1000                       1 1 1 1 0 1
6 REACH  3 24   5   3   1000.0000       .7300     0.00001 0 0 1 0 1
6 RUNOFF 1 25       6       .8400     88.0000      .70000 0 0 0 0 1
6 ADDHYD 4 26   6 3 7                                   0 0 0 0 0 1
6 REACH  3 27   7   3   1200.0000       .7300     0.00000 0 0 0 0 1
6 RUNOFF 1 28       6       .2930     88.0000      .37001 0 0 1 0 1
6 ADDHYD 4 29   3 6 7                                   1 0 0 1 0 1
6 REACH  3 30   7   5   4600.0000       .7800     0.00001 0 0 1 0 1
6 RUNOFF 1 31       6       .5540     88.0000      .28001 0 0 1 0 1
6 ADDHYD 4 32   5 6 7                                   1 0 0 1 0 1
6 REACH  3 33   7   5   1900.0000       .7800     0.00001 0 0 1 0 1
6 RUNOFF 1 34       6      1.0750     88.0000      .78001 0 0 1 0 1
6 ADDHYD 4 35   5 6 7                                   1 0 0 1 0 1
6 REACH  3 36   7   5   3500.0000       .7800     0.00001 0 0 1 0 1
6 RUNOFF 1 37       6      1.3040     88.0000      .67001 0 0 1 0 1
6 ADDHYD 4 38   5 6 7                                   1 0 0 1 0 1
6 REACH  3 39   7   5   5800.0000       .7800     0.00001 0 0 1 0 1
6 RUNOFF 1 40       6      2.3230     88.0000     1.00001 0 0 1 0 1
6 ADDHYD 4 41   5 6 7                                   1 0 0 1 0 1
6 REACH  3 42   7   5   5800.0000       .7800     0.00001 0 0 1 0 1
6 RUNOFF 1 43       6      2.6230     88.0000     1.12001 0 0 1 0 1
6 ADDHYD 4 44   5 6 7                                   1 0 0 1 0 1
6 REACH  3 45   7   5    600.0000       .7800     0.00001 0 0 1 0 1
6 RUNOFF 1 46       6       .4323     88.0000      .53201 0 0 1 0 1
6 ADDHYD 4 47   5 6 7                                   1 0 0 1 0 1
6 RESVOR 2      4 6 7   1380.6000                       1 1 1 1 0 1
6 DIVERT 6 51   7 1 2      0.0000       .2000    52.00000 0 0 0 0 1
6 REACH  3 53   1   3  22000.0000       .7900     0.00001 1 1 1 0 1
6 ADDHYD 4 54   3 4 5                                   1 1 1 1 0 1
6 RESVOR 2      5 5 2   1178.1000                       1 1 1 1 0 1
  ENDATA
```

STANDARD CONTROL INSTRUCTIONS

"100 YR, 50 YR, 10 YR - 24 HR STORM ROUTING"

```
6 RUNOFF 1   1        6      16.0100     89.0000      1.52001 0 0 1 0 1
6 DIVERT 6   2    6 1 2       0.0000       .3000      3.00001 0 0 1 0 1
6 REACH  3   4    1   5   15600.0000       .8400      0.00001 0 0 1 0 1
6 RUNOFF 1   5        6       5.6510     87.0000      1.26001 0 0 1 0 1
6 ADDHYD 4   6    5 6 1                                    1 0 0 1 0 1
6 REACH  3   7    2   5   16650.0000       .8700      0.00001 0 0 1 0 1
6 RUNOFF 1   8        6      33.0700     88.0000      1.72001 0 0 1 0 1
6 ADDHYD 4   9    5 6 7                                    1 0 0 1 0 1
6 ADDHYD 4  10    7 1 2                                    1 0 0 1 0 1
6 RESVOR 2      1 2   7    1380.6000                         0 0 0 0 0 1
6 DIVERT 6  11    7 1 2       0.0000       .2000     12.00000 0 0 0 0 1
6 REACH  3  12    1   3   22000.0000       .7900      0.00001 0 0 1 0 1
6 RUNOFF 1  13        6       6.9000     84.0000      1.20001 0 0 1 0 1
6 REACH  3  13    6   1      10.0000       .8700      0.00000 0 0 0 0 1
6 RESVOR 2      2 1   6    1185.7000                         1 1 1 1 0 1
6 REACH  3  14    6   1    9000.0000       .6000      0.00000 0 0 0 0 1
6 RUNOFF 1  15        6       2.0700     83.0000       .87000 0 0 0 0 1
6 ADDHYD 4  16    1 6 7                                    1 1 1 1 0 1
6 RUNOFF 1  17        1       4.3200     82.0000      1.05001 0 0 1 0 1
6 ADDHYD 4  18    1 3 4                                    0 0 0 0 0 1
6 ADDHYD 4  19    4 7 3                                    0 0 0 0 0 1
6 RUNOFF 1  20        4       4.5100     80.0000      1.61001 0 0 1 0 1
6 ADDHYD 4  21    3 4 6                                    0 0 0 0 0 1
6 RUNOFF 1  22        5       4.4600     85.0000       .80001 0 0 1 0 1
6 ADDHYD 4  23    5 6 1                                    0 0 0 0 0 1
6 RESVOR 2      3 1   5    1178.1000                         1 1 1 1 0 1
6 REACH  3  24    5   3    1000.0000       .7300      0.00001 0 0 1 0 1
6 RUNOFF 1  25        6        .8400     88.0000       .70000 0 0 0 0 1
6 ADDHYD 4  26    6 3 7                                    0 0 0 0 0 1
6 REACH  3  27    7   3    1200.0000       .7300      0.00000 0 0 0 0 1
6 RUNOFF 1  28        6        .2930     88.0000       .37001 0 0 1 0 1
6 ADDHYD 4  29    3 6 7                                    1 0 0 1 0 1
6 REACH  3  30    7   5    4600.0000       .7800      0.00001 0 0 1 0 1
6 RUNOFF 1  31        6        .5540     88.0000       .28001 0 0 1 0 1
6 ADDHYD 4  32    5 6 7                                    1 0 0 1 0 1
6 REACH  3  33    7   5    1900.0000       .7800      0.00001 0 0 1 0 1
6 RUNOFF 1  34        6       1.0750     88.0000       .78001 0 0 1 0 1
6 ADDHYD 4  35    5 6 7                                    1 0 0 1 0 1
6 REACH  3  36    7   5    3500.0000       .7800      0.00001 0 0 1 0 1
6 RUNOFF 1  37        6       1.3040     88.0000       .67001 0 0 1 0 1
6 ADDHYD 4  38    5 6 7                                    1 0 0 1 0 1
6 REACH  3  39    7   5    5800.0000       .7800      0.00001 0 0 1 0 1
6 RUNOFF 1  40        6       2.3230     88.0000      1.00001 0 0 1 0 1
6 ADDHYD 4  41    5 6 7                                    1 0 0 1 0 1
6 REACH  3  42    7   5    5800.0000       .7800      0.00001 0 0 1 0 1
6 RUNOFF 1  43        6       2.6230     88.0000      1.12001 0 0 1 0 1
6 ADDHYD 4  44    5 6 7                                    1 0 0 1 0 1
6 REACH  3  45    7   5     600.0000       .7800      0.00001 0 0 1 0 1
6 RUNOFF 1  46        6        .4323     88.0000       .53201 0 0 1 0 1
6 ADDHYD 4  47    5 6 7                                    1 0 0 1 0 1
6 RESVOR 2      4 6   7    1380.6000                         1 1 1 1 0 1
6 DIVERT 6  51    7 1 2       0.0000       .2000     52.00000 0 0 0 0 1
6 REACH  3  53    1   3   22000.0000       .7900      0.00001 1 1 1 0 1
6 ADDHYD 4  54    3 4 5                                    1 1 1 1 0 1
6 RESVOR 2      5 5   2    1178.1000                         1 1 1 1 0 1
  ENDATA
```

Alternate 6



PSH- 10 DAY ROUTING

INPUT DATA - READHYD. COMPUTED AS DESCRIBED IN NEH. SEC.4 PASS= 6

USE OF TR-20 ——→ FOR STORAGE ROUTING PURPOSE ONLY

DISCHARGE HYDROGRAPH, HYDROGRAPH LOCATION 6

STARTING TIME= 0.00 TIME INCREMENT= 4.80 DRAINAGE AREA= 54.73 BASE FLOW= 0.00

8	0.0000	80.0000	120.0000	130.0000	135.0000
8	140.0000	145.0000	150.0000	155.0000	160.0000
8	170.0000	175.0000	193.0000	200.0000	205.0000
8	225.0000	250.0000	260.0000	300.0000	340.0000
8	370.0000	450.0000	560.0000	730.0000	1100.0000
8	10500.0000	3860.0000	1250.0000	650.0000	490.0000
8	395.0000	350.0000	305.0000	295.0000	255.0000
8	250.0000	210.0000	200.0000	195.0000	190.0000
8	170.0000	165.0000	150.0000	145.0000	140.0000
8	135.0000	130.0000	125.0000	120.0000	115.0000
8	110.0000	15.0000	5.0000	0.0000	0.0000

9 ENDTBL

EXECUTIVE CONTROL CARD OPERATION INCREM, MAIN TIME INCREMENT= 4.80

EXECUTIVE CONTROL CARD OPERATION COMPUT, FROM XSECTN/STRUCT 0/ 4 TO XSECTN/STRUCT 53/ 0

STARTING TIME= 0.00 RAIN DEPTH= 1.00 RAIN DURATION= 1.00 RAIN TABLE NO.= 1. SOIL CONDITION= 2

ALTERNATE NO.= 1 STORM NO.= 6

SUBROUTINE RESVOR STRUCTURE 4

HYDROGRAPH, TZERO= 0.00 DELTA T= 4.80 DRAINAGE AREA= 54.73

TIME											
0.00	DISCHG	0.00	35.39	73.34	92.08	107.30	121.83	131.77	139.34	145.67	151.36
0.00	ELEV	1380.60	1381.13	1381.65	1381.86	1382.02	1382.13	1382.20	1382.26	1382.31	1382.35
48.00	DISCHG	157.92	164.93	174.10	184.88	193.35	203.76	219.99	236.83	257.59	287.61
48.00	ELEV	1382.40	1382.45	1382.52	1382.60	1382.67	1382.75	1382.87	1382.99	1383.15	1383.38
96.00	DISCHG	320.02	363.30	420.42	509.05	669.26	1729.30	2149.31	2175.08	2093.94	1987.30
96.00	ELEV	1383.62	1383.95	1384.26	1384.70	1385.52	1390.89	1394.18	1394.43	1393.70	1392.81
144.00	DISCHG	1875.56	1734.87	1603.14	1369.20	1120.67	850.51	628.56	461.40	354.46	276.56
144.00	ELEV	1391.90	1390.93	1390.02	1388.72	1387.50	1386.36	1385.31	1384.46	1383.88	1383.29
192.00	DISCHG	230.12	200.00	179.56	164.14	153.73	145.92	139.47	133.71	128.32	123.12
192.00	ELEV	1382.94	1382.72	1382.56	1382.45	1382.37	1382.31	1382.26	1382.22	1382.18	1382.14
240.00	DISCHG	118.01	94.68	63.97	15.30	1.76	.20	.02	0.00		
240.00	ELEV	1382.10	1381.89	1381.54	1380.83	1380.63	1380.60	1380.60	1380.60		

SUBROUTINE REACH CROSS SECTION 53

HYDROGRAPH, TZERO= 0.00 DELTA T= 4.80 DRAINAGE AREA= 10.95

TIME											
0.00	DISCHG	0.00	1.42	3.21	4.24	5.23	7.47	9.28	10.63	11.74	12.72
48.00	DISCHG	13.81	14.99	16.49	18.27	19.78	21.49	24.09	26.93	30.35	35.20
96.00	DISCHG	40.64	47.70	57.88	73.74	102.01	292.01	399.92	417.80	405.03	383.78
144.00	DISCHG	360.69	332.50	304.96	256.92	204.44	150.64	105.89	72.37	50.52	36.23
192.00	DISCHG	27.49	21.94	18.21	15.46	13.55	12.16	11.03	10.03	9.10	8.22
240.00	DISCHG	7.35	4.94	3.28	1.09	.19	.02	0.00			

PASS= 6

DISCHARGE HYDROGRAPH, HYDROGRAPH LOCATION 4

STARTING TIME= 0.00 TIME INCREMENT= 4.80 DRAINAGE AREA= 22.26 BASE FLOW= 0.00

8	500.0000	535.0000	540.0000	545.0000	550.0000
8	555.0000	560.0000	563.0000	565.0000	568.0000
8	570.0000	575.0000	578.0000	580.0000	585.0000
8	590.0000	605.0000	610.0000	620.0000	640.0000
8	650.0000	700.0000	750.0000	800.0000	1000.0000
8	6425.0000	1450.0000	860.0000	720.0000	480.0000
8	650.0000	640.0000	635.0000	625.0000	610.0000
8	600.0000	590.0000	580.0000	570.0000	560.0000
8	560.0000	560.0000	558.0000	555.0000	553.0000
8	550.0000	549.0000	548.0000	547.0000	546.0000
8	545.0000	500.0000	500.0000	500.0000	500.0000
8	500.0000	500.0000	500.0000	500.0000	500.0000
8	500.0000	500.0000	500.0000	500.0000	500.0000
8	500.0000	500.0000	500.0000	500.0000	500.0000
8	500.0000	500.0000	500.0000	500.0000	500.0000
8	500.0000	500.0000	500.0000	500.0000	500.0000
8	500.0000	500.0000	500.0000	500.0000	500.0000
8	500.0000	500.0000	500.0000	500.0000	500.0000
8	500.0000	500.0000	500.0000	500.0000	500.0000
9 ENDTBL					

EXECUTIVE CONTROL CARD OPERATION COMPUT. FROM XSECTN/STRUCT S4/ 0 TO XSECTN/STRUCT 0/ 5
STARTING TIME= 0.00 RAIN DEPTH= 1.00 RAIN DURATION= 1.00 RAIN TABLE NO.= 1 SOIL CONDITION= 2
ALTERNATE NO.= 1 STORM NO.= 6

SUBROUTINE ADDHYD CROSS SECTION S4

HYDROGRAPH, TZERO= 0.00 DELTA T= 4.80 DRAINAGE AREA= 33.21

TIME											
0.00	DISCHG	500.00	536.42	543.21	549.24	555.23	562.47	569.28	573.63	576.74	580.72
48.00	DISCHG	583.81	589.99	594.49	598.27	604.78	611.49	629.09	636.93	650.35	675.20
96.00	DISCHG	690.64	747.70	807.88	873.74	1102.01	6717.01	1849.92	1277.80	1125.03	863.78
144.00	DISCHG	1010.69	972.50	939.96	881.92	814.44	750.64	695.89	652.37	620.52	596.23
192.00	DISCHG	587.49	581.94	576.21	570.46	566.55	562.16	560.03	558.03	556.10	554.22
240.00	DISCHG	552.35	504.94	503.28	501.09	500.19	500.02	500.00	500.00	500.00	500.00
288.00	DISCHG	500.00	500.00	500.00	500.00	500.00	500.00	500.00	500.00	500.00	500.00
336.00	DISCHG	500.00	500.00	500.00	500.00	500.00	500.00	500.00	500.00	500.00	500.00
384.00	DISCHG	500.00	500.00	500.00	500.00	500.00	500.00	500.00	500.00	500.00	500.00
432.00	DISCHG	500.00	500.00	500.00	500.00	500.00					

SUBROUTINE RESVOR STRUCTURE 5

HYDROGRAPH, TZERO= 0.00 DELTA T= 4.80 DRAINAGE AREA= 33.21

TIME											
0.00	DISCHG	0.00	117.52	230.10	301.76	358.54	403.94	440.65	470.19	485.45	499.01
0.00	ELEV	1178.10	1180.18	1181.50	1182.10	1182.57	1182.95	1183.26	1183.50	1183.63	1183.75
48.00	DISCHG	511.11	522.12	532.31	541.62	550.33	558.73	567.68	577.17	586.83	597.87
48.00	ELEV	1183.86	1183.95	1184.04	1184.12	1184.20	1184.27	1184.35	1184.43	1184.52	1184.61
96.00	DISCHG	610.23	626.06	648.11	676.12	712.21	949.23	1104.64	1117.77	1120.16	1116.56
96.00	ELEV	1184.72	1184.86	1185.05	1185.29	1185.62	1188.05	1189.88	1190.08	1190.12	1190.06
144.00	DISCHG	1111.44	1108.01	1103.67	1098.16	1091.01	1082.19	1065.07	1044.40	1022.82	1000.90
144.00	ELEV	1189.98	1189.93	1189.86	1189.78	1189.67	1189.53	1189.33	1189.10	1188.86	1188.62
192.00	DISCHG	979.27	958.40	938.34	919.03	900.50	872.93	847.09	823.22	801.17	780.79
192.00	ELEV	1188.38	1188.15	1187.93	1187.71	1187.51	1187.23	1186.97	1186.73	1186.51	1186.31
240.00	DISCHG	761.94	742.61	722.85	704.56	678.37	652.46	630.31	611.37	595.18	581.35
240.00	ELEV	1186.12	1185.93	1185.73	1185.55	1185.31	1185.09	1184.89	1184.73	1184.59	1184.47
288.00	DISCHG	569.53	559.42	550.79	543.41	537.10	531.71	527.10	523.16	519.80	516.92
288.00	ELEV	1184.37	1184.28	1184.20	1184.14	1184.08	1184.04	1184.00	1183.96	1183.93	1183.91
336.00	DISCHG	514.46	512.36	510.56	509.03	507.72	506.59	505.64	504.82	504.12	503.52
336.00	ELEV	1183.89	1183.87	1183.85	1183.84	1183.83	1183.82	1183.81	1183.80	1183.80	1183.79
384.00	DISCHG	503.01	502.57	502.20	501.88	501.60	501.37	501.17	501.00	500.86	500.73
384.00	ELEV	1183.79	1183.78	1183.78	1183.78	1183.77	1183.77	1183.77	1183.77	1183.77	1183.77
432.00	DISCHG	500.63	500.53	500.46	500.39	500.33	460.57	356.17	275.43	210.00	154.00
432.00	ELEV	1183.77	1183.77	1183.76	1183.76	1183.76	1183.42	1182.55	1181.88	1181.26	1180.61
480.00	DISCHG	112.94	82.83	60.74	48.50	38.88	31.17	24.99	20.03	16.06	12.87
480.00	ELEV	1180.12	1179.77	1179.51	1179.23	1179.01	1178.83	1178.68	1178.57	1178.47	1178.40
528.00	DISCHG	10.32	8.27	6.63	5.32	4.26	3.42	2.74	2.20	1.76	1.41
528.00	ELEV	1178.34	1178.29	1178.25	1178.22	1178.20	1178.18	1178.16	1178.15	1178.14	1178.13
576.00	DISCHG	1.13	.91	.73	.58	.47	.37	.30	.24	.19	.15
576.00	ELEV	1178.13	1178.12	1178.12	1178.11	1178.11	1178.11	1178.11	1178.11	1178.10	1178.10
624.00	DISCHG	.12	.10	.08	.06	.05	.04	.03	.03	.02	.02
624.00	ELEV	1178.10	1178.10	1178.10	1178.10	1178.10	1178.10	1178.10	1178.10	1178.10	1178.10
672.00	DISCHG	.01	.01	.01	.01	.01	0.00				
672.00	ELEV	1178.10	1178.10	1178.10	1178.10	1178.10	1178.10				

ENDCMP

SUMMARY TABLE 1

	ALT	STORM	ID	DA SQ-MI.	RAIN TBLE	AMC	DELTA-T HRS.	TZERO HRS.	PRECIP IN.	PRECIP DURATION	PEAK-Q CFS	PEAK-TIME	PEAK-ELEV	RUNOFF IN.	CSM
	1	1	1	16.01	2	2	.20	0.00	3.49	6.00	9910.54	3.36	0.00	2.53	619.02
	1	1	2	4.80	2	2	.20	0.00	3.49	6.00	3368.01	3.36	0.00	2.80	701.23
	1	1	4	4.80	2	2	.20	0.00	3.49	6.00	3299.31	3.84	0.00	2.80	686.93
	1	1	5	5.65	2	2	.20	0.00	3.49	6.00	3578.53	3.17	0.00	2.35	633.26
	1	1	6	10.45	2	2	.20	0.00	3.49	6.00	6869.30	3.55	0.00	2.55	580.57
	1	1	7	11.21	2	2	.20	0.00	3.49	6.00	6417.66	3.77	0.00	2.41	572.65
	1	1	8	33.07	2	2	.20	0.00	3.49	6.00	18018.78	3.54	0.00	2.43	544.87
	1	1	9	44.28	2	2	.20	0.00	3.49	6.00	24213.14	3.61	0.00	2.43	546.86
	1	1	10	54.73	2	2	.20	0.00	3.49	6.00	30270.59	3.60	0.00	2.45	553.08
	1	1	-1	54.73	2	2	.20	0.00	3.49	6.00	3441.87	7.53	1396.79	2.42	62.89
	1	1	11	10.95	2	2	.20	0.00	3.49	6.00	467.80	7.53	0.00	2.18	42.74
	1	1	12	10.95	2	2	.20	0.00	3.49	6.00	467.42	8.50	1384.92	2.17	42.70
	1	1	13	6.90	2	2	.20	0.00	3.99	6.00	4988.49	3.14	0.00	2.62	722.97
	1	1	13	6.90	2	2	.20	0.00	3.99	6.00	5488.49	3.14	0.00	9.34	795.43
	1	1	-2	6.90	2	2	.20	0.00	3.99	6.00	3998.09	3.80	1190.40	9.11	579.43
	1	1	14	6.90	2	2	.20	0.00	3.99	6.00	3799.96	4.88	0.00	9.00	550.72
BSH	1	1	15	2.07	2	2	.20	0.00	3.99	6.00	1753.82	2.90	0.00	2.53	847.26
	1	1	16	8.97	2	2	.20	0.00	3.99	6.00	4289.37	4.80	0.00	7.51	478.19
	1	1	17	4.32	2	2	.20	0.00	3.99	6.00	3133.22	3.04	0.00	2.44	725.28
	1	1	18	15.27	2	2	.20	0.00	3.99	6.00	3143.03	3.04	0.00	2.25	205.88
	1	1	19	24.24	2	2	.20	0.00	3.99	6.00	5755.14	4.65	0.00	4.19	237.46
	1	1	20	4.51	2	2	.20	0.00	3.99	6.00	2320.69	3.51	0.00	2.27	514.56
	1	1	21	28.75	2	2	.20	0.00	3.99	6.00	7294.40	4.35	0.00	3.89	253.75
	1	1	22	4.46	2	2	.20	0.00	3.99	6.00	4255.27	2.84	0.00	2.71	954.10
	1	1	23	33.21	2	2	.20	0.00	3.99	6.00	11062.06	3.00	0.00	3.73	333.13
	1	1	-3	33.21	2	2	.20	0.00	3.99	6.00	1028.38	10.94	1188.93	2.57	30.97
	1	2	1	16.01	2	2	.20	0.00	6.00	6.00	19569.71	3.32	0.00	4.95	1222.34
	1	2	2	4.80	2	2	.20	0.00	6.00	6.00	6710.28	3.32	0.00	5.57	1397.10
	1	2	4	4.80	2	2	.20	0.00	6.00	6.00	6580.89	3.81	0.00	5.57	1370.16
	1	2	5	5.65	2	2	.20	0.00	6.00	6.00	7354.58	3.12	0.00	4.73	1301.47
	1	2	6	10.45	2	2	.20	0.00	6.00	6.00	12298.14	3.47	0.00	5.12	1176.41
	1	2	7	11.21	2	2	.20	0.00	6.00	6.00	12617.80	3.73	0.00	4.68	1125.89
	1	2	8	33.07	2	2	.20	0.00	6.00	6.00	36229.78	3.48	0.00	4.84	1095.55
	1	2	9	44.28	2	2	.20	0.00	6.00	6.00	48388.14	3.56	0.00	4.80	1092.85
	1	2	10	54.73	2	2	.20	0.00	6.00	6.00	60610.76	3.55	0.00	4.86	1107.43
	1	2	-1	54.73	2	2	.20	0.00	6.00	6.00	46006.94	4.47	1398.77	4.80	840.60
	1	2	11	10.95	2	2	.20	0.00	6.00	6.00	510.52	4.47	0.00	2.41	46.64
	1	2	12	10.95	2	2	.20	0.00	6.00	6.00	506.86	5.72	1385.17	2.40	46.30
	1	2	13	6.90	2	2	.20	0.00	6.86	6.00	10406.30	3.09	0.00	5.33	1508.16
	1	2	13	6.90	2	2	.20	0.00	6.86	6.00	10906.30	3.09	0.00	12.05	1580.62
	1	2	-2	6.90	2	2	.20	0.00	6.86	6.00	7083.70	3.84	1192.33	11.84	1026.62
	1	2	14	6.90	2	2	.20	0.00	6.86	6.00	6903.95	4.98	0.00	11.73	1000.57
	1	2	15	2.07	2	2	.20	0.00	6.86	6.00	3703.90	2.87	0.00	5.22	1789.33
FH	1	2	16	8.97	2	2	.20	0.00	6.86	6.00	7787.54	4.85	0.00	10.23	868.18
	1	2	17	4.32	2	2	.20	0.00	6.86	6.00	6740.40	3.00	0.00	5.10	1560.28
	1	2	18	15.27	2	2	.20	0.00	6.86	6.00	6788.15	3.01	0.00	3.17	444.65
	1	2	19	24.24	2	2	.20	0.00	6.86	6.00	11201.40	3.02	0.00	5.78	462.18
	1	2	20	4.51	2	2	.20	0.00	6.86	6.00	5159.44	3.44	0.00	4.89	1144.00
	1	2	21	28.75	2	2	.20	0.00	6.86	6.00	15673.94	3.12	0.00	5.64	545.25
	1	2	22	4.46	2	2	.20	0.00	6.86	6.00	8651.66	2.82	0.00	5.45	1939.83
	1	2	23	33.21	2	2	.20	0.00	6.86	6.00	23480.97	2.98	0.00	5.61	707.13
	1	2	-3	33.21	2	2	.20	0.00	6.86	6.00	1299.05	9.76	1192.77	3.28	39.12
	1	3	1	16.01	1	2	.20	0.00	3.94	24.00	10411.39	12.78	0.00	2.76	650.31
	1	3	2	4.80	1	2	.20	0.00	3.94	24.00	3541.31	12.78	0.00	2.98	737.31
	1	3	4	4.80	1	2	.20	0.00	3.94	24.00	3456.81	13.26	0.00	2.98	719.72
	1	3	5	5.65	1	2	.20	0.00	3.94	24.00	3863.39	12.63	0.00	2.57	683.66
	1	3	6	10.45	1	2	.20	0.00	3.94	24.00	6359.47	12.93	0.00	2.76	608.33
	1	3	7	11.21	1	2	.20	0.00	3.94	24.00	6720.24	13.19	0.00	2.67	599.65
	1	3	8	33.07	1	2	.20	0.00	3.94	24.00	19037.35	12.95	0.00	2.67	575.67

	1	3	9	44.28	1	2	.20	0.00	3.94	24.00	25431.25	13.01	0.00	2.67	574.37
	1	3	10	54.73	1	2	.20	0.00	3.94	24.00	31763.45	13.00	0.00	2.69	580.36
	1	3	-1	54.73	1	2	.20	0.00	3.94	24.00	2475.09	18.79	1396.10	2.51	45.22
	1	3	11	10.95	1	2	.20	0.00	3.94	24.00	452.18	18.79	0.00	2.35	41.31
	1	3	12	10.95	1	2	.20	0.00	3.94	24.00	452.15	19.76	1384.83	2.33	41.31
	1	3	13	6.90	1	2	.20	0.00	4.03	24.00	4533.01	12.60	0.00	2.39	656.96
	1	3	13	6.90	1	2	.20	0.00	4.03	24.00	5033.01	12.60	0.00	9.11	729.42
	1	3	-2	6.90	1	2	.20	0.00	4.03	24.00	3647.06	13.12	1190.20	8.21	528.56
	1	3	14	6.90	1	2	.20	0.00	4.03	24.00	3403.67	14.17	0.00	8.10	493.29
	1	3	15	2.07	1	2	.20	0.00	4.03	24.00	1623.49	12.38	0.00	2.31	784.29
	1	3	16	8.97	1	2	.20	0.00	4.03	24.00	3647.33	14.11	0.00	6.76	406.41
	1	3	17	4.32	1	2	.20	0.00	4.03	24.00	2910.97	12.50	0.00	2.23	673.84
	1	3	18	15.27	1	2	.20	0.00	4.03	24.00	2972.56	12.50	0.00	2.30	194.7[illegible]
	1	3	19	24.24	1	2	.20	0.00	4.03	24.00	5295.24	12.48	0.00	3.95	218.4[illegible]
	1	3	20	4.51	1	2	.20	0.00	4.03	24.00	2050.23	12.92	0.00	2.06	454.6[illegible]
	1	3	21	28.75	1	2	.20	0.00	4.03	24.00	6991.70	12.58	0.00	3.66	243.2[illegible]
	1	3	22	4.46	1	2	.20	0.00	4.03	24.00	3921.83	12.31	0.00	2.48	879.3[illegible]
100 YR - 1 DAY	1	3	23	33.21	1	2	.20	0.00	4.03	24.00	10647.56	12.44	0.00	3.50	320.6[illegible]
	1	3	-3	33.21	1	2	.20	0.00	4.03	24.00	1009.33	27.36	1188.71	2.15	30.4[illegible]
	1	3	24	33.21	1	2	.20	0.00	4.03	24.00	1009.32	27.41	0.00	2.15	30.4[illegible]
	1	3	25	.84	1	2	.20	0.00	4.03	24.00	983.74	12.24	0.00	2.75	1075.8[illegible]
	1	3	26	34.05	1	2	.20	0.00	4.03	24.00	1195.87	12.31	0.00	2.16	35.1[illegible]
	1	3	27	34.05	1	2	.20	0.00	4.03	24.00	1177.81	12.40	0.00	2.16	34.59
	1	3	28	.29	1	2	.20	0.00	4.03	24.00	409.01	12.04	0.00	2.77	1395.93
	1	3	29	34.34	1	2	.20	0.00	4.03	24.00	1442.86	12.26	0.00	2.16	42.0[illegible]
	1	4	1	16.01	1	2	.30	0.00	3.57	24.00	8989.42	12.78	0.00	2.41	561.4[illegible]
	1	4	2	4.80	1	2	.30	0.00	3.57	24.00	3049.28	12.78	0.00	2.59	634.87
	1	4	4	4.80	1	2	.30	0.00	3.57	24.00	2921.93	13.26	0.00	2.59	608.34
	1	4	5	5.65	1	2	.30	0.00	3.57	24.00	3359.42	12.63	0.00	2.24	594.48
	1	4	6	10.45	1	2	.30	0.00	3.57	24.00	5516.08	12.93	0.00	2.40	527.65
	1	4	7	11.21	1	2	.30	0.00	3.57	24.00	5772.89	13.19	0.00	2.33	515.11
	1	4	8	33.07	1	2	.30	0.00	3.57	24.00	16526.73	12.94	0.00	2.33	499.75
	1	4	9	44.28	1	2	.30	0.00	3.57	24.00	22042.68	13.01	0.00	2.33	497.84
	1	4	10	54.73	1	2	.30	0.00	3.57	24.00	27531.35	12.99	0.00	2.34	503.03
	1	4	-1	54.73	1	2	.30	0.00	3.57	24.00	2219.17	18.77	1394.85	2.34	40.55
	1	4	11	10.95	1	2	.30	0.00	3.57	24.00	426.99	18.77	0.00	2.14	39.01
	1	4	12	10.95	1	2	.30	0.00	3.57	24.00	426.94	19.72	1384.67	2.14	39.00
	1	4	13	6.90	1	2	.30	0.00	3.57	24.00	3762.64	12.61	0.00	1.99	545.31
	1	4	13	6.90	1	2	.30	0.00	3.57	24.00	4262.64	12.61	0.00	12.06	617.77
	1	4	-2	6.90	1	2	.30	0.00	3.57	24.00	3152.23	13.14	1189.89	11.12	456.84
	1	4	14	6.90	1	2	.30	0.00	3.57	24.00	2835.98	14.15	0.00	11.01	411.01
50 YR - 1 DAY	1	4	15	2.07	1	2	.30	0.00	3.57	24.00	1332.69	12.39	0.00	1.91	643.81
	1	4	16	8.97	1	2	.30	0.00	3.57	24.00	3045.12	14.09	0.00	8.91	339.4[illegible]
	1	4	17	4.32	1	2	.30	0.00	3.57	24.00	2355.08	12.53	0.00	1.83	545.1[illegible]
	1	4	18	15.27	1	2	.30	0.00	3.57	24.00	2421.59	12.54	0.00	2.06	158.4[illegible]
	1	4	19	24.24	1	2	.30	0.00	3.57	24.00	4330.10	12.54	0.00	4.59	178.4[illegible]
	1	4	20	4.51	1	2	.30	0.00	3.57	24.00	1658.06	12.92	0.00	1.69	367.4[illegible]
	1	4	21	28.75	1	2	.30	0.00	3.57	24.00	5817.58	12.65	0.00	4.14	202.3[illegible]
	1	4	22	4.46	1	2	.30	0.00	3.57	24.00	3309.16	12.34	0.00	2.07	741.9[illegible]
	1	4	23	33.21	1	2	.30	0.00	3.57	24.00	8587.74	12.46	0.00	3.86	258.4[illegible]
	1	4	-3	33.21	1	2	.30	0.00	3.57	24.00	944.28	28.12	1187.99	3.10	28.4[illegible]
	1	4	24	33.21	1	2	.30	0.00	3.57	24.00	944.28	28.17	0.00	3.10	28.4[illegible]
	1	4	25	.84	1	2	.30	0.00	3.64	24.00	773.27	12.28	0.00	2.39	920.6[illegible]
	1	4	26	34.05	1	2	.30	0.00	3.64	24.00	1045.43	12.36	0.00	3.09	30.71
	1	4	27	34.05	1	2	.30	0.00	3.64	24.00	1007.17	12.41	0.00	3.08	29.58
	1	4	28	.29	1	2	.30	0.00	3.64	24.00	354.69	12.04	0.00	2.34	1210.54
	1	4	29	34.34	1	2	.30	0.00	3.64	24.00	1199.43	12.31	0.00	3.08	34.93
	1	4	30	34.34	1	2	.30	0.00	3.64	24.00	1118.12	12.55	0.00	3.07	32.56
	1	4	31	.55	1	2	.30	0.00	3.64	24.00	739.38	11.99	0.00	2.33	1334.62
	1	4	32	34.89	1	2	.30	0.00	3.64	24.00	1448.35	12.14	0.00	3.06	41.51
	1	4	33	34.89	1	2	.30	0.00	3.64	24.00	1353.61	12.37	0.00	3.06	38.79
	1	4	34	1.08	1	2	.30	0.00	3.64	24.00	955.63	12.32	0.00	2.40	888.94
	1	4	35	35.97	1	2	.30	0.00	3.64	24.00	2306.59	12.33	0.00	3.04	64.1[illegible]

1	4	36	35.97	1	2	.30	0.00	3.64	24.00	2140.54	12.50	0.00	3.03	59.73
1	4	37	1.30	1	2	.30	0.00	3.64	24.00	1219.54	12.27	0.00	2.39	935.23
1	4	38	37.27	1	2	.30	0.00	3.64	24.00	3308.07	12.37	0.00	3.01	88.75
1	4	39	37.27	1	2	.30	0.00	3.64	24.00	3060.86	12.66	0.00	3.00	82.12
1	4	40	2.32	1	2	.30	0.00	3.64	24.00	1739.96	12.43	0.00	2.39	749.07
1	4	41	39.60	1	2	.30	0.00	3.64	24.00	4669.87	12.59	0.00	2.97	117.94
1	4	42	39.60	1	2	.30	0.00	3.64	24.00	4375.83	12.86	0.00	2.96	118.51
1	4	43	2.62	1	2	.30	0.00	3.64	24.00	1791.84	12.54	0.00	2.39	683.19
1	4	44	42.22	1	2	.30	0.00	3.64	24.00	5919.48	12.76	0.00	2.93	148.97
1	4	45	42.22	1	2	.30	0.00	3.64	24.00	5872.50	12.79	0.00	2.93	1[illegible].18
1	4	46	.43	1	2	.30	0.00	3.64	24.00	437.30	12.15	0.00	2.37	1011.[illegible]
1	4	47	42.65	1	2	.30	0.00	3.64	24.00	6017.57	12.77	0.00	2.92	141.[illegible]
1	5	1	16.01	1	2	.30	0.00	2.50	24.00	5380.04	12.80	0.00	1.45	336.04
1	5	2	4.80	1	2	.30	0.00	2.50	24.00	1800.36	12.80	0.00	1.53	374.84
1	5	4	4.80	1	2	.30	0.00	2.50	24.00	1723.79	13.28	0.00	1.53	350.90
1	5	5	5.65	1	2	.30	0.00	2.50	24.00	1941.52	12.66	0.00	1.31	343.57
1	5	6	10.45	1	2	.30	0.00	2.50	24.00	3228.85	12.96	0.00	1.41	308.10
1	5	7	11.21	1	2	.30	0.00	2.50	24.00	3480.18	13.21	0.00	1.41	310.54
1	5	8	33.07	1	2	.30	0.00	2.50	24.00	9715.24	12.96	0.00	1.38	293.78
1	5	9	44.28	1	2	.30	0.00	2.50	24.00	13040.91	13.03	0.00	1.39	294.53
1	5	10	54.73	1	2	.30	0.00	2.50	24.00	16248.20	13.02	0.00	1.39	296.87
1	5	-1	54.73	1	2	.30	0.00	2.50	24.00	1807.89	17.45	1391.43	1.39	33.[illegible]
1	5	11	10.95	1	2	.30	0.00	2.50	24.00	343.01	17.45	0.00	1.23	31.34
1	5	12	10.95	1	2	.30	0.00	2.50	24.00	342.94	18.43	1384.14	1.23	31.33
1	5	13	6.90	1	2	.30	0.00	2.50	24.00	2052.93	12.64	0.00	1.11	297.53
1	5	13	6.90	1	2	.30	0.00	2.50	24.00	2452.93	12.64	0.00	9.17	355.58
1	5	-2	6.90	1	2	.30	0.00	2.50	24.00	1786.12	13.23	1188.84	8.26	258.86
1	5	14	6.90	1	2	.30	0.00	2.50	24.00	1605.37	14.25	0.00	8.17	232.66
1	5	15	2.07	1	2	.30	0.00	2.50	24.00	710.89	12.41	0.00	1.05	343.43
1	5	16	8.97	1	2	.30	0.00	2.50	24.00	1727.94	14.20	0.00	6.53	192.64
1	5	17	4.32	1	2	.30	0.00	2.50	24.00	1237.31	12.56	0.00	1.00	286.41
1	5	18	15.27	1	2	.30	0.00	2.50	24.00	1256.18	12.57	0.00	1.16	82.28
1	5	19	24.24	1	2	.30	0.00	2.50	24.00	2319.07	12.56	0.00	3.15	95.40
1	5	20	4.51	1	2	.30	0.00	2.50	24.00	829.98	12.97	0.00	.89	184.[illegible]
1	5	21	28.75	1	2	.30	0.00	2.50	24.00	3039.99	12.65	0.00	2.79	105.7[illegible]
1	5	22	4.46	1	2	.30	0.00	2.50	24.00	1844.47	12.36	0.00	1.18	413.56
1	5	23	33.21	1	2	.30	0.00	2.50	24.00	4593.49	12.49	0.00	2.58	138.33
1	5	-3	33.21	1	2	.30	0.00	2.50	24.00	725.85	28.47	1185.76	2.18	21.86
1	5	24	33.21	1	2	.30	0.00	2.50	24.00	725.84	28.52	0.00	2.18	21.86
1	5	25	.84	1	2	.30	0.00	2.55	24.00	459.81	12.29	0.00	1.42	547.4[illegible]
1	5	26	34.05	1	2	.30	0.00	2.55	24.00	729.02	24.02	0.00	2.16	21.4[illegible]
1	5	27	34.05	1	2	.30	0.00	2.55	24.00	728.82	24.06	0.00	2.16	21.4[illegible]
1	5	28	.29	1	2	.30	0.00	2.55	24.00	209.90	12.04	0.00	1.39	716.[illegible]
1	5	29	34.34	1	2	.30	0.00	2.55	24.00	733.09	23.93	0.00	2.15	21.35
1	5	30	34.34	1	2	.30	0.00	2.55	24.00	732.25	24.08	0.00	2.15	21.3[illegible]
1	5	31	.55	1	2	.30	0.00	2.55	24.00	442.22	12.00	0.00	1.38	79[illegible].2[illegible]
1	5	32	34.89	1	2	.30	0.00	2.55	24.00	810.54	12.15	0.00	2.14	23.2[illegible]
1	5	33	34.89	1	2	.30	0.00	2.55	24.00	755.07	12.39	0.00	2.14	21.64
1	5	34	1.08	1	2	.30	0.00	2.55	24.00	566.42	12.33	0.00	1.43	526.9[illegible]
1	5	35	35.97	1	2	.30	0.00	2.55	24.00	1319.92	12.35	0.00	2.12	36.7[illegible]
1	5	36	35.97	1	2	.30	0.00	2.55	24.00	1227.35	12.51	0.00	2.11	34.1[illegible]
1	5	37	1.30	1	2	.30	0.00	2.55	24.00	726.35	12.28	0.00	1.42	557.0[illegible]
1	5	38	37.27	1	2	.30	0.00	2.55	24.00	1915.02	12.38	0.00	2.09	51.38
1	5	39	37.27	1	2	.30	0.00	2.55	24.00	1769.41	12.67	0.00	2.08	47.47
1	5	40	2.32	1	2	.30	0.00	2.55	24.00	1026.63	12.45	0.00	1.42	441.94
1	5	41	39.60	1	2	.30	0.00	2.55	24.00	2724.90	12.60	0.00	2.05	68.8[illegible]
1	5	42	39.60	1	2	.30	0.00	2.55	24.00	2550.78	12.88	0.00	2.04	64.4[illegible]
1	5	43	2.62	1	2	.30	0.00	2.55	24.00	1060.39	12.56	0.00	1.42	404.27
1	5	44	42.22	1	2	.30	0.00	2.55	24.00	3465.33	12.79	0.00	2.00	82.08
1	5	45	42.22	1	2	.30	0.00	2.55	24.00	3438.35	12.81	0.00	2.00	81.44
1	5	46	.43	1	2	.30	0.00	2.55	24.00	253.18	12.17	0.00	1.41	585.66
1	5	47	42.65	1	2	.30	0.00	2.55	24.00	3524.99	12.79	0.00	2.00	82.6[illegible]
1	6	-4	54.73	1	2	4.80	0.00	2.55	24.00	2178.66	128.36	1394.46	3.77	39.8[illegible]
1	6	51	10.95	1	2	4.80	0.00	2.55	24.00	419.33	128.32	0.00	3.10	[illegible]
1	6	53	10.95	1	2	4.80	0.00	2.55	24.00	417.91	130.00	0.00	3.10	[illegible]
1	6	54	33.21	1	2	4.80	0.00	2.55	24.00	6723.68	120.17	0.00	14.56	2[illegible]
1	6	-5	33.21	1	2	4.80	0.00	2.55	24.00	1128.19	133.92	1190.12	14.27	[illegible]

10 YR - 1 DAY

* PSH-18 day

* see schematic sht. —

SUMMARY TABLE 3

DISCHARGE,CFS

	Q1 ESH	Q2 FH	Q3 100 YR-1 DAY	Q4 50 YR 1 DAY	Q5 10 YR-1 DAY	Q6 ESH-10 DAY*	Q7	Q8	Q9	Q10
XSEC/STRUC NO. -5 ALTERNATE 1	0.00	0.00	0.00	0.00	0.00	1120.19 SADFRS	0.00	0.00	0.00	0.00
XSEC/STRUC NO. -4 ALTERNATE 1	0.00	0.00	0.00	0.00	0.00	2178.66 CAP-DIKE	0.00	0.00	0.00	0.00
XSEC/STRUC NO. -3 ALTERNATE 1 SADFRS	1028.38	1299.05	1009.33	944.28	725.85	0.00	0.00	0.00	0.00	0.00
XSEC/STRUC NO. -2 ALTERNATE 1 BASIN #2	3998.09	7083.70	3647.06	3152.23	1786.12	0.00	0.00	0.00	0.00	0.00
XSEC/STRUC NO. -1 ALTERNATE 1 CAP-DIKE	3441.87	46006.94	2475.09	2219.17	1807.89	0.00	0.00	0.00	0.00	0.00
XSEC/STRUC NO. 1 ALTERNATE 1	9910.54	19569.71	10411.39	8989.42	5380.04	0.00	0.00	0.00	0.00	0.00
XSEC/STRUC NO. 2 ALTERNATE 1	3368.01	6710.28	3541.31	3049.28	1800.36	0.00	0.00	0.00	0.00	0.00
XSEC/STRUC NO. 4 ALTERNATE 1	3299.31	6580.89	3456.81	2921.93	1723.79	0.00	0.00	0.00	0.00	0.00
XSEC/STRUC NO. 5 ALTERNATE 1	3578.53	7354.58	3863.39	3359.42	1941.52	0.00	0.00	0.00	0.00	0.00
XSEC/STRUC NO. 6 ALTERNATE 1	6069.30	12298.14	6359.47	5516.08	3220.85	0.00	0.00	0.00	0.00	0.00
XSEC/STRUC NO. 7 ALTERNATE 1	6417.66	12617.80	6720.24	5772.89	3480.18	0.00	0.00	0.00	0.00	0.00
XSEC/STRUC NO. 8 ALTERNATE 1	18018.78	36229.78	19037.35	16526.73	9715.24	0.00	0.00	0.00	0.00	0.00
XSEC/STRUC NO. 9 ALTERNATE 1	24213.14	48388.14	25431.25	22042.68	13040.91	0.00	0.00	0.00	0.00	0.00
XSEC/STRUC NO. 10 ALTERNATE 1	30270.59	60610.76	31763.45	27531.35	16248.20	0.00	0.00	0.00	0.00	0.00
XSEC/STRUC NO. 11 ALTERNATE 1	467.80	510.52	452.18	426.99	343.01	0.00	0.00	0.00	0.00	
XSEC/STRUC NO. 12 ALTERNATE 1	467.42	506.86	452.15	426.94	342.94	0.00	0.00	0.00	0.00	0.00
XSEC/STRUC NO. 13 ALTERNATE 1	5488.49	10906.30	5033.01	4262.64	2452.93	0.00	0.00	0.00	0.00	0.00
XSEC/STRUC NO. 14 ALTERNATE 1	3799.96	6903.95	3403.67	2835.98	1605.37	0.00	0.00	0.00	0.00	0.00
XSEC/STRUC NO. 15 ALTERNATE 1	1753.82	3703.90	1623.49	1332.69	710.89	0.00	0.00	0.00	0.00	0.00

* See schematic III.5.7

XSEC/STRUC NO. 16 ALTERNATE 1	4289.37	7787.54	3647.33	3045.12	1727.94	0.00	0.00	0.00	0.00	0.00
XSEC/STRUC NO. 17 ALTERNATE 1	3133.22	6740.40	2910.97	2355.08	1237.31	0.00	0.00	0.00	0.00	0.00
XSEC/STRUC NO. 18 ALTERNATE 1	3143.03	6788.15	2972.56	2421.59	1256.18	0.00	0.00	0.00	0.00	0.00
XSEC/STRUC NO. 19 ALTERNATE 1	5755.14	11201.40	5295.24	4330.10	2319.07	0.00	0.00	0.00	0.00	0.00
XSEC/STRUC NO. 20 ALTERNATE 1	2320.69	5159.44	2050.23	1658.06	829.98	0.00	0.00	0.00	0.00	0.00
XSEC/STRUC NO. 21 ALTERNATE 1	7294.40	15673.94	6991.70	5817.58	3039.99	0.00	0.00	0.00	0.00	0.00
XSEC/STRUC NO. 22 ALTERNATE 1	4255.27	8651.66	3921.83	3309.16	1844.47	0.00	0.00	0.00	0.00	0.00
XSEC/STRUC NO. 23 ALTERNATE 1	11062.06	23480.97	10647.56	8587.74	4593.49	0.00	0.00	0.00	0.00	0.00
XSEC/STRUC NO. 24 ALTERNATE 1	0.00	0.00	1009.32	944.28	725.84	0.00	0.00	0.00	0.00	0.00
XSEC/STRUC NO. 25 ALTERNATE 1	0.00	0.00	903.74	773.27	459.81	0.00	0.00	0.00	0.00	0.00
XSEC/STRUC NO. 26 ALTERNATE 1	0.00	0.00	1195.87	1045.43	729.02	0.00	0.00	0.00	0.00	0.00
XSEC/STRUC NO. 27 ALTERNATE 1	0.00	0.00	1177.81	1007.17	728.82	0.00	0.00	0.00	0.00	0.00
XSEC/STRUC NO. 28 ALTERNATE 1	0.00	0.00	409.01	354.69	209.90	0.00	0.00	0.00	0.00	0.00
XSEC/STRUC NO. 29 ALTERNATE 1	0.00	0.00	1442.86	1199.43	733.09	0.00	0.00	0.00	0.00	0.00
XSEC/STRUC NO. 30 ALTERNATE 1	0.00	0.00	0.00	1118.12	732.25	0.00	0.00	0.00	0.00	0.00
XSEC/STRUC NO. 31 ALTERNATE 1	0.00	0.00	0.00	739.38	442.22	0.00	0.00	0.00	0.00	0.00
XSEC/STRUC NO. 32 ALTERNATE 1	0.00	0.00	0.00	1448.35	810.54	0.00	0.00	0.00	0.00	0.00
XSEC/STRUC NO. 33 ALTERNATE 1	0.00	0.00	0.00	1353.61	755.07	0.00	0.00	0.00	0.00	0.00
XSEC/STRUC NO. 34 ALTERNATE 1	0.00	0.00	0.00	955.63	566.42	0.00	0.00	0.00	0.00	0.00
XSEC/STRUC NO. 35 ALTERNATE 1	0.00	0.00	0.00	2306.59	1319.92	0.00	0.00	0.00	0.00	0.00
XSEC/STRUC NO. 36 ALTERNATE 1	0.00	0.00	0.00	2148.54	1227.35	0.00	0.00	0.00	0.00	0.00

XSEC/STRUC NO. 36 ALTERNATE 1	0.00	0.00	0.00	2148.54	1227.35	0.00	0.00	0.00	0.00	0.00
XSEC/STRUC NO. 37 ALTERNATE 1	0.00	0.00	0.00	1219.54	726.35	0.00	0.00	0.00	0.00	0.00
XSEC/STRUC NO. 38 ALTERNATE 1	0.00	0.00	0.00	3308.07	1915.02	0.00	0.00	0.00	0.00	0.00
XSEC/STRUC NO. 39 ALTERNATE 1	0.00	0.00	0.00	3060.86	1769.41	0.00	0.00	0.00	0.00	0.00
XSEC/STRUC NO. 40 ALTERNATE 1	0.00	0.00	0.00	1739.96	1026.63	0.00	0.00	0.00	0.00	0.00
XSEC/STRUC NO. 41 ALTERNATE 1	0.00	0.00	0.00	4669.87	2724.90	0.00	0.00	0.00	0.00	0.00
XSEC/STRUC NO. 42 ALTERNATE 1	0.00	0.00	0.00	4375.83	2550.78	0.00	0.00	0.00	0.00	0.00
XSEC/STRUC NO. 43 ALTERNATE 1	0.00	0.00	0.00	1791.84	1060.39	0.00	0.00	0.00	0.00	0.00
XSEC/STRUC NO. 44 ALTERNATE 1	0.00	0.00	0.00	5919.48	3465.33	0.00	0.00	0.00	0.00	0.00
XSEC/STRUC NO. 45 ALTERNATE 1	0.00	0.00	0.00	5872.50	3438.35	0.00	0.00	0.00	0.00	0.00
XSEC/STRUC NO. 46 ALTERNATE 1	0.00	0.00	0.00	437.30	253.18	0.00	0.00	0.00	0.00	0.00
XSEC/STRUC NO. 47 ALTERNATE 1	0.00	0.00	0.00	6017.57	3524.99	0.00	0.00	0.00	0.00	0.00
XSEC/STRUC NO. 51 ALTERNATE 1	0.00	0.00	0.00	0.00	0.00	419.33	0.00	0.00	0.00	0.00
XSEC/STRUC NO. 53 ALTERNATE 1	0.00	0.00	0.00	0.00	0.00	417.91	0.00	0.00	0.00	0.00
XSEC/STRUC NO. 54 ALTERNATE 1	0.00	0.00	0.00	0.00	0.00	6723.68	0.00	0.00	0.00	0.00

END OF DIVERSION

ENDJOB CARD ENCOUNTERED. END OF JOB.

ACP
10/12/78

TR-20 PASS 6

ROUTED PSH THRU SADFRS

F SVOR STRUCTURE 5

HYDROGRAPH, TZERO= 0.00 DELTA T= 4.80 DRAINAGE AREA= 33.21

Time										
DISCHG	0.00	117.52	230.10	301.76	358.54	403.94	440.65	470.19	485.45	499.01
ELEV 0	1178.10	1180.18	1181.50	1182.10	1182.57	1182.95	1183.26	1183.50	1183.63	1183.75
SCHG 48.	511.11	522.12	532.31	541.62	550.33	558.73	567.68	577.17	586.83	597.87
ELEV	1183.86	1183.95	1184.04	1184.12	1184.20	1184.27	1184.35	1184.43	1184.52	1184.61
SCHG 96.	610.23	626.06	648.11	676.12	712.21	949.23	1104.64	1117.77	1120.16	1116.56
ELEV	1184.72	1184.86	1185.05	1185.29	1185.62	1188.05	1189.88	1190.08	1190.12	1190.06
DISCHG 144.	1111.44	1108.01	1103.67	1098.16	1091.01	1082.19	1065.07	1044.40	1022.82	1000.90
ELEV	1189.98	1189.93	1189.86	1189.78	1189.67	1189.53	1189.33	1189.10	1188.86	1188.62
SCHG 192.	979.27	958.40	938.34	919.03	900.50	872.93	847.09	823.22	801.17	780.79
ELEV	1188.38	1188.15	1187.93	1187.71	1187.51	1187.23	1186.97	1186.73	1186.51	1186.31
DISCHG 240.	761.94	742.61	722.85	704.56	678.37	652.46	630.31	611.37	595.18	581.35
ELEV	1186.12	1185.93	1185.73	1185.55	1185.31	1185.09	1184.89	1184.73	1184.59	1184.47
DISCHG	569.53	559.42	550.79	543.41	537.10	531.71	527.10	523.16	519.80	516.92
ELEV 288.	1184.37	1184.28	1184.20	1184.14	1184.08	1184.04	1184.00	1183.96	1183.93	1183.91
DISCHG 336.	514.46	512.36	510.56	509.03	507.72	506.59	505.64	504.82	504.12	503.52
ELEV	1183.89	1183.87	1183.85	1183.84	1183.83	1183.82	1183.81	1183.80	1183.80	1183.79
DISCHG 384.	503.01	502.57	502.20	501.88	501.60	501.37	501.17	501.00	500.86	500.73
ELEV	1183.79	1183.78	1183.78	1183.78	1183.77	1183.77	1183.77	1183.77	1183.77	1183.77
DISCHG 432.	500.63	500.53	500.46	500.39	500.33	460.57	356.17	275.43	210.00	154.00
ELEV	1183.77	1183.77	1183.76	1183.76	1183.76	1183.42	1182.55	1181.88	1181.26	1180.61
DISCHG 480.	112.94	82.83	60.74	48.50	38.88	31.17	24.99	20.03	16.06	12.87
ELEV	1180.12	1179.77	1179.51	1179.23	1179.01	1178.83	1178.68	1178.57	1178.47	1178.40
DISCHG 528.	10.32	8.27	6.63	5.32	4.26	3.42	2.74	2.20	1.76	1.41
ELEV	1178.34	1178.29	1178.25	1178.22	1178.20	1178.18	1178.16	1178.15	1178.14	1178.13
DISCHG 576.	1.13	.91	.73	.58	.47	.37	.30	.24	.19	.15
ELEV	1178.13	1178.12	1178.12	1178.11	1178.11	1178.11	1178.11	1178.11	1178.10	1178.10
DISCHG 624.	.12	.10	.08	.06	.05	.04	.03	.03	.02	.02
ELEV	1178.10	1178.10	1178.10	1178.10	1178.10	1178.10	1178.10	1178.10	1178.10	1178.10
DISCHG 672.	.01	.01	.01	.01	.01	0.00				
ELEV	1178.10	1178.10	1178.10	1178.10	1178.10	1178.10				

PEAK @ 134.4 hr

20% vol.

DRAWDOWN CHECK: Definition → TR-60, TR-48

(1) 10 day peak occurs @ 134.4 hr, Q_{peak} = 1120 cfs, E_{peak} = 1190.12

Storage Volume @ peak = 4224 Acft (from III.4.12)

(2) Reqd storage vol. for D.D. test = .20 X 4224

= 845 Acft → @ Elev. = 1184.6 (from III.4.12)

(3) D.D. to elev. 1184.6 would occur at 278.4 hr

(4) Drawdown time = $\frac{278.4 - 134.4}{24}$ = 6 days < 10 days ∴ OK

SUMMARY OF TR-20 COMPUTER RESULTS

	DURATION	REF.	PHASE I Preli. design 2-5'x6' w/ drop inlet		PHASE II Final design 1-10'x8' Box w/ 75° wings [c]	
			Outflow (cfs)	Pool Elev. (MSL)	Outflow (cfs)	Pool Elev. (MSL)
ESH	6-hr	TR-20	1130	1189.04	1028	1188.93 [b]
FH	6-hr	TR-20	1308	1192.59	1299	1192.77 [b]
100-YR	1-day	TR-20	1107	1188.61	1009	1188.71 [b]
50-Yr	1-day	TR-20	1069	1187.92	944	1187.99 [b]
10-Yr	1-day	TR-20	923	1185.54	726	1185.76 [b]
PSH	10-day	TR-20	–	–	1120	1190.12 [a]
"	10-day	DAMS-2	1100	1188.67	–	–
D.D.			5.58 days		6.0 days [d]	

a] Assumed Basin #1 & #2 acts simultaneously (Area - Capacity curve sht. III.4.12
b] Assumed Basin #1 & #2 acts independently (Area - Capacity curves sht. III.4.12 & III.4.19
c] Spillway Rating Curve - based on NEH sec. 4, inlet control (sht. III. 4.16)
d] see (sht. III.5.21) for computations

STRUCTURE HYDRAULICS

SAF BASIN

PRINCIPAL SPILLWAY

BUCKEYE - SALOME ROAD RAMP

SAF OUTLET [2]

Given 2-5'×8' BOXES, $Q_{PSH} = 1100$ cfs, $S = .007$ Ft/Ft
$W_E = W_0 = 10'$
TW = 5.86 (from Backwater Analysis) 5.68' SEE 3.1.26, FPS.

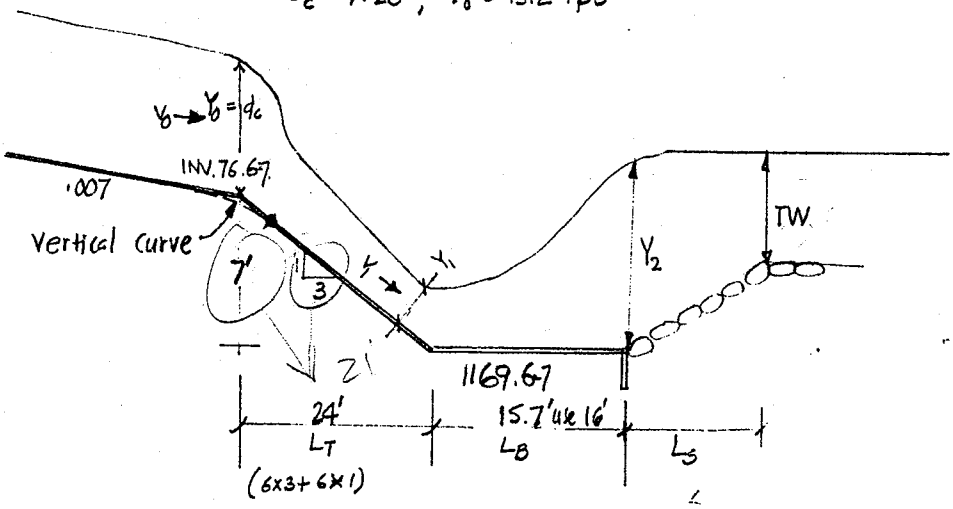
Find Dimension. SAF BASIN

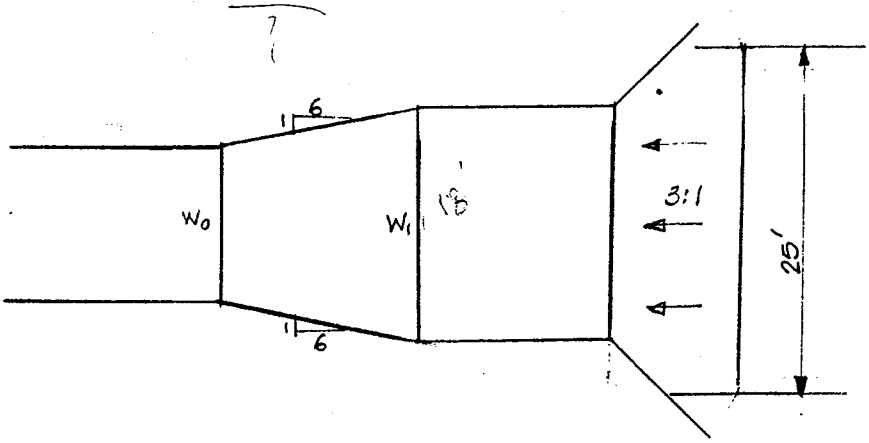
Solution 1. Use a flared section

$Z = 3F = 3 \times 1.95 = 5.84$, use $Z = 6$ [3]

ave. $V = (15.2 + 32.2)^{\frac{1}{2}} = 23.6$ (V_1, Y_1 from step 3)
ave. $Y = (7.23 + 1.91)\frac{1}{2} = 4.57$ (V_0, Y_0 from step 2)
$Fr_1 = 23.6 / \sqrt{32.2 \times 4.57} = 1.95$

2. Assume d_c @ box outlet, $Fr_0 = 1$
$d_c = 7.23'$, $V_0 = 15.2$ Fps





3. Energy balance eqn sec. 0 & sec. 1, from IV-B-7 [2]

$$Q = Y_1 W_B \left[2g(Z_0 - Z_1 + Y_0 - Y_1) + V_0^2 \right]^{\frac{1}{2}}$$

Q = Reqd capacity w/o Freeboard = ~~(1.2+.003F) Qr~~ WHY NOT
= (1.2+.003×6)1100 = 1340 cfs (Not applicable)
Design Q = 1100 cfs

1) NEH-14 (2.197)
2) HEC-14 (VII-G)

3) Design of small Dams (Pg. 393)

$$\therefore 1100 = Y_1\left(10 + \frac{24}{8}\times 2\right)\left[64.4(7+7.23-Y_1)+15.2^2\right]^{\frac{1}{2}}$$

$$= 18\,Y_1\left(916.4 - 64.4\,Y_1 + 231\right)^{\frac{1}{2}}$$

By trial & Error, $Y_1 = 1.91$

$$F_{r_1} = \frac{1100/(18\times 1.91)}{\sqrt{32.2\times 1.91}} = \frac{32}{7.84} = 4.08$$

EQN. VII-G-2

Conjugate depth $Y_j = \frac{Y_1}{2}\left(\sqrt{1+8F_{r_1}^2} - 1\right) = 10.11'$

EQN. VII-G-4 $\quad Y_2 = \left(1.1 - \frac{F_r^2}{120}\right)Y_j = 9.72'$

Since $Y_2 > TW$, $9.72 > 6$ drop the basin

EQN. VII-G-3.

$$L_B = \frac{4.5\,Y_j}{F_{r_1}^{.76}} = \frac{4.5\times 10.11'}{4.08^{.76}} = 15.83' \text{ say } 16'$$

check Water elev. @ end of basin

(i) $Y_2 + Z_2 = 9.72 + 1169.64 = 1179.36$

(ii) $TW + Z_3 = 5.86^{\text{II}} + 1173.5 = 1179.36$

II from backwater analysis

chute Blocks

$h_1 = Y_1 \simeq 2'$

$W_1 = .75\,Y_1 \simeq 1.5'$

$N_c = W_B/2W_1 = 18/2\times 1.5 = 6$ blocks

This gives 6 full blocks, 5 full spaces, and a half space at each wall

Baffle Blocks

$h_3 \simeq Y_1 \simeq 2'$

$W_3 = .75\,Y_1 \simeq 1.5' = W_4$

Basin width, $W_{B_2} = W_B = 18'$

$N_B = \frac{W_{B2}}{2W_3} = \frac{18}{2\times 1.5} = 6$ blocks

stagger the blocks, 6 full spaces 5 full blocks, and a half block at each wall.

check percent : $\frac{\text{Total block width}}{W_B} = \frac{6 \times 1.5}{18} = 0.5$ $.4 < .50 < .55$ OK

Distance from chute block $= \frac{L_B}{3} = \frac{K_0}{3} = 5.33'$
Blocks are to be staggered.

End Sill :

$h_4 = .07\, Y_j = .07 \times 10.11 = 0.71'$ say $0.7'$

Sidewall : Design Q = Q_{FH} (see sht. III.65)

height = 14.25'

wing length = 14.25', $\measuredangle$ 45°

Sidewall Design :

$Z_0 - Z_1 = 7'$
$Y_0 \cong 8'$
$V_0 = \frac{1300}{10 \times 8} = 16.25$

$$1300 = 18\, Y_1 \left[2g\,(Z_0 - Z_1 + Y_0 - Y_1) + V_0^2 \right]^{\frac{1}{2}}$$
$$= 18\, Y_1 \left[64.4\,(7 + 8 - Y_1) + 16.25^2 \right]^{\frac{1}{2}}$$

By trial & error:

$Y_1 = 2.2$ $\qquad Fr_1 = \dfrac{1300/2.2 \times 18}{\sqrt{32.2 \times 2.2}} = 3.93$

EQN. VII-G-2

Conjugate depth $\quad Y_j = \frac{Y_1}{2}\left(\sqrt{1 + 8 Fr_1^2} - 1\right) = 11.08'$

EQN. VII-G-4 $\qquad Y_2 = \left(1.1 - \frac{Fr_1^2}{120}\right) Y_j = 10.79'$

Sidewall height $= Y_2 + \frac{Y_j}{3} = 10.79 + \frac{10.08}{3}$

$= 14.15'$

$= 14.52$

say $14.25'$ ←

$14.5'$

Check SAF design using NEH-14

Ref. ES-73 · sht. 1/3

Q = 1350 cfs

V_1 = entrance velocity = 32.0 fps
d_1 = " depth = 1.91
$g = 32.2$ ft/sec^2

$$F_1 = \frac{V_1^2}{g d_1}$$
$$= \frac{32.0^2}{32.2 \times 1.91}$$
$$= 16.65$$

$3 \leq 16.65 \leq 300$ ∴ SAF can be used.

d_2 = sequent depth of flow to depth d_1

$$= \frac{d_1}{2}\left(-1 + \sqrt{8F_1 + 1}\right)$$
$$= \frac{1.91}{2}\left(-1 + \sqrt{8 \times 16.65 + 1}\right)$$
$$= 10.11'$$

d_2' = Reqd. height of tailwater over SAF stilling basin

$$= 1.4 \times d_1 \times F_1^{.45}$$
$$= 1.4 \times 1.91 \times 16.65^{.45}$$
$$= 9.48'$$

$$L_B = \frac{4.5 d_2}{F_1^{.38}}$$ = Length of SAF stilling Basin

$$= \frac{4.5 \times 10.11}{16.65^{.38}}$$
$$= 15.63' \quad \text{say } 16'$$

$Q_{fr} = 1350 \Rightarrow J$

J = height of sidewalls of SAF basin → $Q = 1100$ cfs

$$= \frac{d_2}{3} + d_2'$$
$$= \overset{12.85}{14.25} \; 1/$$

1/ see sht. III.6.5. Where?

$S = .07 d_2$ = height of transverse end sill

$= .07 \times 10.11$

$= 0.71$ say $0.7'$

$z \geq 3\sqrt{F_1}$

F_1 : average froude no. - begining & end of divergence

Pg. 393 - Design of small dams

$$F_1 = \frac{\text{ave. velocity}^2}{g \times \text{ave. depth}}$$ (from sht. III 6.2, step-1)

$$= \frac{33.6^2}{32.2 \times 4.57} = 3.78$$

$\therefore z = 3\sqrt{3.78}$

$= 5.84$ say $6'$

<u>Conclusion</u>: Design of SAF Basin confirms to NEH-14 standards

3,3

BUCKEYE - SALOME ROAD RAMP

SADDLEBACK FLOODWATER RETARDING STRUCTURE

BUCKEYE- SALOME ROAD CULVERT

basis?

Design criteria :

1. design culvert with a capacity equal to 500 cfs or a 1 year freq. storm
2. design dip section of roadway which will safely convey Freeboard hydrograph.

Procedure For Computing stage-discharge curve at Buckeye-Salome Crossing

1. design drain channel between basin #1 and basin #2
   assumed channel with 200' bottom width
   3:1 side slopes
   fs = 0.000
   invert = 1183.0
   begin channel @ stn 109+00

2. Perform backwater analyses for following Qs

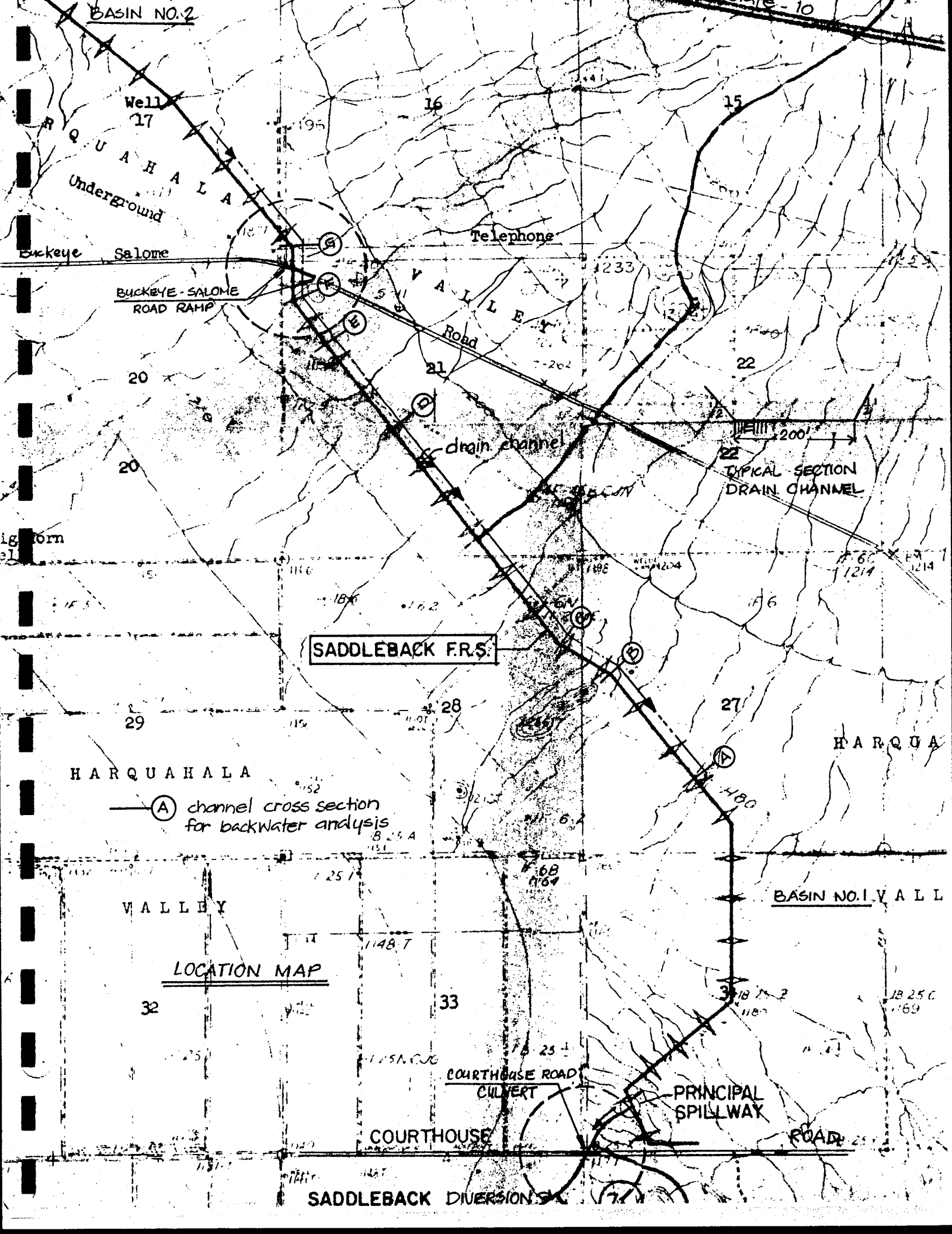
   a. 500 cfs , assume normal depth @ stn 85+00
      assume energy slope = .001 ft/ft

   b. 1000 cfs , assume normal depth @ stn 85+00
      assume energy slope = .0008 ft/ft

   c. 4000 cfs , assume normal depth @ stn 85+00
      assume energy slope = .0008 ft/ft

3. determine tailwater elevations from the backwater analyses in step 2 @ Buckeye-Salome culvert.

4. using tailwater elevations from step 3, prepare stage-discharge curve for the Buckeye-Salome Crossing


BASIN NO. 2
Well
17
16
15
HARQUAHALA
Underground
Buckeye
Salome
Telephone
BUCKEYE-SALOME
ROAD RAMP
VALLEY
Road
21
22
20
drain channel
200'
TYPICAL SECTION
DRAIN CHANNEL
SADDLEBACK F.R.S.
29
28
27
HARQUA
HARQUAHALA
A channel cross section
for backwater analysis
BASIN NO. 1
VALLEY
LOCATION MAP
32
33
COURTHOUSE ROAD
CULVERT
PRINCIPAL
SPILLWAY
COURTHOUSE
ROAD
SADDLEBACK DIVERSION

PROJECT: SADFRS (DRAIN. CHANNEL)

DESIGNER: ACP

BACKWATER ANALYSIS

DATE: 6/27/78

CROSS SECTION	STO. A Side Slope Z:1	STO. B Bot. Width (ft.)	STO. C Length (ft.)	STO. D Discharge (cfs)	STO. E F.L. Elev. (ft.)	STO. O Manning's "n"	STO. I Depth (ft.)	COMMENTS	VEL. (Fps)	CALCULATED WATER SURFACE ELEVATION
(A)		natural section		4000			4.7 ‖	slope = 0.001		1184.7
				1000		–	2.9	slope = 0.0008	1.52	1182.9
85+00	75	10	8500	500	1180	.035	2.2	slope = .0008	1.3	1182.2
(B)				4000					4.60	1187.17
				1000					2.48	1184.98
109+50	2	200	2450	500	1183	.03			1.80	1184.32
(C)				4000					3.55	1188.35
				1000					1.80	1185.71
121+50	2	"	1200	500	"	.03			1.27	1184.93
(D)				4000					2.65	1190.06
				1000					1.31	1186.68
167+34	2	"	4584	500	"	"			0.92	1185.65
(E)				4000					2.49	1190.48
				1000					1.23	1186.90
186+34	2	"	1900	500	"	"			0.86	1185.82
(F)				4000					2.42	1190.68
				1000					1.20	1187.02
197+23	2	"	1089	500	"	"			0.84	1185.92
(G)				4000					2.38	1190.79
		"		1000	"				1.18	1187.07
203+50	2		582	500		"			0.82	1185.95

‖ Normal Depth based on assumed slope. (Mannings Eqn.)

CULVERT COMPUTATION RECORD

PROJECT: SADFRS

STATION: BUCKEYE SALOME CROSSING

DESIGNER: ACP

DATE: 6/27/78

HYDROLOGIC AND CHANNEL INFORMATION

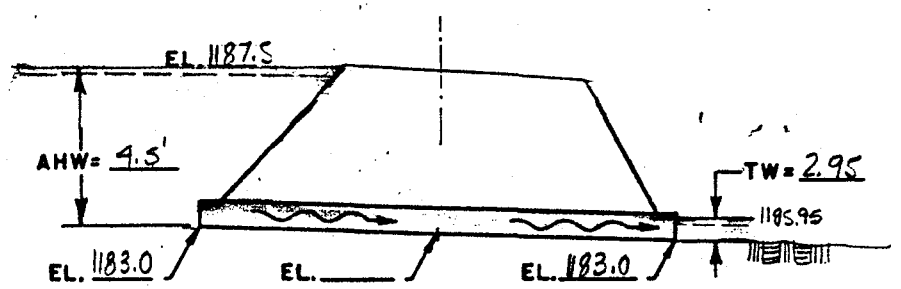
DRAINAGE AREA _____

Q_1 = 500/5 = 100 TW_1 = 2.95

Q_2 = _____ TW_2 = _____

(Q_1 = DESIGN DISCHARGE, SAY Q_{25}
Q_2 = CHECK DISCHARGE, SAY Q_{50})

SKETCH



S_o = 0.00 L = 50 L/100 S_o = _____

MEAN STREAM VELOCITY = _____

CULVERT DESCRIPTION		Q	CAP. CHART HW	HEADWATER COMPUTATION										CONTROL HW	OUTLET VELOCITY	COST	DHW ELEV.	COMMENTS
				INLET CONT.		OUTLET CONTROL $HW = H + h_o - LS_o$												
SIZE	ENTR. TYPE			$\frac{HW}{D}$	HW	K_e	H	d_c	$\frac{d_c + D}{2}$	TW	h_o	LS_o	HW					
65"x40"	Mitered to Conform to	100		1.35	4.5	0.7	2.1	2.26	2.8	2.95	2.95	0	4.9	4.9 1				5-CMP ARCH / MITERED
"	Slope 1	83		1.13	3.8	0.7	1.65	2.26	2.8	2.95	2.95	0	4.60	4.6				6-CMP ARCH / "
"	Headwall flel to Emb, rounded	100		1.23	4.1	0.5	1.6	2.26	2.8	2.95	2.95	0	4.55	4.55				* 5-CMP-ARCH/HEAD WALL
3-6'x3'	CONC. BOX w/Headwall	27.8		1.65	4.95	1.2	1.7	2.9	2.95	2.95	2.95	0	4.65					AHW too high ∴ repeat
2-10x3	"	25		1.55	4.65													too expensive

SUMMARY & RECOMMENDATIONS * USE 5 - 65"x40" CMP-ARCH w/ head wall (0°, rounded)

not in dwgs!

CULVERT COMPUTATION RECORD

PROJECT: SADFRS

STATION: BUCKEYE SALOME CROSSING

DESIGNER: Acl

DATE: 6/28/78

HYDROLOGIC AND CHANNEL INFORMATION

DRAINAGE AREA _____

Q_1 = 450 cfs/5 = 90 cfs 1]

Q_2 = _____

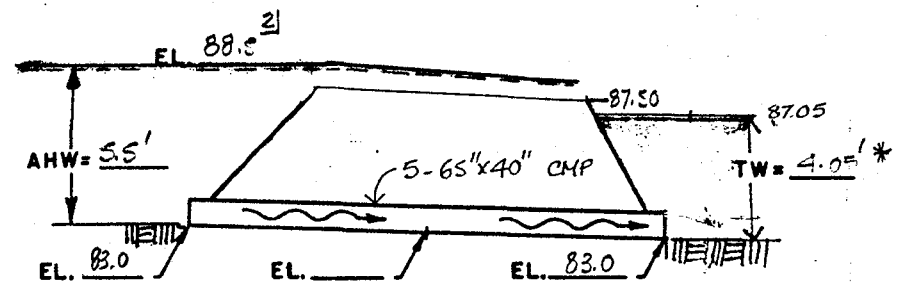
TW_1 = 4.05* from backwater analysis

TW_2 = _____

1000 cfs 1] inflow → 550 cfs (spillway flow)
→ 450 cfs (pipe flow)

(Q_1 = DESIGN DISCHARGE, SAY Q_{25}
Q_2 = CHECK DISCHARGE, SAY Q_{50})

SKETCH



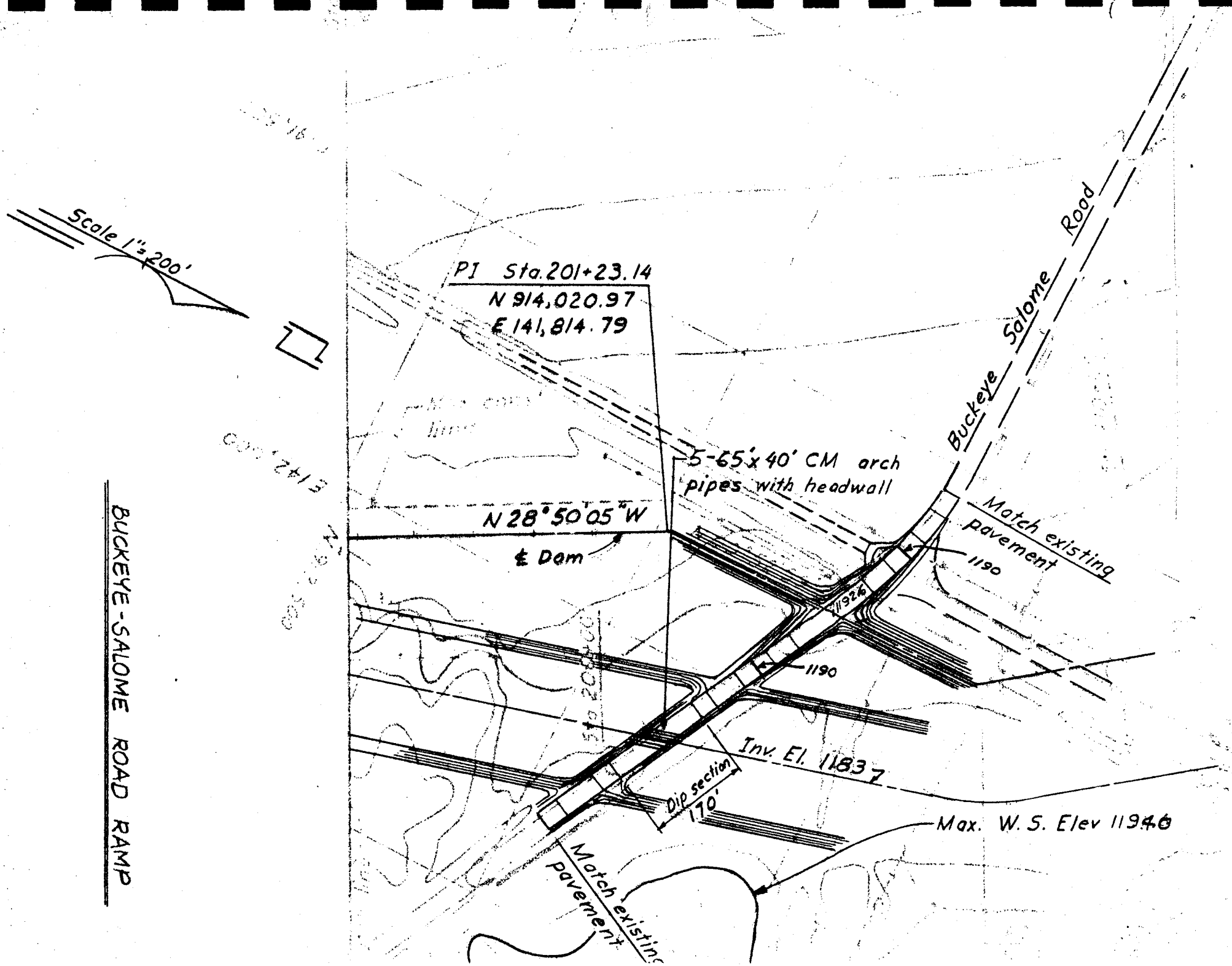
S_0 = 0.00 L = 50 L/100 S_0 = _____

MEAN STREAM VELOCITY = _____

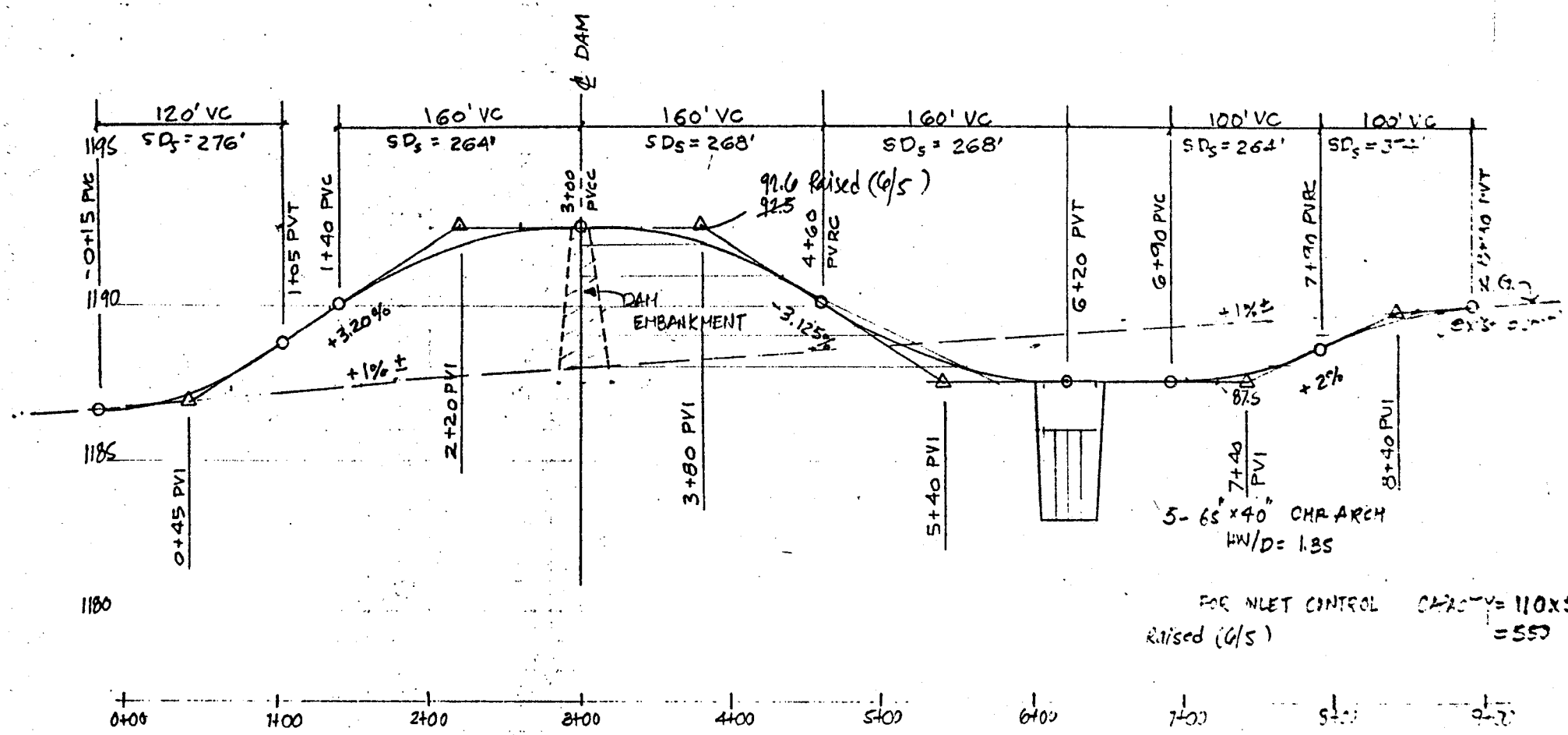
CULVERT DESCRIPTION		Q	CAP. CHART HW	HEADWATER COMPUTATION										CONTROL HW	OUTLET VELOCITY	COST	DHW ELEV.	COMMENTS
				INLET CONT.		OUTLET CONTROL $HW = H + h_o - LS_o$												
SIZE	ENTR. TYPE			$\frac{HW}{D}$	HW	K_e	H	d_c	$\frac{d_c + D}{2}$	TW	h_o	LS_o	HW					
65"x40"	H.W. ∥el to emb, rounded	90				0.5	1.45	–	–	4.05*	4.05	0	5.5					

SUMMARY & RECOMMENDATIONS 1] Design Q = 1000 cfs, Tailwater elev. 87.05 produced by backwater (see sht.)
assume, at this condition, pipe carries 90x5 = 450 cfs & (1000-450 = 550 cfs) overtops the roadway
2] Head water elev = 88.5, spillway flow due to overtopping = $CLH^{3/2}$ = $2.63(170+45H)H^{3/2}$, H = 1'
= 565 cfs ∴ inflow @ culvert = outflow

CONCLUSION: FOR INFLOW OF 1000 cfs, head water required = 5.5'.



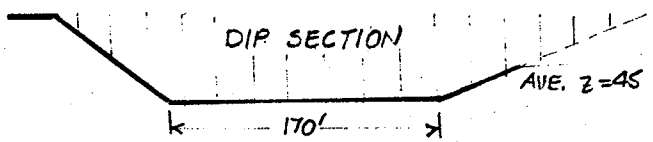
BUCKEYE-SALOME ROAD RAMP



FOR INLET CONTROL CAPACITY = 110 x 5 [1]
Raised (G/S) = 550 CFS

V = 40 MPH [2]
S = 275' (Rounded) S (computed) = 263'
FOR A = 3.5% Length of curve = 193'
A = 4.0% = 216'

1/ FHWA - HEC 5 CULVERT CAPACITY CHARTS
2/ ADOT - D-1.02



SECTION USED FOR CAPACITY CALCS

(1) $Q = CLH^{3/2}$
$= 2.63(170 + 4.5H)H^{3/2}$
OR (2) MANNINGS EQN. FOR CHANNEL FLOW

TOUPS CORPORATION

CONSULTING ENGINEERS AND PLANNERS

BY _____ DATE _____ CLIENT _____ SHEET NO. III-73 OF ____

CHECKED _____ DATE _____ JOB _____ JOB NO. 3044-002

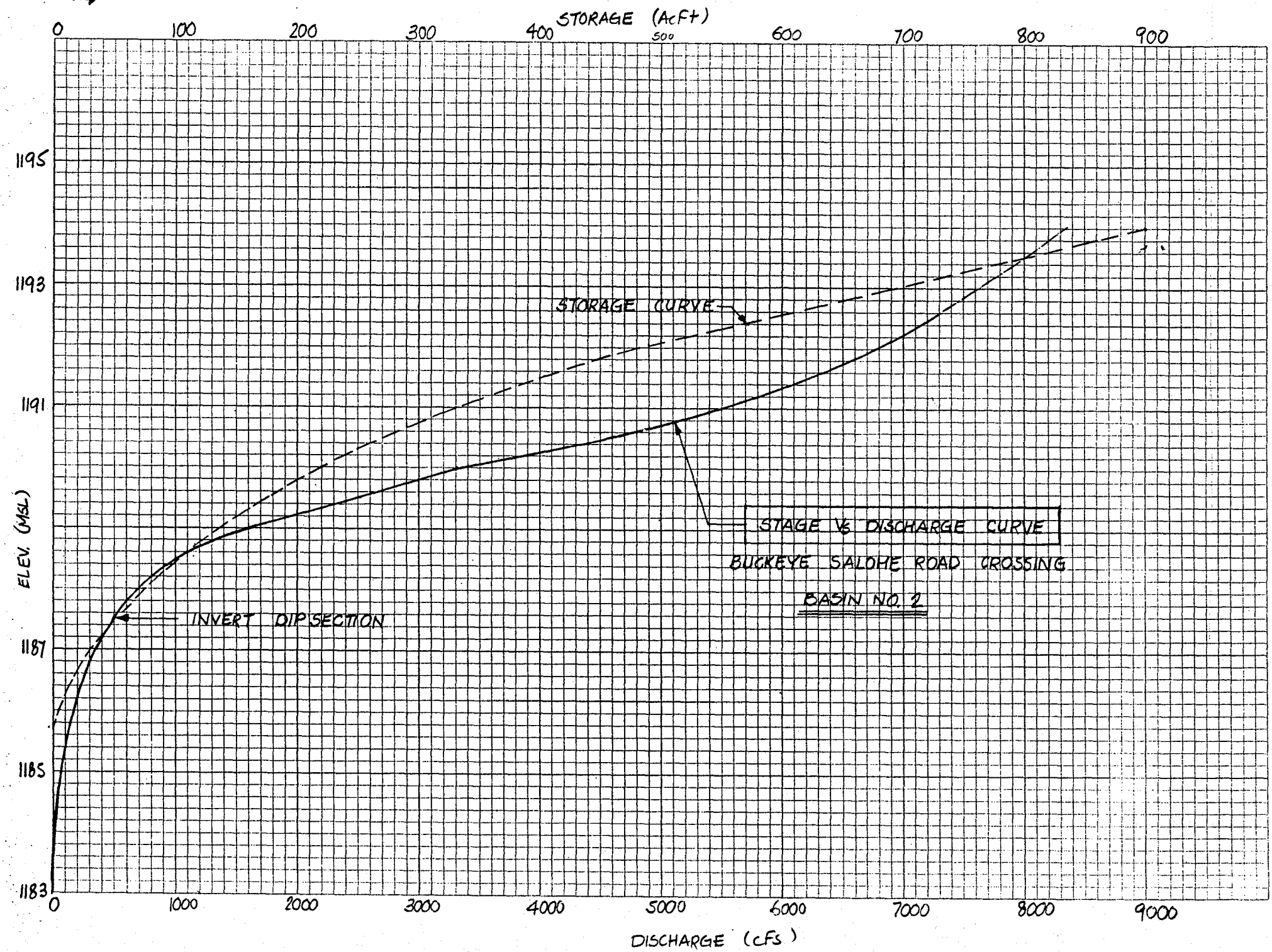
BUCKEYE - SALOME RAMP - CAPACITY* (DIP SECTION + CULVERTS) IN CFS

ELEV. (MSL)		CULVERT (CFS)	DIP SECTION SPILLWAY $Q = 2.63 L H^{3/2}$	DIP SECTION CHANNEL $n = .016, S = .001$	COMBINED CAPACITY (CFS)	REF.
1187.5	INV. DIP SEC.	500	0	0	500	sht. 7
1188.5		450	565 ✓ OR	-	1015	sht 8
1189.0		450	1148	1160 ✓	1610	
1189.5		525	1934	1988 ✓	2513	
1190.0		375	2937 ✓	3055	3312	
1190.5		375	4168 ✓	4378	4543	
1192.6		375	12100	13100	7300	

* See Capacity Chart sht. III-6.16

K+E 10 TO INCH 7 X 10 INCH
KEUFFEL & ESSER CO. MADE IN U.S.A. 703

6/78 AD



CHECK CAPACITY OF DRAIN CHANNEL

BACKWATER ANALYSIS REFLECTS THE FOLLOWING CONDITIONS

A. 100-YR 1 Day storm

1. Peak occurs at begining channel station 185+00 in basin # 1
   Known from TR-20, Pool eleu. in Basin#1 = 1188.87
   Runoff discharge = 550cfs

2. Peak occurs at Buckeye-Salome Rd. crossing
   Known from TR-20, Pool eleu. in Basin #1 = 1185.0
   Runoff discharge = 3650 cfs

B. Freeboard hydrograph

3. Peak occurs at channel sta. 185+00 in Basin #1
   Known from TR-20, Pool eleu. in Basin # 1 = 1192.70
   Runoff discharge = 700 cfs

4. Peak occurs at Buckeye-Salome Rd. Crossing
   Known from TR-20, Pool eleu. in Basin #1 = 1189.2
   Runoff discharge = 7800 cfs

Basin #1 is north of Courthouse Road
Basin #2 is north of Buckeye-Salome Road

```
*************************************************
 HEC2 RELEASE DATED NOV 76 UPDATED FEB 1977
 ERROR CORR -  01
 MODIFICATION -  50,51,52
*************************************************
```

Channel Bottom Width = 150 ft
Sections taken from left to right, looking downstream.

```
C
T1      PRC TOUPS SCS PROJECT
T2      100 YR-1 DAY STORM. PEAK OCCURS AT BEGINNING STA. OF CHANNEL.
T3      DRAIN CHANNEL SADERS.    DRAIN CHANNEL BETWEEN BASINS 1 AND 2.

J1  ICHECK    INQ       NINV      IDIR      STRT      METRIC    NVINS     Q         WSEL      FQ
       0.       2.        0.        0.  0.000000      0.00       0.0       0.  1188.870    0.000

J2  NPROF     IPLOT     PRFVS     XSECV     XSECH     FN        ALLDC     IBW       CHNIM     ITRACE
    1.000     0.000    -1.000     0.000     0.000     0.000     0.000     0.000     0.000     0.000

J3  VARIABLE CODES FOR SUMMARY PRINTOUT

   38.000    43.000     1.000    39.000     3.000     1.000    42.000     8.000    55.000    26.000

   56.000    17.000     0.000    38.000    43.000     1.000     2.000    26.000    39.000    21.000

   22.000    33.000     5.000    53.000    54.000     0.000    38.000    13.000    14.000    15.000

   55.000    26.000    56.000     7.000     1.000     3.000    10.000    11.000    12.000     0.000

  150.000     0.000     0.000     0.000     0.000     0.000     0.000     0.000     0.000     0.000

J5  LPRNT     NUMSEC                    ********REQUESTED SECTION NUMBERS********

  -10.000   -10.000     0.000     0.000     0.000     0.000     0.000     0.000     0.000     0.000
NC     .035      .035      .030      .300      .500     0.000     0.000     0.000     0.000     0.000
QT    8.000   550.000  3650.000   700.000  7800.000   500.000  1000.000  2000.000  3000.000     0.000

X1   85.000     7.000  2090.000  2440.000     0.000     0.000     0.000     0.000     0.000     0.000
GR 1193.000     0.000  1190.000   690.000  1186.000  1600.000  1185.000  1680.000  1182.000  2090.000
GR 1180.500  2400.000  1193.000  2440.000     0.000     0.000     0.000     0.000     0.000     0.000

X1  109.500     7.000   655.000   830.000  2450.000  2450.000  2450.000     0.000     0.000     0.000
GR 1193.000     0.000  1188.500   655.000  1183.000   670.000  1183.000   820.000  1186.700   830.000
GR 1186.000   940.000  1193.000   960.000     0.000     0.000     0.000     0.000     0.000     0.000

X1  121.500     8.000   370.000   562.000  1200.000  1200.000  1200.000     0.000     0.000     0.000
GR 1193.000     0.000  1192.000   160.000  1189.700   370.000  1183.000   392.000  1183.000   542.000
GR 1187.300   562.000  1187.000   665.000  1193.000   685.000     0.000     0.000     0.000     0.000

X1  144.420     8.000   450.000   626.000  2292.000  2292.000  2292.000     0.000     0.000     0.000
GR 1193.000     0.000  1191.000   238.000  1189.300   450.000  1183.000   464.000  1183.000   614.000
GR 1187.300   626.000  1187.000   735.000  1193.000   755.000     0.000     0.000     0.000     0.000

X1  167.340     8.000   530.000   690.000  2292.000  2292.000  2292.000     0.000     0.000     0.000
GR 1193.000     0.000  1190.000   315.000  1188.800   530.000  1183.000   535.000  1183.000   685.000
GR 1187.300   690.000  1186.900   805.000  1193.000   825.000     0.000     0.000     0.000     0.000
```

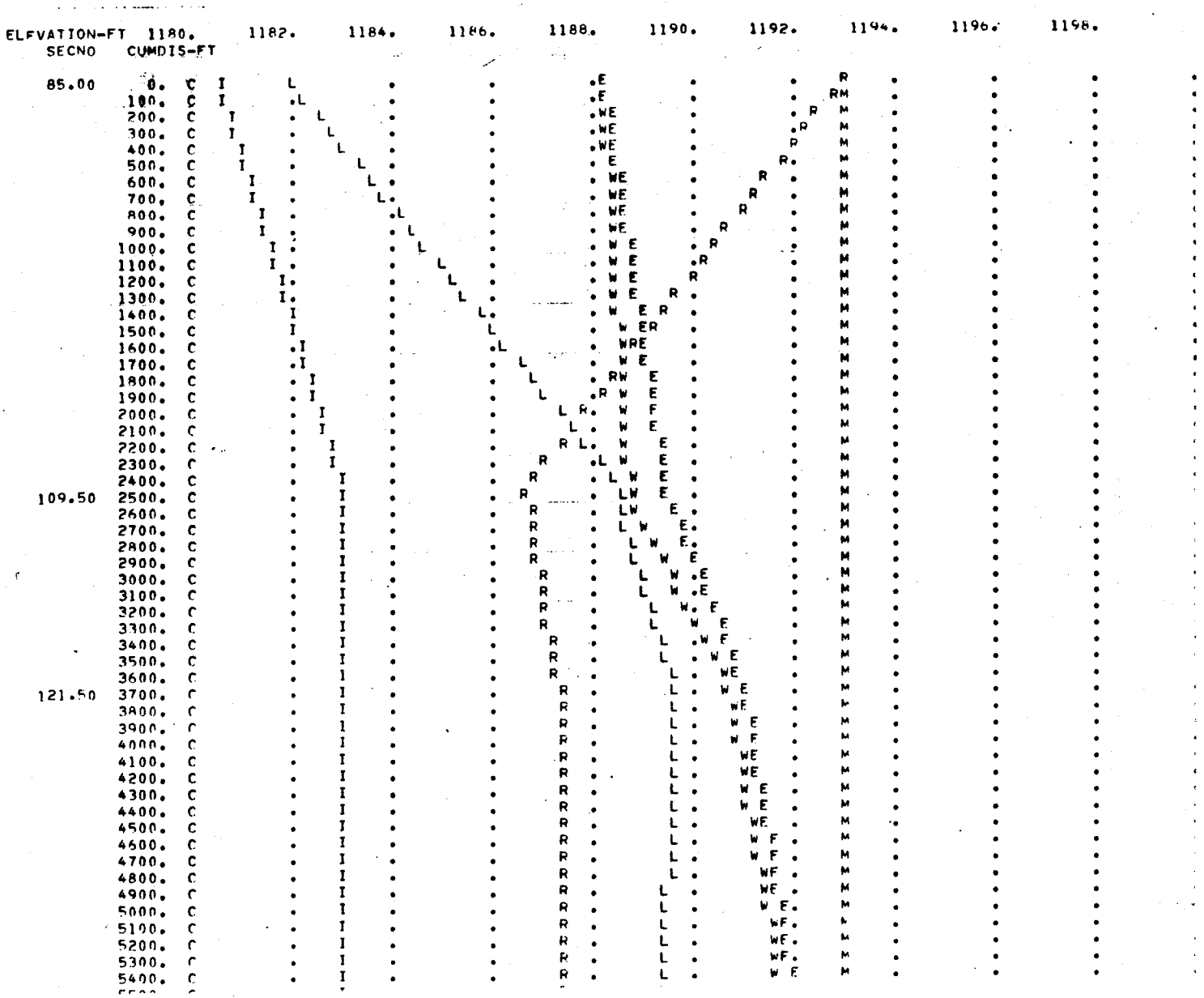
X1	167.340	8.000	530.000	690.000	2292.000	2292.000	2292.000	0.000	0.000	0.00
GR	1193.000	0.000	1190.000	315.000	1186.800	530.000	1183.000	535.000	1183.000	685.00
GR	1187.300	690.000	1186.900	805.000	1193.000	825.000	0.000	0.000	0.000	0.00
X1	186.340	6.000	0.000	185.000	1900.000	1900.000	1900.000	0.000	0.000	0.00
GR	1194.800	0.000	1183.000	20.000	1183.000	170.000	1192.100	185.000	1192.200	305.00
GR	1194.000	310.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.00
X1	197.230	10.000	450.000	615.000	1089.000	1089.000	1089.000	0.000	0.000	0.00
GR	1195.000	0.000	1194.000	60.000	1190.000	250.000	1190.000	360.000	1189.300	450.00
GR	1183.000	460.000	1183.000	610.000	1187.600	615.000	1187.000	735.000	1194.000	752.00
NC	.035	.035	.030	.600	.800	0.000	0.000	0.000	0.000	0.00
X1	200.030	32.000	592.500	627.500	280.000	280.000	280.000	0.000	0.000	0.00
X3	10.000	0.000	0.000	0.000	0.000	0.000	0.000	1187.000	1187.000	0.00
GR	1195.000	0.000	1190.000	250.000	1190.000	360.000	1189.500	410.000	1188.600	460.00
GR	1187.800	510.000	1187.500	560.000	1183.000	592.500	1183.000	593.000	1183.000	597.00
GR	1183.000	597.500	1183.000	600.000	1183.000	600.500	1183.000	604.500	1183.000	605.00
GR	1183.000	607.500	1183.000	608.000	1183.000	612.000	1183.000	612.500	1183.000	615.00
GR	1183.000	615.500	1183.000	619.500	1183.000	620.000	1183.000	622.500	1183.000	623.00
GR	1183.000	627.000	1183.000	627.500	1187.500	628.000	1188.200	710.000	1190.100	790.00
GR	1192.100	870.000	1194.000	950.000	0.000	0.000	0.000	0.000	0.000	0.00
NC	0.000	0.000	.024	0.000	0.000	0.000	0.000	0.000	0.000	0.00
X1	200.080	0.000	0.000	0.000	5.000	5.000	5.000	0.000	0.000	0.00
BT	32.000	0.000	1195.000	1186.200	250.000	1190.000	1186.200	360.000	1189.500	1186.20
BT	410.000	1188.600	1186.200	460.000	1188.600	1186.200	510.000	1187.800	1186.200	560.00
BT	1187.500	1186.200	592.500	1187.500	1183.000	593.000	1187.500	1186.200	597.000	1187.50
BT	1186.200	597.500	1187.500	1183.000	600.000	1187.500	1183.000	600.500	1187.500	1186.20
BT	604.500	1187.500	1186.200	605.000	1187.500	1183.000	607.500	1187.500	1183.000	608.00
BT	1187.500	1186.200	612.000	1187.500	1186.200	612.500	1187.500	1183.000	615.000	1187.50
BT	1183.000	615.500	1187.500	1186.200	619.500	1187.500	1186.200	620.000	1187.500	1183.00
BT	622.500	1187.500	1183.000	623.000	1187.500	1186.200	627.000	1187.500	1186.200	627.50
BT	1187.500	1183.000	628.000	1187.500	1186.200	710.000	1188.200	1186.200	790.000	1190.10
BT	1186.200	870.000	1192.100	1186.200	950.000	1193.000	1186.200	0.000	0.000	0.00

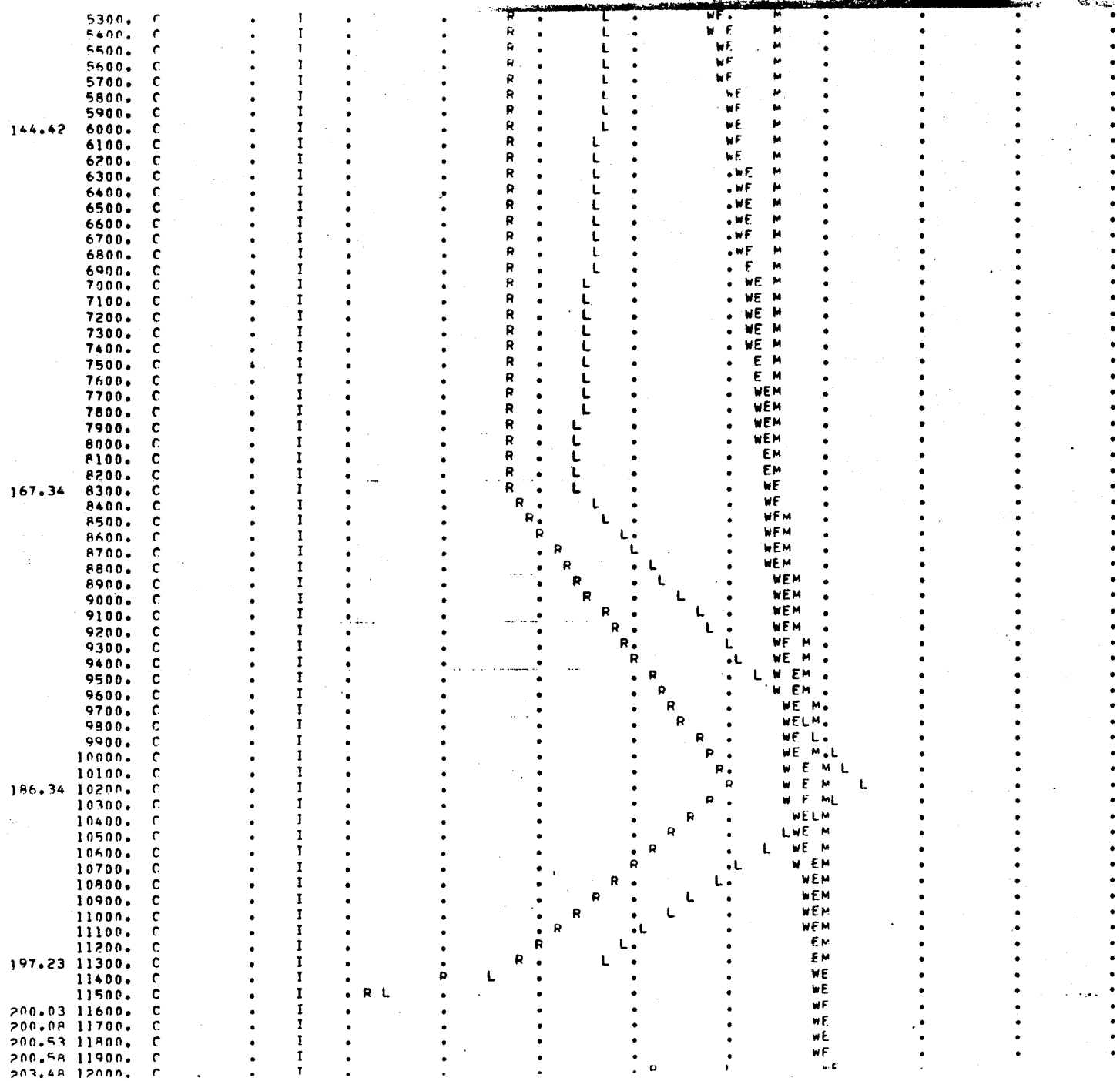
BUCKEYE SALOMF ROAD CROSSING. 5-65*40 CMP ARCHES.

X1	200.530	0.000	0.000	0.000	45.000	45.000	45.000	0.000	0.000	0.00
X2	0.000	0.000	0.000	0.000	0.000	0.000	1.000	0.000	0.000	0.00
NC	0.000	0.000	.030	0.000	0.000	0.000	0.000	0.000	0.000	0.00
X1	200.580	0.000	0.000	0.000	5.000	5.000	5.000	0.000	0.000	0.00
X3	10.000	0.000	0.000	0.000	0.000	0.000	0.000	1187.500	1187.500	0.00
X1	203.480	7.000	380.000	550.000	290.000	290.000	290.000	0.000	0.000	0.00
GR	1195.000	0.000	1192.000	380.000	1183.000	390.000	1183.000	540.000	1190.400	550.00
GR	1189.800	675.000	1194.000	790.000	0.000	0.000	0.000	0.000	0.000	0.00
EJ	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.00

PROFILE FOR STREAM DRAIN CHANNEL SADERS.

PLOTTED POINTS (BY PRIORITY)-E-ENERGY,W-WATER SURFACE,I-INVERT,C-CRITICAL W.S.,L-LEFT BANK,R-RIGHT BANK,M-LOWER END STA




144.42
167.34
186.34
197.23
200.03
200.08
200.53
200.58
203.48

III-80

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*************************************************
  HEC2 RELEASE DATED NOV 76 UPDATED FEB 1977
  ERROR CORR -  01
  MODIFICATION -  50,51,52
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NOTE- ASTERISK (*) AT LEFT OF CROSS-SECTION NUMBER INDICATES MESSAGE IN SUMMARY OF ERRORS LIST

DRAIN CHANNEL SADERS.

SUMMARY PRINTOUT

SECNO	Q	CWSEL	XLCH	EG	CWSEL	ELMIN	DEPTH	VLOB	VCH	VROB	K*XNCH
85.000	550.00	1188.87	0.00	1188.87	1188.87	1180.50	8.37	.07	.12	0.00	30.00
85.000	3650.00	1185.00	0.00	1185.08	1185.00	1180.50	4.50	1.16	2.46	0.00	30.00
85.000	700.00	1192.70	0.00	1192.70	1192.70	1180.50	12.20	.04	.07	0.00	30.00
85.000	7800.00	1188.20	0.00	1188.25	1188.20	1180.50	7.70	1.18	2.05	0.00	30.00
85.000	500.00	1182.26	0.00	1182.30	1182.26	1180.50	1.76	.34	1.57	0.00	30.00
85.000	1000.00	1182.76	0.00	1182.83	1182.76	1180.50	2.26	.70	2.04	0.00	30.00
85.000	2000.00	1183.46	0.00	1183.56	1183.46	1180.50	2.96	1.09	2.64	0.00	30.00
85.000	3000.00	1183.99	0.00	1184.12	1183.99	1180.50	3.49	1.34	3.03	0.00	30.00
109.500	550.00	1188.87	2450.00	1188.87	1188.87	1183.00	5.87	.04	.49	.25	30.00
109.500	3650.00	1186.88	2450.00	1187.38	1186.88	1183.00	3.88	0.00	5.72	1.36	30.00
109.500	700.00	1192.70	2450.00	1192.70	1192.70	1183.00	9.70	.09	.28	.18	30.00
109.500	7800.00	1188.72	2450.00	1189.46	1188.72	1183.00	5.72	.47	7.26	3.58	30.00
109.500	500.00	1184.59	2450.00	1184.66	1184.59	1183.00	1.59	0.00	2.02	0.00	30.00
109.500	1000.00	1185.29	2450.00	1185.41	1185.29	1183.00	2.29	0.00	2.79	0.00	30.00
109.500	2000.00	1186.25	2450.00	1186.48	1186.25	1183.00	3.25	0.00	3.87	.39	30.00
109.500	3000.00	1186.91	2450.00	1187.24	1186.91	1183.00	3.91	0.00	4.65	1.15	30.00
121.500	550.00	1188.88	1200.00	1188.89	1188.88	1183.00	5.88	0.00	.51	.20	30.00
121.500	3650.00	1188.58	1200.00	1188.77	1188.58	1183.00	5.58	0.00	3.60	1.32	30.00
121.500	700.00	1192.70	1200.00	1192.70	1192.70	1183.00	9.70	.09	.31	.19	30.00
121.500	7800.00	1190.69	1200.00	1191.03	1190.69	1183.00	7.69	.72	4.97	2.64	30.00
121.500	500.00	1185.23	1200.00	1185.26	1185.23	1183.00	2.23	0.00	1.41	0.00	30.00
121.500	1000.00	1186.11	1200.00	1186.17	1186.11	1183.00	3.11	0.00	1.99	0.00	30.00
121.500	2000.00	1187.33	1200.00	1187.45	1187.33	1183.00	4.33	0.00	2.76	.30	30.00
121.500	3000.00	1188.18	1200.00	1188.34	1188.18	1183.00	5.18	0.00	3.28	1.02	30.00
144.420	550.00	1188.91	2292.00	1188.91	1188.91	1183.00	5.91	0.00	.52	.21	30.00
144.420	3650.00	1189.64	2292.00	1189.77	1189.64	1183.00	6.64	.23	2.96	1.37	30.00
144.420	700.00	1192.71	2292.00	1192.71	1192.71	1183.00	9.71	.10	.31	.18	30.00
144.420	7800.00	1192.03	2292.00	1192.23	1192.03	1183.00	9.03	1.13	4.93	2.26	30.00
144.420	500.00	1185.72	2292.00	1185.74	1185.72	1183.00	2.72	0.00	1.17	0.00	30.00
144.420	1000.00	1186.78	2292.00	1186.82	1186.78	1183.00	3.78	0.00	1.66	0.00	30.00
144.420	2000.00	1188.19	2292.00	1188.27	1188.19	1183.00	5.19	0.00	2.27	.70	30.00
144.420	3000.00	1189.16	2292.00	1189.26	1189.16	1183.00	6.16	0.00	2.70	1.14	30.00

SECNO	Q	CWSEL	XLCH	EG	CWSEL	FLMIN	DEPTH	VLOB	VCH	VROB	K*XNCH
167.340	550.00	1188.94	2292.00	1188.94	1188.94	1183.00	5.94	.02	.54	.22	30.00
167.340	3650.00	1190.28	2292.00	1190.37	1190.28	1183.00	7.28	.57	2.66	1.33	30.00
167.340	700.00	1192.71	2292.00	1192.71	1192.71	1183.00	9.71	.11	.30	.18	30.00
167.340	7800.00	1192.77	2292.00	1192.90	1192.77	1183.00	9.77	1.20	3.29	1.96	30.00
167.340	500.00	1186.03	2292.00	1186.05	1186.03	1183.00	3.03	0.00	1.08	0.00	30.00
167.340	1000.00	1187.19	2292.00	1187.23	1187.19	1183.00	4.19	0.00	1.54	.15	30.00
167.340	2000.00	1188.71	2292.00	1188.77	1188.71	1183.00	5.71	0.00	2.08	.79	30.00
167.340	3000.00	1189.75	2292.00	1189.83	1189.75	1183.00	6.75	.37	2.47	1.16	30.00
186.340	550.00	1188.96	1900.00	1188.97	1188.96	1183.00	5.96	0.00	.58	0.00	30.00
186.340	3650.00	1190.71	1900.00	1190.84	1190.71	1183.00	7.71	0.00	2.91	0.00	30.00
186.340	700.00	1192.72	1900.00	1192.72	1192.72	1183.00	9.72	0.00	.43	.06	30.00
186.340	7800.00	1193.25	1900.00	1193.56	1193.25	1183.00	10.25	0.00	4.48	.93	30.00
186.340	500.00	1186.23	1900.00	1186.24	1186.23	1183.00	3.23	0.00	1.00	0.00	30.00
186.340	1000.00	1187.46	1900.00	1187.49	1187.46	1183.00	4.46	0.00	1.42	0.00	30.00
186.340	2000.00	1189.05	1900.00	1189.12	1189.05	1183.00	6.05	0.00	2.06	0.00	30.00
186.340	3000.00	1190.15	1900.00	1190.25	1190.15	1183.00	7.15	0.00	2.59	0.00	30.00
197.230	550.00	1188.98	1089.00	1188.98	1188.98	1183.00	5.98	0.00	.54	.20	30.00
197.230	3650.00	1191.00	1089.00	1191.07	1191.00	1183.00	8.00	.55	2.31	1.21	30.00
197.230	700.00	1192.72	1089.00	1192.72	1192.72	1183.00	9.72	.11	.31	.18	30.00
197.230	7800.00	1193.79	1089.00	1193.88	1193.79	1183.00	10.79	1.15	2.89	1.77	30.00
197.230	500.00	1186.32	1089.00	1186.34	1186.32	1183.00	3.32	0.00	.97	0.00	30.00
197.230	1000.00	1187.59	1089.00	1187.62	1187.59	1183.00	4.59	0.00	1.39	.20	30.00
197.230	2000.00	1189.24	1089.00	1189.29	1189.24	1183.00	6.24	0.00	1.84	.75	30.00
197.230	3000.00	1190.39	1089.00	1190.46	1190.39	1183.00	7.39	.35	2.17	1.07	30.00
200.030	550.00	1188.98	280.00	1189.01	1188.98	1183.00	5.98	.73	1.60	.42	30.00
200.030	3650.00	1191.05	280.00	1191.20	1191.05	1183.00	8.05	1.96	4.51	1.81	30.00
200.030	700.00	1192.72	280.00	1192.72	1192.72	1183.00	9.72	.23	.49	.22	30.00
200.030	7800.00	1193.85	280.00	1193.94	1193.85	1183.00	10.85	1.94	3.96	1.90	30.00
200.030	500.00	1186.33	280.00	1186.61	1186.33	1183.00	3.33	0.00	4.28	0.00	30.00
200.030	1000.00	1187.60	280.00	1187.92	1187.60	1183.00	4.60	2.65	4.91	.47	30.00
200.030	2000.00	1189.27	280.00	1189.53	1189.27	1183.00	6.27	2.34	5.14	1.50	30.00
200.030	3000.00	1190.44	280.00	1190.62	1190.44	1183.00	7.44	2.06	4.76	1.76	30.00
200.080	550.00	1188.98	5.00	1189.02	1188.98	1183.00	5.98	1.17	2.04	1.06	24.00
200.080	3650.00	1191.11	5.00	1191.22	1191.11	1183.00	8.11	2.39	3.55	2.52	24.00
200.080	700.00	1192.72	5.00	1192.72	1192.72	1183.00	9.72	.26	.35	.27	24.00
200.080	7800.00	1193.87	5.00	1193.95	1193.87	1183.00	10.87	2.15	2.79	2.20	24.00
200.080	500.00	1186.25	5.00	1187.00	1186.25	1183.00	3.25	0.00	6.94	0.00	24.00
200.080	1000.00	1188.42	5.00	1188.85	1188.42	1183.00	5.42	2.93	6.19	2.41	24.00
200.080	2000.00	1189.27	5.00	1189.59	1189.27	1183.00	6.27	3.61	5.89	3.31	24.00
200.080	3000.00	1190.51	5.00	1190.65	1190.51	1183.00	7.51	2.62	4.02	2.71	24.00
200.530	550.00	1189.01	45.00	1189.05	1189.01	1183.00	6.01	1.16	2.01	1.05	24.00
200.530	3650.00	1191.16	45.00	1191.27	1191.16	1183.00	8.16	2.35	3.48	2.48	24.00
200.530	700.00	1192.72	45.00	1192.72	1192.72	1183.00	9.72	.26	.35	.27	24.00
200.530	7800.00	1193.89	45.00	1193.97	1193.89	1183.00	10.89	2.15	2.78	2.20	24.00
200.530	500.00	1186.67	45.00	1187.42	1186.67	1183.00	3.67	0.00	6.94	0.00	24.00
200.530	1000.00	1189.06	45.00	1189.18	1189.06	1183.00	6.06	2.04	3.49	1.85	24.00
200.530	2000.00	1189.62	45.00	1189.82	1189.62	1183.00	6.62	2.99	4.63	2.77	24.00
200.530	3000.00	1190.59	45.00	1190.72	1190.59	1183.00	7.59	2.51	3.84	2.61	24.00

SECNO	Q	CWSEL	XLCH	EG	CWSEL	ELMIN	DEPTH	VLOB	VCH	VROB	K*XNCH
200.580	550.00	1189.03	5.00	1189.05	1189.03	1183.00	6.03	.72	1.58	.42	30.00
200.580	3650.00	1191.16	5.00	1191.29	1191.16	1183.00	8.16	1.89	4.32	1.75	30.00
200.580	700.00	1192.72	5.00	1192.72	1192.72	1183.00	9.72	.23	.49	.22	30.00
200.580	7800.00	1193.89	5.00	1193.98	1193.89	1183.00	10.89	1.93	3.91	1.88	30.00
200.580	500.00	1187.76	5.00	1187.83	1187.76	1183.00	4.76	1.23	2.35	.21	30.00
200.580	1000.00	1189.12	5.00	1189.20	1189.12	1183.00	6.12	1.25	2.74	.76	30.00
200.580	2000.00	1189.65	5.00	1189.84	1189.65	1183.00	6.65	2.02	4.42	1.41	30.00
200.580	3000.00	1190.59	5.00	1190.75	1190.59	1183.00	7.59	1.93	4.46	1.69	30.00
203.480	550.00	1189.07	290.00	1189.08	1189.07	1183.00	6.07	0.00	.58	0.00	30.00
203.480	3650.00	1191.28	290.00	1191.39	1191.28	1183.00	8.28	0.00	2.67	.63	30.00
203.480	700.00	1192.72	290.00	1192.73	1192.72	1183.00	9.72	.04	.40	.14	30.00
203.480	7800.00	1193.94	290.00	1194.13	1193.94	1183.00	10.94	.67	3.70	1.48	30.00
203.480	500.00	1187.88	290.00	1187.89	1187.88	1183.00	4.88	0.00	.66	0.00	30.00
203.480	1000.00	1189.25	290.00	1189.26	1189.25	1183.00	6.25	0.00	1.02	0.00	30.00
203.480	2000.00	1189.93	290.00	1189.98	1189.93	1183.00	6.93	0.00	1.82	.07	30.00
203.480	3000.00	1190.78	290.00	1190.87	1190.78	1183.00	7.78	0.00	2.38	.41	30.00