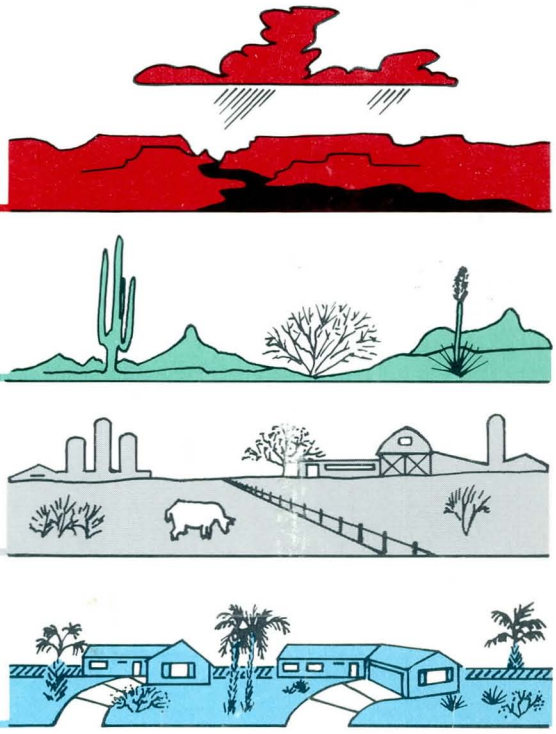

FLOOD CONTROL DISTRICT OF MARICOPA COUNTY

SADDLEBACK DIVERSION DESIGN
VOL. II

FLOOD CONTROL DISTRICT OF

PRC Toups Corporation

prc

William R. Mills Jr., P.E., President David M. Mogo, Senior Vice President Robert Murphy, P.E., Vice President
John Stansel, A.I.A., Associate Vice President Edward A. Adair, P.E., Associate Vice President

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3 May 1979

United States Department of Agriculture
Soil Conservation Service
230 North First Avenue
Phoenix, Arizona
85003

Gentlemen:

Submitted herewith is our Design Report on the Saddleback Floodwater Retarding Structure (Volume I) and Saddleback Diversion (Volume II).

The flood control structures covered in this report are situated in the Harquahala Valley, approximately 35 miles West of Buckeye. The report includes hydrologic and hydraulic computations, structural and stability design and quantity estimates. Also submitted under separate cover, are Bid Schedule, Cost Estimate, CPM Network, Specifications and Construction Drawings.

We wish to thank the design staff of your office, particularly Mr. Paul Monville and Ms. Suzanne Leckband for furnishing information and data for the preparation of this design project.

Respectfully submitted,

PRC Toups Corporation

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Associate Vice President
Arizona Registration No. 9349

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SADDLEBACK DIVERSION DESIGN
VOL. II

A Planning Research Company
4131 North 24th Street, Phoenix, Arizona 85016
Telephone (602) 264-9665

Job No. 3043-000

SADDLEBACK DIVERSION

ENGINEERING DOCUMENTATION - FINAL DESIGN

DESIGN REPORT

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Registered Professional Engineer (Civil) CERTIFICATE No. 9349 EDWARD ALLAIN ADAIR DATE SIGNED 5/3/79 Arizona U. S. A.

Registered Professional Engineer (Civil) CERTIFICATE No. 10512 ASHOK C. PATEL Date Signed 5/3/79 ARIZONA, U.S.A.

SADDLEBACK DIVERSION

Saddleback Diversion begins at the principal spillway outlet of Saddleback F.R.S. and proceeds in a generally southern direction along the west foot slopes of Saddleback Mountain for a distance of 4.72 miles, outletting into an unnamed wash about 1.4 miles above its confluence with Centennial Wash. (See Project Map, Plate 1. Structural Data is shown on Table 1.)

Alignment along the diversion has been changed substantially as compared to the original layout proposed in the Work Plan Supplement. The new alignment was established as a result of comparing various alternative alignments regarding earthwork quantities, and hydraulic characteristics. The alignment shown on the preliminary plans represented a natural average gradient which fell within the velocity parameters set down for the type of soil that is expected to be encountered. This proposed alignment also eliminates excessive excavation which would have occurred with the original alignment.

The diversion is designed to carry the maximum outflow from Saddleback F.R.S. plus the 50-year flood event from the diversion drainage area. Design capacity varies from 1120 cfs at the Saddleback F.R.S. outlet to 6060 cfs at the end of the diversion (see Plate 1.). The diversion will carry floodwater releases from Harquahala F.R.S. and Saddleback F.R.S. The total drainage area contributing runoff to the diversion is 145 square miles of which 102.3 square miles are controlled by Harquahala F.R.S., approximately 11 square miles are controlled by the Granite Reef Aqueduct, 23.1 square miles are controlled by Saddleback

F.R.S. and 8.6 square miles are above the diversion proper.

The diversion channel consists of six reaches described as follows:

1. Station 0+82 to 20+00, Bottom slope 0.0015 ft/ft, depth 5-6'
   0+82 to 10+65 rip rap channel, 10+65 to 20+00 Earth Channel.

2. Station 20+00 to 82+00, Bottom slope 0.0020 ft/ft, Depth3.5-5'
   Earth Channel

3. Station 82+00 to 145+00, Bottom slope 0.0020 ft/ft, Depth 3.5'±
   Earth Channel.

4. Station 145+00 to 237+35.60, Bottom slope 0.0022 ft/ft, Depth
   3.5'-5'±

5. Station 237+35.60, Bottom slope 0.0022 ft/ft, Depth 3.6'±
   Earth Channel

6. Station 245+00 to 249+00, Bottom slope 0.007 ft/ft, Depth 2" ±
   Earth Channel

There are four drop spillway structures designed to reduce flow velocities and to minimize scouring in areas of the channel where tractive stresses exceed allowable values.

The diversion is designed to safely convey storm discharges without excessive scour or excessive sediment deposition. However, geological conditions indicate that some scour will occur in the channel bottom

initially. Subsequent storm flows will eventually cause the formation of bed armor. At the outlet of the diversion, flood flows will be released over land across unimproved rangeland and a natural drainageway to Centennial Wash. Scour at the channel outlet is expected to be minimal due to the presence of shallow deposits of caliche conglomerate, gravelly and cobbly material and very compact silty sands. At the upper end of the channel outlet, the diversion channel dike connects to a hill consisting primarily of basalt material.

From the outlet of the S.A.F. Basin (Sta. 0+82) to the inlet of the Courthouse Road Culvert (Sta. 9+90) it was necessary, based on soil data, to provide riprap protection for the channel. Riprap protection is also provided at the Culvert outlet, for 25 feet beyond the culvert. This protection will insure proper design conditions, for the culverts.

Construction will require land rights acquisition of 369.4 acres of land. An additional 68 acres (State Trust Lands) will be required as flowage right-of-way over the unimproved rangeland between the diversion outlet and Centennial Wash.

Of the 369.4 acres total, 39.1 acres are in private ownership, 85.0 acres are State Trust Lands administered by the State Land Department, 245.0 acres are public lands administered by the U.S. Bureau of Land Management, and an estimated 0.3 acre is under the jurisdiction of Maricopa County.

Of the total right-of-way required, 330.3 acres are on unimproved rangeland. In Section 9, T-1-N, R-8-W, 39.1 acres cover an undeveloped

subdivision. There are no existing improvements within the right-of-way limits of the diversion channel.

DIVERSION STRUCTURAL DESIGN CRITERIA

The diversion channel performs two major functions: (1) to divert runoff from the west slope of Saddleback Mountain and (2) to divert discharges from the Saddleback F.R.S. principal spillway. There are two road crossings of the diversion channel, one at Courthouse Road and one at 479th Avenue. Both of these roads are owned and maintained by Maricopa County Highway Department. The 479th Avenue crossing will serve as an entrance road to an existing subdivision, Rose View Estates. The Flood Control District of Maricopa County has retained Toups Corporation to provide designs for any crossings which will be required once they have determined the need when right-of-way has been acquired.

The diversion is designed for the combined 50-year frequency, 24 hour duration storm discharge, and the Saddleback F.R.S. principal spillway discharge. This criteria was established in the Work Plan Supplement.

Drainage subareas and inflow hydrographs were developed with TR-20. Channel evaluation for stability requirements were met by using criteria set forth in TR-25 Design of Open Channels - October 1977, under the allowable velocity approach and by using TR-25 Tractive Stress, under the tractive stress approach. New design velocities are lower in magnitude than those presented in the S.C.S. work plan. Channel rating curves were developed for various base widths, depth and slopes. This procedure allows for an acceptable velocity to be chosen while keeping a handle on the future earthwork. A channel routing using 7 subareas and estimated x-sections was made to develop the peak flows

at the x-section stations.

Channel dimensions from sta. 0+82 to 9+90 were determined in the design of Saddleback Flood Retarding Structure (SADFRS) to maintain the necessary tailwater condition for safe operation of SADFRS principal spillway. Box culvert cells (3-10'x6'x50') were chosen to provide for the most economical crossing. The designed capacity for this reach was determined using principal spillway 100-year outflow of 1120 cfs.

Channel capacities from sta. 9+90 to sta. 237+11 were found by taking the peak flows at twelve x-section stations, finding the required bottom width for the desired depth of flow, and checking stability requirements for the 50-year 24 hour storm peak flows. The peak Q's from the seven subareas draining into the diversion channel were used to select channel bottom width, the channel bottom was designed to linear increase in width in between referenced stations (Table 1). Pg. 3.1-4 The preliminary design used aged velocities for stability design.

Rock riprap design was slightly modified from that shown in Engineering Design Standards Far West States, (S.C.S.). The riprap was modified to a uniform thickness of 1.5 feet for the channel reaches. The riprap thickness was increased to 2 feet for all of the wash inlet structures.

The diversion channel connects to a basalt hill in the vicinity of drop spillway structure no. 4. The four spillways were designed for grouted riprap protection. An embankment is proposed at the north end

of spillway no. 4, extending for approximately 250 feet, with a top width of 10 feet. The embankment will primarily protect the drop spillway structure. Spillway no. 4 was designed to reduce velocities to an average of 5.5 feet per second in the downstream channel reach.

Sturctural cut and fill quantities from sta. 0+82 to 249+00 were determined by using average end areas.

Vegatative conduits pipe inlet and outlet structures were designed in accordance with Technical Release No. 46, gated outlet appurtenances Earth Dams.

The 50-year storm elevations were determined to be contained within the limits of the right-of-way.

Culvert investigation was based on HEC-5. Quantities were computed using standard details. Preliminary alignment and required distance for rights-of-way upstream 75 feet from the embankment toe has been submitted to the Flood Control District of Maricopa County.

According to the Geologic Investigation Report, Saddleback F.R.S. and Diversion, Harquahala Valley Watershed, the total anticipated average annual sediment yield is broken down as follows:

1. 0.48 Acre Feet/Year - through principal spillway, F.R.S.
2. 0.24 Acre Feet/Year - bedload yield
3. 1.70 Acre Fee/Year - from drainage area to channel

less 4. 0.08 Acre Feet/Year - deposition in channel

On an average annual basis, the total sediment yield is 2.34 acre feet/year which compares favorably with the approximation of 2.25 acre feet/year in the above mentioned report.

The sediment transport analysis performed by the S.C.S., dated February 20, 1979, indicated that during a 50-year storm, 7.6 AF of sediment is anticipated to enter the Centennial Wash Tributary. 4.8 AF of this sediment will be deposited in the Tributary. The Tributary cross sectional change as a result of the deposition will be insignificant to affect the 50-year flood plain boundary.

HYDROLOGY & SITE INFORMATION

LIST OF MAPS 1. drainage area map (see sht. 2.1-2)

CONCEPT & PROCEDURE

1. Treat Saddleback F.R.S. & Diversion as one system.
   50-yr Freq. design, add baseflow = 450 cfs from Harquahala FRS
   10-yr Freq. design, add baseflow = 400 " " FRS

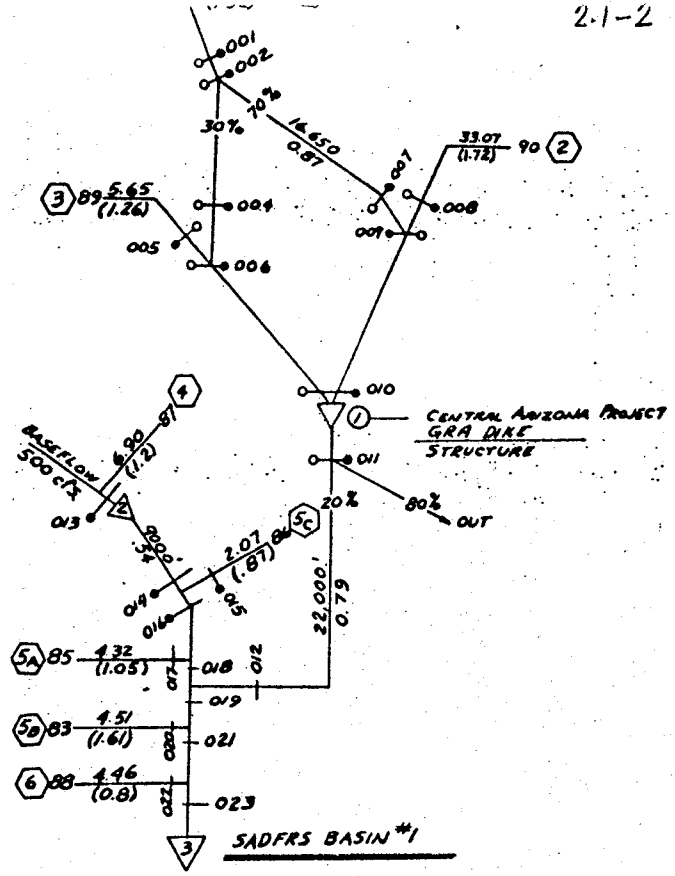
2. For drainage area above SADFRS Flood routing procedure as described on MAP No 1

3. Uncontrolled watershed draining to diversion:
   a. Sub areas, curve numbers, Time of Concentrations are shown on sht. 2.1-8 – 2.1-13
   b. Precip values as shown on sht. 2.1-4
   c. routing coeff. 'c' estimated from channel hyd. characteristics - Phase I design

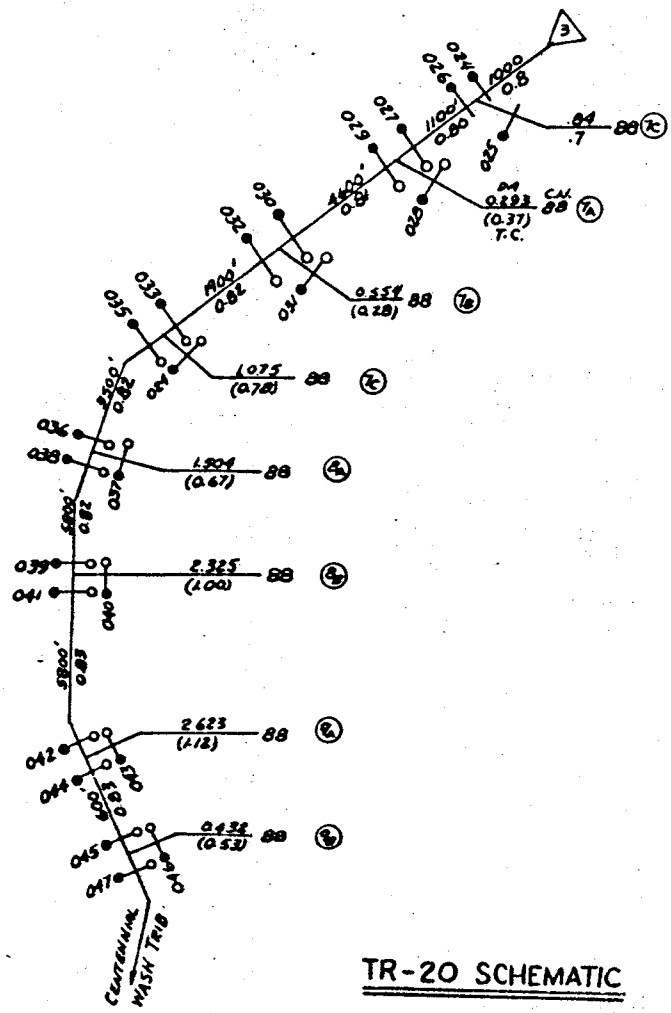
4. Runoff-routing utilizing TR-20 computer,

   Input data (see sht. 2.1-14)
   schematic area above SADFRS (See sht. MAP No 1)
   Schematic area draining to Diversion (See sht. 2.1-3)
   Summary output See Alternate 4 - 50 Yr sht. 2.1-15
   Alternate 5 - 10 Yr sht. 2.1-15

FRS



DIVERSION



EXPLANATION

7c SUBAREA DESIGNATION

16.01 — AREA (Sq. mi.)

1.03 90 — CURVE No.

TIME OF CONCENTRATION (hr.)

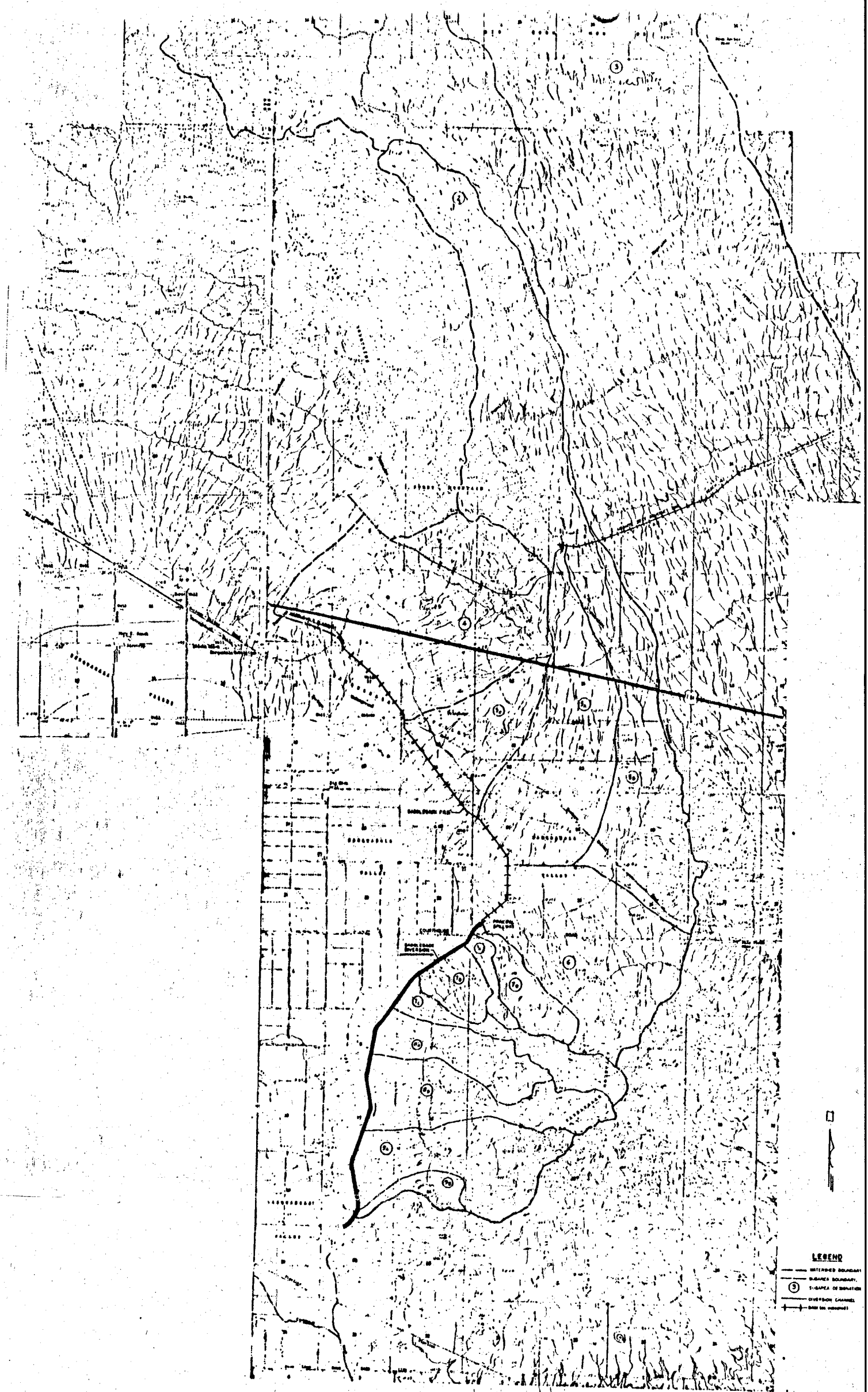
30% — PERCENT OF SPLIT FLOW

CONCENTRATION POINT (CROSS SECTION)

REACH LENGTH (ft.)

ROUTING COEFF. "C"

TR-20 SCHEMATIC



PLATE

DRAINAGE AREA M

Schematic on sht. 2.1-3

Area [illegible]

(1) [illegible] Area = 23.2 sq mi

Area Correction Factor (24 hr Storm) = 1.97

(2) [illegible] Area = 8.25 sq mi

Area Correction Factor (24 hr Storm) = 0.99

50-Yr (24 Hr) (1) Precip = 1.97 x 3.68 = 7.27"
(2) Precip = 0.99 x 3.68 = 3.64"

10-Yr (24 Hr) (1) Precip = 1.97 x 2.59 = 5.10"
(2) Precip = 0.99 x 2.59 = 2.56"

[illegible]

[illegible]

Major soil	% Area	Hydrologic [illegible]	Pavement Density	CN [illegible]	Weighted CN
4	45 %	[illegible] - B [illegible] - D	10	85 92	89.3
10	55 %	[illegible] - D	10 %	92	

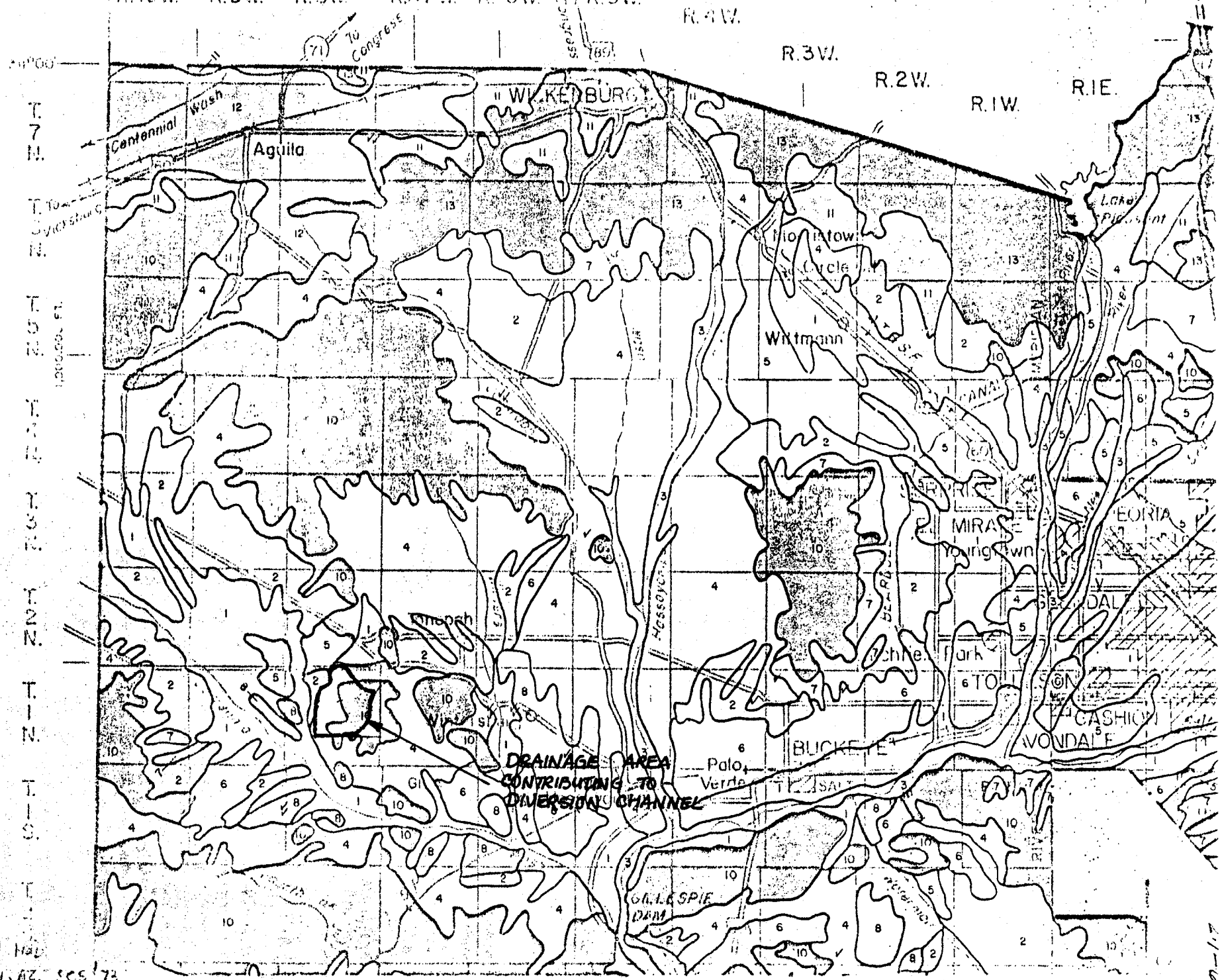
CN [illegible] = 88

42-381 50 SHEETS 5 SQUARE
42-382 100 SHEETS 5 SQUARE
42-389 200 SHEETS 5 SQUARE
NATIONAL

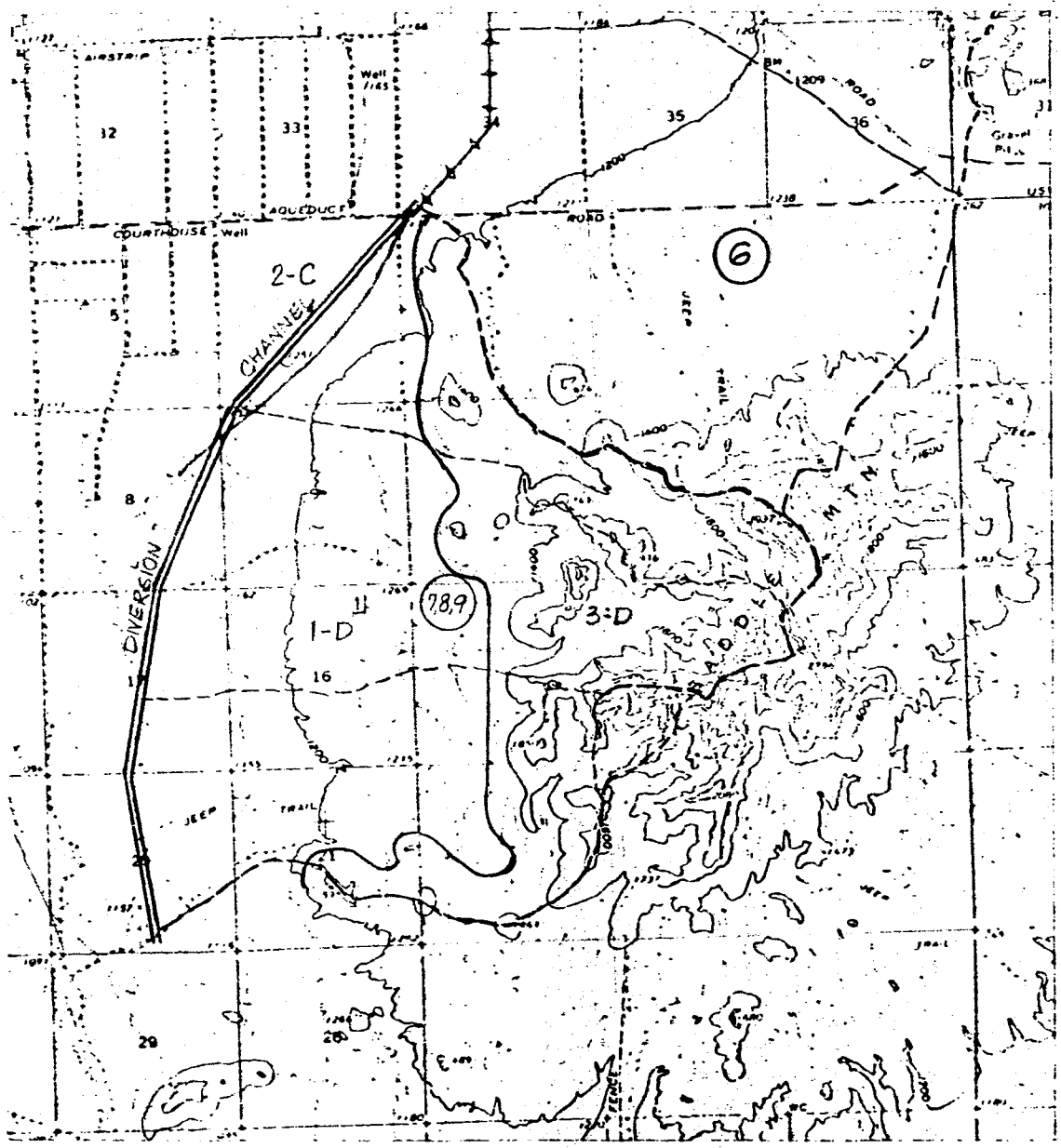
1/ Hydrologic Design for Hwy. Drainage in AZ. - Arizona Hwy. Dept & USH-4

2/ Figure - 4 Woodward . . . Paper No. 73-209 ASAE

4 - Rittelo - Gunsight Associ
10 - Chirioni - Gachado - Rock outcrop Assoc.



General Soil Map
Maricopa County, AZ. SCS '73



1 SOIL UNIT NO. Arroyo Seco Valley Watershed NOV. 74
WORKPLAN SUPPLEMENT DOCUMENTATION SHT. 54 $CN_{1hr} = 93$
$CN_{24hr} = 88$

JOB NO. 3043-000
2/15/78
Revised 9/78

1. Check drainage areas 7A-7B using planimeter on 7½' quad. :

planimeter constant : $K = \frac{(2000)^2}{(5280)^2} = 0.14348$ sq. mi./read.

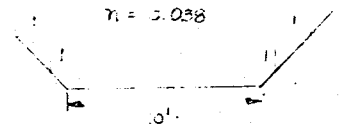
AREA	READING (sq. in.)	CALCULATED AREA (sq. mi.)	SCS values (sq. mi.)
7D		0.84	
7A	2.04 × K =	0.293	0.302
7B	3.86	0.554	0.559
7C	7.49	1.075	1.08
8A	9.09	1.304	1.33
8B	16.19	2.323	2.31
9A	18.28	2.623	2.63
9B	3.01	0.432	0.442
		8.604	8.653

2. Conclusion : difference in total drainage area is < 0.6%
∴ SCS values are acceptable

JOB NO. 3043 - 000
2/17/78
9/78

Compute T_c for drainage areas 7A - 9B :

PROCEDURE :



1. assume trapezoidal section :

2. assume bank-full conditions @ d = 1.0'

3. break down main into reaches with uniform slope

4. solve Manning's for velocity using d = 1.0'
ave. vel. over reach :

$$Vel_{AVE.} = \frac{1.486}{0.038} R^{2/3} S_f^{1/2}$$

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 7A : reach$_1$ = elev. 1180 - elev. 1320 — length = 6800'

AREA 7B : reach$_1$ = elev. 1170 - elev. 1260 — length = 4300'

AREA 7C : reach$_1$ = elev. 1160 - elev. 1300 — length = 7050'
reach$_2$ = elev. 1300 - elev. 1500 — = 6800'
reach$_3$ = elev. 1500 - elev. 1580 — = 3150'

AREA 8A : reach$_1$ = elev. 1160 - elev. 1300 — length = 8600'
reach$_2$ = elev. 1300 - elev. 1500 — = 3800'
reach$_3$ = elev. 1500 - elev. 1620 — = 600'

AREA 8B : reach$_1$ = elev. 1130 - elev. 1300 — length = 9800'
reach$_2$ = elev. 1300 - elev. 1500 — = 7200'
reach$_3$ = elev. 1500 - elev. 1620 — = 2200'

AREA 9A : reach$_1$ = elev. 1120 - elev. 1300 — length = 12,000'
reach$_2$ = elev. 1300 - elev. 1500 — = 6700'
reach$_3$ = elev. 1500 - elev. 1400 — = 1700'

AREA 9B : reach$_1$ = elev. 1110 - elev. 1260 — length = 8800'

AREA 7D : reach$_1$ = elev. 1500 - elev. 1300 — = 1500'
reach$_2$ = elev. 1300 - elev. 1178 — = 9500'

AREA	LENGTH (ft)	S_f (%)	Vel. (fps)	T_c (hrs)	ΣT_c (hrs)
(7A)					
reach 1	6800	2.06	5.06	0.37	
					0.37
(7B)					
reach 1	4800	1.88	4.83	0.28	
					0.28
(7C)					
reach 1	7050	1.99	4.97	0.39	
reach 2	6800	2.94	6.05	0.31	
reach 3	3150	12.06	12.26	0.07	
					0.78
(8A)					
reach 1	8600	1.63	4.50	0.53	
reach 2	3800	5.26	8.10	0.13	
reach 3	600	20.00	15.78	0.01	
					0.67
(8B)					
reach 1	9800	1.73	4.65	0.59	
reach 2	7200	2.78	5.88	0.34	
reach 3	2200	5.45	8.24	0.07	
					1.00
(9A)					
reach 1	12,000	1.50	4.32	0.77	
reach 2	6900	2.90	6.01	0.32	
reach 3	1700	23.53	17.12	0.03	
					1.12
(9B)					
reach 1	8800	1.70	4.61	0.53	
					0.53
7D					
reach 1	1500'	13.3	12.	.04	
reach 2	9500'	1.26	4.0	.66	0.7

Calcs. for TABLE (pg.) :

AREA 7A

reach 1 : $S_f = \frac{1320 - 1180}{6800} = 0.0206$

@ d = 1' : Vel. = 5.06 fps (56 cfs)

$T_c = \frac{6800}{5.06} \times \frac{1}{3600} = 0.37$ hrs.

$\Sigma T_c = \underline{\underline{0.37 \text{ hrs.}}}$

AREA 7B

reach 1 : $S_f = \frac{1260 - 1170}{4800} = 0.0188$

@ d = 1' : Vel. = 4.83 fps (53 cfs)

$T_c = \frac{4800}{4.83} \times \frac{1}{3600} = 0.28$ hrs.

$\Sigma T_c = \underline{\underline{0.28 \text{ hrs.}}}$

AREA 7C

reach 1 : $S_f = \frac{1300 - 1160}{7050} = 0.0199$

@ d = 1' : Vel. = 4.97 fps (55 cfs)

$T_c = \frac{7050}{} \times \frac{1}{3600} = 0.39$ hrs.

reach 2 : $S_f = \frac{1500 - 1300}{6800} = 0.0294$

@ d = 1' : Vel. = 6.05 fps (67 cfs)

$T_c = \frac{6800}{6.05} \times \frac{1}{3600} = 0.31$ hrs.

reach 3 : $S_f = \frac{1880 - 1500}{3150} = 0.1206$

@ d = 1' : Vel. = 12.26 fps (135 cfs)

$T_c = \frac{3150}{12.26} \times \frac{1}{3600} = 0.07$ hrs.

$\Sigma T_c = 0.39 + 0.31 + 0.07 = \underline{\underline{0.78 \text{ hrs.}}}$

AREA (8A)

reach 1 : $S_f = \frac{1300 - 1160}{8600} = 0.0163$

@ d = 1' : Vel. = 4.50 fps (50 cfs)

$T_c = \frac{8600}{4.50} \times \frac{1}{3600} = 0.53$ hrs.

reach 2 : $S_f = \frac{1500 - 1300}{3800} = 0.0526$

@ d = 1' : Vel. = 8.10 fps (89 cfs)

$T_c = \frac{3800}{8.10} \times \frac{1}{3600} = 0.13$ hrs.

reach 3 : $S_f = \frac{1620 - 1500}{600} = 0.200$

@ d = 1' : Vel. = 15.78 fps (174 cfs)

$T_c = \frac{600}{15.78} \times \frac{1}{3600} = 0.01$ hrs.

$\Sigma T_c = 0.53 + 0.13 + 0.01 = \underline{0.67 \text{ hrs.}}$

AREA (8B)

reach 1 : $S_f = \frac{1300 - 1130}{9800} = 0.0173$

@ d = 1' : Vel. = 4.65 fps (51 cfs)

$T_c = \frac{9800}{4.65} \times \frac{1}{3600} = 0.59$ hrs.

reach 2 : $S_f = \frac{1500 - 1300}{7200} = 0.0278$

@ d = 1' : Vel. = 5.88 fps (65 cfs)

$T_c = \frac{7200}{5.88} \times \frac{1}{3600} = 0.34$ hrs.

reach 3 : $S_f = \frac{1620 - 1500}{2200} = 0.0545$

@ d = 1' : Vel. = 8.24 fps (91 cfs)

$T_c = \frac{2200}{8.24} \times \frac{1}{3600} = 0.07$ hrs.

$\Sigma T_c = 0.59 + 0.34 + 0.07 = \underline{1.00 \text{ hrs.}}$

AREA (9A)

reach 1 : $S_f = \frac{1300 - 1120}{12000} = 0.0150$

@ d = 1' : Vel. = 4.32 fps (48 cfs)

$T_c = \frac{12000}{4.32} \times \frac{1}{3600} = 0.77$ hrs.

reach 2 : $S_f = \frac{1500 - 1300}{6900} = 0.0290$

@ d = 1' : Vel. = 6.01 fps (60 cfs)

$T_c = \frac{6900}{6.01} \times \frac{1}{3600} = 0.32$ hrs.

reach 3 : $S_f = \frac{1900 - 1500}{1700} = 0.2353$

@ d = 1' : Vel. = 17.12 fps (188 cfs)

$T_c = \frac{1700}{17.12} \times \frac{1}{3600} = 0.03$ hrs.

$\Sigma T_c = 0.77 + 0.32 + 0.03 = \underline{\underline{1.12 \text{ hrs.}}}$

AREA (9B)

reach 1 : $S_f = \frac{1260 - 1110}{8800} = 0.0170$

@ d = 1' : Vel. = 4.61 fps (51 cfs)

$T_c = \frac{8800}{4.61} \times \frac{1}{3600} = 0.53$ hrs.

$\Sigma T_c = \underline{\underline{0.53 \text{ hrs.}}}$

LISTING OF DATA IN CORE

SADFRS & DIVERSION - TR 20 INPUT DATA

0 SADDLEBACK FRS - ESH,FM,PSH

1 CTABLE

VELOCITY INCREMENT .2000

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

9 ENDTBL

2 XSECTN XSECTN NO. 2 DRAINAGE AREA 1.0000

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

9 ENDTBL

2 XSECTN XSECTN NO. 3 DRAINAGE AREA 1.0000

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

9 ENDTBL

2 XSECTN XSECTN NO. 11 DRAINAGE AREA 1.0000

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

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"

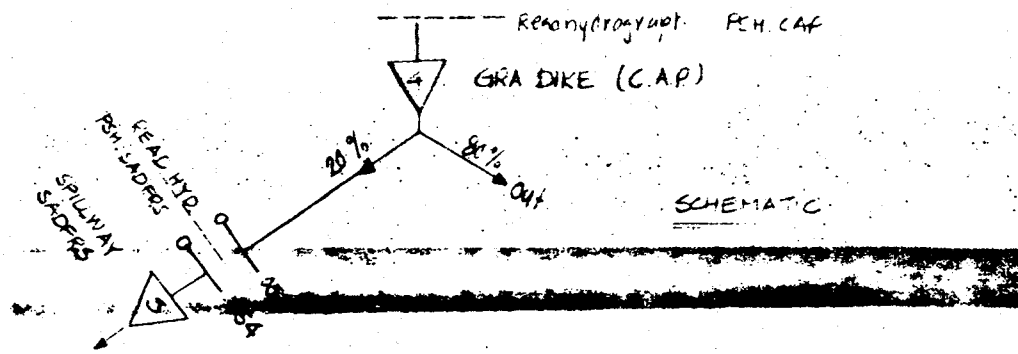
```
6 RUNOFF 1   1       6     16.0100     91.0000     1.52001 0 0 1 0 1
6 DIVERT 6   2   6 1 2      0.0000      .3000      3.00001 0 0 1 0 1
6 REACH  3   4   1   5  15600.0000      .8400      0.00001 0 0 1 0 1
6 RUNOFF 1   5       6      5.6510     89.0000     1.26001 0 0 1 0 1
6 ADDHYD 4   6   5 6 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       2.8700     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        .540      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 - REAHYD. 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	428.42	509.05	669.26	1725.30	2149.31	2175.08	2093.94	1987.30
96.00	ELEV	1383.62	1383.95	1384.25	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			

DISCHARGE HYDROGRAPH, HYDROGRAPH LOCATION 4

STARTING TIME= 0.00 TIME INCREMENT= 4.80 DRAINAGE AREA= 22.24 BASE FLOW= 0.00

	500.0000	535.0000	540.0000	545.0000	550.0000
	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	680.0000
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
8	500.0000	500.0000	500.0000	500.0000	500.0000
9 ENDTBL					

EXECUTIVE CONTROL CARD OPERATION COMPUT. FROM XSECTN/STRUCT 54/ 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 54

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	1717.01	1849.92	1277.88	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					

ROUTINE 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	1178.18	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

21-22

Computer output

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.	CSN
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	3878.53	3.17	0.00	2.35	633.26
1	1	6	10.45	2	2	.20	0.00	3.49	6.00	6869.38	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
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	2328.69	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
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

100 YR - 1 DAY (FAIL)

50 YR - 1 DAY (DIVERSION)

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	500.36
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	482.18	18.79	0.00	2.35	41.31
1	3	12	10.95	1	2	.20	0.00	3.94	24.00	482.15	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	1198.20	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	12.30	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	673.04
1	3	18	15.27	1	2	.20	0.00	4.03	24.00	2972.56	12.50	0.00	2.30	104.9[illegible]
1	3	19	24.24	1	2	.20	0.00	4.03	24.00	5295.24	12.48	0.00	3.95	218.40
1	3	20	4.51	1	2	.20	0.00	4.03	24.00	2050.23	12.92	0.00	2.06	454.4[illegible]
1	3	21	28.75	1	2	.20	0.00	4.03	24.00	6991.70	12.58	0.00	3.66	243.9[illegible]
1	3	22	4.46	1	2	.20	0.00	4.03	24.00	3021.83	12.31	0.00	2.48	879.33
1	3	23	33.21	1	2	.20	0.00	4.03	24.00	10647.56	12.44	0.00	3.50	378.68
1	3	-3	33.21	1	2	.20	0.00	4.03	24.00	1009.33	27.36	1188.71	2.15	38.4[illegible]
1	3	24	33.21	1	2	.20	0.00	4.03	24.00	1009.32	27.41	0.00	2.15	38.4[illegible]
1	3	25	.84	1	2	.20	0.00	4.03	24.00	903.74	12.24	0.00	2.75	1075.88
1	3	26	34.05	1	2	.20	0.00	4.03	24.00	1195.87	12.31	0.00	2.16	35.12
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	42.02
1	4	1	16.01	1	2	.30	0.00	3.57	24.00	8989.42	12.78	0.00	2.41	561.48
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
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.[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	178.44
1	4	20	4.51	1	2	.30	0.00	3.57	24.00	1658.06	12.92	0.00	1.69	367.44
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	741.0[illegible]
1	4	23	33.21	1	2	.30	0.00	3.57	24.00	8587.74	12.46	0.00	3.86	250.4[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	920.84
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	888.06
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	86.75
1	4	39	37.27	1	2	.30	0.00	3.64	24.00	3060.86	12.66	0.00	3.08	82.12
1	4	40	2.32	1	2	.30	0.00	3.64	24.00	1739.96	12.43	0.00	2.39	749.82
1	4	41	39.60	1	2	.30	0.00	3.64	24.00	4669.07	12.59	0.00	2.97	117.96
1	4	42	39.60	1	2	.30	0.00	3.64	24.00	4375.83	12.86	0.00	2.96	110.81
1	4	43	2.62	1	2	.30	0.00	3.64	24.00	1791.84	12.54	0.00	2.39	649.19
1	4	44	42.22	1	2	.30	0.00	3.64	24.00	5919.48	12.76	0.00	2.93	168.97
1	4	45	42.22	1	2	.30	0.00	3.64	24.00	5872.50	12.79	0.00	2.93	190.78
1	4	46	.43	1	2	.30	0.00	3.64	24.00	437.30	12.15	0.00	2.37	1815.08
1	4	47	42.65	1	2	.30	0.00	3.64	24.00	6017.57	12.77	0.00	2.92	167.00
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	1808.36	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	358.98
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	308.18
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	1.30	293.78
1	5	9	44.28	1	2	.30	0.00	2.50	24.00	13640.91	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	33.83
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	1706.12	13.23	1188.04	8.26	250.86
1	5	14	6.90	1	2	.30	0.00	2.50	24.00	1605.37	14.25	0.00	8.17	232.68
1	5	15	2.07	1	2	.30	0.00	2.50	24.00	716.89	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	96.40
1	5	20	4.51	1	2	.30	0.00	2.50	24.00	829.98	12.97	0.00	.89	184.83
1	5	21	28.75	1	2	.30	0.00	2.50	24.00	3039.99	12.65	0.00	2.79	185.98
1	5	22	4.46	1	2	.30	0.00	2.50	24.00	1044.47	12.36	0.00	1.18	413.84
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	21.84
1	5	24	33.21	1	2	.30	0.00	2.50	24.00	725.84	28.52	0.00	2.18	21.84
1	5	25	.84	1	2	.30	0.00	2.55	24.00	459.81	12.29	0.00	1.42	547.48
1	5	26	34.05	1	2	.30	0.00	2.55	24.00	729.02	24.02	0.00	2.16	21.61
1	5	27	34.05	1	2	.30	0.00	2.55	24.00	728.82	24.06	0.00	2.16	21.61
1	5	28	.29	1	2	.30	0.00	2.55	24.00	209.90	12.34	0.00	1.39	718.98
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	21.39
1	5	31	.55	1	2	.30	0.00	2.55	24.00	442.22	12.08	0.00	1.38	708.93
1	5	32	34.89	1	2	.30	0.00	2.55	24.00	810.54	12.15	0.00	2.14	23.93
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	526.98
1	5	35	35.97	1	2	.30	0.00	2.55	24.00	1319.92	12.35	0.00	2.12	36.78
1	5	36	35.97	1	2	.30	0.00	2.55	24.00	1227.35	12.51	0.00	2.11	34.12
1	5	37	1.30	1	2	.30	0.00	2.55	24.00	726.35	12.28	0.00	1.42	557.82
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	68.82
1	5	42	39.60	1	2	.30	0.00	2.55	24.00	2550.78	12.88	0.00	2.04	64.49
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	82.68
1	6	-4	54.73	1	2	4.80	0.00	2.55	24.00	2178.66	128.36	1394.46	3.77	38.87
1	6	51	10.95	1	2	4.80	0.00	2.55	24.00	419.33	128.32	0.00	3.18	[illegible]
1	6	53	10.95	1	2	4.80	0.00	2.55	24.00	417.91	130.08	0.00	3.18	[illegible]
1	6	54	33.21	1	2	4.80	0.00	2.55	24.00	6723.68	120.17	0.00	14.56	[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 (DIVERSION)

(FKS) * PSH-10 day

* see [illegible] 2.1-20

SUMMARY TABLE 3

DIVERSION

DISCHARGE, CFS

	01 BSH	02 PH	03 100 YR-1 DAY	04 50 YR 1 DAY	05 10 YR-1 DAY	06 BSH 10 DAY*	07	08	09	010
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	1069.33	944.28	725.85	0.00	0.00	0.00	0.00	0.00
XSEC/STRUC NO. -2 ALTERNATE 1 BASIN #2	3998.09	7883.70	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	1507.89	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 2.1-20

2-1-26

XSEC/STRUC NO. 16 ALTERNATE 1	6209.37	7707.54	5647.83	3048.12	1987.04	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	[illegible]
XSEC/STRUC NO. 18 ALTERNATE 1	3143.03	6788.15	2972.56	2421.59	1296.10	0.00	0.00	0.00	0.00	0.00
XSEC/STRUC NO. 19 ALTERNATE 1	5755.14	11201.48	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	[illegible]
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	1089.32	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	[illegible]
XSEC/STRUC NO. 27 ALTERNATE 1	0.00	0.00	1177.81	1007.17	728.82	0.00	0.00	0.00	0.00	[illegible]
XSEC/STRUC NO. 28 ALTERNATE 1	0.00	0.00	409.81	354.69	209.99	0.00	0.00	0.00	0.00	[illegible]
XSEC/STRUC NO. 29 ALTERNATE 1	0.00	0.00	1442.86	1199.43	733.09	0.00	0.00	0.00	0.00	[illegible]
XSEC/STRUC NO. 30 ALTERNATE 1	0.00	0.00	0.00	1118.12	732.25	0.00	0.00	0.00	0.00	[illegible]
XSEC/STRUC NO. 31 ALTERNATE 1	0.00	0.00	0.00	739.38	442.22	0.00	0.00	0.00	0.00	[illegible]
XSEC/STRUC NO. 32 ALTERNATE 1	0.00	0.00	0.00	1448.35	810.54	0.00	0.00	0.00	[illegible]	[illegible]
XSEC/STRUC NO. 33 ALTERNATE 1	0.00	0.00	0.00	1353.61	755.07	0.00	0.00	0.00	0.00	[illegible]
XSEC/STRUC NO. 34 ALTERNATE 1	0.00	0.00	0.00	955.63	566.42	0.00	0.00	0.00	0.00	[illegible]
XSEC/STRUC NO. 35 ALTERNATE 1	0.00	0.00	0.00	2306.59	1319.92	0.00	0.00	0.00	0.00	[illegible]
XSEC/STRUC NO. 36 ALTERNATE 1	0.00	0.00	0.00	2148.54	1227.35	0.00	0.00	0.00	0.00	[illegible]

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	2724.59	0.00	0.00	0.00	0.00	0.00
XSEC/STRUC NO. 42 ALTERNATE 1	0.00	0.00	0.00	4375.83	2558.78	0.00	0.00	0.00	0.00	0.00
XSEC/STRUC NO. 43 ALTERNATE 1	0.00	0.00	0.00	1791.84	1088.39	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.

ENGINEERING DESIGN

TOUPS CORPORATION

CONSULTING ENGINEERS AND PLANNERS

BY CES DATE 10-18-78 CLIENT SCS SHEET NO: ____ OF ____

CHECKED ____ DATE ____ JOB SADDLEBACK DIVERSION JOB NO. ____

FLOW LINE ELEVATIONS (REVISED)

STA	DIST.	SLOPE	DROP	ELEV	REMARKS DIST & CHANNEL BOT. TO ℄ CHANNEL DIKE	BASE WIDTH B ft	ELEV DIKE
0+82				1173.50		25	
	908	0.0015	1.36				
9+90				1172.14		25	
	50	" "	0.08		CULVERT		
10+40				1172.06	62'	30	1178.5
	460	" "	0.69				
15+00				1171.37	88'		1181.7
	500	" "	0.75				
20+00				1170.62	90'		1179.6
20+00				1164.80	DROP		
	500	0.0020	1.00			30	
25+00				1163.80	82'		1175.8
	500	0.002	1.00				
30+00				1162.80	88'	38.75	1174.0
	500	" "	"				
35+00				1161.80	85'	47.50	1172.5
	500	" "	"				
40+00				1160.80	90'	56.25	1170.9
	"	"	"				
45+00				1159.80	92'	65.00	1169.2
	200	"	0.40				
47+00				1159.40		68.50	
	300	"	0.60				
50+00				1158.80	96'	73.75	1167.6
	500	0.002	1.00				
55+00				1157.80	100'	82.50	1165.9
	"	"	"				
60+00				1156.80	105'	91.25	1163.8
	"	"	"				
65+00				1155.80	110'	100.00	1162.7
	"	"	"				
70+00				1154.80	111'	108.82	1163.0
	"	"	"				
75+00				1153.80	110'	117.65	1160.2
	"	"	"				
80+00				1152.80	115'	126.47	1159.2
	200	"	0.40				
82+00				1152.40	126'	130.00	1158.3
82+00				1147.80	DROP	130.00	
	300	"	0.60				
85+00				1147.20	128'	133.26	1156.8
	500	"	1.00				

TOUPS CORPORATION

CONSULTING ENGINEERS AND PLANNERS

BY CES DATE 10-18-78 CLIENT SCS SHEET NO. — OF —

CHECKED _____ DATE _____ JOB SADDLEBACK DIVERSION JOB NO. _____

DIKE

FLOW LINE ELEVS (CONT'D)

STA	DIST.	SLOPE	DROP	ELEV	REMARKS		
90+00				1146.20	130'	138.70	1155.2
	500	0.002	1.00				
95+00				1145.20	132'	144.13	1153.8
	500	"	"				
100+00				1144.20	135'	149.57	1153.1
	"	"	"				
105+00				1143.20	137'	155.00	1151.5
	"	"	"				
110+00				1142.20	135'	162.47	1149.2
	"	"	"				
115+00				1141.20	137'	169.94	1148.0
	"	"	"				
120+00				1140.20	140'	177.41	1146.8
	"	"	"				
125+00				1139.20	143'	184.89	1145.6
	"	"	"				
130+00				1138.20	148'	192.36	1146.4
	"	"					
135+00				1137.20	150'	199.83	1143.7
	"	"	"				
140+00				1136.20	155'	207.30	1142.7
	"	"	"				
145+00				1135.20	DROP	214.77	
145+00				1128.85	168'		1139.2
	"	0.0022	1.10			220.00	
148+50							
150+00				1127.75	170'	221.59	1137.0
	"	"	"				
155+00				1126.65	182'	226.87	1135.9
	"	"	"				
160+00				1125.55	172'	232.15	1134.0
	"	"	"				
165+00				1124.45	178'	237.44	1132.7
	"	"	"				
170+00				1123.35	180'	242.72	1131.2
	"	"	"				
175+00				1122.25	178'	248.01	1129.8
	"	"	"				
180+00				1121.15	180'	253.29	1128.2
	"	"	"				
185+00				1120.05	182'	258.58	1126.6
	"	"	"				
190+00				1118.95	185'	263.86	1125.5

TOUPS CORPORATION

CONSULTING ENGINEERS AND PLANNERS

BY CES DATE 10-18-78 CLIENT SCS SHEET NO. ____ OF ____

CHECKED ____ DATE ____ JOB SADDLEBACK DIVERSION JOB NO. ____

STA	DIST.	SLOPE	DROP	ELEV.	REMARKS		DIKE
FLOW LINE ELEVS (CONT'D)							
190+00				1118.95	185'	263.86	1125.5
	500	0.0022	1.10				
195+00				1117.85	188'	269.15	1124.4
	"	"					
200+00				1116.75	190'	274.43	1123.4
	"	"					
205+00				1115.65	190'	279.72	1122.0
	"	"					
210+00				1114.55	192'	285.00	1121.0
	"	"					
215+00				1113.45	195'	287.77	1120.0
	"	"					
220+00				1112.35	198'	290.53	1119.4
	"	"					
225+00				1111.25	202'	293.30	1119.5
	"	"					
230+00				1110.15	195'	296.07	1116.5
235+00				1109.05	200'	298.83	1115.5
	211	0.0022	0.46				
237+11				1108.59		300.00	
					DROP		
237+61				1098.28		300.00	
		0.0020					
239+00				1098.00		331.73	
		0.0020					
241+00				1097.60		377.38	
		0.0020					
243+00				1097.20		423.04	
		0.0020					
245+00				1096.80		468.69	
		0.0070					
247+06				1095.40		517.35	
		0.0070					
249+00				1094.00		560.00	

TOUPS CORPORATION

CONSULTING ENGINEERS AND PLANNERS

BY CES DATE 10-17-78 CLIENT SCS SHEET NO. ____ OF ____

CHECKED ____ DATE ____ JOB SALTLESKAR DIVERSION JOB NO. ____

TABLE I
STRUCTURE DATA

STA	CAPACITY CFS 20-YR	CFS 100-YR	BOTTOM WIDTH	SLOPE	DEPTH OF FLOW	SIDE SLOPE EU	EH	VEL. 20-YR	VEL. 100-YR
0+00	INVERT OF DAM STRUCT & SAF OUTLET								
0+32 CULVERT	720	782 1122	25	0.0015	5.7 6.1	4	2	0.035	4.1
7+90 50X	1070	1088	25	" "	6.0	4	2	0.035	4.2
10+00	1090	1123	30	" "	5.0	5	3	0.030	4.4
20+00	1240	1341	50	" "	5.3	5	3	0.030	4.7
25+00	1370	1380	30	0.002	5.2	5	3	"	5.2
65+00	1900	1880	100 WIDTH VARIES	" "	3.5	"	"	"	4.7
82+00	2350	2410	130 WIDTH VARIES	" "	3.5	"	"	"	4.8
105+00	2860	2856	155 WIDTH VARIES	" "	3.5	"	"	"	4.8
148+50	3970	4014	210 WIDTH VARIES	" "	3.5	"	"	"	4.9
210+00	5430	5427	285 WIDTH VARIES	0.0022	3.5	"	"	"	5.2
237+11	5970	5984	300	0.0022	3.6	"	"	"	5.3
237+63	5970	5975	300 WIDTH VARIES	0.002	3.7	"	"	"	5.1
249+00	6060	6205	560	0.007	1.8	"	"	"	6.1

CHECK ON STA 19+50 MAX Q = 1196 D = 5.2'

DEPTH OF WATER SURFACE INCREASES 0.2' BET. 50YR & 100

STA 21+00 100YR Q = 1443 D = 5.65'

DEPTH INCREASES 0.25'.

1/31/79
superceeds 10/23/78

DIVERSION CENTERLINE SURVEY DATA

FROM	BEARING	DISTANCE	N COORD	E COORD	PT#	
***** AREA						Station 15+93.08 FR
			899217.100	147699.850	57	0+00 Div.
57	S 70 33 36 W	117.378	899178.035	147589.164	358	PC Sta. 1+17.38
358	S 19 26 24 E	469.480	898735.319	147745.415	359	RP
CA=	38 50 11	ARC=	318.225	RAD= 469.480		
CB=	S 51 08 31 W	CHD=	312.168	TAN= 165.498		
359	N 58 16 35 W	469.480	898982.182	147346.078	360	PT Sta. 4+35.603
360	S 31 43 25 W	324.101	898706.504	147175.658	156	AP Sta. 7+59.704
156	S 30 43 31 W	300.000	898448.616	147022.381	60	AP Sta. 10+59.704
60	S 31 33 46 W	229.848	898252.770	146902.071	61	PC Sta. 12+89.552
61	N 58 26 10 W	1015.000	898784.071	146037.233	132	RP
CA=	21 28 51	ARC=	380.535	RAD= 1015.000		
CB=	S 42 18 16 W	CHD=	378.310	TAN= 192.528		
132	S 36 57 19 E	1015.000	897972.979	146647.442	63	PT Sta. 16+70.087
63	S 53 02 41 W	830.230	897473.852	145984.001	65	AP Sta. 25+00.317
65	S 52 32 36 W	3536.830	895322.887	143176.419	92	PC 60+37.147
92	S 37 27 24 E	1967.000	893761.457	144372.674	93	RP
CA=	13 59 43	ARC=	480.464	RAD= 1967.000		
CB=	S 45 32 44 W	CHD=	479.271	TAN= 241.434		
93	N 51 27 07 W	1967.000	894987.235	142834.312	94	PT 65+17.611
94	S 38 32 53 W	2163.466	893295.220	141486.102	73	AP 86+81.077
73	S 38 30 58 W	1388.349	892208.931	140621.526	96	PC 100+69.426
96	S 51 29 02 E	2920.000	890390.541	142906.227	97	RP
CA=	29 55 42	ARC=	1525.253	RAD= 2920.000		
CB=	S 23 33 08 W	CHD=	1507.973	TAN= 780.453		
97	N 81 24 43 W	2920.000	890826.577	140018.967	98	PT 115+94.679
98	S 08 35 17 W	2496.242	888358.323	139646.209	100	PC 140+90.921
100	S 81 24 43 E	2920.000	887922.287	142533.469	101	RP
CA=	16 05 19	ARC=	819.930	RAD= 2920.000		
CB=	S 00 32 37 W	CHD=	817.239	TAN= 412.680		
101	S 82 29 58 W	2920.000	887541.122	139638.454	102	PT 149+10.851
102	S 07 30 02 E	1036.414	886513.575	139773.744	104	PC 159+47.265
104	S 82 29 58 W	4120.000	885975.767	135688.996	105	RP
CA=	24 56 33	ARC=	1793.546	RAD= 4120.000		
CB=	S 04 58 14 W	CHD=	1779.417	TAN= 911.209		
105	S 72 33 29 E	4120.000	884740.850	139619.566	106	PT 177+40.811
106	S 17 26 31 W	2533.284	882324.042	138860.247	108	PC 202+74.095
108	S 72 33 29 E	3894.000	881156.866	142575.208	109	RP
CA=	25 52 30	ARC=	1758.540	RAD= 3894.000		
CB=	S 04 30 16 W	CHD=	1743.635	TAN= 894.525		
109	S 81 34 01 W	3894.000	880585.792	138723.311	110	PT 220+32.635
110	S 08 25 59 E	1581.058	879021.829	138955.181	83	AP 236+13.693
83	S 08 22 32 E	225.400	878798.833	138988.013	84	PC 238+39.073
84	S 81 37 28 W	1458.058	878586.451	137545.505	155	RP
CA=	42 52 48	ARC=	1091.207	RAD= 1458.058		
CB=	S 13 03 52 W	CHD=	1065.918	TAN= 572.581		
155	S 55 29 44 E	1458.058	877760.505	138747.065	85	PT 249+30.300
85	S 84 17 41 W	2727.476	877489.360	136033.100	257	
257	N 28 14 01 E	24661.868	899217.100	147699.850	57	

AREA=21905544.272 SQ.FT. OR 502.88210 ACRES

RP = Radial Point

								878798.833	138988.013	84	PC 238+39.09
84	S	08	22	32	E		572.581	878232.359	139071.415	356	PI 8
356	S	34	30	16	W		572.581	877760.505	138747.065	85	PT 249+30.80
								882324.042	138860.247	108	PC 202+74.10
108	S	17	26	31	W		894.525	881470.645	138592.125	107	PI 7
107	S	08	25	59	E		894.525	880585.792	138723.311	110	PT 220+32.64
								886513.575	139773.744	104	PC 159+47.27
104	S	07	30	02	E		911.209	885610.163	139892.689	103	PI 6
103	S	17	26	31	W		911.209	884740.850	139619.566	106	PT 177+40.81
								888358.323	139646.209	100	PC 140+90.92
100	S	08	35	17	W		412.680	887950.270	139584.584	99	PI 5
99	S	07	30	02	E		412.680	887541.122	139638.454	102	PT 149+10.85
								892208.931	140621.526	96	PC 100+69.43
96	S	38	30	58	W		780.453	891598.280	140135.510	95	PI 4
95	S	08	35	17	W		780.453	890826.577	140018.967	98	PT 115+94.68
								895322.887	143176.419	92	PC 60+37.15
92	S	52	32	36	W		241.434	895176.057	142984.766	91	PI 3
91	S	38	32	53	W		241.434	894987.235	142834.312	94	PT 65+17.61
								898252.770	146902.071	61	PC 12+89.55
61	S	31	33	36	W		192.495	898088.747	146801.321	112	PI 2
112	S	53	02	41	W		192.563	897972.979	146647.442	63	PT 16+70.09
								899178.030	147589.159	58	PC 1+17.38
58	S	70	33	36	W		165.496	899122.954	147433.101	111	PI 1
111	S	31	43	26	W		165.500	898982.187	147346.077	150	PT 4+35.60

TIES

								899217.100	147699.850	57	Sta. 0+00 Div.
57	S	50	11	29	W		1109.428	898506.815	146847.603	255	Brass Cap
255	N	00	43	30	E		1.000	898507.815	146847.616	300	Opp. B.C.
300	N	50	13	50	E		1108.778	899217.100	147699.850	57	
								898706.510	147175.650	156	
156	S	30	43	32	W		234.209	898505.178	147055.986	301	
301	N	89	16	30	W		208.387	898507.815	146847.616	300	
								898505.178	147055.986	301	
301	S	30	43	32	W		65.794	898448.620	147022.370	60	
								893295.220	141486.102	73	
73	S	21	28	13	W		19.450	893277.119	141478.983	256	Section Corner

CHECK TIES

								898706.504	147175.658	156	AP Sta. 7+59.70
156	S	30	43	41	W		234.208	898505.178	147055.986	301	
301	S	30	42	56	W		65.792	898448.616	147022.381	60	

INTERACTIVE COGO MODULE

FROM	BEARING					DISTANCE	N COORD	E COORD	PT#	
							898505.178	147055.986	301	
301	N	89	16	30	W	208.387	898507.815	146847.616	300	
300	S	00	43	30	W	1.000	898506.815	146847.603	255	
255	N	50	11	29	E	1109.428	899217.100	147699.850	57	
57	S	50	13	50	W	1108.778	898507.815	146847.616	300	
							899178.035	147589.164	358	
358	S	70	33	36	W	165.498	899122.954	147433.101	111	P.I. 1

DIVERSION CHANNEL STABILITY DISCUSSION & CONCLUSIONS

Based on soil sample information provided by SCS, the Channel was evaluated for stability by different methodologies.

1. The tractive stress approach (TR 25, Ex. 6-5) revealed that unstable conditions would exist throughout most of the Channel reach. (See pg. 3.1-9 of calculations) However, an analysis of the formation of bed armor indicates that the depth of scour required to form bed armor ranges from 4.4 inches to 5.7 inches. (See 3.1-12 of calculations) This appears acceptable in that the Channel stability will be enhanced by a minimal loss of bed and side material.
2. The allowable velocity approach (TR 25 - see pg. 3.1-11 of calculations) based on D_{75} size of material, basic velocity and alignment, bank slope and depth correction factors, was also used to evaluate the channel stability. The results indicate that the actual velocity, derived from HEC II - velocity of flow resulting from a 2% chance flood, is lower in a majority of cases than the allowable velocity. Therefore, the channel is considered stable in most cases.
3. A further analysis of the channel stability was obtained from a review of the geological data in the proximity of the channel. These data reveal the channel to be located in a cemented stratum that will offer substantial resistance to scour.
4. An attempt was made to determine the maximum allowable channel slope assuming the energy grade line and profile grade are equal. (see pg. 3.1-13 & 14) Using TR 25 procedure, S_t was calculated from $\tau_{sm} / \gamma_w d (0.78)$ and $S_e \simeq S_o$ from $S_t \left(\frac{n}{n_t}\right)^2$. The same methodology was applied to the bed of the channel using τ_{bm}. The results of this attempt are inconsistent with the other analyses and are, therefore, not being considered

TOUPS CORPORATION
CONSULTING ENGINEERS AND PLANNERS

BY VB DATE 10/16/78 CLIENT SCS SHEET NO. ___ OF ___

CHECKED ___ DATE ___ JOB TRACTIVE STRESS INVESTIGATION DIVERSION CHANNEL JOB NO. 3343-000

CHANNEL EVALUATION - TRACTIVE STRESS APPROACH

Test Pit No. (depth ft.)	SCS Sta. / TOUPS Sta.	D_{90} (mm) (inch)	D_{75} ① (mm) (inch)	$n_t = \frac{D_{90}}{39}$ (inch)	S_t = ③ $(n_t/h)^2 S_e$ (inch)	τ_o = ③ $\gamma_w d S_t$	b/d	Actual τ: $\tau_{bed} = .98\tau_o$	Actual τ: $\tau_{side} = .78\tau_o$	ϕ_R ② (Fig. 6-7)	K (Fig. 6-8) Z=3	K (Fig. 6-8) Z=5	Allowable $\tau_b = 0.4 D_{75}$	Allowable $\tau_b = 0.4 K D_{75}$ Z=3	Allowable $\tau_b = 0.4 K D_{75}$ Z=5
410 (2-7.5)	197 / 196+50	175 / 6.89	76.2 / 3	0.0308	0.0032	0.639	$\frac{\tau_s}{\tau_o} = 0.78$	0.626	0.498	39.4	.87	.95	1.20	1.04	1.14
410 (0-2)	197 / 196+50	45 / 1.77	16 / 0.63	0.0237	0.0019	0.379		0.371	0.296	32.5	.81	.93	0.252	0.204	0.234
412 (0-3)	166 / 165	9.5 / 0.374	3.2 / 0.126	<0.25	SEE PAGE 3.1-8			0.0864	0.0814	/	/	/	SEE PAGE 3.1-8		
414 (0-3)	140 / 140+60		6.4 / 0.25	0.0204	0.00139	0.277		0.271	0.216	30.4	.78	.92	0.10	0.078	0.092
416 (3-10)	110 / 109	270 / 10.63	110 / 4.33	0.0327	0.0036	0.719		0.705	0.561	39.5	.87	.95	1.732	1.507	1.645
416 (0-3)	110 / 109	22.5 / 0.886	6.75 / 0.266	0.0206	0.0014	0.280	$\frac{\tau_b}{\tau_o} = 0.98$; $\frac{\tau_s}{\tau_o}$	0.274	0.218	28.3	.75	.91	0.106	0.080	0.096
418 (2-9)	72 / 74+30	75 / 2.95	14 / 0.551	0.0232	0.0018	0.359		0.352	0.280	34.6	.83	.93	0.220	0.183	0.205
420 (2-3)	63 / 58	19.5 / 0.768	6.5 / 0.256	0.0204	0.0014	0.280		0.274	0.218	30.3	.78	.92	0.102	0.080	0.094
422 / 422	34 / 30+60		8.4 / 0.331	0.0213	0.00152	0.303	$b/d > 10 \Rightarrow \frac{\tau_b}{\tau_o}$	0.297	0.236	32.2	.81	.93	0.132	0.107	0.123

① D_{75} from revised grain distribution dated Oct. 11, 1978 (attached)
② Angularity from Geologic Investigation Report, Saddleback FRS & Diversion (judgement)
③ Variables let: $n = 0.03$
$S_e = 0.003$
$\gamma_w = 62.4$ lb/ft³
$d = 3.2$ ft.
$Z = 3$

3.1-10

UNITED STATES DEPARTMENT OF AGRICULTURE
SOIL CONSERVATION SERVICE Room 3008 Federal Bldg., Phoenix, AZ 85025

October 11, 1978

Mr. Edward Adair, P.E.
Toups Corporation
4131 North 24 Street
Phoenix, Arizona 85016

Re: Harquahala WWP, Saddleback FRS

Dear Ed:

Attached are revised grain distribution curves for soils along Saddleback FRS. The laboratory curves have been revised to include cobbles.

Sincerely,

For: Paul B.
Susanne Lockhart acting

Paul J. Monville
Design Engineer

Attachments

MATERIALS TESTING REPORT

U.S. DEPARTMENT of AGRICULTURE
SOIL CONSERVATION SERVICE

SOIL CLASSIFICATION

PROJECT NO. STATE: PACHECO WPC - SACATE BASIN DIVERSION AND PPS

SAMPLE LOCATION: STA. 8+25 - CENTERLINE - DIVERSION

FIELD SAMPLE NO. 1005 (2)

DEPTH 8.5-9.0 FT.

GEOLOGIC ORIGIN

TYPE OF SAMPLE

TESTED AT PHOENIX, ARIZONA

APPROVED BY Dick

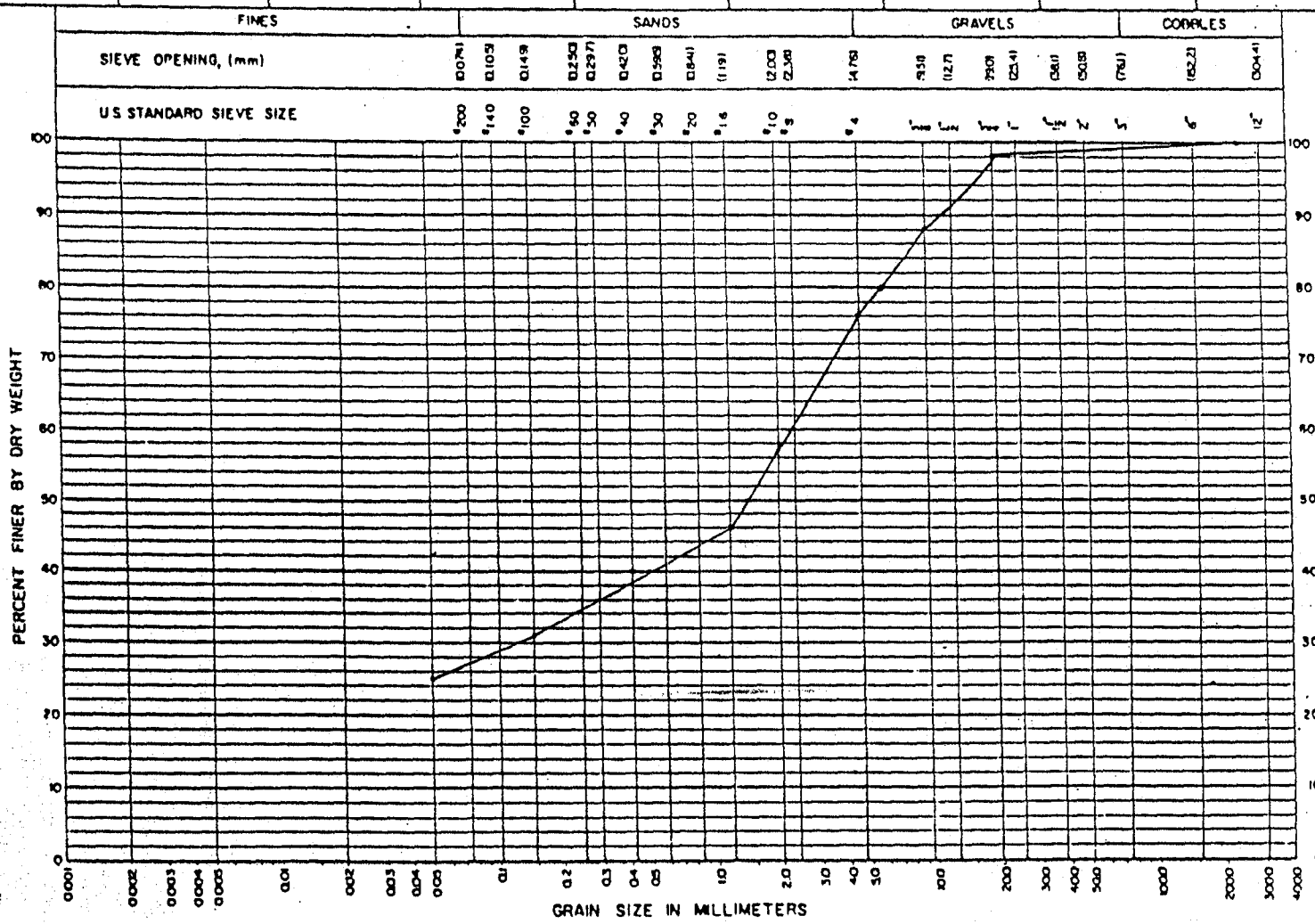
DATE 10-10-78

SYMBOL

DESCRIPTION

GRAIN SIZE DISTRIBUTION

D_{10}	D_{15}	D_{30}	D_{50}	D_{60}	D_{85}	D_{MAX}	C_u	C_c



SPECIFIC GRAVITY (G_s)		ATTERBERG LIMITS						SOLUBLE SALTS	SHRINKAGE LIMIT	UNDISTURBED CONDITION	
		NATURAL MOISTURE		AIR DRY		OVEN DRY				MOISTURE	DRY UNIT WEIGHT
(-) #4	(+) #4	LL	PI	LL	PI	LL	PI	%	%	%	g/cc pcf

REMARKS:

MATERIALS TESTING REPORT

U.S. DEPARTMENT of AGRICULTURE
SOIL CONSERVATION SERVICE

SOIL CLASSIFICATION

PROJECT OR STATE: MARICOPA WPA - SPOOLEBACK DIVERSION AND PRS

SAMPLE LOCATION: Sta. 1774 50' CENTERLINE - CHECK 1

FIELD SAMPLE NO: 1044

DEPTH: 6.0 - 11.0 ft.

TYPE OF SAMPLE

GEOLOGIC ORIGIN

TESTED AT: PHOENIX, ARIZONA

APPROVED BY: [illegible]

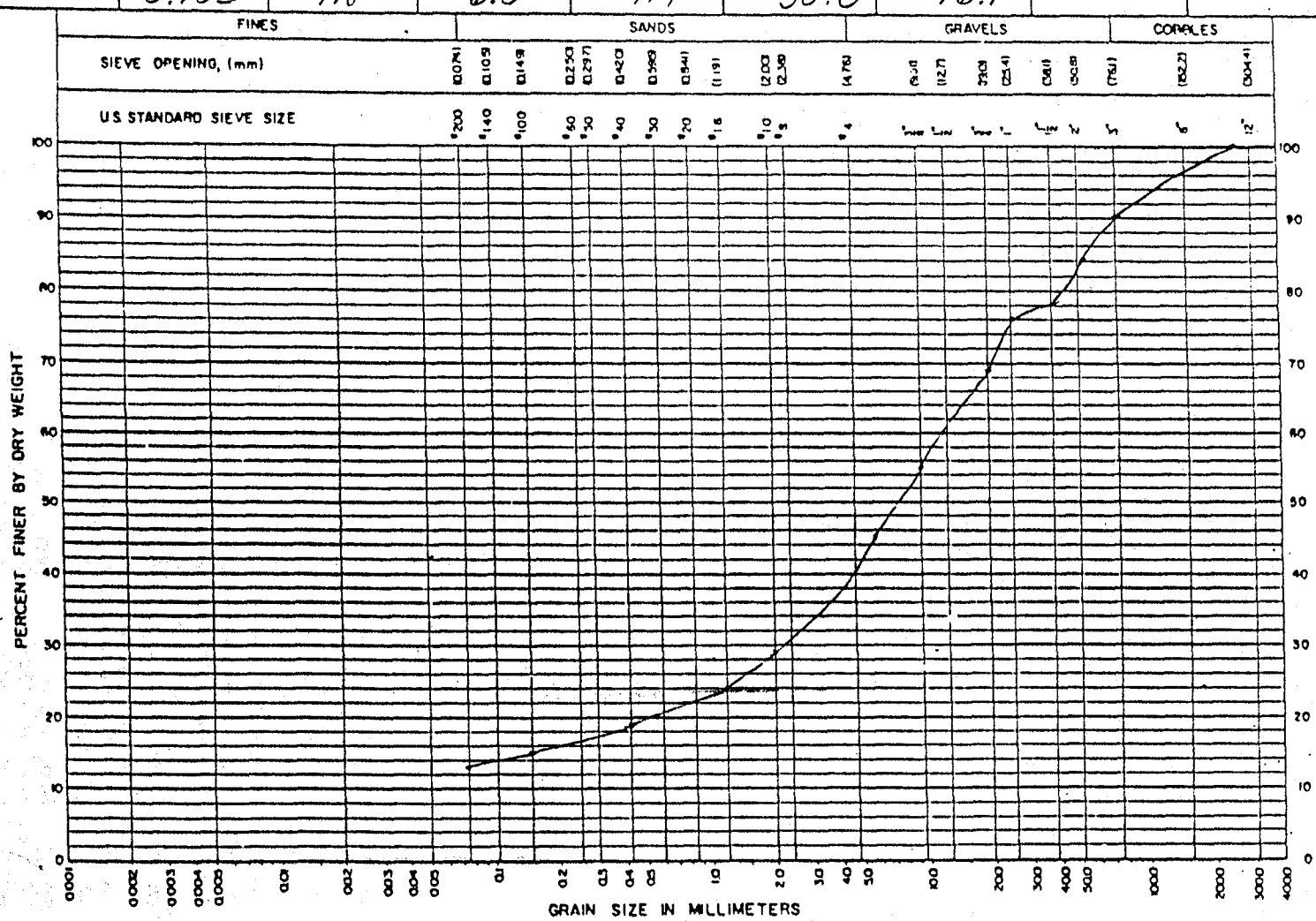
DATE: 10-10-78

SYMBOL

DESCRIPTION

GRAIN SIZE DISTRIBUTION

D_{10}	D_{15}	D_{30}	D_{50}	D_{60}	D_{85}	D_{MAX}	C_u	C_c
	0.105	1.8	6.0	9.4	30.0	76.1		



SPECIFIC GRAVITY (G_s)		ATTERBERG LIMITS						SOLUBLE SALTS	SHRINKAGE LIMIT	UNDISTURBED CONDITION	
		NATURAL MOISTURE		AIR DRY		OVEN DRY				MOISTURE	DRY UNIT WEIGHT
(-) #4	(+) #4	LL	PI	LL	PI	LL	PI	%	%	%	g/cc pcf

REMARKS:

MATERIALS TESTING REPORT

U.S. DEPARTMENT of AGRICULTURE
SOIL CONSERVATION SERVICE

SOIL CLASSIFICATION

PROJECT and STATE: MARYVALE, WPP - SADDLEBACK DIVERSION AND DAM

FIELD SAMPLE NO.: 1301

DEPTH: 3.0-8.5 ft.

SAMPLE LOCATION: Sta. 20+00 ± 40' INC. CENTERLINE

TYPE OF SAMPLE

TESTED AT: PHOENIX, ARIZONA

GEOLOGIC ORIGIN

APPROVED BY: SMC

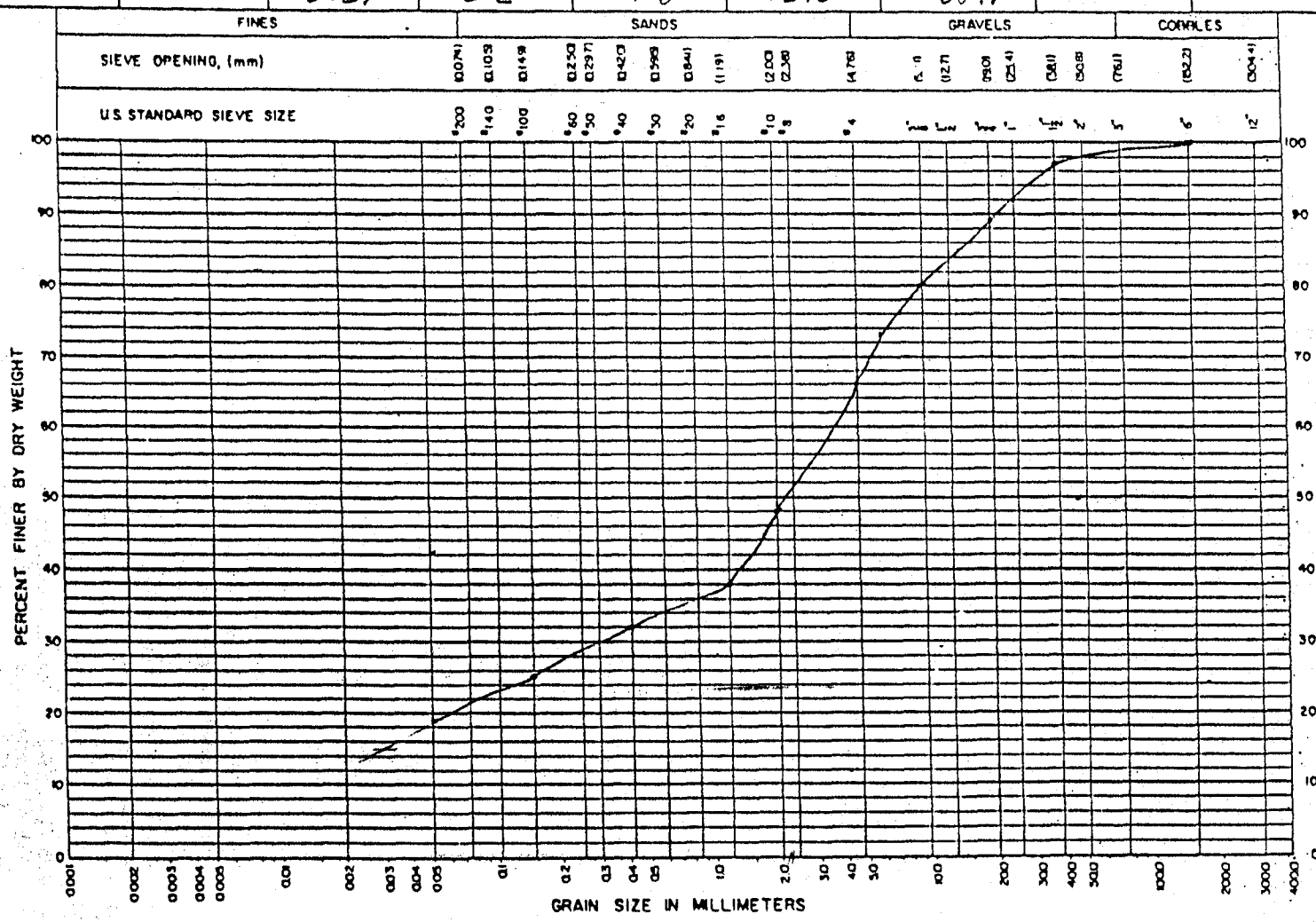
DATE: 10-10-78

SYMBOL

DESCRIPTION

GRAIN SIZE DISTRIBUTION

D_{10}	D_{15}	D_{30}	D_{50}	D_{60}	D_{85}	D_{MAX}	C_u	C_c
		0.27	2.2	4.8	12.0	38.1		



SPECIFIC GRAVITY (G_s)		ATTERBERG LIMITS						SOLUBLE SALTS	SHRINKAGE LIMIT	UNDISTURBED CONDITION	
		NATURAL MOISTURE		AIR DRY		OVEN DRY				MOISTURE	DRY UNIT WEIGHT
(-) #4	(+) #4	LL	PI	LL	PI	LL	PI	%	%	%	g/cc pcf

REMARKS:

MATERIALS TESTING REPORT

U. S. DEPARTMENT of AGRICULTURE
SOIL CONSERVATION SERVICE

SOIL CLASSIFICATION

PROJECT and STATE: HAGQUARTALA WPO SHORELINE FRS

SAMPLE LOCATION: STA. 14+00 ± 500 ft Rt.

FIELD SAMPLE NO.: 2118.2

DEPTH: 2.5 - 6.0 ft.

GEOLOGIC ORIGIN:

TYPE OF SAMPLE:

TESTED AT: Phoenix, AZ. Sergent, Hauskins, Beckwith

APPROVED BY:

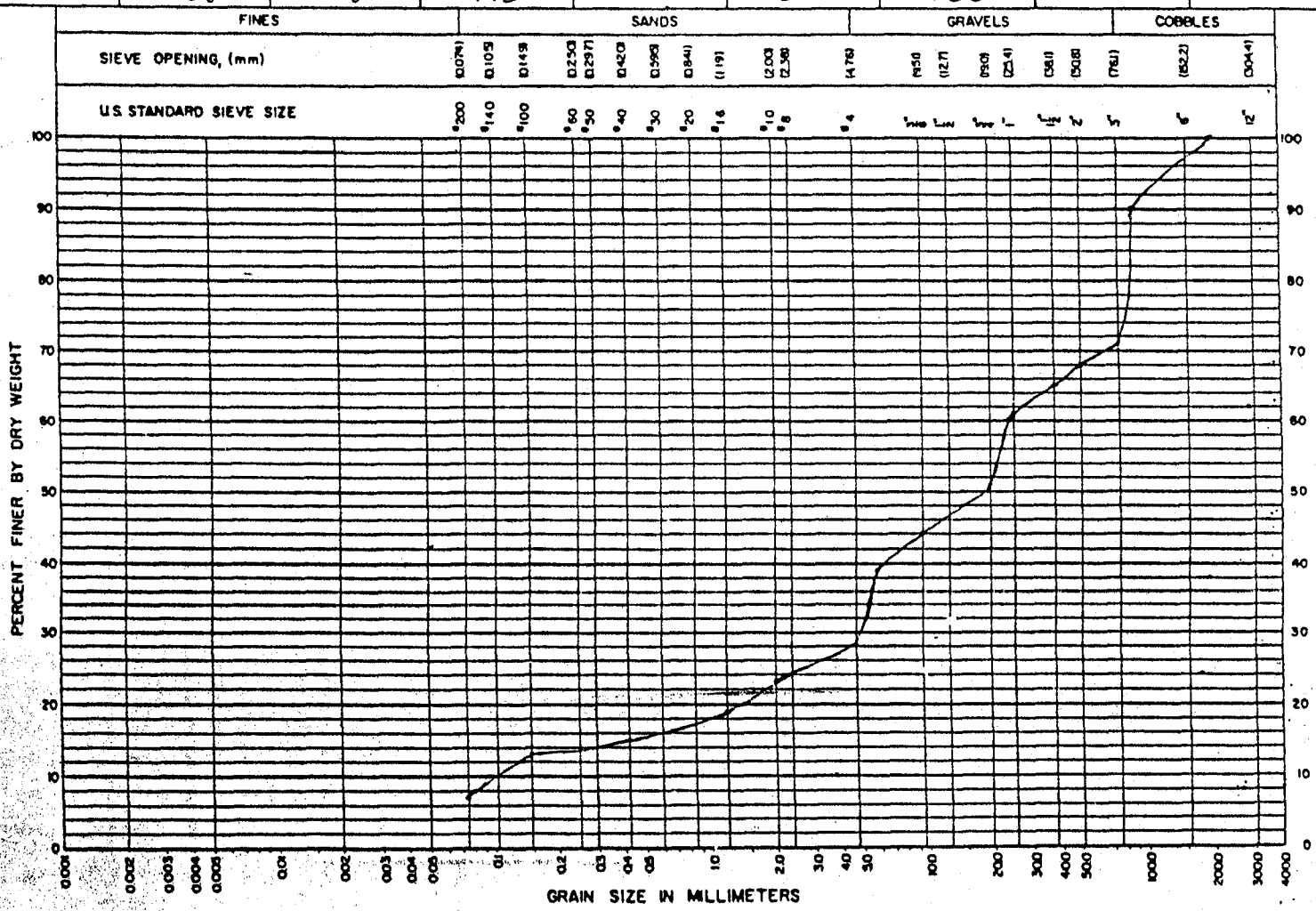
DATE:

SYMBOL:

DESCRIPTION:

GRAIN SIZE DISTRIBUTION

D_{10}	D_{15}	D_{30}	D_{50}	D_{60}	D_{85}	D_{MAX}	C_u	C_c
	0.08	1.8	7.5	11	60	100		



SPECIFIC GRAVITY (G_s)		ATTERBERG LIMITS						SOLUBLE SALTS	SHRINKAGE LIMIT	UNDISTURBED CONDITION	
		NATURAL MOISTURE		AIR DRY		OVEN DRY				MOISTURE	DRY UNIT WEIGHT
(-) #4	(+) #4	LL	PI	LL	PI	LL	PI	%	%	%	g/cc pcf

REMARKS:

UNITED STATES DEPARTMENT OF AGRICULTURE
SOIL CONSERVATION SERVICE Room 3008 Federal Bldg., Phoenix, AZ 85025

October 10, 1978

Mr. Edward Adair, P.E.
Toups Corporation
4131 North 24 Street
Phoenix, AZ 85016

Re: Harquahala WWP, Saddleback Diversion

Dear Ed:

Attached are revised grain distribution curves for soils along Saddleback Diversion. The laboratory curves have been revised to include cobbles. These may be used to determine the maximum allowable velocity in the diversion channel.

Sincerely,

Paul J. Monville
Design Engineer

Attachments

MATERIALS TESTING REPORT

U. S. DEPARTMENT of AGRICULTURE
SOIL CONSERVATION SERVICE

SOIL CLASSIFICATION

PROJECT and STATE: MARQUARTHA WPP - SADDLE BACK DIVERSION AND PCS

SAMPLE LOCATION: STA. 190+00 CENTERLINE - DIVERSION

FIELD SAMPLE NO.: 4/0

DEPTH: 0-2'

GEOLOGIC ORIGIN:

TYPE OF SAMPLE:

TESTED AT: PHOENIX, ARIZONA

APPROVED BY: JRG

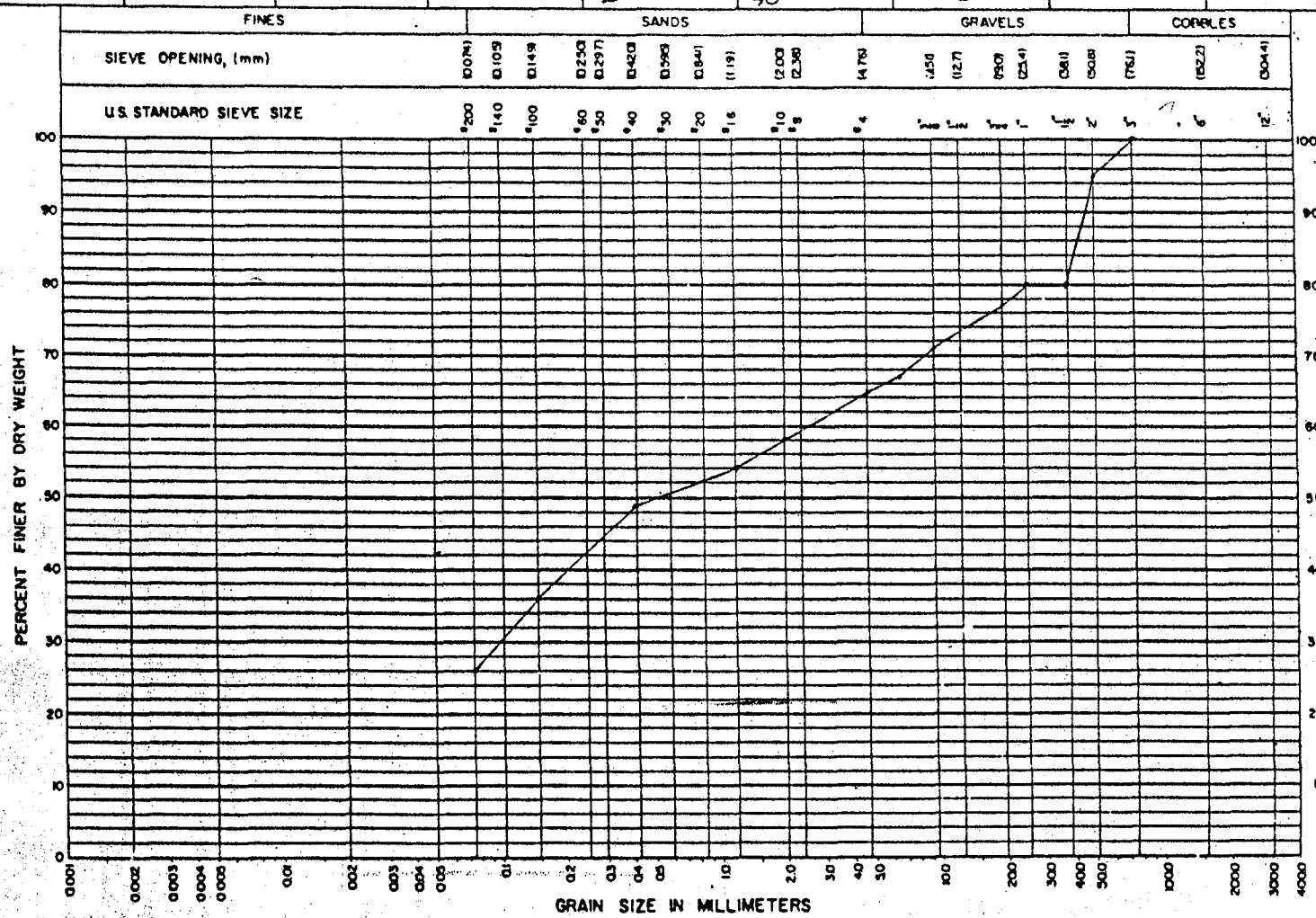
DATE: 10-5-78

SYMBOL

DESCRIPTION

GRAIN SIZE DISTRIBUTION

D_{10}	D_{15}	D_{30}	D_{50}	D_{85} 75 16.0MM	D_{95} 90 45.0MM	D_{MAX} 5"	C_u	C_c



SPECIFIC GRAVITY (G_s)		ATTERBERG LIMITS						SOLUBLE SALTS	SHRINKAGE LIMIT	UNDISTURBED CONDITION	
		NATURAL MOISTURE		AIR DRY		OVEN DRY				MOISTURE	DRY UNIT WEIGHT
(-) #4	(+) #4	LL	PI	LL	PI	LL	PI	%	%	%	g/cc pcf

REMARKS:

10/16/78

MATERIALS TESTING REPORT

U.S. DEPARTMENT of AGRICULTURE
SOIL CONSERVATION SERVICE

SOIL CLASSIFICATION

PROJECT and STATE: MAGGIE WPP - SADDLEBACK DIVERSION, ARIZ.

SAMPLE LOCATION: CENTERLINE - DIVERSION

FIELD SAMPLE NO.: 410

DEPTH: 2 - 6½'

GEOLOGIC ORIGIN:

TYPE OF SAMPLE:

TESTED AT: PHOENIX, ARIZONA

APPROVED BY: JRG

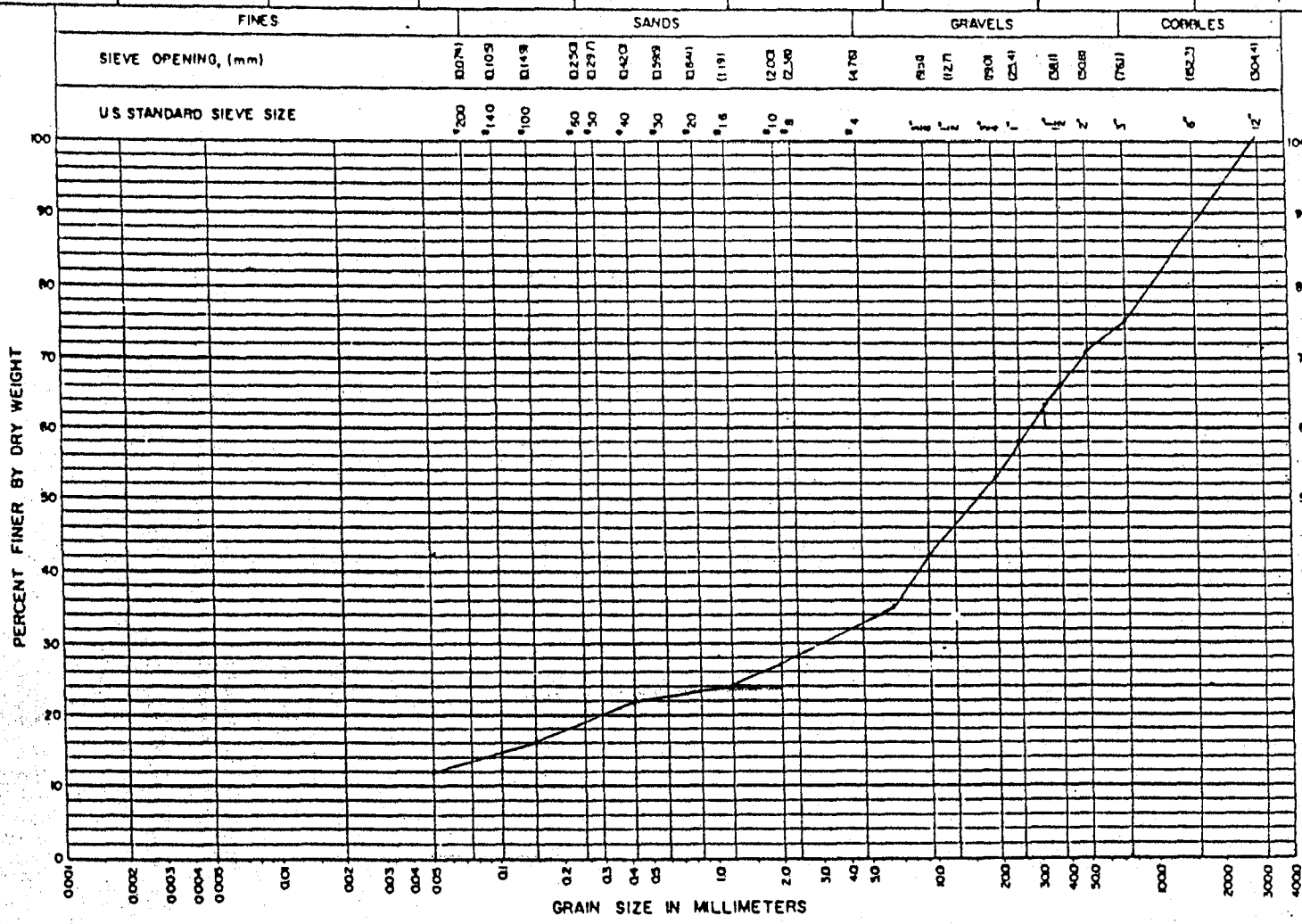
DATE: 10-5-78

SYMBOL

DESCRIPTION

GRAIN SIZE DISTRIBUTION

D_{10}	D_{15}	D_{30}	D_{50}	D_{60} 75	D_{85} 90	D_{MAX}	C_u	C_c
				16.2 64.4mm	170.0mm	11"		



SPECIFIC GRAVITY (G_s)		ATTERBERG LIMITS						SOLUBLE SALTS	SHRINKAGE LIMIT	UNDISTURBED CONDITION	
		NATURAL MOISTURE		AIR DRY		OVEN DRY				MOISTURE	DRY UNIT WEIGHT
(-) #4	(+) #4	LL	PI	LL	PI	LL	PI				g/cc
2.66			NP					%	%	%	pcf

REMARKS:

MATERIALS TESTING REPORT

U.S. DEPARTMENT of AGRICULTURE
SOIL CONSERVATION SERVICE

SOIL CLASSIFICATION

PROJECT OR STATE: MAGGIE BRK. WRP - SADDLEBACK DIVERSION AND PES

SAMPLE LOCATION: CENTERLINE - DIVERSION

FIELD SAMPLE NO: 412

DEPTH: 0-3'

GEOLOGIC ORIGIN:

TYPE OF SAMPLE:

TESTED AT: PHOENIX, ARIZONA

APPROVED BY: JKB

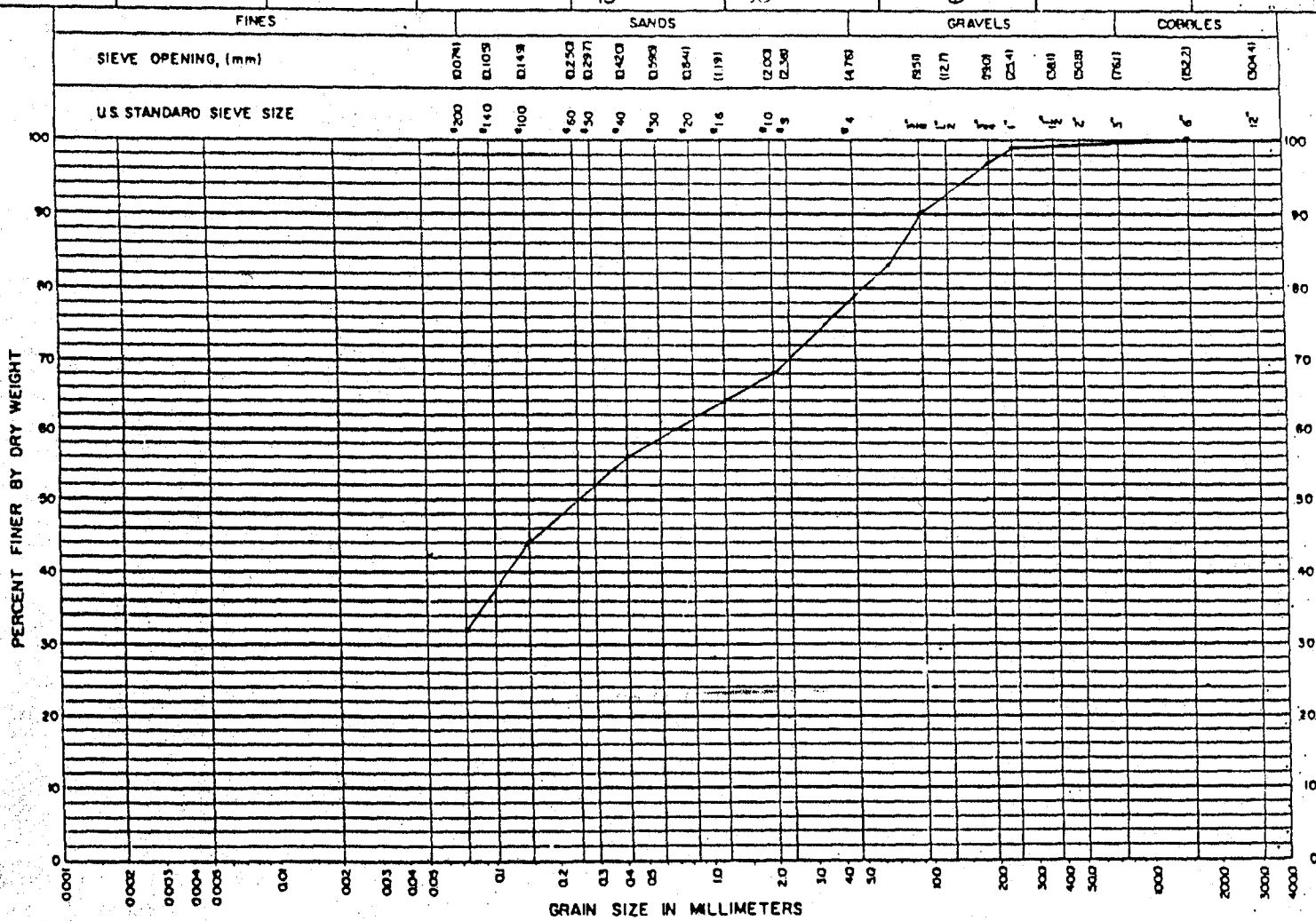
DATE: 10-5-78

SYMBOL

DESCRIPTION

GRAIN SIZE DISTRIBUTION

D_{10}	D_{15}	D_{30}	D_{50}	D_{60} 75 3.2mm	D_{90} 90 9.5mm	D_{MAX} 6"	C_u	C_c



SPECIFIC GRAVITY (G_s)		ATTERBERG LIMITS						SOLUBLE SALTS	SHRINKAGE LIMIT	UNDISTURBED CONDITION	
		NATURAL MOISTURE		AIR DRY		OVEN DRY				MOISTURE	DRY UNIT WEIGHT
(-) #4	(+) #4	LL	PI	LL	PI	LL	PI				g/cc
2.66			NP					%	%	%	pcf

REMARKS:

Check

MATERIALS TESTING REPORT

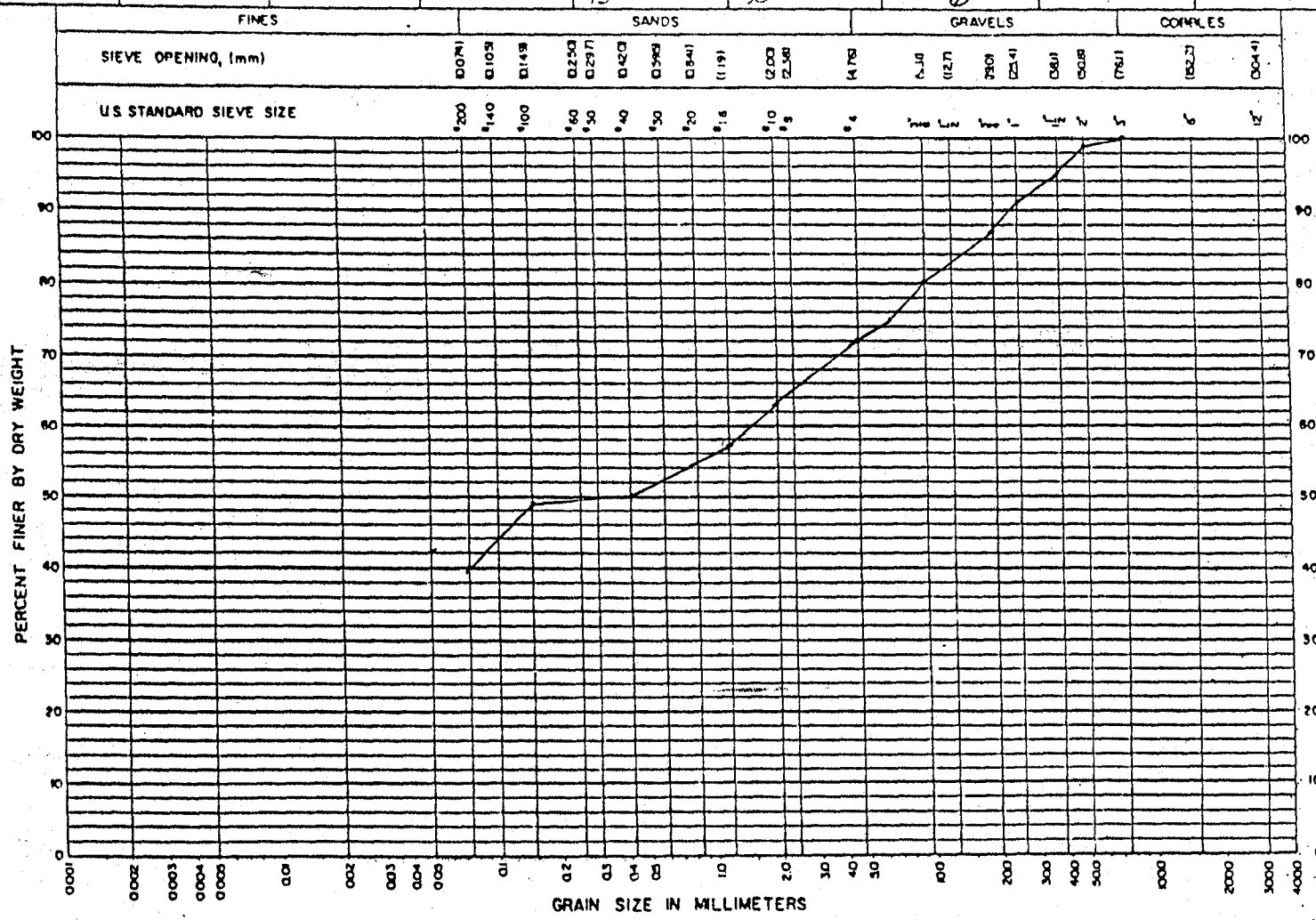
U. S. DEPARTMENT of AGRICULTURE
SOIL CONSERVATION SERVICE

SOIL CLASSIFICATION

PROJECT OR STATE	MAGMA WRP - SACATON DIVERSION AND PRS
FIELD SAMPLE NO.	416
DEPTH	0-2½'
GEOLOGIC ORIGIN	
SAMPLE LOCATION	CENTERLINE - DIVERSION
TYPE OF SAMPLE	
TESTED AT	PHOENIX, ARIZONA
APPROVED BY	JRG
DATE	10-5-78
SYMBOL	SM
DESCRIPTION	

GRAIN SIZE DISTRIBUTION

D_{10}	D_{15}	D_{30}	D_{50}	D_{60} 75	D_{85} 90	D_{MAX}	C_u	C_c
				6.75mm	22.5mm	6"		



SPECIFIC GRAVITY (G_s)		ATTERBERG LIMITS						SOLUBLE SALTS	SHRINKAGE LIMIT	UNDISTURBED CONDITION	
		NATURAL MOISTURE		AIR DRY		OVEN DRY				MOISTURE	DRY UNIT WEIGHT
(-) #4	(+) #4	LL	PI	LL	PI	LL	PI	%	%	%	g/cc pcf
			NP								

REMARKS:

MATERIALS TESTING REPORT

U. S. DEPARTMENT of AGRICULTURE SOIL CONSERVATION SERVICE

SOIL CLASSIFICATION

PROJECT and STATE: SALT RIVER WPP - SADDLE BACK DIVERSION AND RES

SAMPLE LOCATION: CENTERLINE - DIVERSION

FIELD SAMPLE NO.: 416

DEPTH: 3'-4'

GEOLOGIC ORIGIN:

TYPE OF SAMPLE:

TESTED AT: PHOENIX, ARIZONA

APPROVED BY: JRG

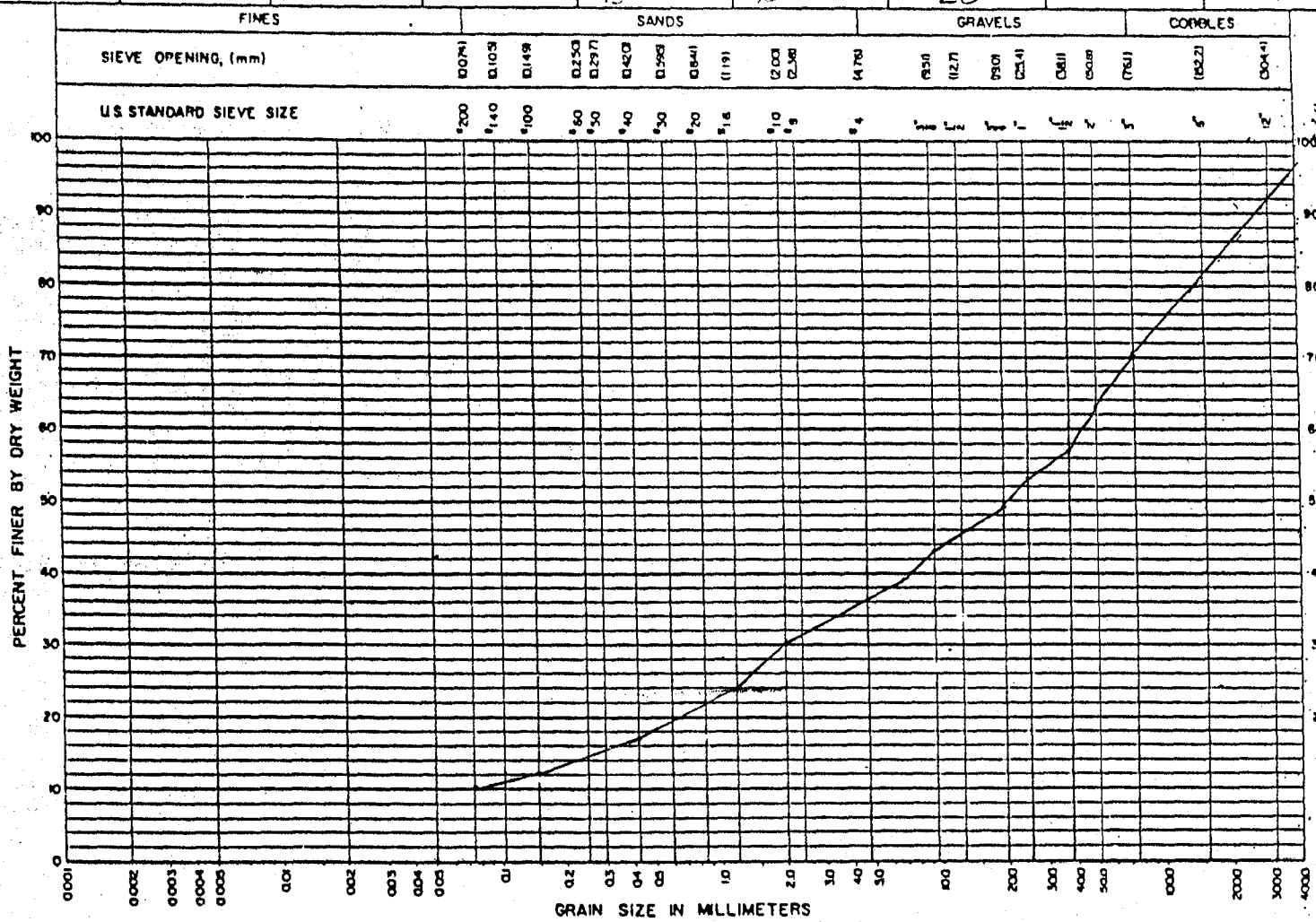
DATE: 10-5-78

SYMBOL

DESCRIPTION

GRAIN SIZE DISTRIBUTION

D_{10}	D_{15}	D_{30}	D_{50}	D_{60} 110.0MM 75	D_{85} 270.0MM 90	D_{MAX} 20"	C_u	C_c



SPECIFIC GRAVITY (G_s)		ATTERBERG LIMITS						SOLUBLE SALTS	SHRINKAGE LIMIT	UNDISTURBED CONDITION	
		NATURAL MOISTURE		AIR DRY		OVEN DRY				MOISTURE	DRY UNIT WEIGHT
(-) #4	(+) #4	LL	PI	LL	PI	LL	PI	%	%	%	g/cc pcf

REMARKS:

MATERIALS TESTING REPORT

U. S. DEPARTMENT of AGRICULTURE
SOIL CONSERVATION SERVICE

SOIL CLASSIFICATION

PROJECT OR STATE: NAVAJO-HOPI WRP - SAGE BRUSH DIVERSION AND PRS

SAMPLE LOCATION: STA. 100+00 CENTERLINE - DIVERSION

FIELD SAMPLE NO.: 419

DEPTH: 5 to 9'

GEOLOGIC ORIGIN:

TYPE OF SAMPLE:

TESTED AT: PHOENIX, ARIZONA

APPROVED BY: JPG

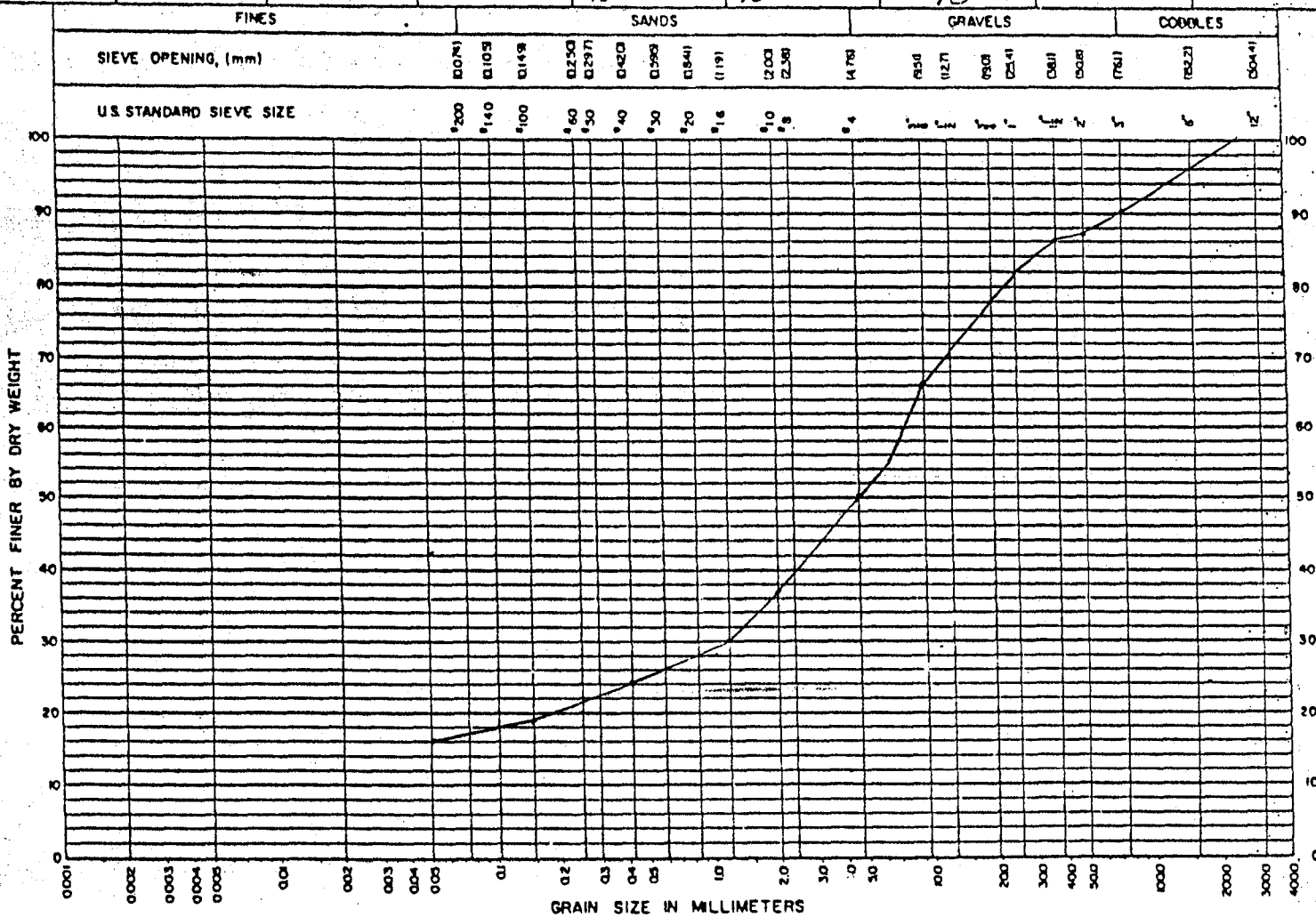
DATE: 10-5-78

SYMBOL

DESCRIPTION

GRAIN SIZE DISTRIBUTION

D_{10}	D_{15}	D_{30}	D_{50}	D_{60} 16.0MM	D_{90} 76.0MM	D_{MAX} 10"	C_u	C_c
				75	90			



SPECIFIC GRAVITY (G_s)		ATTERBERG LIMITS						SOLUBLE SALTS	SHRINKAGE LIMIT	UNDISTURBED CONDITION	
		NATURAL MOISTURE		AIR DRY		OVEN DRY				MOISTURE	DRY UNIT WEIGHT
(-) #4	(+) #4	LL	PI	LL	PI	LL	PI	%	%	%	g/cc pcf

REMARKS:

MATERIALS TESTING REPORT

U.S. DEPARTMENT of AGRICULTURE
SOIL CONSERVATION SERVICE

SOIL CLASSIFICATION

PROJECT OR STATE: MARICOPA WMP - SALT RIVER DIVERSION AND RES

SAMPLE LOCATION: STA 72+00 CENTERLINE - DIVERSION

FIELD SAMPLE NO.: 418

DEPTH: 2'-8'

GEOLOGIC ORIGIN:

TYPE OF SAMPLE:

TESTED AT: PHOENIX, ARIZONA

APPROVED BY: JRG

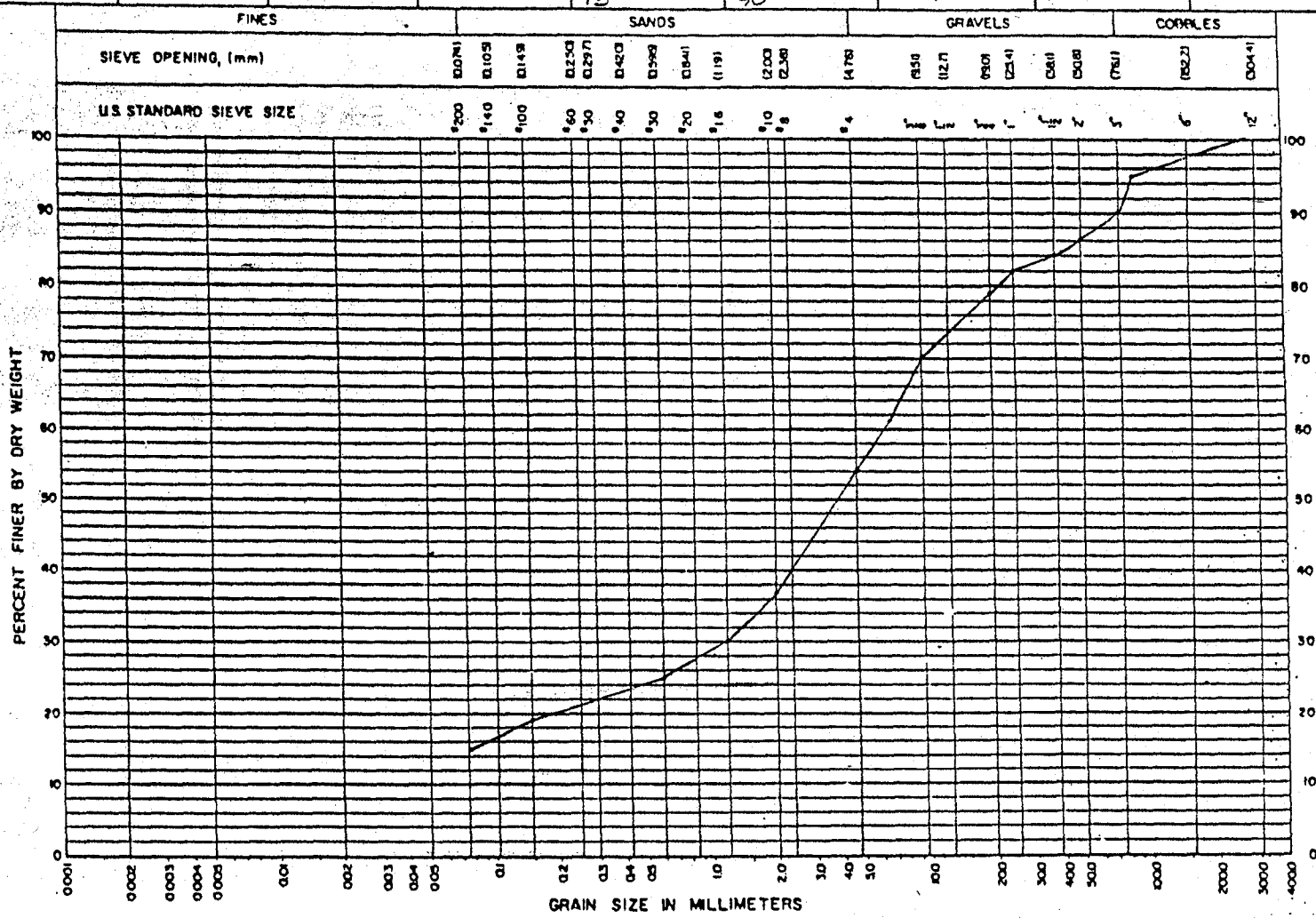
DATE: 10-5-78

SYMBOL: SM

DESCRIPTION:

GRAIN SIZE DISTRIBUTION

D_{10}	D_{15}	D_{30}	D_{50}	D_{60} 14.0 mm 75	D_{85} 75.0 mm 90	D_{MAX} 10"	C_u	C_c



SPECIFIC GRAVITY (G_s)		ATTERBERG LIMITS						SOLUBLE SALTS	SHRINKAGE LIMIT	UNDISTURBED CONDITION	
		NATURAL MOISTURE		AIR DRY		OVEN DRY				MOISTURE	DRY UNIT WEIGHT
(-) #4	(+) #4	LL	PI	LL	PI	LL	PI				g/cc
2.62			NP					%	%	%	pcf

REMARKS:

MATERIALS TESTING REPORT

U.S. DEPARTMENT of AGRICULTURE
SOIL CONSERVATION SERVICE

SOIL CLASSIFICATION

PROJECT and STATE: MARICOPA WPP - SADDLEBACK DIVERSION AND PRS

FIELD SAMPLE NO: 420

DEPTH: 2-3'

SAMPLE LOCATION: STA 52+00 CENTERLINE - DIVERSION

TYPE OF SAMPLE

TESTED AT: PHOENIX, ARIZONA

GEOLOGIC ORIGIN

APPROVED BY: JRB

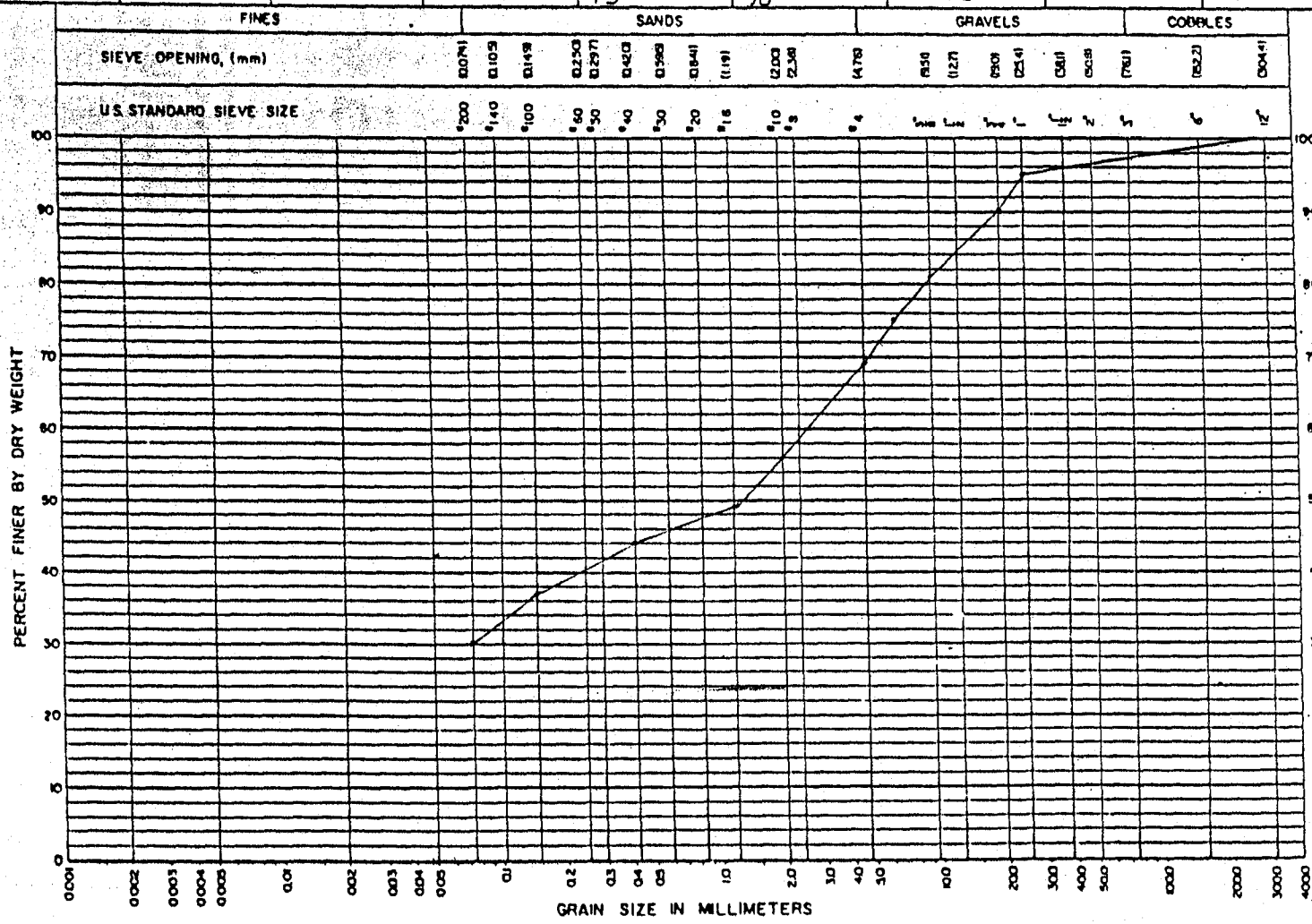
DATE: 10-5-78

SYMBOL: SM

DESCRIPTION

GRAIN SIZE DISTRIBUTION

D_{10}	D_{15}	D_{30}	D_{50}	D_{60} ~~6.25 mm~~ 156.5	D_{90} 19.5 mm 90	D_{MAX} 10"	C_u	C_c



SPECIFIC GRAVITY (G_s)		ATTERBERG LIMITS						SOLUBLE SALTS	SHRINKAGE LIMIT	UNDISTURBED CONDITION	
		NATURAL MOISTURE		AIR DRY		OVEN DRY				MOISTURE	DRY UNIT WEIGHT
(-) #4	(+) #4	LL	PI	LL	PI	LL	PI				g/cc
2.66			NP					%	%	%	pcf

REMARKS:

TOUPS CORPORATION

CONSULTING ENGINEERS AND PLANNERS

BY JB DATE 10/4/78 CLIENT SCS SHEET NO. ____ OF ____

~~CHECKED~~ Revised (JB) DATE ①2/6/79 JOB Saddleback FRS & Div. Ch1 JOB NO. 3043-000

Allowable Velocity Approach TR 25 Ch.6

TOUPS STA.	Test Pit No.	D_{75}* (mm) (in.)	V_{Basic} (Fig. 6-2)	X	Alignment Factor A	X	Bank Slope, B [1]	X	Depth Correction D [2]	=	V_{allow} (fps)	① Actual HEC1 V_{50y} (fps)
196+50	410 (2-7.5')	76.2 3	9.9		1		0.86		1.02		8.68	5.27
"	410 (0-2')	16. 0.63	6.1		1						5.35	5.27
109~	416 (3-10')	110 4.33	11.2		1						9.82	4.56
"	416 (0-3')	6.75 0.266	4.8		1						4.21	4.56
74+30	418 (0-8')	14 0.551	5.9		1						5.18	4.10
58~	420 (0-8.5')	6.5 0.256	4.7		1		0.86		1.02		4.12	4.24
165~	412 (0-3')	3.2 0.126	3.8		1		0.86		1.02		3.33	5.06
140+60	414 (0-3')	6.4 0.252	4.7		0.96		0.86		1.02		3.96	5.17
30+60	422 (0-5')	8.4 0.331	5.0		1		0.86		1.02		4.39	5.74

* Values adjusted by SCS 10/78

[1] Using max. slope = z = 3

[2] Use design d = 3.2'

[3] Same data - slightly different Bank Slope correction Factor, B

TOUPS CORPORATION

CONSULTING ENGINEERS AND PLANNERS

BY JB DATE 10/16/78 CLIENT SCS SHEET NO. ____ OF ____

Revised ~~CHECKED~~ (JB) DATE 2/6/79 JOB Saddleback Div. Chl. JOB NO. 3043-000

TR-25 Chapt. 6 pgs. 30-31 Formation of Bed Armor

$D = \frac{\tau_b}{0.4}$ = limiting size that will produce Bed Armor.

Test Pit #	τ_{bed} (Actual) [2]	$\frac{\tau_b}{0.4} = D$ (in.)	$\frac{D_n}{0.1}$* [1]	D_{90} (in.)
410 (2-7.5')	0.626	1.565 D_{67}	$\frac{1.565}{0.33} = 4.74''$	6.89
410 (0-2')	0.371	0.928 D_{74}	$\frac{0.928}{0.21} = 4.42''$	1.77
416 (3-10')	0.705	1.763 D_{60}	$\frac{1.763}{0.40} = 4.41''$	10.63
416 (0-3')	0.274	0.685 D_{85}	$\frac{0.685}{0.15} = 4.57''$	0.886
418 (2-8')	0.352	0.88 D_{80}	$\frac{0.88}{0.20} = 4.40''$	2.95
420 (2-3')	0.274	0.685 D_{88}	$\frac{0.685}{0.12} = 5.71''$	0.768

$\frac{D_n}{1 - \frac{n}{100}}$ = Depth of scour to formation of Bed Armor

* Using D_{90} of sample → 10% of material is equal to or larger than D_{90} size.

[1] Find D_n $\left(= \frac{\tau_b}{0.4}\right)$ from grain distribution chart for sample

[2] Figures Based on S&S Revised grain distribution graphs. See pg 3.1-9 of Calcs.

TOUPS CORPORATION

CONSULTING ENGINEERS AND PLANNERS

BY JB DATE 10/17/78 CLIENT SCS SHEET NO. ____ OF ____

CHECKED ____ DATE ____ JOB Saddleback Div. Chl. JOB NO. 3043-000

Allowable Tractive Stresses in Diversion Channel

A review of the applicable soil samples indicates a "top soil" layer that would be subjected to erosive forces. By dropping the channel invert in the problem areas, this layer would be excavated to caliche layer in most cases. In those few cases where total excavation of unsuitable material is impractical, riprap or other protective measures will be used.*

A review of the allowable tractive stresses on the side slopes indicates that extensive protection is required or grade (velocity) of channel needs revision. Using the maximum allowable τ_{sm}, calculate max. slope. $(\tau_s = \gamma_w d S_t)(0.78) = \tau_s$, $d = 4'$

Set $\tau_s = \tau_{sm}$, Solve for S_t. Solve for S_e in $S_t = \left(\frac{n_t}{n}\right)^2 S_e$

τ_{sm} z = 3 z = 5	$S_t = \tau_{sm}/(\gamma_w d(0.78))$ =	$\frac{\tau_{sm}}{195}$	$S_e = S_t\left(\frac{n}{n_t}\right)^2$	Test Pit No.
0.204 0.234		0.0010 0.0012	0.0016 0.0019	410 (0-2')
0.078 0.092		0.0004 0.0005	0.0009 — 0.0011	414 (0-3')
0.080 0.096		0.0004 0.0005	0.00085 — 0.0011	416 (0-3')
0.183 0.205		0.0009 0.0011	0.0015 0.0018	418 (2-8')
0.080 0.094		0.0004 0.0005	0.00087 — 0.0011	420 (2-3')
0.107 0.123		0.0005 0.0006	0.0010 0.0012	422 (2-8')

Not used - results inconsistent with other analyses

JB 2/6/79

Set d = 4'

* See next page for τ_{bm} analysis

TOUPS CORPORATION

CONSULTING ENGINEERS AND PLANNERS

BY JB DATE 10/17/78 CLIENT CS SHEET NO. ____ OF ____

CHECKED ____ DATE ____ JOB Saddleback Div Channel JOB NO. 3043-000

Allowable Tractive Stresses (cont.) $\tau_{bm} = \tau_{actual\ on\ bed}$

Use same procedure as $\tau_{sm} = \tau_{actual\ on\ sides}$

$(\tau_o = \gamma_w d S_e)0.98 = \tau_{bm} = \tau_{all.}$ Solve for $S_e = \frac{\tau_{bm}}{\gamma_w d\ 0.98}$, Let $d = 4'$

Solve for n_e in $S_e = \left(\frac{n_e}{n}\right)^2 S_e$

τ_{bm}	$S_e = \frac{\tau_{bm}}{245}$	$S_e = \left(\frac{n}{n_e}\right)^2 S_e$	Test Pit No.	TOUPS STA.
0.252	0.0010	0.0016	410 (0-2')	196+50
0.100	0.0004	0.0009	414 (0-3')	140+60
0.106	0.0004	0.0008	416 (0-3')	109~
0.220	0.0009	0.0015	418 (2-8')	74+30
0.102	0.0004	0.0009	420 (2-3')	58~
0.132	0.0005	0.0010	422 (0-5')	30+60

Not used / Results inconsistent with other analyses 2/6/79 JB

TOUPS CORPORATION

CONSULTING ENGINEERS AND PLANNERS

BY JB DATE 10/3/78 CLIENT US. Soil Conservation Service SHEET NO. ____ OF ____

Revised (JB) CHECKED ____ DATE 2/6/79 JOB Saddleback Diversion Chl. JOB NO. 3043-000

Channel Evaluation - Tractive Stress Approach $D_{75} < 0.25''$

TR 25, Chapter 6, Example 6-6

Test pit #412 SCS Sta 166+00, TOUPS Sta. 165+00

D_{75} = 3.2 mm = 0.126 in. Non-plastic SM

D_{65} = 1.19 mm = 0.047 in.

D_{50} = 0.250 mm = 0.010 in. Design V = 5.0 fps

Water temperature (judgement) = 60°F ⇒ $\nu = 1.23 \times 10^{-5}$ ft/sec

⇒ $\rho = 1.938$ lb-sec²/ft⁴

From Figure 6-11 TR25 pg. 6-24

ν = Kinematic Viscosity

ρ = Water density

Compute $\dfrac{V^3}{g \nu s_e} = \dfrac{(5)^3 \quad 10^{5}}{(32.2)(1.23 \times 10^{-5})(0.003)} = 1.052 \times 10^8$

Compute $\dfrac{V}{\sqrt{g k_s s_e}}$, where $k_s = D_{65}$ in feet $= \dfrac{0.047}{12}$

$$\frac{5}{\left[(32.2)\left(\frac{0.047}{12}\right)(0.003)\right]^{1/2}} = 257 \Rightarrow \frac{V}{\sqrt{\tau/\rho}} = 27.5$$

(From Figure 6-9)

$$\tau = V^2\rho \Big/ \left[V/(\tau/\rho)^{1/2}\right]^2 = \frac{(5)^2(1.938)}{(27.5)^2} = 0.064 \text{ psf}$$

$\dfrac{b}{d} > 8 \therefore$ Use $\dfrac{\tau_s}{\tau} = 1.27$ & $\dfrac{\tau_b}{\tau} = 1.35$ } From Fig 6-12, 6-13

Actual $\tau_s = (0.064)(1.27) = 0.0814$ psf

" $\tau_b = (0.064)(1.35) = 0.0864$ psf } Actual ≃ allowable

From Figure 6-14 and D_{50} = 0.25 mm ⇒ Allowable $\tau = 0.078$ lb/ft²

Curve #1

TOUPS CORPORATION

CONSULTING ENGINEERS AND PLANNERS

BY DEW DATE _____ CLIENT S.C.S. SHEET NO. _____ OF _____

CHECKED _____ DATE _____ JOB _____ JOB NO. _____

STA. 9+90 to 10+40

Computations for culverts crossing Courthouse Road

Design to pass 50 year Q ; 3 - 10' x 6' Box Culverts, operating under Inlet Control

See sheet 3.1-17 for culvert investigation.

A backwater analysis was performed to verify velocities and water surface elevations. (HEC-2) SEE NEXT SHEETS

ARIZONA DEPARTMENT OF TRANSPORTATION

CULVERT COMPUTATION RECORD

PROJECT: Saddleback Diversion

DESIGNER: DEW

STATION: Courthouse Culverts

DATE: 5-31-78

HYDROLOGIC AND CHANNEL INFORMATION

DRAINAGE AREA _____

Q_1 = _____

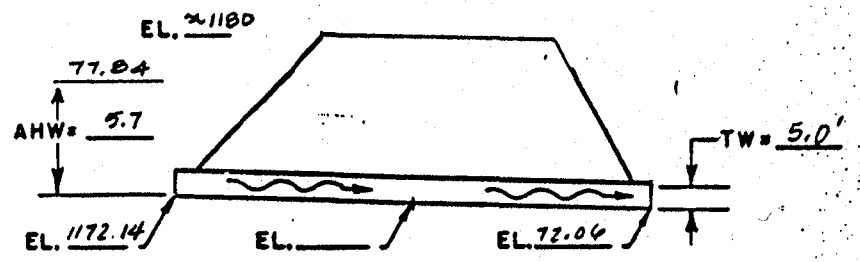
Q_2 = 1067 cfs - 50yr. (1120 cfs 100-YY PSH)

TW_1 = _____

TW_2 = 5.0' (4.8)

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

SKETCH



S_0 = 0.0015 L = 50 L/100 S_0 = 0.08

MEAN STREAM VELOCITY = _____

CULVERT DESCRIPTION		Q	CAP. CHART HW	HEADWATER COMPUTATION										CONTROL HW	OUTLET VELOCITY	COST	DHW ELEV.	COMMENTS
				INLET CONT.		OUTLET CONTROL $HW = H + h_0 - LS_0$												
SIZE	ENTR. TYPE			HW/D	HW	K_e	H	d_c	$\frac{d_c + D}{2}$	TW	h_0	LS_0	HW					
3-10'×6'	w/headwall at 90°	1067/3 = 356		0.95	5.7	0.2	0.76	3.5	4.75	5	5	0.08	5.68	5.7	7.1			PROVIDE RIPRAP PROTECTION @ OUTLET
"	Square edge	1120/3 = 373		0.98	5.9	0.5	0.95	3.5	4.75	4.8	4.8	.08	5.67	5.9				

SUMMARY & RECOMMENDATIONS

Design Q per box = 1067/3 = 356 cfs

REF. HEC 5 AHWA Culvert Hydraulics

BACKWATER ANALYSIS- DIVERSION - Using HEC-2 Program

FINAL RUN

HEC-2 INPUT

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

C
T1      PRC TOUPS CORPORATION
T2      10 YEAR PROFILE    AGED CONDITION
T3      SADDLEBACK DIVERSION            SEPT 1978  JOB NO 3043.000

J1  ICHECK    INQ      NINV     IDIR     STRT     METRIC   HVINS    Q        WSEL     FQ
      0.       2.       0.       0. -1.000000     0.00     0.0      0.      0.000    0.000

J2  NPROF     IPLOT    PRFVS    XSECV    XSECH    FN       ALLDC    IBW      CHNIM    ITRACE
    1.000    0.000    5.000    0.000   166.700   0.000    0.000    0.000    0.000    0.000

J3  VARIABLE CODES FOR SUMMARY PRINTOUT

   38.000   39.000   43.000    1.000   42.000    8.000   17.000    4.000    3.000   26.000

    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    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     .035     .100     .300    0.000    0.000    0.000    0.000    0.000
QT    3.000 3550.000 6060.000 1120.000    0.000    0.000    0.000    0.000    0.000    0.00

        CHANNEL STATION =0.00 AT FPS PRINCIPAL SPILLWAY.

       X-SECTION STATIONING FROM LEFT TO RIGHT LOOKING DOWNSTREAM.

        X-SECTION STATION 1000 LOCATED AT WEST TOE OF CHANNEL.

        CRITICAL DEPTH USED AS STARTING WATER SURFACE ELEVATION.

        CONFLUENCE WITH CENTENNIAL WASH.

X1   333.700    5.000  300.000 1390.000    0.000    0.000    0.000    0.000    0.000    0.00
GR  1065.000    0.000 1060.000  300.000 1055.700  680.000 1060.000 1390.000 1065.000 2800.00

X1   326.200    6.000   50.000  400.000  735.000  735.000  735.000    0.000    0.000    0.00
GR  1070.000    0.000 1065.000   50.000 1060.000   75.000 1056.600  400.000 1060.000  920.00
GR  1065.000 1950.000    0.000    0.000    0.000    0.000    0.000    0.000    0.000    0.00

X1   313.200    5.000    0.000  900.000 1285.000 1285.000 1285.000    0.000    0.000    0.00
GR  1065.000    0.000 1060.000  530.000 1057.200  620.000 1060.000  700.000 1065.000  900.00
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HEC-2 INPUT

X1	293.200	3.000	0.000	500.000	1980.000	1980.000	1980.000	0.000	0.000	0.00
GR	1065.000	0.000	1060.800	330.000	1065.000	500.000	0.000	0.000	0.000	0.00
X1	289.300	23.000	140.000	1490.000	390.000	390.000	390.000	0.000	0.000	0.00
GR	1075.000	100.000	1074.000	140.000	1072.000	165.000	1070.000	250.000	1070.000	335.00
GR	1069.300	385.000	1068.000	440.000	1068.000	460.000	1068.800	520.000	1068.000	650.00
GR	1066.000	730.000	1066.000	790.000	1064.000	990.000	1063.800	1000.000	1064.000	1015.00
GR	1064.600	1070.000	1064.000	1100.000	1062.000	1290.000	1061.000	1300.000	1062.000	1305.00
GR	1064.000	1440.000	1070.000	1490.000	1080.000	1520.000	0.000	0.000	0.000	0.00
X1	272.300	23.000	0.000	1285.000	1800.000	70.000	935.000	0.000	0.000	0.00
GR	1072.000	0.000	1070.200	40.000	1070.500	105.000	1072.000	180.000	1072.000	230.00
GR	1070.300	260.000	1072.000	515.000	1070.500	560.000	1072.000	580.000	1073.600	680.00
GR	1072.000	850.000	1070.000	935.000	1069.500	950.000	1070.000	960.000	1070.000	985.00
GR	1069.500	1000.000	1070.000	1030.000	1070.000	1160.000	1069.500	1180.000	1070.000	1200.00
GR	1070.000	1285.000	1071.200	1355.000	1075.000	1360.000	0.000	0.000	0.000	0.00
X1	266.400	29.000	360.000	1370.000	600.000	600.000	600.000	0.000	0.000	0.00
GR	1078.000	325.000	1079.600	360.000	1078.000	390.000	1076.000	410.000	1074.000	455.00
GR	1073.000	460.000	1074.000	470.000	1075.000	510.000	1076.000	560.000	1076.000	620.00
GR	1074.000	660.000	1076.000	700.000	1078.000	715.000	1078.000	755.000	1076.500	770.00
GR	1078.000	780.000	1078.000	845.000	1076.000	865.000	1075.000	885.000	1076.000	935.00
GR	1074.500	1000.000	1074.000	1090.000	1074.000	1105.000	1076.000	1155.000	1074.500	1220.00
GR	1075.000	1245.000	1074.500	1280.000	1076.000	1370.000	1078.000	1380.000	0.000	0.00
X1	260.900	25.000	420.000	1360.000	550.000	550.000	550.000	0.000	0.000	0.00
GR	1080.000	410.000	1078.000	420.000	1077.500	455.000	1078.000	475.000	1080.000	510.00
GR	1082.000	560.000	1082.000	595.000	1080.500	630.000	1082.000	650.000	1084.000	705.00
GR	1084.000	750.000	1082.200	800.000	1084.000	830.000	1085.400	855.000	1084.000	900.00
GR	1082.000	970.000	1081.500	1000.000	1082.000	1012.000	1081.000	1035.000	1082.000	1075.00
GR	1082.000	1155.000	1081.700	1220.000	1082.000	1270.000	1082.500	1360.000	1085.000	1370.00
X1	255.600	20.000	610.000	1310.000	530.000	530.000	530.000	0.000	0.000	0.00
GR	1088.500	600.000	1086.500	610.000	1087.300	640.000	1086.000	710.000	1086.700	745.00
GR	1086.000	815.000	1087.100	825.000	1087.000	850.000	1087.300	900.000	1086.000	1000.00
GR	1086.000	1050.000	1088.000	1100.000	1088.000	1155.000	1085.500	1165.000	1088.000	1182.00
GR	1087.700	1200.000	1088.000	1210.000	1088.300	1230.000	1088.000	1310.000	1090.000	1370.00
X1	250.300	4.000	305.000	1015.000	530.000	530.000	530.000	0.000	0.000	0.00
GR	1098.800	305.000	1093.800	330.000	1093.800	1000.000	1098.800	1015.000	0.000	0.00
NC	.035	.030	.030	.100	.300	0.000	0.000	0.000	0.000	0.00

DIVERSION CHANNEL OUTLET.

X1	249.000	4.000	433.000	1020.000	130.000	130.000	130.000	0.000	0.000	0.00
GR	1099.000	433.000	1094.000	440.000	1094.000	1000.000	1098.000	1020.000	0.000	0.00
X1	248.000	4.000	453.000	1017.000	100.000	100.000	100.000	0.000	0.000	0.00
GR	1098.500	453.000	1094.700	463.000	1094.700	1000.000	1099.000	1017.000	0.000	0.00

HEC-2 INPUT

X1	247.000	4.000	472.000	1015.000	100.000	100.000	100.000	0.000	0.000	0.000
GR	1098.000	472.000	1095.400	486.000	1095.400	1000.000	1100.000	1015.000	0.000	0.000
QT	3.000	3490.000	5970.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
X1	246.000	4.000	491.000	1013.000	100.000	100.000	100.000	0.000	0.000	0.000
GR	1101.000	491.000	1096.100	510.000	1096.100	1000.000	1100.400	1013.000	0.000	0.000
X1	245.000	4.000	509.000	1011.000	100.000	100.000	100.000	0.000	0.000	0.000
GR	1104.000	509.000	1096.800	533.000	1096.800	1000.000	1100.700	1011.000	0.000	0.000
X1	243.000	4.000	530.000	1020.000	200.000	200.000	200.000	0.000	0.000	0.000
GR	1106.500	530.000	1097.200	578.000	1097.200	1000.000	1103.200	1020.000	0.000	0.000
X1	241.000	4.000	577.000	1040.000	200.000	200.000	200.000	0.000	0.000	0.000
GR	1107.000	577.000	1097.600	623.000	1097.600	1000.000	1117.000	1040.000	0.000	0.000
X1	239.000	4.000	610.000	1100.000	200.000	200.000	200.000	0.000	0.000	0.000
GR	1109.000	610.000	1098.000	668.000	1098.000	1000.000	1131.000	1100.000	0.000	0.000
X1	237.710	4.000	638.000	1080.000	129.000	129.000	129.000	0.000	0.000	0.000
GR	1110.700	638.000	1098.300	700.000	1098.300	1000.000	1124.500	1080.000	0.000	0.000
NC	.035	.035	.035	.100	.300	0.000	0.000	0.000	0.000	0.000
X1	237.610	4.000	638.000	1080.000	10.000	10.000	10.000	0.000	0.000	0.000
GR	1110.700	638.000	1098.300	700.000	1098.300	1000.000	1124.500	1080.000	0.000	0.000
X1	237.590	4.000	638.000	1080.000	2.000	2.000	2.000	0.000	0.000	0.000
GR	1110.700	638.000	1097.100	700.000	1097.100	1000.000	1124.500	1080.000	0.000	0.000
X1	237.340	0.000	0.000	0.000	25.000	25.000	25.000	0.000	0.000	0.000

DIVERSION CHANNEL DROP SPILLWAY DOWNSTREAM OF THIS STATION

	2ES NO	No Sta	Left Bank Sta	Right	Reach Length	Right	channel			
X1	237.110	4.000	678.000	1020.000	23.000	23.000	23.000	0.000	0.000	0.000
GR	1113.000	678.000	1108.600	700.000	1108.600	1000.000	1116.000	1020.000	0.000	0.000
X1	236.960	0.000	0.000	0.000	15.000	15.000	15.000	0.000	.080	0.000
NC	.035	.030	.030	0.000	0.000	0.000	0.000	0.000	0.000	0.000
	Left overbank	Roadway	Channel							
X1	236.920	0.000	0.000	0.000	4.000	4.000	4.000	0.000	0.000	0.000
X1	236.850	5.000	540.000	1020.000	7.000	7.000	7.000	0.000	.090	0.000
GR	1113.000	400.000	1114.000	540.000	1108.600	700.000	1108.600	1000.000	1116.000	1020.000

3.1-21

HEC-2 INPUT

X1	236.500	5.000	540.000	1020.000	35.000	35.000	35.000	0.000	.170	0.000
GR	1113.000	400.000	1114.000	540.000	1108.600	700.000	1108.600	1000.000	1116.000	1020.000
QT	3.000	3360.000	5750.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
X1	235.000	8.000	688.000	1010.000	150.000	150.000	150.000	0.000	0.000	0.000
GR	1114.000	590.000	1112.000	630.000	1112.000	688.000	1109.100	700.000	1109.100	1000.000
GR	1112.500	1010.000	1113.000	1030.000	1115.500	1040.000	0.000	0.000	0.000	0.000
X1	230.000	7.000	683.000	1010.000	500.000	500.000	500.000	0.000	0.000	0.000
GR	1116.000	600.000	1114.400	683.000	1110.200	703.000	1110.200	1000.000	1113.600	1010.000
GR	1114.100	1030.000	1116.500	1040.000	0.000	0.000	0.000	0.000	0.000	0.000
X1	225.000	6.000	656.000	1014.000	500.000	500.000	500.000	0.000	0.000	0.000
GR	1119.800	656.000	1111.300	708.000	1111.300	1000.000	1116.500	1014.000	1117.000	1034.000
GR	1119.500	1044.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
QT	3.000	3180.000	5430.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
X1	220.000	6.000	667.000	1012.000	500.000	500.000	500.000	0.000	0.000	0.000
GR	1120.700	667.000	1112.400	709.000	1112.400	1000.000	1116.500	1012.000	1117.000	1032.000
GR	1119.500	1042.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
X1	215.000	6.000	678.000	1010.000	500.000	500.000	500.000	0.000	0.000	0.000
GR	1120.800	678.000	1113.500	712.000	1113.500	1000.000	1117.000	1010.000	1117.500	1030.000
GR	1120.000	1040.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
X1	210.000	6.000	678.000	1010.000	500.000	500.000	500.000	0.000	0.000	0.000
GR	1122.400	678.000	1114.600	715.000	1114.600	1000.000	1118.000	1010.000	1118.500	1030.000
GR	1121.000	1040.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
QT	3.000	2990.000	5110.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
X1	205.000	6.000	680.000	1010.000	500.000	500.000	500.000	0.000	0.000	0.000
GR	1124.000	680.000	1115.700	720.000	1115.700	1000.000	1119.200	1010.000	1119.700	1030.000
GR	1122.200	1040.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
X1	200.000	6.000	692.000	1010.000	500.000	500.000	500.000	0.000	0.000	0.000
GR	1123.400	692.000	1116.800	725.000	1116.800	1000.000	1120.300	1010.000	1120.800	1030.000
GR	1123.300	1040.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
X1	195.000	6.000	703.000	1010.000	500.000	500.000	500.000	0.000	0.000	0.000
GR	1124.100	703.000	1117.900	732.000	1117.900	1000.000	1121.400	1010.000	1121.900	1030.000
GR	1124.400	1040.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
X1	190.000	6.000	700.000	1010.000	500.000	500.000	500.000	0.000	0.000	0.000
GR	1126.000	700.000	1119.000	735.000	1119.000	1000.000	1122.500	1010.000	1123.000	1030.000
GR	1125.500	1040.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
QT	3.000	2760.000	4720.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000

HEC-2 INPUT

X1	185.000	6.000	710.000	1010.000	500.000	500.000	500.000	0.000	0.000	0.000
GR	1126.500	710.000	1120.100	741.000	1120.100	1000.000	1123.600	1010.000	1124.100	1030.000
GR	1126.600	1040.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
X1	180.000	6.000	710.000	1010.000	500.000	500.000	500.000	0.000	0.000	0.000
GR	1128.900	710.000	1121.200	748.000	1121.200	1000.000	1124.800	1010.000	1125.300	1030.000
GR	1127.800	1040.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
X1	175.000	6.000	720.000	1012.000	500.000	500.000	500.000	0.000	0.000	0.000
GR	1128.800	720.000	1122.300	752.000	1122.300	1000.000	1126.000	1012.000	1126.500	1032.000
GR	1129.000	1042.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
QT	3.000	2520.000	4320.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
X1	170.000	6.000	720.000	1010.000	500.000	500.000	500.000	0.000	0.000	0.000
GR	1130.600	720.000	1123.400	757.000	1123.400	1000.000	1126.800	1010.000	1127.300	1030.000
GR	1129.800	1040.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
X1	165.000	6.000	726.000	1010.000	500.000	500.000	500.000	0.000	0.000	0.000
GR	1131.600	726.000	1124.500	761.000	1124.500	1000.000	1128.000	1010.000	1128.500	1030.000
GR	1131.000	1040.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
X1	160.000	6.000	722.000	1015.000	500.000	500.000	500.000	0.000	0.000	0.000
GR	1134.700	722.000	1125.600	768.000	1125.600	1000.000	1130.500	1015.000	1131.000	1035.000
GR	1133.500	1045.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
QT	3.000	2310.000	3970.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
X1	155.000	6.000	728.000	1018.000	500.000	500.000	500.000	0.000	0.000	0.000
GR	1136.100	728.000	1126.700	774.000	1126.700	1000.000	1132.600	1018.000	1133.100	1038.000
GR	1135.600	1048.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
X1	150.000	6.000	732.000	1020.000	500.000	500.000	500.000	0.000	0.000	0.000
GR	1136.700	732.000	1127.800	780.000	1127.800	1000.000	1134.000	1020.000	1134.500	1040.000
GR	1137.000	1050.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
NC	.035	.035	.035	0.000	0.000	0.000	0.000	0.000	0.000	0.000
QT	3.000	2170.000	3740.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
X1	145.190	6.000	722.000	1025.000	481.000	481.000	481.000	0.000	0.000	0.000
GR	1140.000	722.000	1128.900	785.000	1128.900	1000.000	1136.100	1025.000	1136.600	1045.000
GR	1139.100	1055.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000

DIVERSION CHANNEL DROP SPILLWAY, DOWNSTREAM OF THIS SECTION.

X1	144.820	8.000	765.000	1010.000	37.000	37.000	37.000	0.000	0.000	0.000
GR	1142.000	650.000	1140.000	722.000	1139.300	765.000	1135.200	785.000	1135.200	1000.000
GR	1138.700	1010.000	1139.200	1030.000	1141.700	1040.000	0.000	0.000	0.000	0.000
X1	144.720	0.000	0.000	0.000	10.000	10.000	10.000	0.000	.020	0.000

X1

HEC-2 INPUT

X1	144.670	0.000	0.000	0.000	5.000	5.000	5.000	0.000	.010	0.000
NC	.035	.030	.030	0.000	0.000	0.000	0.000	0.000	0.000	0.000
X1	144.000	0.000	0.000	0.000	67.000	67.000	67.000	0.000	.100	0.000
X1	140.000	6.000	762.000	1010.000	400.000	400.000	400.000	0.000	0.000	0.000
GR	1142.300	762.000	1136.200	792.000	1136.200	1000.000	1139.800	1010.000	1140.300	1030.000
GR	1142.800	1040.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
QT	3.000	2030.000	3500.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
X1	135.000	6.000	770.000	1010.000	500.000	500.000	500.000	0.000	0.000	0.000
GR	1143.200	770.000	1137.200	800.000	1137.200	1000.000	1140.700	1010.000	1141.200	1030.000
GR	1143.700	1040.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
X1	130.000	7.000	770.000	1013.000	500.000	500.000	500.000	0.000	0.000	0.000
GR	1146.000	710.000	1145.800	770.000	1138.200	808.000	1138.200	1000.000	1143.500	1013.000
GR	1144.000	1033.000	1146.500	1043.000	0.000	0.000	0.000	0.000	0.000	0.000
QT	3.000	1890.000	3250.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
X1	125.000	6.000	778.000	1010.000	500.000	500.000	500.000	0.000	0.000	0.000
GR	1146.700	778.000	1139.200	815.000	1139.200	1000.000	1142.700	1010.000	1143.200	1030.000
GR	1145.700	1040.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
X1	120.000	6.000	793.000	1010.000	500.000	500.000	500.000	0.000	0.000	0.000
GR	1146.300	793.000	1140.200	823.000	1140.200	1000.000	1143.800	1010.000	1144.300	1030.000
GR	1146.800	1040.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
X1	115.000	6.000	795.000	1010.000	500.000	500.000	500.000	0.000	0.000	0.000
GR	1148.500	795.000	1141.200	830.000	1141.200	1000.000	1145.000	1010.000	1145.500	1030.000
GR	1148.000	1040.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
QT	3.000	1660.000	2860.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
X1	110.000	6.000	800.000	1010.000	500.000	500.000	500.000	0.000	0.000	0.000
GR	1150.000	800.000	1142.200	838.000	1142.200	1000.000	1145.700	1010.000	1146.200	1032.000
GR	1148.700	1040.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
X1	105.000	6.000	807.000	1017.000	500.000	500.000	500.000	0.000	0.000	0.000
GR	1150.700	807.000	1143.200	843.000	1143.200	1000.000	1148.500	1017.000	1149.000	1037.000
GR	1151.500	1047.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
QT	3.000	1500.000	2590.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
X1	100.000	6.000	808.000	1019.000	500.000	500.000	500.000	0.000	0.000	0.000
GR	1152.500	808.000	1144.200	850.000	1144.200	1000.000	1150.100	1019.000	1150.600	1039.000
GR	1153.100	1049.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
X1	95.000	6.000	821.000	1018.000	500.000	500.000	500.000	0.000	0.000	0.000
GR	1151.500	821.000	1145.200	857.000	1145.200	1000.000	1149.800	1018.000	1150.300	1038.000
GR	1152.800	1048.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
QT	3.000	1360.000	2350.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000

HEC-2 INPUT

X1	90.000	6.000	823.000	1017.000	500.000	500.000	500.000	0.000	0.000	0.000
GR	1153.700	823.000	1146.200	861.000	1146.200	1000.000	1151.200	1017.000	1151.700	1037.000
GR	1154.200	1047.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
X1	85.000	6.000	823.000	1018.000	500.000	500.000	500.000	0.000	0.000	0.000
GR	1155.900	823.000	1147.200	868.000	1147.200	1000.000	1153.200	1018.000	1153.700	1038.000
GR	1156.200	1048.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
NC	.035	.035	.035	0.000	0.000	0.000	0.000	0.000	0.000	0.000
X1	82.180	6.000	820.000	1022.000	282.000	282.000	282.000	0.000	0.000	0.000
GR	1157.700	820.000	1147.800	870.000	1147.800	1000.000	1155.300	1022.000	1155.800	1042.000
GR	1158.300	1052.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000

DIVERSION CHANNEL DROP SPILLWAY, DOWNSTREAM OF THIS SECTION.

X1	81.830	6.000	843.000	1010.000	35.000	35.000	35.000	0.000	0.000	0.000
GR	1157.500	843.000	1152.400	870.000	1152.400	1000.000	1155.900	1010.000	1156.400	1030.000
GR	1158.900	1040.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
X1	81.730	0.000	0.000	0.000	10.000	10.000	10.000	0.000	.020	0.000
X1	81.680	0.000	0.000	0.000	5.000	5.000	5.000	0.000	.010	0.000
NC	.035	.030	.030	0.000	0.000	0.000	0.000	0.000	0.000	0.000
X1	81.640	0.000	0.000	0.000	4.000	4.000	4.000	0.000	0.000	0.000
X1	81.000	0.000	0.000	0.000	64.000	64.000	64.000	0.000	.170	0.000
X1	80.000	6.000	847.000	1010.000	100.000	100.000	100.000	0.000	0.000	0.000
GR	1158.400	847.000	1152.800	873.000	1152.800	1000.000	1156.300	1010.000	1156.800	1030.000
GR	1159.300	1040.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
OT	3.000	1060.000	1900.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
X1	75.000	6.000	854.000	1010.000	500.000	500.000	500.000	0.000	0.000	0.000
GR	1157.600	854.000	1153.800	882.000	1153.800	1000.000	1157.300	1010.000	1157.800	1030.000
GR	1160.300	1040.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
X1	70.000	6.000	850.000	1017.000	500.000	500.000	500.000	0.000	0.000	0.000
GR	1162.800	850.000	1154.800	891.000	1154.800	1000.000	1160.100	1017.000	1160.600	1037.000
GR	1163.100	1047.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
X1	65.000	6.000	870.000	1012.000	500.000	500.000	500.000	0.000	0.000	0.000
GR	1161.700	870.000	1155.800	900.000	1155.800	1000.000	1159.700	1012.000	1160.200	1032.000
GR	1162.700	1042.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
OT	3.000	790.000	1500.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000

HEC-2 INPUT

X1	60.000	6.000	875.000	1010.000	500.000	500.000	500.000	0.000	0.000	0.000
GR	1163.400	875.000	1156.800	908.000	1156.800	1000.000	1160.500	1010.000	1161.000	1030.000
GR	1163.500	1040.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
X1	55.000	7.000	896.000	1012.000	500.000	500.000	500.000	0.000	0.000	0.000
GR	1164.000	820.000	1162.500	896.000	1157.800	918.000	1157.800	1000.000	1162.000	1012.000
GR	1162.500	1032.000	1165.000	1042.000	0.000	0.000	0.000	0.000	0.000	0.000
X1	50.000	8.000	911.000	1010.000	500.000	500.000	500.000	0.000	0.000	0.000
GR	1166.000	720.000	1164.000	800.000	1162.700	911.000	1158.800	928.000	1158.800	1000.000
GR	1163.000	1010.000	1163.500	1030.000	1166.000	1040.000	0.000	0.000	0.000	0.000
X1	45.000	7.000	905.000	1015.000	500.000	500.000	500.000	0.000	0.000	0.000
GR	1168.000	700.000	1166.000	905.000	1159.800	936.000	1159.800	1000.000	1164.900	1015.000
GR	1165.400	1035.000	1167.900	1045.000	0.000	0.000	0.000	0.000	0.000	0.000
QT	3.000	760.000	1370.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
X1	40.000	7.000	911.000	1015.000	500.000	500.000	500.000	0.000	0.000	0.000
GR	1168.000	820.000	1167.000	911.000	1160.800	942.000	1160.800	1000.000	1165.800	1015.000
GR	1166.300	1035.000	1168.800	1045.000	0.000	0.000	0.000	0.000	0.000	0.000
X1	35.000	7.000	922.000	1018.000	500.000	500.000	500.000	0.000	0.000	0.000
GR	1170.000	750.000	1168.000	922.000	1161.800	952.000	1161.800	1000.000	1167.300	1018.000
GR	1167.800	1038.000	1170.300	1048.000	0.000	0.000	0.000	0.000	0.000	0.000
X1	30.000	7.000	923.000	1020.000	500.000	500.000	500.000	0.000	0.000	0.000
GR	1174.000	770.000	1170.500	923.000	1162.800	961.000	1162.800	1000.000	1169.500	1020.000
GR	1170.000	1040.000	1172.500	1050.000	0.000	0.000	0.000	0.000	0.000	0.000
X1	25.000	7.000	923.000	1025.000	500.000	500.000	500.000	0.000	0.000	0.000
GR	1174.500	800.000	1173.200	923.000	1163.800	970.000	1163.800	1000.000	1171.900	1025.000
GR	1172.400	1045.000	1174.900	1055.000	0.000	0.000	0.000	0.000	0.000	0.000
NC	.035	.035	.035	0.000	0.000	0.000	0.000	0.000	0.000	0.000
QT	3.000	730.000	1240.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
X1	20.310	7.000	902.000	1036.000	469.000	469.000	469.000	0.000	0.000	0.000
GR	1180.000	800.000	1178.500	902.000	1164.700	970.000	1164.700	1000.000	1176.700	1036.000
GR	1177.200	1056.000	1179.700	1066.000	0.000	0.000	0.000	0.000	0.000	0.000

DIVERSION CHANNEL DROP SPILLWAY, DOWNSTREAM OF THIS SECTION.

X1	19.690	7.000	930.000	1019.000	62.000	62.000	62.000	0.000	0.000	0.000
GR	1180.000	800.000	1178.100	930.000	1170.700	970.000	1170.700	1000.000	1176.900	1019.000
GR	1177.400	1039.000	1179.900	1049.000	0.000	0.000	0.000	0.000	0.000	0.000
X1	19.590	0.000	0.000	0.000	10.000	10.000	10.000	0.000	.020	0.000
X1	19.540	0.000	0.000	0.000	5.000	5.000	5.000	0.000	.010	0.000
NC	.035	.030	.030	0.000	0.000	0.000	0.000	0.000	0.000	0.000

5-1-66

HEC-2 INPUT

X1	19.000	0.000	0.000	0.000	54.000	54.000	54.000	0.000	.100	0.000
QT	3.000	730.000	1160.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
X1	15.000	7.000	925.000	1021.000	400.000	400.000	400.000	0.000	0.000	0.000
GR	1180.500	900.000	1180.200	925.000	1171.400	970.000	1171.400	1000.000	1178.300	1021.000
GR	1178.800	1041.000	1181.800	1051.000	0.000	0.000	0.000	0.000	0.000	0.000
NC	.035	.035	.035	.300	.500	0.000	0.000	0.000	0.000	0.000
QT	3.000	730.000	1090.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
X1	10.900	4.000	925.000	1025.000	410.000	410.000	410.000	0.000	0.000	0.000
GR	1180.000	925.000	1172.000	968.000	1172.000	1000.000	1179.000	1025.000	0.000	0.000
X1	10.410	0.000	968.000	1000.000	49.000	49.000	49.000	0.000	.070	0.000
X3	10.000	0.000	0.000	0.000	0.000	0.000	0.000	1178.100	1178.100	0.000
NC	0.000	0.000	.012	0.000	0.000	0.000	0.000	0.000	0.000	0.000

COURTHOUSE ROAD BRIDGE, 3-10X6BOX CULVERTS.

X1	10.400	14.000	968.000	1000.000	1.000	1.000	1.000	0.000	.070	0.000
X2	0.000	0.000	0.000	1178.070	1180.500	0.000	0.000	0.000	0.000	0.000
GR	1180.000	943.000	1178.000	968.000	1172.000	968.000	1172.000	978.000	1178.000	978.000
GR	1178.000	979.000	1172.000	979.000	1172.000	989.000	1178.000	989.000	1178.000	990.000
GR	1172.000	990.000	1172.000	1000.000	1178.000	1000.000	1180.000	1116.000	0.000	0.000
X1	9.900	0.000	0.000	0.000	50.000	50.000	50.000	0.000	.070	0.000
X2	0.000	0.000	0.000	1178.140	1180.500	0.000	0.000	0.000	0.000	0.000
NC	0.000	0.000	.035	0.000	0.000	0.000	0.000	0.000	0.000	0.000
X1	9.890	4.000	968.000	1000.000	1.000	1.000	1.000	0.000	0.000	0.000
X3	10.000	0.000	0.000	0.000	0.000	0.000	0.000	1178.100	1178.100	0.000
GR	1180.000	943.000	1172.140	968.000	1172.140	1000.000	1180.000	1116.000	0.000	0.000
X1	9.400	4.000	943.000	1016.000	50.000	50.000	50.000	0.000	0.000	0.000
GR	1180.000	943.000	1172.220	975.000	1172.220	1000.000	1180.000	1016.000	0.000	0.000
NC	.030	.030	.030	.100	.300	0.000	0.000	0.000	0.000	0.000
QT	3.000	730.000	1020.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
X1	5.000	4.000	942.000	1012.000	440.000	440.000	440.000	0.000	0.000	0.000
GR	1180.500	942.000	1173.000	975.000	1173.000	1000.000	1179.000	1012.000	0.000	0.000
QT	3.000	730.000	950.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
X1	.820	4.000	940.000	1018.000	418.000	418.000	418.000	0.000	0.000	0.000
GR	1182.200	940.000	1173.500	975.000	1173.500	1000.000	1182.300	1018.000	0.000	0.000
EJ	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000

3.1-27

HEC-2 OUTPUT

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*************************************************
 HEC2 RELEASE DATED NOV 76 UPDATED FEB 1977
 ERROR CORP -  01
 MODIFICATION -  50.51.52
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NOTE- ASTERISK (*) AT LEFT OF CROSS-SECTION NUMBER INDICATES MESSAGE IN SUMMARY OF ERRORS LIST

SADDLEBACK DIVERSION

SUMMARY PRINTOUT

WS El(a) - Bridge El(a) .035 n/1000

	SECNO	XLCH (ft)	Q (CFS)	CWSEL (MSL)	ELMIN (MSL)	DEPTH (ft)	K*XNCH	TOPWID (ft)	EG (MSL)	VCH (FPS)	
*	333.700 1/	0.00	3550.00	1057.86	1055.70	2.16	35.00	548.17	1058.42	5.99	← 10-YR FREQY
*	333.700	0.00	6060.00	1058.40	1055.70	2.70	35.00	683.18	1059.07	6.58	← 50-YR FREQY
*	333.700	0.00	1120.00	1057.06	1055.70	1.36	35.00	345.66	1057.41	4.75	← PS OUTFLOW FRS
	326.200	735.00	3550.00	1060.30	1056.60	3.70	35.00	906.85	1060.37	2.10	
	326.200	735.00	6060.00	1060.98	1056.60	4.38	35.00	1051.18	1061.08	2.63	
	326.200	735.00	1120.00	1059.11	1056.60	2.51	35.00	624.85	1059.14	1.43	
	313.200	1285.00	3550.00	1062.23	1057.20	5.03	35.00	495.47	1062.43	3.62	
	313.200	1285.00	6060.00	1063.04	1057.20	5.84	35.00	612.81	1063.32	4.25	
	313.200	1285.00	1120.00	1060.77	1057.20	3.57	35.00	282.46	1060.88	2.72	
	293.200	1980.00	3550.00	1065.58	1060.80	4.78	35.00	500.00	1065.69	2.65	
	293.200	1980.00	6060.00	1066.58	1060.80	5.78	35.00	500.00	1066.75	3.29	
	293.200	1980.00	1120.00	1063.95	1060.80	3.15	35.00	374.98	1064.01	1.90	
	289.300	390.00	3550.00	1066.05	1061.00	5.05	35.00	728.73	1066.13	2.39	
	289.300	390.00	6060.00	1067.04	1061.00	6.04	35.00	776.91	1067.15	2.71	
	289.300	390.00	1120.00	1064.48	1061.00	3.48	35.00	484.08	1064.54	1.97	
*	272.300	935.00	3550.00	1071.19	1069.50	1.69	35.00	770.73	1071.63	5.38	
*	272.300	935.00	6060.00	1071.59	1069.50	2.09	35.00	900.95	1072.16	6.09	
*	272.300	935.00	1120.00	1070.58	1069.50	1.08	35.00	538.09	1070.85	4.15	
	266.400	600.00	3550.00	1076.35	1073.00	3.35	35.00	806.56	1076.53	3.40	
	266.400	600.00	6060.00	1076.84	1073.00	3.84	35.00	827.70	1077.11	4.22	
	266.400	600.00	1120.00	1075.57	1073.00	2.57	35.00	581.96	1075.65	2.36	
*	260.900	550.00	3550.00	1082.16	1077.50	4.66	35.00	578.54	1082.75	5.59	
*	260.900	550.00	6060.00	1082.64	1077.50	5.14	35.00	689.83	1083.36	6.44	
*	260.900	550.00	1120.00	1079.86	1077.50	2.36	35.00	96.85	1080.68	7.36	
	255.600	530.00	3550.00	1088.20	1085.50	2.70	35.00	682.53	1088.48	4.23	
	255.600	530.00	6060.00	1088.67	1085.50	3.17	35.00	730.16	1089.08	5.17	
	255.600	530.00	1120.00	1087.26	1085.50	1.76	35.00	480.54	1087.44	3.41	
*	250.300	530.00	3550.00	1094.75	1093.80	.95	35.00	677.60	1095.23	5.55	
*	250.300	530.00	6060.00	1095.16	1093.80	1.36	35.00	680.87	1095.84	6.61	
	250.300	530.00	1120.00	1094.29	1093.80	.49	35.00	673.91	1094.47	3.41	

n = .035

1/ SECNO 333.700 = Sta. 333+70 diversion / Centennial wash tributary

2.1-20

HEC-2 OUTPUT

	SECNO	XLCH	Q	CWSEL	ELMIN	DEPTH	K*XNCH	TOPWID	EG	VCH
	249.000	130.00	3550.00	1095.75	1094.00	1.75	30.00	571.22	1095.95	3.58
	249.000	130.00	6060.00	1096.29	1094.00	2.29	30.00	574.70	1096.63	4.65
	249.000	130.00	1120.00	1094.96	1094.00	.96	30.00	566.15	1095.03	2.07
	248.000	100.00	3550.00	1096.02	1094.70	1.32	30.00	545.65	1096.40	4.99
	248.000	100.00	6060.00	1096.56	1094.70	1.86	30.00	549.27	1097.12	5.99
	248.000	100.00	1120.00	1095.24	1094.70	.54	30.00	540.55	1095.48	3.86
	247.000	100.00	3550.00	1096.73	1095.40	1.33	30.00	525.50	1097.14	5.14
	247.000	100.00	6060.00	1097.21	1095.40	1.81	30.00	529.67	1097.85	6.41
	247.000	100.00	1120.00	1096.15	1095.40	.75	30.00	520.45	1096.28	2.90
	246.000	100.00	3490.00	1097.47	1096.10	1.37	30.00	499.39	1097.88	5.19
	246.000	100.00	5970.00	1097.97	1096.10	1.87	30.00	502.88	1098.61	6.44
	246.000	100.00	1120.00	1096.76	1096.10	.66	30.00	494.55	1096.94	3.45
	245.000	100.00	3490.00	1098.19	1096.80	1.39	30.00	475.60	1098.63	5.30
	245.000	100.00	5970.00	1098.70	1096.80	1.90	30.00	478.70	1099.39	6.64
	245.000	100.00	1120.00	1097.53	1096.80	.73	30.00	471.51	1097.69	3.26
	243.000	200.00	3490.00	1099.22	1097.20	2.02	30.00	439.19	1099.47	4.01
	243.000	200.00	5970.00	1099.91	1097.20	2.71	30.00	444.96	1100.31	5.09
	243.000	200.00	1120.00	1098.30	1097.20	1.10	30.00	431.32	1098.39	2.39
	241.000	200.00	3490.00	1099.74	1097.60	2.14	30.00	391.88	1100.02	4.24
	241.000	200.00	5970.00	1100.47	1097.60	2.87	30.00	396.94	1100.92	5.38
	241.000	200.00	1120.00	1098.73	1097.60	1.13	30.00	384.87	1098.84	2.60
	239.000	200.00	3490.00	1100.27	1098.00	2.27	30.00	350.89	1100.59	4.49
	239.000	200.00	5970.00	1101.04	1098.00	3.04	30.00	357.33	1101.54	5.68
	239.000	200.00	1120.00	1099.21	1098.00	1.21	30.00	341.95	1099.33	2.77
	237.710	129.00	3490.00	1100.63	1098.30	2.33	30.00	318.81	1100.99	4.83
	237.710	129.00	5970.00	1101.42	1098.30	3.12	30.00	325.09	1102.00	6.13
	237.710	129.00	1120.00	1099.54	1098.30	1.24	30.00	309.92	1099.68	2.98
	237.610	10.00	3490.00	1100.68	1098.30	2.38	35.00	319.07	1101.03	4.76
	237.610	10.00	5970.00	1101.48	1098.30	3.18	35.00	325.64	1102.04	5.99
	237.610	10.00	1120.00	1099.58	1098.30	1.28	35.00	310.23	1099.71	2.69
	237.590	2.00	3490.00	1100.92	1097.10	3.82	35.00	326.61	1101.06	2.90
	237.590	2.00	5970.00	1101.83	1097.10	4.73	35.00	335.42	1102.08	3.97
	237.590	2.00	1120.00	1099.69	1097.10	2.59	35.00	319.36	1099.72	1.40
	237.340	25.00	3490.00	1100.95	1097.10	3.85	35.00	328.77	1101.08	2.89
	237.340	25.00	5970.00	1101.87	1097.10	4.77	35.00	335.64	1102.11	3.94
	237.340	25.00	1120.00	1099.70	1097.10	2.60	35.00	319.42	1099.73	1.39
*	237.110	23.00	3490.00	1110.20	1108.60	1.60	35.00	312.35	1110.99	7.11
*	237.110	23.00	5970.00	1110.88	1108.60	2.28	35.00	317.60	1112.00	8.46
*	237.110	23.00	1120.00	1109.35	1108.60	.75	35.00	305.80	1109.73	4.91
	236.960	15.00	3490.00	1110.66	1108.68	1.98	35.00	315.24	1111.17	5.73
	236.960	15.00	5970.00	1111.41	1108.68	2.73	35.00	321.01	1112.18	7.05
	236.960	15.00	1120.00	1109.71	1108.68	1.03	35.00	307.94	1109.91	3.57

HEC-2 OUTPUT

SECNO	XLCH	Q	CWSEL	ELMIN	DEPTH	K*XNCH	TOPWID	EG	VCH
236.920	4.00	3490.00	1110.71	1108.68	2.03	30.00	315.62	1111.20	5.59
236.920	4.00	5970.00	1111.46	1108.68	2.78	30.00	321.39	1112.21	6.92
236.920	4.00	1120.00	1109.75	1108.68	1.07	30.00	306.31	1109.93	3.41
236.850	7.00	3490.00	1110.90	1108.69	2.21	30.00	371.72	1111.24	4.68
236.850	7.00	5970.00	1111.80	1108.69	3.11	30.00	400.40	1112.26	5.49
236.850	7.00	1120.00	1109.81	1108.69	1.12	30.00	335.81	1109.96	3.18
236.500	35.00	3490.00	1111.04	1108.77	2.27	30.00	373.73	1111.36	4.54
236.500	35.00	5970.00	1111.93	1108.77	3.16	30.00	402.43	1112.38	5.37
236.500	35.00	1120.00	1109.95	1108.77	1.18	30.00	338.18	1110.09	2.97
235.000	150.00	3360.00	1111.49	1109.10	2.39	30.00	316.91	1111.81	4.56
235.000	150.00	5750.00	1112.34	1109.10	3.24	30.00	386.23	1112.84	5.69
235.000	150.00	1120.00	1110.38	1109.10	1.28	30.00	309.03	1110.51	2.88
230.000	500.00	3360.00	1112.77	1110.20	2.57	30.00	316.75	1113.05	4.27
230.000	500.00	5750.00	1113.69	1110.20	3.49	30.00	327.15	1114.13	5.31
230.000	500.00	1120.00	1111.54	1110.20	1.34	30.00	307.36	1111.66	2.76
225.000	500.00	3360.00	1113.88	1111.30	2.58	30.00	314.70	1114.17	4.30
225.000	500.00	5750.00	1114.84	1111.30	3.54	30.00	323.15	1115.27	5.29
225.000	500.00	1120.00	1112.64	1111.30	1.34	30.00	303.73	1112.77	2.82
220.000	500.00	3180.00	1114.97	1112.40	2.57	30.00	311.61	1115.23	4.09
220.000	500.00	5430.00	1115.95	1112.40	3.55	30.00	319.38	1116.34	5.01
220.000	500.00	1120.00	1113.75	1112.40	1.35	30.00	301.84	1113.87	2.78
215.000	500.00	3180.00	1116.02	1113.50	2.52	30.00	306.98	1116.30	4.23
215.000	500.00	5430.00	1116.98	1113.50	3.48	30.00	314.19	1117.40	5.18
215.000	500.00	1120.00	1114.85	1113.50	1.35	30.00	298.14	1114.98	2.83
210.000	500.00	3180.00	1117.13	1114.60	2.53	30.00	304.46	1117.41	4.26
210.000	500.00	5430.00	1118.09	1114.60	3.49	30.00	315.01	1118.51	5.22
210.000	500.00	1120.00	1115.96	1114.60	1.36	30.00	295.50	1116.09	2.82
205.000	500.00	2990.00	1118.23	1115.70	2.53	30.00	299.48	1118.49	4.07
205.000	500.00	5110.00	1119.19	1115.70	3.49	30.00	306.82	1119.58	4.98
205.000	500.00	1120.00	1117.07	1115.70	1.37	30.00	290.55	1117.20	2.86
200.000	500.00	2990.00	1119.29	1116.80	2.49	30.00	294.59	1119.56	4.21
200.000	500.00	5110.00	1120.24	1116.80	3.44	30.00	302.08	1120.65	5.14
200.000	500.00	1120.00	1118.19	1116.80	1.39	30.00	285.91	1118.31	2.88
195.000	500.00	2990.00	1120.42	1117.90	2.52	30.00	286.95	1120.70	4.28
195.000	500.00	5110.00	1121.35	1117.90	3.45	30.00	294.00	1121.78	5.27
195.000	500.00	1120.00	1119.31	1117.90	1.41	30.00	278.57	1119.44	2.92
190.000	500.00	2990.00	1121.55	1119.00	2.55	30.00	285.03	1121.83	4.26
190.000	500.00	5110.00	1122.50	1119.00	3.50	30.00	292.44	1122.93	5.25
190.000	500.00	1120.00	1120.43	1119.00	1.43	30.00	276.22	1120.56	2.90
185.000	500.00	2760.00	1122.65	1120.10	2.55	30.00	278.60	1122.90	4.03
185.000	500.00	4720.00	1123.62	1120.10	3.52	30.00	286.77	1123.99	4.92
185.000	500.00	1120.00	1121.54	1120.10	1.44	30.00	270.06	1121.67	2.95

D.1-30

HEC-2 OUTPUT

	SECNO	XLCH	Q	CWSEL	ELMIN	DEPTH	K*XNCH	TOPWID	EG	VCH
	180.000	500.00	2760.00	1123.69	1121.20	2.49	30.00	271.26	1123.97	4.22
	180.000	500.00	4720.00	1124.64	1121.20	3.44	30.00	278.56	1125.06	5.17
	180.000	500.00	1120.00	1122.66	1121.20	1.46	30.00	263.27	1122.80	2.97
	175.000	500.00	2760.00	1124.82	1122.30	2.52	30.00	268.58	1125.10	4.24
	175.000	500.00	4720.00	1125.77	1122.30	3.47	30.00	276.30	1126.16	5.20
	175.000	500.00	1120.00	1123.78	1122.30	1.48	30.00	260.06	1123.92	2.99
	170.000	500.00	2520.00	1125.92	1123.40	2.52	30.00	263.33	1126.16	3.96
	170.000	500.00	4320.00	1126.88	1123.40	3.48	30.00	274.21	1127.24	4.82
	170.000	500.00	1120.00	1124.89	1123.40	1.49	30.00	255.09	1125.03	3.01
	165.000	500.00	2520.00	1126.95	1124.50	2.45	30.00	258.11	1127.21	4.13
	165.000	500.00	4320.00	1127.88	1124.50	3.38	30.00	265.35	1128.28	5.06
	165.000	500.00	1120.00	1126.01	1124.50	1.51	30.00	250.72	1126.15	3.04
	160.000	500.00	2520.00	1128.07	1125.60	2.47	30.00	252.03	1128.34	4.22
	160.000	500.00	4320.00	1129.00	1125.60	3.40	30.00	259.59	1129.41	5.17
	160.000	500.00	1120.00	1127.14	1125.60	1.54	30.00	244.41	1127.28	3.08
	155.000	500.00	2310.00	1129.18	1126.70	2.48	30.00	245.75	1129.42	3.94
	155.000	500.00	3970.00	1130.13	1126.70	3.43	30.00	253.23	1130.49	4.83
	155.000	500.00	1120.00	1128.26	1126.70	1.56	30.00	238.40	1128.41	3.09
	150.000	500.00	2310.00	1130.22	1127.80	2.42	30.00	240.96	1130.49	4.12
	150.000	500.00	3970.00	1131.16	1127.80	3.36	30.00	248.98	1131.56	5.04
	150.000	500.00	1120.00	1129.38	1127.80	1.58	30.00	233.62	1129.53	3.13
	145.190	481.00	2170.00	1131.41	1128.90	2.51	35.00	237.96	1131.64	3.82
	145.190	481.00	3740.00	1132.36	1128.90	3.46	35.00	246.68	1132.70	4.68
	145.190	481.00	1120.00	1130.57	1128.90	1.67	35.00	230.29	1130.71	3.01
*	144.820	37.00	2170.00	1136.65	1135.20	1.45	35.00	226.25	1137.36	6.76
*	144.820	37.00	3740.00	1137.28	1135.20	2.08	35.00	231.06	1138.29	8.08
*	144.820	37.00	1120.00	1136.14	1135.20	.94	35.00	222.25	1136.60	5.46
	144.720	10.00	2170.00	1137.05	1135.22	1.83	35.00	229.12	1137.50	5.35
	144.720	10.00	3740.00	1137.75	1135.22	2.53	35.00	234.56	1138.42	6.58
	144.720	10.00	1120.00	1136.48	1135.22	1.26	35.00	224.79	1136.73	4.02
	144.670	5.00	2170.00	1137.12	1135.23	1.89	35.00	229.54	1137.53	5.19
	144.670	5.00	3740.00	1137.82	1135.23	2.59	35.00	234.92	1138.46	6.45
	144.670	5.00	1120.00	1136.52	1135.23	1.29	35.00	225.08	1136.76	3.91
	144.000	67.00	2170.00	1137.53	1135.33	2.20	30.00	232.01	1137.83	4.42
	144.000	67.00	3740.00	1138.30	1135.33	2.97	30.00	237.95	1138.78	5.57
	144.000	67.00	1120.00	1136.86	1135.33	1.53	30.00	226.80	1137.03	3.32
	140.000	400.00	2170.00	1138.60	1136.20	2.40	30.00	226.52	1138.87	4.15
	140.000	400.00	3740.00	1139.48	1136.20	3.28	30.00	233.23	1139.89	5.17
	140.000	400.00	1120.00	1137.84	1136.20	1.64	30.00	220.64	1138.00	3.18
	135.000	500.00	2030.00	1139.70	1137.20	2.50	30.00	219.62	1139.93	3.87
	135.000	500.00	3500.00	1140.63	1137.20	3.43	30.00	226.98	1140.99	4.77
	135.000	500.00	1120.00	1138.92	1137.20	1.72	30.00	213.47	1139.07	3.16

3.1-31

HEC-2 OUTPUT

SECNO	XLCH	Q	CWSEL	ELMIN	DEPTH	K*XNCH	TOPWID	EG	VCH
130.000	500.00	2030.00	1140.69	1138.20	2.49	30.00	210.57	1140.95	4.05
130.000	500.00	3500.00	1141.63	1138.20	3.43	30.00	217.58	1142.02	4.98
130.000	500.00	1120.00	1139.95	1138.20	1.75	30.00	205.09	1140.11	3.21
125.000	500.00	1890.00	1141.72	1139.20	2.52	30.00	204.58	1141.95	3.86
125.000	500.00	3250.00	1142.68	1139.20	3.48	30.00	212.11	1143.02	4.70
125.000	500.00	1120.00	1140.99	1139.20	1.79	30.00	198.94	1141.16	3.26
120.000	500.00	1890.00	1142.70	1140.20	2.50	30.00	196.32	1142.96	4.03
120.000	500.00	3250.00	1143.65	1140.20	3.45	30.00	203.54	1144.03	4.95
120.000	500.00	1120.00	1142.04	1140.20	1.84	30.00	191.13	1142.21	3.31
115.000	500.00	1890.00	1143.75	1141.20	2.55	30.00	188.95	1144.02	4.13
115.000	500.00	3250.00	1144.71	1141.20	3.51	30.00	196.04	1145.10	5.07
115.000	500.00	1120.00	1143.08	1141.20	1.88	30.00	184.01	1143.25	3.35
110.000	500.00	1660.00	1144.78	1142.20	2.58	30.00	181.91	1144.99	3.75
110.000	500.00	2860.00	1145.76	1142.20	3.56	30.00	192.32	1146.08	4.56
110.000	500.00	1120.00	1144.13	1142.20	1.93	30.00	176.87	1144.31	3.44
105.000	500.00	1660.00	1145.70	1143.20	2.50	30.00	177.06	1145.95	3.97
105.000	500.00	2860.00	1146.67	1143.20	3.47	30.00	184.76	1147.03	4.83
105.000	500.00	1120.00	1145.18	1143.20	1.98	30.00	172.86	1145.36	3.43
100.000	500.00	1500.00	1146.70	1144.20	2.50	30.00	170.74	1146.92	3.73
100.000	500.00	2590.00	1147.67	1144.20	3.47	30.00	178.72	1147.99	4.54
100.000	500.00	1120.00	1146.21	1144.20	2.01	30.00	166.70	1146.40	3.51
95.000	500.00	1500.00	1147.66	1145.20	2.46	30.00	166.75	1147.90	3.93
95.000	500.00	2590.00	1148.61	1145.20	3.41	30.00	175.88	1148.96	4.76
95.000	500.00	1120.00	1147.27	1145.20	2.07	30.00	162.90	1147.47	3.54
90.000	500.00	1360.00	1148.67	1146.20	2.47	30.00	159.93	1148.88	3.68
90.000	500.00	2350.00	1149.62	1146.20	3.42	30.00	167.93	1149.93	4.48
90.000	500.00	1120.00	1148.32	1146.20	2.12	30.00	156.94	1148.51	3.57
85.000	500.00	1360.00	1149.63	1147.20	2.43	30.00	151.91	1149.87	3.93
85.000	500.00	2350.00	1150.56	1147.20	3.36	30.00	159.52	1150.91	4.79
85.000	500.00	1120.00	1149.36	1147.20	2.16	30.00	149.69	1149.57	3.67
82.180	282.00	1360.00	1150.31	1147.80	2.51	35.00	150.01	1150.54	3.68
82.180	282.00	2350.00	1151.24	1147.80	3.44	35.00	157.44	1151.59	4.76
82.180	282.00	1120.00	1150.04	1147.80	2.24	35.00	147.90	1150.24	3.60
* 81.830	35.00	1360.00	1153.88	1152.40	1.48	35.00	142.07	1154.59	6.75
* 81.830	35.00	2350.00	1154.51	1152.40	2.11	35.00	147.19	1155.51	8.04
* 81.830	35.00	1120.00	1153.70	1152.40	1.30	35.00	140.61	1154.33	6.36
81.730	10.00	1360.00	1154.28	1152.42	1.86	35.00	145.10	1154.72	5.34
81.730	10.00	2350.00	1154.99	1152.42	2.57	35.00	150.90	1155.65	6.53
81.730	10.00	1120.00	1154.08	1152.42	1.66	35.00	143.52	1154.46	4.94
81.680	5.00	1360.00	1154.34	1152.43	1.91	35.00	145.54	1154.76	5.18
81.680	5.00	2350.00	1155.05	1152.43	2.62	35.00	151.28	1155.69	6.40
81.680	5.00	1120.00	1154.14	1152.43	1.71	35.00	143.96	1154.50	4.77

HEC-2 OUTPUT

SECNO	XLCH	Q	CWSEL	ELMIN	DEPTH	K*XNCH	TOPWID	EG	VCH
81.640	4.00	1360.00	1154.38	1152.43	1.95	30.00	145.87	1154.78	5.06
81.640	4.00	2350.00	1155.11	1152.43	2.68	30.00	151.88	1155.71	6.21
81.640	4.00	1120.00	1154.18	1152.43	1.75	30.00	144.20	1154.52	4.69
81.000	64.00	1360.00	1154.71	1152.60	2.11	30.00	147.22	1155.05	4.64
81.000	64.00	2350.00	1155.47	1152.60	2.87	30.00	153.48	1155.99	5.75
81.000	64.00	1120.00	1154.49	1152.60	1.89	30.00	145.44	1154.78	4.29
80.000	100.00	1360.00	1155.07	1152.80	2.27	30.00	144.00	1155.37	4.43
80.000	100.00	2350.00	1155.85	1152.80	3.05	30.00	149.89	1156.33	5.56
80.000	100.00	1120.00	1154.84	1152.80	2.04	30.00	142.28	1155.10	4.08
75.000	500.00	1060.00	1156.28	1153.80	2.48	30.00	143.26	1156.45	3.28
75.000	500.00	1900.00	1157.22	1153.80	3.42	30.00	152.96	1157.48	4.10
75.000	500.00	1120.00	1156.11	1153.80	2.31	30.00	141.53	1156.32	3.75
70.000	500.00	1060.00	1157.13	1154.80	2.33	30.00	128.39	1157.36	3.84
70.000	500.00	1900.00	1158.08	1154.80	3.28	30.00	136.32	1158.43	4.72
70.000	500.00	1120.00	1157.18	1154.80	2.38	30.00	128.83	1157.43	3.96
65.000	500.00	1060.00	1158.22	1155.80	2.42	30.00	119.76	1158.47	3.98
65.000	500.00	1900.00	1159.18	1155.80	3.38	30.00	127.55	1159.56	4.95
65.000	500.00	1120.00	1158.30	1155.80	2.50	30.00	120.36	1158.56	4.08
60.000	500.00	790.00	1159.24	1156.80	2.44	30.00	110.77	1159.40	3.20
60.000	500.00	1500.00	1160.27	1156.80	3.47	30.00	118.70	1160.53	4.11
60.000	500.00	1120.00	1159.42	1156.80	2.62	30.00	112.21	1159.69	4.18
55.000	500.00	790.00	1160.08	1157.80	2.28	30.00	99.19	1160.31	3.82
55.000	500.00	1500.00	1161.13	1157.80	3.33	30.00	107.07	1161.48	4.77
55.000	500.00	1120.00	1160.56	1157.80	2.76	30.00	102.74	1160.86	4.41
50.000	500.00	790.00	1161.22	1158.80	2.42	30.00	88.31	1161.48	4.07
50.000	500.00	1500.00	1162.27	1158.80	3.47	30.00	95.35	1162.68	5.17
50.000	500.00	1120.00	1161.75	1158.80	2.95	30.00	91.82	1162.09	4.65
45.000	500.00	790.00	1162.40	1159.80	2.60	30.00	84.59	1162.66	4.10
45.000	500.00	1500.00	1163.50	1159.80	3.70	30.00	93.37	1163.91	5.15
45.000	500.00	1120.00	1162.95	1159.80	3.15	30.00	89.08	1163.29	4.63
40.000	500.00	760.00	1163.52	1160.80	2.72	30.00	79.78	1163.78	4.05
40.000	500.00	1370.00	1164.67	1160.80	3.87	30.00	88.95	1165.03	4.82
40.000	500.00	1120.00	1164.12	1160.80	3.32	30.00	84.54	1164.47	4.74
35.000	500.00	760.00	1164.66	1161.80	2.86	30.00	71.17	1164.97	4.47
35.000	500.00	1370.00	1165.75	1161.80	3.95	30.00	80.07	1166.21	5.41
35.000	500.00	1120.00	1165.32	1161.80	3.52	30.00	76.59	1165.73	5.10
30.000	500.00	760.00	1165.95	1162.80	3.15	30.00	63.91	1166.29	4.70
30.000	500.00	1370.00	1167.07	1162.80	4.27	30.00	72.81	1167.58	5.74
30.000	500.00	1120.00	1166.65	1162.80	3.85	30.00	69.46	1167.09	5.37
25.000	500.00	760.00	1167.28	1163.80	3.48	30.00	58.14	1167.66	4.96
25.000	500.00	1370.00	1168.48	1163.80	4.68	30.00	67.84	1169.04	5.98
25.000	500.00	1120.00	1168.03	1163.80	4.23	30.00	64.23	1168.52	5.62

HEC-2 OUTPUT

	SECNO	XLCH	Q	CWSEL	ELMIN	DEPTH	K*XNCH	TOPWID	EG	VCH
	20.310	469.00	730.00	1168.60	1164.70	3.90	35.00	60.94	1168.87	4.11
	20.310	469.00	1240.00	1169.91	1164.70	5.21	35.00	71.30	1170.25	4.70
	20.310	469.00	1120.00	1169.45	1164.70	4.75	35.00	67.66	1169.81	4.83
*	19.690	62.00	730.00	1173.04	1170.70	2.34	35.00	49.82	1173.99	7.82
*	19.690	62.00	1240.00	1173.89	1170.70	3.19	35.00	57.05	1175.13	8.92
*	19.690	62.00	1120.00	1173.71	1170.70	3.01	35.00	55.50	1174.89	8.70
	19.590	10.00	730.00	1173.53	1170.72	2.81	35.00	53.76	1174.13	6.21
	19.590	10.00	1240.00	1174.46	1170.72	3.74	35.00	61.69	1175.27	7.23
	19.590	10.00	1120.00	1174.26	1170.72	3.54	35.00	60.00	1175.03	7.03
	19.540	5.00	730.00	1173.59	1170.73	2.86	35.00	54.18	1174.17	6.07
	19.540	5.00	1240.00	1174.53	1170.73	3.80	35.00	62.08	1175.31	7.11
	19.540	5.00	1120.00	1174.33	1170.73	3.60	35.00	60.37	1175.07	6.91
	19.000	54.00	730.00	1174.01	1170.83	3.18	30.00	56.88	1174.45	5.30
	19.000	54.00	1240.00	1174.99	1170.83	4.16	30.00	65.26	1175.60	6.25
	19.000	54.00	1120.00	1174.79	1170.83	3.96	30.00	63.51	1175.36	6.05
	15.000	400.00	730.00	1175.19	1171.40	3.79	30.00	60.93	1175.47	4.24
	15.000	400.00	1160.00	1176.28	1171.40	4.88	30.00	69.81	1176.63	4.76
	15.000	400.00	1120.00	1176.06	1171.40	4.66	30.00	68.00	1176.43	4.91
	10.900	410.00	730.00	1176.03	1172.00	4.03	35.00	68.03	1176.23	3.62
	10.900	410.00	1090.00	1177.12	1172.00	5.12	35.00	77.77	1177.35	3.88
	10.900	410.00	1120.00	1176.98	1172.00	4.98	35.00	76.53	1177.24	4.15
	10.410	49.00	730.00	1176.12	1172.07	4.05	35.00	68.20	1176.32	3.60
	10.410	49.00	1090.00	1177.19	1172.07	5.12	35.00	77.87	1177.43	3.87
	10.410	49.00	1120.00	1177.07	1172.07	5.00	35.00	76.73	1177.33	4.12
	10.400	1.00	730.00	1175.91	1172.07	3.84	12.00	30.00	1176.53	6.34
	10.400	1.00	1090.00	1176.86	1172.07	4.79	12.00	30.00	1177.76	7.57
	10.400	1.00	1120.00	1176.70	1172.07	4.63	12.00	30.00	1177.71	8.06
	9.900	50.00	730.00	1175.95	1172.14	3.81	12.00	30.00	1176.58	6.39
	9.900	50.00	1090.00	1176.92	1172.14	4.78	12.00	30.00	1177.81	7.59
	9.900	50.00	1120.00	1176.76	1172.14	4.62	12.00	30.00	1177.77	8.06
	9.890	1.00	730.00	1176.11	1172.14	3.97	35.00	32.00	1176.62	5.75
	9.890	1.00	1090.00	1177.16	1172.14	5.02	35.00	32.00	1177.87	6.78
	9.890	1.00	1120.00	1177.05	1172.14	4.91	35.00	32.00	1177.84	7.12
	9.400	50.00	730.00	1176.51	1172.22	4.29	35.00	51.50	1176.81	4.44
	9.400	50.00	1090.00	1177.77	1172.22	5.55	35.00	59.22	1178.11	4.67
	9.400	50.00	1120.00	1177.74	1172.22	5.52	35.00	59.07	1178.10	4.83
	5.000	440.00	730.00	1177.39	1173.00	4.39	30.00	53.12	1177.68	4.25
	5.000	440.00	1020.00	1178.53	1173.00	5.53	30.00	60.37	1178.82	4.32
	5.000	440.00	1120.00	1178.56	1173.00	5.56	30.00	60.56	1178.90	4.71
	.820	418.00	730.00	1178.05	1173.50	4.55	30.00	52.60	1178.31	4.14
	.820	418.00	950.00	1179.07	1173.50	5.57	30.00	58.79	1179.32	4.07
	.820	418.00	1120.00	1179.18	1173.50	5.68	30.00	59.49	1179.52	4.66

Vegetation conduit (stn. 212+42)

design criteria (S.C.S. & BLM)

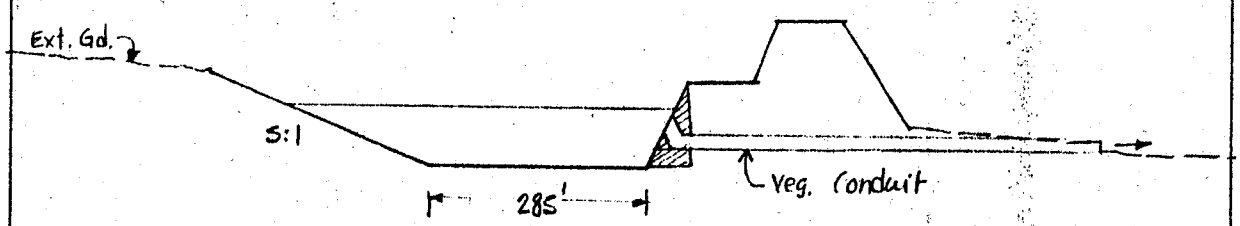
(1) Capacity of pipe for one year storm = one year Q from uncontrolled watershed (present cond.)

1 Yr CSM from the similar watershed (FRS) : 30 to 50 csm (Re. TR-20).

Uncontrolled watershed (present cond.) - Contributing area = 0.2 sq.mi.

1 Yr Q = 0.2 × 40 = 8 cfs

= design capacity of proposed veg. conduit.



(2) Estimate 1 Yr Q @ stn 212+42

Known $Q_{10} = 3600$ cfs
$Q_{50} = 6000$ cfs

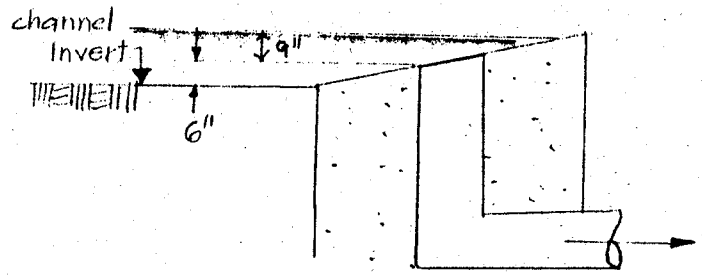
$Q_1 = 1000$ cfs approximated on log paper

(3) Estimate the depth of flow in channel

Known $Q_1 = 1000$ cfs
$b = 285'$
$z = (5+3)\frac{1}{2} = 4$
$S = .0025$ ft/ft
$n = .03$ (aged)

$d_n = 1.25'$, $V_n = 2.8$ fps

(4)



$d_h = 1.25'$

Try 24" RCP, Area of opening = 3.14 ft^2
Perimeter = 6.28 ft.

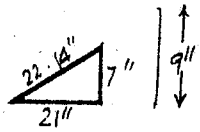
a. assume weir flow : $= CLH^{3/2}$
$= 3 \times 3.14 \times 0.75^{3/2} + 3 \times 3.14 \times .17^{3/2}$
$= 6.8$ cfs

b. assume orifice flow: ave. $Y_0 = 0.46'$

capacity $= A \times Q \frac{cfs}{ft^2}$
$= 3.14 \times 3.35$
$= 10.5$ cfs

c. $H_T = (6.2 - 1.2) = 5'$
TR 46. Fig 8-2 capacity = 27 cfs N/A

Try 21" RCP Area of opening = 2.405 ft^2
Perimeter = 5.5'



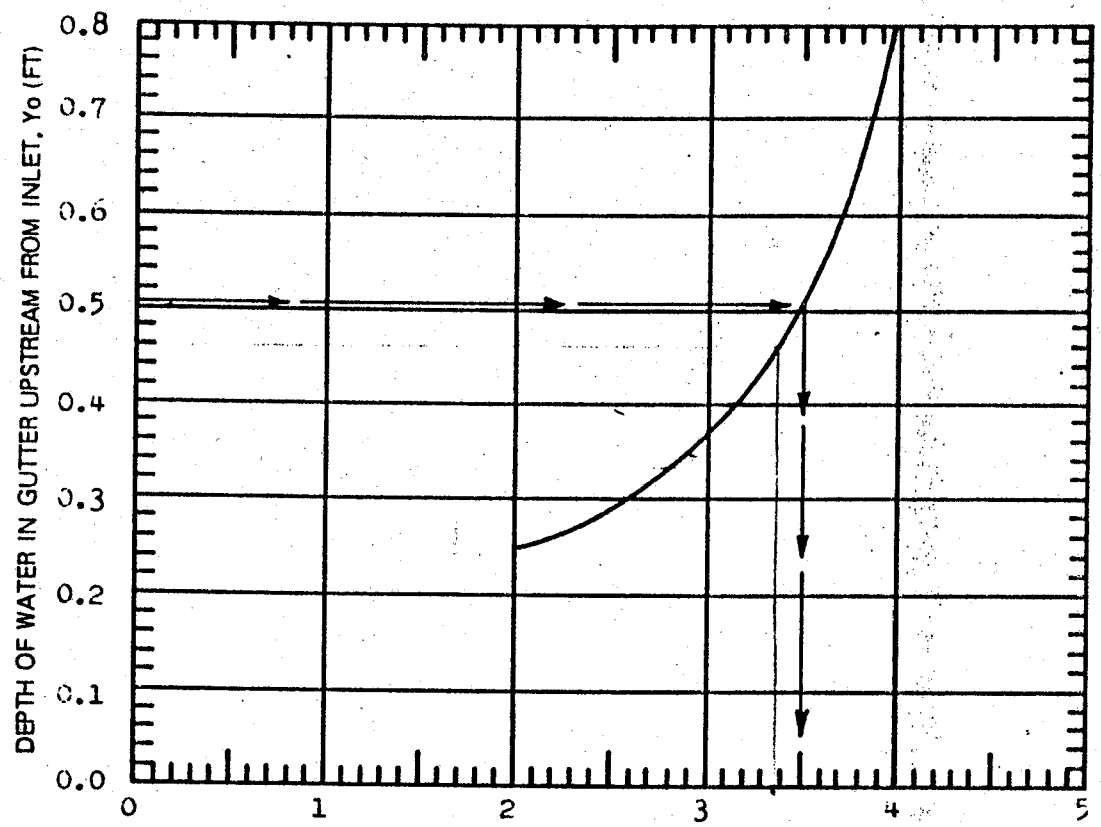
a. assume weir flow $= CLH^{3/2}$
$= 3 \times 2.25 \times 0.75^{3/2} + 3 \times 2.25 \times 0.2^{3/2}$
$= 6.1$ cfs

b. assume orifice flow: ave. $Y_0 = 0.46'$

Capacity $= 2.405 \times 3.35$
$= 8.06$ cfs

<u>Use 21" RCP @ stn ≈ 212+42</u>

Alt. No. 1 Capacity of wash with freeboard feeding the slo tank
2 BUT - using the tank or not, if not no need for a larger pipe
3 Relocate tank upstream of Dam (SADFRS) - E.I.S
4 1-yr storm design - based on existing condition



FLOW INTO INLET PER SQ. FT. OF OPEN AREA (CFS/FT^2)

FIGURE 4 - 1. CAPACITY OF GRATED INLET IN SUMP

FOR TYPE "E" AREA = 1.25 x 3.34 x 0.75 = 3.1 ft^2
FOR TYPE "F" AREA = 2.125 x 3.41 x 0.75 = 5.43 ft^2

FOR TYPE "D" AREA = 2.125 x 3.34 x 0.65 = 4.6 ft^2
Capacity from this chart + 4" curb opening

TOUPS CORPORATION

CONSULTING ENGINEERS AND PLANNERS

BY G.S. DATE 10/27/78 CLIENT S.C.S. SHEET NO. ____ OF ____

CHECKED ____ DATE ____ JOB ____ JOB NO. ____

VEGETATIVE MAINTENANCE CONDUITS — DIVERSION

Conduits were provided at intervals along the diversion channel, at locations where natural washes intersected the channel. Five conduits were designed, four of 12"Ø and one of 21"Ø. The 21"Ø conduit was selected to provide adequate water to supply a water tank. Below are the stationing of the conduits along the channel center line.

Conduit No.	Station	Dia
1	60+60	12" R/C
2	111+70	12" R/C
3	125+50	12" R/C
4	184+75	12" R/C
5	210+35	21" R/C

A Public Works Department (PWD) outlet basin was selected from p. F-21, TR #46, SCS for all conduit outlets.

For the 12"Ø conduits (see sh. 3.1-39 for head and discharges) a size "C" structure was selected.

For the 21"Ø conduit (see sh. 3.1-39 for head and discharges) a size "D" structure was selected.

A sketch is shown on p. III.4-4 and dimensions are shown below.

	Size "C"		Size "D"
1	1'-6"	1	2'-3"
2	9"	2	1'-2"
3	3'-0"	3	4'-6"
4	2'-3"	4	3'-4"
5	1'-8"	5	2'-6"
6	5-4"	6	8'-3"
7	2'-0"	7	2'-3"
8	6"	8	6"
9	3'-6"	9	4'-6"
		Length	9'-6"
		Concrete	3.6 yd³
		Steel	274 #

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BY G.S. DATE 9/12/78 CLIENT SCS SHEET NO ____ OF ____

CHECKED ____ DATE ____ JOB ____ JOB NO. ____

VEGETATIVE CONDUIT - DESIGN INLET CONDITIONS

Refering to design tables on p. C-9 of Technical Release No. 46, SCS, design an inlet structure for a 12" conduit

Structure size for a 12" dia. conduit is size 'C'

With one intermediate cross bar use curve C-1 and a head of 7 ft to determine bar sizes.

Longitudinal member = 3/4" rod
Cross bar A = 2" x 3/8"
Cross bar B = 2" x 3/8"
Z = 2"

A sketch is shown on p. IV. 4-15 and dimensions and quantities are shown below.

Dimensions

1 - 6"	5 - 1'9"
2 - 1'4"	6 - 2'0"
3 - 1'6"	Length - 4'6"
4 - 2'6"	A1 = 3'11 1/2"
	B1 = 2'9"
	C1 = 2'6"
	Bar Spacing - 6" c-c

Quantities
Vol. Conc. C.Y. = 1.57
Reinforcing steel = 127 lb.

Structure size for the 21 in. dia. conduit (210+75) is size 'H.'

Trash Rack - For one intermediate crossbar and size 'H' structure use curve H-1 on p. C-9, TR-46 with head of 6 ft.

Longitudinal member = 1 1/4" pipe
Cross Bar A = 3" x 3/8", Cross Bar B = 3" x 5/8" Z = 3"

A sketch is shown on p. IV. 4-15 and dimensions and quant. are shown below.

Dimensions

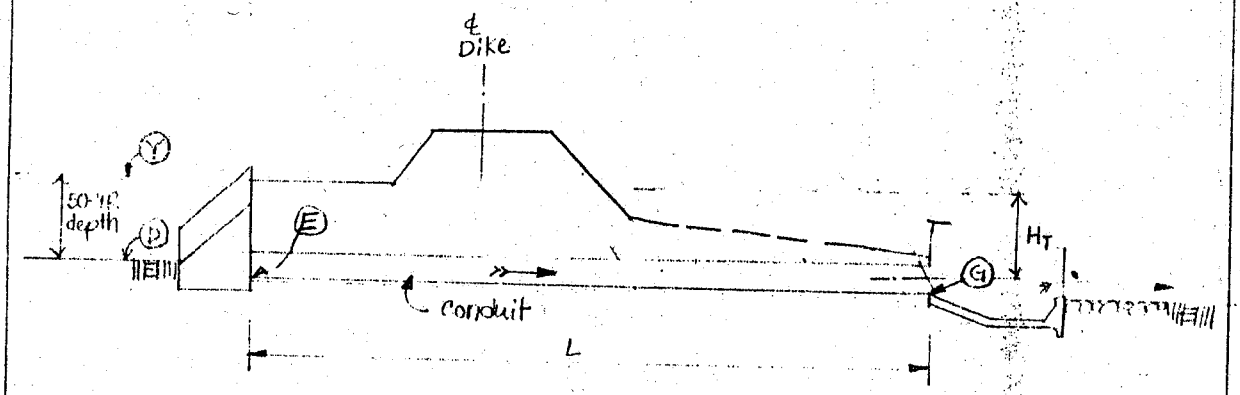
1 - 1'-0"	6 4'-0"
2 2'6"	Length - 8'0"
3 2'-6"	A1 = 7'-7 3/4"
4 3'-8"	B1 = 4'-9"
5 2'-2"	C1 = 4'6"

Bar Spacing = 10" c-c

Quantities
Vol. Conc. = 4.72 c.yd.
Rein. steel = 302 #

REVISED 2/6/79 AJ

VEGETATIVE MAINTENANCE CONDUIT - CAPACITIES



Discharge & velocity - estimated using figure E-7 (TR-46)

Elev. Y from HEC-2 Printout (see shts 3.1-27 thru 3.1-33)
Elev. G, D sht. 12/28 of construction plans
Length L as shown on plan/profile sheets

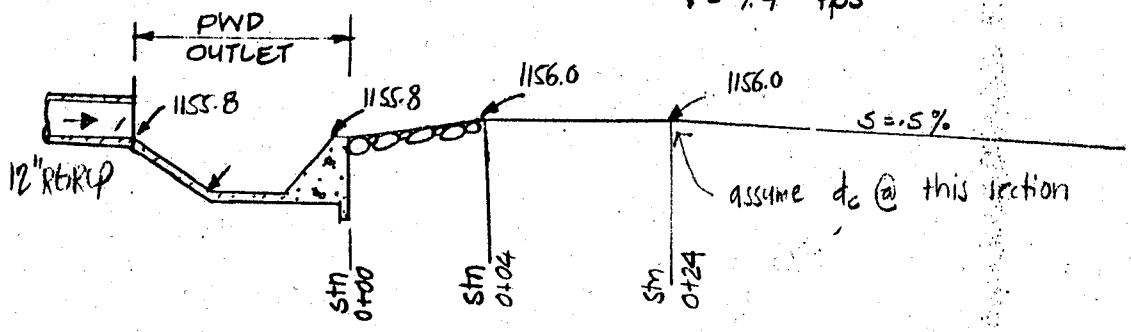
Station	D (MSL)	50-yr-depth (ft)	Y (MSL)	G (MSL)	H_T ft	L ft	Q cfs	V fps	E (MSL)
60+60 (12"Φ)	1156.68	3.4	1160.08	1155.8	3.78	70	6.2	7.9	1156.00
111+70 (12"Φ)	1141.80	3.56	1145.36	1140.8	4.06	"	5.0	6.4	1141.00
125+50 (12"Φ)	1138.98	3.46	1142.44	1137.8	4.14	70	5.0	6.4	1138.00
184+75 (12"Φ)	1120.03	3.52	1123.55	1117.0	6.05	"	8.0	10.2	1119.03
210+35 (21"Φ)	1114.39	3.49	1117.88	1113.8	3.21	"	19.5	8.1	1114.0

VEGETATIVE MAINTENANCE CONDUITS

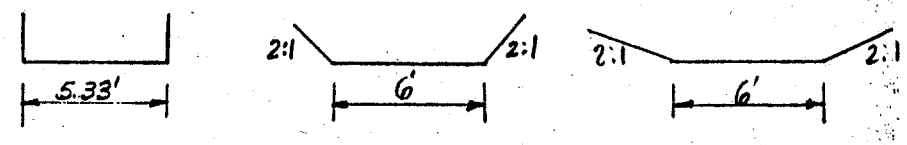
To check tailwater depth @ sill of PWD outlet (stn. 60+60)

Ref: Construction plans Sht. No. 6/28, 12/28

Conduit capacity from sht. 3.1-32 Q = 6.2 cfs
V = 7.9 fps



channel sections



stn 0+00 stn 0+04 stn 0+24

BACKWATER ANALYSIS (Results of HP.97 : Standard step Procedure used)

CROSS SECTION	INPUT							OUTPUT		COMMEI
	SIDE SLOPE Z:1	BOTTOM WIDTH B	LENGTH ft L	DISCHARGE cfs Q	INVERT ELEV. E	MANNING'S "n"	DEPTH "d" ft	VELOCITY fps	CWSEL	
0+24	2	6	0	6.2	1156.0	.02	d_c = .3	3.13	1156.3	Assume c
0+04	"	"	20	"	"	.035		1.51	1156.57	
0+00	.01	5.33	4	"	1155.8	"	.79	1.47	1156.59	

Tailwater depth @ PWD sill = .79 > (d_c = .35)

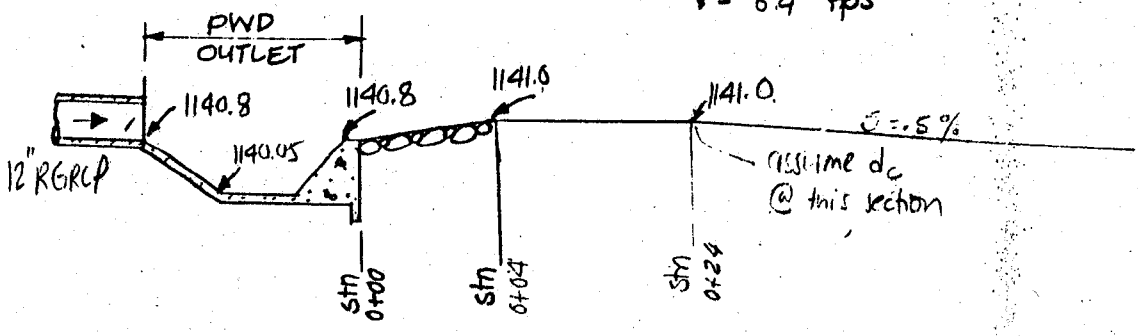
Revised 2/8/79

VEGETATIVE MAINTENANCE CONDUITS

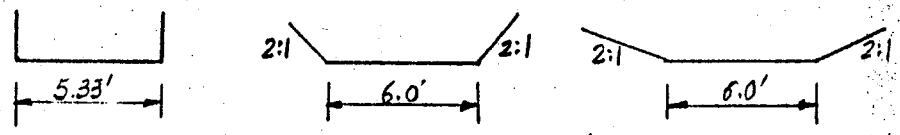
To check tailwater depth @ sill of PWD outlet (stn. 111+70)

Ref: Construction plans Sht. No. 7/28, 12/28

Conduit capacity from sht. 3.1-32 Q = 5.0 cfs
V = 6.4 fps



channel Sections



stn 0+00 stn 0+04 stn 0+24

BACKWATER ANALYSIS (Results of HP.97 : Standard step Procedure used)

CROSS SECTION	INPUT: SIDE SLOPE Z:1	BOTTOM WIDTH B	LENGTH ft L	DISCHARGE cfs Q	INVERT ELEV. E	MANNING'S "n"	DEPTH "d" ft	OUTPUT: VELOCITY fps	CWSEL	COMMEN
0+24	2	6	0	5.0	1141.0	.03	d_c = .27	2.83	1141.27	Assume d
0+04	2	6	20	"	"	.035		1.40	1141.51	
0+00	.01	5.33	4	"	1140.8	.035	.72	1.29	1141.52	

Tailwater depth @ PWD sill = .72' > (d_c = .3')

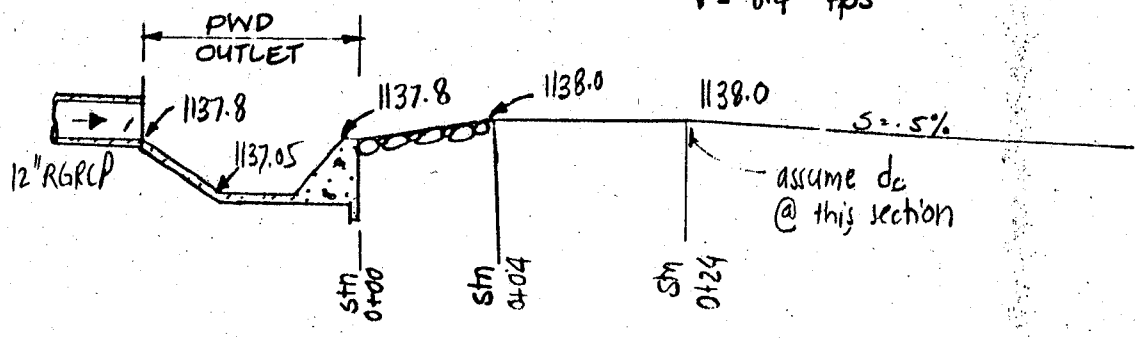
Design OK

VEGETATIVE MAINTENANCE CONDUITS

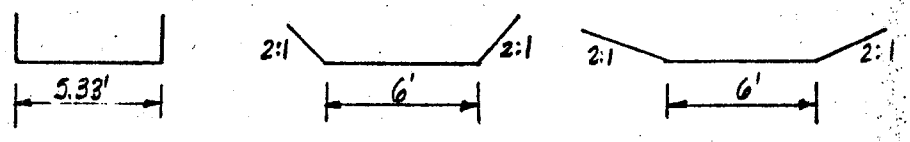
To check tailwater depth @ sill of PWD outlet (stn. 125+50)

Ref: Construction plans Sht. No. 8/28, 12/28

Conduit capacity from sht. 3.1-32 Q = 5.0 cFs
V = 6.4 fps



channel sections



stn 0+00 stn 0+04 stn 0+24

BACKWATER ANALYSIS (Results of HP-97 : Standard step Procedure used)

CROSS SECTION	INPUT							OUTPUT		COMMEN
	SIDE SLOPE Z:1	BOTTOM WIDTH B	LENGTH ft L	DISCHARGE cFs Q	INVERT ELEV. E	MANNING'S "n"	DEPTH "d" ft	VELOCITY fps	CWSEL	
0+24	2	6	0	5.0	1138.0	.03	d_c = .27	2.84	1138.27	Assume d_c
0+04	2	6	20	"	"	.035			1138.51	
0+00	.01	5.33	4	"	1137.8	"	.72		1138.52	

Tailwater depth @ PWD sill = .72' > (d_c = .3')

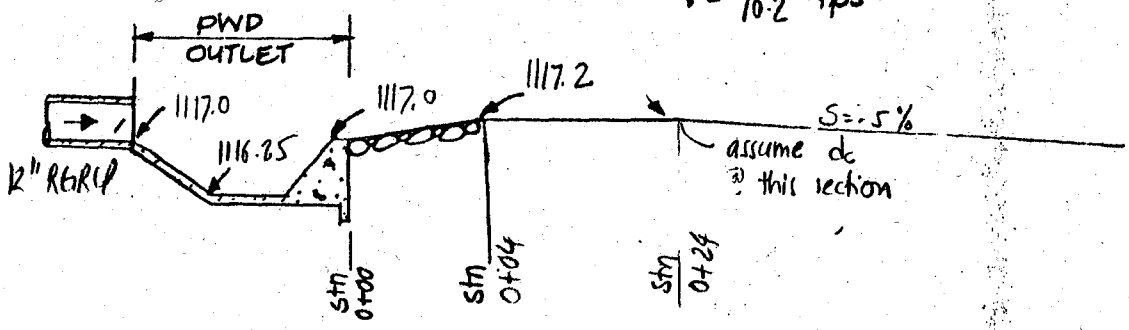
AD 2/8/79

VEGETATIVE MAINTENANCE CONDUITS

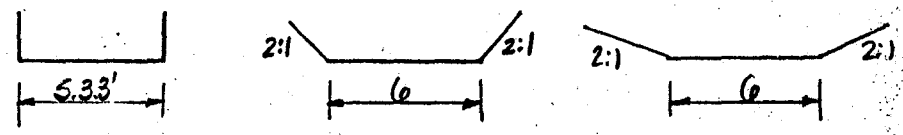
To check tailwater depth @ sill of PWD outlet (stn. 184+75)

Ref: Construction plans Sht. No. 9/28, 12/28

Conduit capacity from sht. 3.1-32 Q = 8.0 cfs
V = 10.2 fps



channel sections



stn 0+00 stn 0+04 stn 0+24

BACKWATER ANALYSIS (Results of HP.97 : Standard step Procedure used)

CROSS SECTION	INPUT							OUTPUT		COMMEN
	SIDE SLOPE Z:1	BOTTOM WIDTH B	LENGTH ft L	DISCHARGE cfs Q	INVERT ELEV. E	MANNING'S "n"	DEPTH "d" ft	VELOCITY fps	CWSEL	
0+24	2	6	0	8.0	1117.2	.03	d_c=.36	3.31	1117.56	Assume d_c
0+04	2	6	20	"	"	.035		1.71	1117.84	
0+00	.01	5.33	4	"	1117.0	"	.85	1.76	1117.85	

Tailwater depth @ PWD sill = .85' > (d_c = .41')

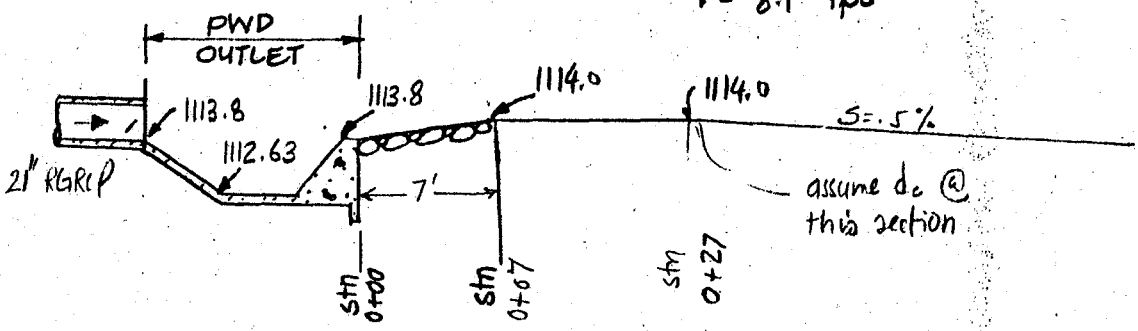
Reviewed
AP 2/8/79

VEGETATIVE MAINTENANCE CONDUITS

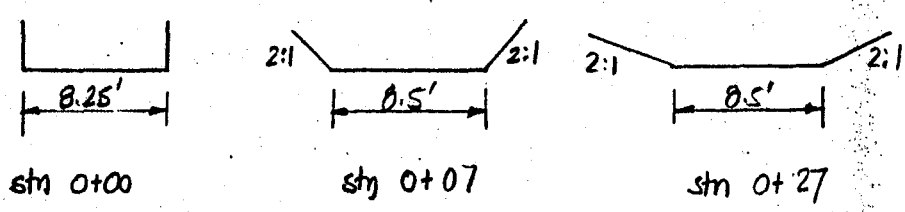
To check tailwater depth @ sill of PWD outlet (stn. 210+35)

Ref: Construction plans Sht. No. 10/28, 12/28

Conduit capacity from sht. 3.1-32 Q = 19.5 cfs
V = 8.1 fps



channel sections



BACKWATER ANALYSIS (Results of HP.97 : Standard step Procedure used)

CROSS SECTION	INPUT							OUTPUT		COMM
	SIDE SLOPE Z:1	BOTTOM WIDTH B	LENGTH ft L	DISCHARGE cfs Q	INVERT ELEV. E	MANNING'S "n"	DEPTH "d" ft	VELOCITY fps	CNSEL	
0+27	2	8.5	0	19.5	1114.0	.03	d_c=.52	3.93	1114.52	Assume
0+07	2	"	20	"	"	.035		2.24	1114.85	
0+00	.01	8.25	7	"	1113.8	"	1.08	2.18	1114.88	

Tailwater depth @ PWD sill = 1.08 > (d_c = .56)

Design OK

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BY G.S. DATE 10/27/78 CLIENT S.C.S. SHEET NO. ____ OF ____

CHECKED ____ DATE ____ JOB ____ JOB NO. ____

VEGETATIVE MAINTENANCE CONDUITS

Selection of antiseep collars and cradle length

Ref. TR-46 p. E-23
Assume Type 1 embankment and ML, SM soil, ∴ Use chart 1.20

Use vertical projection (v) of 2.5'

From chart 1.20 p. E-23 for v = 2.5' and length for conduit read number of collars

Conduit 60+60

Use L'=L of 80' Min number of collars = 3 Use 3 collars ←

Length of cradle = 95' Collar spacing (s) = $\frac{80}{4}$ = 20' >10<25 (ok)

Conduit 111+70

Use L'=L of 80' Min. number of collars = 3 Use 3 collars ←

Length of cradle = 210' Collar spacing = $\frac{80}{4}$ = 20' >10<25 (ok)

Conduit 125+50

Use L'=L of 80' Use 3 collars

Length of cradle = 102' Collar spacing 80/4 = 20' >10<25 (ok)

Conduit 184+75

Use L'=L of 80 Use 3 collars ←

Length of cradle = 105' Collar spacing 80/4 = 20' >10<25 (ok)

Conduit 210+35

Use L'=L of 80' Use 3 collars ←

Length of cradle = 93' Collar spacing 80/4 = 20' >10<25' (ok)

Note: The lengths of the conduits were standardized at 70ft. long. The collar spacing was standardized to 16ft spacing.

Vegetative Maintenance Conduits

Reference: Diversion Channel Plans

Comment was made that collar spacing be changed from 21' to 16' to more centrally locate the collars under the embankment. Because top width of compacted embankment was changed from 22' to 12' it has been decided to put one collar @ the ℄ of the embankment and a collar @ 12' on either side of the ℄. This will put all three collars within the compacted embankment. A 12' spacing will meet the requirements for spacing, 10' min. and 25' max. from TR-46.

Camber and Settlement

References: Geologic Investigation Report, Saddleback FRS and Diversion, Horquehola Valley Watershed.
Same title as above, Material Testing Results

Station	① Top of Dike Elev.	② ~Nat. Ground Elev. (Ave)	③ Pipe Invert Elev.	④ Surcharge Ht. (ft) = ①-②
60+60	1163.8	1159	1156.00	4.8
111+70	1148.8	1145	1141.00	3.8
125+50	1145.5	1140	1138.00	5.5
184+75	1126.6	1120.5	1119.03	6.1
210+35	1121.0	1116	1114.00	5.0

The above table indicates the average height of embankment that will be acting as a surcharge pressure on the conduit foundation. From the geology reports, referenced above, it was found that the conduits will be at or very close (within 3.0') to caliche, a cemented regolith, that has fairly high in-place density. Caliche is assumed to be incompressible for the relatively small surcharges applied to it. Camber of the conduits was not deemed necessary because of negligible settlement for the reasons stated above.

The conduits were placed at a slight slope to insure that ponding in the pipe will not occur.

Any stresses that might otherwise occur between the anti-seep collar and conduit because of minor differential settlement will be minimized or eliminated by the ½ in. thick preformed joint filler between the cradle and collar and the cradle itself.

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DIVERSION CHANNEL BOTTOM ACCESS RAMPS

Required: Access to channel bottom at one mile intervals. Ramp grade is not to exceed a slope of 6:1. Ramp width is to be 12'.

Ramp Location and type

Sta. 9+50 from west side sloping to the channel bottom in north direction

Sta. 75+00 from west side to channel bottom, ⊥ to channel

Sta. 135+00 from west side to channel bottom, ⊥ to channel

Sta 180+00 from west side to channel bottom, ⊥ to channel

Sta 230+00 " " " " " " " " "

A dip section at 479th Ave (Sta. 47+76) will serve as the sixth and final access ramp.

Additional access ramps were added at the following locations 11+20, 110+00, 141+00, & 46+50 (479th Ave). Ramp width was changed to 20'.

Station	Depth	h(ft)	Ramp Slope
11+20	5.0	1.5	5.9:1
110+00	5.0	1.5	5.9:1
141+00	4.0	1.5	6.3:1

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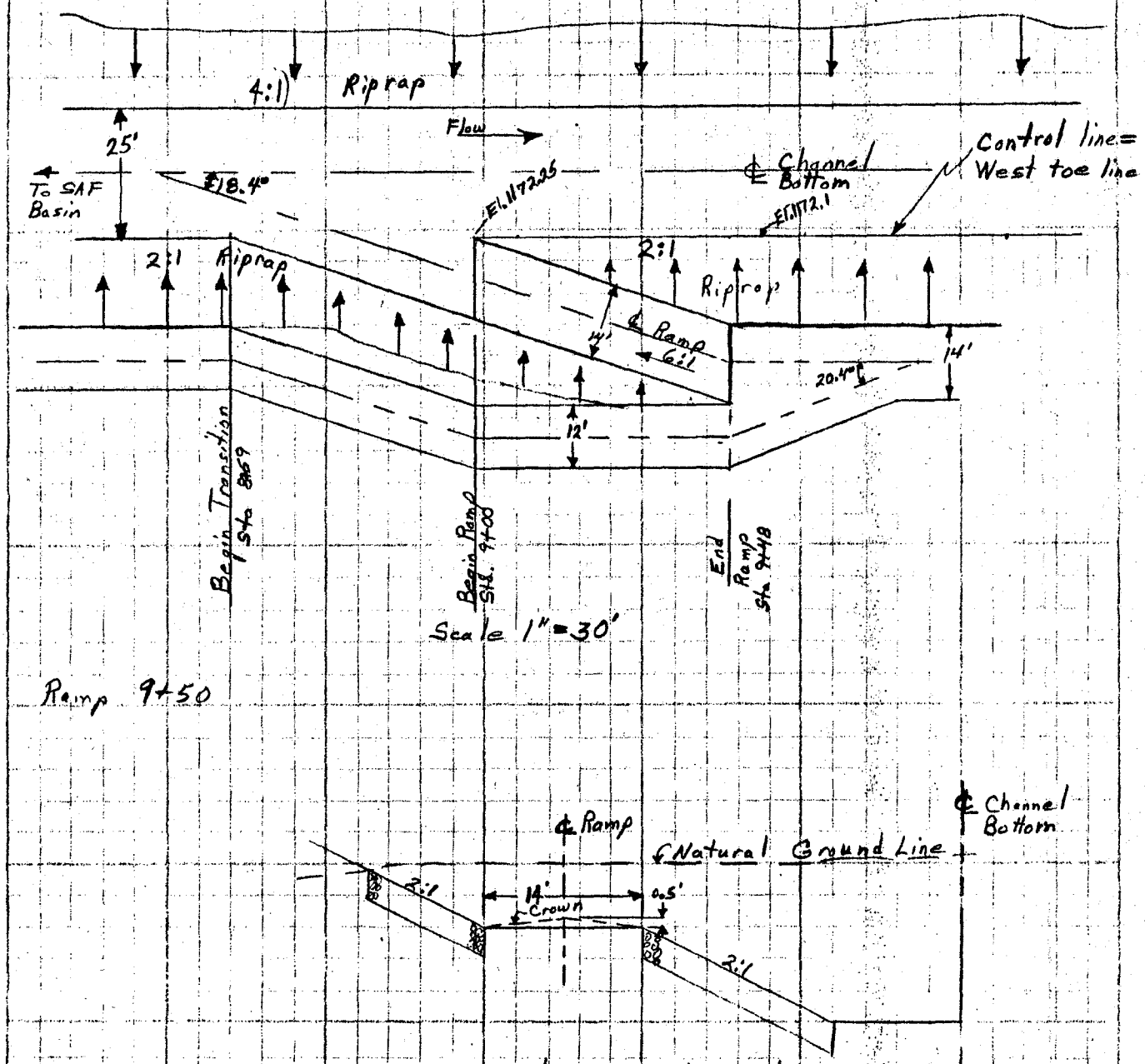
DIVERSION CHANNEL BOTTOM ACCESS RAMPS



Ramp 9+50

Typical Ramp Half Section
(Not to Scale)

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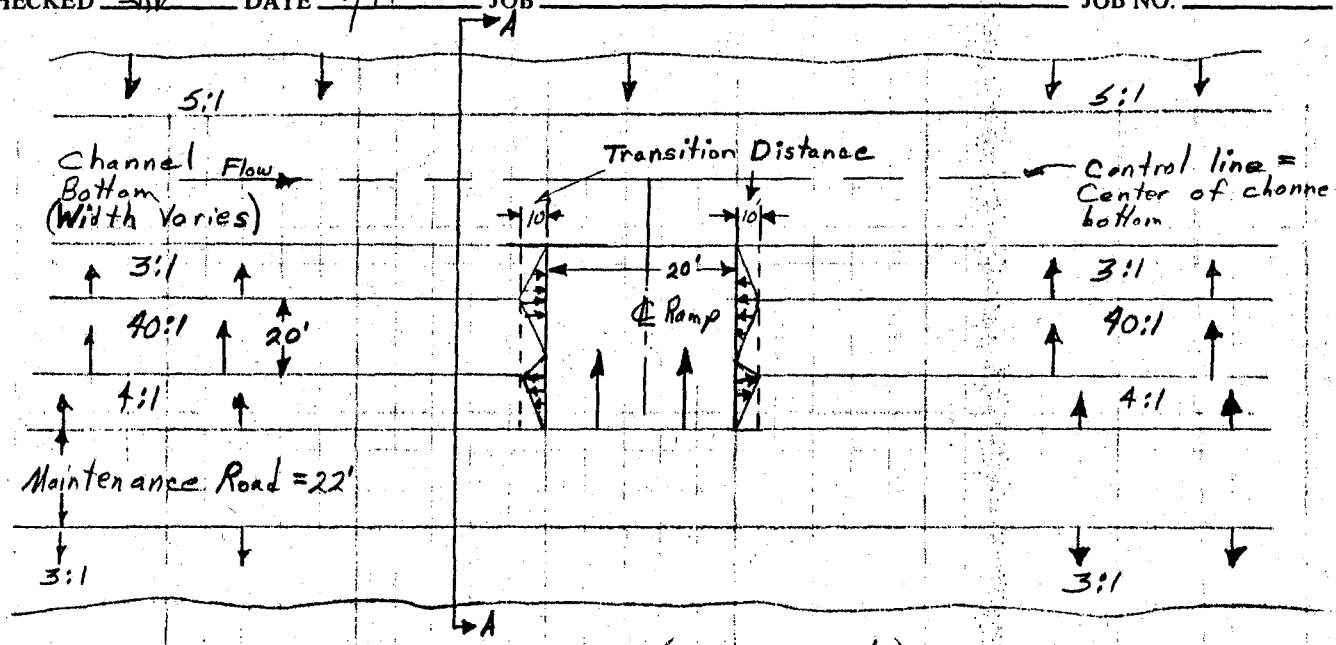
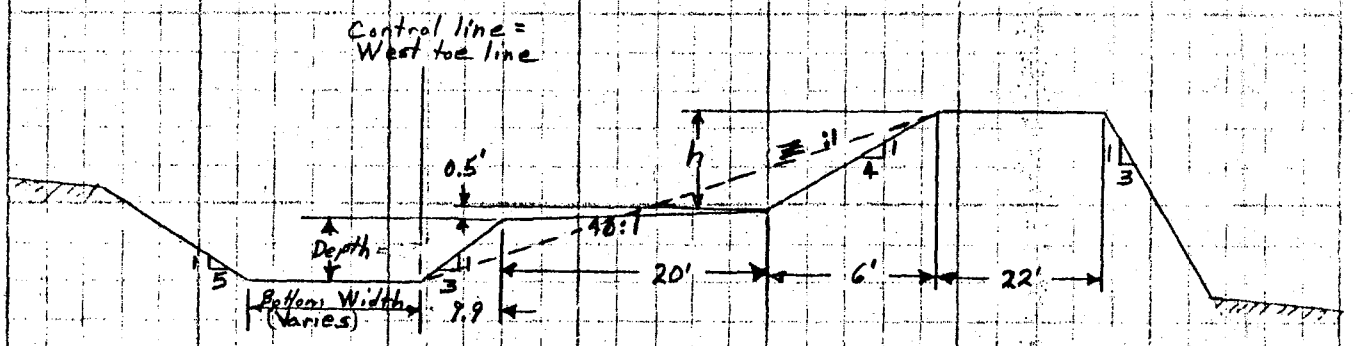
CHECKED ____ DATE 2/79 JOB ____ JOB NO. ____



Plan (Not to Scale)



Section A-A (Not to Scale)

DIVERSION CHANNEL BOTTOM ACCESS RAMPS

Location of above access ramps (℄) by control line stationing

Ramp	Station	Depth (ft)	h (ft)	Ramp Slope z:1 (not greater than 6:1)
1	75+00	4.5	1.5	6.1:1 (OK)
2	135+00	4.2	1.5	6.2:1 (OK)
3	180+00	5.0	1.5	5.9:1 (OK)
4	230+00	4.5	1.5	6.1:1 (OK)

Note: Transition Distance, as shown above, is the distance used to adjust from the standard embankment profile to the ramp profile and vise versa.

Inlet	Station	
#2	14+00	damaged
#3	29+00	overtopped
#4	41+62	Underdesigned
5	52+00	located wrong
#6	61+25	Collector channel
7	80+12	new inlet at 72+00
#8	94+08	overtopped
9		Collector channel
10		Collector channel
11	128+32	overtopped
12		Collector channel
13		Collector channel
14	173+98	overtopped
15	183+65	Collector channel
16	202+00	erosion
17	220+00	
18	241+75	new inlet

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BY JB DATE 9/26/78 CLIENT U.S. Soil Conservation Service SHEET NO. ____ OF ____

CHECKED ____ DATE ____ JOB Saddleback FRS & Div. Chl. JOB NO. 3043-000

Weir Inlets - 50-YR Design Discharge Estimation

TR-20 AREA (Schematic)	AREA SQ MI.	CFS Q	SUB AREA	AREA SQ. MI.	cfs Q (Design Weir)	Approx. Q/2	Approx. Q/3
7c (025)	0.84	773	1	0.84	773	400	25[illegible]
7A (028)	0.293	355	2	0.293	355	200	11[illegible]
7B (031)	0.554	739	3	0.129	172	100	[illegible]
			4	0.136	182	100	[illegible]
			5	0.133	177	100	[illegible]
			6	0.156	208	100	[illegible]
7c (034)	1.075	956	7	1.075	956	500	32[illegible]
8A (037)	1.304	1220	8	0.160	150	100	[illegible]
			9	0.572	535	250	[illegible]
			10	0.572	535	250	[illegible]
8B (040)	2.323	1740	11	0.235	176	100	[illegible]
			12	1.064	797	400	[illegible]
			13	0.228	171	100	[illegible]
			14	0.600	449	200	[illegible]
			15	0.196	147	100	[illegible]
9A (043)	2.623	1792	16	0.310	212	100	
			17	1.156	790	400	
			18	1.157	790	400	
9B (046)	0.432	437	19	0.432	437	200	[illegible]

* Swale Design Q

TOUPS CORPORATION

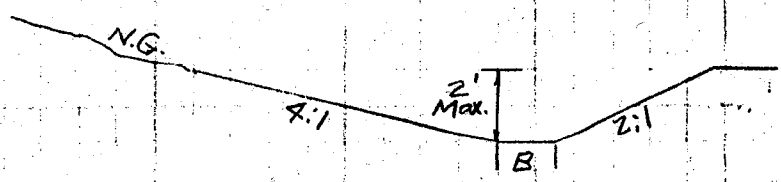
CONSULTING ENGINEERS AND PLANNERS

BY JB DATE 9/27/78 CLIENT US. Soil Conservation Service SHEET NO. ____ OF ____

CHECKED ____ DATE ____ JOB Saddleback FRS & Div. Ch1 JOB NO. 3043-000

Lateral Swale Design Table for subarea (1-19) contributary

50 yr frequency storm runoffs.



TYPICAL SECTION
(LOOKING DOWNSTREAM)

Z:1 = 3 (Average)
B = Varies
n = 0.03
d = 2' (Max.)
S = 0.003%

B	d	Q	V	Dist. out from top of 2:1 slope
0.0001	1	4.95	1.65	+6'
10	1	30	2.33	+16
20	1	57	2.48	+26
30	1	84	2.54	+36
40	1	111	2.58	+46
0.0001	2	31	2.62	+12'
10	2	109	3.42	+22'
20	2	192	3.70	+32'
30	2	277	3.85	+42'
40	2	362	3.94	+52'
50	2	448	4.00	+62'
ITCH TO PT 1	10	2	141	4.4	S = 0.005 Z = 3 (AV.)

LATERAL WASHES SECTIONS THRU EAST BANK

PT (1) [a] AREA 7_c 0.34 SM Q_{50} = 773 CFS

CHANNEL THRU BANK

B = 60' Z = 2 n = 0.03 D = 2' S = 0.067

V = 6.1 Q = 782 CFS

PT (2) AREA 7A 0.29 SM Q_{50} = 355 CFS

B = 22' Z = 2 n = 0.03 D = 2' S = 0.01

V = 7.0 Q = 364

PT (3) AREA 0.129 SM Q_{50} = 172

B = 10' Z = 2 n = 0.03 D = 2' S = 0.01

V = 6.4 Q = 180

PT (4) AREA 0.136 SM Q_{50} = 182

B = 10' Z = 2 n = 0.03 D = 2' S = 0.01

V = 6.4 Q = 180

PT (6) AREA 0.133 SM Q_{50} = 177

B = 10' Z = 2 n = 0.03 D = 2' S = 0.01

V = 6.4 Q = 180

PT (5) AREA 0.156 SM Q_{50} = 208

B = 12' Z = 2 n = 0.03 D = 2' S = 0.01

V = 6.6 Q = 210

PT (7) AREA 1.075 SM Q_{50} = 956

B = 45 Z = 2 n = 0.03 D = 2' S = 0.02

V = 10.4 Q = 1022

PT (8) AREA 0.16 SM Q_{50} = 150

B = 10 Z = 2 n = 0.03 D = 2' S = 0.0155

V = 7.4 Q = 207

[a] See sht. 3.1-55 for approx. weir inlet location

LATERAL WASHES (CONT'D)

PT (9) AREA 0.572 SM $Q_{50} = 535$

B= 45' Z= 2' n= 0.03 D= 2' S= 0.0057

V = 5.6 Q= 546

PT (10) AREA 0.572 SM $Q_{50} = 535$ S= 0.01

B= 35' Z= 2 n= 0.03 D= 2'

V= 7.3 Q= 566

PT (11) AREA 0.235 SM $Q_{50} = 176$

B= 12 Z= 2 n= 0.03 D= 2 S= 0.008

V= 5.9 Q= 188

PT (12) AREA 1.064 $Q_{50} = 797$

B= 45 Z= 2 n= 0.03 D= 2 S= 0.0133

V= 8.5 Q= 834

PT (13) AREA 0.600 Q= 447

B= 25' Z= 2 n= 0.03 D= 2 S= 0.0133

V= 8.1 Q= 474

PT (14) AREA 0.196 Q= 147

B= 10 Z= 2 n= 0.03 D= 2 S= 0.01

V= 6.4 Q= 180

PT (15) AREA 0.310 $Q_{50} = 212$

B= 15 Z= 2 n= 0.03 D= 2 S= 0.01

V= 6.7 Q= 256

PT (16) AREA = 1.156 $Q_{50} = 790$

B= 50 Z= 2 n= 0.03 D= 2 S= 0.01

V= 7.4 Q= 801

LATERAL WASHES (CONT'D)

BY (17) AREA = 1.157 Q_{50} = 790

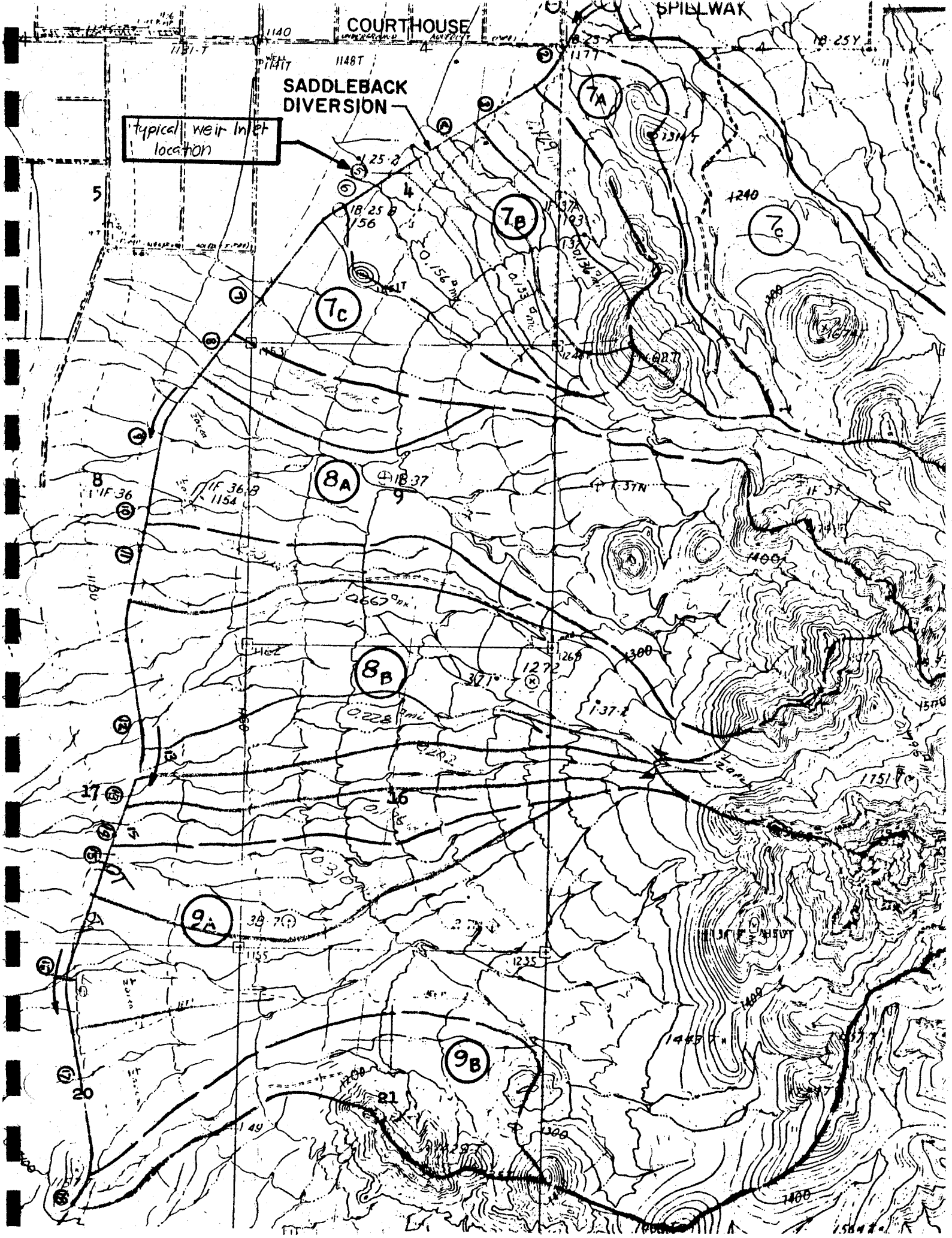
B = 45 Z = 2 n = [illegible] S = 0.0125

V = 8.2 Q = 808

BY (18) AREA = 0.432 Q_{50} = 437

B = 20 Z = 2 n = [illegible] S = 0.02

V = 9.8 Q = 471


COURTHOUSE
SPILLWAY
SADDLEBACK DIVERSION
Typical weir inlet location
7A
7B
7C
8A
8B
9A
9B

SEDIMENT TRANSPORT AND DEPOSITION

The Soil Conservation Service analysis, based on sedimentation data dated February 21, 1979 and the geologic report, reveals that sediment deposition would take place in the diversion. Several factors affect the amount of deposition: e.g., the flow depth in diversion, average flow velocity and amount of concentrated flow from uncontrolled watershed tributary at weir inlets.

The following points were considered in this analysis:

1. Since the design discharge is based upon size of contributing drainage area, the sediment delivered at weir inlets was prorated based on drainage area.

2. Deposition would occur immediately downstream of the weir inlet for which sediment delivery was calculated.

Based on above conditions, average deposition was estimated in Table No. 1 for a 50-Year and average annual storm in columns (i) and (k) respectively.

50-Year: The most severe estimated deposition of 1.3 feet, would occur from Station 7+00 to Station 14+00. However, because of the channel design calling for a freeboard of two feet in this reach, there are no critical conveyence areas. In the remaining portion of the diversion, deposition is estimated to range from less than an inch to five inches. A minimum freeboard of one foot will still be available after the loss in hydraulic capacity due to this deposition.

Average Annual:

Average annual deposition will be insignificant to create any critical hydraulic conditions. It is estimated that, in the reach from Station 7+00 to Station 14+00, it will take 130 years before any potential of dike overtopping would occur. This estimate is based upon an average annual storm.

Deposition more frequently would occur immediately downstream from the weir inlet locations. Removal of these sediment deposits is therefore recommended on a regular basis.

Tributary to Centennial Wash:

It is estimated that in the Tributary 4.8 AF deposition would occur in a 50-Year frequency storm.

The diversion channel outlets in a sheet flow fashion to the Centennial Wash Tributary. The discharged flow concentrates in the Tributary and flows in a Southerly direction. There will be substantial loss in energy where the flow becomes concentrated in the Tributary. At this location, it is estimated that the 50-Year water surface elevation will be raised by 0.3 feet because of a loss of hydraulic capacity due to deposition.

$$\text{deposition depth} = \frac{4.8\ \text{AF} \times 43560\ \frac{\text{CF}}{\text{AF}}}{\text{deposition area}}$$

$$= \frac{4.8 \times 43560}{1000 \times 700} = 0.3\ \text{feet}$$

Since the deposition of 0.3 feet is not major, in a 50-Year flood event it's effect on the 50-Year Floodplain will be insignificant.

CENTENNIAL WASH

An estimated 2.8 AF of sediments will enter Centennial Wash from the Tributary in a 50-Year Storm Event. Since both the Wash and Tributary flow in the same general direction, a more gradual sediment drop is expected to occur in the Centennial Wash.

The sediment deposition is estimated to be:

$$= \frac{\text{sediment volume in Cu. Ft.}}{\text{floodplain width (ft) x reach length (ft)}}$$

$$= \frac{2.8 \times 43560}{1000 \times 2000}$$

$$= 0.06 \text{ feet}$$

The 0.06 feet deposition is insignificant to produce any change in the 50-Year Floodplain elevation.

SEDIMENTATION: SADDLEBACK DIVERSION

	Average Annual Storm	50-Year Storm
Sediment Yield in to Diversion:		
a. From FRS	.48 AF	.6 AF
b. From uncontrolled Area	1.85 AF	14.2 AF
TOTAL	2.33 AF	14.8 AF
Bedload deposition in Diversion	.08 AF	7.2 AF
Sediment entering Tributary	2.25 AF	7.6 AF
Sediment deposition in Tributary	2.25 AF±	4.8 AF
Sediment entering Centennial Wash	0 AF	2.8 AF

SEDIMENT ANALYSIS - TABLE 1

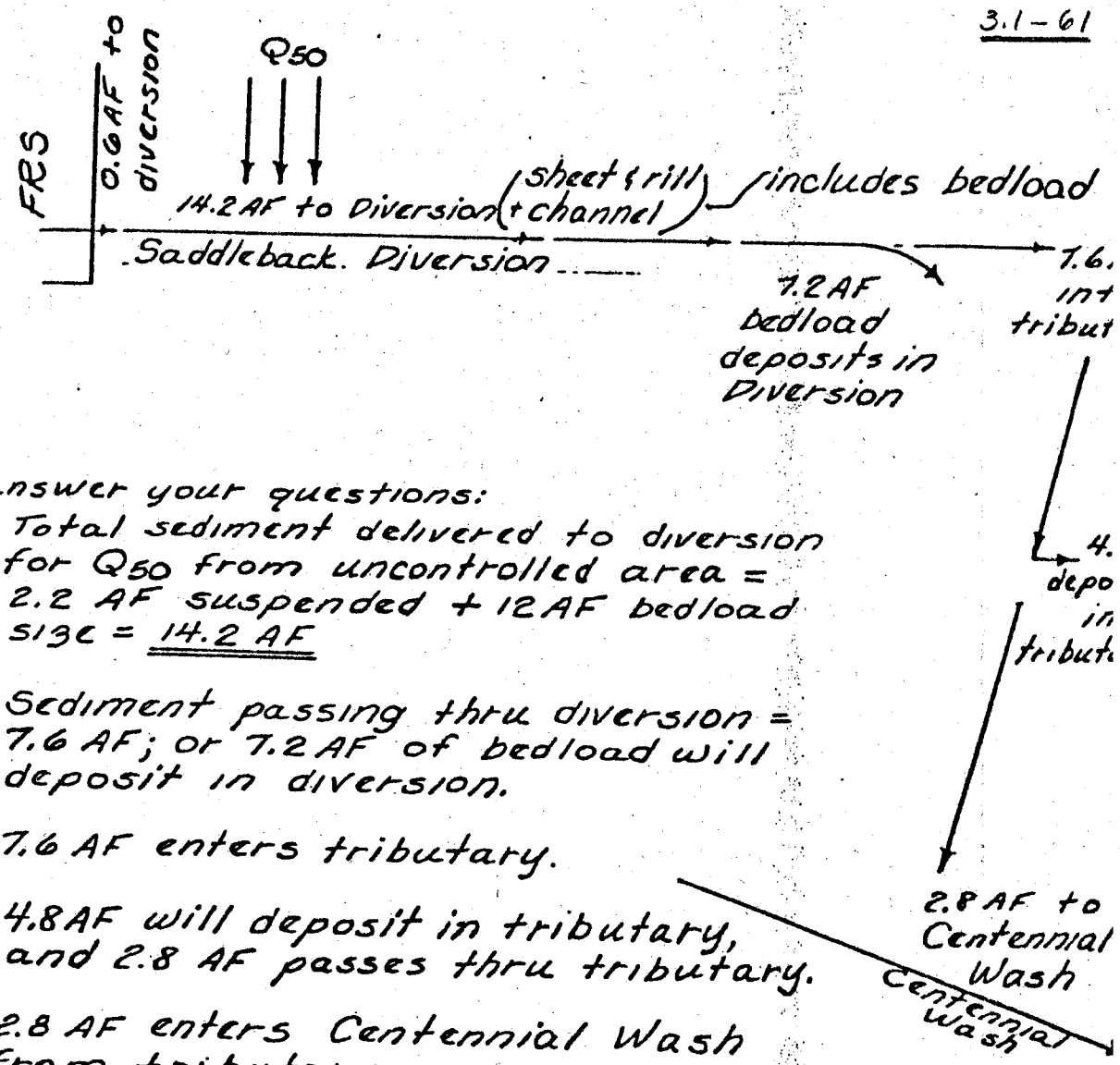
WEIR INLET NO.	APPROX. STA. (Ft)	CH. BTM WIDTH (Ft)	LENGTH STA. to STA (Ft)	AREA OF DEPOSITION (Ac)	APPROX. D.A. (Sq.mi.)	% AREA	50-YEAR SED DEPOSIT (Ac Ft)	50-YEAR AVE. DEPOSITION (Ft)	AVE. ANNUAL SED DEPOSIT (Ac Ft)	AVE. ANNUAL AVE. DEPOSITION (Ft)
a	b	c	d	$e = \frac{c \times d}{43560}$	f	$g = \frac{f}{\Sigma A}$	$h = 7.2 \times g$	$i = \frac{h}{e}$	$j = .08 \times g$	$k = \frac{j}{e}$
1	7+00	30	700	.48	.84	.09	.65	1.3	.0072	.015
2	14+00	30	1500	1.21	.29	.03	.22	.18	.0024	.002
3	29+00	40	1250	1.36	.13	.01	.07	.05	.0008	.0006
4	41+50	55	1050	1.57	.14	.01	.09	.06	.0008	.0005
5	52+00	75	925	1.75	.13	.01	.07	.04	.0008	.0005
6	61+25	90	1875	4.63	.16	.02	.14	.03	.0016	.0003
7	80+00	125	1400	4.34	1.07	.11	.82	.19	.0088	.002
8	94+00	145	1450	5.08	.16	.02	.14	.03	.0016	.0003
9	108+50	160	1300	5.07	.57	.06	.43	.08	.0048	.0009
10	121+50	180	600	2.55	.57	.06	.43	.17	.0048	.0019
11	127+50	190	3100	14.94	.29	.03	.22	.02	.0024	.0002
12	158+50	230	1150	6.2	1.12	.12	.86	.14	.0096	.0015
13	170+00	240	400	2.2	.65	.07	.50	.23	.0056	.0025
14	174+00	240	950	5.34	.26	.03	.22	.04	.0024	.0004
15	183+50	250	1850	10.62	.31	.03	.22	.02	.0024	.0002
16	202+00	250	1900	12.43	1.16	.12	.89	.07	.0096	.0008
17	221+00	290	300	2.01	1.16	.12	.88	.44	.0096	.0048
18	224+00	295	2600	23.73	.43	.05	.36	.02	.004	.0002
	250+00	500								
					$\Sigma 9.4$	$\Sigma 1.0$	$\Sigma 7.2$		$\Sigma .08$	

COMPUTATION SHEET
SCS-ENG-523 Rev. 8-69

U. S. DEPARTMENT OF AGRICULT
SOIL CONSERVATION SERVICE

STATE ARIZONA		PROJECT Harquahala Valley Watershed	
BY JG (copy)	DATE 2-20-79	CHECKED BY	DATE
SUBJECT Sedimentation - Saddleback Diversion			JOB NO. Saddleback Diver
			SHEET 1 OF 1

3.1-61



To answer your questions:

1) Total sediment delivered to diversion for Q50 from uncontrolled area = 2.2 AF suspended + 12 AF bedload size = 14.2 AF

2) Sediment passing thru diversion = 7.6 AF; or 7.2 AF of bedload will deposit in diversion.

3) 7.6 AF enters tributary.

4) 4.8 AF will deposit in tributary, and 2.8 AF passes thru tributary.

5) 2.8 AF enters Centennial Wash from tributary.

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CONSULTING ENGINEERS AND PLANNERS

BY JB DATE 10/24/78 CLIENT SCS SHEET NO. ____ OF ____

CHECKED ____ DATE ____ JOB Saddleback Diversion Chl. JOB NO. 3043-000

Sediment Transport Capacity of Tributary to Cardwell Wash (South of Div. Chl. outlet)

National Engineering Handbook (SCS), Section 3, Ch. 4.
"Rate of transport of that part of the total sediment load (suspended plus bed load) comprised of grain sizes found in the bed material is "bed-material load"."

This gives only bed-load (bed particles only).

Given: q_{50} (design: HEC 2, FRS + Div. Chl.) = 6160 cfs

Average width of tributary = 680 ft.

$q_{50} = q$ = discharge/ft of width = $\frac{6160}{680}$ = 8.91 cfs/ft

S_e = energy gradient (From HEC 2) = 0.0046 %

S_o = average tributary bottom slope (100' typ) = 0.004 %

d_{50} = grain size, 50% finer or larger (From TP 401.1, 0-1.2 ft, Geologic Invest. Report TOUPS LIB. 248)
= 0.12 mm = 0.0047 in = 0.000394 ft

Schoklitsch Formula: Bed-load only (Bed particles only)

$$q_B = \frac{86.7}{\sqrt{d_{50}}} S_e^{3/2} (q - q_o)$$ where,

q_B = lb/sec/ft of width (bed)

d_{50} = N inches

$$q_o = 0.00532 \frac{d_{50}}{S_o^{4/3}}$$ (English units)

$$q_o = 0.00532 \frac{(0.0047)}{(0.004)^{4/3}} = 0.0394$$

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Sediment Transport Capacity (cont.)

$$q_B = \frac{86.7}{\sqrt{0.0047}}(0.0046)^{3/2}(8.91 - 0.0394)^{8.8706}$$

$$q_B = 3.5 \text{ lb/sec/ft}$$

$$Q_B = (3.5 \text{ lb/sec/ft})(680 \text{ ft}) = 2380 \text{ lb/sec}$$

during Q_{50} storm at peak, time = 12.77 hours ‖

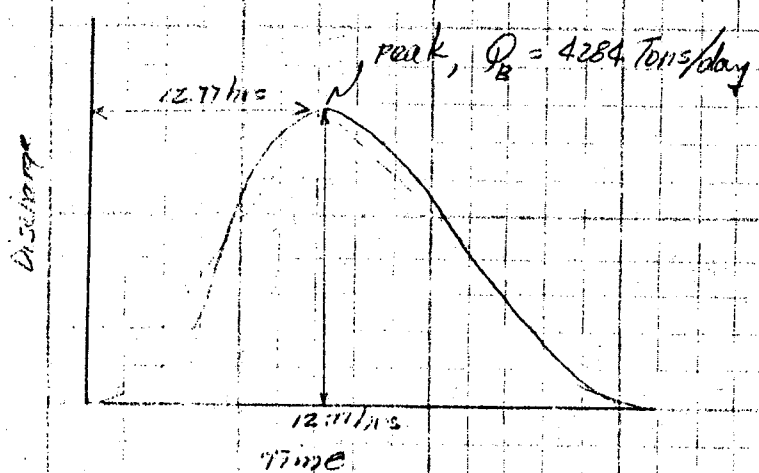
Total Q_B = Area under hydrograph where peak ordinate of equivalent area triangle = 2380 lb/sec = 4284 Tons/day

and the base = 2.67 × T_{peak} = 2.67 × 12.77 hrs / 24 hrs = 1.421 days

Total $Q_B = \frac{1}{2}(1.421)(4284) = 3043$ Tons

Assuming Density of material = 110 lb/ft³

$$\frac{(2000 \text{ lb/Ton})(3043 \text{ Tons})}{110 \text{ lb/ft}^3} = 55{,}327 \text{ ft}^3 \Rightarrow \underline{1.27 \text{ Acre-ft}}$$



Bed material load transported by tributary

‖ From TR-20 - Hydrology

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Sediment Transport Capacity of Tributary to Cottonwood Wash

See NEH Section 3, Ch. 4 pg. 4-21

Colby procedure for relating mean velocity to sand transport with grain size (d_{50}), water temp., fines concentration correction factors.

Given: TR-20 & HEC-2 runs.

Q_{50} @ Div. Chl. outlet = 6060 cfs

Sta. 211 – Mean Velocity (HEC-2) = 4.35 fps in tributary

Sta. 333 – " Depth = 4.54 ft " "

d_{50} = 0.12 mm (TP 401.1, 0-1.2' Geo. Invest. Report)

d_{50} ⇒ Correction factor of 70%

Figs. 4-7 a,b pg. 4-23

Assume water temp. = 60°F ⇒ No correction factor

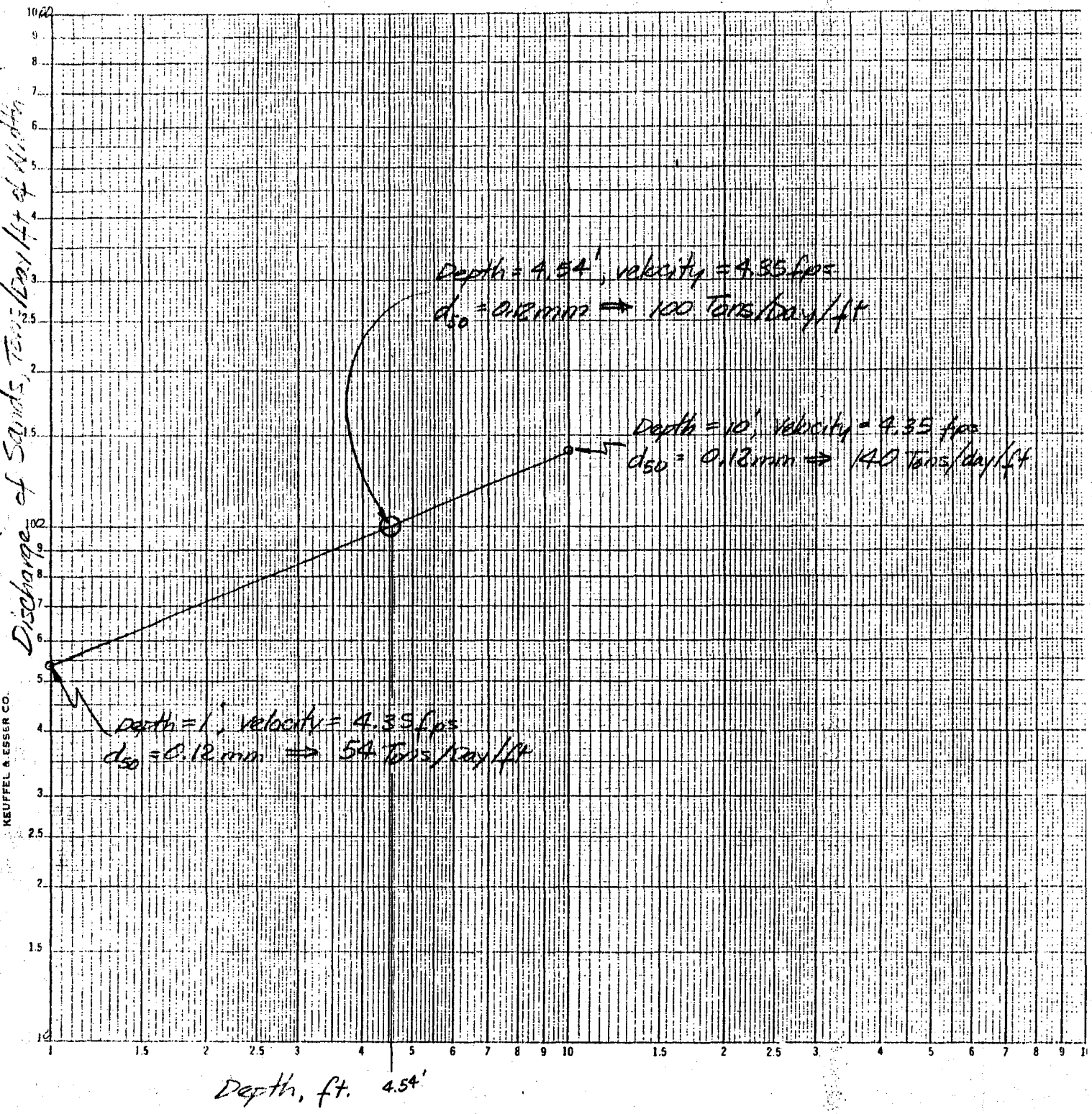
Assume sediment load = 30,000 ppm ⇒ correction factor = 1.50

From Figure 4-6,7 velocity-discharge-depth-d_{50} relationships were obtained bracketing the above given data. These values were plotted on log-log paper and velocity-discharge value interpolated. See attached.

Applying correction factor,

$(0.70)(1.5-1)(100 \text{ tons/day/ft.}) = 135 \text{ tons/day/ft}$

⇒ 91,800 tons/Day @ peak of 50 yr frequency storm.



Interpolation Between 1' and 10' Depth Curves.

From Fig. 4-6. SCS NEH 3
pg. 4-22

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To calculate total capacity as a basis of comparison with anticipated sediment to the tributary, use same method as on page (B.1-51) of these calcs.

Total Capacity = Area under triangle with peak of 91,800 Tons/Day

$= \frac{1}{2}(91{,}800 \text{ Tons/Day})(1421 \text{ Days}) = 65{,}224 \text{ Tons}$

Total Sediment Trap Capacity $= \dfrac{(65{,}224 \text{ Tons})(2000 \text{ lb/Ton})}{\dfrac{110 \text{ lb/ft}^3}{43{,}560 \text{ ft}^2/\text{Acre}}} = \underline{\underline{27.22 \text{ Acre-ft.}}}$

Revised 2/11/79 AP

DROP STRUCTURES

(GROUTED RIPRAP)

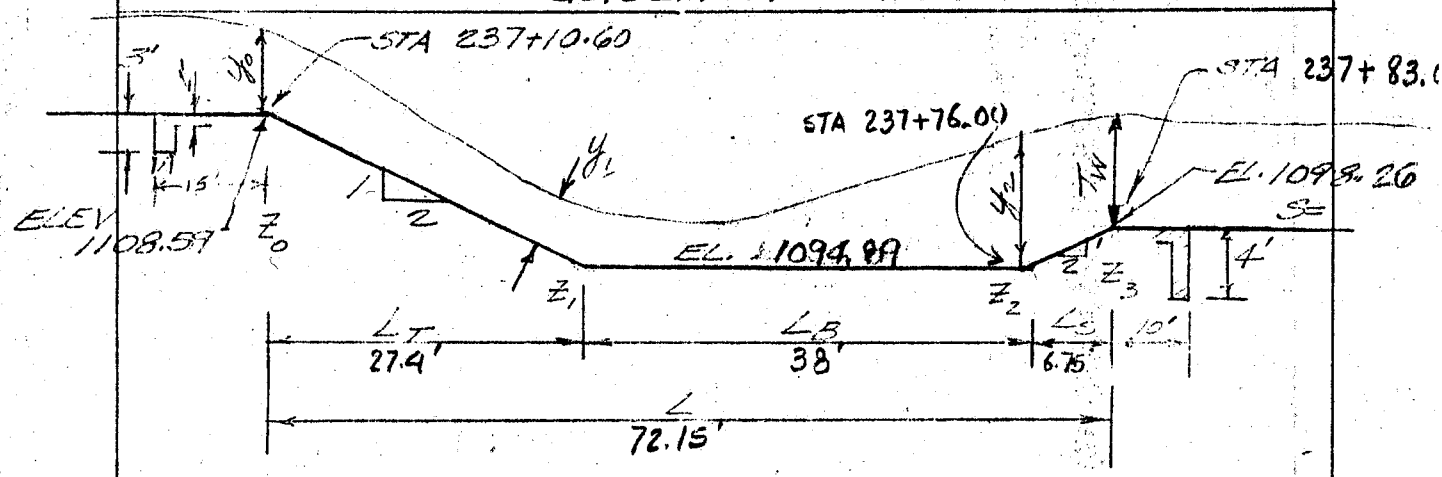
STA 237+10.60 Nº 4

DESIGN Q = 5970 CFS

LENGTH OF WEIR = 300'

q = 19.9 CFS / FT.

DESIGN REFER. : HEC Nº 14 – HYDRAULIC DESIGN OF ENERGY DISSIPATORS. U.S. DEPT. OF TRANSPORTATION



USE 10' WIDTH SECTION FOR DESIGN (RECT.)

FROM FIG III-3 HEC Nº 14 :

$y_0 = d_c = 2.3'$ $\quad V_0 = Q/A = 19.9 \times 10/23 = 8.65$ FPS

$W_B = 10'$

$$Q = y_1 W_B \left[2g(Z_0 - Z_1 + y_0 - y_1) + V_0^2\right]^{1/2}$$

$$199 = y_1 (10) \left[64.4(13.7 + 2.3 - y_1) + 8.65^2\right]^{1/2}$$

$y_1 = 0.61'$

$V_1 = \frac{199}{10 \times .61} = 32.65$ FPS

FROUDE $Fr_1 = V_1/\sqrt{g y_1} = \frac{32.65}{\sqrt{32.2 \times .61}} = 7.37$

FIG III-11 :

$Fr_1 = 7.37$; $L/y_1 = 62$; $L_B = 38'$ $\quad L_T = 27.4'$ $\quad L_S = 6.75$

$C_1 = 1.0$ for hyd. jump p. IV-B-9 HEC #14

$y_2 = C_1 y_1 \left[\sqrt{1 + 8Fr_1^2} - 1\right]/2 = 6.06'$

$T_W = 3.15'$ (FROM HEC 2 RUN) ELEV 1101.41

$y_2 + 1094.89' = $ ELEV 1100.95

T_W ELEV > y_2 ELEV ∴ OK

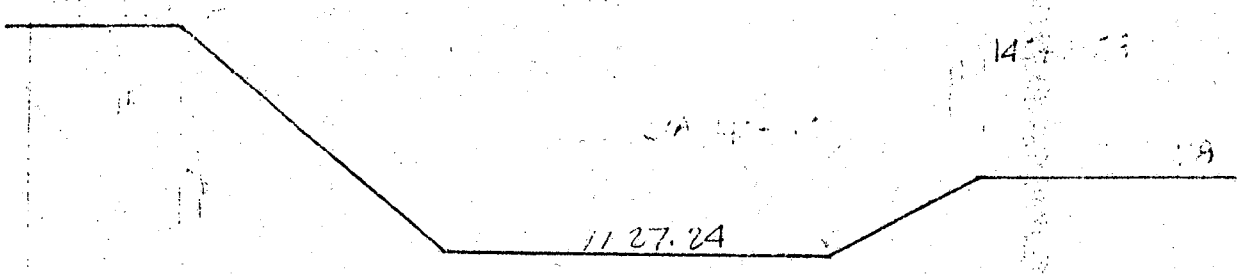
2/1/19

3.2-2

N=3

16'

3.98'



16'

4.98'

3.4'

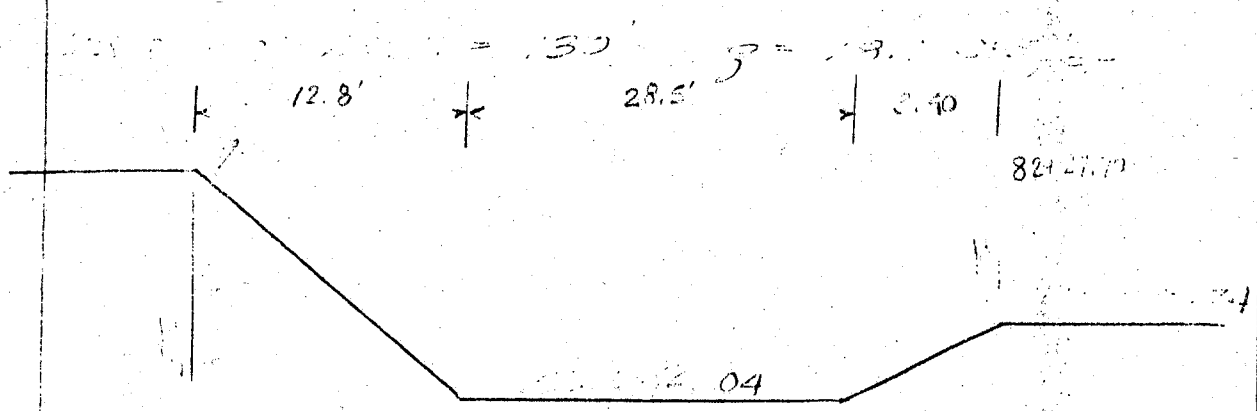
1123.18'

1127.24

10 for hyd jump from pt 5.1 HEC 14

2/11/79

№ 2



0.10'

75 = 24.1

24.1 × .75 = 4.91

38 = 28.5' = 12.8'

4.85'

3.4'

14

1146.04

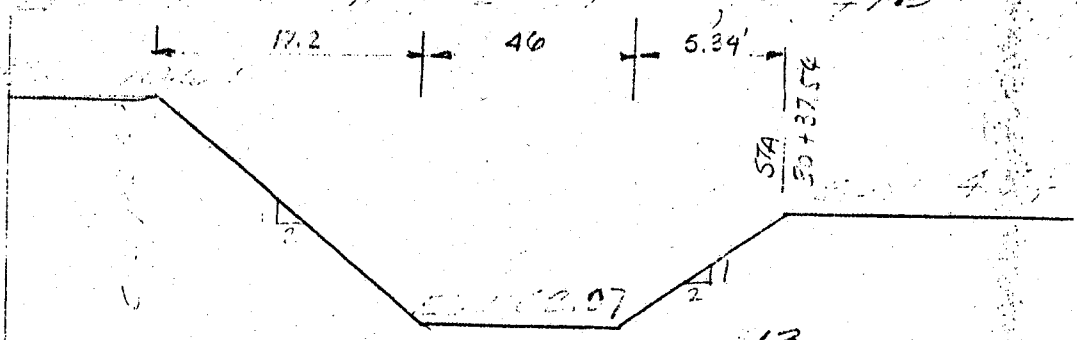
1150.89

C_1 = 1.0 for hyd. jump from, p. IV-B-7, HEC #14

2/11/19

3.2 -

№ 1



$= 1.13$

$3.7 = 1.16$

$8.60' + 3.7 = 1.16$

1.44

$14.4 \quad 28.7$

$28.7 \times 1.44 = 4.21$

$32 \quad 46' \quad 17.2' \quad 5.34'$

$y_2 = C_1 Y_1 \left[\sqrt{1 + 8F_r^2} - 1\right] \times \frac{1}{2} = 7.88$

$2'$ $\quad$ 1169.94

$2.07'$ $\quad$ 1169.95

$C_1 = 1.0$ for hyd. jump from p. IV-B-7; HEC #14

DROP STRUCTURES

The drop structures proposed for the Saddleback Diversion project were designed for the purpose of reducing stream velocities to levels of decreased erosion potential. The structures were designed of grouted riprap materials for reasons of durability, availability of materials and economics.

An economic analysis between the use of grouted riprap materials and reinforced concrete reveals substantial differences in cost in favor of the grouted riprap.

Historical data available relating to drop structures constructed with grouted riprap is found in similiar structures designed by the Corps of Engineers.

The following drop structures have been designed and constructed by the Corps of Engineers.

1. Name of Stream: White Water River Channel
   Location: Cochella Valley County Water District, Calif.
   Structural Data:
   - No. of Drop Structures: 2
   - Vertical Drop: 16' and 20'
   - Channel Average Width: 280'
   - Construction Material: Grouted Riprap
   - Design Flow: 40,000 cfs
   - Installation Date: 1969

   Historical Data: Since installation in 1969, the structures have withstood flows up to 20,000 cfs without imperiling the structural integrity. Structu
   functioning - Satisfactory
   Maintenance - Very Minor

2. Name of Stream: San Gabriel River Channel
   Location: Mouth of Canyon to Santa Fe Flood Control Basin, Los Angeles County, California

   Structural Data:
   - No. of Drop Structures: 10
   - Average Vertical Drop: 15.5'
   - Width of Channel: 500'
   - Construction Material: Grouted riprap
   - Design Flow: 98,000 cfs
   - Installation Date: 1969

   Historical Data: Experienced 3 good size floods (magnitudes unknown). Structural Functioning - Very Good. Maintenance - Minor manintenance work required to regrout some portion of the structure. This maintenance is a cause of continuous, low flow in the channel.

3. Name of Stream: Indian Bend Wash Outlet Channel*
Location: Scottsdale, Arizona

Structural Data:

No. of Structures	1
Vertical Drop	6'
Width of Channel	400'
Construction Material	Grouted riprap
Design Flow	30,000 cfs
Installation Date	1978

Historical Data: Experienced approximately 3000 cfs in December 1978. Maintenance required: None (Information furnished by Hydraulic Engineer, Mr. Len Erie, City of Scottsdale)

*The Corps has also designed a similar drop structure at the Indian Bend Wash Inlet Channel near Scottsdale Road and Indian Bend Road. The structure is expected to be completed by 1980.

Details of the above listed structures are enclosed with this report.

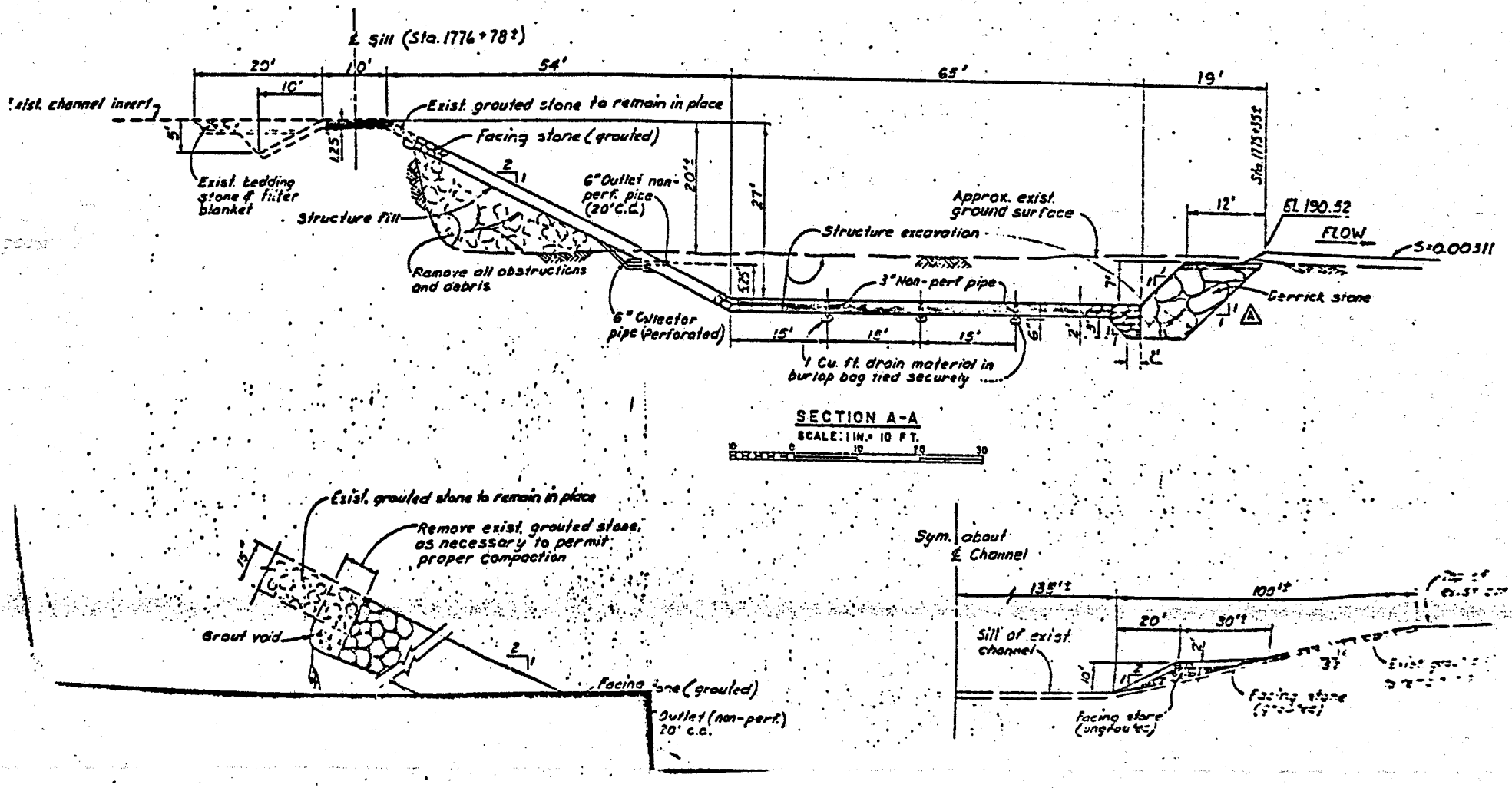
There are several other projects installed in California that utilize drop structures of grouted riprap in conjunction with reinforced concrete. These projects are listed as follows:

San Gabriel Channel - U.S. Army Corps of Engineers, March 1967

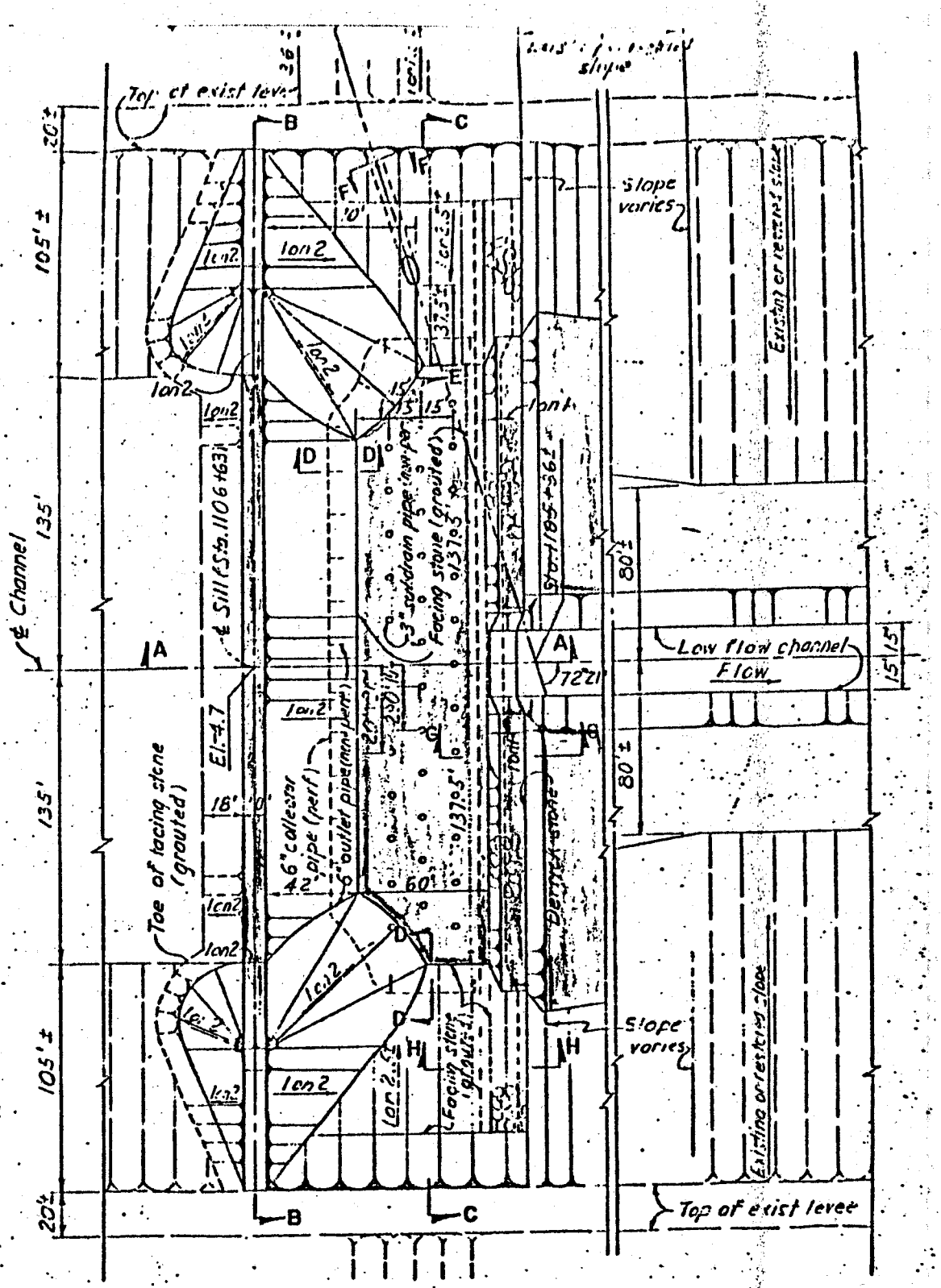
Santa Ana River Channel - U.S. Army Corps of Engineers, April 1976

Santa Clara Diversion Structure - PRC Toups Corporation, June 1978

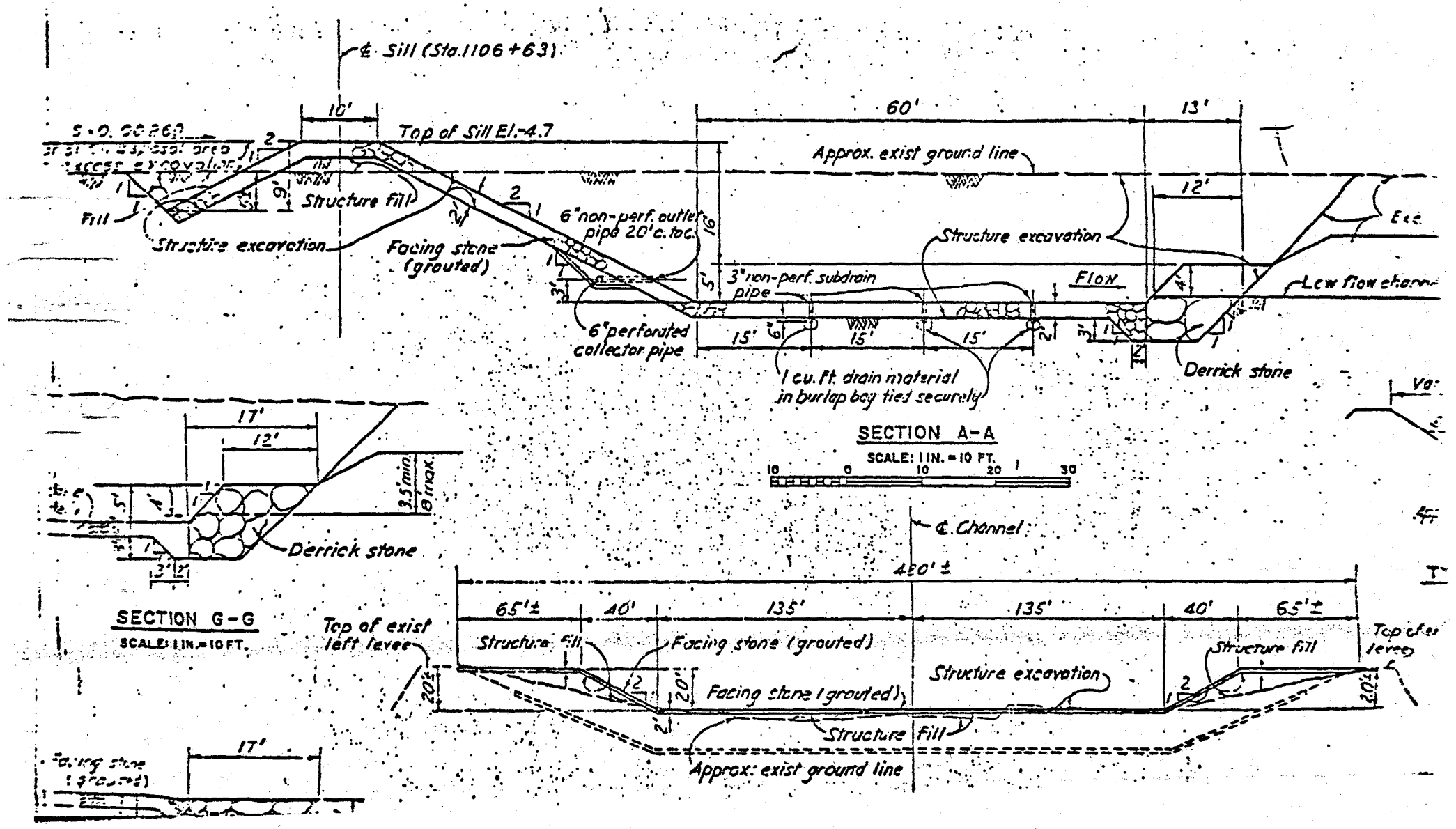
To date, as far as it can be determined the riprap portions of these structures have experienced no structural deficiencies.



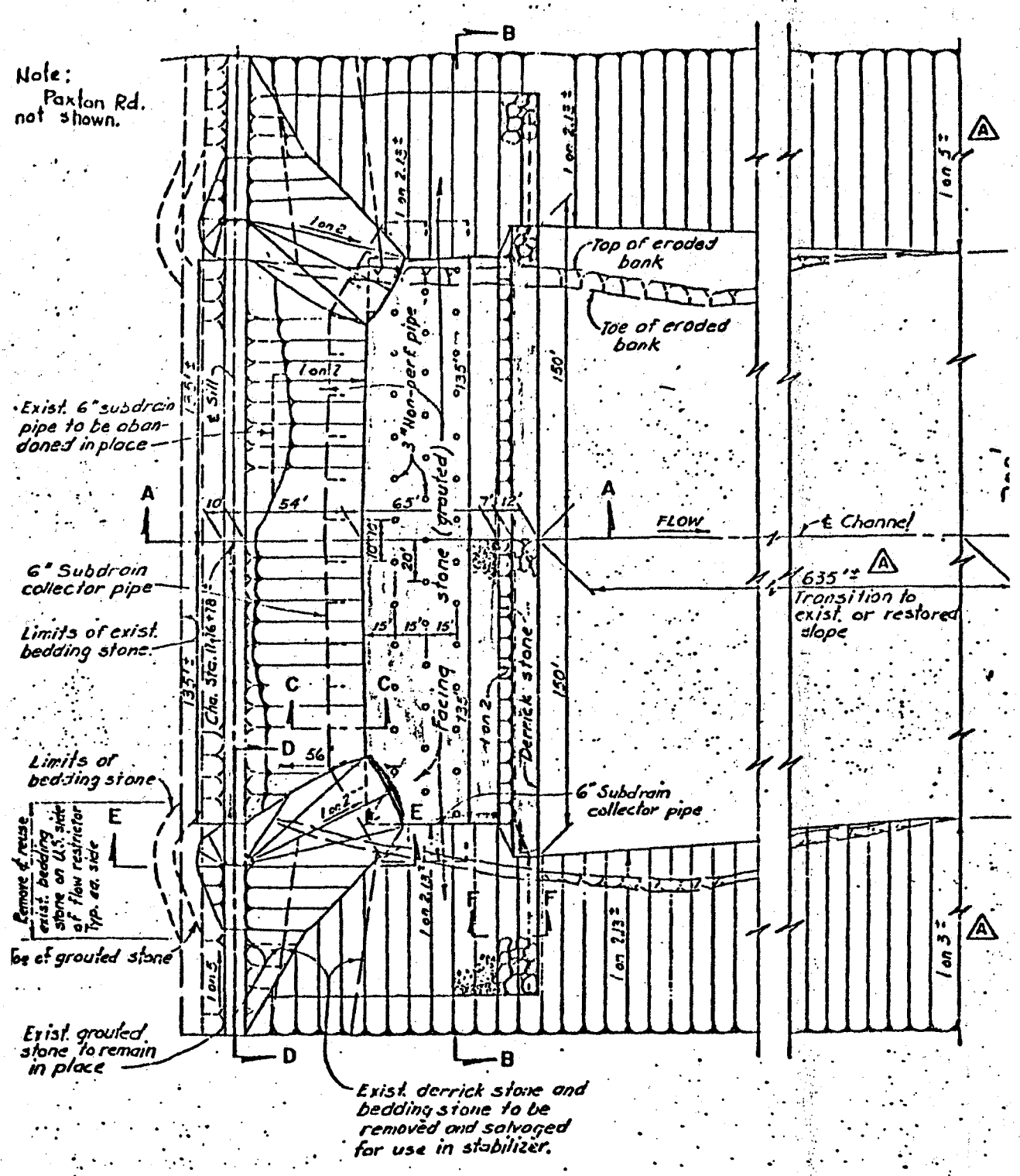
DROP STRUCTURE
WHITE WATER RIVER CHANNEL



DROP STRUCTURE
WHITE WATER RIVER CHANNEL



DROP STRUCTURE
WHITE WATER RIVER CHANNEL



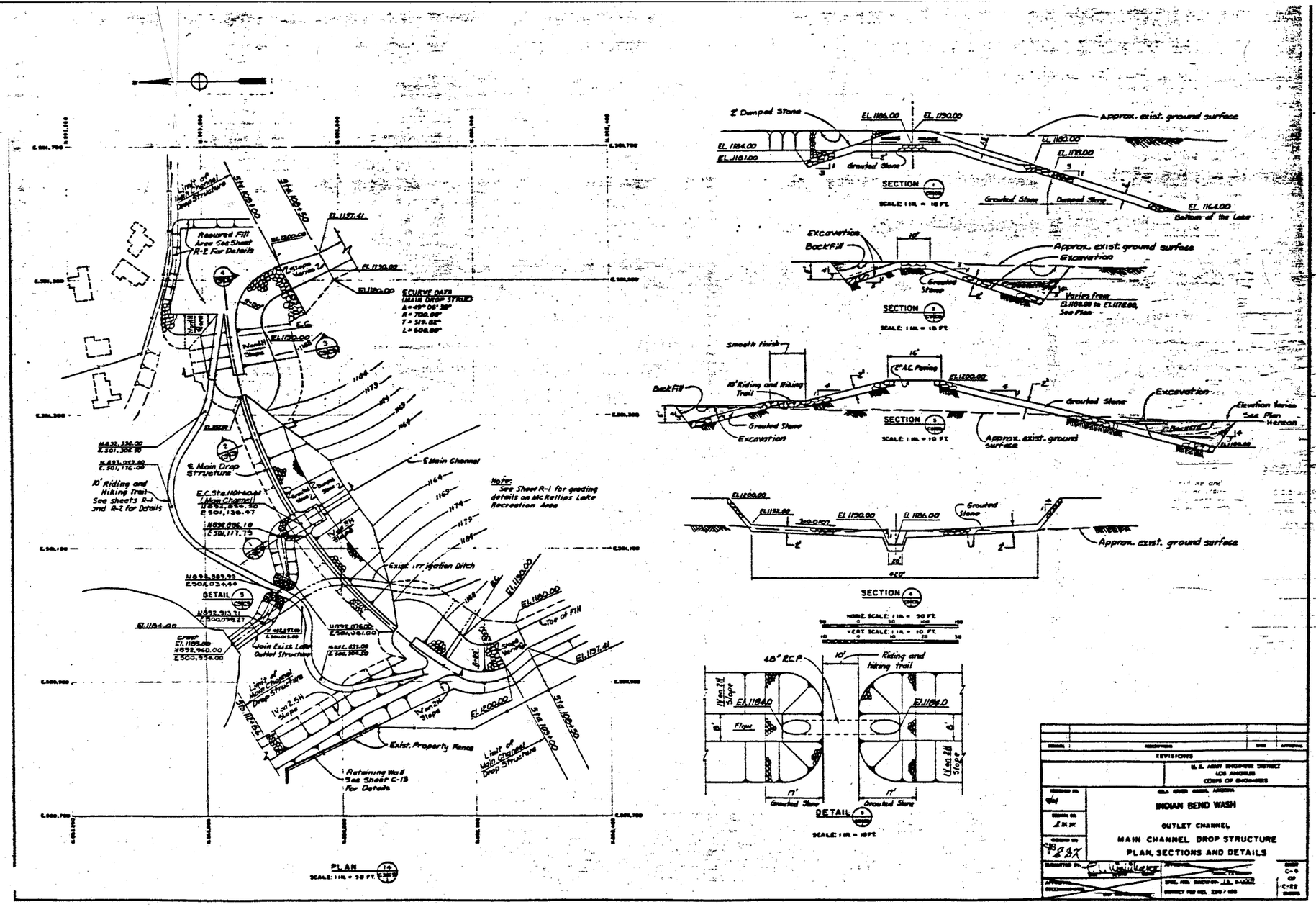
PLAN

SCALE: 1 IN. = 40 FT.

20 0 20 100

1" = 72' ±

DROP STRUCTURE
WHITE WATER RIVER CHANNEL



REVISIONS

U. S. ARMY ENGINEER DISTRICT
LOS ANGELES
CORPS OF ENGINEERS

GILA RIVER BASIN, ARIZONA

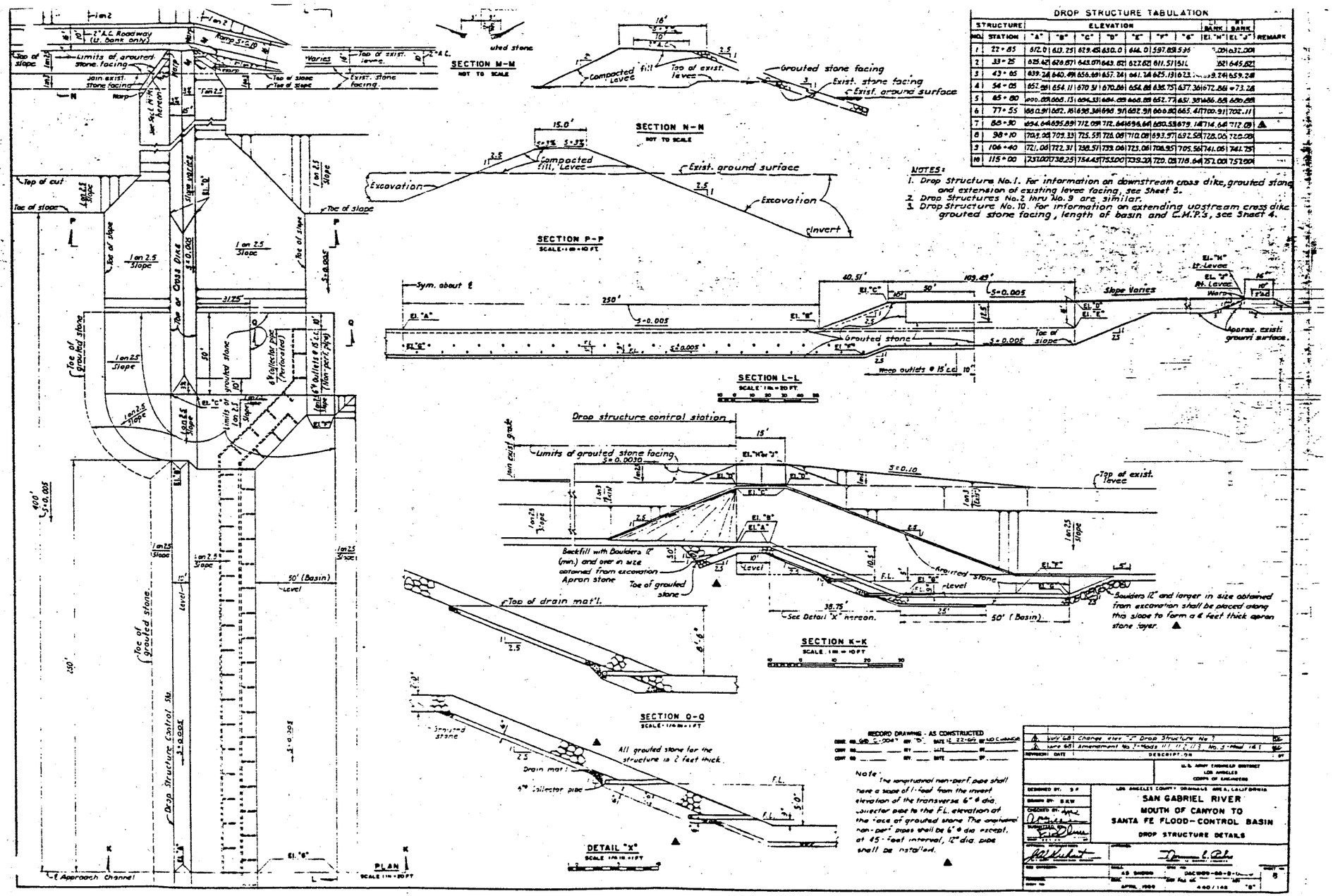
INDIAN BEND WASH

OUTLET CHANNEL

MAIN CHANNEL DROP STRUCTURE

PLAN, SECTIONS AND DETAILS

DRAWING NO. C-12



DROP STRUCTURE TABULATION

STRUCTURE NO.	STATION	"A"	"B"	"C"	"D"	"E"	"F"	"G"	"H" BANK EL. "H"	"I" BANK EL. "J"	REMARK
1	22+85	612.0	613.25	629.45	630.0	646.0	597.85	595	[illegible]	632.00	
2	33+25	625.62	626.87	643.07	643.82	622.82	611.51	611	[illegible]	645.82	
3	43+05	639.24	640.49	656.69	657.24	641.24	625.13	623	[illegible]	659.24	
4	54+05	652.86	654.11	670.31	670.86	654.86	638.75	637.36	672.86	673.28	
5	65+80	666.68	668.13	684.33	684.88	668.88	652.77	651.35	686.88	688.88	
6	77+55	680.91	682.16	698.36	698.91	682.91	666.80	665.41	700.91	702.11	
7	86+90	694.64	695.89	712.09	712.64	696.64	680.53	679.14	714.64	712.08	▲
8	98+10	709.08	709.33	725.53	726.08	710.08	693.97	692.58	728.08	726.08	
9	106+40	721.08	722.31	738.51	739.06	723.06	706.95	705.56	741.06	741.75	
10	115+00	737.00	738.25	754.45	753.00	739.20	720.08	718.64	751.00	752.00	

NOTES:

1. Drop Structure No. 1. For information on downstream cross dike, grouted stone and extension of existing levee facing, see Sheet 5.
2. Drop Structures No. 2 thru No. 9 are similar.
3. Drop Structure No. 10. For information on extending upstream cross dike grouted stone facing, length of basin and C.M.P.'s, see Sheet 4.

RECORD DRAWING - AS CONSTRUCTED

Note: The longitudinal non-perf. pipe shall have a slope of 1-foot from the invert elevation of the transverse 6" ϕ dia. collector pipe to the F.L. elevation of the face of grouted stone. The longitudinal non-perf. pipes shall be 6" ϕ dia. except, at 45-feet interval, 12" dia. pipe shall be installed. ▲

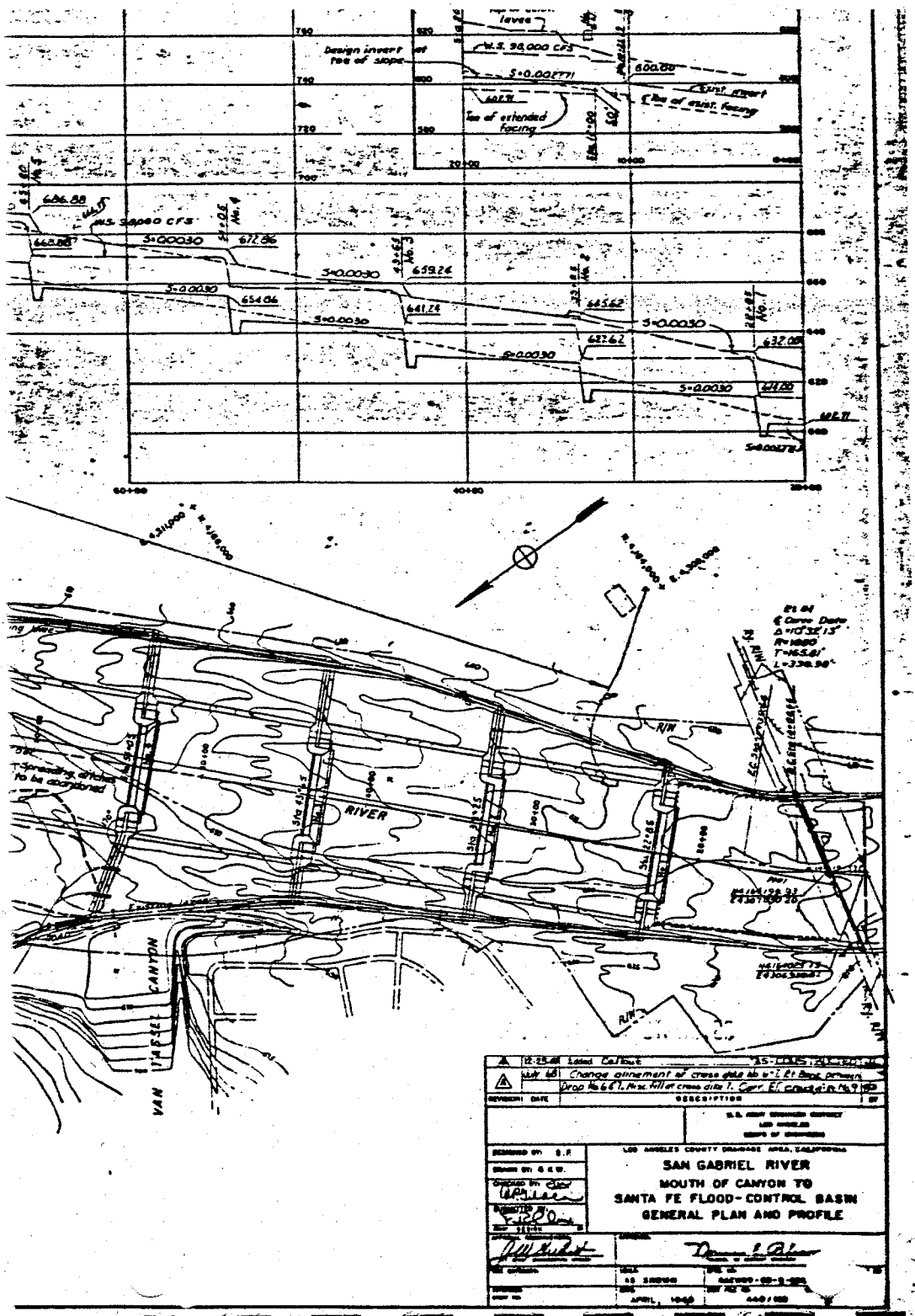
REVISION	DATE	DESCRIPTION	BY
A	July 68	Change elev. "F" Drop Structure No. 1	
A	June 68	Amendment No. 3 - Mods. 11, 12, 13	

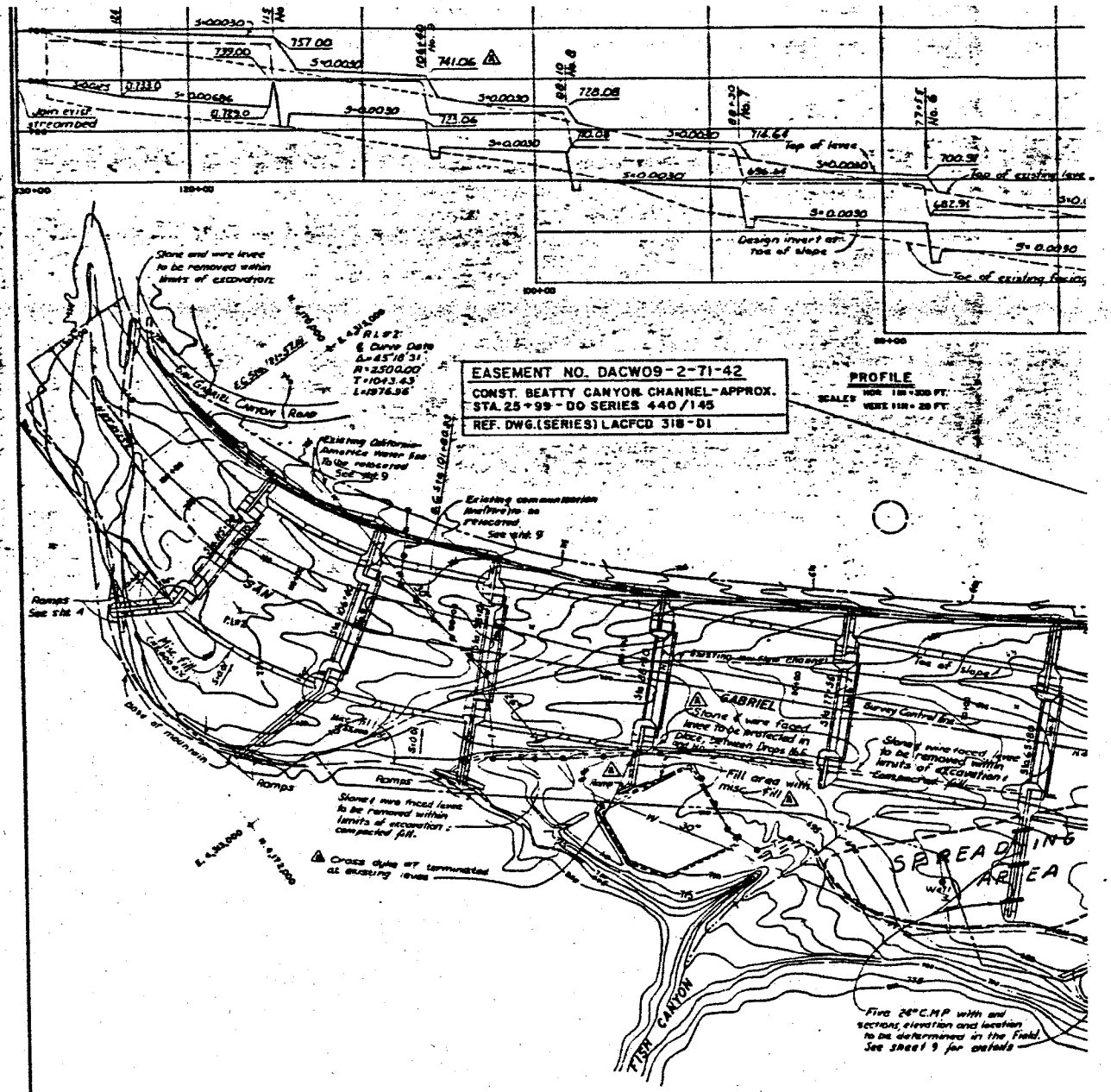
U.S. ARMY ENGINEER DISTRICT
LOS ANGELES
CORPS OF ENGINEERS

LOS ANGELES COUNTY DRAINAGE AREA, CALIFORNIA

SAN GABRIEL RIVER
MOUTH OF CANYON TO SANTA FE FLOOD-CONTROL BASIN
DROP STRUCTURE DETAILS

AS SHOWN
APRIL 1969
460/148
8


Levee
Design invert at toe of slope
W.S. 98,000 CFS
S=0.001771
Toe of extended facing
Toe of exist. facing
W.S. 54,000 CFS
S=0.0030
RIVER
CANYON
VAN TUNSEL
SAN GABRIEL RIVER
MOUTH OF CANYON TO
SANTA FE FLOOD-CONTROL BASIN
GENERAL PLAN AND PROFILE
LOS ANGELES COUNTY DRAINAGE AREA, CALIFORNIA
APRIL, 1949


EASEMENT NO. DACW09-2-71-42
CONST. BEATTY CANYON CHANNEL-APPROX.
STA. 25+99 - DO SERIES 440/145
REF. DWG.(SERIES) LACFCD 318-D1
PROFILE
PLAN
SAN GABRIEL
SPREADING AREA
TYLER CANYON
Ramps
Stone and wire levee to be removed within limits of excavation
Existing California-American Water Co. To be relocated See sht 9
Existing communication (telephone) to be relocated See sht 9
Fill area with misc. Fill
Fire 26" C.M.P. with end sections, elevation and location to be determined in the Field. See sheet 9 for details
Design invert at toe of slope
Top of levee
Toe of existing levee
Toe of slope
Survey Control Est.
Existing channel
Cross dyke wt terminated at crossing levee

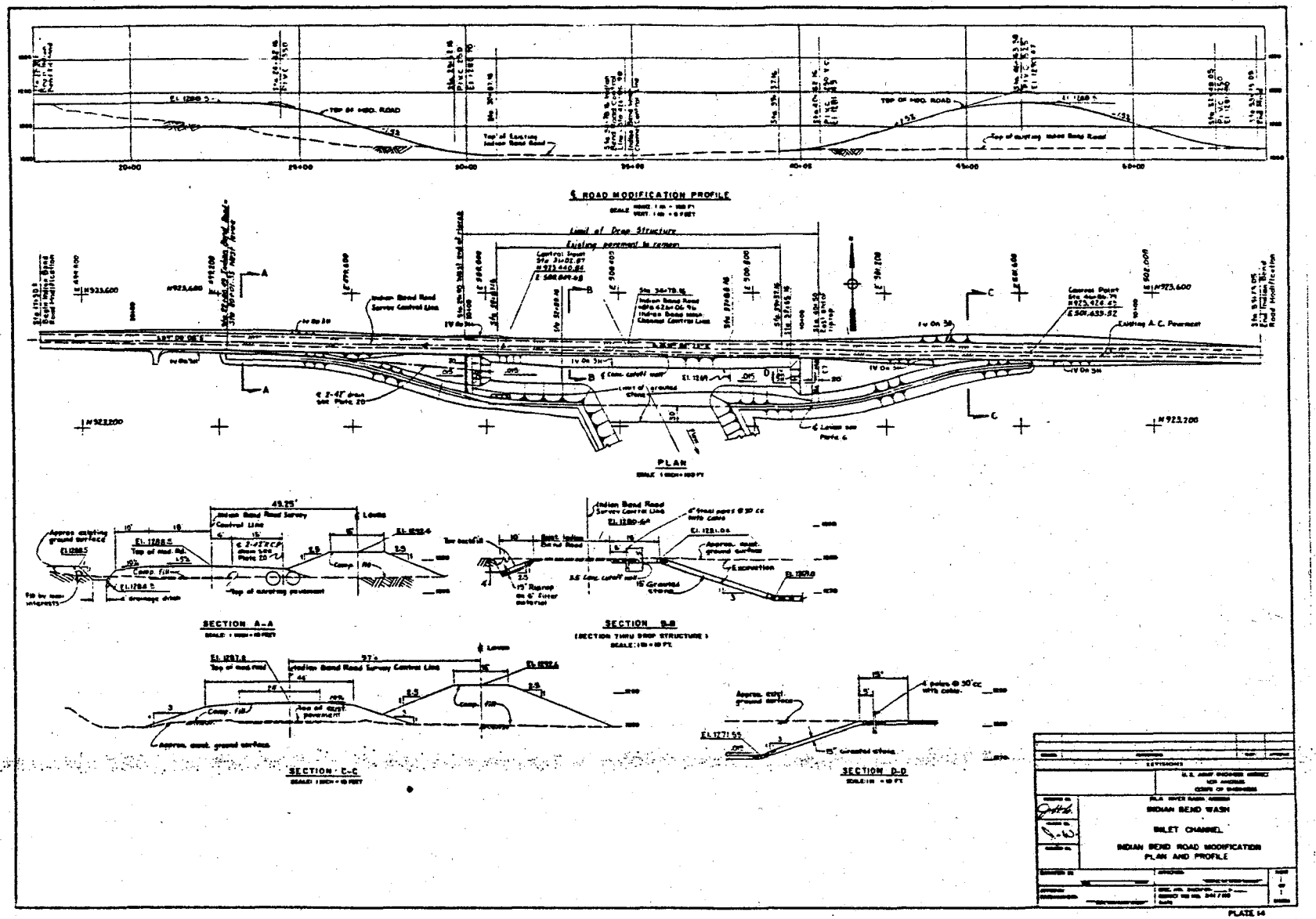

℄ ROAD MODIFICATION PROFILE
PLAN
SECTION A-A
SECTION B-B
(SECTION THRU DROP STRUCTURE)
SECTION C-C
SECTION D-D
INDIAN BEND WASH
INLET CHANNEL
INDIAN BEND ROAD MODIFICATION
PLAN AND PROFILE

PLATE 14

QUANTITIES

Quantity Summary

Concrete Item	Reinforcing Steel (lb)	Concrete (cu. yd.)
Size "C" PWD basins (4) TR-46	572	7.8
Size "D" PWD basins (1) TR-46	274	3.7
Size "H" Inlet structure (1) TR-46	302	4.7
Size "C" Inlet structure (4) TR-46	518	5.9
Type A1 Conduit Cradle 12" (280 ft) TR-46	1708	26.0
Type A1 Conduit Cradle 21" (70 ft) TR-46	807	10.4
Anti-Seep Collar 12"Ø (12) TR-46	934	16.6
Anti-Seep Collar 21"Ø (3) TR-46	260	5.0
	538716	80.1 yd³

Loose Riprap:

	Loose	Drain Fill
PWD outlet basin channel	20 yd³	10 yd³
Protective berm	138 yd³	
Access ramps	40 yd³	
Total =	198 yd³	10 yd³
	= 198 yd³	

Structure Excavation:

Conduit	469 yd³
Inlets (Vegetative)	29 yd³
Outlets (PWD)	199 yd³
Drop Structures	7189 yd³
Weir Inlets	3463 yd³
Total =	11349 yd³

Structure Backfill:

Drop Spillways	6481 yd³
Outlets	116 yd³
Inlets	25 yd³
Conduit	469 yd³
	7091 yd³

Grouted Riprap:

	Drain Fill	G. Riprap
Inlet Weirs		3361 yd³
Channel 0+82 to 9+61 and 10+26 to 10+54	1188 yd³	3565 yd³
Drop Spillways	612 yd³	6577 yd³
Total =	1800 yd³	13,503 yd³
Total (G.R.) =		13,503 yd³

Drain Fill

Grouted Riprap = 1800 yd³
Loose Riprap = 10 yd³
1816 yd³

TOUPS CORPORATION

CONSULTING ENGINEERS AND PLANNERS

BY JB DATE 10/25/78 CLIENT S.C.S. SHEET NO. ____ OF ____

CHECKED ____ DATE Revised 2/79 JOB Saddleback Diversion Chl. JOB NO. 3043-000

FINAL DESIGN EARTHWORK (dike top width = 12')

Computed from S.A.F. outlet to end of drop spillway

$$V = \frac{L}{2}(A_1 + A_2)$$

X-Section Sta.	Cut Area (ft^2)	Fill Area (ft^2)	Length/2 (ft)	Volume Cut (ft^3)	Cu. Yds. Cut	Cu. Yds. Fill
0+82	500	0				
			418/2	188,100	6,967	0
5+00	400	0				
			500/2	227,500	8,426	0
10+00	510	0				
Template	Change		0	0		0
10+60	610	0				
			440/2	261,800	9,696	896
15+00	520	110				
			500/2	295,000	10,926	1,852
20+00	660	90				
(Drop Structure - use avg)			500/2	311,250	11,528	2315
25+00	585	160				
			500/2	266,250	9,861	3194
30+00	480	185				
			500/2	222,500	8,241	3657
35+00	410	210				
			500/2	212,500	7,870	3889
40+00	440	210				
			500/2	228,750	8,472	3611
45+00	475	180				
			500/2	191,250	7,083	3981
50+00	290	250				
			500/2	170,000	6,296	4120
55+00	390	195				
			500/2	243,750	9,028	3102
60+00	585	140				
			500/2	287,500	10,648	2248
65+00	565	105				
			500/2	371,250	13,750	1712

TOUPS CORPORATION

CONSULTING ENGINEERS AND PLANNERS

BY JB DATE 10/25/78 CLIENT SCS SHEET NO. ____ OF ____

CHECKED ____ DATE Revised 2/79 JOB ____ JOB NO. 3043-000

X-Section Sta.	Cut Area (ft²)	Fill Area (ft²)	Length / 2 (ft)	Volume Cut (ft³)		Cu. Yds. Cut	Cu. Yds. Fill
70+00	920	80					
			500/2	375,000		13,889	2222
75+00	580	160					
			500/2	312,500		11,574	2500
80+00	670	110					
			200/2	169,000		6,259	926
82+00 (Dip Structure Average)	1020	140					
			300/2	330,000		12,222	1556
85+00	1180	140					
			500/2	505,000		18,704	2778
90+00	940	160					
			500/2	487,500		18,056	3009
95+00	1010	165					
			500/2	550,000		20,370	2639
100+00	1190	120					
			500/2	590,000		21,852	2130
105+00	1170	110					
			500/2	590,000		21,852	1851
110+00	1190	90					
			500/2	560,000		20,741	1759
115+00	1050	100					
			500/2	496,250		18,380	1905
120+00	935	95					
			500/2	503,750		18,657	1991
125+00	1080	120					
			500/2	610,000		22,593	2130
130+00	1360	110					
			500/2	600,000		22,222	2203
135+00	1040	135					
			500/2	462,500		17,130	3333
140+00	810	225					
			500/2	557,500		20,648	2902
145+00	1420	95					
			500/2	837,500		31,017	1991
150+00	1930	120					
			500/2	970,000		35,926	2315
155+00	1950	130					
			500/2	893,500		33,056	2130
160+00	1620	100					
			500/2	742,500		27,500	2824
165+00	1350	205					
			500/2	642,500		23,796	3935

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BY UB DATE 10/26/78 CLIENT SCS SHEET NO. ____ OF ____

CHECKED ____ DATE Revised 2/79 JOB ____ JOB NO. 3043-00

X-Section Sta	Cut Area (ft²)	Fill Area (ft²)	Dist (ft)	Volume Cut (ft³)	Volume Fill (ft³)	Cu. Yds. Cut	Cu. Yds. Fill
170+00	1220	220	500/2	635,000		23,519	3420
175+00	1320	150	500/2	722,500		26,759	2778
180+00	1570	150	500/2	707,500		26,204	2870
185+00	1260	160	500/2	685,000		25,370	2963
190+00	1480	160	500/2	680,000		25,185	3056
195+00	1240	170	500/2	675,000		25,000	2546
200+00	1520	105	500/2	815,000		30,185	1851
205+00	1740	95	500/2	855,000		31,667	1944
210+00	1680	115	500/2	828,750		30,694	2269
215+00	1635	130	500/2	918,750		34,028	2130
220+00	2040	100	500/2	980,000		36,296	1805
225+00	1880	95	500/2	730,000		27,037	2454
230+00	1040	170	200/2	190400		7052	1340
232+00	864	192	300/2	219600		8133	2317
235+00	600	225	211/2	101,280		3,751	1856
237+11 (Lift Station)	560	250	50/2	102,750		3,806	231
237+61	3750	0	139/2	588,675		21,799	0
239+00	4000	0	200/2	701,000		25,963	0
241+00	3010	0	200/2	523,000		19,370	0
243+00	2220	0	200/2	382,000		14,148	0
245+00	1600	0	200/2	242,500		8,981	0
247+00	825	0	200/2	82,500		3,056	222
249+00 (negligible)	(negligible)	60 0@9'					10

rock

TOUPS CORPORATION

CONSULTING ENGINEERS AND PLANNERS

BY VB DATE 10/25/78 CLIENT SCS SHEET NO. ____ OF ____

CHECKED ____ DATE Revised 2/79 JOB Saddleback Diversion Chl JOB NO. 3043-000

Raw Volumes (no shrink or swell factors applied)

Total Cut = 914,790 cu.yds.

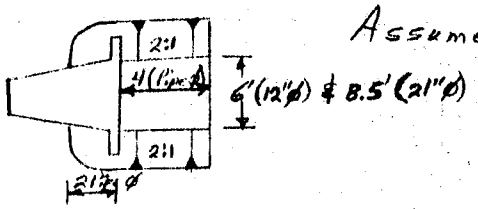
Total Fill = 122,528 cu yds (Compacted)

Rock Excavation

Total Cut = 107,157 cu.yds

Quantity Survey

Loose rock riprap & filter material at P(U)D basin outlet channels



Assume channel 2' deep
Riprap 1.0' thick with 6" of drain fill.

Vol. (riprap) 12"Ø = [4' x 6' x 1.0' + 8' x 2 sides x 4.5' (2:1 slope) x 1.0'] x 4 outlets
= 384 ft³ = 14 cu. yd. (loose riprap)

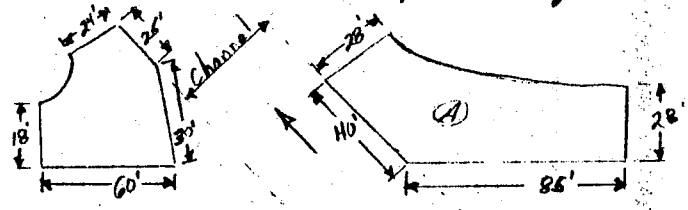
Vol. (drain fill) 12"Ø = ½ of above = 7 cu. yd (filter)

Vol. (riprap) 21"Ø = [7' x 8.5' x 1.0' + 10.5' x 2 sides x 4.5' (2:1 slope) x 1.0'] x 1 outlet
= 154 ft³ = 6 cu. yd (loose riprap)

Vol. (drain fill) = ½ of above = 3 cu. yd. (filter)

Loose Rock riprap at 479th Ave dip crossing

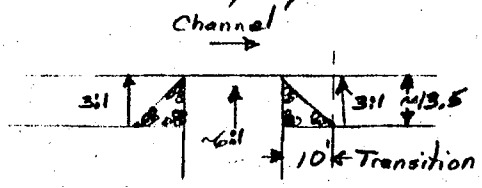
Riprap depth = 1'



included in Courthouse Rd Quantities

Vol. A = ~110' (long) x 28' x 1' = 4620 ft³ = 114 yd³
Vol B = ~60' (long) x 30' wide x 1' = 2700 ft³ = 33 yd³
147 yd³

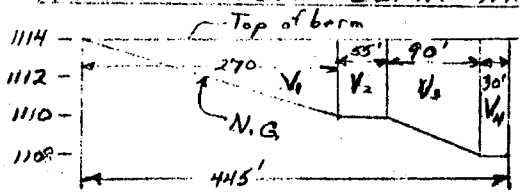
Loose rock riprap at access ramps

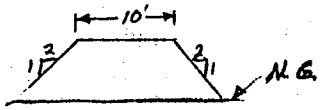


Depth of riprap = 1.0'
Depth of channel @ 3:1 = ~4.5

Vol. = 13.5' x 10' x 1' x 8 access ramps
= 1080 ft³
= 40 yd³

Protective berm earth fill

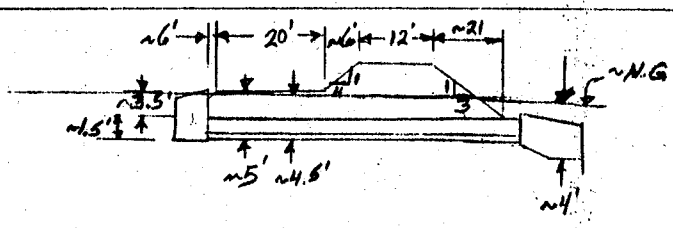


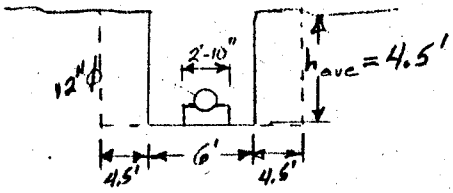


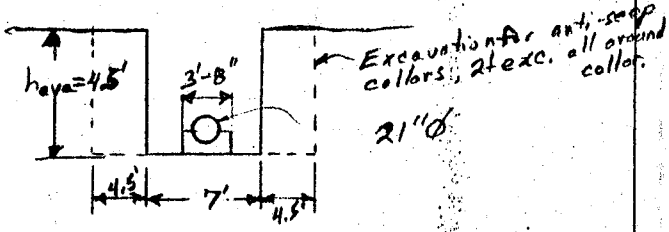
$$\text{Vol.} = \underbrace{\frac{72\,ft^2}{2}(270')}_{(V_1)} + \underbrace{72\,ft^2 \times 55'}_{V_2} + \underbrace{\frac{72\,ft^2 + 132\,ft^2}{2}(90')}_{(V_3)} + \underbrace{132\,ft^2 \times 30'}_{(V_4)} = 26820\,ft^3 = 993\,yd^3$$

Quantity Survey

Structure Excavation for Vegetative Conduits







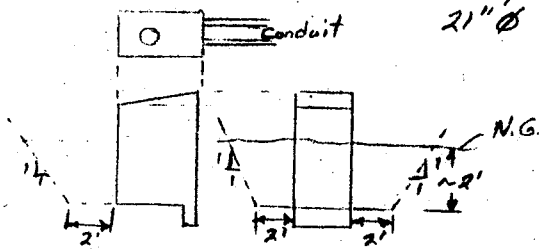
All conduits are 70' long

12"Ø conduit = 70' x 4 conduits x 6' x 4.5' = 7560 ft³ = 280 yd³
21"Ø conduit = 70' x 1 conduit x 7' x 4.5 = 2205 ft³ = 82 yd³
Anti-seep collars - 4.5' x 4.75' (thickness of collar + 2' on each side) x 4.5 deep - x 2 sides x 15 collars = 2886 ft³ = 107 yd³

Total = 469 yd³

Inlets

12"Ø outside dimensions = 3' x 5'
21"Ø " " = 5 x 8.5'

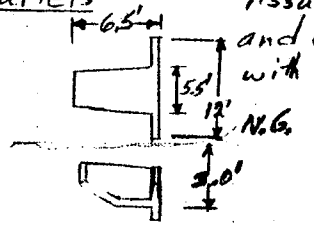


$Vol_{(12"\phi\ inlet)} = (3'+4') \times (5'+2') \times 2.0' + \underbrace{2 \times 2 \times \tfrac{1}{2}}_{Area} \times ((7' \times 2 sides) + 3)) \times 4 inlets$
$= 528 ft^3$
$= 20 yd^3$

$Vol.(21"\phi) = (5'+4) \times (8.5+2) \times 2.0 + 2ft^2 \times ((10.5 \times 2) + 3))$
$= 237 ft^3$
$= 9 yd^3$

Outlets

Assume depth of excavation is 3.5 ft and excavation will be 4 ft around structure with lil slope up to N.G.



$Vol. = (12+8) \times (6.5+4) \times 3.0' (Hmp) + \left(\frac{3.0^2}{2} \times [((6.5+4)2) + 16]\right) \times 5\ PWDs = 3983 ft^3$
$= 148 yd^3$

Structure Backfill:

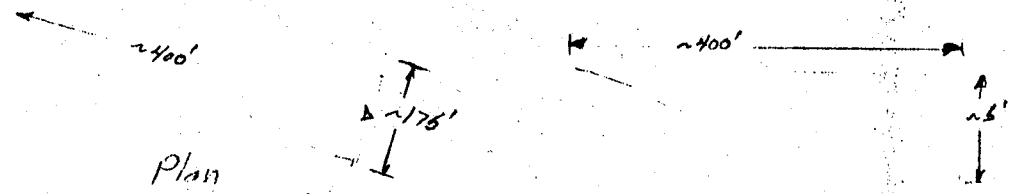
Outlets; $Vol. = 148 yd^3 - \left[\frac{6.5' \times 5.5 \times 3.0}{27}\right] 5 PWDs = 116 yd^3$

Inlets; $Vol. = 27 yd^3 - \left[\frac{3 \times 5 \times 2}{27}\right] 4 - \left(\frac{5 \times 8.5 \times 2}{27}\right) = 25 yd^3$

Conduits; Use same vol. as for excavation

Structure Backfill for Drop Spillways

Structure #4 (23'+10.60) requires backfill from plans. Other structures cannot be estimated as the lower limits are as determined by the Engineer.



Plan

$$Vol. = \frac{400' \times 5'}{2} \times \frac{175'}{2} \times 2 \text{ sides} = 175{,}000 \text{ ft}^3 = 6481 \text{ yd}^3$$

(from Elev. view)

Drain Pipe at Drop Structures

From Drop structure detail sheet,

Lengths across channel width = 30' + 130' + 215' + 300' = 675'
L_B × 2 sides for each structure = 92' + 57' + 61' + 76' = 286'
Assume outlet pipes are 5' long, 3 for each side × 2 sides × 4 struct. = 120'
5' long outlet pipes along channel @ 20' o.c. = 10 + 30 + 50 + 75 = 165'
Total = 1246'

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BY DSW DATE 2/27/74 CLIENT _____ SHEET NO. _____ OF _____

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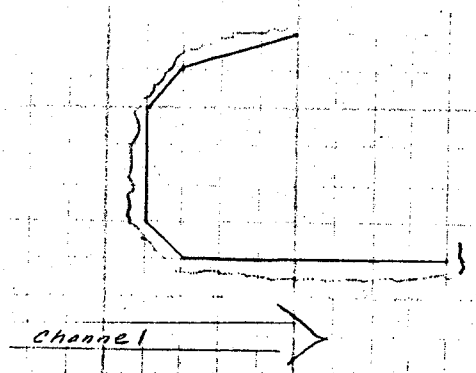
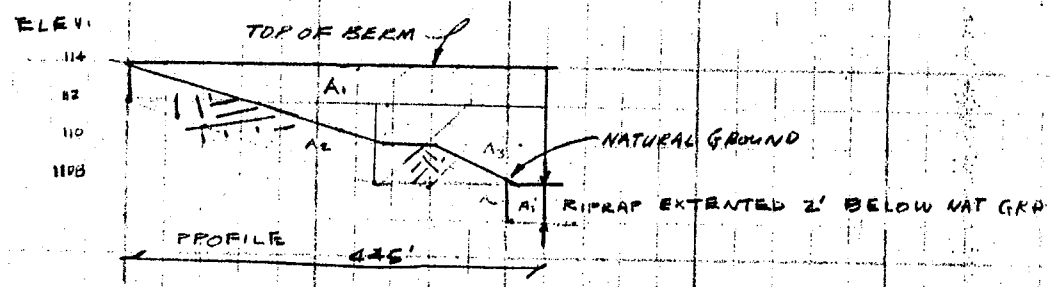
BERM @ OUTLET OF CHANNEL RIPRAP (Loose)

SKETCH - PLAN VIEW



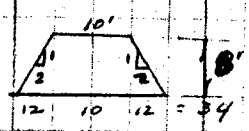


Area = $A_1 + A_2 + A_3 + A_4 + A_5$

$(445 \times 2) + (260 \times 4 \times \frac{1}{2}) + (4 \times 185) + (\frac{1}{2}(2 \times 80)) + (2 \times 40)$

$A_1 = 890 + 520 + 740 + 80 + 80 = 2310$ sq. ft

want to protect downstream face



$A_2 = (8 \times (\frac{10+34}{2})) = 176$ sq. ft

$\Sigma A = A_1 + A_2 = 2310 + 176 = 2486 \times 1.5^{FT}$ (thickness) 3729 cu ft

138 cu yds.

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BY VSW DATE 2-28-79 CLIENT S.C.S. SHEET NO. ____ OF ____

CHECKED ____ DATE ____ JOB ____ JOB NO. ____

DIVERSION CHANNEL

RIPRAP QUANTITIES

	CUBIC YARDS		
	GROUTED RIPRAP	RIPRAP	Drain Fill
Section 0+82 to 9+61	3565		1188
Drop structure #1	718		73
Drop structure #2	1046		88
Drop structure #3	1720		165
Drop structure #4	3093		286
	Σ = 10142		Σ = 1800

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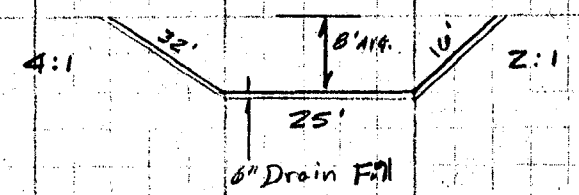
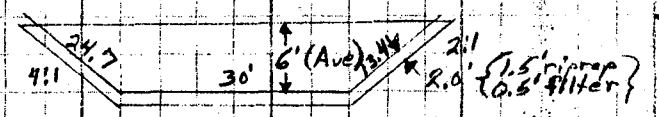
0+82 to 9+61



RIPRAP (32 + 25 + 10) × (thickness = 1.5) = 109.5 sq. ft.
(961 − 82) × (109.5) = 96251 c.f. = 3565 c.y.

Drain Fill (32 + 25 + 10)(0.5) = 36.5 sq. ft.
(961 − 82)(36.5) = 32084 c.f. = 1188 c.y.

10+26 to 10+54



Riprap (24.7 + 30 + 13.4) × (1.5' thickness) = 102.0 ft²
(1054 − 1026) × (102.0) = 2856 c.f. = 106 yd³

Drain Fill (24.7 + 30 + 13.4) × (0.5' thickness) = 34 ft²
(1054 − 1026) × (34) = 952 ft³ = 35 yd³

included in Courthouse Rd Quantity

TOUPS CORPORATION

CONSULTING ENGINEERS AND PLANNERS

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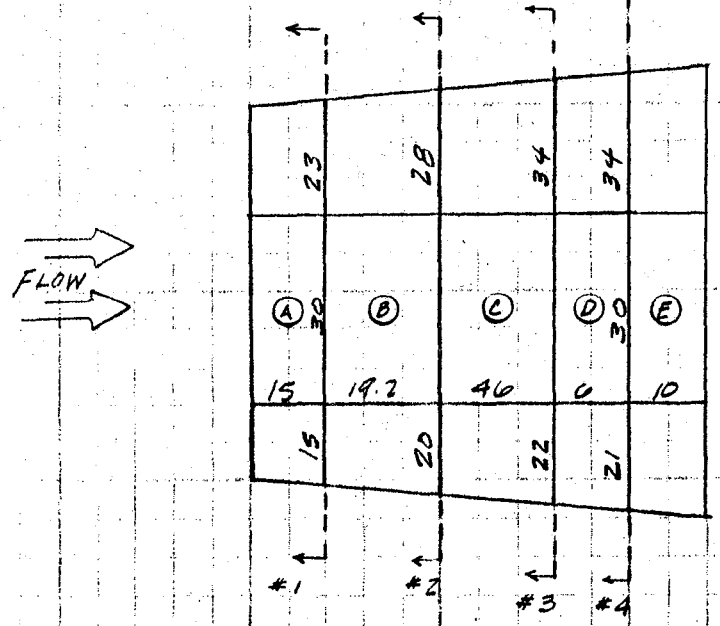
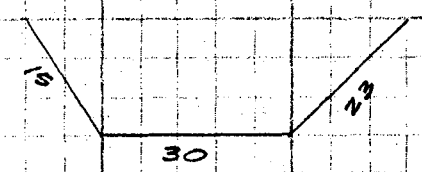
CHECKED _____ DATE _____ JOB _____ JOB NO. _____

DROP STRUCTURE #1



(B) denotes areas

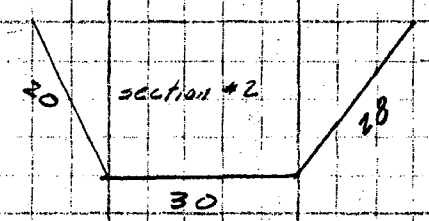
(A)



section #1

$(15+30+23) \times 15 = 1020$ sq ft.

(B)



section #2

$$\frac{(20+30+28)+(15+30+23)}{2} \times 19.2 = 1402$$

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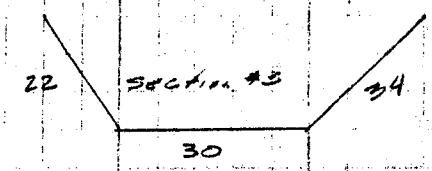
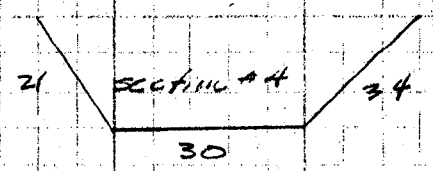
(C)



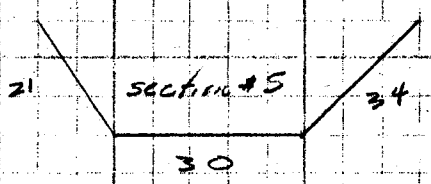
$\frac{(78+86)}{2} \times 46 = 3772$ sq. ft.

(D)



$\frac{(86+85)}{2} \times 6 = 513$ sq. ft

(E)



$85 \times 10 = 850$ sq. ft.

Grouted Riprap

Area A, B, E = 3272 sq. ft × 2 ft = 242 c.y.

Area C, D = 4285 sq. ft. × 3 ft. = 476 c.y.

Σ = 718 c.y.

Drain Fill

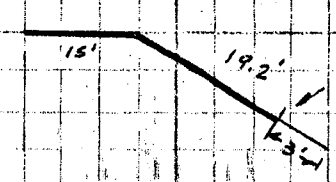
Area A = 1020

Area E adjusted = 78 × (19.2 − 3)* = 1264

Area C adjusted = 3772 sq. ft. − (3×46 + 30×46 + 3×46) = 1656

C = 3940 × 0.5 = 73 c.y.

*



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CONSULTING ENGINEERS AND PLANNERS

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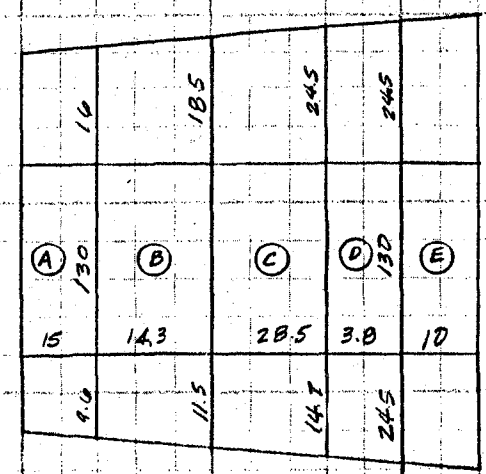
DROP STRUCTURE #2



(A) $(9.6 + 130 + 16)(15) = 2184$ sq ft

(B) $\left(\frac{156+160}{2}\right) 14.3 = 2259$ sq ft

(C) $\left(\frac{160+169}{2}\right) 28.5 = 4688$ sq ft

(D) $\left(\frac{169+169}{2}\right) 3.8 = 642$ sq. ft

(E) $169\ (10) = 1690$ sq. ft

Grouted Riprap

Area A, B, E = 6133 sq ft × 2 ft. = 454 c.y.
Area C, D = 5330 × 3 = 592 c.y.

Σ = 1046 c.y.

Drain Fill

Area A = 2184
Area B adjusted = 158 (14.3 − 3) = 1785
Area C adjusted = 4688 − (3×28.5 + 130×28.5 + 3×28.5) = 812

Σ = 4781 × 0.5 = 88 c.y.

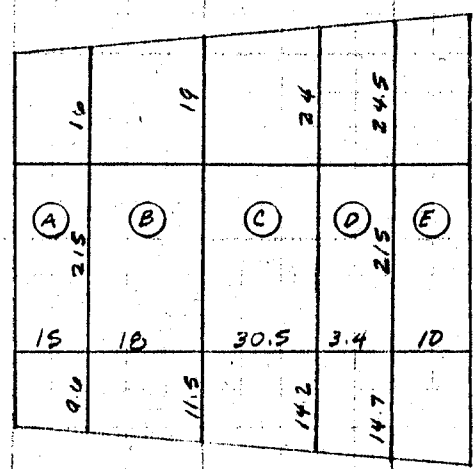
TOUPS CORPORATION

CONSULTING ENGINEERS AND PLANNERS

BY _____ DATE _____ CLIENT _____ SHEET NO. _____ OF _____

CHECKED _____ DATE _____ JOB _____ JOB NO. _____

DROP STRUCTURE #3



(A) 241 × 15 = 3615 sq. ft

(B) $\frac{245.5+241}{2}(18) = 4378$

(C) $\frac{245.5+253}{2}(30.5) = 7602$

(D) $\frac{253+254}{2}(3.4) = 862$

(E) 254 (10) = 2540

Grouted Riprap

Area A, B, E = 10533 sq. ft. × 2 ft = 780 c.y.

Area C, D = 8464 × 3 = 940 c.y.

Σ = 1720 c.y.

Drain Fill

Area A = 4378

Area B adjusted = 245.5 × (18−3) = 3682

Area C adjusted = 7602 − ((3 × 30.5)2 + 30.5 × 21.5) = 861

Σ = 8921 × 0.5 = 165 c.y.

TOUPS CORPORATION

CONSULTING ENGINEERS AND PLANNERS

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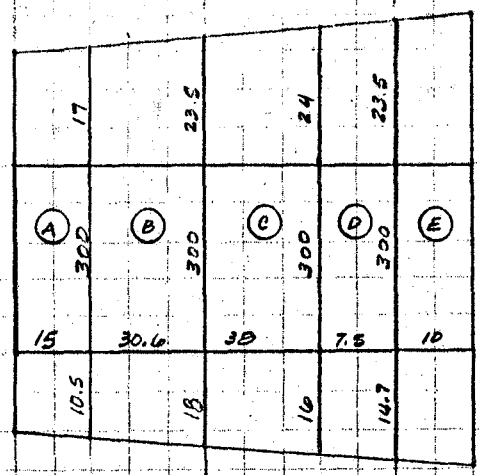
DROP STRUCTURE #4



(A) (10.5 + 300 + 17) (15) = 4912 sq. ft.

(B) $\frac{327.5 + 341.5}{2}$ (30.6) = 10236 sq. ft.

(C) $\frac{341.5 + 340}{2}$ (38) = 12949 sq. ft.

(D) $\frac{340 + 338}{2}$ (7.5) = 2543 sq. ft.

(E) 338 × 10 = 3380 sq. ft.

GROUTED RIPRAP

Area A, B, E = 18,528 sq. ft. × 2 ft = 1372 c.y.

Area C, D = 15,492 sq. ft. × 3 ft = 1721 c.y.

Σ = 3093 c.y.

Drain Fill

Area A = 4912

Area B adjusted 3345 (30.6 - 3) = 9232

Area C adjusted 12949 ([3 + 300 + 3]/38) = 1321

Σ = 15464 × 5 = 2860

TOUPS CORPORATION

CONSULTING ENGINEERS AND PLANNERS

BY _____ DATE _____ CLIENT _____ SHEET NO. _____ OF _____

CHECKED _____ DATE _____ JOB _____ JOB NO. _____

INLET WEIR QUANTITIES RIPRAP = 3361 cu. yds

LOCATION POINT	L_2 ①	L_1 ②	L_3 ③	ΣL	W ④	AREA	MISC. ⑤ AREA	TOTAL AREA
1	14	31.6	19.2	64.8	76-12 = 64	4147	547	4694
2	14	39.9	19.2	72	38-12 26	1872	634	2506
3	14	38.3	19.2	71.5	26-12 14	1001	628	1629
4	14	28.6	19.2	61.8	14	865	511	1376
5	14	18.4	19.2	51.6	14	721	389	1111
6	14	18.4	19.2	51.6	16	825	389	1214
7	14	31.6	19.2	64.8	61-12 49	3175	547	3722
8	14	28.6	19.2	61.8	14	865	510	1375
9	14	31.6	19.2	64.8	49	3175	547	3722
10	14	26.5	19.2	59.7	39	2329	486	2815
11	14	33.7	19.2	66.9	25-12 16	1070	572	1642
12	14	31.6	19.2	64.8	49	3175	547	3722
13	14	35.2	19.2	68.4	19	1300	590	1890
14	14	25.5	19.2	58.7	14	822	474	1296
15	14	24	19.2	57	31-12 19	1086	432	1518
16	14	24	19.2	57	54	3078	456	3534
17	14	31	19.2	64.3	61-12 49	3152	540	3692

① from sheet 19 of 27

② L_1/.98

③ L_3 = 10.2 + 5 + 4 (under cut at CRL) = 19.2

④ from sht 19 of 27 W - 2(6) =

⑤ this is the side slope 3:1

$[(L_1 + L_2) \times 6] \times 2$ =

TOUPS CORPORATION

CONSULTING ENGINEERS AND PLANNERS

BY _____ DATE _____ CLIENT _____ SHEET NO. _____ OF _____

CHECKED _____ DATE _____ JOB _____ JOB NO. _____

W = table value - 12 + (6×2) ← this is only true for $L_1 + L_2$ not L_3 therefore need correction

L_3 = 19.2 × (2×6) = 230.4

1 location

3917 sq. ft.

Grand total = 45375 sq. ft.

if 2 m Thick 2

= 90750 / 27

= 3361 cu. yds

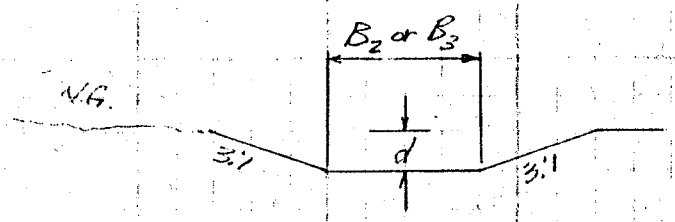
TOUPS CORPORATION

CONSULTING ENGINEERS AND PLANNERS

BY JTS DATE 10/28/98 CLIENT SCS SHEET NO. ____ OF ____

CHECKED ____ DATE ____ JOB Willdack Div. Ch1 JOB NO. 3043 000

Bioswale Excavation Quantities (Collector Ditches)



$d = 2'$

B_2 or B_3 = 10, 20 or 30'

Volume/ft = Area × 1 ft of length

$$\text{Area} = (2)(\tfrac{1}{2})(6)(2) + Bd = A$$

$$A_{10} = 12 + B_{10}d = 12 + 20 = 32 \text{ ft}^2$$

$$A_{20} = 12 + 40 = 52 \text{ ft}^2$$

$$A_{30} = 12 + 60 = 72 \text{ ft}^2$$

Volume = 32 ft³/ft for 10' Bottom

= 52 ft³/ft for 20' Bottom

= 72 ft³/ft for 30' Bottom

B=10'	B=20'	B=30'
280	670	1420
330	920	
180	700	
800	1020	
1130		
860		
320		
520		
160		
640		
6370	3310	1420

Volumes:

$10' \Rightarrow \frac{32}{27}(6370) = 7550$ CY

$20' \Rightarrow \frac{52}{27}(3310) = 6375$ CY

$30' \Rightarrow \frac{72}{27}(1420) = 3787$ CY

17,712 Cu Yds

Clearing & Grubbing (Ref: Drawings Sht. 4-11)

Stn	Length(ft)	Width(ft)	Area (Ac)
0+82	918	80	1.7
10+00	1685	230	8.9
26+85	4020	232	21.4
67+05	4595	320	33.8
113+00	3678	385	32.5
149+78	4156	455	43.4
191+34	3318	470	35.8
224+52	948	235	5.1
234+00	200	595	2.7
236+00	1400	750	24.1
250+00			

PWD. outlet channels, say 209.4 + 0.6 Ac = 210.0

Clearing & Grubbing = 210 Ac

By GS

Fencing - 4 strand barbed wire fence

$56\frac{1}{2}'' \times 1000 \frac{ft}{in} = \underline{56.500'}$ (from R/W acquisition map)

Structure Excavation and Backfill for triple box culvert at Courthouse Rd

Bottom of culvert El. = 1172.1 (invert) − $\frac{11.5'}{12}$ (thickness of bottom) = 1171.0
Top of culvert El. = 1172.1 + 6' + $\frac{(16'')}{12}$' thick of top = 1178.9
Top of finished road El. = ~1181
Length of box = 65' ; width of box = 33.3'
Assume excavation for 10' on either side @ 1:1 slope to N.G.
Assume excavation for 15' on either end of box @ 1:1 slope to N.G.

Excavation Vol. = $\overbrace{1181 - 1171}^{\text{depth}} \times [\overbrace{65' + (2 \times 15')}^{\text{length}}] \times [\overbrace{33.3 + (2 \times 10')}^{\text{width}}]$ + excavation for li[illegible] sl[illegible]
= 50635 ft³ + (10' x 10')(area for both sides at 1:1) x $\overbrace{95' + 53.3'}^{\text{length}}$
= 1875 yd³ + 14830 ft³ (549 yd³)
= 2424 yd³

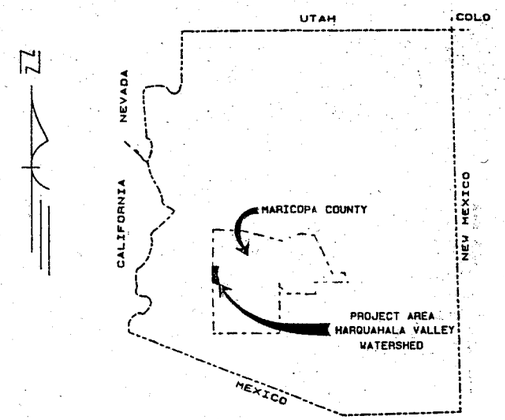
Backfill Vol. = $(\overbrace{1181 - 1171}^{\text{depth}}) \times 65' \times [\overbrace{33.3 + (2 \times 10)}^{\text{width}}]$ + $\overbrace{10' \times 10}^{\text{(area)}} \times \overbrace{95'}^{\text{(length)}}$ − $\overbrace{[8' \times 65' \times 33.3]}^{\text{vol of box}}$
= 44145 − 17316
= 26829 ft³ + Backfill behind wingwalls
= 26,829 ft³ + 6.3' ave ht of backfill x 10' back x 8' wide x 4 wingwalls
= 26829 ft³ + 2016
= 28,845 ft³
= 1068 yd³

HARQUAHALA VALLEY WATERSHED
PROTECTION AND FLOOD PREVENTION PROJECT
MARICOPA COUNTY, ARIZONA

PLANS FOR THE CONSTRUCTION OF
SADDLEBACK DIVERSION REPAIR

PREPARED FOR THE
FLOOD CONTROL DISTRICT OF MARICOPA COUNTY
BUCKEYE-ROOSEVELT NATURAL RESOURCE CONSERVATION DISTRICT
WICKENBURG NATURAL RESOURCE CONSERVATION DISTRICT

BY
SOIL CONSERVATION SERVICE
U.S. DEPARTMENT OF AGRICULTURE



ARIZONA

Direction of section or detail

Sht. from which it is taken — 5 6 — Sht. from which it is shown

INDEX OF DRAWINGS

SHT. NO.	TITLE
1.	INDEX OF DRAWINGS
2.	LOCATION MAP
3.	PROFILE DIVERSION STA. 12+00 TO STA. 80+00
4.	PROFILE DIVERSION STA. 80+00 TO STA. 146+00
5.	PROFILE DIVERSION STA. 146+00 TO STA. 212+00
6.	PROFILE DIVERSION STA. 212+00 TO STA. 245+00
7.	TYPICAL EARTH CROSS SECTIONS STA. 12+00 TO STA. 245+00
8.	PLAN AND PROFILE FRS DRAIN CHANNEL STA. 113+00 TO STA.147+00
9.	DETAILS--NEW SIDE INLETS 1 - 28
10.	DETAILS--NEW SIDE INLETS 29 & 30
11.	DETAILS--BACKFILL.EARTHFILL.EROSION.UTILITIES
12.	DETAILS--INLET 31 & TYPICAL EARTH CROSS-SECTION 113+00 TO 147+00

GENERAL NOTES

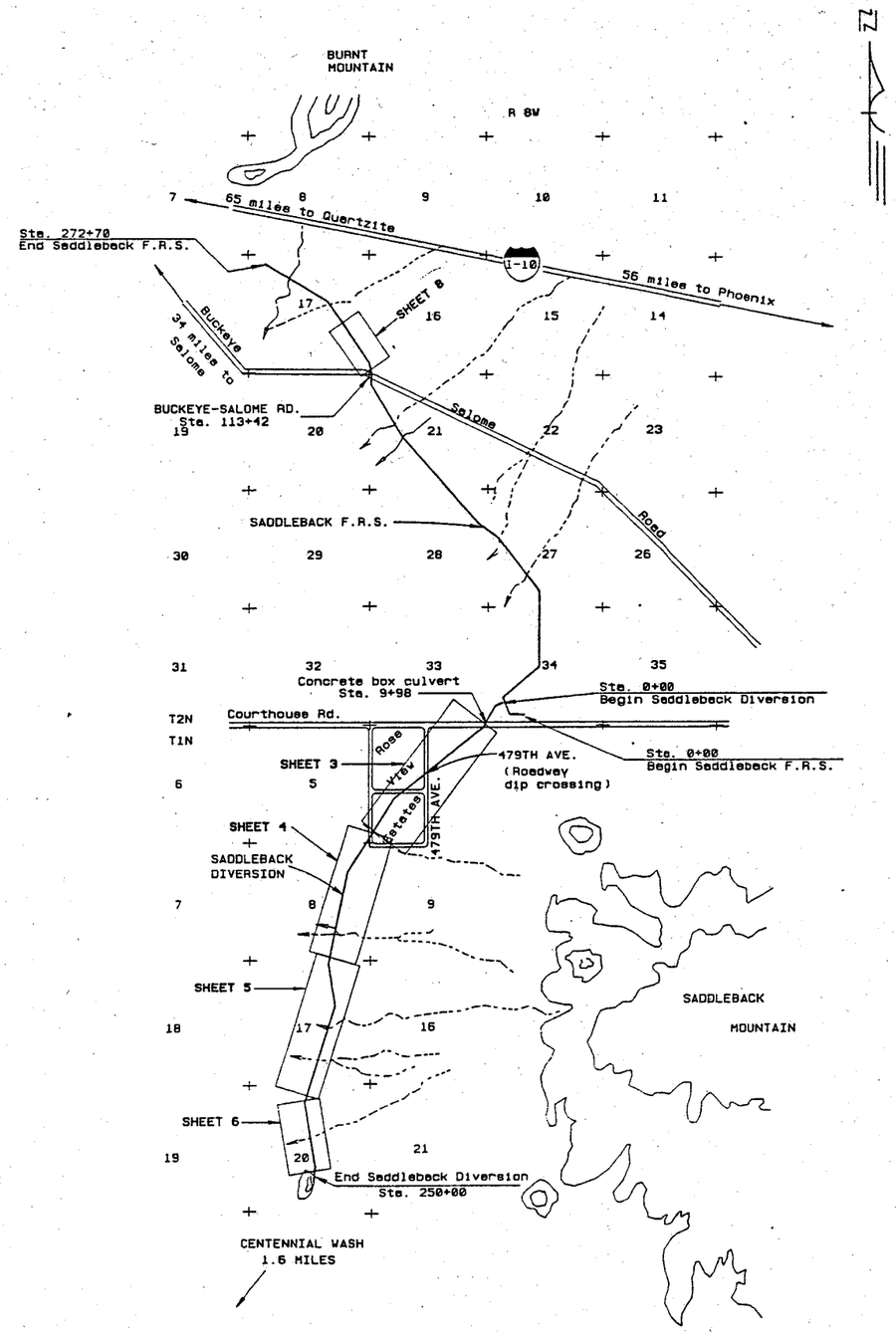
1. All existing conditions are to be verified in the field prior to construction and any adjustments from drawings to be made as directed by the engineer.
2. All utilities as shown on the plans are approximate. It shall be the responsibility of the contractor to field verify locations of all utilities and to coordinate construction with the respective utility companies.
3. Elevations are in feet above mean sea level U.S.G.S datum.
4. All stationing refers to centerline of existing Diversion Channel and F.R.S. Drain Channel and is the measured horizontal distance.
5. The Saddleback Diversion monuments are located near the easterly right-of-way and vary from 150 feet to 400 feet left of the Diversion Channel centerline. The Saddleback FRS control monuments are located near the westerly top edge of the FRS structure. All monuments outside of the channel excavation limits are to remain undisturbed. Monuments damaged, by the contractor, outside of the channel excavation limits will be replaced by the government at the contractors expense.
6. Drilling logs, laboratory reports and geology reports are available for inspection at the Soil Conservation Service, 201 East Indianola, Suite 200, Phoenix, Az.
7. All sections are shown looking downstream of the Diversion Channel and FRS Drain Channel except as noted.

WICKENBURG N.R.C.D.	BUCKEYE-ROOSEVELT N.R.C.D.	FLOOD CONTROL DISTRICT OF MARICOPA COUNTY	REVISIONS
APPROVED	APPROVED	APPROVED	
DATE: 4-7-89 CHAIRMAN	DATE: 4/6/1989 CHAIRMAN	DATE: 4-7-89 CHIEF ENGINEER	

INDEX OF DRAWINGS
SADDLEBACK DIVERSION REPAIR
HARQUAHALA VALLEY W.P.P.
MARICOPA COUNTY, ARIZONA

U. S. DEPARTMENT OF AGRICULTURE
SOIL CONSERVATION SERVICE

		Date		
Designed	J. HARRINGTON	1/89	Approved By	STATE CONSERVATION ENGINEER
Drawn	A. MOLINA	1/89	Title	
Traced			Title	
Checked	D.E.PAULUS	1/89	Sheet No. 1 of 12	Drawing No. AZ-89001-B



PROJECT LOCATION MAP

1000 0 5000
SCALE IN FEET

SADDLEBACK DIVERSION
CONTROL MONUMENTS

MONUMENT	STATION	ELEVATION
1	1+17.38	1183.46
2	4+35.60	1181.65
3	10+59.70	1181.93
4	12+89.55	1179.09
5	16+70.09	1181.33
6	19+69	1179.62
7	25+00.32	1173.80
8	30+00	1171.69
9	35+00	1169.22
10	40+00	1168.11
11	45+00	1166.93
12	50+00	1163.83
13	55+00	1164.21
14	60+37.15	1164.00
15	NOT	FOUND
16	70+00	1163.66
17	75+00	1161.36
18	81+83	1158.22
19	86+81.08	1155.38
20	90+00	1154.12
21	95+00	1151.91
22	100+69.43	1152.67
23	105+00	1151.16
24	110+00	1149.92
25	115+94.68	1148.47
26	120+00	1147.71
27	125+00	1147.64
28	130+00	1146.29
29	135+00	1144.79
30	140+90.92	1143.05
31	144+82	1142.14
32	149+10.85	1139.65
33	155+00	1138.44
34	159+47.27	1135.14
35	165+00	1133.39
36	NOT	FOUND
37	177+40.81	1129.33
38	185+00	1127.84
39	190+00	1125.68
40	195+00	1125.56
41	202+74.10	1124.71
42	210+00	1123.86
43	215+00	1121.53
44	220+32.64	1122.27
45	225+00	1118.79
46	230+00	1115.95
47	238+39.09	1110.84
48	245+00	1103.79
49	249+30.30	1096.93

SADDLEBACK FLOODWATER
RETARDING STRUCTURE
CONTROL MONUMENTS

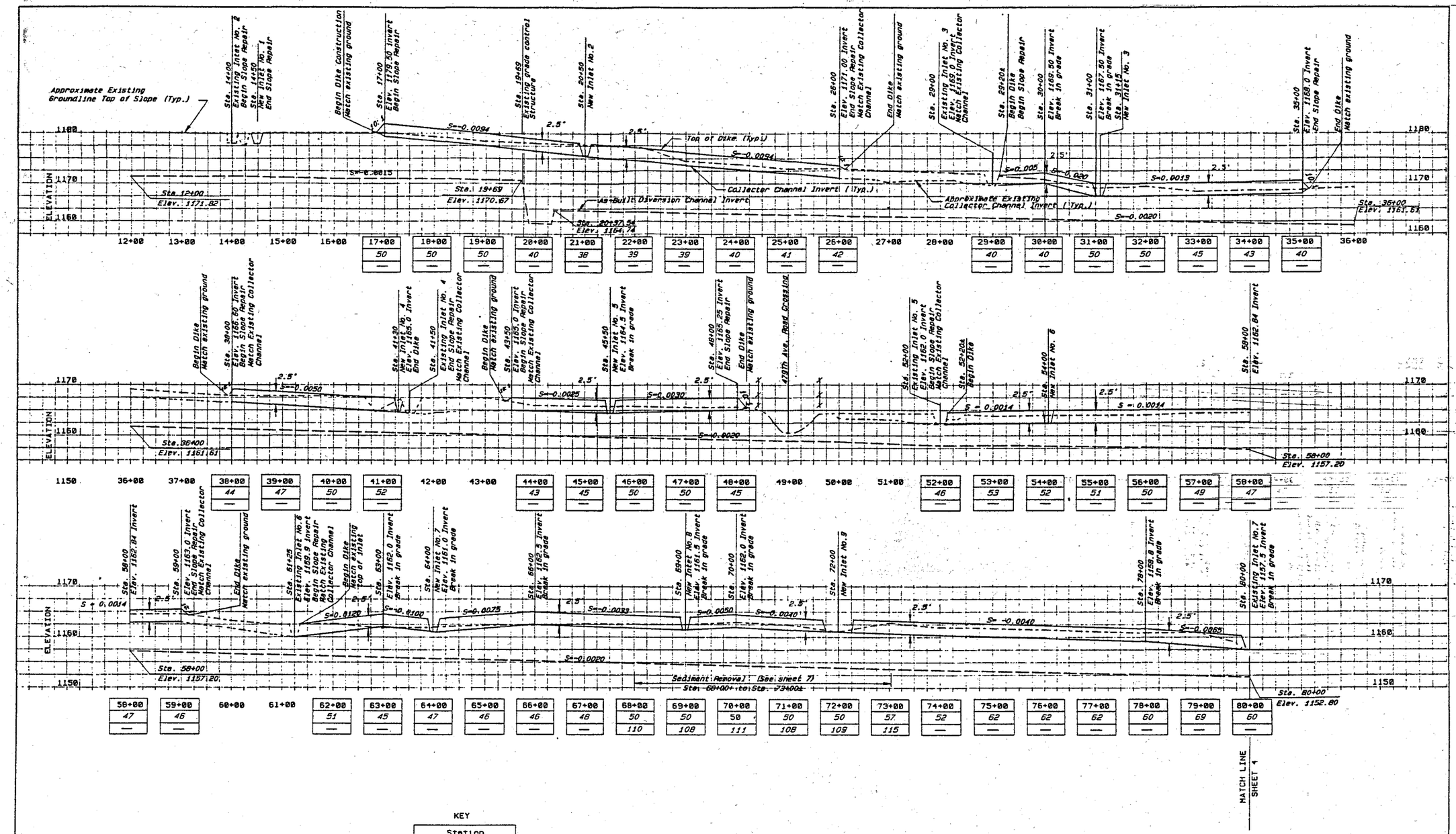
MONUMENT	STATION	ELEVATION
A-21	121+56	1193.90
A-22	131+56	1194.19
A-23	141+56	1194.43

LOCATION MAP
SADDLEBACK FRS & DIVERSION

HARQUAHALA VALLEY W.P.P.
MARICOPA COUNTY, ARIZONA

U. S. DEPARTMENT OF AGRICULTURE
SOIL CONSERVATION SERVICE

Designed J. HARRINGTON	Date 1-89	Approved By	
Drawn ART MOLINA	1-89	Title STATE CONSERVATION ENGINEER	
Traced		Title	
Checked DON PAULUS	1-89	Sheet No. 2 of 12	Drawing No. AZ-89001-B



KEY

Station
C\L Dike Offset (X) *
Toe Offset (T) **

Existing groundline
As-built diversion invert
Existing fence (barbed wire)
Design

*Distance (X) from control line (fence) to centerline of new dike.
**Distance (T) from control line (fence) to toe of slope for sediment removal. See Typical Cross Section Sheet 7.

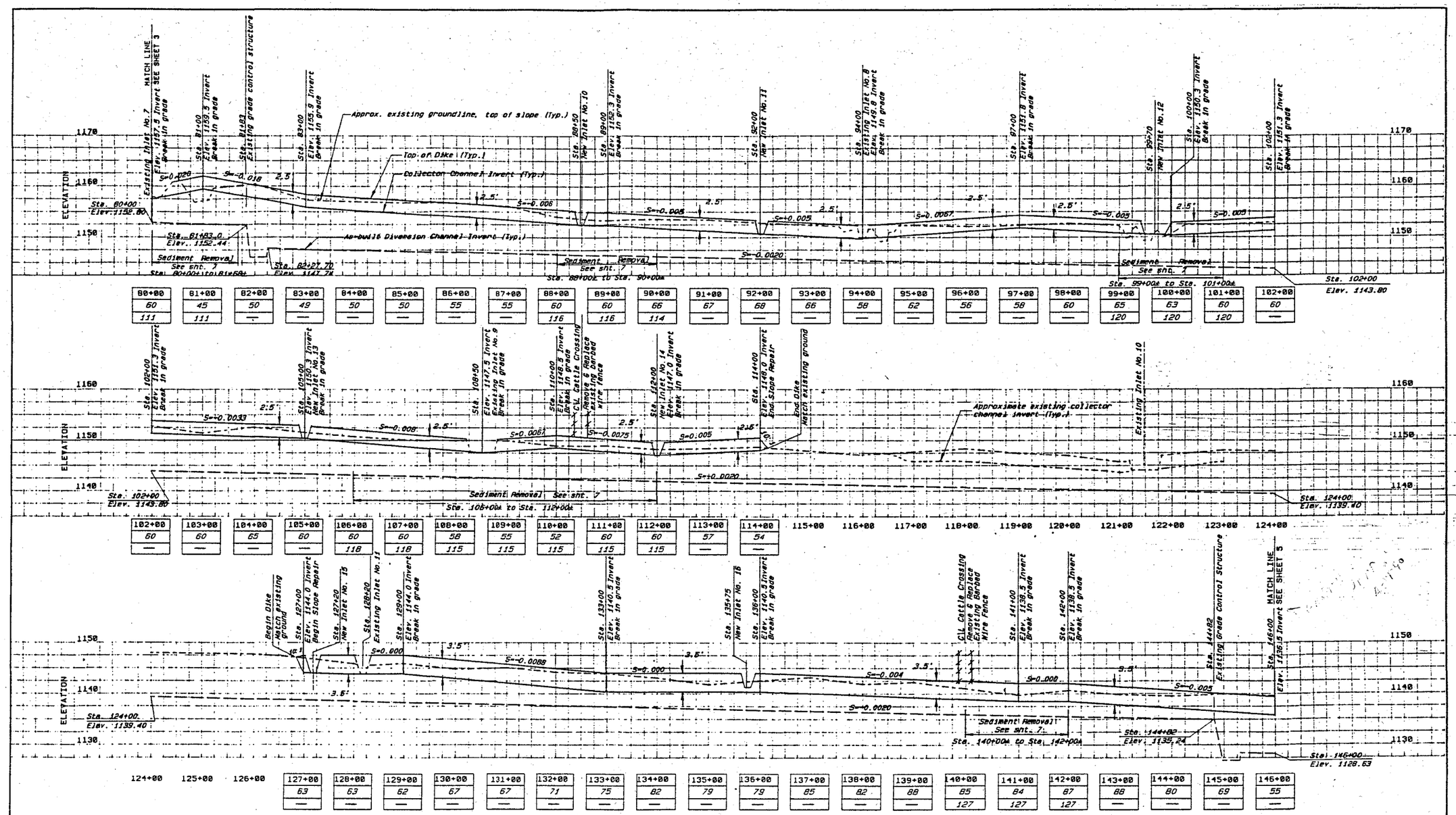
HORIZONTAL SCALE

100 0 100
SCALE IN FEET

PROFILE DIVERSION CHANNEL
Sta. 12+00 To STA. 80+00
SADDLEBACK DIVERSION REPAIR
HARQUAHALA W.P.P.
MARICOPA COUNTY, ARIZONA

U. S. DEPARTMENT OF AGRICULTURE
SOIL CONSERVATION SERVICE

		Date		
Designed	J. HARRINGTON	1-89	Approved By	
Drawn	ART MOLINA	1-89	Title	STATE CONSERVATION ENGINEER
Traced			Title	
Checked	DON PAULUS	1-89	Sheet No. 3 of 12	Drawing No. AZ-89001-B



KEY

Station
C\L Dike Offset (X) *
Toe Offset (T) **

Existing groundline
As-built diversion invert
Existing fence (barbed wire)
Design

*Distance (X) from control line (fence) to centerline of new dike.
**Distance (T) from control line (fence) to toe of slope for sediment removal. See Typical Cross Section Sheet 7.

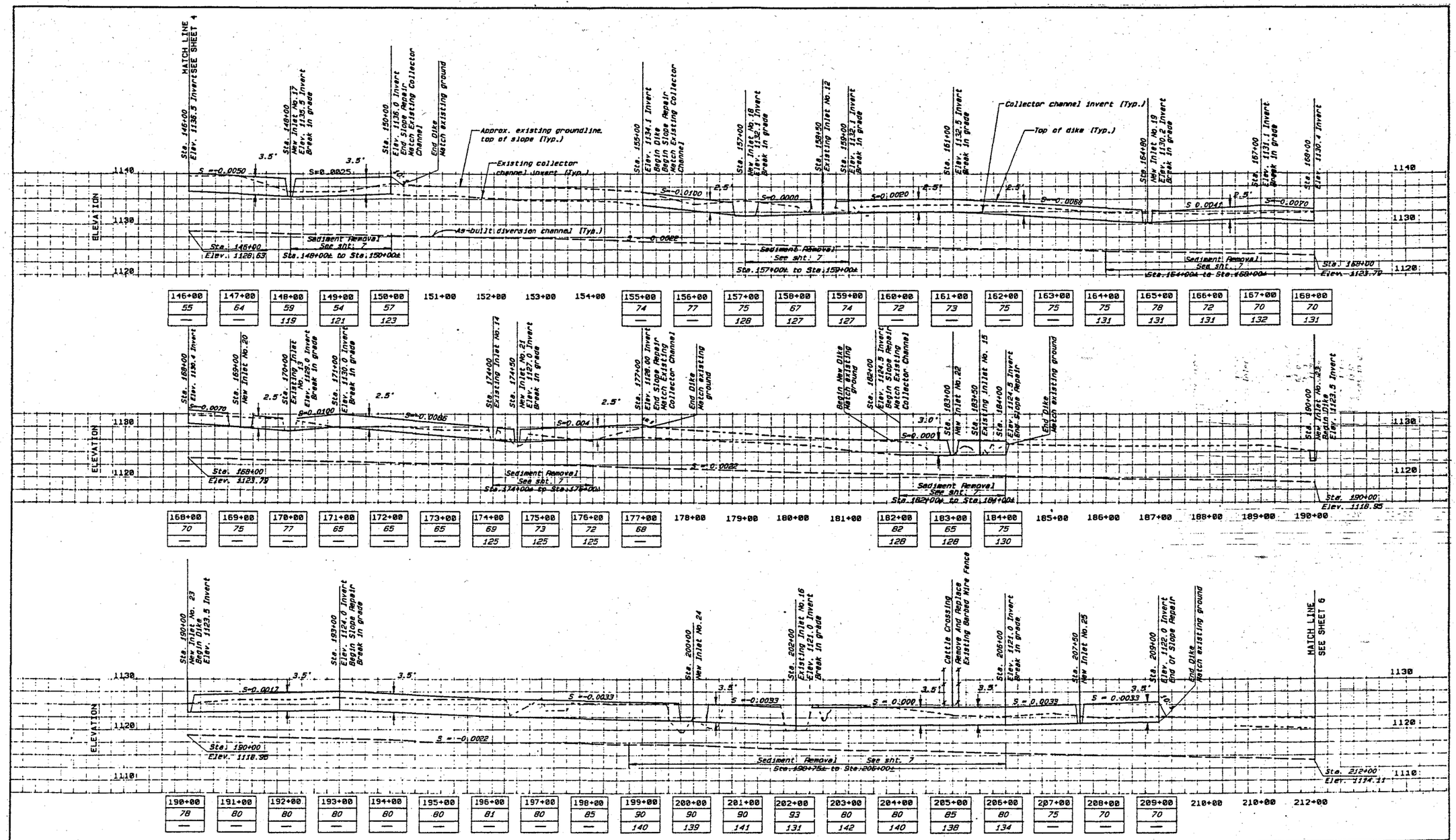
HORIZONTAL SCALE

100 0 100
SCALE IN FEET

PROFILE DIVERSION CHANNEL
STA. 80+00 TO STA. 146+00
SADDLEBACK DIVERSION REPAIR
HARQUAHALA W.P.P.
MARICOPA COUNTY. ARIZONA

U. S. DEPARTMENT OF AGRICULTURE
SOIL CONSERVATION SERVICE

		Date		
Designed	J. HARRINGTON	1-89	Approved By	
Drawn	ART MOLINA	1-89	Title	STATE CONSERVATION ENGINEER
Traced			Title	
Checked	DON PAULUS	1-89	Sheet No. 4 of 12	Drawing No. AZ-89001-B



KEY

Station
C\L Dike Offset (X) #
Toe Offset (T) ##

Existing groundline
As-built diversion invert
Existing fence (barbed wire)
Design

#Distance (X) from control line (fence) to centerline of new dike.
##Distance (T) from control line (fence) to toe of slope for sediment removal. See Typical Cross Section Sheet 7.

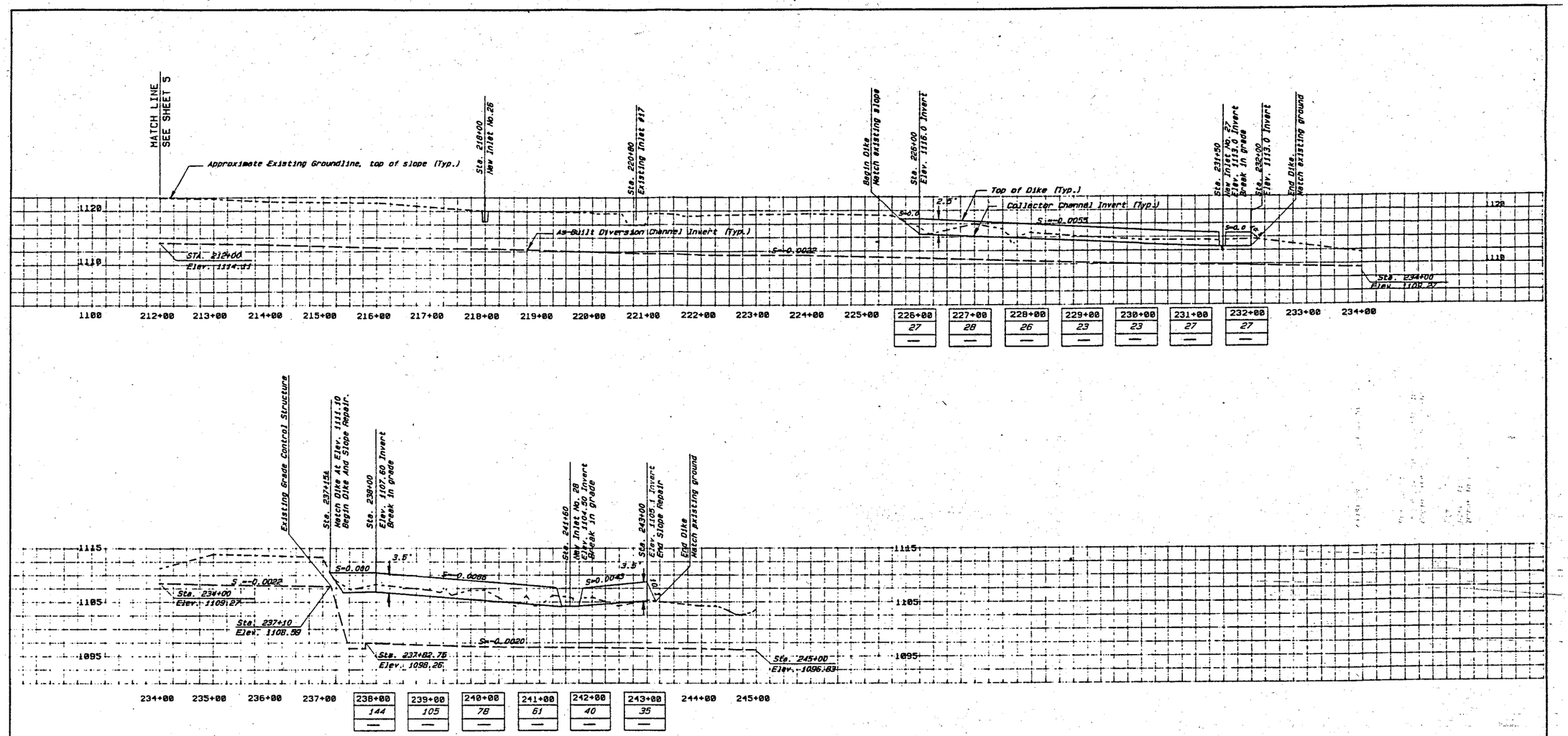
HORIZONTAL SCALE

100 0 100
SCALE IN FEET

PROFILE DIVERSION CHANNEL
STA. 146+00 TO STA. 212+00
SADDLEBACK DIVERSION REPAIR
HARQUAHALA W.P.P.
MARICOPA COUNTY, ARIZONA

U. S. DEPARTMENT OF AGRICULTURE
SOIL CONSERVATION SERVICE

		Date		
Designed	J. HARRINGTON	1-89	Approved By	
Drawn	B. J. LLOYD	1-89	Title	STATE CONSERVATION ENGINEER
Traced			Title	
Checked	DON PAULUS	1-89	Sheet No. 5 of 12	Drawing No. AZ-89001-B



*DISTANCE (X)	
Sta. 226+00 to Sta. 232+00	Sta. 238+00 to Sta. 243+00
From control line (Fence) to centerline of new dike.	From monumentline (Brass Cap at Sta. 238+39 to BC at Sta. 245+00) to centerline of new dike.

KEY

Station
C\L Dike Offset (X) *

Existing groundline
As-built diversion invert
Existing fence (barbed wire)
Design

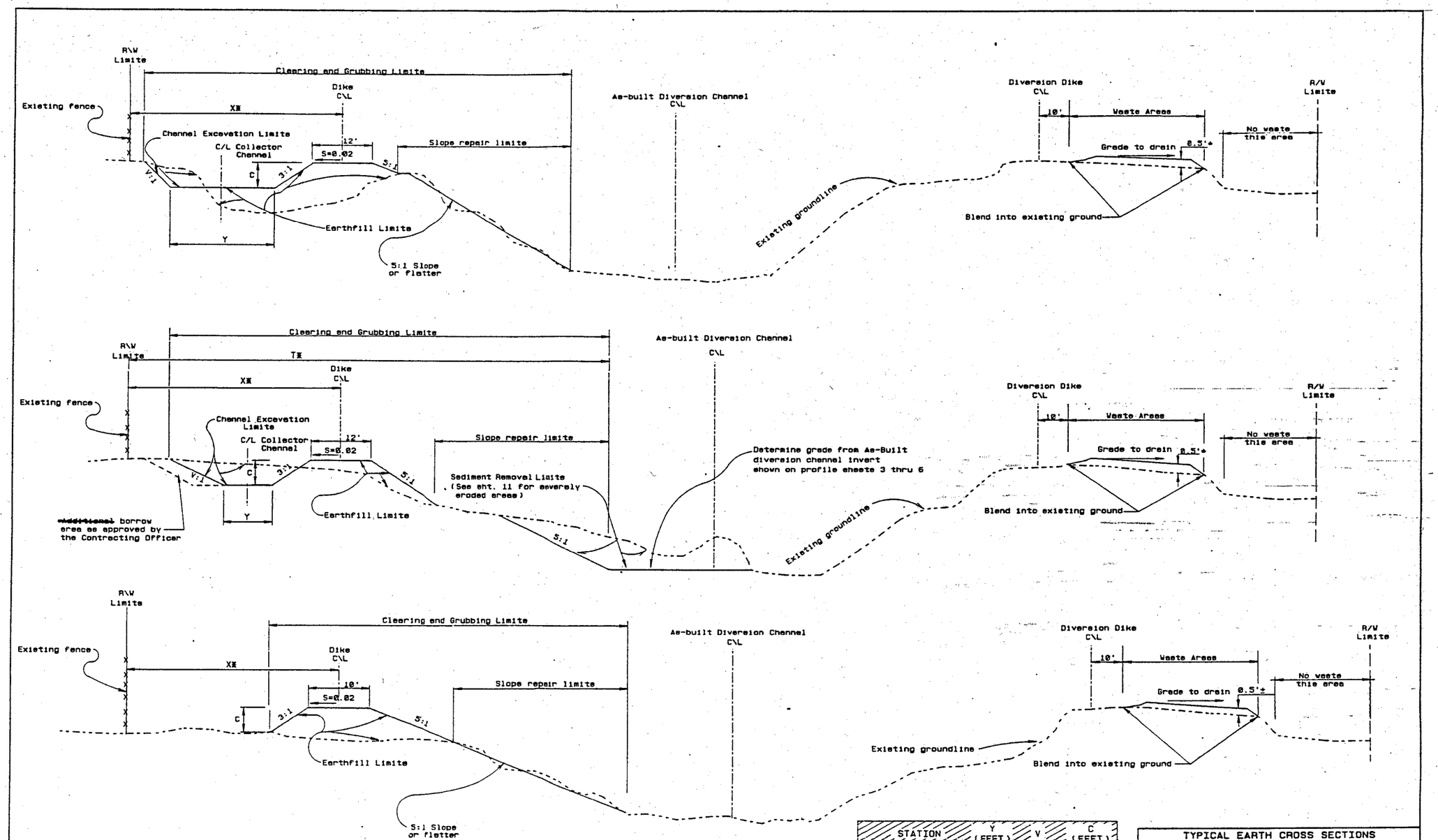
HORIZONTAL SCALE

100 0 100
SCALE IN FEET

PROFILE DIVERSION CHANNEL
STA. 212+00 TO STA.245+00
SADDLEBACK DIVERSION REPAIR
HARQUAHALA W.P.P.
MARICOPA COUNTY, ARIZONA

U. S. DEPARTMENT OF AGRICULTURE
SOIL CONSERVATION SERVICE

		Date		
Designed	J. HARRINGTON	1-89	Approved By	
Drawn	ART MOLINA	1-89	Title STATE CONSERVATION ENGINEER	
Drawn	B.J. LLOYD	1-89	Title	
Checked	DON PAULUS	1-89	Sheet No. 6 of 12	Drawing No. AZ-89001-B



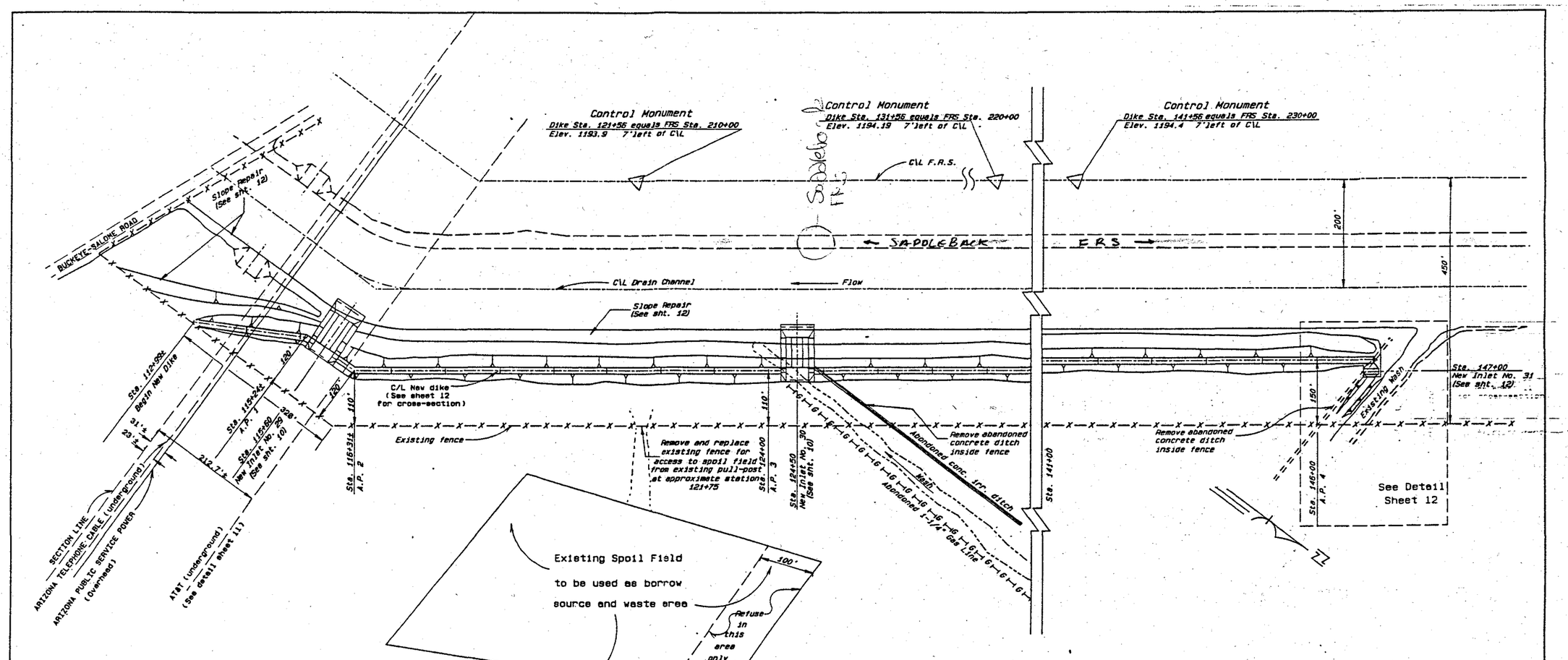
STATION	Y (FEET)	V	C (FEET)
17+00 to 26+00	14	5	2.5
29+00 to 35+00	14	5	2.5
38+00 to 41+50	20	5	2.5
43+50 to 48+00	20	5	2.5
52+00 to 59+00	20	5	2.5
61+25 to 114+00	24	5	2.5
127+00 to 150+00	28	3	3.5
155+00 to 177+00	28	5	2.5
182+00 to 184+00	30	5	3.0
190+00 to 209+00	20	5	3.5
226+00 to 232+00	10	2	2.5
237+15 to 243+00	30	5	3.5

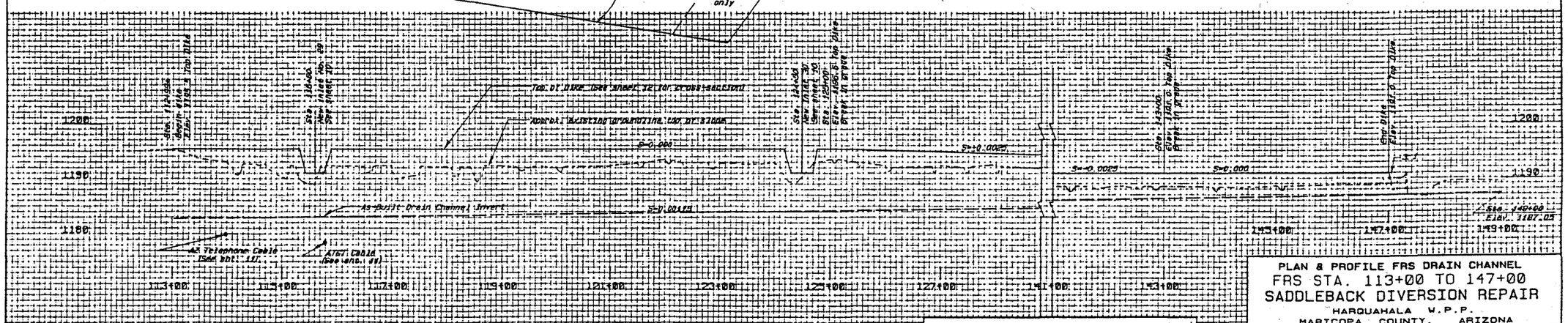
* Note:
Dimensions for X and T are given at each applicable station. See sheets 3 thru 6

TYPICAL EARTH CROSS SECTIONS
STA. 12+00 TO STA. 245+00
SADDLEBACK DIVERSION REPAIR
HARQUAHALA W.P.P.
MARICOPA COUNTY, ARIZONA

U. S. DEPARTMENT OF AGRICULTURE
SOIL CONSERVATION SERVICE

		Date		
Designed	J. HARRINGTON	1-89	Approved By	
Drawn	ART MOLINA	1-89	Title	STATE CONSERVATION ENGINEER
Traced			Title	
Checked	DON PAULUS	1-89	Sheet No. 7 of 12	Drawing No. AZ-89001-B





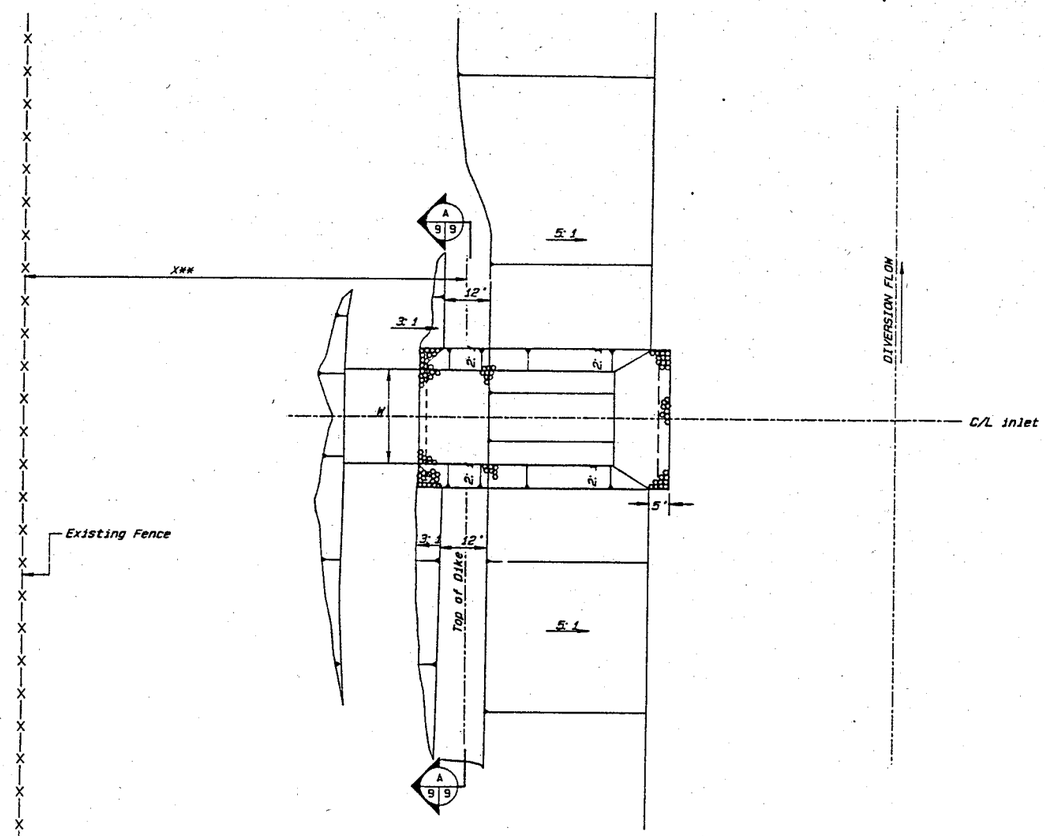
C\L NEW DIKE LOCATION

STA.	OFFSET FROM FENCE FEET
112+99	-0-
112+99 TO 115+24	Varies 0' to 120'
115+24 TO 116+31	120
116+31 TO 124+00	110
124+00 TO 146+00	Varies 110' to 150'
146+00 TO 147+00	150

PLAN & PROFILE FRS DRAIN CHANNEL
FRS STA. 113+00 TO 147+00
SADDLEBACK DIVERSION REPAIR
HARQUAHALA W.P.P.
MARICOPA COUNTY. ARIZONA

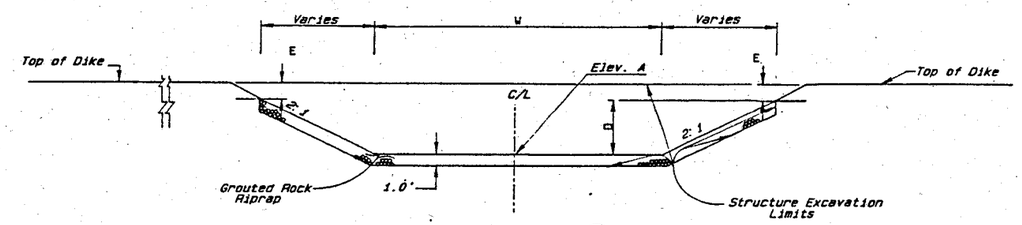
U. S. DEPARTMENT OF AGRICULTURE
SOIL CONSERVATION SERVICE

		Date	
Designed	J. HARRINGTON	1-89	Approved By
Drawn	ART MOLINA	1-89	Title STATE CONSERVATION ENGINEER
Traced			Title
Checked	DON PAULUS	1-89	Sheet No. 8 of 12 — Drawing No. AZ-89001-B

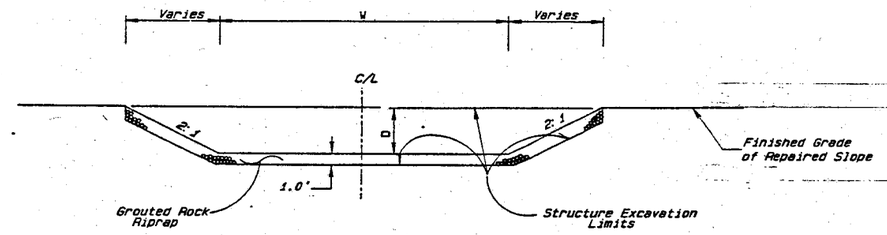


PLAN

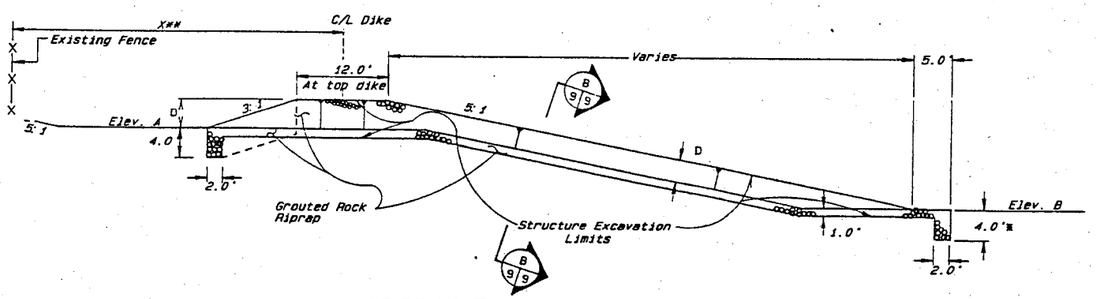
10 0 20
SCALE IN FEET



SECTION A 9 9



SECTION B 9 9



PROFILE ON C\L INLET

5 0 10
SCALE IN FEET

*Downstream cutoff wall may be terminated at moderately hard caliche as approved by the Engineer.

**Dimensions for (X) are given at each applicable station. See sheets 3-6.

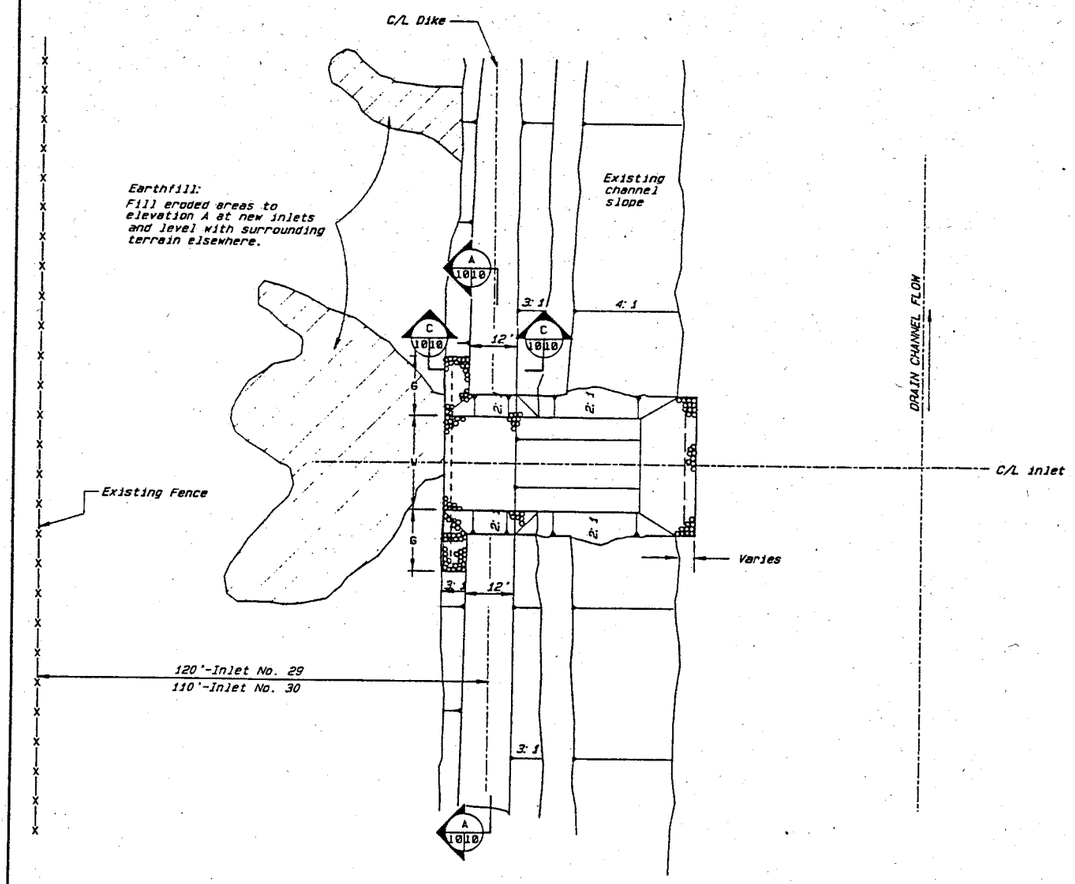
NEW INLET	STATION	W FEET	D FEET	A ELEV.	B ELEV.	E FEET
1	14+50	10.0	2.0	1178.0	1171.5	-
2	20+50	5.0	2.5	1176.2	1164.7	-
3	31+15	5.0	2.5	1167.5	1162.6	-
4	41+30	5.0	2.0	1165.0	1160.6	0.5
5	45+50	10.0	2.5	1164.5	1159.7	-
6	54+00	10.0	2.5	1162.3	1158.0	-
7	64+00	10.0	2.5	1161.0	1156.0	-
8	69+00	10.0	2.5	1161.5	1155.0	-
9	72+00	50.0	2.5	1161.2	1154.4	-
10	88+50	5.0	2.5	1152.6	1146.5	-
11	92+00	5.0	2.5	1150.8	1145.8	-
12	99+70	45.0	2.5	1150.4	1144.3	-
13	105+00	5.0	2.5	1150.3	1143.2	-
14	112+00	10.0	2.5	1147.0	1141.8	-
15	127+20	5.0	2.5	1144.0	1138.8	1.0
16	135+75	5.0	2.5	1141.0	1137.0	0.5
17	148+00	10.0	2.5	1135.5	1128.2	1.0
18	157+00	45.0	2.5	1132.1	1126.2	-
19	164+80	15.0	2.5	1130.2	1124.4	-
20	169+00	45.0	2.5	1129.7	1123.6	-
21	174+50	5.0	2.5	1127.0	1122.3	-
22	183+00	10.0	2.5	1124.5	1120.5	0.5
23	190+00	5.0	2.5	1123.5	1119.0	1.0
24	200+00	50.0	3.5	1121.7	1116.8	-
25	207+50	5.0	2.5	1121.5	1115.1	1.0
26	218+00	5.0	2.5	1118.5	1112.8	-
27	231+50	5.0	2.5	1113.0	1109.5	-
28	241+60	35.0	3.5	1104.5	1097.5	-

10 5 0 10
SCALE IN FEET

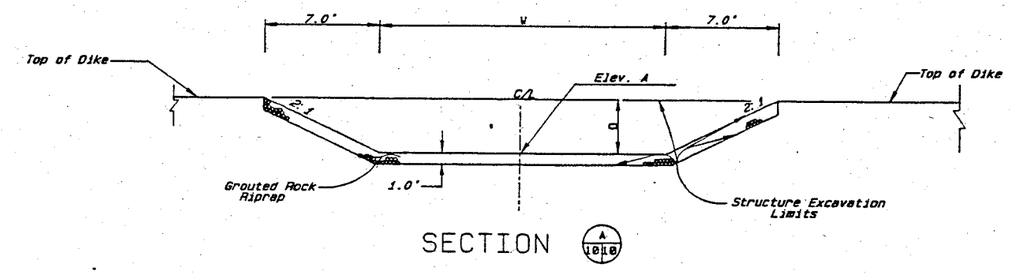
DETAILS-NEW SIDE INLETS 1 TO 28
SADDLEBACK DIVERSION REPAIR
HARQUAHALA VALLEY W.P.P.
MARICOPA COUNTY, ARIZONA

U. S. DEPARTMENT OF AGRICULTURE
SOIL CONSERVATION SERVICE

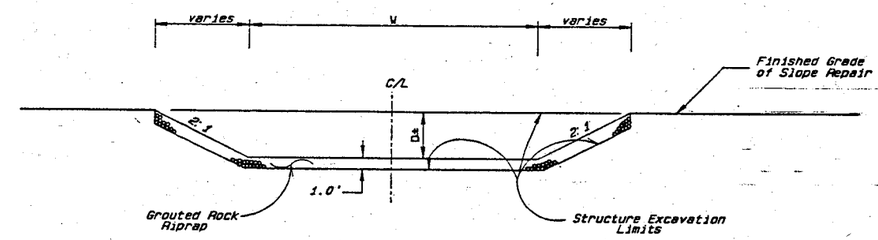
Designed J.M.HARRINGTON	Date 1-89	Approved By	
Drawn ART MOLINA	1-89	Title STATE CONSERVATION ENGINEER	
Traced		Title	
Checked D.E.PAULUS	1-89	Sheet No 9 of 12	Drawing No. AZ-89001-B



PLAN
NTS



SECTION A/1010



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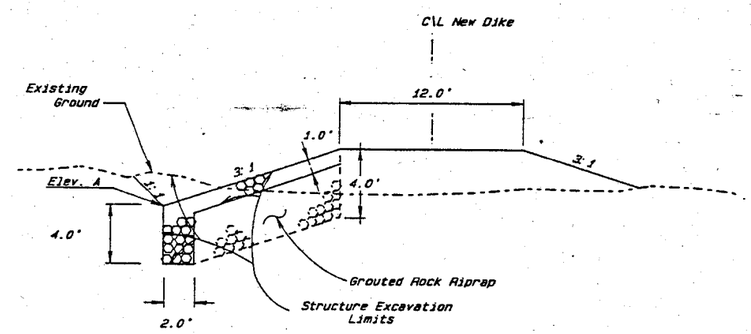

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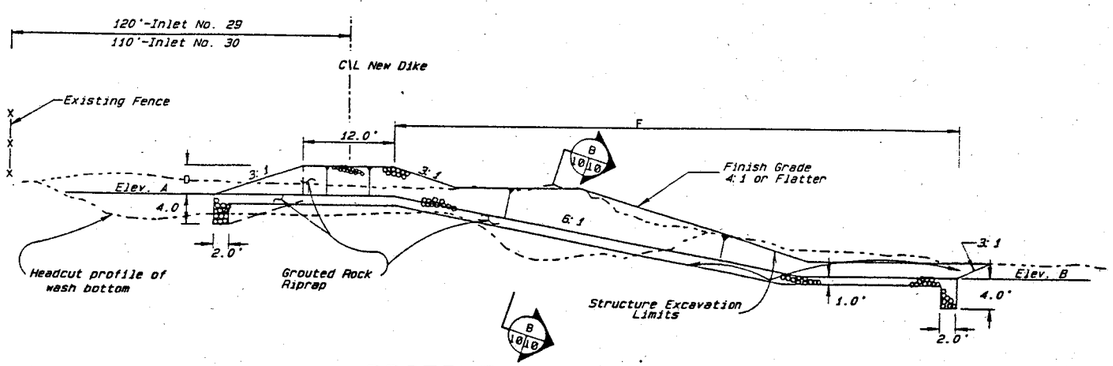
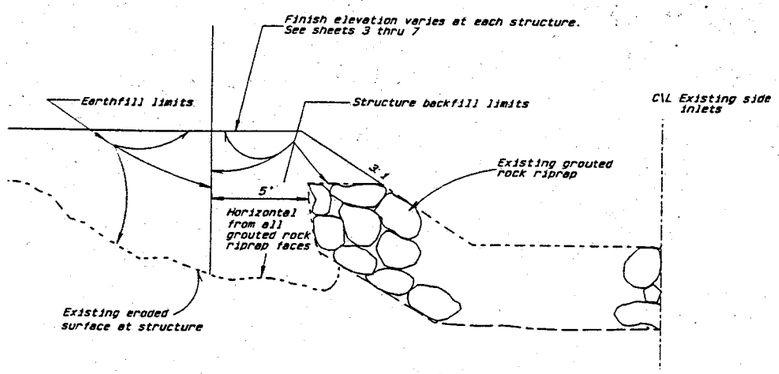


PROFILE ON C\L INLET
NTS

NEW INLET	STATION	W FEET	D FEET	A ELEV.	B ELEV.	F FEET	G FEET
29	115+60	40.0	3.5	1192.0	1183.2	61	7
30	124+50	40.0	3.5	1192.0	1184.3	64	20

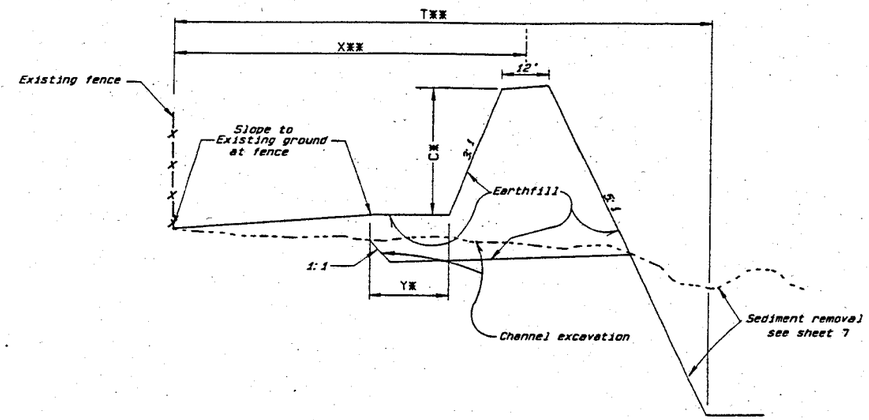
DETAILS-NEW SIDE INLETS 29 & 30
SADDLEBACK DIVERSION REPAIR
HARQUAHALA VALLEY W.P.P.
MARICOPA COUNTY. ARIZONA
U. S. DEPARTMENT OF AGRICULTURE
SOIL CONSERVATION SERVICE

Designed J.M.HARRINGTON Date 1-89
Drawn ART MOLINA 1-89
Traced
Checked D.E.PAULUS 1-89
Approved By
Title STATE CONSERVATION ENGINEER
Title
Sheet No. 10 of 12
Drawing No. AZ-89001-B



TYPICAL SECTION--STRUCTURE BACKFILL AT EXISTING SIDE INLETS

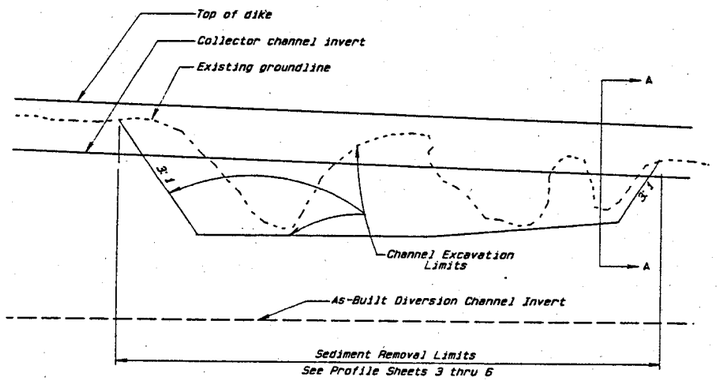
NTS



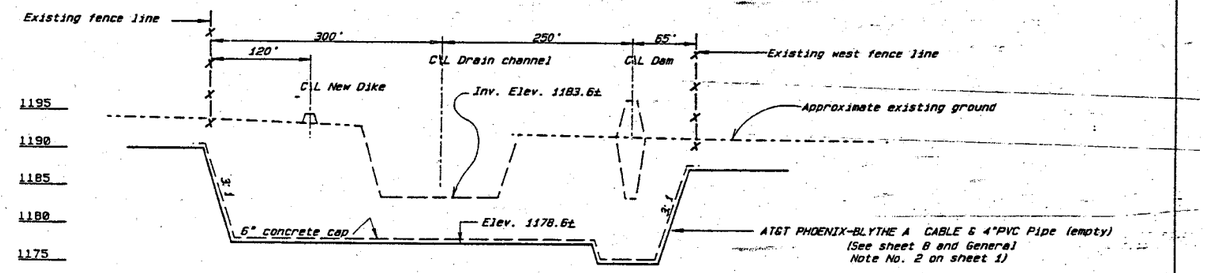
SECTION A-A NTS

* See table sheet 7

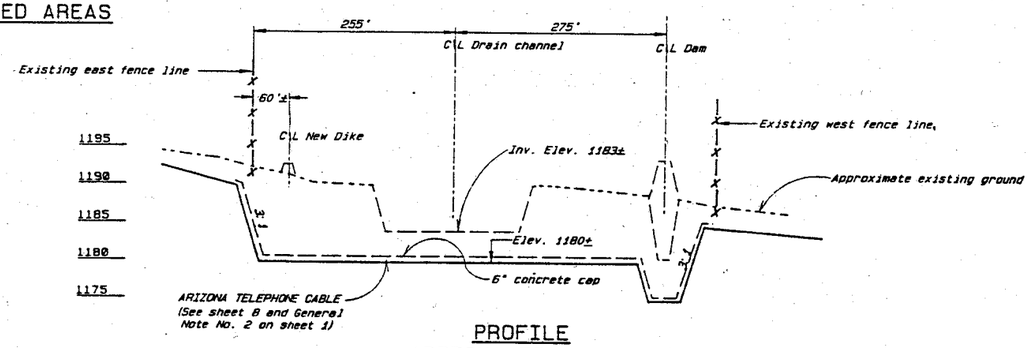
** See sheet's 3 thru 7 for dimensions



TYPICAL PROFILE--SEVERELY ERODED AREAS



PROFILE
AMERICAN TELEPHONE AND TELEGRAPH

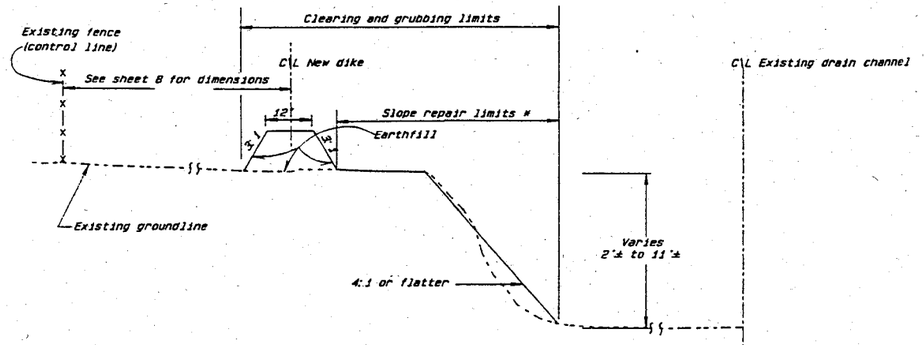


PROFILE
ARIZONA TELEPHONE

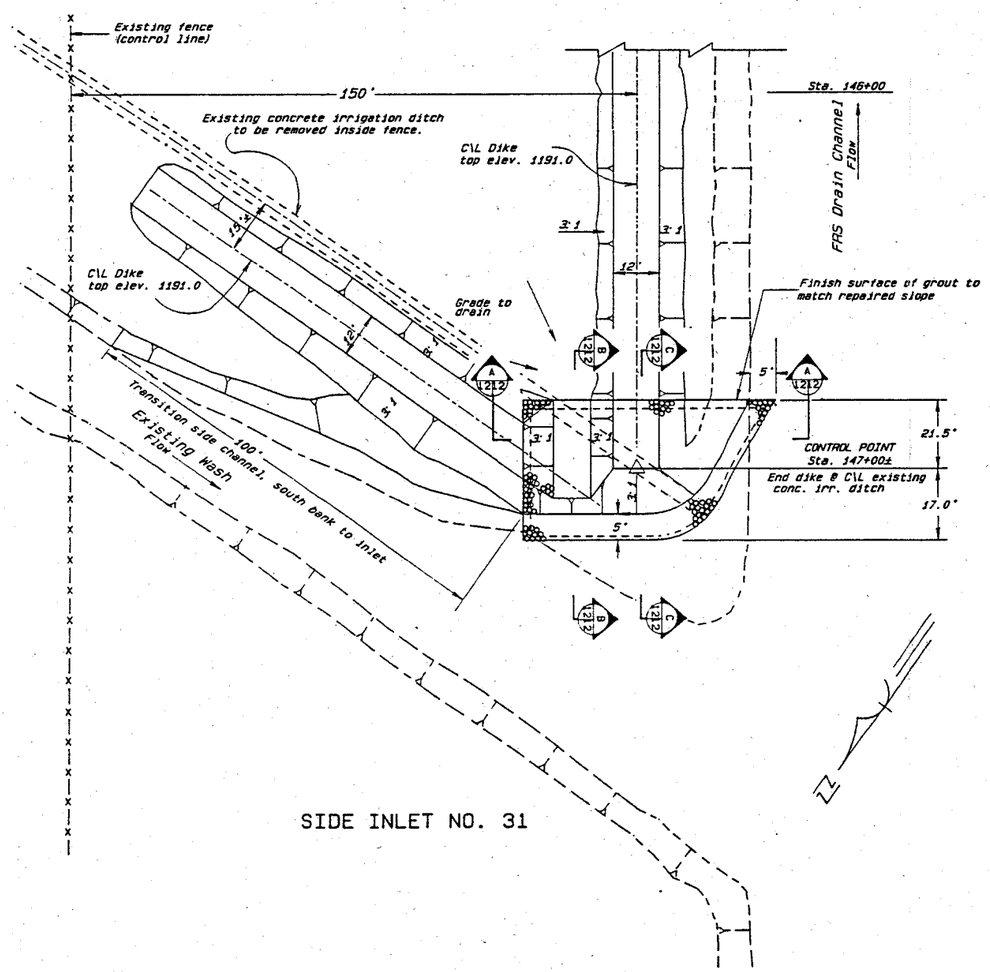
DETAILS
BACKFILL-EARTHFILL-EROSION-UTILITIES
SADDLEBACK DIVERSION REPAIR
HARQUAHALA W.P.P.
MARICOPA COUNTY. ARIZONA

U. S. DEPARTMENT OF AGRICULTURE
SOIL CONSERVATION SERVICE

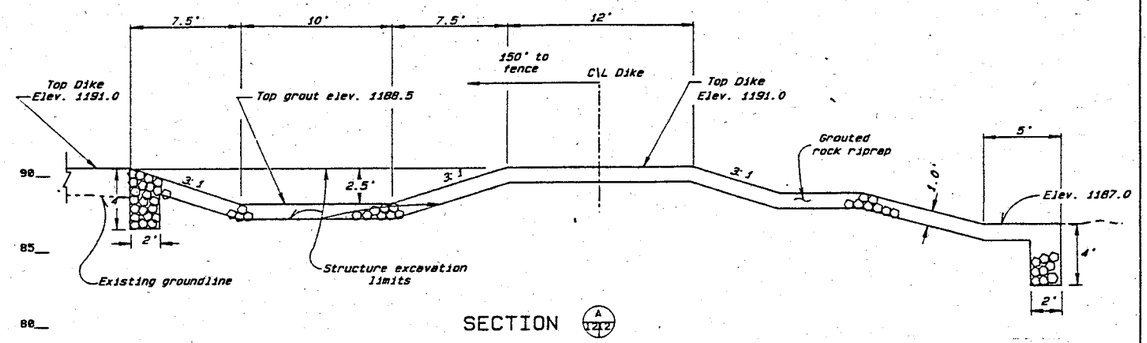
Designed J. HARRINGTON	Date 1-89	Approved By	
Drawn ART MOLINA	1-89	Title STATE CONSERVATION ENGINEER	
Traced		Title	
Checked DON PAULUS	1-89	Sheet No. 11 of 12	Drawing No. AZ-89001-B



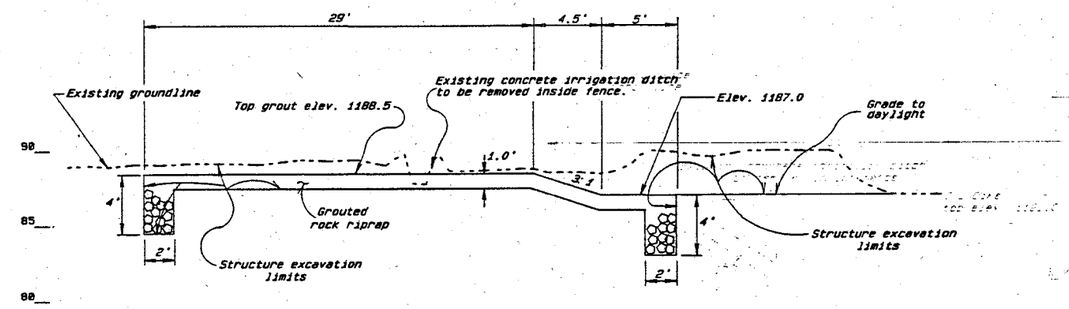
TYPICAL CROSS SECTION
DRAINAGE CHANNEL STA. 113+00* TO STA. 147+00
(*SLOPE REPAIR BEGINS AT BUCKEYE-SALOME RD.)



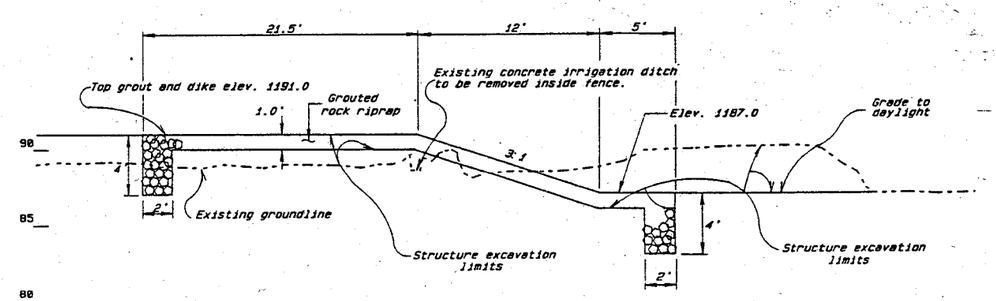
SIDE INLET NO. 31



SECTION A 12|2



SECTION B 12|2



SECTION C 12|2

SCALE 5 0 5 IN FEET

DETAILS
INLET NO.31 & TYPICAL EARTH
CROSS SECTION Sta. 113+00 TO Sta. 147+00
SADDLEBACK DIVERSION REPAIR
MARQUAHALA W.P.P.
MARICOPA COUNTY. ARIZONA

U. S. DEPARTMENT OF AGRICULTURE
SOIL CONSERVATION SERVICE

Designed J. HARRINGTON	Date 1-89	Approved By	
Drawn ART MOLINA	1-89	Title STATE CONSERVATION ENGINEER	
Traced		Title	
Checked DON PAULUS	1-89	Sheet No. 12 of 12	Drawing No. AZ-89001-B