Lower Hassayampa

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DRAINAGE REPORT
SUN VALLEY PARKWAY
PHASE III - 291ST AVENUE
FROM I-10 TO NORTHERN AVENUE
CWW NO. 850840-7
MARICOPA COUNTY, ARIZONA

Prepared for
THE ADAMS GROUP
4520 NORTH CENTRAL AVENUE
SUITE 500
PHOENIX, ARIZONA 85012

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INTRODUCTION

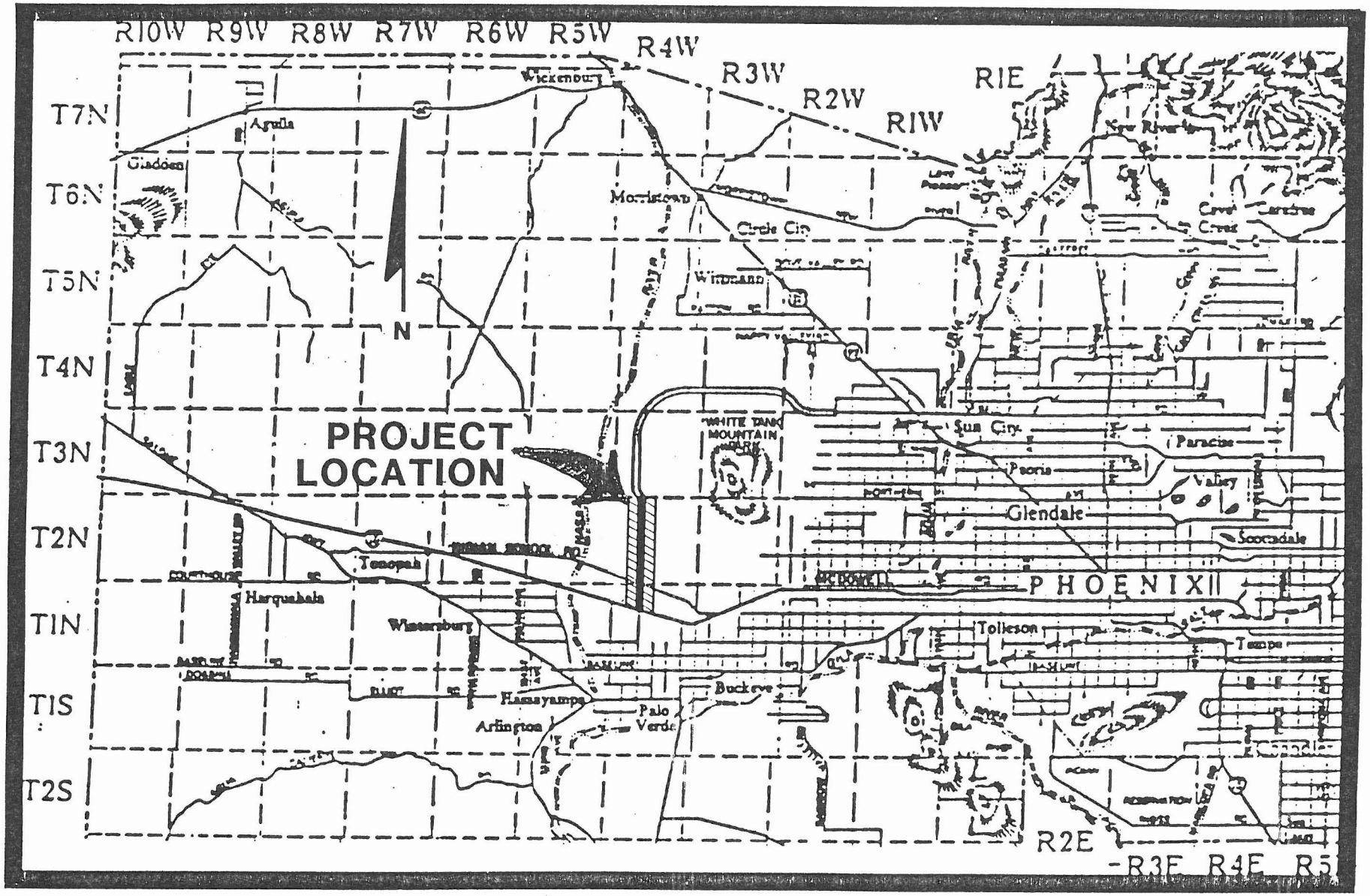
This drainage report is for the extension of 291st Avenue (Palo Verde Road) for approximately 7-3/4 miles from Interstate 10 to Northern Avenue as a portion of the development for the proposed master planned community of Sun Valley, Arizona. Collar, Williams & White Engineering Inc. was contracted by the Adams Group, Inc. to prepare the construction plans and drainage report for this road.

This report quantifies the amount of runoff that will cross the roadway in the 100-year storm and sizes the culverts necessary to carry the runoff under the road. This report is only for the roadway improvements and is not intended to be used as master drainage study for future development. It is the future development's responsibility to not adversely impact the highway.

II. DESCRIPTION OF AREA AND MAJOR DRAINAGE FEATURES

This project area is located in Townships 1 and 2 North and Range 4 West of Maricopa County and lies between the White Tank Mountains to the east and the Hassayampa River to the west (See Exhibit 1 - Location Map). The surrounding area is mostly undeveloped desert with a few scattered homesites along the southern 2 miles of the road.

The area contributing runoff that crosses the road alignment consists of a portion of the western slopes of the White Tank Mountains and the lower alluvial fan slopes of the White Tanks. The land slopes to the southwest and drains into the Hassayampa River. The alluvial fan slope area, across which the proposed road will be built, is characterized by a number of active washes, braided split-flow channels, and overland sheet flow. The washes intersecting the northernmost mile of the road are predominantly incised with well-defined, stable ridges in between. The remaining washes crossing the road for the most part have wide braided channels with evidence of overbank flow and sheet flow and are relatively unstable and unpredictable.



LOCATION MAP

Exhibit - 1

One of the major man-made improvements in the area is Interstate 10 and the associated Buckeye Watershed Project which consists of an earthen dike and large retention basins along the north side of the freeway. The dike and basins collect runoff from the White Tank Mountains and surrounding areas and prevent the water from crossing the freeway.

Other man-made improvements include a two-lane paved road on the southern 1-3/4 miles of this project which includes a dirt channel along the east side of the road to collect runoff and transport it south to the Buckeye Watershed retention basins. This channel is approximately 2-3 feet deep, varies from 12 to 20 feet in width, and was apparently constructed to prevent runoff from crossing 291st Avenue and impacting the development on the west side of the road. There are no drainage improvements in the subdivision west of 291st Avenue

III. PROPOSED DEVELOPMENT AND DRAINAGE SYSTEM

This project consists of 7-3/4 miles of a 6-lane parkway including a raised median. The Maricopa County Highway Department has stipulated that this road be designed with a 70 mile-per-hour design speed and that crossroad drainage structures are to be designed for a flow of a 100 year, 1 hour duration storm with pavement and median designed for a 10 year storm.

The proposed drainage system for the north six miles of the road consists of a series of collection channels along the east side of the road to collect overbank and sheet flows and direct these flows to the main channels. Concrete box culverts or pipe culverts are placed at the main channels to carry the stormwater under the roadway. The culverts have been designed to carry the runoff from a 100-year storm with the headwater contained within the banks of the washes. Pipe culverts are reinforced concrete pipes, concrete lined and bituminous lined corregated steel pipe; in those areas where the cover depth is between one and two feet Class IV pipe was used.

Catch basins have been located at sufficient spacing in the median to collect the water that falls in the median to prevent runoff from overtopping the curbs in a 100-year storm, although the minimum requirement is only for the 10 year storm.

The proposed drainage system for the south 1-3/4 miles of the project also includes a concrete lined channel running along the east side of the road. This channel will serve the same purpose as the existing dirt channel; it will intercept all runoff on the upstream side of the road and transport it to the Buckeye Watershed Project retention basins. The hydrologic/hydraulic analysis of the potential impact at the proposed roadway on the ADOT right of way and Buckeye watershed structure will be addressed separately associated with the I-10 interchange design and any Dam Safety Analysis that might be required. This concrete channel will be sized to carry the flows from a 100-year storm. A series of catch basins and curb openings within the parkway will intercept street runoff from the parkway and convey it into this channel. The channel is being sized with an additional minimum half one-foot of freeboard.

No major changes of diversions of flow are proposed. The interceptor channel for south 1 3/4 miles is simply replacing the existing earthen channel which currently collects and carries flow south in to the Buckeye Flood Control structure.

Future development upstream of the roadway may increase runoff from present conditions, however, it will not affect the performance of the hydraulic structures on the project because design discharges were derived using projected future condition runoff curve numbers and because of County retention requirements.

Ponding during the 100 year event will occur upstream of culverts, however, the proposed project will have minimal effect on drainage flows and flood levels. In the case of areas of unpredictable split

flow situations the road will improve the developability of downstream areas because the culverts will convey flows in a well defined location which will permit easier and safer planning and development of the areas.

IV. ANALYSIS PROCEDURES

Watershed areas for the area draining across the project are delineated on Exhibit 2, the Drainage Area Map, which is a combination of U.S.G.S. quadrangle maps overlayed on Orthophoto quads obtained from the State Land Department. Watershed boundaries were also confirmed with 1985 areial photography of the entire watershed area at a scale of 1"=1000' and with contact prints of the strip aerial photography used for the topographic mapping of the road alignment at a scale of 1"=400'.

Peak discharges for the watershed areas were determined using the Rational formula for areas less than 100 acres in size and using the Corps of Engineers HEC-1 Computer Program with the SCS runoff curve number and dimensionless unit hydrograph options for areas in excess of 100 acres. The drainage areas on the slopes of the White Tank Mountains were assumed to have curve numbers of 93 based on "D" hydrologic soil group and five percent desert brush vegetative cover. The flatter desert areas were assumed to have a curve number of 83 in an undeveloped condition, based on "B" hydrologic soil group and 15% desert brush. A curve number of 86 was used in the calculations to account for a potential increase in runoff due to future development based on "B" soils with average R1-70 single family development. Likewise, a runoff coefficient of 0.42 was used in the rational method calculations instead of the undevleoped desert runoff coefficient of 0.35 to account for future development (values selected from ADOT's Figure 3-3)

Times of concentration for each drainage area were determined using Figure 3-1, in the Appendix, for flow in the washes and Figure 2-8 for overland flow (velocity in parenthesis on calculation sheets). TLAG in

the HEC-1 calculations is 0.6 TC. A precipitation value of 2.43 inches for the 100-year, one-hour duration storm were determined using the A.D.O.T. drainage manual procedures (results are included in Table I and Figure 1 in the Appendix). Rainfall intensities for the rational method were obtained from Figure 3-2 in the Appendix.

Runoff hydrographs of upstream drainage areas were routed through the downstream drainage areas with flow splits as indicated on Exhibit 2. Split flow conditions were identified with the use of 1"-1000 feet, 1986 aerial photography, U.S.G.S. Topographic maps and State Land Department orthophoto quadrangle maps. Percentages for flow splits shown on Exhibit 2 were determined by measuring channel widths on the aerial photo and dividing each by the combined total width.

In several locations flow splits were identified but were not shown on Exhibit 2, either, because; the split came back together further downstream within the same drainage area; or that the flow split was considered too minor or inactive to account for; or a split of comparable size compensated for the flow diverted. The required downstream freeboard requirements on channels and culverts are assumed to more than compensated for these minor split flow conditions, and any errors in the percentage splits used. Splits used in HEC-1 are the straight percentage shown on Exhibit 2.

Future upstream development as in all cases must take into account the contributing area assumptions used in the design the parkway drainage structures so that significant upstream diversions from one area to another are not made. Natural conditions are such that a minor unintential improvement in the wrong location could cause a significant major diversion of flows.

Runoff hydrographs were combined at the concentration points of the drainage areas as they intersect the proposed roadway to determine the peak 100-year runoff that would intersect the road. A summary of the 100-year peak flows and the culverts designed to carry the flows under

the road are shown in Table II. Copies of the HEC-1 runoff summary sheets are included at the back of the Appendix. Copies of the entire HEC-1 computer runs are available upon request. Rational method design forms for small drainage areas are included in the Appendix.

Runoff from the small areas calculated separately using the Rational Method is a conservative approach in accounting for all runoff on the upstream side of the road. These areas drain directly into the upstream side of the road and are not tributary to a larger wash. These areas could have been lumped in with the contributing area above the next downstream concentration point in the HEC-1 model however the small percentage increase in drainage area would have less effect on the design discharge value than if figured separately, as was done.

Concrete box culverts and pipe culverts were designed using Hydraulic Engineering Circulars #5 and #10 from the U.S. Department of Commerce, Bureau of Public Roads. Culvert design forms are included in the Appendix.

Catch basins were placed in the median at the low points of sag vertical curves and were also spaced at sufficient intervals on continuous grades so that the water carrying capacity of the median was not exceeded. The minimum capacity of the median swale (@ S = 0.32%) is 1.0 cfs. Using the Rational formula a 100-year storm would produce 0.85 cubic feet per second of runoff per 1000 feet of median length (Q = CIA = 0.35 x 6.6"/hr x .37 acres = 0.85 cfs). The runoff coefficient of 0.35 was selected from ADOT's Figure 3-3 based on worst case values for lawn or playground conditions. Therefore the maximum catch basin spacing is 1200 feet (1.2 x 0.85 = 1.0 cfs) where slope is at the minimum. Containment dikes were placed immediately downstream from median catch basins to provide a maximum ponding depth of 0.36 feet above the top of the grate. In many cases the 15 inch pipes can't maintain the minimum velocity of 3 fps desirable for silt carrying purposes because of the small discharges being intercepted, however,

the small discharges will not cause much erosion and the medians should stablize after several rains and runoff should be silt free.

The design for the south 1-3/4 miles of the road includes vertical curb and gutter on the outside edges of the roadway. A series of catch basins and collector pipes were placed along the west side of the road to collect street runoff and carry it to the roadside drainage channel on the east side of the road to avoid discharging onto adjacent landowners. Curb openings were placed on the east side of the road to allow street runoff to enter directly into the drainage channel.

Pavement drainage and catch basin and curb opening calculations are summarized in Tables III A and B. The amount of runoff intercepted by the catch basins and curb openings were determined using the equations on the page following Table III and in Figure 3-46 (from City of Scottsdale's Stormwater Runoff Manual). The sizes and spacings were selected so that the width of the water spread across the street will generally leave 2 lanes of roadway dry in a 100 year storm.

The concrete-lined drainage channel on the east side of the south 1-3/4 miles of the road is designed to intercept runoff before it crosses the roadway and transport it to the Buckeye Watershed Project. The channel was sized to carry the runoff from a 100-year storm with an additional 0.5 feet of freeboard. The channel calculations are summarized in Table V and calculation sheets are located in the Appendix.

ADOT recommendations obtained from 1972 Training Manual were used as a guide in evaluating the need for scour protection at the outlet of culverts. Culvert outlet velocity was compared to natural channel velocity on the culvert calculation sheets. If the outlet velocity was less than 1.5 times the natural or the drainage area size less than 64 acres no protection is required. In areas greater than 64 acres outlet velocity did not exceed natural by more than 2.5, therefore energy dissapators were not recommended. A quantitive scour analysis was also

done using HEC-14 procedures, as recommended, with results shown in Table VII. Areas with an asterisk have less than 4.0 feet of scour depth or don't need outlet protection based on the ADOT recommendations referred to above. Peak discharge values used in scour calculations are the average maximum 30 minute peak discharge. Analysis of HEC-1 hydrographs in Phase II showed this to be 77% of instantaneous peak discharge. Grouted rip-rap aprons which are being installed to the end of the wingwalls on all box culverts will protect the culvert where depths of scour are greater than 4.0 feet. The apron will move the location of potential maximum scour depth downstream away from the end wall foundation by providing an area to spread out and decrease flow concentration before outletting into the natural channel.

The recommended procedure contained in HEC-14 is to provide at least minimum protection and then inspect the outlet channel after major storms to determine if protection must be increased or extended, which we have more than complied with by having a minimum 4.0 feet cut off wall on all boxes and by providing an apron at the outlet.

Roadside ditches and improved channels were evaluated for scour protection by determining velocity at the design discharge for channels and bank full discharge for roadside ditches. Based average soil conditions and maximum permissable velocities (from SCS Stnd. Drwg. No. 7-N-20104 in Appendix) if channel velocity exceeded 5.0 fps or ditch flow exceeded 6.0 generally lining or installation of drop instructions or combination of both were recommended. (See calculation sheets in the Appendix). Slightly higher velocities were accepted on roadside ditches because of the conservative assumption that ditches would be bank full (to the edge of road shoulder) when in most cases there is not a large enough contributing area to fill the ditches. On the downslope side of the parkway in most cases no ditch calculations were performed because of the small quantity of runoff which will be carried in these ditches. Pavement drainage is generally the only runoff entering these ditches.

An additional factor applied to evaluating the need for protection on the uphill roadside ditches was also the amount of contributing area. In many cases if the ditches were full, velocities would be higher than maximum permissible, but many of these steeper sections of roadside ditches are also only collecting pavement drainage, and would never flow full, therefore, protection was not recommended.

Manning's "n" values for roughness used were: for natural channels at culvert crossings, 0.035; improved earthen channels 0.03; lined channels, 0.015; and pavement drainage .016; and natural channel routing in the HEC-1 modeling, .045 (reference CHOW, Table VIII in Appendix.)

VI. APPENDIX

A. TABLES

ADDENDUM to "HYDROLOGIC DESIGN FOR HIGHWAY DRAINAGE IN ARIZONA" April 1975

Steps to be used to determine precipitation values for various durations and return periods.

STEP 1. From the precipitation maps in the manual "Hydrologic Design for Highway Drainage in Arizona", determine the precipitation values for the 6 and 24 hour duration storms for return periods of 2, 5, 10, 25, 50 and 100 years. Tabulate these values in Table 1 in the column headed 'Map Values'

TABLE I

Return Period (Years)	Precipitation Values (inches)			
	6 hour duration		24 hour duration	
	Map Value	Corrected Value	Map Value	Corrected Value
2	1.4	1.43	1.6	1.59
5	1.8	1.90	2.2	2.25
10	2.15	2.21	2.62	2.69
25	2.7	2.59	3.4	3.27
50	3.0	2.95	3.8	3.77
100	3.2	3.31	4.2	4.28

NOTE: There is a possibility of making an error while reading the maps because, (1) a site is not easy to locate precisely on a series of 12 maps, (2) there may be some slight registration differences in printing, and (3) precise interpolation between isolines is difficult. In order to minimize any errors in reading the maps, these values should be plotted on the diagram "Precipitation Depth versus Return Period" Fig. 1.

$$Y_2 = -0.011 + 0.942 \frac{(1.43)^2}{1.59} = 1.20$$

$$Y_{100} = 0.494 + 0.755 \frac{(3.31)^2}{4.28} = 2.43$$

TABLE I (cont.)

HEC-1 'PH' RECORD
HYPOTHETICAL STORM

PRECIPITATION CALCULATIONS

From the manual "Hydrologic Design for Highway Drainage in Arizona," Table I and Figure 1 have been completed and the 100 year 1 hour precipitation value calculated. From the same manual we can calculate the 5-minute and 15-minute precipitation values.

100-year 5-minute = (0.29)(100 year 1 hour) = 0.70 in.
100-year 15-minute = (0.57)(100 year 1 hour) = 1.39 in.

TABLE II

Runoff and Culvert Summary

Drainage Basin	Watershed Area (acres)	Peak Discharge Q100 (cfs)	Culvert Size & Type	Culvert Location
1	27	46	2- 35"x24"CSP	STA 404+55
2	38	31	1-30" RGRCP	STA 397+66
		31	1-30" CLCSP	STA 398+51
3	18.5	40**	Routed to Area #4	
4	275	330	10' x 4' RCBC	STA 386+05
5	48	83	42" CLCSP	STA 382+81
6	3850*	610	4-10'x3' RCBC	STA 374+64
7	30	61	42" CLCSP	STA 363+05
8D	3940*	1031	4-10'x4' RCBC	STA 360+44
		120	6'x3' RCBC	STA 356+13
9	29	52	36" RGRCP	STA 350+40
10	16	36**	Routed to Area #8E	
8E	4120*	250	10' x 4' RCBC	STA 337+14
		739	3-10'x4' RCBC	STA 333+84
11	4120*	300	2-10'x3' RCBC	STA 329+27
11		360	3-8' x 3' RCBC	STA 327+07
11B	16	36	30" CLCSP	STA 326+17
12	58	112	2 - 36" CLCSP	STA 316+73
13	102	168	6'x 3' RCBC	STA 312+17
14	26	52	2-30" RGRCP	STA 300+31
15	35	61	42" RGRCP	STA 292+09
16	864	115	10'x3' RCBC	STA 289+26
		688	4-10'x4' RCBC	STA 285+00
17	13	32**	Routed to Area 18	
18	2828	534	3-10'x3' RCBC	STA 271+21
		1575	6-10'x4' RCBC	STA 266+50
19	34	70	42" RGRCP	STA 253+94
20	81	136	10'x3' RCBC	STA 243+74
21	1205	280	2-10'x3' RCBC	STA 230+27
		200	2-10'x3' RCBC	STA 227+85
		450	3-10'x3' RCBC	STA 225+19

TABLE II (Continued)

Drainage Basin	Watershed Area (acres)	Runoff Q100 (cfs)	Culvert Size	Culvert Location
22	27	45	Route to Area 23	
23	4200*	756	4-10'x3' RCBC	STA 197+95
24	3630*	1820	6-10'x4' RCBC	STA 195+10
25	3630*	369	2-8'x3' RCBC	STA 172+93
26	10	23	30" RGRCP	STA 171+20
27	77	130	Routed to Area #28	
28	4135*	1067	6-10'x3' RCBC	STA 161+67
29	36	63	42" RGRCP	STA 142+48
30	3994*	284	3-10'x3' RCBC	STA 136+90
31	3917*	277	3-10'x3' RCBC	STA 129+55
32	27	51	Routed to Area 36	
33	163	284	2-8' x 3' RCBC	STA 92+80
34	98	177	Routed to Area 36	
35	40	73	Routed to Area 36	
36	1925*	658	3-10'x3' RCBC & Routed to Area 37	STA 38+82
37	2060*	881	Routed to Buckeye Watershed Project.	

*Portions of the runoff from this watershed have been diverted to other watersheds.

**Assumed R.O. peaked too soon to add to peak of area routed to.

TABLE III-A

Arizona Department of Transportation

PAVEMENT DRAINAGE CALCULATION REPORT

LOCATION DATA
Highway: Sun Valley Parkway
Location: Phase III, 291st Ave
Project No.: 850840-7

DESIGN DATA
Frequency: 100 years
P6= 3.31 in. P24= 4.29 in. P1= 2.43 in.
T(all) n= 0.016
Curb Height= 7 in.

RUNOFF CALCULATIONS

From Station	To Station	L (ft.)	W (ft.)	D.A. (arc.)	C	Tc (min.)	I (in/hr)	Q (cfs)	Qc (cfs)	Qt (cfs)	So (ft/ft)	Sx (ft/ft)	Z/n	D (ft.)	T (ft.)
92+50	88+00	450	41.5	0.43	0.95	10	6.6	2.688	-	2.688	0.0092	0.02	3125	0.212	10.61
88+00	83+00	500	41.5	0.48	0.95	10	6.6	2.987	1.779	4.765	0.0092	0.02	3125	0.263	13.15
83+00	79+00	400	41.5	0.38	0.95	10	6.6	2.389	3.537	5.926	0.0092	0.02	3125	0.285	14.27
79+00	74+00	500	41.5	0.48	0.95	10	6.6	2.987	4.548	7.535	0.0080	0.02	3125	0.321	16.03
74+00	70+15	385	41.5	0.37	0.95	10	6.6	2.300	5.921	8.220	0.0080	0.02	3125	0.331	16.56
70+15	65+50	465	41.5	0.44	0.95	10	6.6	2.778	5.832	8.610	-	-	-	-	-
65+00	61+50	350	41.5	0.33	0.95	10	6.6	2.091	0.000	2.091	0.0092	0.02	3125	0.193	9.65
61+50	56+50	500	41.5	0.48	0.95	10	6.6	2.987	1.294	4.281	0.0092	0.02	3125	0.253	12.63
56+50	52+50	400	41.5	0.38	0.95	10	6.6	2.389	3.119	5.509	0.0092	0.02	3125	0.278	13.88
52+50	47+80	470	41.5	0.45	0.95	10	6.6	2.808	4.183	6.990	0.0092	0.02	3125	0.304	15.18
47+50	43+20	460	41.5	0.44	0.95	10	6.6	2.748	5.488	8.236	0.0092	0.02	3125	0.323	16.14
43+20	39+00	420	41.5	0.40	0.95	10	6.6	2.509	5.919	8.427	-	-	-	-	-
38+40	34+25	415	41.5	0.40	0.95	10	6.6	2.479	0.000	2.479	0.0092	0.02	3125	0.206	10.29
34+25	29+75	450	41.5	0.43	0.95	10	6.6	2.688	1.607	4.296	0.0092	0.02	3125	0.253	12.65
29+75	24+50	525	41.5	0.50	0.95	10	6.6	3.136	3.132	6.268	0.0080	0.02	3125	0.299	14.96
24+50	19+00	550	41.5	0.52	0.95	10	6.6	3.285	4.803	8.089	0.0080	0.02	3125	0.329	16.46
176+00	168+40	760	41.5	0.72	0.95	10	6.6	4.540	-	4.540	0.0124	0.014	4464	0.214	15.26
197+50	195+37	213	41.5	0.20	0.95	10	6.6	1.272	-	1.272	0.0036	0.013	4808	0.163	12.51

INLET CALCULATIONS (Catch Basin)

Station	Inlet Type C.B.	D (ft)	Qi (cfs)	Qc= Qt-Qi
88+00	531-B	0.212	0.909	1.779
83+00	531-B	0.263	1.229	3.537
79+00	531-B	0.285	1.378	4.548
74+00	531-B	0.321	1.615	5.921
70+15	532-C	0.331	2.389	5.832
61+50	531-B	0.193	0.797	1.294
56+50	531-B	0.253	1.161	3.119
52+50	531-B	0.278	1.326	4.183
47+50	531-B	0.304	1.503	5.488
43+20	532-C	0.323	2.317	5.919
34+25	531-B	0.206	0.872	1.607
29+75	531-B	0.253	1.163	3.132
24+50	531-B	0.299	1.465	4.803
19+00	531-B	0.329	1.676	6.412
168+40	ADOT C-15.3	0.214	2.133	2.407
195+37	Type 4, DBL	0.163	1.208	0.064

Notes: Clogging Factor:
Curb Opening Catch Basin = 0.8
Grate Inlet Catch Basin = 0.5

TABLE III-B

Arizona Department of Transportation

PAVEMENT DRAINAGE CALCULATION REPORT

LOCATION DATA
Highway Sun Valley
Location 291st Ave
Project No. 850840-7

DESIGN DATA
Frequency 100 years
P6= 3.31 in. P24= 4.28 in. P1= 2.43 in.
T(all) n= 0.016
Curb Height= 7 in.

RUNOFF CALCULATIONS

From Station	To Station	L (ft.)	W (ft.)	D.A. (arc.)	C	Tc (min.)	I (in/hr)	Q (cfs)	Qc (cfs)	Qt (cfs)	So (ft/ft)	Sx (ft/ft)	Z/n	D (ft.)	T (ft.)
94+00	88+50	550	41.5	0.52	0.95	10	6.6	3.285	-	3.285	0.0092	0.02	3125	0.229	11.44
88+50	83+50	500	41.5	0.48	0.95	10	6.6	2.987	2.331	5.318	0.0092	0.02	3125	0.274	13.70
83+50	78+50	500	41.5	0.48	0.95	10	6.6	2.987	4.043	7.030	0.0092	0.02	3125	0.304	15.21
78+50	73+50	500	41.5	0.48	0.95	10	6.6	2.987	5.524	8.511	0.0080	0.02	3125	0.336	16.78
73+50	69+00	450	41.5	0.43	0.95	10	6.6	2.688	6.761	9.449	0.0080	0.02	3125	0.349	17.45
69+00	66+50	250	41.5	0.24	0.95	10	6.6	1.493	7.588	9.082	0.0080	0.02	3125	0.344	17.19
66+50	61+50	500	41.5	0.48	0.95	10	6.6	2.987	5.954	8.941	0.0092	0.02	3125	0.333	16.65
61+50	56+50	500	41.5	0.48	0.95	10	6.6	2.987	7.204	10.191	0.0092	0.02	3125	0.350	17.49
56+50	51+50	500	41.5	0.48	0.95	10	6.6	2.987	8.316	11.302	0.0092	0.02	3125	0.364	18.18
51+50	46+50	500	41.5	0.48	0.95	10	6.6	2.987	9.309	12.296	0.0092	0.02	3125	0.375	18.76
46+50	41+50	500	41.5	0.48	0.95	10	6.6	2.987	8.659	11.646	0.0092	0.02	3125	0.368	18.38
41+50	33+75	775	41.5	0.74	0.95	10	6.6	4.629	5.462	10.091	0.0092	0.02	3125	0.348	17.42
33+75	28+50	525	41.5	0.50	0.95	10	6.6	3.136	8.226	11.363	0.0092	0.02	3125	0.364	18.21
28+50	23+50	500	41.5	0.48	0.95	10	6.6	2.987	9.363	12.350	0.0080	0.02	3125	0.386	19.29
23+50	18+00	550	41.5	0.52	0.95	10	6.6	3.285	10.171	13.456	0.0080	0.02	3125	0.398	19.92

INLET CALCULATIONS (Curb Opening)

Station	Inlet Type C.O. (ft)	D (ft)	Qi (cfs)	Qc= Qt-Qi
88+50	5.50	0.229	0.954	2.331
83+50	5.50	0.274	1.275	4.043
78+50	5.50	0.304	1.506	5.524
73+50	5.50	0.336	1.749	6.761
69+00	5.50	0.349	1.861	7.588
66+50	10.00	0.344	3.128	5.954
61+50	5.50	0.333	1.736	7.204
56+50	5.50	0.350	1.876	8.316
51+50	5.50	0.364	1.993	9.309
46+50	10.00	0.375	3.637	8.659
41+50	19.50	0.368	6.184	5.462
33+75	5.50	0.348	1.865	8.226
28+50	5.50	0.364	2.000	9.363
23+50	5.50	0.386	2.179	10.171
18+00	10.00	0.398	3.979	9.477

FORMULAS USED IN PAVEMENT DRAINAGE CALCULATIONS (TABLE III)

$$D.A. = L \times W/43560$$

$$Q = 0.95 \times I \times D.A.$$

$$Q_c = Q_t - Q_i$$

$$\frac{Z}{N} = \frac{1}{N \times S_x}$$

$$D = \left[\frac{Q_t \times N \times S_x}{0.56 \times (S_o)\ 0.5}\right]^{3/8}$$

$$Q_i = \left[\frac{\left(\frac{a}{D} + 1\right)^{2.5} - \left(\frac{a}{D} + 1 - \frac{L_o}{L_a}\right)^{2.5}}{\left(\frac{a}{D} + 1\right)^{2.5} - \left(\frac{a}{D}\right)^{2.5}}\right] \times Q_t$$

Where

$$\frac{1}{L_a} = \left(0.7\ (a + D)^{1.5}\ \left[1 - \left(1 - \frac{D}{a + D}\right)^{2.5} \right] \right) / Q_t$$

a = Gutter Depression = 2" (for catch basin)
= 0 (for curb opening)

L_o = Length of opening

= 5.5' for MAG 531-B

= 8' for MAG 532-C

Clogging Factor = 80% (for catch basin)

= 0 (for curb opening)

For ADOT C-15.3 Catch Basin

$$Q_i = 3 \times P \times (D)^{1.5}$$

ARIZONA HIGHWAY DEPARTMENT
STRUCTURES SECTION
HYDRAULICS BRANCH

TABLE IV

MEDIAN DRAINAGE WORKSHEET

LOCATION DATA

Highway: Sun Valley Parkway Phase III
Location:
Project No.: 850840-7

DESIGN DATA

Frequency: 100 years
P_6 = 3.31 in. P_{24} = 4.28 in. P_1 = 2.43 in.
AHW = 0.4'

RUNOFF CALCULATIONS

From Station	To Station	L ft.	W ft.	D.A. acr.	C	T_c min.	I in/hr	Q cfs	Channel Type	S_o ft/ft	Z	n	D ft.	V fps
42+90	65+19.39	2030	14.5	.68	.35	21	4.7	1.12	'V'	.0092	2.0	.03	.4	1.6
69+82	90+53.09	2071	14.5	.64	.35	21	4.7	1.14	'V'	.0092	2.0	.03	.4	1.6
96+75	119+50	2275	14.5	.76	.35	22	4.6	1.22	'V'	.0096	2.0	.03	.4	1.7
119+50	142+16	2266	14.5	.75	.35	17	5.2	1.37	'V'	.0164	2.0	.03	.4	2.2
149+00	172+65	2365	14.5	.79	.35	20	4.9	1.33	'V'	.0136	2.0	.03	.4	2.0
172+65	195+00	2235	14.5	.74	.35	20	4.8	1.24	'V'	.0120	2.0	.03	.4	1.9
201+80	235+00	3320	14.5	1.11	.35	29	3.9	1.52	'V'	.0132	2.0	.03	.4	1.9

INLET CALCULATIONS

Station	Inlet Type	Q cfs	HW ft.	DHW Elev.	Dike Elev.
42+90	C-15.80	1.12	.19	5.04	5.12
69+82	C-15.80	1.14	.19	29.15	29.33
96+75	C-15.80	1.22	.20	53.63	53.74
119+50	C-15.80	1.37	.21	71.50	71.8
149+00	C-15.80	1.33	.21	99.18	99.7
172+65	C-15.80	1.24	.20	21.47	22.01
201+80	C-15.80	1.52	.23	44.29	44.35

Channel Type: Trapezoidal
Triangular

Inlet Type: C-15.08
C-15.09
C-15.10
Pipe Culvert

C-15.80
Effective Perimeter with 50% clogging factor P = 4.635 ft
Weir equation from Scottsdale Manual Section 3 $Q = 3.0Pd^{1.5}$

Computed by: RE Checked by: CJL Date: 3/17/87

ARIZONA HIGHWAY DEPARTMENT
STRUCTURES SECTION
HYDRAULICS BRANCH

TABLE IV (cont.)

MEDIAN DRAINAGE WORKSHEET

LOCATION DATA
Highway: Sun Valley Parkway Phase III
Location:
Project No.: 85084D-7

DESIGN DATA
Frequency: 100 years
P_6= [illegible] in. P_{24}= 4.38 in. P_1= 2.48 in.
AHW = [illegible]

RUNOFF CALCULATIONS

From Station	To Station	L ft.	W ft.	D.A. acr.	C	T_c min.	I in/hr	Q cfs	Channel Type	S_o ft/ft	Z	n	D ft.	V fps
242+10	280+62	3852	14.5	1.28	.35	32	3.6	1.61	'V'	.0140	20	.03	.4	2.0
280+62	303+28	2266	14.5	.75	.35	24	4.3	1.13	'V'	.0084	20	.03	.4	1.6
307+85	333+84	2399	14.5	.80	.35	22	4.6	1.30	'V'	.0137	20	.03	.4	2.0
333+84	354+02	2018	14.5	.67	.35	20	4.8	1.13	'V'	.0097	20	.03	.4	1.7
362+16	377+03	1487	14.5	.49	.35	12	6.1	1.05	'V'	.0092	20	.03	.4	1.6
377+03	407+56	3053	14.5	1.02	.35	21	4.7	1.68	'V'	.0160	20	.03	.4	2.1

INLET CALCULATIONS

Station	Inlet Type	Q cfs	HW ft.	DHW Elev.	Dike Elev.
242+10	C-15.80	1.61	.24	80.64	80.6
280+62	C-15.80	1.13	.19	10.08	10.3
307+85	C-15.80	1.30	.21	24.93	25.00
333+84	C-15.80	1.13	.19	44.95	45.0
365+80	C-15.80	1.05	.18	61.52	No Berm Located in Sag
330+69.74	C-15.80	1.68	.24	67.93	No Berm Located in Sag

Channel Type: Trapezoidal
Triangular

Inlet Type: C-15.08
C-15.09
C-15.10
Pipe Culvert

C-15.80
Effective Perimeter with 50% clogging factor P= 4.635 ft
Weir equation from Scottsdale Manual Section 3 $Q = 3.0Pd^{1.5}$

Computed by: RE Checked by: CSL Date: 3/17/87
Revised 4/2/87 CSL

TABLE V. SUN VALLEY PARKWAY EAST SIDE CHANNEL DESIGN SUMMARY PHASE III

STATION	129 + 02	127 + 00	122 + 50	119 + 00	118 + 25	111 + 25	107 + 75	102 + 25	93 + 49	92 + 11	80 + 00	73 + 80	60 + 20	49 + 10	38 + 82	25 + 60	15 + 00
SLOPE FT/FT		.0079	.0100	.0080	.0074	.0070	.0048	.0092	.0096		.0092	.0092	.0080	.0092	.0092	.0092	.0080
CHANNEL TYPE		Vee	4T	6T	6T	8T	8T	CL 8T	CL 8T		CL 10T	CL 10T	CL 10T	CL 10T	CL 14T	CL 18T	CL 20T
DEPTH WATER FT		1.55	1.10	1.31	1.34	1.38	1.91	1.14	1.75	Original Transition From un-lined to lined, Now	2.10	2.27	2.35	2.44	2.44	2.50	2.50
VELOCITY FPS		4.60	4.88	5.09	4.94	5.04	5.02	8.35	10.79		12.62	13.20	12.56	13.73	14.31	15.05	14.09
CHANNEL DEPTH		2.00	1.60	1.80	1.80	1.90	2.40	1.64	2.25		3.00	3.00	3.00	3.00	3.00	3.00	3.00
FREEBOARD FT		0.50	0.50	.50	0.50	0.50	0.50	0.50	0.50	New	0.90	0.70	0.65	0.56	0.56	0.50	0.50
DESIGN Q CFS		35	35	60	60	75	120	120	284	Culv.	374	435		499	658	881	

SIDE SLOPES ALL 4:1 ---------- SIDE SLOPES 2:1 ----------

CL = CONCRETE LINED 10 T = 10 FT TRAPEZOIDAL

PROJECT NAME — SUN VALLEY PARKWAY

JOB NO. 850840-

HYDROLOGY DATA

DATE 3/9/87

SUMMARY OF CONTRIBUTING AREAS STA. 15+04 TO 409+95

AREA	ACRES	SQ. MILES	L	TOP ELEV.	BOTTOM ELEV.	STA. PKWY	S	HYDROLOGY METHOD USED
1	27.0	0.04	3700	1440	1375	406+00	1.8	RATIONAL
2	37.7	0.06	3990	1440	1367	399+00	1.8	RAT.
3	18.5	0.03	2680	1405	1360	390+00	1.7	RAT.
4	275.2	0.43	12200	1590	1360	385+00	1.9	HEC-1
5	47.7	0.07	4940	1425	1337	382+00	1.8	RAT.
6A	748.8	1.17	13000	1760	1434	N.A.	2.5	HEC-1
6B	339.2	0.53	10500	1570	1385	N.A.	1.8	HEC-1
6C	38.4	0.06	3600	1408	1355	375+00	1.5	HEC-1
7	29.8	0.05	2625	1385	1358	366+00	1.0	RAT.
8A	507.0	0.79	6200	3260	2000	N.A.	20.0	HEC-1
8B	2214.4	3.46	19000	2000	1440	N.A.	2.9	HEC-1
8C	134.4	0.21	6300	1480	1400	N.A.	1.3	HEC-1
8D	128.0	0.20	5300	1420	1355	357+00	1.2	HEC-1
8E	153.6	0.24	7000	1425	1340	335+00	1.2	HEC-1
9	29.2	0.05	3000	1383	1348	350+00	1.2	RAT.
10	15.7	0.02	1900	1367	1343	342+00	1.3	RAT.
11A	364.8	0.57	10800	1520	1330	326+00	1.8	HEC-1
11B	16.0	0.02	2000	1354	1330	323+00	1.2	RAT.
12	57.8	0.09	3620	1370	1320	318+00	1.4	RAT.
13	102.4	0.16	7000	1410	1320	311+00	1.3	HEC-1
14	25.6	0.04	3100	1360	1315	300+00	1.45	RAT.
15	34.9	0.05	4600	1367	1308	292+00	1.28	RAT.
16	865.0	1.35	19400	1600	1300	283+00	1.55	HEC-1
17	12.8	0.02	1700	1334	1300	278+00	1.4	RAT.
18A	913.0	1.43	10000	4080	2060	N.A.	20.2	HEC-1
18B	1910.0	2.98	31600	2000	1290	263+00	2.2	HEC-1
19	34.2	1.83	3200	1325	1279	255+00	1.4	RAT.
20	81.1	0.13	4700	1333	1272	242+00	1.3	RAT.
21	1203.2	1.88	25200	1680	1265	226+00	1.6	HEC-1
22	26.6	0.42	3800	1272	1240	203+00	0.84	RAT.

PROJECT NAME — SUN VALLEY PARKWAY

JOB NO. 850840-

HYDROLOGY DATA

DATE 3/9/87

SUMMARY OF CONTRIBUTING AREAS STA. 15+04 TO 409+95

AREA	AC	S.M.	L	TOP ELEV.	BOT. ELEV.	STA. PKWY	S %	HYDROLOGY METHOD USED
23	579.0	0.90	23,200	1600	1190	197+00	1.8	HEC-1
24A	1392.0	2.18	10,000	3450	2000	N.A.	14.5	HEC-1
24B	1760.0	2.75	25,600	2000	1410	N.A.	2.3	HEC-1
24C	416.0	0.65	10,300	1410	1233	N.A.	1.7	HEC-1
24D	57.6	0.09	2000	1250	1233	195+00	0.9	HEC-1
25	44.8	0.07	3000	1252	1220	176+00	1.07	HEC-1
26	10.0	0.02	2000	1239	1218	171+50	1.05	RATIONAL
27	76.8	0.12	6400	1284	1210	165+00	1.2	HEC-1
28A	659.2	1.03	13500	1690	1404	N.A.	2.1	HEC-1
28B	243.2	0.38	13600	1404	1208	160+50	1.4	HEC-1
29	35.6	0.56	3850	1230	1192	145+00	0.99	RAT.
30	74.0	0.12	5000	1242	1187	135+00	1.1	HEC-1
31	102.4	0.16	9200	1292	1183	129+00	1.2	HEC-1
32	26.6	0.04	2600	1207	1175	122+00	1.2	RAT.
33	185.6	0.29	8600	1250	1148	94+00	1.2	HEC-1
34	98.3	0.15	5200	1180	1128	70+00	1.0	HEC-1
35	39.8	0.06	4400	1155	1110	50+00	1.0	HEC-1
36	41.0	0.06	3900	1140	1100	39+00	1.0	HEC-1
37A	1560.6	2.44	34000	1578	1137	N.A.	1.3	HEC-1
37B	134.4	0.21	5800	1137	1089	20+00	0.8	HEC-1

TABLE VII-A

Sun Valley Parkway Phase III
291 st Avenue
Culvert Outlet Scour Calculation

CULVERT LOCATION	SIZE C.B.C. (ft)	SIZE Pipe (in)	TW (ft)	Q (cfs)	K C.B.C.	K Pipe	t (min)	To (min)	SCOUR Depth Hs (ft)	SCOUR Width Ws (ft)	SCOUR Length Ls (ft)	SCOUR Max. 0.4 * Ls
404+55		2-36x 22	1.5	18	-	2.223	30	316	5.32 *	31.50	40.51	16.20
397+66		1- 30	1.5	24	-	3.097	30	316	8.04 *	56.50	68.83	27.53
398+51		1- 30	1.5	24	-	3.097	30	316	8.04 *	56.50	68.83	27.53
386+05	1- 10 x 4		3.0	254	1.517	-	30	316	10.69	52.06	74.05	29.62
382+81		1- 42	1.5	64	-	2.228	30	316	9.18 *	52.11	72.00	28.80
374+64	4- 10 x 3		1.5	118	1.673	-	30	316	7.70	39.56	62.47	24.99
363+05		1- 42	1.5	47	-	2.228	30	316	9.25 *	52.63	72.96	29.19
360+44	4- 10 x 4		2.5	199	1.490	-	30	316	10.05	48.93	72.05	28.82
356+13	1- 6 x 3		1.5	92	2.484	-	30	316	8.96	55.86	70.92	28.37
350+40		1- 36	1.5	40	-	2.595	30	316	9.22 *	59.43	73.98	29.59
337+14	1- 10 x 4		2.4	193	1.519	-	30	316	11.24	54.13	75.41	30.16
333+84	3- 10 x 4		2.5	189	1.420	-	30	316	10.54	49.42	70.98	28.39
329+27	2- 10 x 3		1.5	116	1.640	-	30	316	9.65	48.50	67.78	27.11
327+07	3- 8 x 3		2.0	92	1.210	-	30	316	8.00	34.02	49.71	19.88
326+17		1- 30	1.5	28	-	3.097	30	316	8.21 *	58.28	69.90	27.96
316+78		2- 36	2.0	86	-	1.645	30	316	7.59 *	38.61	53.29	21.32
312+17	1- 6 x 3		2.0	129	2.428	-	30	316	8.99	55.90	70.57	28.23
300+31		2- 30	1.0	40	-	5.864	30	316	9.90	85.73	98.22	39.29
292+09		1- 42	1.5	47	-	2.228	30	316	8.17	44.75	67.00	26.80
289+26	1- 10 x 3		2.0	89	0.878	-	30	316	6.04	27.02	44.42	17.77
285+00	4- 10 x 4		2.0	132	1.312	-	30	316	9.76	44.93	66.40	26.56
271+21	3- 10 x 3		2.0	137	1.358	-	30	316	9.34	42.30	60.32	24.13
266+50	6- 10 x 4		2.5	202	1.513	-	30	316	10.80	52.20	74.09	29.63
253+94		1- 42	1.5	54	-	2.228	30	316	9.59 *	55.56	74.07	29.63
243+74	1- 10 x 3		2.0	105	1.038	-	30	316	8.44	33.02	49.83	19.93
230+27	2- 10 x 3		2.0	108	1.068	-	30	316	8.53	33.91	50.87	20.35
227+85	2- 10 x 3		2.0	77	0.763	-	30	316	7.19	24.93	40.29	16.12
225+19	3- 10 x 3		2.0	116	1.145	-	30	316	8.40	35.47	53.08	21.23
197+95	4- 10 x 3		2.0	146	1.442	-	30	316	9.32	44.33	62.75	25.10
195+10	6- 10 x 4		2.2	233	2.052	-	30	316	12.31 *	70.00	92.75	37.10
172+93	2- 8 x 3		2.0	142	1.856	-	30	316	8.96	47.96	65.79	26.32
171+20		1- 30	1.5	18	-	3.097	30	316	8.21 *	58.28	69.90	27.96
161+67	6- 10 x 3		2.0	136	1.351	-	30	316	9.02 *	41.22	59.58	23.83
142+48		1- 42	1.5	49	-	2.228	30	316	10.16 *	60.26	77.46	30.98
136+90	3- 10 x 3		2.0	73	0.725	-	30	316	7.25	23.80	38.66	15.46
129+55	3- 10 x 3		1.5	71	1.006	-	30	316	8.21	31.96	48.62	19.45
92+80	2- 8 x 3		2.0	109	1.432	-	30	316	8.39	39.29	55.69	22.28

Notes: * No outlet protection required per ADOT's recommendations.

$$K = \frac{Q}{g^{0.5} \times Ye^{2.5}}$$

$Ye = D$ (for circular pipe)

$= (A/2)^{0.5}$ (for noncircular shapes)

Q : 30 minute average maximun flow (15 minute each side of the instantaneous peak flow) per barrel, assuming 77% of the instantaneous peak flow.

TW: Tail water depth at the culvert outlet, obtained from culvert calculation worksheets.

TABLE VII-B

Sun Valley Parkway Phase III
291 st Avenue
Coefficients for Culvert Outlets Scour

CULVERT LOCATION	SIZE C.B.C. (ft)	SIZE Pipe (in)	DEPTH α	DEPTH β	DEPTH θ	WIDTH α	WIDTH β	WIDTH θ	LENGTH α	LENGTH β	LENGTH θ	VOLUME α	VOLUME β	VOLUME θ
404+55		2-36x 22	2.72	0.375	0.100	11.73	0.920	0.150	16.82	0.710	0.125	203.36	2.00	0.375
397+66		1- 30	2.65	0.380	0.100	11.49	0.890	0.140	16.71	0.700	0.124	196.00	1.96	0.373
398+51		1- 30	2.65	0.380	0.100	11.49	0.890	0.140	16.71	0.700	0.124	196.00	1.96	0.373
386+05	1-10 x 4		2.56	0.390	0.098	11.18	0.860	0.135	17.06	0.680	0.133	186.38	1.90	0.369
382+81		1- 42	2.38	0.404	0.096	10.45	0.780	0.115	17.39	0.630	0.143	163.74	1.77	0.361
374+64	4-10 x 3		1.96	0.440	0.090	8.80	0.610	0.070	18.11	0.530	0.165	112.80	1.48	0.344
363+05		1- 42	2.40	0.403	0.096	10.52	0.790	0.117	17.36	0.640	0.140	166.00	1.78	0.388
360+44	4-10 x 4		2.40	0.403	0.096	10.52	0.790	0.117	17.36	0.640	0.140	166.00	1.78	0.388
356+13	1- 6 x 3		2.67	0.379	0.099	11.55	0.900	0.145	16.90	0.700	0.128	197.70	1.97	0.373
350+40		1- 36	2.72	0.375	0.100	11.73	0.920	0.150	16.82	0.710	0.125	203.36	2.00	0.375
337+14	1-10 x 4		2.72	0.375	0.100	11.73	0.920	0.150	16.82	0.710	0.125	203.36	2.00	0.375
333+84	3-10 x 4		2.60	0.385	0.099	11.27	0.870	0.138	17.02	0.680	0.131	189.21	1.92	0.380
329+27	2-10 x 3		2.60	0.385	0.099	11.27	0.870	0.138	17.02	0.680	0.131	189.21	1.92	0.380
327+07	3- 8 x 3		2.72	0.375	0.100	11.73	0.920	0.150	16.82	0.710	0.125	203.36	2.00	0.375
326+17		1- 30	2.72	0.375	0.100	11.73	0.920	0.150	16.82	0.710	0.125	203.36	2.00	0.375
316+73		2- 36	2.65	0.380	0.100	11.49	0.890	0.140	16.71	0.700	0.122	196.00	1.96	0.373
312+17	1- 6 x 3		2.72	0.375	0.100	11.73	0.920	0.150	16.82	0.710	0.125	203.36	2.00	0.375
300+31		2- 30	2.46	0.398	0.097	10.74	0.820	0.123	17.26	0.650	0.139	172.80	1.82	0.364
292+09		1- 42	2.05	0.433	0.092	9.17	0.650	0.080	17.96	0.550	0.160	124.12	1.54	0.348
289+26	1-10 x 3		2.05	0.433	0.092	9.17	0.650	0.080	17.96	0.550	0.160	124.12	1.54	0.348
285+00	4-10 x 4		2.46	0.398	0.097	10.74	0.820	0.123	17.26	0.650	0.139	172.80	1.82	0.364
271+21	3-10 x 3		2.72	0.375	0.100	11.73	0.920	0.150	16.82	0.710	0.125	203.36	2.00	0.375
266+50	6-10 x 4		2.60	0.385	0.099	11.27	0.870	0.138	17.02	0.680	0.131	189.21	1.92	0.380
253+94		1- 42	2.52	0.392	0.098	11.00	0.840	0.130	17.14	0.660	0.135	180.72	1.87	0.367
243+74	1-10 x 3		2.72	0.375	0.100	11.73	0.920	0.150	16.82	0.710	0.125	203.36	2.00	0.375
230+27	2-10 x 3		2.72	0.375	0.100	11.73	0.920	0.150	16.82	0.710	0.125	203.36	2.00	0.375
227+85	2-10 x 3		2.60	0.385	0.099	11.27	0.870	0.138	17.02	0.680	0.131	189.21	1.92	0.380
225+19	3-10 x 3		2.60	0.385	0.099	11.27	0.870	0.138	17.02	0.680	0.131	189.21	1.92	0.380
197+95	4-10 x 3		2.65	0.380	0.100	11.49	0.890	0.140	16.71	0.700	0.122	196.00	1.96	0.373
195+10	6-10 x 4		2.65	0.380	0.100	11.49	0.890	0.140	16.71	0.700	0.122	196.00	1.96	0.373
172+93	2- 8 x 3		2.56	0.390	0.098	11.18	0.860	0.135	17.06	0.680	0.133	186.38	1.90	0.369
171+20		1- 30	2.72	0.375	0.100	11.73	0.920	0.150	16.82	0.710	0.125	203.36	2.00	0.375
161+67	6-10 x 3		2.62	0.383	0.099	11.36	0.880	0.140	16.98	0.690	0.130	192.04	1.93	0.371
142+48		1- 42	2.72	0.375	0.100	11.73	0.920	0.150	16.82	0.710	0.125	203.36	2.00	0.375
136+90	3-10 x 3		2.67	0.379	0.099	11.55	0.900	0.145	16.90	0.700	0.128	197.70	1.97	0.373
129+55	3-10 x 3		2.67	0.379	0.099	11.55	0.900	0.145	16.90	0.700	0.128	197.70	1.97	0.373
92+80	2- 8 x 3		2.67	0.379	0.099	11.55	0.900	0.145	16.90	0.700	0.128	197.70	1.97	0.373

B. FIGURES

Project No. SUNVALLEY/PALO VERDE ROAD Station _____

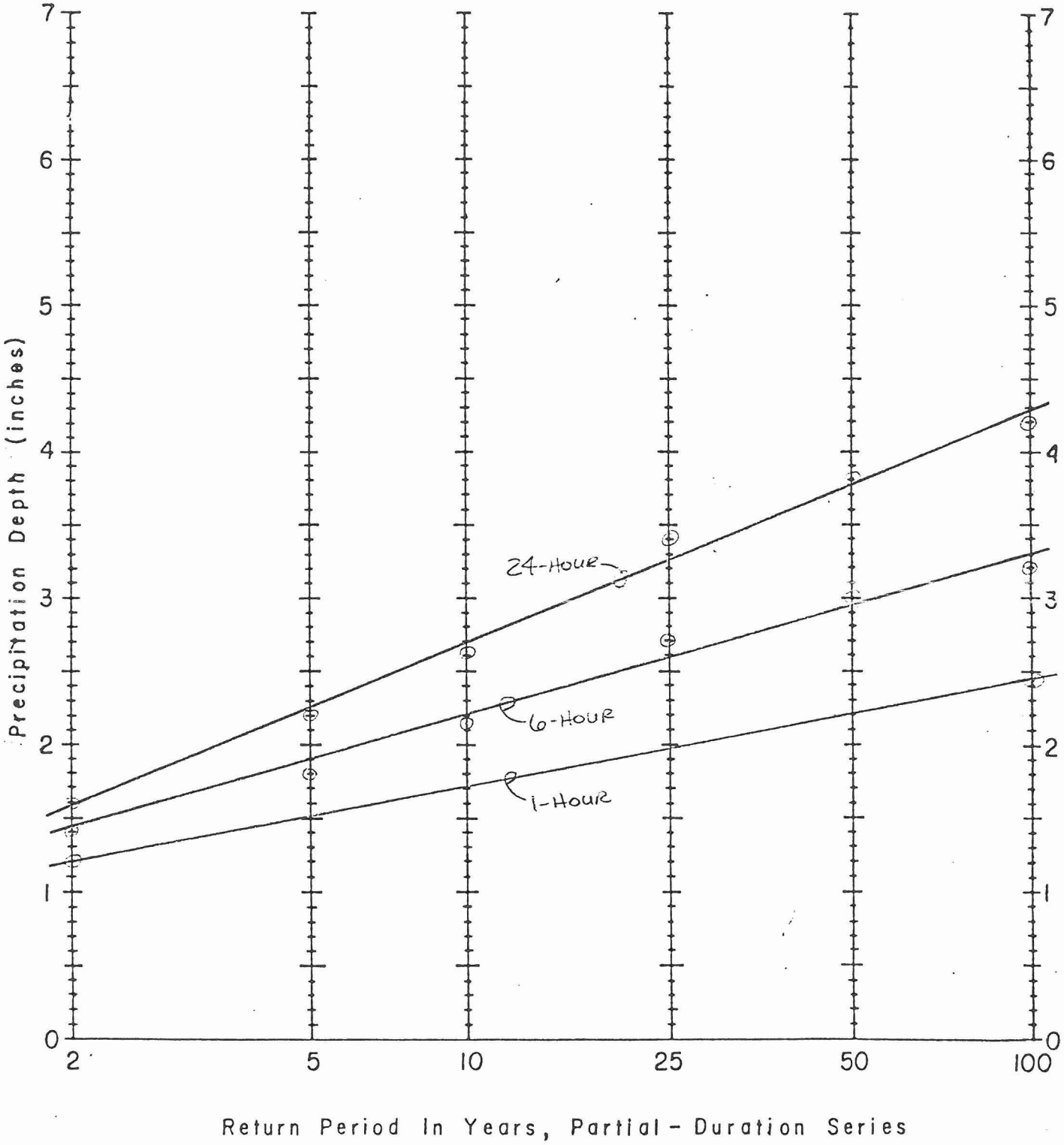


FIGURE 1

Precipitation Depth Versus Return Period for Partial – Duration Series

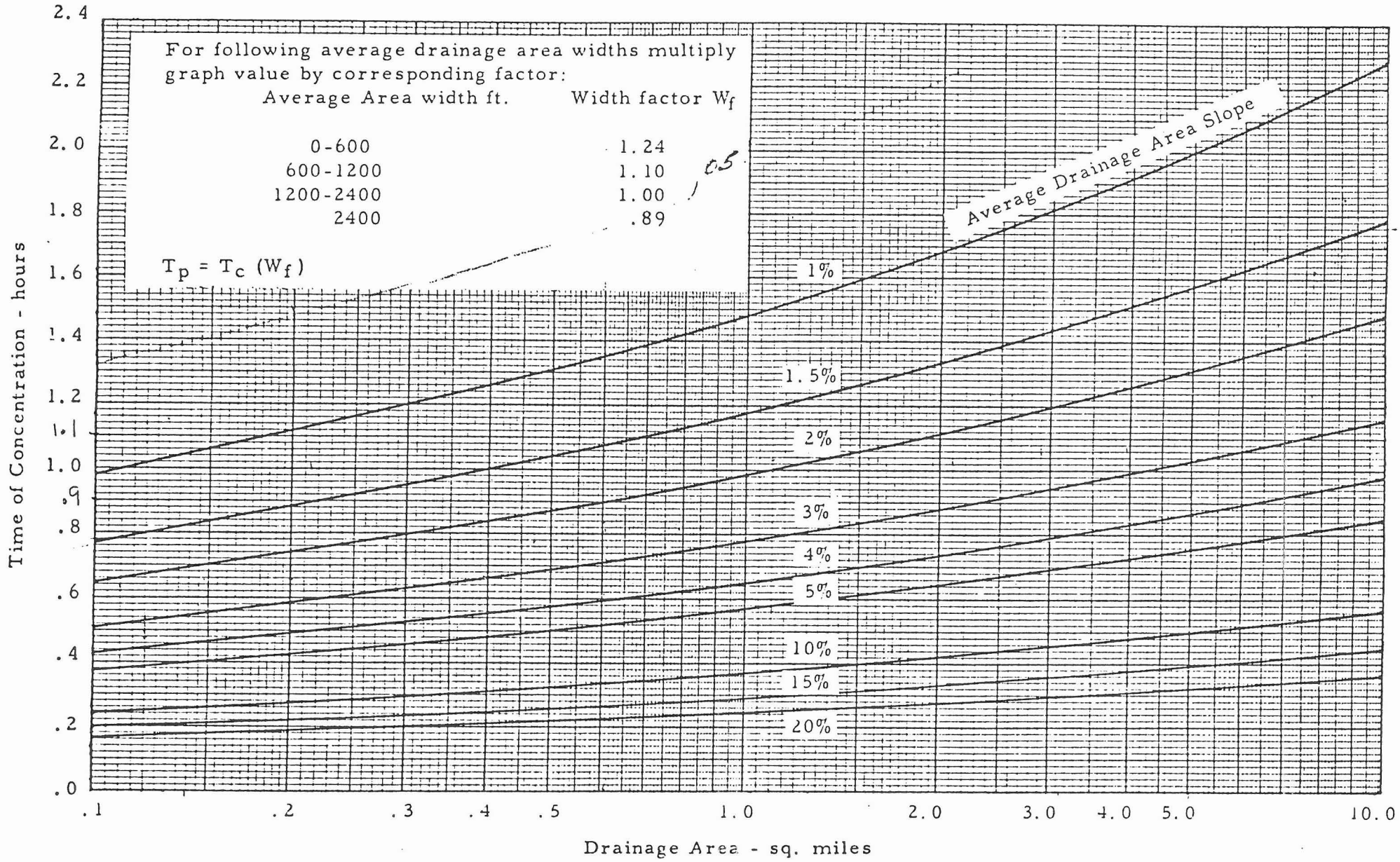
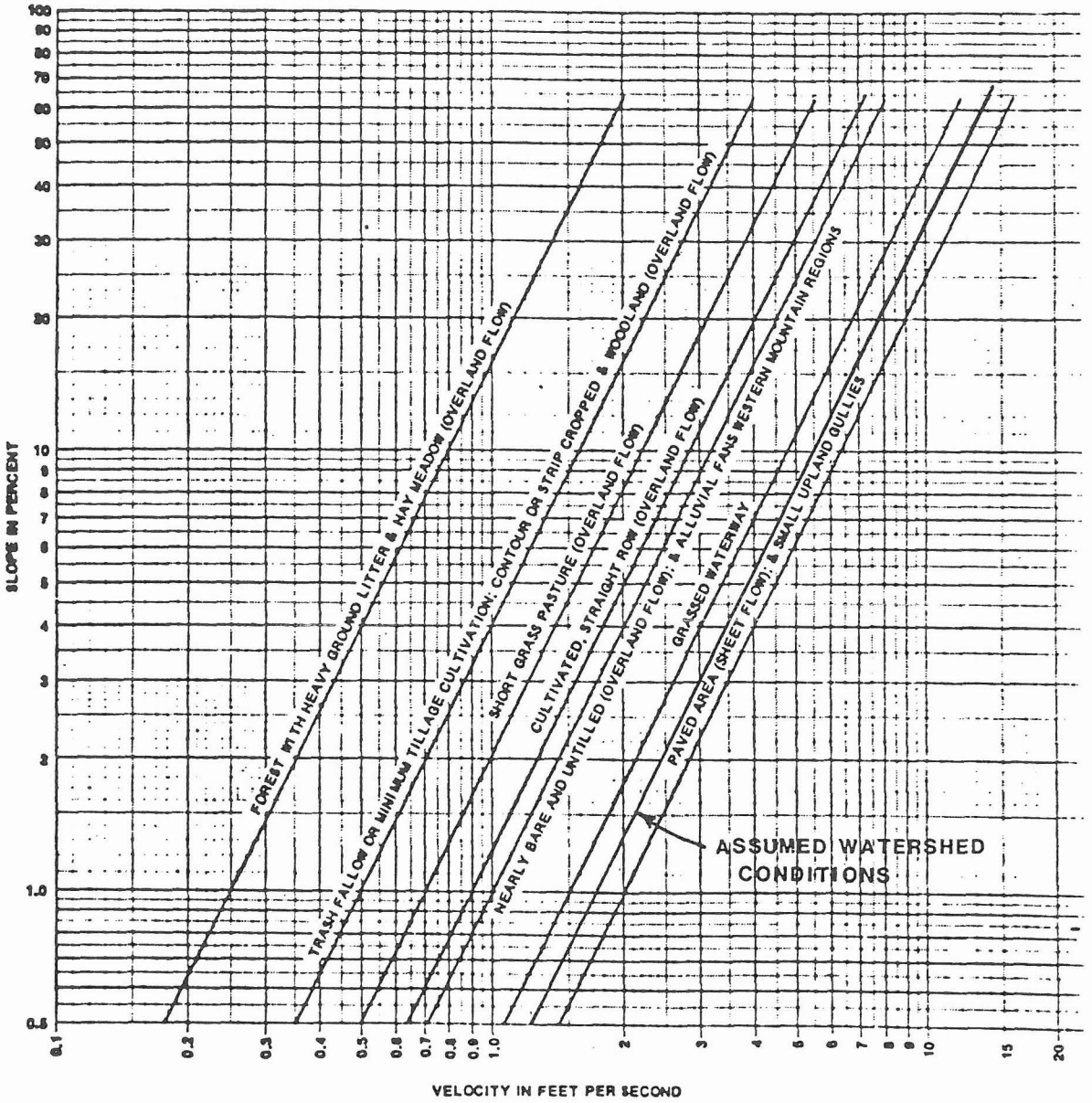


Fig. 2-5

TIME OF CONCENTRATION
FOR
DRAINAGE AREAS LESS THAN 10 SQ. MILES

Soil Conservation Service

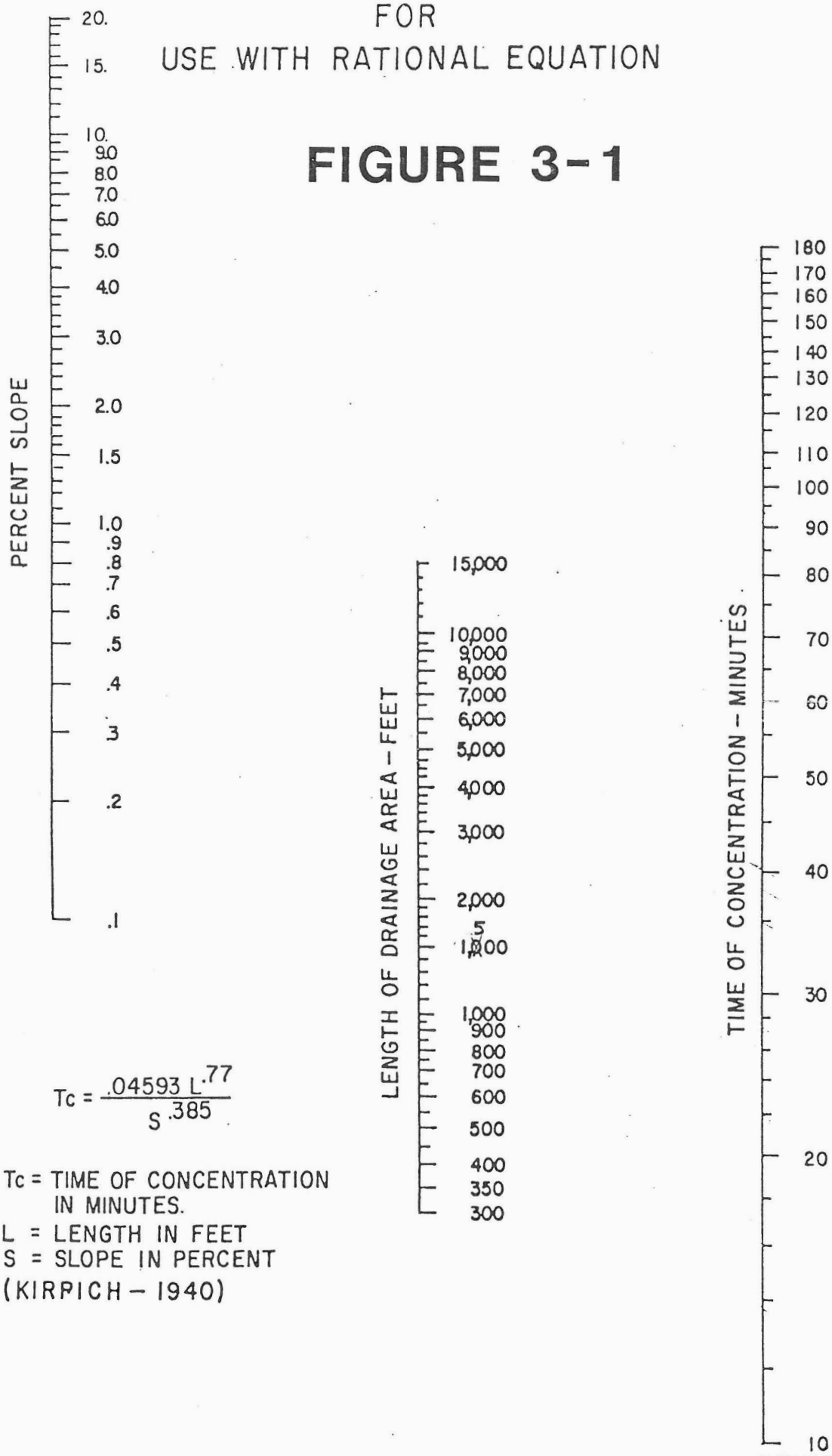


Overland flow velocities for upland method of estimating T_c

FIGURE 2-8

TIME OF CONCENTRATION
FOR
USE WITH RATIONAL EQUATION

FIGURE 3-1



$$Tc = \frac{.04593\ L^{.77}}{S^{.385}}$$

Tc = TIME OF CONCENTRATION IN MINUTES.
L = LENGTH IN FEET
S = SLOPE IN PERCENT
(KIRPICH – 1940)

REVISED 5-1-75

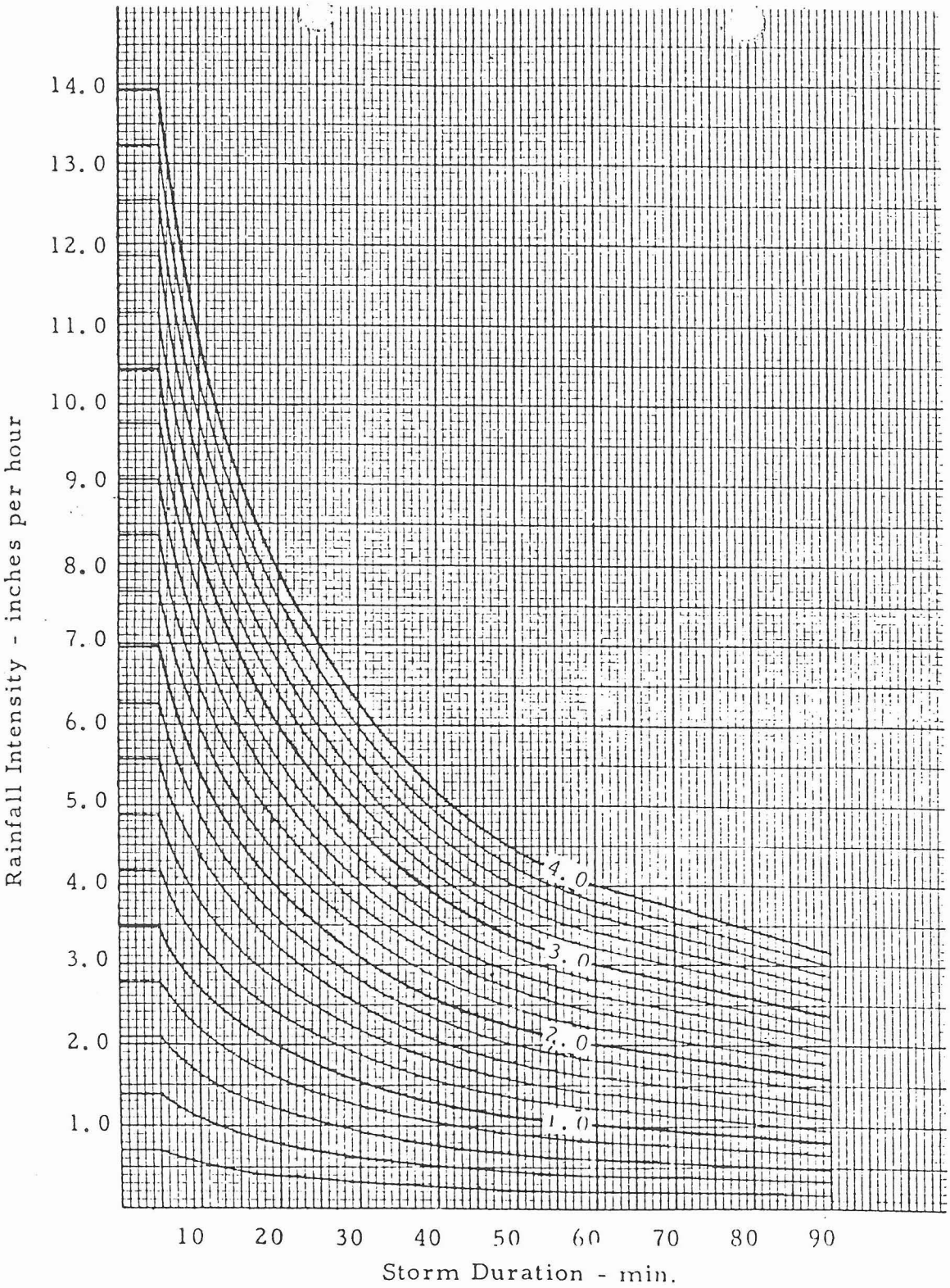


FIGURE 3-2

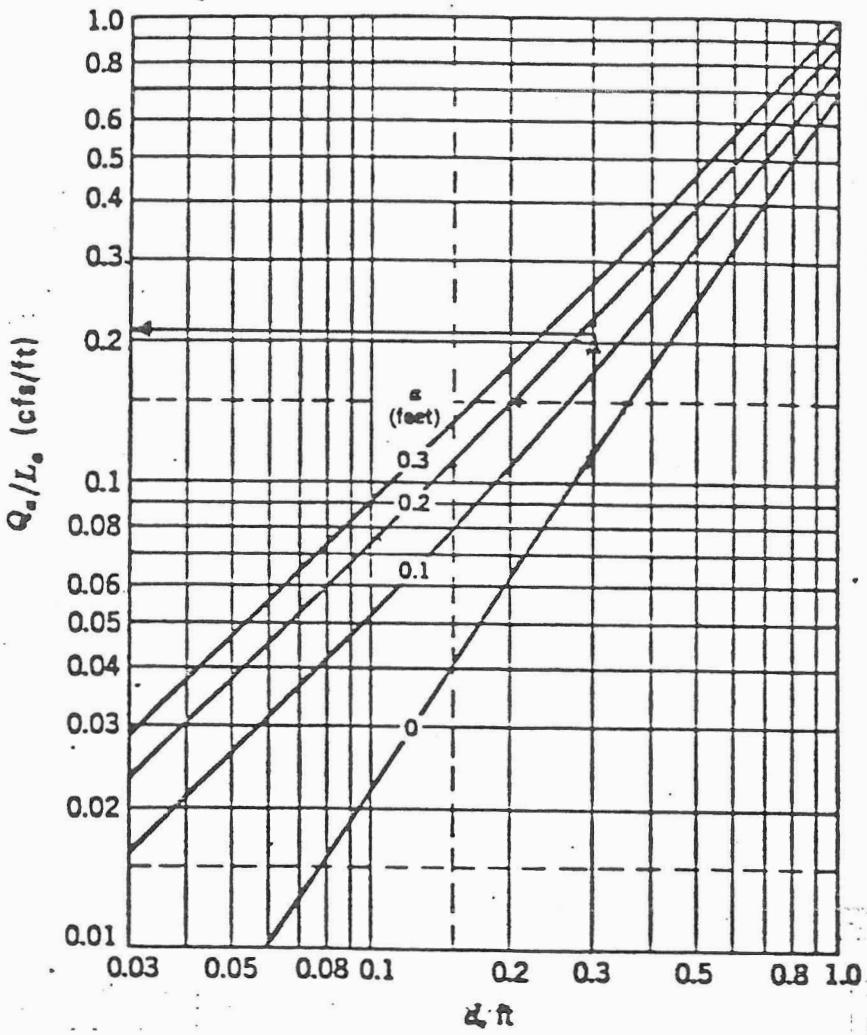
STANDARD DURATION RAINFALL - INTENSITY CURVES

Based on:
Weather Bureau
Technical Paper No. 40

Streets	
Asphaltic	0.70 - 0.95
Concrete	0.80 - 0.95
Gravel roadways & shoulders	0.40 - 0.60
Industrial Areas	
Flat commercial - about 90% of area impervious	0.80
Heavy areas	0.60 - 0.90
Light areas	0.50 - 0.80
Business Areas	
Downtown areas	0.70 - 0.95
Neighborhood areas	0.50 - 0.70
Residential Areas	
Lawns - flat	0.05 - 0.15
- steep	0.15 - 0.35
Suburban areas	0.25 - 0.40
Single family areas	0.30 - 0.50
Multi-unit areas	0.40 - 0.60
Apartment areas	0.50 - 0.70
Parks, Cemeteries	0.10 - 0.25
Playgrounds	0.20 - 0.35

Fig. 3-3

VALUES OF RUNOFF COEFFICIENT C



a

EXAMPLE USING FIGURE 3-46a

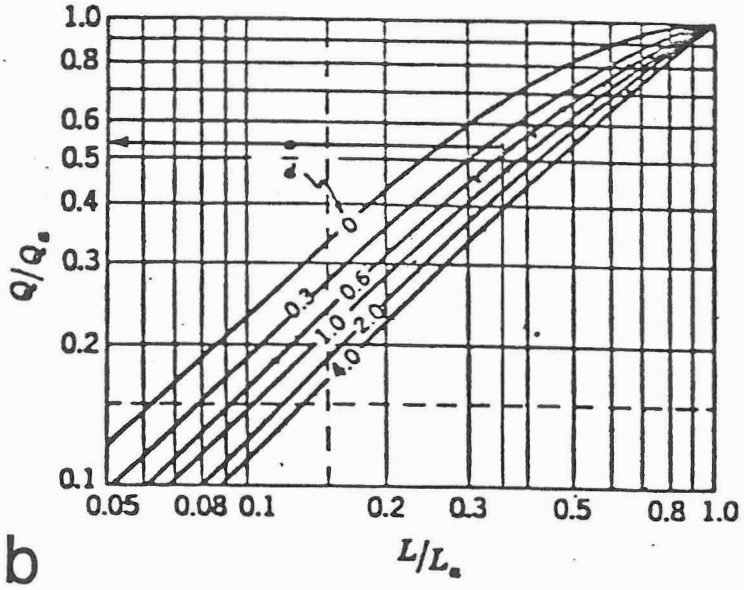
Given:

d = 0.3'

a = 0.167' (2")

Find:

$\frac{Q_a}{L_a}$ = 0.21 cfs/ft.



b

EXAMPLE USING FIGURE 3-46b

Given:

The above information and

Q_a = 5.9 cfs

L = 10'

Find: Q

$\frac{a}{d} = \frac{0.167}{0.3} = 0.56$

$L_a = \frac{5.9}{0.21} = 28'$

$\frac{L}{L_a} = \frac{10}{28} = 0.36$

$\frac{Q}{Q_a} = 0.53$

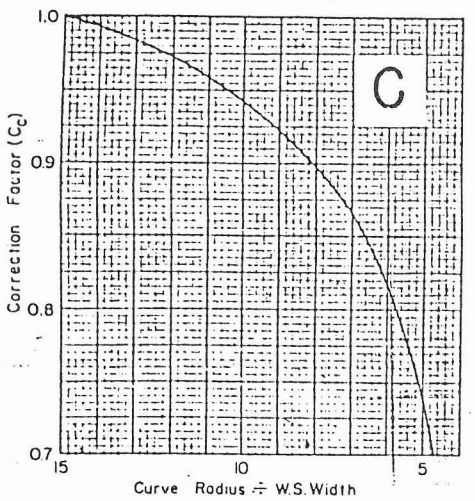
Q = (0.53)(5.9) = 3.1 cfs

DESIGN CHARTS FOR CURB-OPENING INLETS ON CONTINUOUS GRADES

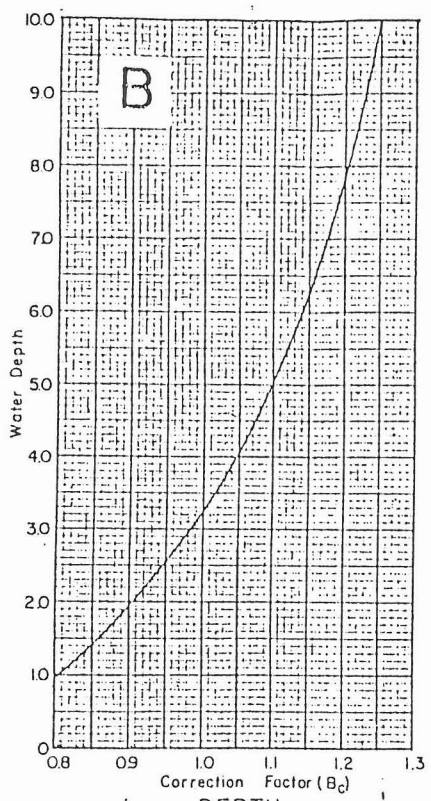
FIGURE 3-46

HYDRAULIC DESIGN: Permissible Velocities, Non-Cohesive Soil

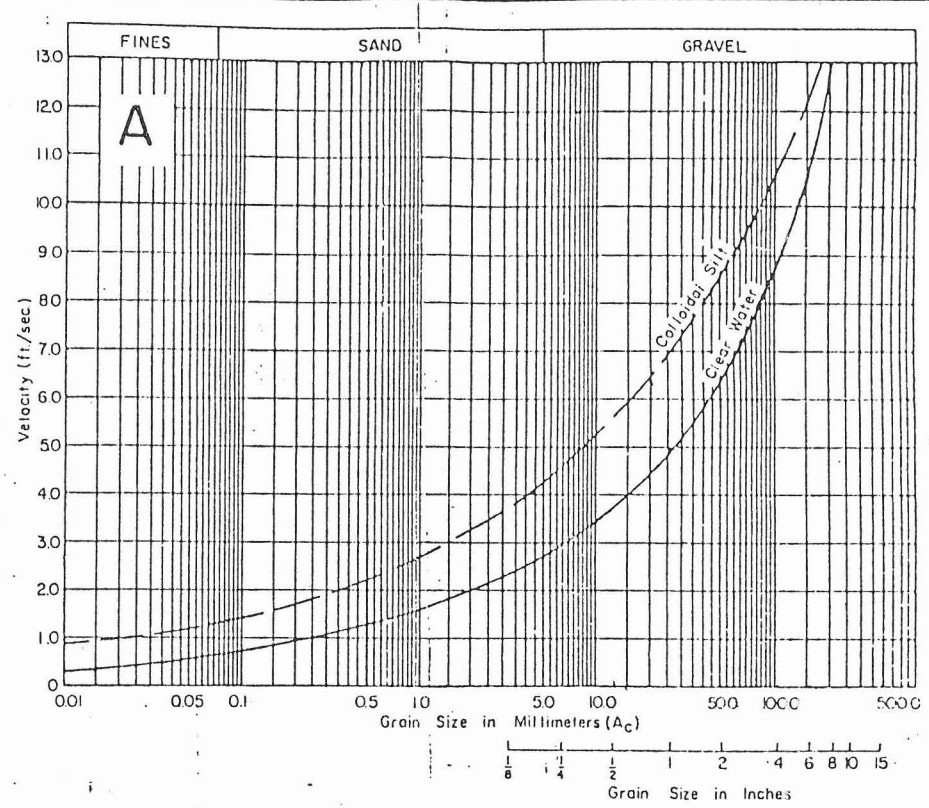
FIG. 6.3



ALIGNMENT



DEPTH



MATERIAL

EXAMPLE:

Determine permissible clear water velocity 5'-0" deep in an unlined channel with a coarse gravel ($d_{75} = \frac{1}{2}$") invert, straight alignment.

Permissible velocity $= A_c B_c C_c$

$= (3.6)(1.1)(1.0)$

$= 3.96$ ft./sec.

Figure 6-3

PRELIMINARY

REFERENCE: Design of Stable Channels A S C E Trans. Vol. 120 1955

U. S. DEPARTMENT of AGRICULTURE
SOIL CONSERVATION SERVICE
ENGINEERING and WATERSHED PLANNING UNIT
PORTLAND, OREGON

STANDARD DWG. NO.
7-N-20104
SHEET 1 OF 1

C. DESIGN DATA SHEETS

ARIZONA HIGHWAY DEPARTMENT
BRIDGE DIVISION
SUMMARY
HYDROLOGIC DESIGN DATA SHEET

S C S METHOD: PART I

LOCATION DATA:

Highway Sun Valley Parkway County Maricopa
Location South 8 miles - Phase III
Project No. 850840-7 Station
Name of Stream All - SUMMARY OF COMMON DESIGN ASSUMPTIONS FOR ALL CONC. POINTS.

DESIGN DATA:

Design Frequency	100	years
Drainage Area	varies	square miles
Drainage Length	varies	feet
Elevation		
Top of Drainage Area	varies	feet
At Structure	"	feet
Drainage Area Slope	"	%
Drainage Width	"	feet
Width factor W_f	"	
Vegetative Cover Type	Desert Brush	
Vegetative Cover Density	Mts. { 5 to 15 } Flats	%
Soil Group	Mts. { D and B } Flats	
Precipitation	Future Developed Conditions	
P = 6 hour =	3.3	inches Assumed
P = 24 hour =	4.3	inches Average RI-70 on Flats only

DESIGN COMPUTATION:

Precipitation	P = 1 hour =	2.43	inches
Curve Number		93 86	
Runoff	Q =	varies	inches
Time of Concentration	Tc	varies	hours
Time of Peak	Tp = (Tc)(W_f)	varies	hours

Peak Discharge $Qp = \frac{484\,AQ}{Tp}$ = See HEC-1 Printouts and Rational Calc. Sheets

= _____ cfs

Computed by C. Lovely Date 3-7-87

RATIONAL METHOD

ARIZONA HIGHWAY DEPARTMENT
BRIDGE DIVISION

HYDROLOGIC DESIGN DATA SHEET
RATIONAL METHOD

LOCATION DATA

Highway 291st AVE County MARICOPA
Location AREA #1
Project No. 850F40-7 Station
Name of Stream

DESIGN DATA

Design Frequency		100	years
Drainage Area	A_1	27	acres
	A_2		acres
	A_3		acres
Drainage Length		3700	feet
Elevation			
Top of Drainage Area		1440	feet
At Structure		1375	feet
Drainage Area Slope		1.8	%
Precipitation			
P = 6-hour		3.31	inches
P = 24-hour		4.28	inches

DESIGN COMPUTATIONS

Precipitation P_1 = 1-hour		2.43	inches
Time of Concentration	Tc	27	minutes (V=2.3 FPS) fig 2-8
Rainfall Intensity	i	4.1	inches/hour
Runoff Coefficient	C_1	0.42	
	C_2		
	C_3		
Weighted Runoff Coefficient	C		

Peak Discharge Qp = CiA = (0.42)(4.1)(27) = 46 cfs

Computed by RAD Date 5/20/86
CJL 3/16/87

ARIZONA HIGHWAY DEPARTMENT
BRIDGE DIVISION

HYDROLOGIC DESIGN DATA SHEET
RATIONAL METHOD

LOCATION DATA

Highway 291st [illegible] County [illegible]
Location Arch #2
Project No. [illegible] Station
Name of Stream

DESIGN DATA

Design Frequency		100	years
Drainage Area	A_1	37.7	acres
	A_2		acres
	A_3		acres
Drainage Length		[illegible]	feet
Elevation			
Top of Drainage Area		1440	feet
At Structure		[illegible]	feet
Drainage Area Slope		1.8	%
Precipitation			
P = 6-hour		3.31	inches
P = 24-hour		4.2[illegible]	inches

DESIGN COMPUTATIONS

Precipitation P_1 = 1-hour		2.43	inches
Time of Concentration	Tc	29	minutes (1.23 hrs) Fig 2-3
Rainfall Intensity	i	3.9	inches/hour
Runoff Coefficient	C_1	0.42	
	C_2		
	C_3		
Weighted Runoff Coefficient	C		

Peak Discharge Qp = CiA = (0.42)(3.9)(37.7) = 62 cfs

Computed by RAD Date 5/20/85
CJL 3/16/87

ARIZONA HIGHWAY DEPARTMENT
BRIDGE DIVISION

HYDROLOGIC DESIGN DATA SHEET
RATIONAL METHOD

LOCATION DATA

Highway 291st AVE County MARICOPA
Location AREA #3
Project No. 850 F401 Station
Name of Stream

DESIGN DATA

Design Frequency		100	years
Drainage Area	A_1	18.5	acres
	A_2		acres
	A_3		acres
Drainage Length		2680	feet
Elevation			
Top of Drainage Area		1405	feet
At Structure		1360	feet
Drainage Area Slope		1.7	%
Precipitation			
P = 6-hour		3.31	inches
P = 24-hour		4.23	inches

DESIGN COMPUTATIONS

Precipitation P_1 = 1-hour		2.43	inches
Time of Concentration	Tc	17	minutes
Rainfall Intensity	i	5.2	inches/hour
Runoff Coefficient	C_1	0.42	
	C_2		
	C_3		
Weighted Runoff Coefficient	C		

Peak Discharge Qp = CiA = (0.42)(5.2)(18.5) = 40 cfs

Computed by RAD Date 5/20/86
CJL 3/16/87

ARIZONA HIGHWAY DEPARTMENT
BRIDGE DIVISION

HYDROLOGIC DESIGN DATA SHEET
RATIONAL METHOD

LOCATION DATA

Highway 27TH AVE County MARICOPA
Location AREA #5
Project No. 950-[illegible]-7 Station
Name of Stream

DESIGN DATA

Design Frequency		100	years
Drainage Area	A_1	47.7	acres
	A_2		acres
	A_3		acres
Drainage Length		4940	feet
Elevation			
Top of Drainage Area		1425	feet
At Structure		1337	feet
Drainage Area Slope		1.8	%
Precipitation			
P = 6-hour		3.31	inches
P = 24-hour		4.72	inches

DESIGN COMPUTATIONS

Precipitation P_1 = 1-hour		2.43	inches
Time of Concentration	Tc	26	minutes
Rainfall Intensity	i	4.15	inches/hour
Runoff Coefficient	C_1	0.42	
	C_2		
	C_3		
Weighted Runoff Coefficient	C		

Peak Discharge Qp = CiA = (.42)(4.15)(47.7) = 83 cfs

Computed by RAD Date 5/20/86
CSL 3/16/87

ARIZONA HIGHWAY DEPARTMENT
BRIDGE DIVISION

HYDROLOGIC DESIGN DATA SHEET
RATIONAL METHOD

LOCATION DATA

Highway 291st AVE County MARICOPA
Location Area 7
Project No. 850 F4D-7 Station
Name of Stream

DESIGN DATA

Design Frequency		100	years
Drainage Area	A_1	29.8	acres
	A_2		acres
	A_3		acres
Drainage Length		2625	feet
Elevation			
Top of Drainage Area		1385	feet
At Structure		1358	feet
Drainage Area Slope		1.0	%
Precipitation			
P = 6-hour		3.31	inches
P = 24-hour		4.25	inches

DESIGN COMPUTATIONS

Precipitation P_1 = 1-hour		2.43	inches
Time of Concentration	Tc	20	minutes
Rainfall Intensity	i	4.9	inches/hour
Runoff Coefficient	C_1	0.42	
	C_2		
	C_3		
Weighted Runoff Coefficient	C		

Peak Discharge Qp = CiA = (0.42)(4.9)(29.8) 61 cfs

Computed by RAD Date 5/22/86
CJC 3/16/87

ARIZONA HIGHWAY DEPARTMENT
BRIDGE DIVISION

HYDROLOGIC DESIGN DATA SHEET
RATIONAL METHOD

LOCATION DATA

Highway 291st Ave County Maricopa
Location Arrow #1
Project No. [illegible] Station
Name of Stream

DESIGN DATA

Design Frequency		100	years
Drainage Area	A_1	29.2	acres
	A_2		acres
	A_3		acres
Drainage Length		3000	feet
Elevation			
Top of Drainage Area		1355	feet
At Structure		1342	feet
Drainage Area Slope		1.2	%
Precipitation			
P = 6-hour		3.31	inches
P = 24-hour		4.22	inches

DESIGN COMPUTATIONS

Precipitation P_1 = 1-hour		2.43	inches
Time of Concentration	Tc	26	minutes (V=1.9 FPS) Fig 2-3
Rainfall Intensity	i	4.2	inches/hour
Runoff Coefficient	C_1	0.42	
	C_2		
	C_3		
Weighted Runoff Coefficient	C		

Peak Discharge Qp = CiA = (0.42)(4.2)(29.2) = 52 cfs

Computed by RAD Date 6/11/86
CSL 3/16/87

ARIZONA HIGHWAY DEPARTMENT
BRIDGE DIVISION

HYDROLOGIC DESIGN DATA SHEET
RATIONAL METHOD

LOCATION DATA

Highway 291st Ave County MARICOPA
Location Area [illegible]
Project No. [illegible] Station
Name of Stream

DESIGN DATA

Design Frequency		100	years
Drainage Area	A_1	15.7	acres
	A_2		acres
	A_3		acres
Drainage Length		1900	feet
Elevation			
Top of Drainage Area		1367	feet
At Structure		1343	feet
Drainage Area Slope		1.3	%
Precipitation			
P = 6-hour		3.31	inches
P = 24-hour		4.23	inches

DESIGN COMPUTATIONS

Precipitation P_1 = 1-hour		2.43	inches
Time of Concentration	Tc	16	minutes
Rainfall Intensity	i	5.45	inches/hour
Runoff Coefficient	C_1	0.42	
	C_2		
	C_3		
Weighted Runoff Coefficient	C		

Peak Discharge Qp = CiA = (0.42)(5.45)(15.7) = 36 cfs

Computed by RAD Date 6/13/96
CJL 3/16/97

ARIZONA HIGHWAY DEPARTMENT
BRIDGE DIVISION

HYDROLOGIC DESIGN DATA SHEET
RATIONAL METHOD

LOCATION DATA

Highway 29[illegible] County [illegible]
Location [illegible]
Project No. [illegible] Station
Name of Stream

DESIGN DATA

Design Frequency		100	years
Drainage Area	A_1	[illegible]	acres
	A_2		acres
	A_3		acres
Drainage Length		2000	feet
Elevation			
Top of Drainage Area		1254	feet
At Structure		[illegible]	feet
Drainage Area Slope		[illegible]	%
Precipitation			
P = 6-hour		3.31	inches
P = 24-hour		4.22	inches

DESIGN COMPUTATIONS

Precipitation P_1 = 1-hour		2.43	inches
Time of Concentration	Tc	16	minutes
Rainfall Intensity	i	5.4	inches/hour
Runoff Coefficient	C_1	0.42	
	C_2		
	C_3		
Weighted Runoff Coefficient	C		

Peak Discharge Qp = CiA = (0.42)(5.4)(16) = 36 cfs

Computed by [illegible] Date 6/17/86
25C 3/16/87

ARIZONA HIGHWAY DEPARTMENT
BRIDGE DIVISION

HYDROLOGIC DESIGN DATA SHEET
RATIONAL METHOD

LOCATION DATA

Highway 291st Ave County MARICOPA
Location AREA #12
Project No. 850-MC-7 Station
Name of Stream

DESIGN DATA

Design Frequency		100	years
Drainage Area	A_1	57.8	acres
	A_2		acres
	A_3		acres
Drainage Length		3620	feet
Elevation			
Top of Drainage Area		1370	feet
At Structure		1320	feet
Drainage Area Slope		1.4	%
Precipitation			
P = 6-hour		3.31	inches
P = 24-hour		4.28	inches

DESIGN COMPUTATIONS

Precipitation P_1 = 1-hour		2.43	inches
Time of Concentration	Tc	22	minutes
Rainfall Intensity	i	4.6	inches/hour
Runoff Coefficient	C_1	0.42	
	C_2		
	C_3		
Weighted Runoff Coefficient	C		

Peak Discharge Qp = CiA = (0.42)(4.6)(57.8) = 112 cfs

Computed by RAD Date 6/17/86
CJC 3/16/87

ARIZONA HIGHWAY DEPARTMENT
BRIDGE DIVISION

HYDROLOGIC DESIGN DATA SHEET
RATIONAL METHOD

LOCATION DATA

Highway 291st Ave — County MARICOPA
Location [illegible]
Project No. [illegible] — Station
Name of Stream

DESIGN DATA

Design Frequency		100	years
Drainage Area	A_1	25.6	acres
	A_2		acres
	A_3		acres
Drainage Length		3100	feet
Elevation			
Top of Drainage Area		1360	feet
At Structure		1315	feet
Drainage Area Slope		1.45	%
Precipitation			
P = 6-hour		3.31	inches
P = 24-hour		4.25	inches

DESIGN COMPUTATIONS

Precipitation P_1 = 1-hour		2.43	inches
Time of Concentration	Tc	19.5	minutes
Rainfall Intensity	i	4.85	inches/hour
Runoff Coefficient	C_1	0.42	
	C_2		
	C_3		
Weighted Runoff Coefficient	C		

Peak Discharge Qp = CiA = (0.42)(4.85)(25.6) = 52 cfs

Computed by RAD — Date 5/27/86
CSC 3/16/87

ARIZONA HIGHWAY DEPARTMENT
BRIDGE DIVISION

HYDROLOGIC DESIGN DATA SHEET
RATIONAL METHOD

LOCATION DATA

Highway 291ST AVE County MARICOPA
Location [illegible]
Project No. [illegible] Station
Name of Stream

DESIGN DATA

Design Frequency		100	years
Drainage Area	A_1	34.9	acres
	A_2		acres
	A_3		acres
Drainage Length		4600	feet
Elevation			
Top of Drainage Area		1367	feet
At Structure		1308	feet
Drainage Area Slope		1.28	%
Precipitation			
P = 6-hour		3.31	inches
P = 24-hour		4.28	inches

DESIGN COMPUTATIONS

Precipitation P_1 = 1-hour		2.43	inches
Time of Concentration	Tc	27	minutes
Rainfall Intensity	i	4.15	inches/hour
Runoff Coefficient	C_1	0.42	
	C_2		
	C_3		
Weighted Runoff Coefficient	C		

Peak Discharge Qp = CiA = (0.42)(4.15)(34.9) = 61 cfs

Computed by RAD Date 6/19/[illegible]
CJL 3/16/87

ARIZONA HIGHWAY DEPARTMENT
BRIDGE DIVISION

HYDROLOGIC DESIGN DATA SHEET
RATIONAL METHOD

LOCATION DATA

Highway [illegible] County Maricopa
Location [illegible]
Project No. [illegible] Station
Name of Stream

DESIGN DATA

Design Frequency		100	years
Drainage Area	A_1	12.8	acres
	A_2		acres
	A_3		acres
Drainage Length		1700	feet
Elevation			
Top of Drainage Area		1334	feet
At Structure		[illegible]	feet
Drainage Area Slope		1.4	%
Precipitation			
P = 6-hour		3.31	inches
P = 24-hour		4.35	inches

DESIGN COMPUTATIONS

Precipitation P_1 = 1-hour		2.43	inches
Time of Concentration	Tc	13.5	minutes
Rainfall Intensity	i	5.9	inches/hour
Runoff Coefficient	C_1	0.42	
	C_2		
	C_3		
Weighted Runoff Coefficient	C		

Peak Discharge Qp = CiA = (0.42)5.9(12.8) = 32 cfs

Computed by RID Date 6/23/86
JSC 3/13/87

ARIZONA HIGHWAY DEPARTMENT
BRIDGE DIVISION

HYDROLOGIC DESIGN DATA SHEET
RATIONAL METHOD

LOCATION DATA

Highway 291st Ave County Maricopa
Location Area # 14
Project No. 85SR-0-7 Station
Name of Stream

DESIGN DATA

Design Frequency		100	years
Drainage Area	A_1	34.2	acres
	A_2		acres
	A_3		acres
Drainage Length		3200	feet
Elevation			
Top of Drainage Area		1325	feet
At Structure		1274	feet
Drainage Area Slope		1.4	%
Precipitation			
P = 6-hour		3.31	inches
P = 24-hour		4.62	inches

DESIGN COMPUTATIONS

Precipitation P_1 = 1-hour		2.43	inches
Time of Concentration	Tc	20.2	minutes
Rainfall Intensity	i	4.85	inches/hour
Runoff Coefficient	C_1	0.42	
	C_2		
	C_3		
Weighted Runoff Coefficient	C		

Peak Discharge Qp = CiA = (0.42)(4.85)(34.2) = 70 cfs

Computed by [illegible] Date 6/25/[illegible]
CJC 3/15/87

ARIZONA HIGHWAY DEPARTMENT
BRIDGE DIVISION

HYDROLOGIC DESIGN DATA SHEET
RATIONAL METHOD

LOCATION DATA

Highway _____ County _____
Location _____
Project No. _____ Station _____
Name of Stream _____

DESIGN DATA

Design Frequency		100	years
Drainage Area	A_1	81.1	acres
	A_2		acres
	A_3		acres
Drainage Length		4700	feet
Elevation			
Top of Drainage Area		1553	feet
At Structure		1272	feet
Drainage Area Slope		1.3	%
Precipitation			
P = 6-hour		3.31	inches
P = 24-hour		4.28	inches

DESIGN COMPUTATIONS

Precipitation P_1 = 1-hour		2.43	inches
Time of Concentration	Tc	28	minutes
Rainfall Intensity	i	4.0	inches/hour
Runoff Coefficient	C_1	0.42	
	C_2		
	C_3		
Weighted Runoff Coefficient	C		

Peak Discharge Qp = CiA = (0.42)(4.0)(81.1) 136 cfs

Computed by RAD Date 6/25/86
Chk 3/16/87

ARIZONA HIGHWAY DEPARTMENT
BRIDGE DIVISION

HYDROLOGIC DESIGN DATA SHEET
RATIONAL METHOD

LOCATION DATA

Highway 291st Ave County MARICOPA
Location AREA #22
Project No. [illegible] Station
Name of Stream

DESIGN DATA

Design Frequency		100	years
Drainage Area	A_1	26.6	acres
	A_2		acres
	A_3		acres
Drainage Length		3800	feet
Elevation			
Top of Drainage Area		1272	feet
At Structure		1240	feet
Drainage Area Slope		0.84	%
Precipitation			
P = 6-hour		3.31	inches
P = 24-hour		4.29	inches

DESIGN COMPUTATIONS

Precipitation P_1 = 1-hour		2.43	inches
Time of Concentration	Tc	28	minutes
Rainfall Intensity	i	4.0	inches/hour
Runoff Coefficient	C_1	0.42	
	C_2		
	C_3		
Weighted Runoff Coefficient	C		

Peak Discharge Qp = CiA = (0.42)(4.0)(26.6) = 45 cfs

Computed by RAD Date 6/30/96
CJL 3/13/97

ARIZONA HIGHWAY DEPARTMENT
BRIDGE DIVISION

HYDROLOGIC DESIGN DATA SHEET
RATIONAL METHOD

LOCATION DATA

Highway 2914 County MARICOPA
Location Apache 26
Project No. [illegible] Station
Name of Stream

DESIGN DATA

Design Frequency		100	years
Drainage Area	A_1	10	acres
	A_2		acres
	A_3		acres
Drainage Length		2000	feet
Elevation			
Top of Drainage Area		1239	feet
At Structure		1210	feet
Drainage Area Slope		1.05	%
Precipitation			
P = 6-hour		3.31	inches
P = 24-hour		[illegible]	inches

DESIGN COMPUTATIONS

Precipitation P_1 = 1-hour		2.45	inches
Time of Concentration	Tc	16	minutes
Rainfall Intensity	i	5.5	inches/hour
Runoff Coefficient	C_1	0.42	
	C_2		
	C_3		
Weighted Runoff Coefficient	C		
Peak Discharge Qp = CiA = (0.42)(5.5)(10)		23	cfs

Computed by RID Date 7/7/82
BSL 3/13/87

ARIZONA HIGHWAY DEPARTMENT
BRIDGE DIVISION

HYDROLOGIC DESIGN DATA SHEET
RATIONAL METHOD

LOCATION DATA

Highway 291st AVE County MARICOPA
Location AREA # 29
Project No. [illegible] Station
Name of Stream

DESIGN DATA

Design Frequency		100	years
Drainage Area	A_1	35.6	acres
	A_2		acres
	A_3		acres
Drainage Length		2950	feet
Elevation			
Top of Drainage Area		1230	feet
At Structure		1172	feet
Drainage Area Slope		0.79	%
Precipitation			
P = 6-hour		3.31	inches
P = 24-hour		4.22	inches

DESIGN COMPUTATIONS

Precipitation P_1 = 1-hour		2.43	inches
Time of Concentration	Tc	26	minutes
Rainfall Intensity	i	4.2	inches/hour
Runoff Coefficient	C_1	0.42	
	C_2		
	C_3		
Weighted Runoff Coefficient	C		

Peak Discharge Qp = CiA = (0.42)(4.2)(35.6) = 63 cfs

Computed by RAD Date 7/11/66
CSL 3/16/87

ARIZONA HIGHWAY DEPARTMENT
BRIDGE DIVISION

HYDROLOGIC DESIGN DATA SHEET
RATIONAL METHOD

LOCATION DATA

Highway 29th AVE County [illegible]
Location [illegible]
Project No. [illegible] Station
Name of Stream

DESIGN DATA

Design Frequency		100	years
Drainage Area	A_1	242	acres
	A_2		acres
	A_3		acres
Drainage Length		2700	feet
Elevation			
Top of Drainage Area		[illegible]	feet
At Structure		[illegible]	feet
Drainage Area Slope		[illegible]	%
Precipitation			
P = 6-hour		[illegible]	inches
P = 24-hour		[illegible]	inches

DESIGN COMPUTATIONS

Precipitation P_1 = 1-hour		2.43	inches
Time of Concentration	Tc	[illegible]	minutes
Rainfall Intensity	i	4.2	inches/hour
Runoff Coefficient	C_1	0.42	
	C_2		
	C_3		
Weighted Runoff Coefficient	C		
Peak Discharge Qp = CiA =		51	cfs

Computed by P.E. Date 3/17/87
ASC 3/17/87

CULVERT DESIGN

CULVERT DESIGN

PROJECT: SUN VALLEY

DESIGNER: RAD

DATE: 3/11/87

HYDROLOGIC AND CHANNEL INFORMATION

Q_{100} = 46

Q_2 = ____

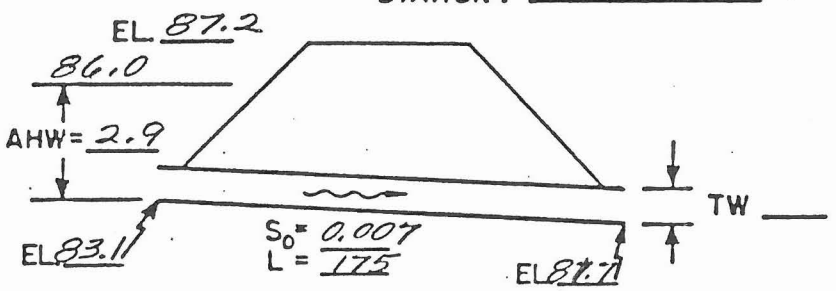
TW_1 = 1.5

TW_2 = ____

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

SKETCH

STATION: 404+55



MEAN STREAM VELOCITY = 3.1

MAX. STREAM VELOCITY = 4.7

CULVERT DESCRIPTION (ENTRANCE TYPE)	Q	SIZE	HEADWATER COMPUTATION										CONTROLLING HW	OUTLET VELOCITY	COMMENTS
			INLET CONT.		OUTLET CONTROL $HW = H + h_o - LS_o$										
			$\frac{HW}{D}$	HW	K_e	H	d_c	$\frac{d_c+D}{2}$	TW	h_o	LS_o	HW			
2-36"x22" C.M.P.	23		1.2	2.30	0.2	1.58	1.25	1.54	1.5	1.54	1.2	1.92	2.2	13.0	OK
(HEADWALL)															

SUMMARY & RECOMMENDATIONS:

CSZ 3/13/87

CULVERT DESIGN

PROJECT: SUN VALLEY

DESIGNER: RAD

DATE: 3/11/87

HYDROLOGIC AND CHANNEL INFORMATION

Q_{100} = 31

Q_2 = _____

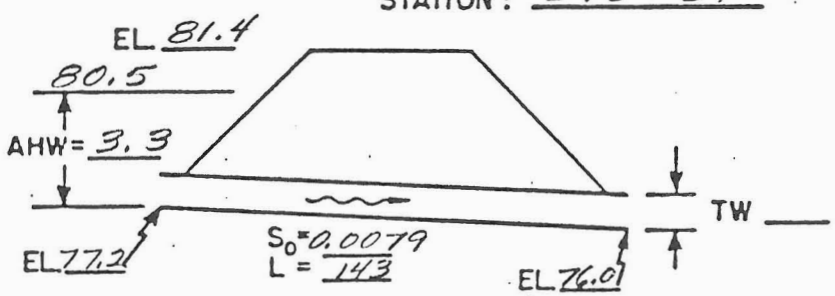
TW_1 = 1.5

TW_2 = _____

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

SKETCH

STATION: 398+51



MEAN STREAM VELOCITY = 4.2

MAX. STREAM VELOCITY = 6.3

CULVERT DESCRIPTION (ENTRANCE TYPE)	Q	SIZE	HEADWATER COMPUTATION: INLET CONT.		OUTLET CONTROL $HW = H + h_o - LS_o$								CONTROLLING HW	OUTLET VELOCITY	COMMENTS
			$\frac{HW}{D}$	HW	K_e	H	d_c	$\frac{d_c+D}{2}$	TW	h_o	LS_o	HW			
1-30" C.L.C.M.P.	31		1.2	3.0	0.5	1.6	1.9	2.2	1.5	2.2	1.13	2.7	3.0	10.5	OK
(PROJECTING)															

SUMMARY & RECOMMENDATIONS:

CSY 3/13/87

CULVERT DESIGN

PROJECT: SUN VALLEY

DESIGNER: RAD

DATE: 3/11/87

HYDROLOGIC AND CHANNEL INFORMATION

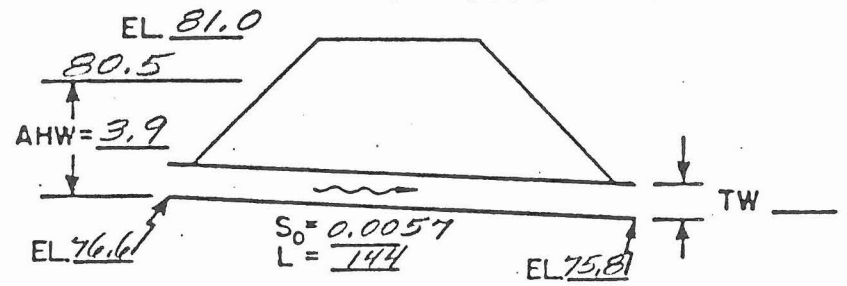
$Q_{100} =$ 31 $\qquad TW_1 =$ 1.5

$Q_2 =$ $\qquad TW_2 =$

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

SKETCH

STATION: 397+66



MEAN STREAM VELOCITY = 3.2
MAX. STREAM VELOCITY = 4.8

CULVERT DESCRIPTION (ENTRANCE TYPE)	Q	SIZE	HEADWATER COMPUTATION: INLET CONT.		OUTLET CONTROL $HW = H + h_o - LS_o$								CONTROLLING HW	OUTLET VELOCITY	COMMENTS
			$\frac{HW}{D}$	HW	K_e	H	d_c	$\frac{d_c+D}{2}$	TW	h_o	LS_o	HW			
1-30" RGRCP	31		1.2	3.0	0.5	1.6	1.9	2.2	1.5	2.2	0.8	3.0	3.0	10.5	OK
(PROJECTING)															

SUMMARY & RECOMMENDATIONS:

CSL 3/13/87

CULVERT DESIGN

PROJECT: Sun Valley

DESIGNER: RAD

DATE: 3/11/87

HYDROLOGIC AND CHANNEL INFORMATION

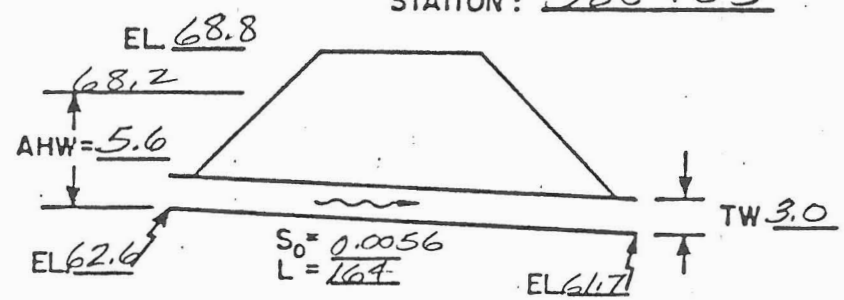
Q_1 = 330 TW_1 = 3.0

Q_2 = ____ TW_2 = ____

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

SKETCH

STATION: 386 +05



MEAN STREAM VELOCITY = 5.8

MAX. STREAM VELOCITY = 8.7

CULVERT DESCRIPTION (ENTRANCE TYPE)	Q %	SIZE /	HEADWATER COMPUTATION: INLET CONT. HW/D	INLET CONT. HW	OUTLET CONTROL HW=H+h_o−LS_o: K_e	H	d_c	$\frac{d_c+D}{2}$	TW	h_o	LS_o	HW	CONTROLLING HW	OUTLET VELOCITY	COMMENTS
1−10×4	33	4.0	1.35	5.4	0.2	1.72	3.3	3.65	3.0	3.65	.92	4.45	5.4	13.1	OK
(HEADWALL)															

SUMMARY & RECOMMENDATIONS:

CKD: CSL 3/13/87

CULVERT DESIGN

PROJECT: SUN VALLEY

DESIGNER: RAD

DATE: 3/11/87

HYDROLOGIC AND CHANNEL INFORMATION

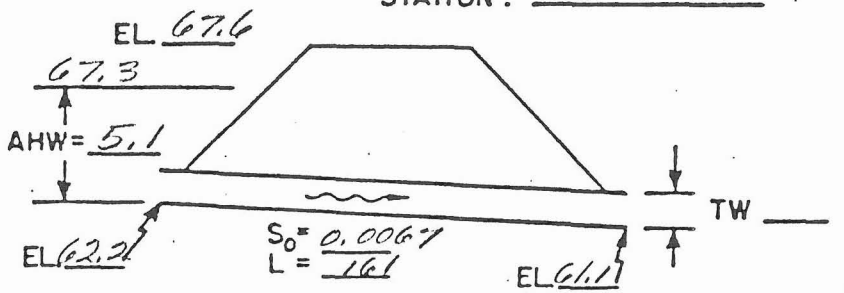
Q_{100} = 83 TW_1 = 1.5

Q_2 = TW_2 =

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

SKETCH

STATION: 382+81



MEAN STREAM VELOCITY = 4.0

MAX. STREAM VELOCITY = 6.0

CULVERT DESCRIPTION (ENTRANCE TYPE)	Q	SIZE	HEADWATER COMPUTATION: INLET CONT. $\frac{HW}{D}$	HW	OUTLET CONTROL $HW=H+h_o-LS_o$: K_e	H	d_c	$\frac{d_c+D}{2}$	TW	h_o	LS_o	HW	CONTROLLING HW	OUTLET VELOCITY	COMMENTS
1-42" C.L.C.M.P.	83		1.4	4.9	0.5	2.7	2.8	3.2	1.5	3.2	1.1	4.8	4.9	10.5	OK
(PROJECTING)															

SUMMARY & RECOMMENDATIONS:

CSL 3/13/87

CULVERT DESIGN

PROJECT: SUN VALLEY

DESIGNER: RAD

DATE: 3/11/87

HYDROLOGIC AND CHANNEL INFORMATION

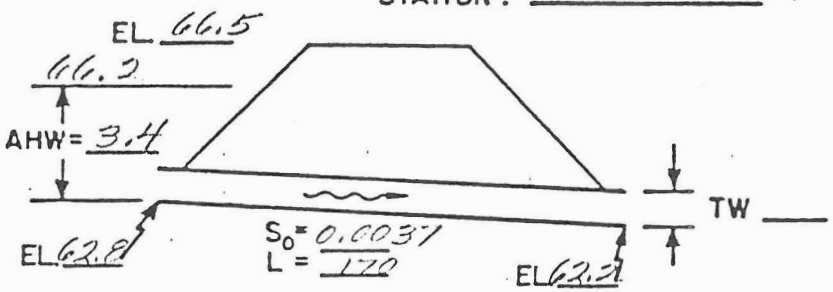
Q_{100} = 610 TW_1 = 1.5

Q_2 = TW_2 =

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

SKETCH

STATION: 374+64



MEAN STREAM VELOCITY = 2.9

MAX. STREAM VELOCITY = 6.0

CULVERT DESCRIPTION (ENTRANCE TYPE)	Q	SIZE	HEADWATER COMPUTATION: INLET CONT. $\frac{HW}{D}$	HW	OUTLET CONTROL $HW = H + h_o - LS_o$: K_e	H	d_c	$\frac{d_c+D}{2}$	TW	h_o	LS_o	HW	CONTROLLING HW	OUTLET VELOCITY	COMMENTS
4 - 10'x3' CBC	152.5		1.0	3.0	0.2	0.4	1.9	2.5	1.5	2.5	0.6	2.3	3.0	7.2	OK
(HEADWALL)															

SUMMARY & RECOMMENDATIONS:

CJL 3/13/87

CULVERT DESIGN

PROJECT: SUN VALLEY

DESIGNER: RAD

DATE: 3/11/87

HYDROLOGIC AND CHANNEL INFORMATION

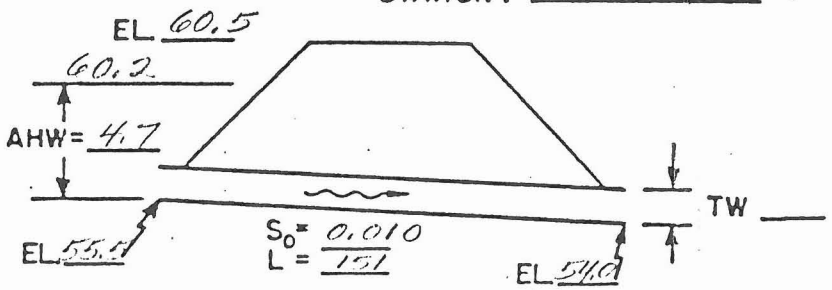
Q_1 = 61 TW_1 = 1.5

Q_2 = TW_2 =

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

SKETCH

STATION: 363+05



MEAN STREAM VELOCITY = 4.1

MAX. STREAM VELOCITY = 6.0

CULVERT DESCRIPTION (ENTRANCE TYPE)	Q	SIZE	HEADWATER COMPUTATION										CONTROLLING HW	OUTLET VELOCITY	COMMENTS
			INLET CONT.		OUTLET CONTROL $HW = H + h_o - LS_o$										
			$\frac{HW}{D}$	HW	K_e	H	d_c	$\frac{d_c+D}{2}$	TW	h_o	LS_o	HW			
1-42" RCP	61		1.06	3.7	0.9	1.4	2.4	2.95	1.5	2.95	1.51	2.84	3.7	11.6	OK
(PROJECTING)															

SUMMARY & RECOMMENDATIONS:

CSL 3/13/87

CULVERT DESIGN

PROJECT: SUN VALLEY

DESIGNER: RAD

DATE: 3/11/87

HYDROLOGIC AND CHANNEL INFORMATION

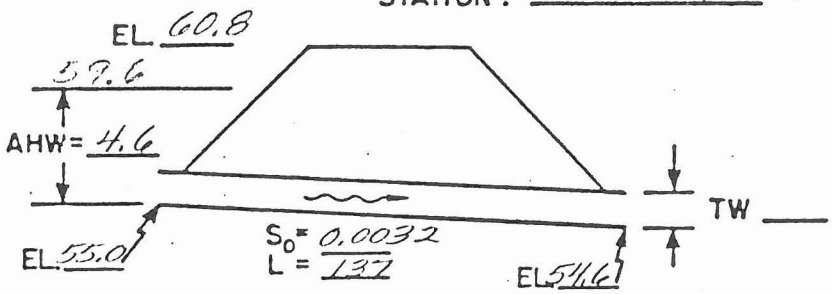
Q_{100} = 1031 TW_1 = 2.5

Q_2 = ____ TW_2 = ____

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

SKETCH

STATION: 360+44



MEAN STREAM VELOCITY = 5.6

MAX. STREAM VELOCITY = 8.4

CULVERT DESCRIPTION (ENTRANCE TYPE)	Q	SIZE	HEADWATER COMPUTATION: INLET CONT.		OUTLET CONTROL HW=H + h_o − LS_o								CONTROLLING HW	OUTLET VELOCITY	COMMENTS
			$\frac{HW}{D}$	HW	K_e	H	d_c	$\frac{d_c+D}{2}$	TW	h_o	LS_o	HW			
4 — 10'x4' CBC	258		1.09	4.36	0.2	1.05	2.8	3.4	2.5	3.4	0.44	4.0	4.36	10.0	OK
(HEADWALL)															

SUMMARY & RECOMMENDATIONS:

CJC 3/12/87

CULVERT DESIGN

PROJECT: SUN VALLEY

DESIGNER: RAD

DATE: 3/11/87

HYDROLOGIC AND CHANNEL INFORMATION

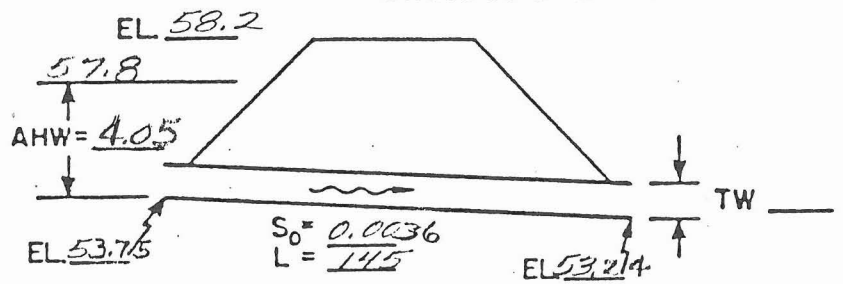
Q_{100} = 120 TW_1 = 1.5

Q_2 = TW_2 =

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

SKETCH

STATION: 356+13



MEAN STREAM VELOCITY = 3.1

MAX. STREAM VELOCITY = 4.7

CULVERT DESCRIPTION (ENTRANCE TYPE)	Q	SIZE	HEADWATER COMPUTATION: INLET CONT. HW/D	INLET CONT. HW	OUTLET CONTROL HW=H+h_o−LS_o: K_e	H	d_c	$\frac{d_c+D}{2}$	TW	h_o	LS_o	HW	CONTROLLING HW	OUTLET VELOCITY	COMMENTS
1-6'x3' CBC	120	3.0	1.27	3.8	0.2	1.1	2.3	2.7	1.5	2.7	0.6	3.2	3.8	8.4	OK
(HEADWALL)															

SUMMARY & RECOMMENDATIONS:

CJL 3/13/87

CULVERT DESIGN

PROJECT: SUN VALLEY

DESIGNER: RAD

DATE: 3/11/87

HYDROLOGIC AND CHANNEL INFORMATION

Q_{100} = 52

Q_2 = _____

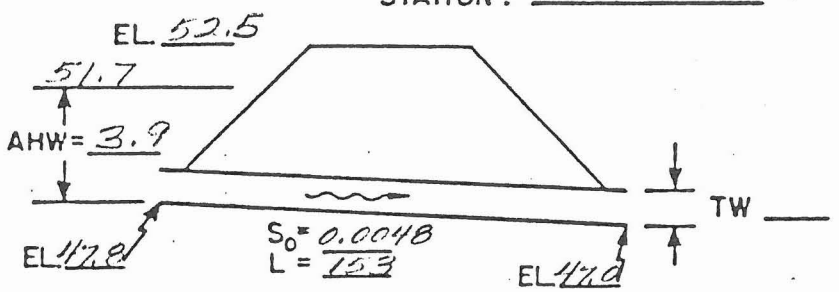
TW_1 = 1.5

TW_2 = _____

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

SKETCH

STATION: 350+40



MEAN STREAM VELOCITY = 4.5

MAX. STREAM VELOCITY = 6.75

CULVERT DESCRIPTION (ENTRANCE TYPE)	Q	SIZE	HEADWATER COMPUTATION										CONTROLLING HW	OUTLET VELOCITY	COMMENTS
			INLET CONT.		OUTLET CONTROL $HW = H + h_o - LS_o$										
			$\frac{HW}{D}$	HW	K_e	H	d_c	$\frac{d_c+D}{2}$	TW	h_o	LS_o	HW			
1-36" R.C.R.C.P.	52		1.25	3.75	0.2	1.8	2.3	2.7	1.5	2.7	0.7	3.8	3.8	10.2	OK
(HEADWALL)															

SUMMARY & RECOMMENDATIONS:

ASL 3/13/87

CULVERT DESIGN

PROJECT: SUNVALLEY

DESIGNER: RAD

DATE: 3/11/87

HYDROLOGIC AND CHANNEL INFORMATION

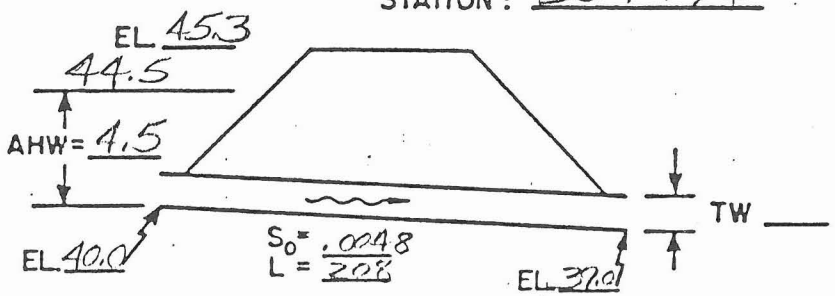
Q_1 = 250 TW_1 = 2.5

Q_2 = TW_2 =

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

SKETCH

STATION: 337+14



MEAN STREAM VELOCITY = 5.3

MAX. STREAM VELOCITY = 8.0

CULVERT DESCRIPTION (ENTRANCE TYPE)	Q/b	SIZE	HEADWATER COMPUTATION: INLET CONT. $\frac{HW}{D}$	HW	OUTLET CONTROL $HW = H + h_o - LS_o$: K_e	H	d_c	$\frac{d_c+D}{2}$	TW	h_o	LS_o	HW	CONTROLLING HW	OUTLET VELOCITY	COMMENTS
1-10' x 4' CBC	25	4.0	1.07	4.28	0.2	.99	2.75	3.4	2.4	3.4	1.0	3.4	4.3	11.4	OK
(Headwall)															

SUMMARY & RECOMMENDATIONS:

CJC 3/13/87

CULVERT DESIGN

PROJECT: SUN VALLEY

DESIGNER: RAD

DATE: 3/11/87

HYDROLOGIC AND CHANNEL INFORMATION

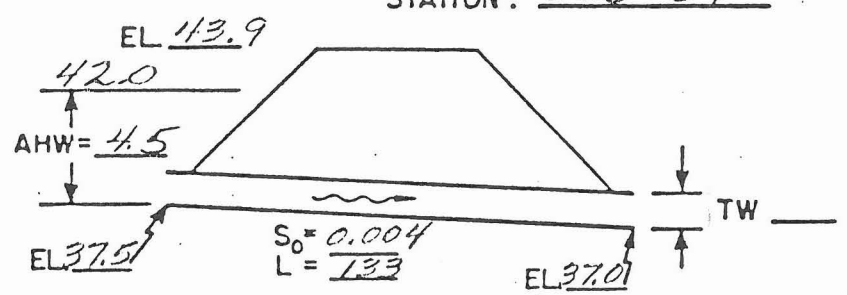
Q_{100} = 739 TW_1 = 2.5

Q_2 = ____ TW_2 = ____

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

SKETCH

STATION: 333+84



MEAN STREAM VELOCITY = 6.2

MAX. STREAM VELOCITY = 9.3

CULVERT DESCRIPTION (ENTRANCE TYPE)	Q	SIZE	HEADWATER COMPUTATION: INLET CONT. $\frac{HW}{D}$	HW	OUTLET CONTROL $HW=H+h_o-LS_o$: K_e	H	d_c	$\frac{d_c+D}{2}$	TW	h_o	LS_o	HW	CONTROLLING HW	OUTLET VELOCITY	COMMENTS
3-10'x4' CBC	246		1.05	4.2	0.2	1.0	2.7	3.4	2.5	3.4	0.5	3.9	4.2	9.9	OK
(HEADWALL)															

SUMMARY & RECOMMENDATIONS:

CJL 3/13/87

CULVERT DESIGN

PROJECT: SUN VALLEY

DESIGNER: RAD

DATE: 3/11/87

HYDROLOGIC AND CHANNEL INFORMATION

Q_{100} = 300

Q_2 = _____

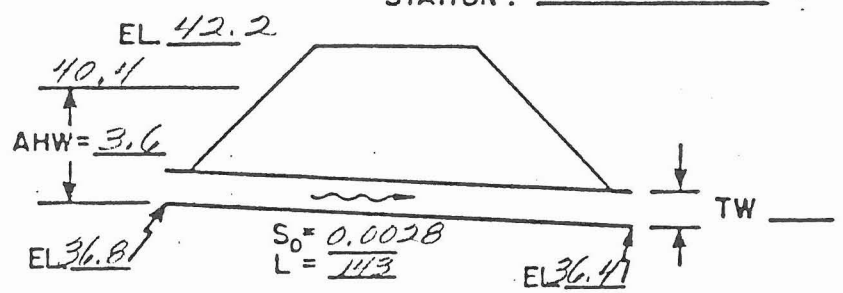
TW_1 = 1.5

TW_2 = _____

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

SKETCH

STATION: 329+27



MEAN STREAM VELOCITY = 4.2

MAX. STREAM VELOCITY = 6.3

CULVERT DESCRIPTION (ENTRANCE TYPE)	Q	SIZE	HEADWATER COMPUTATION										CONTROLLING HW	OUTLET VELOCITY	COMMENTS
			INLET CONT.		OUTLET CONTROL $HW = H + h_o - LS_o$										
			$\frac{HW}{D}$	HW	K_e	H	d_c	$\frac{d_c+D}{2}$	TW	h_o	LS_o	HW			
2 - 10'x3' CRC	150		1.0	3.0	0.2	0.7	1.9	2.5	1.5	2.5	0.4	3.8	3.0	8.0	OK
(HEADWALL)															

SUMMARY & RECOMMENDATIONS:

CSL 3/13/87

CULVERT DESIGN

PROJECT: SUN VALLEY

DESIGNER: RAD

DATE: 3/11/87

HYDROLOGIC AND CHANNEL INFORMATION

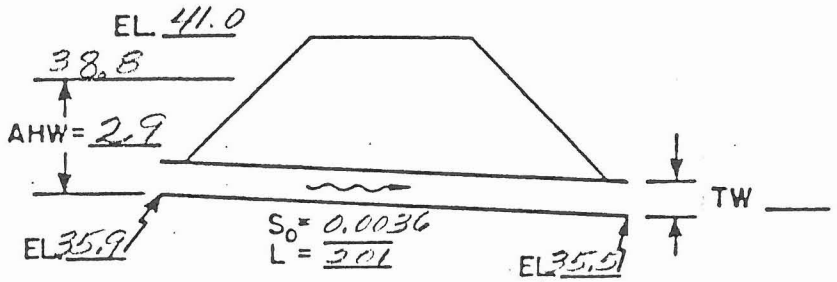
Q_{100} = 360 TW_1 = 2.0

Q_2 = TW_2 =

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

SKETCH

STATION: 327+07



MEAN STREAM VELOCITY = 4.7

MAX. STREAM VELOCITY = 7.1

CULVERT DESCRIPTION (ENTRANCE TYPE)	Q	SIZE	HEADWATER COMPUTATION: INLET CONT. HW/D	INLET CONT. HW	OUTLET CONTROL HW=H+h_o−LS_o: K_e	H	d_c	$\frac{d_c+D}{2}$	TW	h_o	LS_o	HW	CONTROLLING HW	OUTLET VELOCITY	COMMENTS
2 − 10'x3' CBC	180		1.16	3.48	0.2	1.1	2.16	2.58	2.0	2.58	0.72	2.96	3.48	9.3	NO
(HEADWALL)															
3 − 8x3'	180		.98	2.94	0.2	.72	1.9	2.45	2.0	2.45	0.72	2.45	2.9	8.9	OK - USE

SUMMARY & RECOMMENDATIONS:

Use 3 - 8'x3' CBC

CSL 3/13/87

CULVERT DESIGN

PROJECT: SUN VALLEY

DESIGNER: RAD

DATE: 3/11/87

HYDROLOGIC AND CHANNEL INFORMATION

Q_{100} = 36

Q_2 =

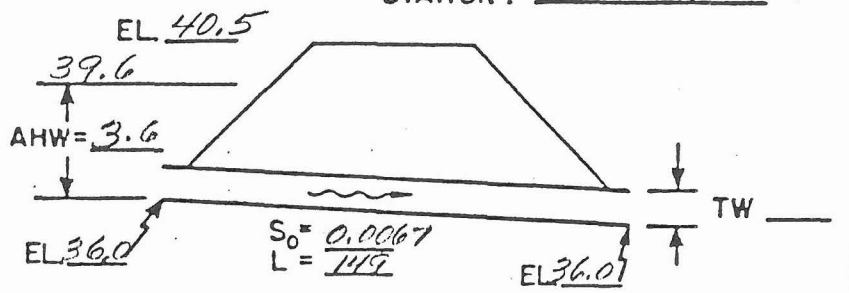
TW_1 = 1.5

TW_2 =

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

SKETCH

STATION: 326+17



MEAN STREAM VELOCITY = 3.7

MAX. STREAM VELOCITY = 5.6

CULVERT DESCRIPTION (ENTRANCE TYPE)	Q	SIZE	HEADWATER COMPUTATION: INLET CONT. HW/D	INLET CONT. HW	OUTLET CONTROL HW=H+h₀−LS₀: K_e	H	d_c	$\frac{d_c+D}{2}$	TW	h_o	LS_o	HW	CONTROLLING HW	OUTLET VELOCITY	COMMENTS
1 – 30" C.L. C.M.P.	36		1.35	3.4	0.5	1.8	2.0	2.3	1.5	2.3	1.0	3.1	3.4	9.2	OK
(PROJECTING)															

SUMMARY & RECOMMENDATIONS:

CJL 3/13/87

CULVERT DESIGN

PROJECT: SUN VALLEY

DESIGNER: RAD

DATE: 3/11/87

HYDROLOGIC AND CHANNEL INFORMATION

Q_{100} = 112

Q_2 = _____

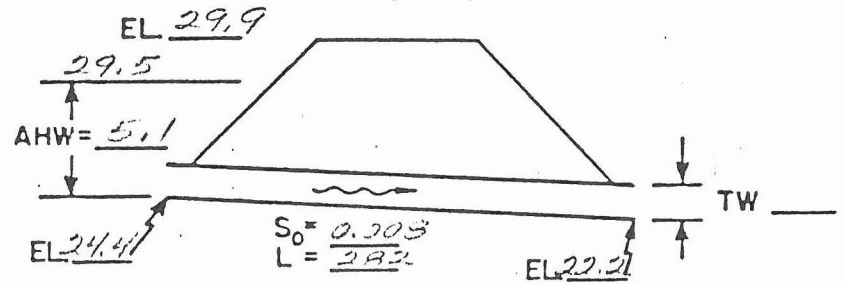
TW_1 = 2.0

TW_2 = _____

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

SKETCH

STATION: 316+78



MEAN STREAM VELOCITY = 7.5

MAX. STREAM VELOCITY = 11.25

CULVERT DESCRIPTION (ENTRANCE TYPE)	Q	SIZE	HEADWATER COMPUTATION: INLET CONT.		OUTLET CONTROL HW=H + h_o − LS_o								CONTROLLING HW	OUTLET VELOCITY	COMMENTS
			$\frac{HW}{D}$	HW	K_e	H	d_c	$\frac{d_c+D}{2}$	TW	h_o	LS_o	HW			
1-48" R.G.R.C.P.	112	4.0	1.49	5.96	0.5	2.6	3.2	3.6	2.0	3.6	2.3	3.9	6.0	12.5	NO, TOO SMALL
1-6 x 3	112	3.0	1.19	3.57								less than 3.6	3.6	11.5	Too Large
1-4' x 3'	112	3.0	1.65	4.95	0.2	3.9	3.0	3.0	2.0	3.0	2.3	4.6	4.95		OK
2-36"	56	3.0	1.55	4.65	0.2	2.9	2.4	2.65	2.0	2.65	2.3	3.25	4.65	11.1	OK - Recommend

SUMMARY & RECOMMENDATIONS:

USE 2-36' RGRCP

Rev. 4/2 CSL 2/10/87

CULVERT DESIGN

PROJECT: SUN VALLEY

DESIGNER: RAD

DATE: 3/11/87

HYDROLOGIC AND CHANNEL INFORMATION

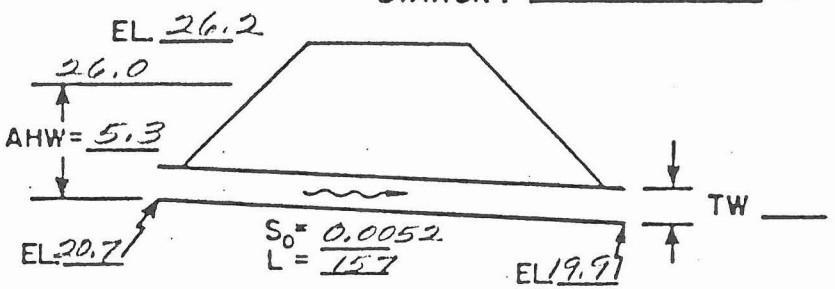
$Q_{100} =$ 168 $\qquad TW_1 =$ 2.0

$Q_2 =$ _____ $\qquad TW_2 =$ _____

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

SKETCH

STATION: 312+17



MEAN STREAM VELOCITY = 5.85

MAX. STREAM VELOCITY = 8.78

CULVERT DESCRIPTION (ENTRANCE TYPE)	Q	SIZE	HEADWATER COMPUTATION: INLET CONT.		OUTLET CONTROL HW=H + h_o − LS_o								CONTROLLING HW	OUTLET VELOCITY	COMMENTS
			$\frac{HW}{D}$	HW	K_e	H	d_c	$\frac{d_c+D}{2}$	TW	h_o	LS_o	HW			
1 — 6'x3' CBC	168		1.75	5.3	0.9	2.4	3.0	3.0	2.0	3.0	0.8	4.6	5.3	11.1	OK
(HEADWALL)															

SUMMARY & RECOMMENDATIONS:

CSC 3/13/87

CULVERT DESIGN

PROJECT: SUN VALLEY

DESIGNER: RAD

DATE: 3/11/86

HYDROLOGIC AND CHANNEL INFORMATION

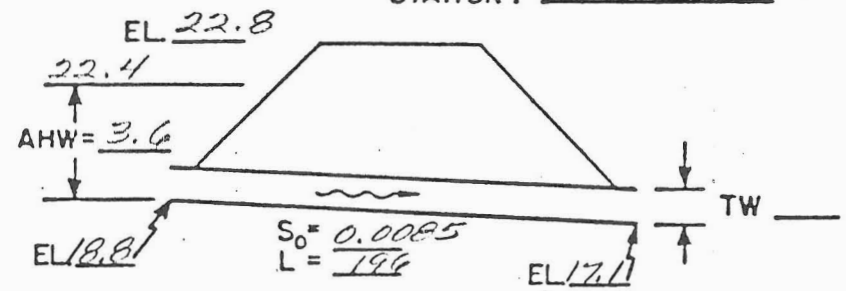
Q_{100} = 52 TW_1 = 1.0

Q_2 = TW_2 =

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

SKETCH

STATION: 300+31



MEAN STREAM VELOCITY = 4.1

MAX. STREAM VELOCITY = 6.2

CULVERT DESCRIPTION (ENTRANCE TYPE)	Q	SIZE	HEADWATER COMPUTATION: INLET CONT. $\frac{HW}{D}$	HW	OUTLET CONTROL $HW = H + h_o - LS_o$: K_e	H	d_c	$\frac{d_c+D}{2}$	TW	h_o	LS_o	HW	CONTROLLING HW	OUTLET VELOCITY	COMMENTS
2-30" R.C.P. (HEADWALL)	26		1.06	2.7	0.2	1.15	1.8	2.2	1.0	2.2	1.7	1.7	2.7	10.7	OK

SUMMARY & RECOMMENDATIONS:

CTL 3/13/87

CULVERT DESIGN

PROJECT: SUN VALLEY

DESIGNER: RAD

DATE: 3/11/87

HYDROLOGIC AND CHANNEL INFORMATION

Q_{100} = 61

Q_2 =

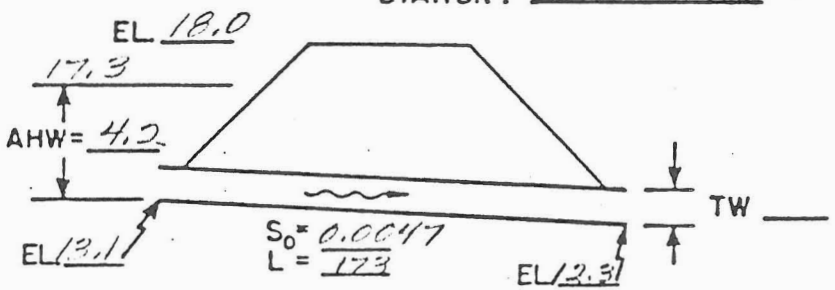
TW_1 = 1.5

TW_2 =

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

SKETCH

STATION: 292+09



MEAN STREAM VELOCITY = 4.22

MAX. STREAM VELOCITY = 6.3

CULVERT DESCRIPTION (ENTRANCE TYPE)	Q	SIZE	HEADWATER COMPUTATION: INLET CONT. HW/D	INLET CONT. HW	OUTLET CONTROL HW=H+h_o−LS_o: K_e	H	d_c	$\frac{d_c+D}{2}$	TW	h_o	LS_o	HW	CONTROLLING HW	OUTLET VELOCITY	COMMENTS
1−42" R.G.R.C.P. (PROJECTING)	61		1.05	3.7	0.5	1.35	2.4	2.95	1.5	2.95	0.8	3.5	3.7	10.7	OK

SUMMARY & RECOMMENDATIONS:

CJC 3/13/87

CULVERT DESIGN

PROJECT: SUN VALLEY

DESIGNER: RAD

DATE: 3/11/87

HYDROLOGIC AND CHANNEL INFORMATION

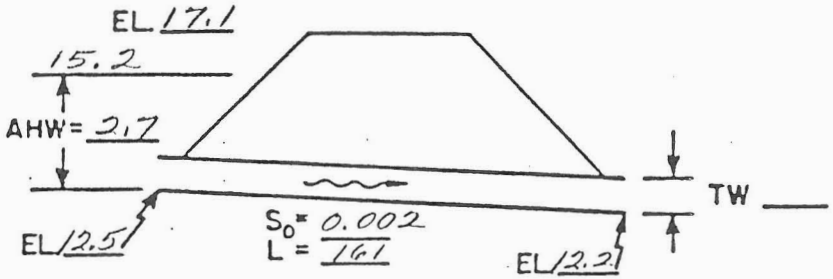
Q_1 = 115 TW_1 = 2.0

Q_2 = TW_2 =

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

SKETCH

STATION: 289+26



MEAN STREAM VELOCITY = 3.2

MAX. STREAM VELOCITY = 4.8

CULVERT DESCRIPTION (ENTRANCE TYPE)	Q	SIZE	HEADWATER COMPUTATION: INLET CONT. HW/D	INLET CONT. HW	OUTLET CONTROL HW=H+h_o−LS_o: K_e	H	d_c	$\frac{d_c+D}{2}$	TW	h_o	LS_o	HW	CONTROLLING HW	OUTLET VELOCITY	COMMENTS
1 − 10'x3' CBC	115		0.83	2.5	0.2	0.4	1.6	2.3	2.0	2.3	0.3	2.4	2.5	6.6	OK
(HEADWALL)															

SUMMARY & RECOMMENDATIONS:

CJC 3/13/87

CULVERT DESIGN

PROJECT: SUN VALLEY

DESIGNER: RAD

DATE: 3/11/87

HYDROLOGIC AND CHANNEL INFORMATION

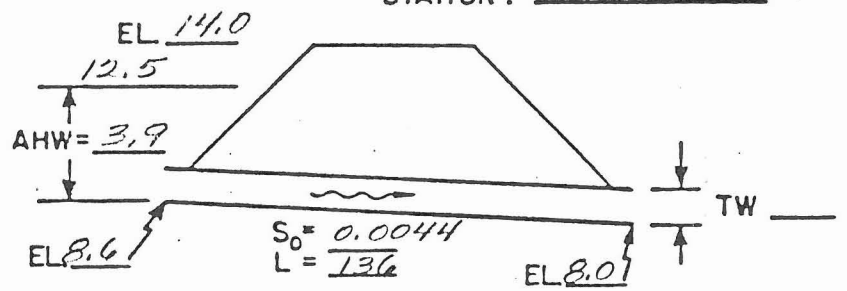
Q_{100} = 688 TW_1 = 2.0

Q_2 = ____ TW_2 = ____

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

SKETCH

STATION: 285+00



MEAN STREAM VELOCITY = 5.2

MAX. STREAM VELOCITY = 7.8

CULVERT DESCRIPTION (ENTRANCE TYPE)	Q	SIZE	HEADWATER COMPUTATION										CONTROLLING HW	OUTLET VELOCITY	COMMENTS
			INLET CONT.		OUTLET CONTROL $HW = H + h_o - LS_o$										
			$\frac{HW}{D}$	HW	K_e	H	d_c	$\frac{d_c+D}{2}$	TW	h_o	LS_o	HW			
4 — 10'x4' CBC	172		0.9	3.6	0.2	0.5	2.1	3.1	2.0	3.1	0.6	3.0	3.6	9.8	OK
(HEADWALL)															

SUMMARY & RECOMMENDATIONS:

CSL 3/13/87

CULVERT DESIGN

PROJECT: SUN VALLEY

DESIGNER: RAD

DATE: 3/11/87

HYDROLOGIC AND CHANNEL INFORMATION

Q_{100} = 534

Q_2 = _____

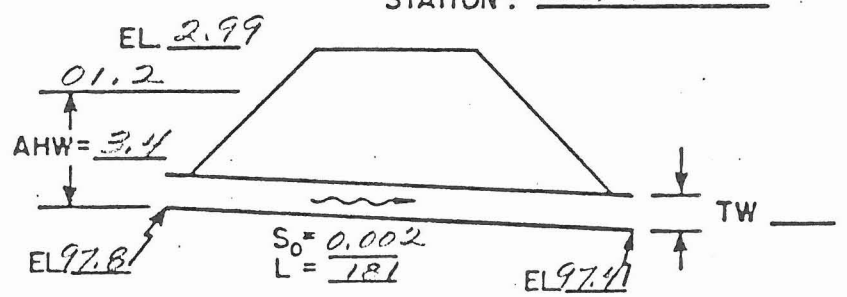
TW_1 = 2.0

TW_2 = _____

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

SKETCH

STATION: 271+21



MEAN STREAM VELOCITY = 4.8

MAX. STREAM VELOCITY = 7.2

CULVERT DESCRIPTION (ENTRANCE TYPE)	Q	SIZE	HEADWATER COMPUTATION										CONTROLLING HW	OUTLET VELOCITY	COMMENTS
			INLET CONT.		OUTLET CONTROL $HW = H + h_o - LS_o$										
			$\frac{HW}{D}$	HW	K_e	H	d_c	$\frac{d_c+D}{2}$	TW	h_o	LS_o	HW			
3 – 10'x3' CBC	178		1.13	3.4	0.2	0.9	2.2	2.6	2.0	2.6	0.4	3.1	3.4	7.6	OK
(HEADWALL)															

SUMMARY & RECOMMENDATIONS:

CJL 3/13/87

22 of 32

CULVERT DESIGN

PROJECT: SUN VALLEY

DESIGNER: RAD

DATE: 3/11/87

HYDROLOGIC AND CHANNEL INFORMATION

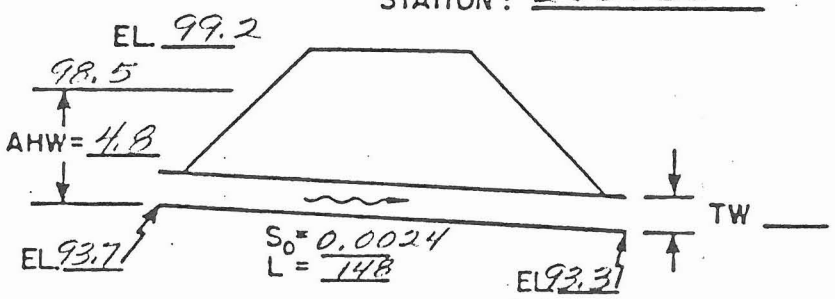
Q_{100} = 1575 TW_1 = 2.5

Q_2 = _____ TW_2 = _____

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

SKETCH

STATION: 266+50



MEAN STREAM VELOCITY = 9.1

MAX. STREAM VELOCITY = 13.6

CULVERT DESCRIPTION (ENTRANCE TYPE)	Q	SIZE	HEADWATER COMPUTATION: INLET CONT. HW/D	INLET CONT. HW	OUTLET CONTROL HW=H+h₀−LS₀: K_e	H	d_c	$\frac{d_c+D}{2}$	TW	h_o	LS_o	HW	CONTROLLING HW	OUTLET VELOCITY	COMMENTS
6 — 10'×4' CBC	263		1.2	4.8	0.2	1.1	2.8	3.4	2.5	3.4	0.4	4.1	4.8	10.0	OK
(HEADWALL)															

SUMMARY & RECOMMENDATIONS:

CJZ 3/13/87

CULVERT DESIGN

PROJECT: SUN VALLEY

DESIGNER: RAD

DATE: 3/11/87

HYDROLOGIC AND CHANNEL INFORMATION

Q_{100} = 70

Q_2 = _____

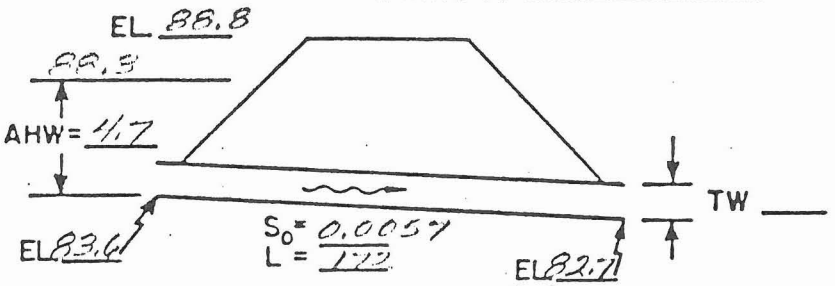
TW_1 = 1.5

TW_2 = _____

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

SKETCH

STATION: 253+94



MEAN STREAM VELOCITY = 4.4

MAX. STREAM VELOCITY = 6.6

CULVERT DESCRIPTION (ENTRANCE TYPE)	Q	SIZE	HEADWATER COMPUTATION: INLET CONT.		OUTLET CONTROL HW=H + h_o − LS_o								CONTROLLING HW	OUTLET VELOCITY	COMMENTS
			$\frac{HW}{D}$	HW	K_e	H	d_c	$\frac{d_c+D}{2}$	TW	h_o	LS_o	HW			
1 – 42" R.C.P.C.P.	70		1.18	4.1	0.5	1.7	2.7	3.1	1.5	3.1	1.0	3.8	4.1	11.0	OK
(END SECTION)															

SUMMARY & RECOMMENDATIONS:

QJC 3/13/87

CULVERT DESIGN

PROJECT: SUN VALLEY

DESIGNER: RAD

DATE: 3/11/87

HYDROLOGIC AND CHANNEL INFORMATION

Q_{100} = 136

Q_2 = _____

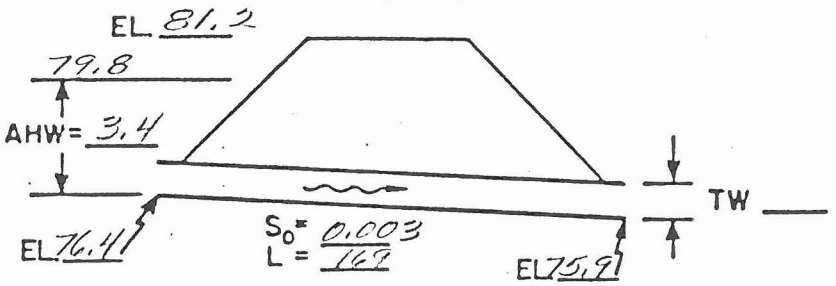
TW_1 = 1.5

TW_2 = _____

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

SKETCH

STATION: 243+74



MEAN STREAM VELOCITY = 4.2

MAX. STREAM VELOCITY = 6.3

CULVERT DESCRIPTION (ENTRANCE TYPE)	Q	SIZE	HEADWATER COMPUTATION										CONTROLLING HW	OUTLET VELOCITY	COMMENTS
			INLET CONT.		OUTLET CONTROL $HW = H + h_o - LS_o$										
			$\frac{HW}{D}$	HW	K_e	H	d_c	$\frac{d_c+D}{2}$	TW	h_o	LS_o	HW			
1—10'x3' CBC	136		0.97	2.9	0.2	0.6	1.8	2.4	1.5	2.4	0.5	2.5	2.9	7.8	OK

SUMMARY & RECOMMENDATIONS:

CSL 3/13/87

CULVERT DESIGN

PROJECT: SUN VALLEY

DESIGNER: RAD

DATE: 3/11/87

HYDROLOGIC AND CHANNEL INFORMATION

Q_{100} = 280

Q_2 = _____

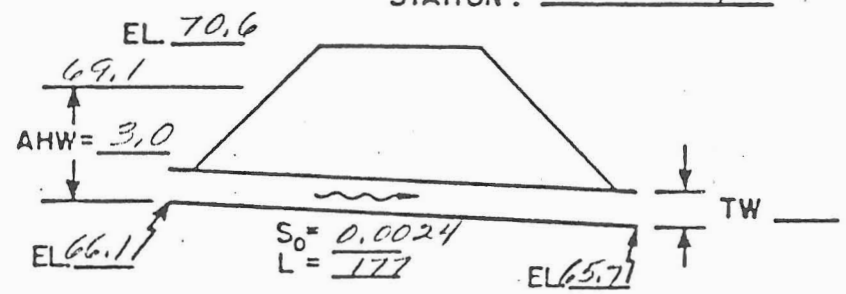
TW_1 = 2.0

TW_2 = _____

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

SKETCH

STATION: 230+27



MEAN STREAM VELOCITY = 4.7

MAX. STREAM VELOCITY = 7.05

CULVERT DESCRIPTION (ENTRANCE TYPE)	Q	SIZE	HEADWATER COMPUTATION: INLET CONT.		OUTLET CONTROL HW=H + h_o − LS_o								CONTROLLING HW	OUTLET VELOCITY	COMMENTS
			$\frac{HW}{D}$	HW	K_e	H	d_c	$\frac{d_c+D}{2}$	TW	h_o	LS_o	HW			
2 — 10'x3' CBC (HEADWALL)	140		0.95	2.85	0.2	0.7	1.9	2.5	2.0	2.5	0.4	2.8	2.85	7.5	OK

SUMMARY & RECOMMENDATIONS:

CJL 3/13/87

CULVERT DESIGN

PROJECT: Sun Valley

DESIGNER: RAD

DATE: 3/11/87

HYDROLOGIC AND CHANNEL INFORMATION

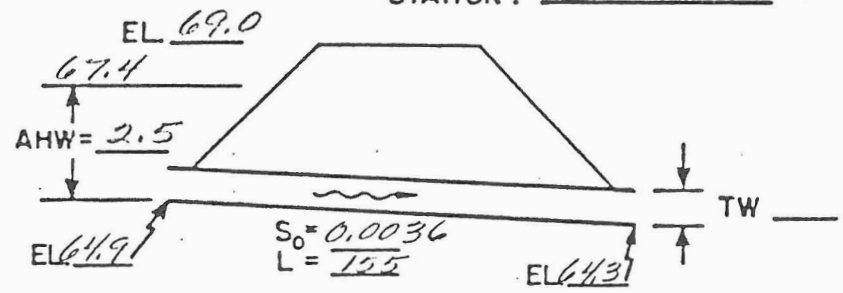
Q_{100} = 200 TW_1 = 2.0

Q_2 = TW_2 =

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

SKETCH

STATION: 227+85



MEAN STREAM VELOCITY = 2.6

MAX. STREAM VELOCITY = 3.7

CULVERT DESCRIPTION (ENTRANCE TYPE)	Q	SIZE	HEADWATER COMPUTATION										CONTROLLING HW	OUTLET VELOCITY	COMMENTS
			INLET CONT.		OUTLET CONTROL $HW=H+h_o-LS_o$										
			$\frac{HW}{D}$	HW	K_e	H	d_c	$\frac{d_c+D}{2}$	TW	h_o	LS_o	HW			
2—10'x3' CBC	100		0.83	2.5	0.2	0.4	1.5	2.3	2.0	2.3	0.6	2.1	2.5	6.3	OK
(HEADWALL)															

SUMMARY & RECOMMENDATIONS:

CONT. 3/12/87

CULVERT DESIGN

PROJECT: SUN VALLEY

DESIGNER: RAD

DATE: 3/11/87

HYDROLOGIC AND CHANNEL INFORMATION

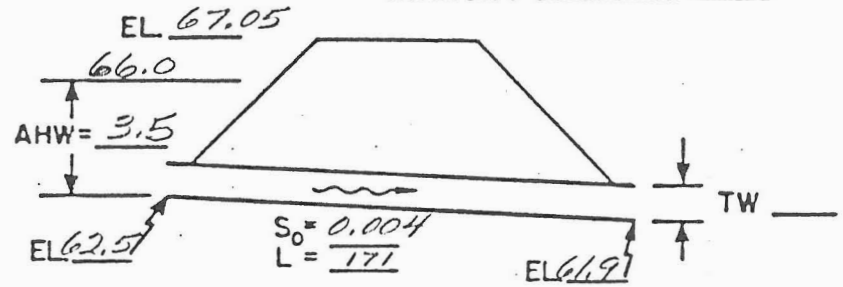
Q_1 = 1/50 TW_1 = 2.0

Q_2 = TW_2 =

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

SKETCH

STATION: 225+19



MEAN STREAM VELOCITY = 4.2

MAX. STREAM VELOCITY = 6.3

CULVERT DESCRIPTION (ENTRANCE TYPE)	Q	SIZE	HEADWATER COMPUTATION										CONTROLLING HW	OUTLET VELOCITY	COMMENTS
			INLET CONT.		OUTLET CONTROL $HW=H+h_o-LS_o$										
			$\frac{HW}{D}$	HW	K_e	H	d_c	$\frac{d_c+D}{2}$	TW	h_o	LS_o	HW			
3—10'x3' CBC	150		1.0	3.0	0.2	0.7	1.9	2.5	2.0	2.5	0.6	2.6	3.0	7.2	OK
(HEADWALL)															

SUMMARY & RECOMMENDATIONS:

CJL 3/13/87

CULVERT DESIGN

PROJECT: SUN VALLEY

DESIGNER: RAD

DATE: 3/11/87

HYDROLOGIC AND CHANNEL INFORMATION

Q_{10} = 756

Q_2 = _____

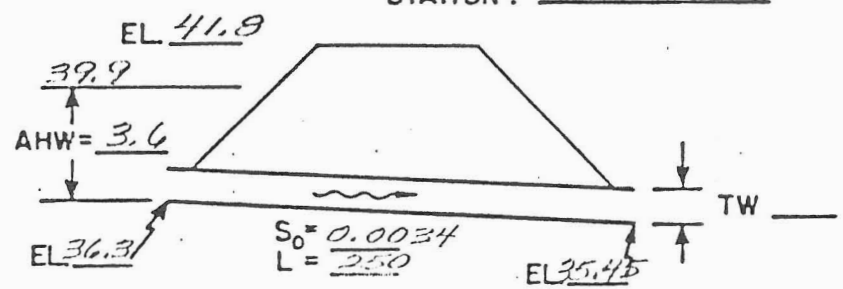
TW_1 = 2.0

TW_2 = _____

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

SKETCH

STATION: 197+95



MEAN STREAM VELOCITY = 4.15

MAX. STREAM VELOCITY = 6.23

CULVERT DESCRIPTION (ENTRANCE TYPE)	Q	SIZE	HEADWATER COMPUTATION: INLET CONT. $\frac{HW}{D}$	HW	OUTLET CONTROL $HW = H + h_o - LS_o$: K_e	H	d_c	$\frac{d_c+D}{2}$	TW	h_o	LS_o	HW	CONTROLLING HW	OUTLET VELOCITY	COMMENTS
4 – 10'X3' CBC	189		1.2	3.6	0.2	1.0	2.2	2.6	2.0	2.6	0.3	3.5	3.6	7.7	OK
(HEADWALL)															

SUMMARY & RECOMMENDATIONS:

Rev. 4/2. CJC 3/13/87

CULVERT DESIGN

PROJECT: SUN VALLEY

DESIGNER: RdD

DATE: 3/11/87

HYDROLOGIC AND CHANNEL INFORMATION

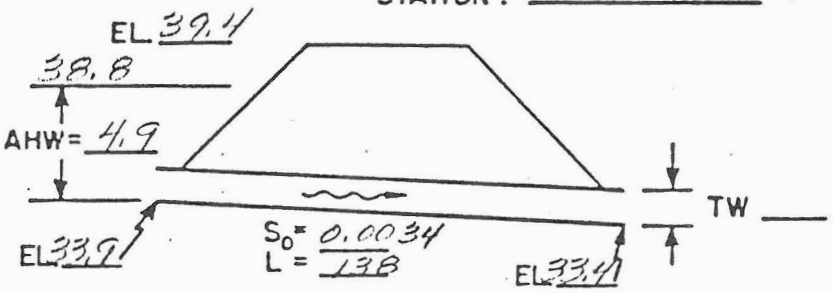
Q_{100} = 1820 TW_1 = 2.2

Q_2 = ____ TW_2 = ____

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

SKETCH

STATION: 195+10



MEAN STREAM VELOCITY = 7.73

MAX. STREAM VELOCITY = 11.62

CULVERT DESCRIPTION (ENTRANCE TYPE)	Q	SIZE	HEADWATER COMPUTATION: INLET CONT.		OUTLET CONTROL $HW = H + h_o - LS_o$								CONTROLLING HW	OUTLET VELOCITY	COMMENTS
			$\frac{HW}{D}$	HW	K_e	H	d_c	$\frac{d_c+D}{2}$	TW	h_o	LS_o	HW			
6 – 10'x4' C.B.C.	303		1.23	4.9	0.2	1.3	3.1	3.6	2.2	3.6	0.5	4.4	4.9	9.2	OK
(HEADWALL)															

SUMMARY & RECOMMENDATIONS:

CSL 3/13/87

CULVERT DESIGN

PROJECT: Sun Valley

DESIGNER: RAD

DATE: 3/11/87

HYDROLOGIC AND CHANNEL INFORMATION

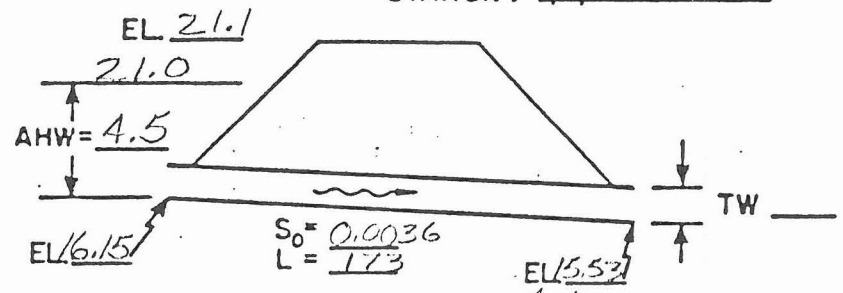
Q_1 = 369 TW_1 = 2.0

Q_2 = TW_2 =

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

SKETCH

STATION: 172+93



MEAN STREAM VELOCITY = 4.1

MAX. STREAM VELOCITY = 6.1

CULVERT DESCRIPTION (ENTRANCE TYPE)	Q	SIZE	HEADWATER COMPUTATION: INLET CONT. HW/D	INLET CONT. HW	OUTLET CONTROL HW=H+h_o−LS_o: K_e	H	d_c	$\frac{d_c+D}{2}$	TW	h_o	LS_o	HW	CONTROLLING HW	OUTLET VELOCITY	COMMENTS
2-8'x3' CBC	185	3.0	1.43	4.27	0.2	1.7	2.6	2.8	2.0	2.8	0.62	3.9	4.3	10.1	OK

SUMMARY & RECOMMENDATIONS:

CJS 3/13/87

CULVERT DESIGN

PROJECT: SUN VALLEY

DESIGNER: RAD

DATE: 3/11/87

HYDROLOGIC AND CHANNEL INFORMATION

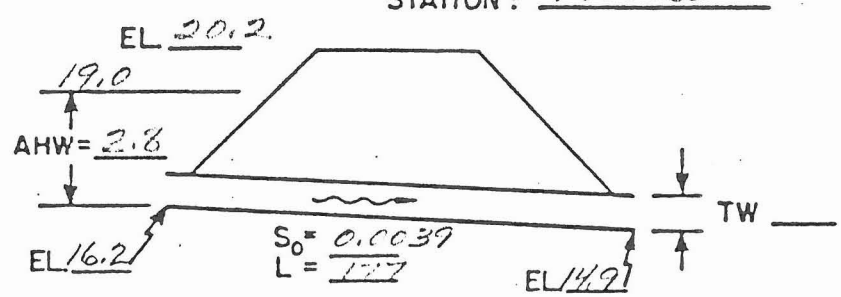
Q_{100} = 23 TW_1 = 1.5

Q_2 = TW_2 =

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

SKETCH

STATION: 171+20



MEAN STREAM VELOCITY = 1.9

MAX. STREAM VELOCITY = 2.9

CULVERT DESCRIPTION (ENTRANCE TYPE)	Q	SIZE	HEADWATER COMPUTATION: INLET CONT. $\frac{HW}{D}$	HW	OUTLET CONTROL $HW = H + h_o - LS_o$: K_e	H	d_c	$\frac{d_c+D}{2}$	TW	h_o	LS_o	HW	CONTROLLING HW	OUTLET VELOCITY	COMMENTS
1 — 30" RCP	23		0.97	2.4	0.5	0.9	1.7	2.1	1.5	2.1	0.7	2.3	2.4	6.3	OK
(PROJECTING)															

SUMMARY & RECOMMENDATIONS:

CSL 3/13/87

CULVERT DESIGN

PROJECT: SUN VALLEY

DESIGNER: RAD

DATE: 3/11/87

HYDROLOGIC AND CHANNEL INFORMATION

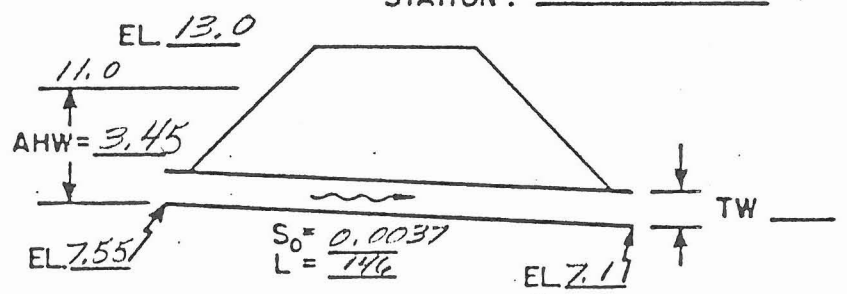
Q_{100} = 1067 TW_1 = 2.0

Q_2 = ____ TW_2 = ____

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

SKETCH

STATION: 161+67



MEAN STREAM VELOCITY = 5.24

MAX. STREAM VELOCITY = 7.86

CULVERT DESCRIPTION (ENTRANCE TYPE)	Q	SIZE	HEADWATER COMPUTATION										CONTROLLING HW	OUTLET VELOCITY	COMMENTS
			INLET CONT.		OUTLET CONTROL HW=H + h_o − LS_o										
			$\frac{HW}{D}$	HW	K_e	H	d_c	$\frac{d_c+D}{2}$	TW	h_o	LS_o	HW			
6 — 10'x3' CBC	178		1.15	3.45	0.2	0.9	2.2	2.6	2.0	2.6	0.5	3.0	3.45	7.6	OK
(HEADWALL)															

SUMMARY & RECOMMENDATIONS:

RSC 3/12/87

CULVERT DESIGN

PROJECT: SUN VALLEY

DESIGNER: RAD

DATE: 3/11/87

HYDROLOGIC AND CHANNEL INFORMATION

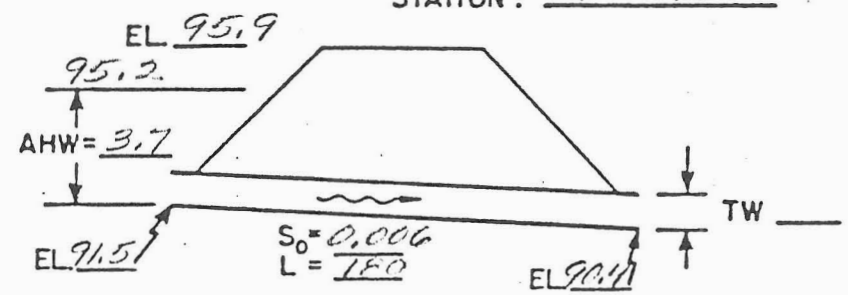
Q_{100} = 63 TW_1 = 1.5

Q_2 = TW_2 =

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

SKETCH

STATION: 142+48



MEAN STREAM VELOCITY = 2.1

MAX. STREAM VELOCITY = 3.0

CULVERT DESCRIPTION (ENTRANCE TYPE)	Q	SIZE	HEADWATER COMPUTATION: INLET CONT. HW/D	INLET CONT. HW	OUTLET CONTROL HW=H+h_o−LS_o: K_e	H	d_c	$\frac{d_c+D}{2}$	TW	h_o	LS_o	HW	CONTROLLING HW	OUTLET VELOCITY	COMMENTS
1-42" R.C.R.C.P. (PROJECTING)	63		1.05	3.7	0.5	1.3	2.5	3.0	1.5	3.0	1.1	3.2	3.7	10.3	OK

SUMMARY & RECOMMENDATIONS:

CTR 3/13/87

CULVERT DESIGN

PROJECT: SUN VALLEY

DESIGNER: RAD

DATE: 3/11/87

HYDROLOGIC AND CHANNEL INFORMATION

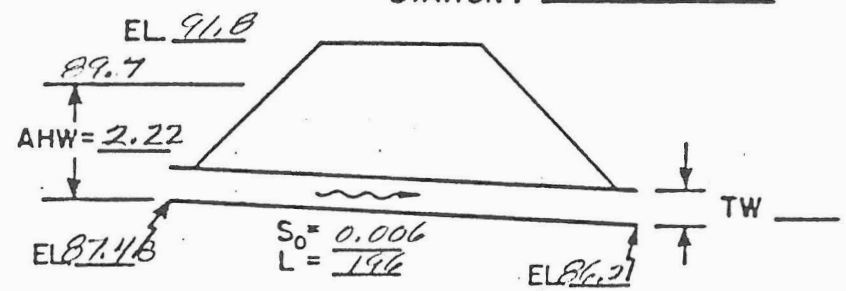
Q_1 = 284 TW_1 = 2.0

Q_2 = TW_2 =

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

SKETCH

STATION: 136+90



MEAN STREAM VELOCITY = 4.88

MAX. STREAM VELOCITY = 7.32

CULVERT DESCRIPTION (ENTRANCE TYPE)	Q	SIZE	HEADWATER COMPUTATION: INLET CONT. HW/D	INLET CONT. HW	OUTLET CONTROL HW=H+h_o−LS_o: K_e	H	d_c	$\frac{d_c+D}{2}$	TW	h_o	LS_o	HW	CONTROLLING HW	OUTLET VELOCITY	COMMENTS
3 — 10'X3' CBC	95		0.72	2.2	0.2	0.4	1.4	2.2	2.0	2.2	1.2	1.4	2.2	8.9	OK
(HEADWALL)															

SUMMARY & RECOMMENDATIONS:

CJL 3/13/87

CULVERT DESIGN

PROJECT: SUN VALLEY

DESIGNER: RAD

DATE: 3/11/87

HYDROLOGIC AND CHANNEL INFORMATION

Q_{100} = 277

Q_2 = _____

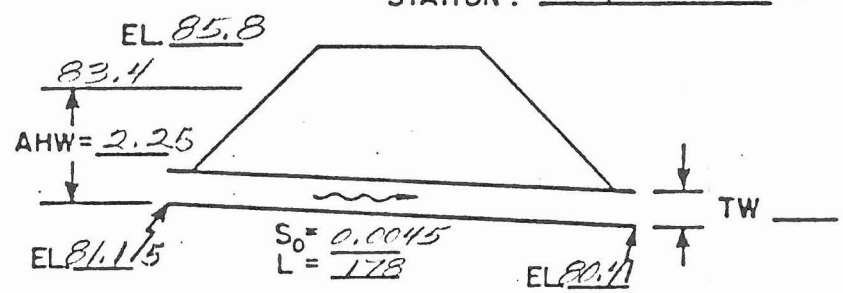
TW_1 = 1.5

TW_2 = _____

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

SKETCH

STATION: 129+55



MEAN STREAM VELOCITY = 2.38

MAX. STREAM VELOCITY = 3.57

CULVERT DESCRIPTION (ENTRANCE TYPE)	Q	SIZE	HEADWATER COMPUTATION: INLET CONT. $\frac{HW}{D}$	HW	OUTLET CONTROL $HW = H + h_o - LS_o$: K_e	H	d_c	$\frac{d_c+D}{2}$	TW	h_o	LS_o	HW	CONTROLLING HW	OUTLET VELOCITY	COMMENTS
3 — 10'x3' CBC	92		0.71	2.13	0.2	0.4	1.4	2.2	1.5	2.2	0.8	1.8	2.13	6.1	OK
(HEADWALL)															

SUMMARY & RECOMMENDATIONS:

CTC 3/13/87

CULVERT DESIGN

PROJECT: Sun Valley

DESIGNER: CJL

DATE: 3/13/87

HYDROLOGIC AND CHANNEL INFORMATION

CULVERT UNDER McDOWELL RD.
PARALLEL TO PARKWAY

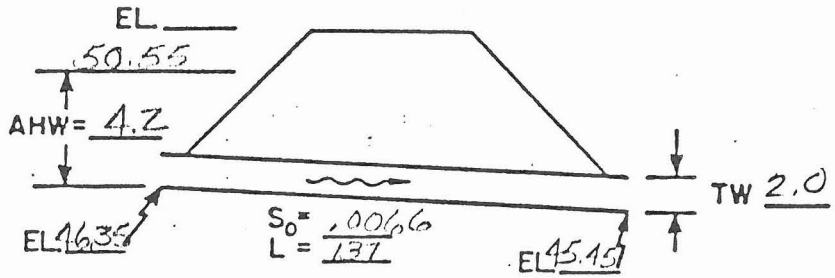
Q_1 = 284 TW_1 = 2.0

Q_2 = TW_2 =

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

SKETCH

STATION: 92+80



MEAN STREAM VELOCITY = 12.6

MAX. STREAM VELOCITY = N/A

CULVERT DESCRIPTION (ENTRANCE TYPE)	Q	SIZE	HEADWATER COMPUTATION: INLET CONT. HW/D	INLET CONT. HW	OUTLET CONTROL HW=H+h_o−LS_o: K_e	H	d_c	$\frac{d_c+D}{2}$	TW	h_o	LS_o	HW	CONTROLLING HW	OUTLET VELOCITY	COMMENTS
2-10'x3' CBC	142	3.0	.96	2.9											TOO LARGE
2-8'x3' CBC	142	3.0	1.15	3.45	.2	.95	2.3	2.65	2.0	2.65	0.7	2.7	3.5	11	OK

SUMMARY & RECOMMENDATIONS:

USE 2-8'x3' CBC

CULVERT DESIGN

PROJECT: Sun Valley

DESIGNER: RAD

DATE: 3/11/87

HYDROLOGIC AND CHANNEL INFORMATION

CULVERT UNDER VAN BUREN ST. PARALLEL TO PARKWAY

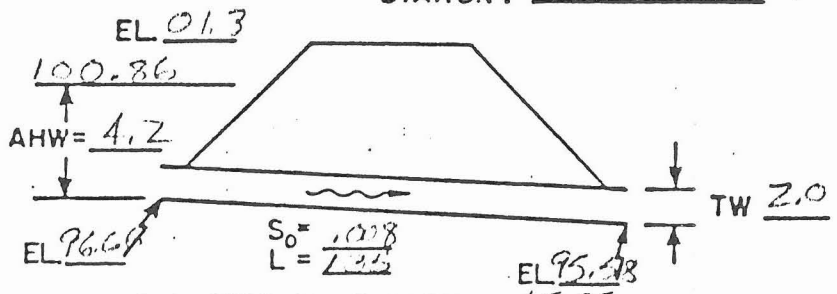
Q_1 = 658 TW_1 = 2.0

Q_2 = TW_2 =

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

SKETCH

STATION: 38 + 82



MEAN STREAM VELOCITY = 15.05

MAX. STREAM VELOCITY = N/A

CULVERT DESCRIPTION (ENTRANCE TYPE)	Q	SIZE	HEADWATER COMPUTATION: INLET CONT. HW/D	INLET CONT. HW	OUTLET CONTROL HW=H + h_o − LS_o: K_e	H	d_c	$\frac{d_c+D}{2}$	TW	h_o	LS_o	HW	CONTROLLING HW	OUTLET VELOCITY	COMMENTS
3-10'x3'	219	3.0	1.38	4.1	.2	1.7	2.5	2.8	2.0	2.8	1.1	3.4	4.1	13	ok

SUMMARY & RECOMMENDATIONS:

CSL 3/13/87

EAST SIDE CHANNEL.

CALCULATIONS

NORMAL DEPTH FOR TRAPEZOIDAL CHANNELS
CHANNEL SV CH STA 15 TO 25

DISCHARGE IS = 881 CFS
BOTTOM WIDTH IS = 20 FT
SLOPE IS = .008 FT/FT
SIDE SLOPE (Z1) = 2
SIDE SLOPE (Z2) = 2
MANNING'S N = .015
TOP WIDTH IS = 30 FT
AREA IS = 62.53 SQ FT
WETTED PERIMETER IS = 31.18 FT
HYDRAULIC RADIUS IS = 2.01 FT
NORMAL DEPTH IS = 2.5 FT
VELOCITY IS = 14.09 FPS
FROUDE NUMBER IS = 1.72

NORMAL DEPTH FOR TRAPEZOIDAL CHANNELS
CHANNEL

DISCHARGE IS = 881 CFS
BOTTOM WIDTH IS = 18 FT
SLOPE IS = .0092 FT/FT
SIDE SLOPE (Z1) = 2
SIDE SLOPE (Z2) = 2
MANNING'S N = .015
TOP WIDTH IS = 28.15 FT
AREA IS = 58.52 SQ FT
WETTED PERIMETER IS = 29.34 FT
HYDRAULIC RADIUS IS = 1.99 FT
NORMAL DEPTH IS = 2.54 FT
VELOCITY IS = 15.05 FPS
FROUDE NUMBER IS = 1.84

NORMAL DEPTH FOR TRAPEZOIDAL CHANNELS
CHANNEL SV CH STA 49+T038+

DISCHARGE IS = 658 CFS
BOTTOM WIDTH IS = 14 FT
SLOPE IS = .0092 FT/FT
SIDE SLOPE (Z1) = 2
SIDE SLOPE (Z2) = 2
MANNING'S N = .015
TOP WIDTH IS = 23.75 FT
AREA IS = 46 SQ FT
WETTED PERIMETER IS = 24.9 FT
HYDRAULIC RADIUS IS = 1.85 FT
NORMAL DEPTH IS = 2.44 FT
VELOCITY IS = 14.31 FPS
FROUDE NUMBER IS = 1.81

NORMAL DEPTH FOR TRAPEZOIDAL CHANNELS
CHANNEL SV CH STA 60+T049+

DISCHARGE IS = 499 CFS
BOTTOM WIDTH IS = 10 FT
SLOPE IS = .0092 FT/FT
SIDE SLOPE (Z1) = 2
SIDE SLOPE (Z2) = 2
MANNING'S N = .015
TOP WIDTH IS = 19.77 FT
AREA IS = 36.34 SQ FT
WETTED PERIMETER IS = 20.92 FT
HYDRAULIC RADIUS IS = 1.74 FT
NORMAL DEPTH IS = 2.44 FT
VELOCITY IS = 13.73 FPS
FROUDE NUMBER IS = 1.78

NORMAL DEPTH FOR TRAPEZOIDAL CHANNELS
CHANNEL SV CH STA 80+T060+

DISCHARGE IS = 435 CFS
BOTTOM WIDTH IS = 10 FT
SLOPE IS = .008 FT/FT
SIDE SLOPE (Z1) = 2
SIDE SLOPE (Z2) = 2
MANNING'S N = .015
TOP WIDTH IS = 19.42 FT
AREA IS = 34.64 SQ FT
WETTED PERIMETER IS = 20.53 FT
HYDRAULIC RADIUS IS = 1.69 FT
NORMAL DEPTH IS = 2.35 FT
VELOCITY IS = 12.56 FPS
FROUDE NUMBER IS = 1.66

NORMAL DEPTH FOR TRAPEZOIDAL CHANNELS
CHANNEL SV CH STA 73 TO 80

DISCHARGE IS = 435 CFS
BOTTOM WIDTH IS = 10 FT
SLOPE IS = .0092 FT/FT
SIDE SLOPE (Z1) = 2
SIDE SLOPE (Z2) = 2
MANNING'S N = .015
TOP WIDTH IS = 19.07 FT
AREA IS = 32.96 SQ FT
WETTED PERIMETER IS = 20.14 FT
HYDRAULIC RADIUS IS = 1.64 FT
NORMAL DEPTH IS = 2.27 FT
VELOCITY IS = 13.2 FPS
FROUDE NUMBER IS = 1.77

NORMAL DEPTH FOR TRAPEZOIDAL CHANNELS

CHANNEL SV CH STA 92+T080+

DISCHARGE IS = 374 CFS
BOTTOM WIDTH IS = 10 FT
SLOPE IS = .0092 FT/FT
SIDE SLOPE (Z1) = 2
SIDE SLOPE (Z2) = 2
MANNING'S N = .015
TOP WIDTH IS = 18.36 FT
AREA IS = 29.62 SQ FT
WETTED PERIMETER IS = 19.34 FT
HYDRAULIC RADIUS IS = 1.53 FT
NORMAL DEPTH IS = 2.09 FT
VELOCITY IS = 12.62 FPS
FROUDE NUMBER IS = 1.75

NORMAL DEPTH FOR TRAPEZOIDAL CHANNELS

CHANNEL SV CH STA 93 TO 102

DISCHARGE IS = 284 CFS
BOTTOM WIDTH IS = 8 FT
SLOPE IS = 9.600001E-03 FT/FT
SIDE SLOPE (Z1) = 4
SIDE SLOPE (Z2) = 4
MANNING'S N = .015
TOP WIDTH IS = 22.03 FT
AREA IS = 26.32 SQ FT
WETTED PERIMETER IS = 22.46 FT
HYDRAULIC RADIUS IS = 1.17 FT
NORMAL DEPTH IS = 1.75 FT
VELOCITY IS = 10.79 FPS
FROUDE NUMBER IS = 1.74

NORMAL DEPTH FOR TRAPEZOIDAL CHANNELS

CHANNEL SV CH STA 102 TO 107

DISCHARGE IS = 120 CFS
BOTTOM WIDTH IS = 8 FT
SLOPE IS = .0092 FT/FT
SIDE SLOPE (Z1) = 4
SIDE SLOPE (Z2) = 4
MANNING'S N = .015
TOP WIDTH IS = 17.14 FT
AREA IS = 14.36 SQ FT
WETTED PERIMETER IS = 17.42 FT
HYDRAULIC RADIUS IS = .82 FT
NORMAL DEPTH IS = 1.14 FT
VELOCITY IS = 8.35 FPS
FROUDE NUMBER IS = 1.61

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((((((((((((((((((((((((((((((((((((((((()))))))))))))))))))))))))))))))))))))))))
                   Advanced Engineering Software [AES]
                           SERIAL No. I0549I
                   REV. 2.0      RELEASE DATE:12/30/82

((((((((((((((((((((((((((((((((((((((((()))))))))))))))))))))))))))))))))))))))))


*********DESCRIPTION OF RESULTS********************************************
* SV CH STA 107+75-111+25                                                 *
*                                                                         *
*                                                                         *
***************************************************************************

***************************************************************************
))))CHANNEL INPUT INFORMATION((((
---------------------------------------------------------------------------
    CHANNEL Z(HORIZONTAL/VERTICAL) =    4.00
    BASEWIDTH(FEET) =     8.00
    CONSTANT CHANNEL SLOPE(FEET/FEET) =  .004800
    UNIFORM FLOW(CFS) =      120.00
    MANNINGS FRICTION FACTOR =  .0300
===========================================================================
    NORMAL-DEPTH FLOW INFORMATION:
---------------------------------------------------------------------------
    ))))) NORMAL DEPTH(FEET) =   1.91
    FLOW TOP- WIDTH(FEET) =         23.30
    FLOW AREA(SQUARE FEET) =           29.94
    HYDRAULIC DEPTH(FEET) =     1.28
    FLOW AVERAGE VELOCITY(FEET/SEC.) =     4.01
    UNIFORM FROUDE NUMBER =     .623
    PRESSURE + MOMENTUM(POUNDS) =         2427.95
    AVERAGED VELOCITY HEAD(FEET) =       .249
    SPECIFIC ENERGY(FEET) =      2.162
===========================================================================
    CRITICAL-DEPTH FLOW INFORMATION:
---------------------------------------------------------------------------
    CRITICAL FLOW TOP-WIDTH(FEET) =        19.89
    CRITICAL FLOW AREA(SQUARE FEET) =          20.73
    CRITICAL FLOW HYDRAULIC DEPTH(FEET) =     1.04
    CRITICAL FLOW AVERAGE VELOCITY(FEET/SEC.) =     5.79
    CRITICAL DEPTH(FEET) =     1.49
    CRITICAL FLOW PRESSURE + MOMENTUM(POUNDS) =          2170.92
    AVERAGED CRITICAL FLOW VELOCITY HEAD(FEET) =        .520
    CRITICAL FLOW SPECIFIC ENERGY(FEET) =      2.007


***************************************************************************
))))CHANNEL INPUT INFORMATION((((
---------------------------------------------------------------------------
    CHANNEL Z(HORIZONTAL/VERTICAL) =    4.00
    BASEWIDTH(FEET) =     8.00
    CONSTANT CHANNEL SLOPE(FEET/FEET) =  .004800
    UNIFORM FLOW(CFS) =      120.00
    MANNINGS FRICTION FACTOR =  .0220
===========================================================================
    NORMAL-DEPTH FLOW INFORMATION:
---------------------------------------------------------------------------
    ))))) NORMAL DEPTH(FEET) =   1.64
    FLOW TOP- WIDTH(FEET) =        21.14
    FLOW AREA(SQUARE FEET) =           23.93
    HYDRAULIC DEPTH(FEET) =     1.13
    FLOW AVERAGE VELOCITY(FEET/SEC.) =     5.02
    UNIFORM FROUDE NUMBER =     .831
    PRESSURE + MOMENTUM(POUNDS) =         2207.99
    AVERAGED VELOCITY HEAD(FEET) =       .391
    SPECIFIC ENERGY(FEET) =      2.033
===========================================================================
    CRITICAL-DEPTH FLOW INFORMATION:
---------------------------------------------------------------------------
    CRITICAL FLOW TOP-WIDTH(FEET) =        19.89
    CRITICAL FLOW AREA(SQUARE FEET) =          20.73
    CRITICAL FLOW HYDRAULIC DEPTH(FEET) =     1.04
    CRITICAL FLOW AVERAGE VELOCITY(FEET/SEC.) =     5.79
    CRITICAL DEPTH(FEET) =     1.49
    CRITICAL FLOW PRESSURE + MOMENTUM(POUNDS) =          2170.92
    AVERAGED CRITICAL FLOW VELOCITY HEAD(FEET) =        .520
    CRITICAL FLOW SPECIFIC ENERGY(FEET) =      2.007
===========================================================================
```

4 of

```
**********DESCRIPTION OF RESULTS*****************************************
* SV CH STA 111 TO 117                                                 *
*                                                                      *
*                                                                      *
************************************************************************

************************************************************************
))))CHANNEL INPUT INFORMATION((((
------------------------------------------------------------------------
    CHANNEL Z(HORIZONTAL/VERTICAL) =    4.00
    BASEWIDTH(FEET) =     8.00
    CONSTANT CHANNEL SLOPE(FEET/FEET) =  .007000
    UNIFORM FLOW(CFS) =       75.00
    MANNINGS FRICTION FACTOR =  .0300
========================================================================
    NORMAL-DEPTH FLOW INFORMATION:
------------------------------------------------------------------------
    ))))) NORMAL DEPTH(FEET) =   1.38
    FLOW TOP- WIDTH(FEET) =        19.00
    FLOW AREA(SQUARE FEET) =          18.57
    HYDRAULIC DEPTH(FEET) =       .98
    FLOW AVERAGE VELOCITY(FEET/SEC.) =     4.04
    UNIFORM FROUDE NUMBER =      .720
    PRESSURE + MOMENTUM(POUNDS) =         1275.54
    AVERAGED VELOCITY HEAD(FEET) =       .253
    SPECIFIC ENERGY(FEET) =      1.629
========================================================================
    CRITICAL-DEPTH FLOW INFORMATION:
------------------------------------------------------------------------
    CRITICAL FLOW TOP-WIDTH(FEET) =        17.16
    CRITICAL FLOW AREA(SQUARE FEET) =          14.41
    CRITICAL FLOW HYDRAULIC DEPTH(FEET) =      .84
    CRITICAL FLOW AVERAGE VELOCITY(FEET/SEC.) =     5.20
    CRITICAL DEPTH(FEET) =     1.15
    CRITICAL FLOW PRESSURE + MOMENTUM(POUNDS) =         1208.90
    AVERAGED CRITICAL FLOW VELOCITY HEAD(FEET) =       .420
    CRITICAL FLOW SPECIFIC ENERGY(FEET) =      1.566


************************************************************************
))))CHANNEL INPUT INFORMATION((((
------------------------------------------------------------------------
    CHANNEL Z(HORIZONTAL/VERTICAL) =    4.00
    BASEWIDTH(FEET) =     8.00
    CONSTANT CHANNEL SLOPE(FEET/FEET) =  .007000
    UNIFORM FLOW(CFS) =       75.00
    MANNINGS FRICTION FACTOR =  .0220
========================================================================
    NORMAL-DEPTH FLOW INFORMATION:
------------------------------------------------------------------------
    ))))) NORMAL DEPTH(FEET) =   1.17
    FLOW TOP- WIDTH(FEET) =        17.38
    FLOW AREA(SQUARE FEET) =          14.89
    HYDRAULIC DEPTH(FEET) =       .86
    FLOW AVERAGE VELOCITY(FEET/SEC.) =     5.04
    UNIFORM FROUDE NUMBER =      .959
    PRESSURE + MOMENTUM(POUNDS) =         1209.90
    AVERAGED VELOCITY HEAD(FEET) =       .394
    SPECIFIC ENERGY(FEET) =      1.567
========================================================================
    CRITICAL-DEPTH FLOW INFORMATION:
------------------------------------------------------------------------
    CRITICAL FLOW TOP-WIDTH(FEET) =        17.16
    CRITICAL FLOW AREA(SQUARE FEET) =          14.41
    CRITICAL FLOW HYDRAULIC DEPTH(FEET) =      .84
    CRITICAL FLOW AVERAGE VELOCITY(FEET/SEC.) =     5.20
    CRITICAL DEPTH(FEET) =     1.15
    CRITICAL FLOW PRESSURE + MOMENTUM(POUNDS) =         1208.90
    AVERAGED CRITICAL FLOW VELOCITY HEAD(FEET) =       .420
    CRITICAL FLOW SPECIFIC ENERGY(FEET) =      1.566
========================================================================
```

```
**********DESCRIPTION OF RESULTS*****************************************
* SV CH STA 117 TO 119                                                  *
*                                                                       *
*                                                                       *
*************************************************************************

*************************************************************************
))))CHANNEL INPUT INFORMATION((((
-------------------------------------------------------------------------
    CHANNEL Z(HORIZONTAL/VERTICAL) =    4.00
    BASEWIDTH(FEET) =     6.00
    CONSTANT CHANNEL SLOPE(FEET/FEET) =  .007400
    UNIFORM FLOW(CFS) =       60.00
    MANNINGS FRICTION FACTOR =  .0300
=========================================================================
    NORMAL-DEPTH FLOW INFORMATION:
-------------------------------------------------------------------------
    ))))) NORMAL DEPTH(FEET) =   1.34
    FLOW TOP- WIDTH(FEET) =        16.70
    FLOW AREA(SQUARE FEET) =          15.17
    HYDRAULIC DEPTH(FEET) =       .91
    FLOW AVERAGE VELOCITY(FEET/SEC.) =     3.95
    UNIFORM FROUDE NUMBER =     .731
    PRESSURE + MOMENTUM(POUNDS) =          993.31
    AVERAGED VELOCITY HEAD(FEET) =       .243
    SPECIFIC ENERGY(FEET) =      1.580
=========================================================================
    CRITICAL-DEPTH FLOW INFORMATION:
-------------------------------------------------------------------------
    CRITICAL FLOW TOP-WIDTH(FEET) =        15.05
    CRITICAL FLOW AREA(SQUARE FEET) =          11.91
    CRITICAL FLOW HYDRAULIC DEPTH(FEET) =      .79
    CRITICAL FLOW AVERAGE VELOCITY(FEET/SEC.) =     5.04
    CRITICAL DEPTH(FEET) =     1.13
    CRITICAL FLOW PRESSURE + MOMENTUM(POUNDS) =          945.95
    AVERAGED CRITICAL FLOW VELOCITY HEAD(FEET) =       .394
    CRITICAL FLOW SPECIFIC ENERGY(FEET) =      1.526


*************************************************************************
))))CHANNEL INPUT INFORMATION((((
-------------------------------------------------------------------------
    CHANNEL Z(HORIZONTAL/VERTICAL) =    4.00
    BASEWIDTH(FEET) =     6.00
    CONSTANT CHANNEL SLOPE(FEET/FEET) =  .007400
    UNIFORM FLOW(CFS) =       60.00
    MANNINGS FRICTION FACTOR =  .0220
=========================================================================
    NORMAL-DEPTH FLOW INFORMATION:
-------------------------------------------------------------------------
    ))))) NORMAL DEPTH(FEET) =   1.15
    FLOW TOP- WIDTH(FEET) =        15.17
    FLOW AREA(SQUARE FEET) =          12.13
    HYDRAULIC DEPTH(FEET) =       .80
    FLOW AVERAGE VELOCITY(FEET/SEC.) =     4.94
    UNIFORM FROUDE NUMBER =     .974
    PRESSURE + MOMENTUM(POUNDS) =          946.26
    AVERAGED VELOCITY HEAD(FEET) =       .380
    SPECIFIC ENERGY(FEET) =      1.526
=========================================================================
    CRITICAL-DEPTH FLOW INFORMATION:
-------------------------------------------------------------------------
    CRITICAL FLOW TOP-WIDTH(FEET) =        15.05
    CRITICAL FLOW AREA(SQUARE FEET) =          11.91
    CRITICAL FLOW HYDRAULIC DEPTH(FEET) =      .79
    CRITICAL FLOW AVERAGE VELOCITY(FEET/SEC.) =     5.04
    CRITICAL DEPTH(FEET) =     1.13
    CRITICAL FLOW PRESSURE + MOMENTUM(POUNDS) =          945.95
    AVERAGED CRITICAL FLOW VELOCITY HEAD(FEET) =       .394
    CRITICAL FLOW SPECIFIC ENERGY(FEET) =      1.526
```

```
**********DESCRIPTION OF RESULTS*****************************************
* SV CH STA 119 TO 122                                                 *
*                                                                      *
*                                                                      *
************************************************************************

************************************************************************
))))CHANNEL INPUT INFORMATION((((
------------------------------------------------------------------------
    CHANNEL Z(HORIZONTAL/VERTICAL) =    4.00
    BASEWIDTH(FEET) =     6.00
    CONSTANT CHANNEL SLOPE(FEET/FEET) =  .008000
    UNIFORM FLOW(CFS) =       60.00
    MANNINGS FRICTION FACTOR =  .0300
========================================================================
    NORMAL-DEPTH FLOW INFORMATION:
------------------------------------------------------------------------
    ))))) NORMAL DEPTH(FEET) =   1.31
    FLOW TOP- WIDTH(FEET) =        16.51
    FLOW AREA(SQUARE FEET) =          14.79
    HYDRAULIC DEPTH(FEET) =      .90
    FLOW AVERAGE VELOCITY(FEET/SEC.) =     4.06
    UNIFORM FROUDE NUMBER =     .755
    PRESSURE + MOMENTUM(POUNDS) =          983.73
    AVERAGED VELOCITY HEAD(FEET) =       .255
    SPECIFIC ENERGY(FEET) =      1.570
========================================================================
    CRITICAL-DEPTH FLOW INFORMATION:
------------------------------------------------------------------------
    CRITICAL FLOW TOP-WIDTH(FEET) =        15.05
    CRITICAL FLOW AREA(SQUARE FEET) =          11.91
    CRITICAL FLOW HYDRAULIC DEPTH(FEET) =      .79
    CRITICAL FLOW AVERAGE VELOCITY(FEET/SEC.) =     5.04
    CRITICAL DEPTH(FEET) =     1.13
    CRITICAL FLOW PRESSURE + MOMENTUM(POUNDS) =          945.95
    AVERAGED CRITICAL FLOW VELOCITY HEAD(FEET) =       .394
    CRITICAL FLOW SPECIFIC ENERGY(FEET) =      1.526


************************************************************************
))))CHANNEL INPUT INFORMATION((((
------------------------------------------------------------------------
    CHANNEL Z(HORIZONTAL/VERTICAL) =    4.00
    BASEWIDTH(FEET) =     6.00
    CONSTANT CHANNEL SLOPE(FEET/FEET) =  .008000
    UNIFORM FLOW(CFS) =       60.00
    MANNINGS FRICTION FACTOR =  .0220
========================================================================
    NORMAL-DEPTH FLOW INFORMATION:
------------------------------------------------------------------------
    ))))) NORMAL DEPTH(FEET) =   1.12
    FLOW TOP- WIDTH(FEET) =        14.99
    FLOW AREA(SQUARE FEET) =          11.79
    HYDRAULIC DEPTH(FEET) =      .79
    FLOW AVERAGE VELOCITY(FEET/SEC.) =     5.09
    UNIFORM FROUDE NUMBER =    1.011
    PRESSURE + MOMENTUM(POUNDS) =          946.01
    AVERAGED VELOCITY HEAD(FEET) =       .402
    SPECIFIC ENERGY(FEET) =      1.526
========================================================================
    CRITICAL-DEPTH FLOW INFORMATION:
------------------------------------------------------------------------
    CRITICAL FLOW TOP-WIDTH(FEET) =        15.05
    CRITICAL FLOW AREA(SQUARE FEET) =          11.91
    CRITICAL FLOW HYDRAULIC DEPTH(FEET) =      .79
    CRITICAL FLOW AVERAGE VELOCITY(FEET/SEC.) =     5.04
    CRITICAL DEPTH(FEET) =     1.13
    CRITICAL FLOW PRESSURE + MOMENTUM(POUNDS) =          945.95
    AVERAGED CRITICAL FLOW VELOCITY HEAD(FEET) =       .394
    CRITICAL FLOW SPECIFIC ENERGY(FEET) =      1.526
```

```
((((((((((((((((((((((((((((((((((((((((()))))))))))))))))))))))))))))))))))))))))
                  Advanced Engineering Software [AES]
                          SERIAL No. I0549I
                  REV. 2.0      RELEASE DATE:12/30/82

((((((((((((((((((((((((((((((((((((((((()))))))))))))))))))))))))))))))))))))))))


**********DESCRIPTION OF RESULTS********************************************
* SV CH STA 122 TO 127                                                     *
*                                                                          *
*                                                                          *
****************************************************************************

****************************************************************************
))))CHANNEL INPUT INFORMATION((((
----------------------------------------------------------------------------
    CHANNEL Z(HORIZONTAL/VERTICAL) =    4.00
    BASEWIDTH(FEET) =      4.00
    CONSTANT CHANNEL SLOPE(FEET/FEET) =  .010000
    UNIFORM FLOW(CFS) =        35.00
    MANNINGS FRICTION FACTOR =  .0300
============================================================================
    NORMAL-DEPTH FLOW INFORMATION:
----------------------------------------------------------------------------
    ))))) NORMAL DEPTH(FEET) =   1.08
    FLOW TOP- WIDTH(FEET) =        12.65
    FLOW AREA(SQUARE FEET) =           9.00
    HYDRAULIC DEPTH(FEET) =        .71
    FLOW AVERAGE VELOCITY(FEET/SEC.) =     3.89
    UNIFORM FROUDE NUMBER =      .812
    PRESSURE + MOMENTUM(POUNDS) =          514.84
    AVERAGED VELOCITY HEAD(FEET) =       .235
    SPECIFIC ENERGY(FEET) =      1.316
============================================================================
    CRITICAL-DEPTH FLOW INFORMATION:
----------------------------------------------------------------------------
    CRITICAL FLOW TOP-WIDTH(FEET) =        11.77
    CRITICAL FLOW AREA(SQUARE FEET) =           7.66
    CRITICAL FLOW HYDRAULIC DEPTH(FEET) =     .65
    CRITICAL FLOW AVERAGE VELOCITY(FEET/SEC.) =     4.57
    CRITICAL DEPTH(FEET) =        .97
    CRITICAL FLOW PRESSURE + MOMENTUM(POUNDS) =          503.93
    AVERAGED CRITICAL FLOW VELOCITY HEAD(FEET) =        .324
    CRITICAL FLOW SPECIFIC ENERGY(FEET) =      1.296


****************************************************************************
))))CHANNEL INPUT INFORMATION((((
----------------------------------------------------------------------------
    CHANNEL Z(HORIZONTAL/VERTICAL) =    4.00
    BASEWIDTH(FEET) =      4.00
    CONSTANT CHANNEL SLOPE(FEET/FEET) =  .010000
    UNIFORM FLOW(CFS) =        35.00
    MANNINGS FRICTION FACTOR =  .0220
============================================================================
    NORMAL-DEPTH FLOW INFORMATION:
----------------------------------------------------------------------------
    ))))) NORMAL DEPTH(FEET) =    .93
    FLOW TOP- WIDTH(FEET) =        11.43
    FLOW AREA(SQUARE FEET) =           7.17
    HYDRAULIC DEPTH(FEET) =        .63
    FLOW AVERAGE VELOCITY(FEET/SEC.) =     4.88
    UNIFORM FROUDE NUMBER =     1.087
    PRESSURE + MOMENTUM(POUNDS) =          505.60
    AVERAGED VELOCITY HEAD(FEET) =       .370
    SPECIFIC ENERGY(FEET) =      1.299
============================================================================
    CRITICAL-DEPTH FLOW INFORMATION:
----------------------------------------------------------------------------
    CRITICAL FLOW TOP-WIDTH(FEET) =        11.77
    CRITICAL FLOW AREA(SQUARE FEET) =           7.66
    CRITICAL FLOW HYDRAULIC DEPTH(FEET) =     .65
    CRITICAL FLOW AVERAGE VELOCITY(FEET/SEC.) =     4.57
    CRITICAL DEPTH(FEET) =        .97
    CRITICAL FLOW PRESSURE + MOMENTUM(POUNDS) =          503.93
    AVERAGED CRITICAL FLOW VELOCITY HEAD(FEET) =        .324
    CRITICAL FLOW SPECIFIC ENERGY(FEET) =      1.296
```

```
(((((((((((((((((((((((((((((((((((((((())))))))))))))))))))))))))))))))))))))))
                    Advanced Engineering Software [AES]
                            SERIAL No. I0549I
                    REV. 2.0      RELEASE DATE:12/30/82

(((((((((((((((((((((((((((((((((((((((())))))))))))))))))))))))))))))))))))))))


**********DESCRIPTION OF RESULTS********************************************
* SV EASTSIDE CHANNEL PHASE III                                            *
* STA 129 TO 127                                                           *
*                                                                          *
****************************************************************************

****************************************************************************
))))CHANNEL INPUT INFORMATION((((
----------------------------------------------------------------------------
    CHANNEL Z(HORIZONTAL/VERTICAL) =     4.00
    BASEWIDTH(FEET) =        .00
    CONSTANT CHANNEL SLOPE(FEET/FEET) =  .007900
    UNIFORM FLOW(CFS) =        35.00
    MANNINGS FRICTION FACTOR =  .0300
============================================================================
    NORMAL-DEPTH FLOW INFORMATION:
----------------------------------------------------------------------------
    >>>>> NORMAL DEPTH(FEET) =   1.55
    FLOW TOP- WIDTH(FEET) =         12.41
    FLOW AREA(SQUARE FEET) =            9.62
    HYDRAULIC DEPTH(FEET) =        .78
    FLOW AVERAGE VELOCITY(FEET/SEC.) =      3.64
    UNIFORM FROUDE NUMBER =      .728
    PRESSURE + MOMENTUM(POUNDS) =           557.04
    AVERAGED VELOCITY HEAD(FEET) =        .206
    SPECIFIC ENERGY(FEET) =       1.756
============================================================================
    CRITICAL-DEPTH FLOW INFORMATION:
----------------------------------------------------------------------------
    CRITICAL FLOW TOP-WIDTH(FEET) =         10.92
    CRITICAL FLOW AREA(SQUARE FEET) =             7.45
    CRITICAL FLOW HYDRAULIC DEPTH(FEET) =       .68
    CRITICAL FLOW AVERAGE VELOCITY(FEET/SEC.) =      4.70
    CRITICAL DEPTH(FEET) =       1.36
    CRITICAL FLOW PRESSURE + MOMENTUM(POUNDS) =            530.12
    AVERAGED CRITICAL FLOW VELOCITY HEAD(FEET) =        .342
    CRITICAL FLOW SPECIFIC ENERGY(FEET) =       1.707


****************************************************************************
))))CHANNEL INPUT INFORMATION((((
----------------------------------------------------------------------------
    CHANNEL Z(HORIZONTAL/VERTICAL) =     4.00
    BASEWIDTH(FEET) =        .00
    CONSTANT CHANNEL SLOPE(FEET/FEET) =  .007900
    UNIFORM FLOW(CFS) =        35.00
    MANNINGS FRICTION FACTOR =  .0220
============================================================================
    NORMAL-DEPTH FLOW INFORMATION:
----------------------------------------------------------------------------
    >>>>> NORMAL DEPTH(FEET) =   1.38
    FLOW TOP- WIDTH(FEET) =         11.03
    FLOW AREA(SQUARE FEET) =            7.61
    HYDRAULIC DEPTH(FEET) =        .69
    FLOW AVERAGE VELOCITY(FEET/SEC.) =      4.60
    UNIFORM FROUDE NUMBER =      .976
    PRESSURE + MOMENTUM(POUNDS) =           530.27
    AVERAGED VELOCITY HEAD(FEET) =        .329
    SPECIFIC ENERGY(FEET) =       1.708
============================================================================
    CRITICAL-DEPTH FLOW INFORMATION:
----------------------------------------------------------------------------
    CRITICAL FLOW TOP-WIDTH(FEET) =         10.92
    CRITICAL FLOW AREA(SQUARE FEET) =             7.45
    CRITICAL FLOW HYDRAULIC DEPTH(FEET) =       .68
    CRITICAL FLOW AVERAGE VELOCITY(FEET/SEC.) =      4.70
    CRITICAL DEPTH(FEET) =       1.36
    CRITICAL FLOW PRESSURE + MOMENTUM(POUNDS) =            530.12
    AVERAGED CRITICAL FLOW VELOCITY HEAD(FEET) =        .342
    CRITICAL FLOW SPECIFIC ENERGY(FEET) =       1.707
============================================================================
```

EAST SIDE DITCH CALCULATIONS

```
**********DESCRIPTION OF RESULTS*****************************************
* STA 109+00                                                            *
*                                                                       *
*                                                                       *
*************************************************************************

*************************************************************************
))))CHANNEL INPUT INFORMATION((((
-------------------------------------------------------------------------
    NORMAL DEPTH(FEET) =   2.00
    CHANNEL Z(HORIZONTAL/VERTICAL) =    4.00
    BASEWIDTH(FEET) =     8.00
    CONSTANT CHANNEL SLOPE(FEET/FEET) =  .004000
    MANNINGS FRICTION FACTOR =  .0350
=========================================================================
    NORMAL-DEPTH FLOW INFORMATION:
-------------------------------------------------------------------------
    ))))) NORMAL DEPTH FLOW(CFS) =    102.69
    FLOW TOP- WIDTH(FEET) =        24.00
    FLOW AREA(SQUARE FEET) =          32.00
    HYDRAULIC DEPTH(FEET) =     1.33
    FLOW AVERAGE VELOCITY(FEET/SEC.) =     3.21
    UNIFORM FROUDE NUMBER =     .490
    PRESSURE + MOMENTUM(POUNDS) =         2302.65
    AVERAGED VELOCITY HEAD(FEET) =       .160
    SPECIFIC ENERGY(FEET) =      2.160
=========================================================================
    CRITICAL-DEPTH FLOW INFORMATION:
-------------------------------------------------------------------------
    CRITICAL FLOW TOP-WIDTH(FEET) =        18.92
    CRITICAL FLOW AREA(SQUARE FEET) =          18.37
    CRITICAL FLOW HYDRAULIC DEPTH(FEET) =      .97
    CRITICAL FLOW AVERAGE VELOCITY(FEET/SEC.) =     5.59
    CRITICAL DEPTH(FEET) =     1.36
    CRITICAL FLOW PRESSURE + MOMENTUM(POUNDS) =         1789.00
    AVERAGED CRITICAL FLOW VELOCITY HEAD(FEET) =       .485
    CRITICAL FLOW SPECIFIC ENERGY(FEET) =      1.850


**********DESCRIPTION OF RESULTS*****************************************
* STA 115+00                                                            *
*                                                                       *
*                                                                       *
*************************************************************************

*************************************************************************
))))CHANNEL INPUT INFORMATION((((
-------------------------------------------------------------------------
    NORMAL DEPTH(FEET) =   2.00
    CHANNEL Z(HORIZONTAL/VERTICAL) =    4.00
    BASEWIDTH(FEET) =     8.00
    CONSTANT CHANNEL SLOPE(FEET/FEET) =  .007000
    MANNINGS FRICTION FACTOR =  .0350
=========================================================================
    NORMAL-DEPTH FLOW INFORMATION:
-------------------------------------------------------------------------
    ))))) NORMAL DEPTH FLOW(CFS) =    135.85
    FLOW TOP- WIDTH(FEET) =        24.00
    FLOW AREA(SQUARE FEET) =          32.00
    HYDRAULIC DEPTH(FEET) =     1.33
    FLOW AVERAGE VELOCITY(FEET/SEC.) =     4.25
    UNIFORM FROUDE NUMBER =     .648
    PRESSURE + MOMENTUM(POUNDS) =         2781.64
    AVERAGED VELOCITY HEAD(FEET) =       .280
    SPECIFIC ENERGY(FEET) =      2.280
=========================================================================
    CRITICAL-DEPTH FLOW INFORMATION:
-------------------------------------------------------------------------
    CRITICAL FLOW TOP-WIDTH(FEET) =        20.71
    CRITICAL FLOW AREA(SQUARE FEET) =          22.81
    CRITICAL FLOW HYDRAULIC DEPTH(FEET) =     1.10
    CRITICAL FLOW AVERAGE VELOCITY(FEET/SEC.) =     5.95
    CRITICAL DEPTH(FEET) =     1.59
    CRITICAL FLOW PRESSURE + MOMENTUM(POUNDS) =         2531.85
    AVERAGED CRITICAL FLOW VELOCITY HEAD(FEET) =       .551
    CRITICAL FLOW SPECIFIC ENERGY(FEET) =      2.140
```

```
**********DESCRIPTION OF RESULTS*********************************************
* STA 118+50                                                                 *
*                                                                            *
*                                                                            *
******************************************************************************

******************************************************************************
))))CHANNEL INPUT INFORMATION((((
------------------------------------------------------------------------------
    NORMAL DEPTH(FEET) =   1.75
    CHANNEL Z(HORIZONTAL/VERTICAL) =    4.00
    BASEWIDTH(FEET) =     6.00
    CONSTANT CHANNEL SLOPE(FEET/FEET) =  .007600
    MANNINGS FRICTION FACTOR =  .0350
==============================================================================
    NORMAL-DEPTH FLOW INFORMATION:
------------------------------------------------------------------------------
    ))))) NORMAL DEPTH FLOW(CFS) =     90.46
    FLOW TOP- WIDTH(FEET) =        20.00
    FLOW AREA(SQUARE FEET) =          22.75
    HYDRAULIC DEPTH(FEET) =     1.14
    FLOW AVERAGE VELOCITY(FEET/SEC.) =     3.98
    UNIFORM FROUDE NUMBER =     .657
    PRESSURE + MOMENTUM(POUNDS) =         1716.28
    AVERAGED VELOCITY HEAD(FEET) =       .246
    SPECIFIC ENERGY(FEET) =      1.996
==============================================================================
    CRITICAL-DEPTH FLOW INFORMATION:
------------------------------------------------------------------------------
    CRITICAL FLOW TOP-WIDTH(FEET) =        17.26
    CRITICAL FLOW AREA(SQUARE FEET) =          16.38
    CRITICAL FLOW HYDRAULIC DEPTH(FEET) =      .95
    CRITICAL FLOW AVERAGE VELOCITY(FEET/SEC.) =     5.52
    CRITICAL DEPTH(FEET) =     1.41
    CRITICAL FLOW PRESSURE + MOMENTUM(POUNDS) =         1571.65
    AVERAGED CRITICAL FLOW VELOCITY HEAD(FEET) =       .474
    CRITICAL FLOW SPECIFIC ENERGY(FEET) =      1.882


**********DESCRIPTION OF RESULTS*********************************************
* STA 120+                                                                   *
* 00                                                                         *
*                                                                            *
******************************************************************************

******************************************************************************
))))CHANNEL INPUT INFORMATION((((
------------------------------------------------------------------------------
    NORMAL DEPTH(FEET) =   1.50
    CHANNEL Z(HORIZONTAL/VERTICAL) =    4.00
    BASEWIDTH(FEET) =     6.00
    CONSTANT CHANNEL SLOPE(FEET/FEET) =  .008000
    MANNINGS FRICTION FACTOR =  .0350
==============================================================================
    NORMAL-DEPTH FLOW INFORMATION:
------------------------------------------------------------------------------
    ))))) NORMAL DEPTH FLOW(CFS) =     67.44
    FLOW TOP- WIDTH(FEET) =        18.00
    FLOW AREA(SQUARE FEET) =          18.00
    HYDRAULIC DEPTH(FEET) =     1.00
    FLOW AVERAGE VELOCITY(FEET/SEC.) =     3.75
    UNIFORM FROUDE NUMBER =     .660
    PRESSURE + MOMENTUM(POUNDS) =         1191.59
    AVERAGED VELOCITY HEAD(FEET) =       .218
    SPECIFIC ENERGY(FEET) =      1.718
==============================================================================
    CRITICAL-DEPTH FLOW INFORMATION:
------------------------------------------------------------------------------
    CRITICAL FLOW TOP-WIDTH(FEET) =        15.62
    CRITICAL FLOW AREA(SQUARE FEET) =          13.00
    CRITICAL FLOW HYDRAULIC DEPTH(FEET) =      .83
    CRITICAL FLOW AVERAGE VELOCITY(FEET/SEC.) =     5.19
    CRITICAL DEPTH(FEET) =     1.20
    CRITICAL FLOW PRESSURE + MOMENTUM(POUNDS) =         1093.31
    AVERAGED CRITICAL FLOW VELOCITY HEAD(FEET) =       .418
    CRITICAL FLOW SPECIFIC ENERGY(FEET) =      1.620
```

```
**********DESCRIPTION OF RESULTS*****************************************
* STA 120+50                                                            *
*                                                                       *
*                                                                       *
*************************************************************************

*************************************************************************
))))CHANNEL INPUT INFORMATION((((
-------------------------------------------------------------------------
    NORMAL DEPTH(FEET) =   1.88
    CHANNEL Z(HORIZONTAL/VERTICAL) =    4.00
    BASEWIDTH(FEET) =     6.00
    CONSTANT CHANNEL SLOPE(FEET/FEET) =  .008000
    MANNINGS FRICTION FACTOR =  .0350
=========================================================================
    NORMAL-DEPTH FLOW INFORMATION:
-------------------------------------------------------------------------
    ))))) NORMAL DEPTH FLOW(CFS) =    107.91
    FLOW TOP- WIDTH(FEET) =        21.04
    FLOW AREA(SQUARE FEET) =          25.42
    HYDRAULIC DEPTH(FEET) =     1.21
    FLOW AVERAGE VELOCITY(FEET/SEC.) =     4.25
    UNIFORM FROUDE NUMBER =     .681
    PRESSURE + MOMENTUM(POUNDS) =         2102.26
    AVERAGED VELOCITY HEAD(FEET) =       .280
    SPECIFIC ENERGY(FEET) =      2.160
=========================================================================
    CRITICAL-DEPTH FLOW INFORMATION:
-------------------------------------------------------------------------
    CRITICAL FLOW TOP-WIDTH(FEET) =        18.35
    CRITICAL FLOW AREA(SQUARE FEET) =          18.80
    CRITICAL FLOW HYDRAULIC DEPTH(FEET) =     1.02
    CRITICAL FLOW AVERAGE VELOCITY(FEET/SEC.) =     5.74
    CRITICAL DEPTH(FEET) =     1.54
    CRITICAL FLOW PRESSURE + MOMENTUM(POUNDS) =         1952.81
    AVERAGED CRITICAL FLOW VELOCITY HEAD(FEET) =       .512
    CRITICAL FLOW SPECIFIC ENERGY(FEET) =      2.056


**********DESCRIPTION OF RESULTS*****************************************
* STA 128+00                                                            *
*                                                                       *
*                                                                       *
*************************************************************************

*************************************************************************
))))CHANNEL INPUT INFORMATION((((
-------------------------------------------------------------------------
    NORMAL DEPTH(FEET) =    .50
    CHANNEL Z(HORIZONTAL/VERTICAL) =    4.00
    BASEWIDTH(FEET) =      .00
    CONSTANT CHANNEL SLOPE(FEET/FEET) =  .005600
    MANNINGS FRICTION FACTOR =  .0350
=========================================================================
    NORMAL-DEPTH FLOW INFORMATION:
-------------------------------------------------------------------------
    ))))) NORMAL DEPTH FLOW(CFS) =      1.24
    FLOW TOP- WIDTH(FEET) =         4.00
    FLOW AREA(SQUARE FEET) =           1.00
    HYDRAULIC DEPTH(FEET) =      .25
    FLOW AVERAGE VELOCITY(FEET/SEC.) =     1.24
    UNIFORM FROUDE NUMBER =     .436
    PRESSURE + MOMENTUM(POUNDS) =           13.36
    AVERAGED VELOCITY HEAD(FEET) =       .024
    SPECIFIC ENERGY(FEET) =       .524
=========================================================================
    CRITICAL-DEPTH FLOW INFORMATION:
-------------------------------------------------------------------------
    CRITICAL FLOW TOP-WIDTH(FEET) =         2.87
    CRITICAL FLOW AREA(SQUARE FEET) =            .52
    CRITICAL FLOW HYDRAULIC DEPTH(FEET) =      .18
    CRITICAL FLOW AVERAGE VELOCITY(FEET/SEC.) =     2.40
    CRITICAL DEPTH(FEET) =      .36
    CRITICAL FLOW PRESSURE + MOMENTUM(POUNDS) =            9.59
    AVERAGED CRITICAL FLOW VELOCITY HEAD(FEET) =       .089
    CRITICAL FLOW SPECIFIC ENERGY(FEET) =       .448
```

```
**********DESCRIPTION OF RESULTS*********************************************
* STA 133+00                                                                 *
*                                                                            *
*                                                                            *
******************************************************************************

******************************************************************************
))))CHANNEL INPUT INFORMATION((((
------------------------------------------------------------------------------
    NORMAL DEPTH(FEET) =   1.50
    CHANNEL Z(HORIZONTAL/VERTICAL) =    4.00
    BASEWIDTH(FEET) =       .00
    CONSTANT CHANNEL SLOPE(FEET/FEET) =  .007500
    MANNINGS FRICTION FACTOR =  .0350
==============================================================================
    NORMAL-DEPTH FLOW INFORMATION:
------------------------------------------------------------------------------
    ))))) NORMAL DEPTH FLOW(CFS) =     26.77
    FLOW TOP- WIDTH(FEET) =        12.00
    FLOW AREA(SQUARE FEET) =           9.00
    HYDRAULIC DEPTH(FEET) =      .75
    FLOW AVERAGE VELOCITY(FEET/SEC.) =     2.97
    UNIFORM FROUDE NUMBER =     .605
    PRESSURE + MOMENTUM(POUNDS) =          435.11
    AVERAGED VELOCITY HEAD(FEET) =       .137
    SPECIFIC ENERGY(FEET) =      1.637
==============================================================================
    CRITICAL-DEPTH FLOW INFORMATION:
------------------------------------------------------------------------------
    CRITICAL FLOW TOP-WIDTH(FEET) =         9.81
    CRITICAL FLOW AREA(SQUARE FEET) =           6.02
    CRITICAL FLOW HYDRAULIC DEPTH(FEET) =      .61
    CRITICAL FLOW AVERAGE VELOCITY(FEET/SEC.) =     4.45
    CRITICAL DEPTH(FEET) =     1.23
    CRITICAL FLOW PRESSURE + MOMENTUM(POUNDS) =          384.31
    AVERAGED CRITICAL FLOW VELOCITY HEAD(FEET) =       .307
    CRITICAL FLOW SPECIFIC ENERGY(FEET) =      1.534


**********DESCRIPTION OF RESULTS*********************************************
* STA 135+00                                                                 *
*                                                                            *
*                                                                            *
******************************************************************************

******************************************************************************
))))CHANNEL INPUT INFORMATION((((
------------------------------------------------------------------------------
    NORMAL DEPTH(FEET) =   1.50
    CHANNEL Z(HORIZONTAL/VERTICAL) =    4.00
    BASEWIDTH(FEET) =       .00
    CONSTANT CHANNEL SLOPE(FEET/FEET) =  .009600
    MANNINGS FRICTION FACTOR =  .0350
==============================================================================
    NORMAL-DEPTH FLOW INFORMATION:
------------------------------------------------------------------------------
    ))))) NORMAL DEPTH FLOW(CFS) =     30.29
    FLOW TOP- WIDTH(FEET) =        12.00
    FLOW AREA(SQUARE FEET) =           9.00
    HYDRAULIC DEPTH(FEET) =      .75
    FLOW AVERAGE VELOCITY(FEET/SEC.) =     3.37
    UNIFORM FROUDE NUMBER =     .685
    PRESSURE + MOMENTUM(POUNDS) =          478.32
    AVERAGED VELOCITY HEAD(FEET) =       .176
    SPECIFIC ENERGY(FEET) =      1.676
==============================================================================
    CRITICAL-DEPTH FLOW INFORMATION:
------------------------------------------------------------------------------
    CRITICAL FLOW TOP-WIDTH(FEET) =        10.31
    CRITICAL FLOW AREA(SQUARE FEET) =           6.64
    CRITICAL FLOW HYDRAULIC DEPTH(FEET) =      .64
    CRITICAL FLOW AVERAGE VELOCITY(FEET/SEC.) =     4.56
    CRITICAL DEPTH(FEET) =     1.29
    CRITICAL FLOW PRESSURE + MOMENTUM(POUNDS) =          445.66
    AVERAGED CRITICAL FLOW VELOCITY HEAD(FEET) =       .323
    CRITICAL FLOW SPECIFIC ENERGY(FEET) =      1.611
```

```
**********DESCRIPTION OF RESULTS*********************************************
* STA 140+00                                                                 *
*                                                                            *
*                                                                            *
******************************************************************************

******************************************************************************
))))CHANNEL INPUT INFORMATION((((
------------------------------------------------------------------------------
    NORMAL DEPTH(FEET) =   1.00
    CHANNEL Z(HORIZONTAL/VERTICAL) =    4.00
    BASEWIDTH(FEET) =      .00
    CONSTANT CHANNEL SLOPE(FEET/FEET) =  .009800
    MANNINGS FRICTION FACTOR =  .0350
==============================================================================
    NORMAL-DEPTH FLOW INFORMATION:
------------------------------------------------------------------------------
    ))))) NORMAL DEPTH FLOW(CFS) =     10.38
    FLOW TOP- WIDTH(FEET) =         8.00
    FLOW AREA(SQUARE FEET) =           4.00
    HYDRAULIC DEPTH(FEET) =       .50
    FLOW AVERAGE VELOCITY(FEET/SEC.) =     2.59
    UNIFORM FROUDE NUMBER =     .647
    PRESSURE + MOMENTUM(POUNDS) =          135.39
    AVERAGED VELOCITY HEAD(FEET) =       .105
    SPECIFIC ENERGY(FEET) =      1.105
==============================================================================
    CRITICAL-DEPTH FLOW INFORMATION:
------------------------------------------------------------------------------
    CRITICAL FLOW TOP-WIDTH(FEET) =         6.72
    CRITICAL FLOW AREA(SQUARE FEET) =           2.83
    CRITICAL FLOW HYDRAULIC DEPTH(FEET) =      .42
    CRITICAL FLOW AVERAGE VELOCITY(FEET/SEC.) =     3.67
    CRITICAL DEPTH(FEET) =      .84
    CRITICAL FLOW PRESSURE + MOMENTUM(POUNDS) =          123.28
    AVERAGED CRITICAL FLOW VELOCITY HEAD(FEET) =       .210
    CRITICAL FLOW SPECIFIC ENERGY(FEET) =      1.050
==============================================================================


**********DESCRIPTION OF RESULTS*********************************************
* STA 146+00                                                                 *
*                                                                            *
*                                                                            *
******************************************************************************

******************************************************************************
))))CHANNEL INPUT INFORMATION((((
------------------------------------------------------------------------------
    NORMAL DEPTH(FEET) =   1.75
    CHANNEL Z(HORIZONTAL/VERTICAL) =    4.00
    BASEWIDTH(FEET) =     6.00
    CONSTANT CHANNEL SLOPE(FEET/FEET) =  .004000
    MANNINGS FRICTION FACTOR =  .0350
==============================================================================
    NORMAL-DEPTH FLOW INFORMATION:
------------------------------------------------------------------------------
    ))))) NORMAL DEPTH FLOW(CFS) =     65.63
    FLOW TOP- WIDTH(FEET) =        20.00
    FLOW AREA(SQUARE FEET) =          22.75
    HYDRAULIC DEPTH(FEET) =     1.14
    FLOW AVERAGE VELOCITY(FEET/SEC.) =     2.88
    UNIFORM FROUDE NUMBER =     .477
    PRESSURE + MOMENTUM(POUNDS) =         1386.09
    AVERAGED VELOCITY HEAD(FEET) =       .129
    SPECIFIC ENERGY(FEET) =      1.879
==============================================================================
    CRITICAL-DEPTH FLOW INFORMATION:
------------------------------------------------------------------------------
    CRITICAL FLOW TOP-WIDTH(FEET) =        15.49
    CRITICAL FLOW AREA(SQUARE FEET) =          12.74
    CRITICAL FLOW HYDRAULIC DEPTH(FEET) =      .82
    CRITICAL FLOW AVERAGE VELOCITY(FEET/SEC.) =     5.15
    CRITICAL DEPTH(FEET) =     1.19
    CRITICAL FLOW PRESSURE + MOMENTUM(POUNDS) =         1057.14
    AVERAGED CRITICAL FLOW VELOCITY HEAD(FEET) =       .412
    CRITICAL FLOW SPECIFIC ENERGY(FEET) =      1.598
```

```
**********DESCRIPTION OF RESULTS*********************************************
* 150+00                                                                    *
*                                                                           *
*                                                                           *
*****************************************************************************

*****************************************************************************
))))CHANNEL INPUT INFORMATION((((
-----------------------------------------------------------------------------
    NORMAL DEPTH(FEET) =   1.63
    CHANNEL Z(HORIZONTAL/VERTICAL) =    4.00
    BASEWIDTH(FEET) =     6.00
    CONSTANT CHANNEL SLOPE(FEET/FEET) =  .006000
    MANNINGS FRICTION FACTOR =  .0350
=============================================================================
    NORMAL-DEPTH FLOW INFORMATION:
-----------------------------------------------------------------------------
    ))))) NORMAL DEPTH FLOW(CFS) =     68.88
    FLOW TOP- WIDTH(FEET) =        19.00
    FLOW AREA(SQUARE FEET) =          20.31
    HYDRAULIC DEPTH(FEET) =     1.07
    FLOW AVERAGE VELOCITY(FEET/SEC.) =     3.39
    UNIFORM FROUDE NUMBER =     .578
    PRESSURE + MOMENTUM(POUNDS) =         1303.98
    AVERAGED VELOCITY HEAD(FEET) =       .179
    SPECIFIC ENERGY(FEET) =      1.804
=============================================================================
    CRITICAL-DEPTH FLOW INFORMATION:
-----------------------------------------------------------------------------
    CRITICAL FLOW TOP-WIDTH(FEET) =        15.74
    CRITICAL FLOW AREA(SQUARE FEET) =          13.23
    CRITICAL FLOW HYDRAULIC DEPTH(FEET) =      .84
    CRITICAL FLOW AVERAGE VELOCITY(FEET/SEC.) =     5.21
    CRITICAL DEPTH(FEET) =     1.22
    CRITICAL FLOW PRESSURE + MOMENTUM(POUNDS) =         1122.38
    AVERAGED CRITICAL FLOW VELOCITY HEAD(FEET) =       .421
    CRITICAL FLOW SPECIFIC ENERGY(FEET) =      1.638


**********DESCRIPTION OF RESULTS*********************************************
* 164+00                                                                    *
*                                                                           *
*                                                                           *
*****************************************************************************

*****************************************************************************
))))CHANNEL INPUT INFORMATION((((
-----------------------------------------------------------------------------
    NORMAL DEPTH(FEET) =   1.00
    CHANNEL Z(HORIZONTAL/VERTICAL) =    4.00
    BASEWIDTH(FEET) =     8.00
    CONSTANT CHANNEL SLOPE(FEET/FEET) =  .009200
    MANNINGS FRICTION FACTOR =  .0350
=============================================================================
    NORMAL-DEPTH FLOW INFORMATION:
-----------------------------------------------------------------------------
    ))))) NORMAL DEPTH FLOW(CFS) =     39.93
    FLOW TOP- WIDTH(FEET) =        16.00
    FLOW AREA(SQUARE FEET) =          12.00
    HYDRAULIC DEPTH(FEET) =       .75
    FLOW AVERAGE VELOCITY(FEET/SEC.) =     3.33
    UNIFORM FROUDE NUMBER =     .677
    PRESSURE + MOMENTUM(POUNDS) =          590.30
    AVERAGED VELOCITY HEAD(FEET) =       .172
    SPECIFIC ENERGY(FEET) =      1.172
=============================================================================
    CRITICAL-DEPTH FLOW INFORMATION:
-----------------------------------------------------------------------------
    CRITICAL FLOW TOP-WIDTH(FEET) =        14.38
    CRITICAL FLOW AREA(SQUARE FEET) =           8.92
    CRITICAL FLOW HYDRAULIC DEPTH(FEET) =      .62
    CRITICAL FLOW AVERAGE VELOCITY(FEET/SEC.) =     4.47
    CRITICAL DEPTH(FEET) =      .80
    CRITICAL FLOW PRESSURE + MOMENTUM(POUNDS) =          547.20
    AVERAGED CRITICAL FLOW VELOCITY HEAD(FEET) =       .311
    CRITICAL FLOW SPECIFIC ENERGY(FEET) =      1.108
```

```
**********DESCRIPTION OF RESULTS*********************************************
* 166+50                                                                    *
*                                                                           *
*                                                                           *
*****************************************************************************

*****************************************************************************
))))CHANNEL INPUT INFORMATION((((
-----------------------------------------------------------------------------
    NORMAL DEPTH(FEET) =   1.75
    CHANNEL Z(HORIZONTAL/VERTICAL) =    4.00
    BASEWIDTH(FEET) =     4.00
    CONSTANT CHANNEL SLOPE(FEET/FEET) =  .020000
    MANNINGS FRICTION FACTOR =  .0350
=============================================================================
    NORMAL-DEPTH FLOW INFORMATION:
-----------------------------------------------------------------------------
    ))))) NORMAL DEPTH FLOW(CFS) =    118.98
    FLOW TOP- WIDTH(FEET) =        18.00
    FLOW AREA(SQUARE FEET) =          19.25
    HYDRAULIC DEPTH(FEET) =     1.07
    FLOW AVERAGE VELOCITY(FEET/SEC.) =     6.18
    UNIFORM FROUDE NUMBER =    1.053
    PRESSURE + MOMENTUM(POUNDS) =         2253.28
    AVERAGED VELOCITY HEAD(FEET) =       .593
    SPECIFIC ENERGY(FEET) =      2.343
=============================================================================
    CRITICAL-DEPTH FLOW INFORMATION:
-----------------------------------------------------------------------------
    CRITICAL FLOW TOP-WIDTH(FEET) =        18.35
    CRITICAL FLOW AREA(SQUARE FEET) =          20.05
    CRITICAL FLOW HYDRAULIC DEPTH(FEET) =     1.09
    CRITICAL FLOW AVERAGE VELOCITY(FEET/SEC.) =     5.93
    CRITICAL DEPTH(FEET) =     1.79
    CRITICAL FLOW PRESSURE + MOMENTUM(POUNDS) =         2250.38
    AVERAGED CRITICAL FLOW VELOCITY HEAD(FEET) =       .547
    CRITICAL FLOW SPECIFIC ENERGY(FEET) =      2.341


**********DESCRIPTION OF RESULTS*********************************************
* STA 169                                                                   *
*                                                                           *
*                                                                           *
*****************************************************************************

*****************************************************************************
))))CHANNEL INPUT INFORMATION((((
-----------------------------------------------------------------------------
    CHANNEL Z(HORIZONTAL/VERTICAL) =    4.00
    BASEWIDTH(FEET) =      .00
    CONSTANT CHANNEL SLOPE(FEET/FEET) =  .011400
    UNIFORM FLOW(CFS) =       33.00
    MANNINGS FRICTION FACTOR =  .0350
=============================================================================
    NORMAL-DEPTH FLOW INFORMATION:
-----------------------------------------------------------------------------
    ))))) NORMAL DEPTH(FEET) =   1.50
    FLOW TOP- WIDTH(FEET) =        12.01
    FLOW AREA(SQUARE FEET) =           9.01
    HYDRAULIC DEPTH(FEET) =      .75
    FLOW AVERAGE VELOCITY(FEET/SEC.) =     3.66
    UNIFORM FROUDE NUMBER =     .745
    PRESSURE + MOMENTUM(POUNDS) =          515.56
    AVERAGED VELOCITY HEAD(FEET) =       .208
    SPECIFIC ENERGY(FEET) =      1.709
=============================================================================
    CRITICAL-DEPTH FLOW INFORMATION:
-----------------------------------------------------------------------------
    CRITICAL FLOW TOP-WIDTH(FEET) =        10.67
    CRITICAL FLOW AREA(SQUARE FEET) =           7.12
    CRITICAL FLOW HYDRAULIC DEPTH(FEET) =      .67
    CRITICAL FLOW AVERAGE VELOCITY(FEET/SEC.) =     4.64
    CRITICAL DEPTH(FEET) =     1.33
    CRITICAL FLOW PRESSURE + MOMENTUM(POUNDS) =          493.98
    AVERAGED CRITICAL FLOW VELOCITY HEAD(FEET) =       .334
    CRITICAL FLOW SPECIFIC ENERGY(FEET) =      1.668
```

NORMAL DEPTH FOR TRAPEZOIDAL CHANNELS
CHANNEL 176+00

DISCHARGE IS = 55 CFS
BOTTOM WIDTH IS = 12 FT
SLOPE IS = .0072 FT/FT
SIDE SLOPE (Z1) = 4
SIDE SLOPE (Z2) = 10
MANNING'S N = .035
TOP WIDTH IS = 25.96 FT
AREA IS = 18.93 SQ FT
WETTED PERIMETER IS = 26.13 FT
HYDRAULIC RADIUS IS = .72 FT
NORMAL DEPTH IS = 1 FT
VELOCITY IS = 2.91 FPS
FROUDE NUMBER IS = .6

```
**********DESCRIPTION OF RESULTS*********************************************
* STA 182+50                                                                *
*                                                                           *
*                                                                           *
*****************************************************************************

*****************************************************************************
))))CHANNEL INPUT INFORMATION((((
-----------------------------------------------------------------------------
    CHANNEL Z(HORIZONTAL/VERTICAL) =    4.00
    BASEWIDTH(FEET) =     4.00
    CONSTANT CHANNEL SLOPE(FEET/FEET) =  .004600
    UNIFORM FLOW(CFS) =       57.00
    MANNINGS FRICTION FACTOR =  .0350
=============================================================================
    NORMAL-DEPTH FLOW INFORMATION:
-----------------------------------------------------------------------------
    ))))) NORMAL DEPTH(FEET) =   1.75
    FLOW TOP- WIDTH(FEET) =        17.99
    FLOW AREA(SQUARE FEET) =          19.23
    HYDRAULIC DEPTH(FEET) =     1.07
    FLOW AVERAGE VELOCITY(FEET/SEC.) =     2.96
    UNIFORM FROUDE NUMBER =     .505
    PRESSURE + MOMENTUM(POUNDS) =         1154.32
    AVERAGED VELOCITY HEAD(FEET) =       .136
    SPECIFIC ENERGY(FEET) =      1.885
=============================================================================
    CRITICAL-DEPTH FLOW INFORMATION:
-----------------------------------------------------------------------------
    CRITICAL FLOW TOP-WIDTH(FEET) =        13.98
    CRITICAL FLOW AREA(SQUARE FEET) =          11.22
    CRITICAL FLOW HYDRAULIC DEPTH(FEET) =      .80
    CRITICAL FLOW AVERAGE VELOCITY(FEET/SEC.) =     5.08
    CRITICAL DEPTH(FEET) =     1.25
    CRITICAL FLOW PRESSURE + MOMENTUM(POUNDS) =          917.16
    AVERAGED CRITICAL FLOW VELOCITY HEAD(FEET) =       .400
    CRITICAL FLOW SPECIFIC ENERGY(FEET) =      1.649
```

```
**********DESCRIPTION OF RESULTS*********************************************
* 185+00                                                                    *
*                                                                           *
*                                                                           *
*****************************************************************************

*****************************************************************************
))))CHANNEL INPUT INFORMATION((((
-----------------------------------------------------------------------------
    NORMAL DEPTH(FEET) =   1.75
    CHANNEL Z(HORIZONTAL/VERTICAL) =    4.00
    BASEWIDTH(FEET) =     4.00
    CONSTANT CHANNEL SLOPE(FEET/FEET) =  .005600
    MANNINGS FRICTION FACTOR =  .0350
=============================================================================
    NORMAL-DEPTH FLOW INFORMATION:
-----------------------------------------------------------------------------
    ))))) NORMAL DEPTH FLOW(CFS) =     62.96
    FLOW TOP- WIDTH(FEET) =        18.00
    FLOW AREA(SQUARE FEET) =          19.25
    HYDRAULIC DEPTH(FEET) =     1.07
    FLOW AVERAGE VELOCITY(FEET/SEC.) =     3.27
    UNIFORM FROUDE NUMBER =     .557
    PRESSURE + MOMENTUM(POUNDS) =         1227.15
    AVERAGED VELOCITY HEAD(FEET) =       .166
    SPECIFIC ENERGY(FEET) =      1.916
=============================================================================
    CRITICAL-DEPTH FLOW INFORMATION:
-----------------------------------------------------------------------------
    CRITICAL FLOW TOP-WIDTH(FEET) =        14.50
    CRITICAL FLOW AREA(SQUARE FEET) =          12.14
    CRITICAL FLOW HYDRAULIC DEPTH(FEET) =      .84
    CRITICAL FLOW AVERAGE VELOCITY(FEET/SEC.) =     5.19
    CRITICAL DEPTH(FEET) =     1.31
    CRITICAL FLOW PRESSURE + MOMENTUM(POUNDS) =         1035.83
    AVERAGED CRITICAL FLOW VELOCITY HEAD(FEET) =       .418
    CRITICAL FLOW SPECIFIC ENERGY(FEET) =      1.730


**********DESCRIPTION OF RESULTS*********************************************
* 188+00                                                                    *
*                                                                           *
*                                                                           *
*****************************************************************************

*****************************************************************************
))))CHANNEL INPUT INFORMATION((((
-----------------------------------------------------------------------------
    NORMAL DEPTH(FEET) =   1.50
    CHANNEL Z(HORIZONTAL/VERTICAL) =    4.00
    BASEWIDTH(FEET) =      .00
    CONSTANT CHANNEL SLOPE(FEET/FEET) =  .012000
    MANNINGS FRICTION FACTOR =  .0350
=============================================================================
    NORMAL-DEPTH FLOW INFORMATION:
-----------------------------------------------------------------------------
    ))))) NORMAL DEPTH FLOW(CFS) =     33.86
    FLOW TOP- WIDTH(FEET) =        12.00
    FLOW AREA(SQUARE FEET) =           9.00
    HYDRAULIC DEPTH(FEET) =      .75
    FLOW AVERAGE VELOCITY(FEET/SEC.) =     3.76
    UNIFORM FROUDE NUMBER =     .766
    PRESSURE + MOMENTUM(POUNDS) =          527.70
    AVERAGED VELOCITY HEAD(FEET) =       .220
    SPECIFIC ENERGY(FEET) =      1.720
=============================================================================
    CRITICAL-DEPTH FLOW INFORMATION:
-----------------------------------------------------------------------------
    CRITICAL FLOW TOP-WIDTH(FEET) =        10.79
    CRITICAL FLOW AREA(SQUARE FEET) =           7.27
    CRITICAL FLOW HYDRAULIC DEPTH(FEET) =      .67
    CRITICAL FLOW AVERAGE VELOCITY(FEET/SEC.) =     4.66
    CRITICAL DEPTH(FEET) =     1.35
    CRITICAL FLOW PRESSURE + MOMENTUM(POUNDS) =          509.51
    AVERAGED CRITICAL FLOW VELOCITY HEAD(FEET) =       .337
    CRITICAL FLOW SPECIFIC ENERGY(FEET) =      1.685
```

NORMAL DEPTH FOR TRAPEZOIDAL CHANNELS
CHANNEL 196+00

DISCHARGE IS = 271 CFS
BOTTOM WIDTH IS = 10 FT
SLOPE IS = .0132 FT/FT
SIDE SLOPE (Z1) = 4
SIDE SLOPE (Z2) = 10
MANNING'S N = .035
TOP WIDTH IS = 37.96 FT
AREA IS = 47.88 SQ FT
WETTED PERIMETER IS = 38.3 FT
HYDRAULIC RADIUS IS = 1.25 FT
NORMAL DEPTH IS = 2 FT
VELOCITY IS = 5.66 FPS
FROUDE NUMBER IS = .89

```
**********DESCRIPTION OF RESULTS*******************************************
* 199+00                                                                  *
*                                                                         *
*                                                                         *
***************************************************************************

***************************************************************************
))))CHANNEL INPUT INFORMATION((((
---------------------------------------------------------------------------
    NORMAL DEPTH(FEET) =   2.50
    CHANNEL Z(HORIZONTAL/VERTICAL) =    4.00
    BASEWIDTH(FEET) =    20.00
    CONSTANT CHANNEL SLOPE(FEET/FEET) =  .010000
    MANNINGS FRICTION FACTOR =  .0350
===========================================================================
    NORMAL-DEPTH FLOW INFORMATION:
---------------------------------------------------------------------------
    ))))) NORMAL DEPTH FLOW(CFS) =    479.28
    FLOW TOP- WIDTH(FEET) =        40.00
    FLOW AREA(SQUARE FEET) =          75.00
    HYDRAULIC DEPTH(FEET) =     1.88
    FLOW AVERAGE VELOCITY(FEET/SEC.) =     6.39
    UNIFORM FROUDE NUMBER =     .822
    PRESSURE + MOMENTUM(POUNDS) =        11135.43
    AVERAGED VELOCITY HEAD(FEET) =       .634
    SPECIFIC ENERGY(FEET) =      3.134
===========================================================================
    CRITICAL-DEPTH FLOW INFORMATION:
---------------------------------------------------------------------------
    CRITICAL FLOW TOP-WIDTH(FEET) =        37.88
    CRITICAL FLOW AREA(SQUARE FEET) =          64.69
    CRITICAL FLOW HYDRAULIC DEPTH(FEET) =     1.71
    CRITICAL FLOW AVERAGE VELOCITY(FEET/SEC.) =     7.41
    CRITICAL DEPTH(FEET) =     2.24
    CRITICAL FLOW PRESSURE + MOMENTUM(POUNDS) =        10928.25
    AVERAGED CRITICAL FLOW VELOCITY HEAD(FEET) =       .852
    CRITICAL FLOW SPECIFIC ENERGY(FEET) =      3.088
```

```
**********DESCRIPTION OF RESULTS*********************************************
* 201+00                                                                    *
*                                                                           *
*                                                                           *
*****************************************************************************

*****************************************************************************
))))CHANNEL INPUT INFORMATION((((
-----------------------------------------------------------------------------
    NORMAL DEPTH(FEET) =   2.00
    CHANNEL Z(HORIZONTAL/VERTICAL) =    4.00
    BASEWIDTH(FEET) =     5.00
    CONSTANT CHANNEL SLOPE(FEET/FEET) =  .010000
    MANNINGS FRICTION FACTOR =  .0350
=============================================================================
    NORMAL-DEPTH FLOW INFORMATION:
-----------------------------------------------------------------------------
    ))))) NORMAL DEPTH FLOW(CFS) =    125.33
    FLOW TOP- WIDTH(FEET) =        21.00
    FLOW AREA(SQUARE FEET) =          26.00
    HYDRAULIC DEPTH(FEET) =     1.24
    FLOW AVERAGE VELOCITY(FEET/SEC.) =     4.82
    UNIFORM FROUDE NUMBER =     .763
    PRESSURE + MOMENTUM(POUNDS) =         2460.32
    AVERAGED VELOCITY HEAD(FEET) =       .361
    SPECIFIC ENERGY(FEET) =      2.361
=============================================================================
    CRITICAL-DEPTH FLOW INFORMATION:
-----------------------------------------------------------------------------
    CRITICAL FLOW TOP-WIDTH(FEET) =        19.01
    CRITICAL FLOW AREA(SQUARE FEET) =          21.02
    CRITICAL FLOW HYDRAULIC DEPTH(FEET) =     1.11
    CRITICAL FLOW AVERAGE VELOCITY(FEET/SEC.) =     5.96
    CRITICAL DEPTH(FEET) =     1.75
    CRITICAL FLOW PRESSURE + MOMENTUM(POUNDS) =         2373.12
    AVERAGED CRITICAL FLOW VELOCITY HEAD(FEET) =       .552
    CRITICAL FLOW SPECIFIC ENERGY(FEET) =      2.303
```

```
**********DESCRIPTION OF RESULTS*********************************************
* 204+25                                                                    *
*                                                                           *
*                                                                           *
*****************************************************************************

*****************************************************************************
))))CHANNEL INPUT INFORMATION((((
-----------------------------------------------------------------------------
    NORMAL DEPTH(FEET) =   1.75
    CHANNEL Z(HORIZONTAL/VERTICAL) =    4.00
    BASEWIDTH(FEET) =     5.00
    CONSTANT CHANNEL SLOPE(FEET/FEET) =  .016000
    MANNINGS FRICTION FACTOR =  .0350
=============================================================================
    NORMAL-DEPTH FLOW INFORMATION:
-----------------------------------------------------------------------------
    ))))) NORMAL DEPTH FLOW(CFS) =    118.77
    FLOW TOP- WIDTH(FEET) =        19.00
    FLOW AREA(SQUARE FEET) =          21.00
    HYDRAULIC DEPTH(FEET) =     1.11
    FLOW AVERAGE VELOCITY(FEET/SEC.) =     5.66
    UNIFORM FROUDE NUMBER =     .948
    PRESSURE + MOMENTUM(POUNDS) =         2225.43
    AVERAGED VELOCITY HEAD(FEET) =       .497
    SPECIFIC ENERGY(FEET) =      2.247
=============================================================================
    CRITICAL-DEPTH FLOW INFORMATION:
-----------------------------------------------------------------------------
    CRITICAL FLOW TOP-WIDTH(FEET) =        18.63
    CRITICAL FLOW AREA(SQUARE FEET) =          20.13
    CRITICAL FLOW HYDRAULIC DEPTH(FEET) =     1.08
    CRITICAL FLOW AVERAGE VELOCITY(FEET/SEC.) =     5.90
    CRITICAL DEPTH(FEET) =     1.70
    CRITICAL FLOW PRESSURE + MOMENTUM(POUNDS) =         2222.36
    AVERAGED CRITICAL FLOW VELOCITY HEAD(FEET) =       .541
    CRITICAL FLOW SPECIFIC ENERGY(FEET) =      2.244
```

```
**********DESCRIPTION OF RESULTS*********************************************
* STA 208                                                                   *
*                                                                           *
*                                                                           *
*****************************************************************************

*****************************************************************************
))))CHANNEL INPUT INFORMATION((((
-----------------------------------------------------------------------------
    CHANNEL Z(HORIZONTAL/VERTICAL) =    4.00
    BASEWIDTH(FEET) =     5.00
    CONSTANT CHANNEL SLOPE(FEET/FEET) =  .010000
    UNIFORM FLOW(CFS) =       94.00
    MANNINGS FRICTION FACTOR =  .0350
=============================================================================
    NORMAL-DEPTH FLOW INFORMATION:
-----------------------------------------------------------------------------
    ))))) NORMAL DEPTH(FEET) =   1.75
    FLOW TOP- WIDTH(FEET) =        18.99
    FLOW AREA(SQUARE FEET) =          20.98
    HYDRAULIC DEPTH(FEET) =     1.10
    FLOW AVERAGE VELOCITY(FEET/SEC.) =     4.48
    UNIFORM FROUDE NUMBER =     .751
    PRESSURE + MOMENTUM(POUNDS) =         1738.49
    AVERAGED VELOCITY HEAD(FEET) =       .312
    SPECIFIC ENERGY(FEET) =      2.061
=============================================================================
    CRITICAL-DEPTH FLOW INFORMATION:
-----------------------------------------------------------------------------
    CRITICAL FLOW TOP-WIDTH(FEET) =        17.12
    CRITICAL FLOW AREA(SQUARE FEET) =          16.76
    CRITICAL FLOW HYDRAULIC DEPTH(FEET) =      .98
    CRITICAL FLOW AVERAGE VELOCITY(FEET/SEC.) =     5.61
    CRITICAL DEPTH(FEET) =     1.52
    CRITICAL FLOW PRESSURE + MOMENTUM(POUNDS) =         1669.28
    AVERAGED CRITICAL FLOW VELOCITY HEAD(FEET) =       .489
    CRITICAL FLOW SPECIFIC ENERGY(FEET) =      2.004


**********DESCRIPTION OF RESULTS*********************************************
* STA 214                                                                   *
*                                                                           *
*                                                                           *
*****************************************************************************

*****************************************************************************
))))CHANNEL INPUT INFORMATION((((
-----------------------------------------------------------------------------
    CHANNEL Z(HORIZONTAL/VERTICAL) =    4.00
    BASEWIDTH(FEET) =     5.00
    CONSTANT CHANNEL SLOPE(FEET/FEET) =  .007100
    UNIFORM FLOW(CFS) =       79.00
    MANNINGS FRICTION FACTOR =  .0350
=============================================================================
    NORMAL-DEPTH FLOW INFORMATION:
-----------------------------------------------------------------------------
    ))))) NORMAL DEPTH(FEET) =   1.75
    FLOW TOP- WIDTH(FEET) =        18.99
    FLOW AREA(SQUARE FEET) =          20.98
    HYDRAULIC DEPTH(FEET) =     1.10
    FLOW AVERAGE VELOCITY(FEET/SEC.) =     3.77
    UNIFORM FROUDE NUMBER =     .631
    PRESSURE + MOMENTUM(POUNDS) =         1498.81
    AVERAGED VELOCITY HEAD(FEET) =       .220
    SPECIFIC ENERGY(FEET) =      1.969
=============================================================================
    CRITICAL-DEPTH FLOW INFORMATION:
-----------------------------------------------------------------------------
    CRITICAL FLOW TOP-WIDTH(FEET) =        16.09
    CRITICAL FLOW AREA(SQUARE FEET) =          14.62
    CRITICAL FLOW HYDRAULIC DEPTH(FEET) =      .91
    CRITICAL FLOW AVERAGE VELOCITY(FEET/SEC.) =     5.40
    CRITICAL DEPTH(FEET) =     1.39
    CRITICAL FLOW PRESSURE + MOMENTUM(POUNDS) =         1348.78
    AVERAGED CRITICAL FLOW VELOCITY HEAD(FEET) =       .453
    CRITICAL FLOW SPECIFIC ENERGY(FEET) =      1.840
```

```
**********DESCRIPTION OF RESULTS*********************************************
* 218+00                                                                    *
*                                                                           *
*                                                                           *
*****************************************************************************

*****************************************************************************
))))CHANNEL INPUT INFORMATION((((
-----------------------------------------------------------------------------
    NORMAL DEPTH(FEET) =   1.75
    CHANNEL Z(HORIZONTAL/VERTICAL) =    4.00
    BASEWIDTH(FEET) =     2.00
    CONSTANT CHANNEL SLOPE(FEET/FEET) =  .013200
    MANNINGS FRICTION FACTOR =  .0350
=============================================================================
    NORMAL-DEPTH FLOW INFORMATION:
-----------------------------------------------------------------------------
    ))))) NORMAL DEPTH FLOW(CFS) =     74.69
    FLOW TOP- WIDTH(FEET) =        16.00
    FLOW AREA(SQUARE FEET) =          15.75
    HYDRAULIC DEPTH(FEET) =       .98
    FLOW AVERAGE VELOCITY(FEET/SEC.) =     4.74
    UNIFORM FROUDE NUMBER =     .842
    PRESSURE + MOMENTUM(POUNDS) =         1323.40
    AVERAGED VELOCITY HEAD(FEET) =       .349
    SPECIFIC ENERGY(FEET) =      2.099
=============================================================================
    CRITICAL-DEPTH FLOW INFORMATION:
-----------------------------------------------------------------------------
    CRITICAL FLOW TOP-WIDTH(FEET) =        14.96
    CRITICAL FLOW AREA(SQUARE FEET) =          13.74
    CRITICAL FLOW HYDRAULIC DEPTH(FEET) =      .92
    CRITICAL FLOW AVERAGE VELOCITY(FEET/SEC.) =     5.44
    CRITICAL DEPTH(FEET) =     1.62
    CRITICAL FLOW PRESSURE + MOMENTUM(POUNDS) =         1304.44
    AVERAGED CRITICAL FLOW VELOCITY HEAD(FEET) =       .459
    CRITICAL FLOW SPECIFIC ENERGY(FEET) =      2.079
=============================================================================


**********DESCRIPTION OF RESULTS*********************************************
* 220+00                                                                    *
*                                                                           *
*                                                                           *
*****************************************************************************

*****************************************************************************
))))CHANNEL INPUT INFORMATION((((
-----------------------------------------------------------------------------
    NORMAL DEPTH(FEET) =   2.50
    CHANNEL Z(HORIZONTAL/VERTICAL) =    4.00
    BASEWIDTH(FEET) =      .00
    CONSTANT CHANNEL SLOPE(FEET/FEET) =  .006000
    MANNINGS FRICTION FACTOR =  .0350
=============================================================================
    NORMAL-DEPTH FLOW INFORMATION:
-----------------------------------------------------------------------------
    ))))) NORMAL DEPTH FLOW(CFS) =     93.50
    FLOW TOP- WIDTH(FEET) =        20.00
    FLOW AREA(SQUARE FEET) =          25.00
    HYDRAULIC DEPTH(FEET) =     1.25
    FLOW AVERAGE VELOCITY(FEET/SEC.) =     3.74
    UNIFORM FROUDE NUMBER =     .589
    PRESSURE + MOMENTUM(POUNDS) =         1977.61
    AVERAGED VELOCITY HEAD(FEET) =       .217
    SPECIFIC ENERGY(FEET) =      2.717
=============================================================================
    CRITICAL-DEPTH FLOW INFORMATION:
-----------------------------------------------------------------------------
    CRITICAL FLOW TOP-WIDTH(FEET) =        16.18
    CRITICAL FLOW AREA(SQUARE FEET) =          16.37
    CRITICAL FLOW HYDRAULIC DEPTH(FEET) =     1.01
    CRITICAL FLOW AVERAGE VELOCITY(FEET/SEC.) =     5.71
    CRITICAL DEPTH(FEET) =     2.02
    CRITICAL FLOW PRESSURE + MOMENTUM(POUNDS) =         1723.66
    AVERAGED CRITICAL FLOW VELOCITY HEAD(FEET) =       .507
    CRITICAL FLOW SPECIFIC ENERGY(FEET) =      2.530
```

```
**********DESCRIPTION OF RESULTS*********************************************
* 221+00                                                                    *
*                                                                           *
*                                                                           *
*****************************************************************************

*****************************************************************************
))))CHANNEL INPUT INFORMATION((((
-----------------------------------------------------------------------------
    NORMAL DEPTH(FEET) =   2.75
    CHANNEL Z(HORIZONTAL/VERTICAL) =    4.00
    BASEWIDTH(FEET) =      .00
    CONSTANT CHANNEL SLOPE(FEET/FEET) =  .010000
    MANNINGS FRICTION FACTOR =  .0350
=============================================================================
    NORMAL-DEPTH FLOW INFORMATION:
-----------------------------------------------------------------------------
    ))))) NORMAL DEPTH FLOW(CFS) =    155.63
    FLOW TOP- WIDTH(FEET) =        22.00
    FLOW AREA(SQUARE FEET) =          30.25
    HYDRAULIC DEPTH(FEET) =     1.38
    FLOW AVERAGE VELOCITY(FEET/SEC.) =     5.14
    UNIFORM FROUDE NUMBER =     .773
    PRESSURE + MOMENTUM(POUNDS) =         3282.00
    AVERAGED VELOCITY HEAD(FEET) =       .411
    SPECIFIC ENERGY(FEET) =      3.161
=============================================================================
    CRITICAL-DEPTH FLOW INFORMATION:
-----------------------------------------------------------------------------
    CRITICAL FLOW TOP-WIDTH(FEET) =        19.85
    CRITICAL FLOW AREA(SQUARE FEET) =          24.62
    CRITICAL FLOW HYDRAULIC DEPTH(FEET) =     1.24
    CRITICAL FLOW AVERAGE VELOCITY(FEET/SEC.) =     6.32
    CRITICAL DEPTH(FEET) =     2.48
    CRITICAL FLOW PRESSURE + MOMENTUM(POUNDS) =         3177.01
    AVERAGED CRITICAL FLOW VELOCITY HEAD(FEET) =       .621
    CRITICAL FLOW SPECIFIC ENERGY(FEET) =      3.101


**********DESCRIPTION OF RESULTS*********************************************
* STA 224                                                                   *
*                                                                           *
*                                                                           *
*****************************************************************************

*****************************************************************************
))))CHANNEL INPUT INFORMATION((((
-----------------------------------------------------------------------------
    CHANNEL Z(HORIZONTAL/VERTICAL) =    4.00
    BASEWIDTH(FEET) =      .00
    CONSTANT CHANNEL SLOPE(FEET/FEET) =  .014200
    UNIFORM FLOW(CFS) =       12.00
    MANNINGS FRICTION FACTOR =  .0350
=============================================================================
    NORMAL-DEPTH FLOW INFORMATION:
-----------------------------------------------------------------------------
    ))))) NORMAL DEPTH(FEET) =    .99
    FLOW TOP- WIDTH(FEET) =         7.89
    FLOW AREA(SQUARE FEET) =           3.89
    HYDRAULIC DEPTH(FEET) =      .49
    FLOW AVERAGE VELOCITY(FEET/SEC.) =     3.09
    UNIFORM FROUDE NUMBER =     .774
    PRESSURE + MOMENTUM(POUNDS) =          151.52
    AVERAGED VELOCITY HEAD(FEET) =       .148
    SPECIFIC ENERGY(FEET) =      1.134
=============================================================================
    CRITICAL-DEPTH FLOW INFORMATION:
-----------------------------------------------------------------------------
    CRITICAL FLOW TOP-WIDTH(FEET) =         7.12
    CRITICAL FLOW AREA(SQUARE FEET) =           3.17
    CRITICAL FLOW HYDRAULIC DEPTH(FEET) =      .45
    CRITICAL FLOW AVERAGE VELOCITY(FEET/SEC.) =     3.78
    CRITICAL DEPTH(FEET) =      .89
    CRITICAL FLOW PRESSURE + MOMENTUM(POUNDS) =          146.73
    AVERAGED CRITICAL FLOW VELOCITY HEAD(FEET) =       .222
    CRITICAL FLOW SPECIFIC ENERGY(FEET) =      1.113
```

NORMAL DEPTH FOR TRAPEZOIDAL CHANNELS

CHANNEL 229+50

DISCHARGE IS = 102 CFS
BOTTOM WIDTH IS = 15 FT
SLOPE IS = .0088 FT/FT
SIDE SLOPE (Z1) = 4
SIDE SLOPE (Z2) = 10
MANNING'S N = .035
TOP WIDTH IS = 31.76 FT
AREA IS = 27.99 SQ FT
WETTED PERIMETER IS = 31.97 FT
HYDRAULIC RADIUS IS = .88 FT
NORMAL DEPTH IS = 1.2 FT
VELOCITY IS = 3.64 FPS
FROUDE NUMBER IS = .68

```
**********DESCRIPTION OF RESULTS*********************************************
* STA 234                                                                   *
*                                                                           *
*                                                                           *
*****************************************************************************

*****************************************************************************
))))CHANNEL INPUT INFORMATION((((
-----------------------------------------------------------------------------
    CHANNEL Z(HORIZONTAL/VERTICAL) =    4.00
    BASEWIDTH(FEET) =     4.00
    CONSTANT CHANNEL SLOPE(FEET/FEET) =  .004000
    UNIFORM FLOW(CFS) =       53.00
    MANNINGS FRICTION FACTOR =  .0350
=============================================================================
    NORMAL-DEPTH FLOW INFORMATION:
-----------------------------------------------------------------------------
    ))))) NORMAL DEPTH(FEET) =   1.75
    FLOW TOP- WIDTH(FEET) =        17.96
    FLOW AREA(SQUARE FEET) =          19.16
    HYDRAULIC DEPTH(FEET) =     1.07
    FLOW AVERAGE VELOCITY(FEET/SEC.) =     2.77
    UNIFORM FROUDE NUMBER =     .472
    PRESSURE + MOMENTUM(POUNDS) =         1106.42
    AVERAGED VELOCITY HEAD(FEET) =       .119
    SPECIFIC ENERGY(FEET) =      1.864
=============================================================================
    CRITICAL-DEPTH FLOW INFORMATION:
-----------------------------------------------------------------------------
    CRITICAL FLOW TOP-WIDTH(FEET) =        13.62
    CRITICAL FLOW AREA(SQUARE FEET) =          10.60
    CRITICAL FLOW HYDRAULIC DEPTH(FEET) =      .78
    CRITICAL FLOW AVERAGE VELOCITY(FEET/SEC.) =     5.00
    CRITICAL DEPTH(FEET) =     1.20
    CRITICAL FLOW PRESSURE + MOMENTUM(POUNDS) =          838.96
    AVERAGED CRITICAL FLOW VELOCITY HEAD(FEET) =       .388
    CRITICAL FLOW SPECIFIC ENERGY(FEET) =      1.591
```

```
**********DESCRIPTION OF RESULTS*********************************************
* 238+00                                                                    *
*                                                                           *
*                                                                           *
*****************************************************************************

*****************************************************************************
))))CHANNEL INPUT INFORMATION((((
-----------------------------------------------------------------------------
    NORMAL DEPTH(FEET) =   1.50
    CHANNEL Z(HORIZONTAL/VERTICAL) =    4.00
    BASEWIDTH(FEET) =       .00
    CONSTANT CHANNEL SLOPE(FEET/FEET) =  .010400
    MANNINGS FRICTION FACTOR =  .0350
=============================================================================
    NORMAL-DEPTH FLOW INFORMATION:
-----------------------------------------------------------------------------
    ))))) NORMAL DEPTH FLOW(CFS) =     31.52
    FLOW TOP- WIDTH(FEET) =        12.00
    FLOW AREA(SQUARE FEET) =           9.00
    HYDRAULIC DEPTH(FEET) =      .75
    FLOW AVERAGE VELOCITY(FEET/SEC.) =     3.50
    UNIFORM FROUDE NUMBER =     .713
    PRESSURE + MOMENTUM(POUNDS) =          494.78
    AVERAGED VELOCITY HEAD(FEET) =       .191
    SPECIFIC ENERGY(FEET) =      1.691
=============================================================================
    CRITICAL-DEPTH FLOW INFORMATION:
-----------------------------------------------------------------------------
    CRITICAL FLOW TOP-WIDTH(FEET) =        10.48
    CRITICAL FLOW AREA(SQUARE FEET) =           6.87
    CRITICAL FLOW HYDRAULIC DEPTH(FEET) =      .66
    CRITICAL FLOW AVERAGE VELOCITY(FEET/SEC.) =     4.59
    CRITICAL DEPTH(FEET) =     1.31
    CRITICAL FLOW PRESSURE + MOMENTUM(POUNDS) =          467.59
    AVERAGED CRITICAL FLOW VELOCITY HEAD(FEET) =       .327
    CRITICAL FLOW SPECIFIC ENERGY(FEET) =      1.637


**********DESCRIPTION OF RESULTS*********************************************
* 246+00                                                                    *
*                                                                           *
*                                                                           *
*****************************************************************************

*****************************************************************************
))))CHANNEL INPUT INFORMATION((((
-----------------------------------------------------------------------------
    NORMAL DEPTH(FEET) =   2.50
    CHANNEL Z(HORIZONTAL/VERTICAL) =    4.00
    BASEWIDTH(FEET) =     3.00
    CONSTANT CHANNEL SLOPE(FEET/FEET) =  .004000
    MANNINGS FRICTION FACTOR =  .0350
=============================================================================
    NORMAL-DEPTH FLOW INFORMATION:
-----------------------------------------------------------------------------
    ))))) NORMAL DEPTH FLOW(CFS) =    107.97
    FLOW TOP- WIDTH(FEET) =        23.00
    FLOW AREA(SQUARE FEET) =          32.50
    HYDRAULIC DEPTH(FEET) =     1.41
    FLOW AVERAGE VELOCITY(FEET/SEC.) =     3.32
    UNIFORM FROUDE NUMBER =     .493
    PRESSURE + MOMENTUM(POUNDS) =         2580.17
    AVERAGED VELOCITY HEAD(FEET) =       .171
    SPECIFIC ENERGY(FEET) =      2.671
=============================================================================
    CRITICAL-DEPTH FLOW INFORMATION:
-----------------------------------------------------------------------------
    CRITICAL FLOW TOP-WIDTH(FEET) =        17.47
    CRITICAL FLOW AREA(SQUARE FEET) =          18.51
    CRITICAL FLOW HYDRAULIC DEPTH(FEET) =     1.06
    CRITICAL FLOW AVERAGE VELOCITY(FEET/SEC.) =     5.83
    CRITICAL DEPTH(FEET) =     1.81
    CRITICAL FLOW PRESSURE + MOMENTUM(POUNDS) =         2018.96
    AVERAGED CRITICAL FLOW VELOCITY HEAD(FEET) =       .529
    CRITICAL FLOW SPECIFIC ENERGY(FEET) =      2.337
```

```
**********DESCRIPTION OF RESULTS*****************************************
* STA 247+75                                                            *
*                                                                       *
*                                                                       *
*************************************************************************

*************************************************************************
))))CHANNEL INPUT INFORMATION((((
-------------------------------------------------------------------------
    CHANNEL Z(HORIZONTAL/VERTICAL) =    4.00
    BASEWIDTH(FEET) =    20.00
    CONSTANT CHANNEL SLOPE(FEET/FEET) =  .024000
    UNIFORM FLOW(CFS) =      766.00
    MANNINGS FRICTION FACTOR =  .0350
=========================================================================
    NORMAL-DEPTH FLOW INFORMATION:
-------------------------------------------------------------------------
    ))))) NORMAL DEPTH(FEET) =   2.54
    FLOW TOP- WIDTH(FEET) =        40.34
    FLOW AREA(SQUARE FEET) =          76.71
    HYDRAULIC DEPTH(FEET) =     1.90
    FLOW AVERAGE VELOCITY(FEET/SEC.) =     9.99
    UNIFORM FROUDE NUMBER =    1.276
    PRESSURE + MOMENTUM(POUNDS) =        20224.65
    AVERAGED VELOCITY HEAD(FEET) =      1.548
    SPECIFIC ENERGY(FEET) =      4.091
=========================================================================
    CRITICAL-DEPTH FLOW INFORMATION:
-------------------------------------------------------------------------
    CRITICAL FLOW TOP-WIDTH(FEET) =        43.36
    CRITICAL FLOW AREA(SQUARE FEET) =          92.48
    CRITICAL FLOW HYDRAULIC DEPTH(FEET) =     2.13
    CRITICAL FLOW AVERAGE VELOCITY(FEET/SEC.) =     8.28
    CRITICAL DEPTH(FEET) =     2.92
    CRITICAL FLOW PRESSURE + MOMENTUM(POUNDS) =        19683.79
    AVERAGED CRITICAL FLOW VELOCITY HEAD(FEET) =      1.065
    CRITICAL FLOW SPECIFIC ENERGY(FEET) =      3.985
```

```
**********DESCRIPTION OF RESULTS*****************************************
* STA 250                                                               *
*                                                                       *
*                                                                       *
*************************************************************************

*************************************************************************
))))CHANNEL INPUT INFORMATION((((
-------------------------------------------------------------------------
    CHANNEL Z(HORIZONTAL/VERTICAL) =    4.00
    BASEWIDTH(FEET) =      .00
    CONSTANT CHANNEL SLOPE(FEET/FEET) =  .010800
    UNIFORM FLOW(CFS) =       12.00
    MANNINGS FRICTION FACTOR =  .0350
=========================================================================
    NORMAL-DEPTH FLOW INFORMATION:
-------------------------------------------------------------------------
    ))))) NORMAL DEPTH(FEET) =   1.04
    FLOW TOP- WIDTH(FEET) =         8.29
    FLOW AREA(SQUARE FEET) =           4.29
    HYDRAULIC DEPTH(FEET) =      .52
    FLOW AVERAGE VELOCITY(FEET/SEC.) =     2.80
    UNIFORM FROUDE NUMBER =     .685
    PRESSURE + MOMENTUM(POUNDS) =          157.47
    AVERAGED VELOCITY HEAD(FEET) =       .121
    SPECIFIC ENERGY(FEET) =      1.157
=========================================================================
    CRITICAL-DEPTH FLOW INFORMATION:
-------------------------------------------------------------------------
    CRITICAL FLOW TOP-WIDTH(FEET) =         7.12
    CRITICAL FLOW AREA(SQUARE FEET) =           3.17
    CRITICAL FLOW HYDRAULIC DEPTH(FEET) =      .45
    CRITICAL FLOW AVERAGE VELOCITY(FEET/SEC.) =     3.78
    CRITICAL DEPTH(FEET) =      .89
    CRITICAL FLOW PRESSURE + MOMENTUM(POUNDS) =          146.73
    AVERAGED CRITICAL FLOW VELOCITY HEAD(FEET) =       .222
    CRITICAL FLOW SPECIFIC ENERGY(FEET) =      1.113
```

```
**********DESCRIPTION OF RESULTS*******************************************
* STA 251                                                                 *
*                                                                         *
*                                                                         *
***************************************************************************

***************************************************************************
))))CHANNEL INPUT INFORMATION((((
---------------------------------------------------------------------------
    CHANNEL Z(HORIZONTAL/VERTICAL) =    4.00
    BASEWIDTH(FEET) =       .00
    CONSTANT CHANNEL SLOPE(FEET/FEET) =  .012000
    UNIFORM FLOW(CFS) =       21.00
    MANNINGS FRICTION FACTOR =  .0350
===========================================================================
    NORMAL-DEPTH FLOW INFORMATION:
---------------------------------------------------------------------------
    ))))) NORMAL DEPTH(FEET) =   1.25
    FLOW TOP- WIDTH(FEET) =        10.03
    FLOW AREA(SQUARE FEET) =           6.28
    HYDRAULIC DEPTH(FEET) =       .63
    FLOW AVERAGE VELOCITY(FEET/SEC.) =     3.34
    UNIFORM FROUDE NUMBER =     .744
    PRESSURE + MOMENTUM(POUNDS) =          299.78
    AVERAGED VELOCITY HEAD(FEET) =       .174
    SPECIFIC ENERGY(FEET) =      1.427
===========================================================================
    CRITICAL-DEPTH FLOW INFORMATION:
---------------------------------------------------------------------------
    CRITICAL FLOW TOP-WIDTH(FEET) =         8.92
    CRITICAL FLOW AREA(SQUARE FEET) =           4.97
    CRITICAL FLOW HYDRAULIC DEPTH(FEET) =       .56
    CRITICAL FLOW AVERAGE VELOCITY(FEET/SEC.) =     4.23
    CRITICAL DEPTH(FEET) =     1.11
    CRITICAL FLOW PRESSURE + MOMENTUM(POUNDS) =          287.18
    AVERAGED CRITICAL FLOW VELOCITY HEAD(FEET) =       .277
    CRITICAL FLOW SPECIFIC ENERGY(FEET) =      1.392
```

```
**********DESCRIPTION OF RESULTS*******************************************
* STA 253                                                                 *
*                                                                         *
*                                                                         *
***************************************************************************

***************************************************************************
))))CHANNEL INPUT INFORMATION((((
---------------------------------------------------------------------------
    CHANNEL Z(HORIZONTAL/VERTICAL) =    4.00
    BASEWIDTH(FEET) =       .00
    CONSTANT CHANNEL SLOPE(FEET/FEET) =  .007200
    UNIFORM FLOW(CFS) =       26.00
    MANNINGS FRICTION FACTOR =  .0350
===========================================================================
    NORMAL-DEPTH FLOW INFORMATION:
---------------------------------------------------------------------------
    ))))) NORMAL DEPTH(FEET) =   1.49
    FLOW TOP- WIDTH(FEET) =        11.95
    FLOW AREA(SQUARE FEET) =           8.92
    HYDRAULIC DEPTH(FEET) =       .75
    FLOW AVERAGE VELOCITY(FEET/SEC.) =     2.91
    UNIFORM FROUDE NUMBER =     .594
    PRESSURE + MOMENTUM(POUNDS) =          423.98
    AVERAGED VELOCITY HEAD(FEET) =       .132
    SPECIFIC ENERGY(FEET) =      1.625
===========================================================================
    CRITICAL-DEPTH FLOW INFORMATION:
---------------------------------------------------------------------------
    CRITICAL FLOW TOP-WIDTH(FEET) =         9.70
    CRITICAL FLOW AREA(SQUARE FEET) =           5.88
    CRITICAL FLOW HYDRAULIC DEPTH(FEET) =       .61
    CRITICAL FLOW AVERAGE VELOCITY(FEET/SEC.) =     4.42
    CRITICAL DEPTH(FEET) =     1.21
    CRITICAL FLOW PRESSURE + MOMENTUM(POUNDS) =          371.08
    AVERAGED CRITICAL FLOW VELOCITY HEAD(FEET) =       .304
    CRITICAL FLOW SPECIFIC ENERGY(FEET) =      1.516
```

```
**********DESCRIPTION OF RESULTS*********************************************
* 256+00                                                                    *
*                                                                           *
*                                                                           *
*****************************************************************************

*****************************************************************************
))))CHANNEL INPUT INFORMATION((((
-----------------------------------------------------------------------------
    NORMAL DEPTH(FEET) =   1.75
    CHANNEL Z(HORIZONTAL/VERTICAL) =    4.00
    BASEWIDTH(FEET) =     4.00
    CONSTANT CHANNEL SLOPE(FEET/FEET) =  .004400
    MANNINGS FRICTION FACTOR =  .0350
=============================================================================
    NORMAL-DEPTH FLOW INFORMATION:
-----------------------------------------------------------------------------
    ))))) NORMAL DEPTH FLOW(CFS) =     55.81
    FLOW TOP- WIDTH(FEET) =        18.00
    FLOW AREA(SQUARE FEET) =          19.25
    HYDRAULIC DEPTH(FEET) =     1.07
    FLOW AVERAGE VELOCITY(FEET/SEC.) =     2.90
    UNIFORM FROUDE NUMBER =     .494
    PRESSURE + MOMENTUM(POUNDS) =         1141.64
    AVERAGED VELOCITY HEAD(FEET) =       .131
    SPECIFIC ENERGY(FEET) =      1.881
=============================================================================
    CRITICAL-DEPTH FLOW INFORMATION:
-----------------------------------------------------------------------------
    CRITICAL FLOW TOP-WIDTH(FEET) =        13.87
    CRITICAL FLOW AREA(SQUARE FEET) =          11.02
    CRITICAL FLOW HYDRAULIC DEPTH(FEET) =      .79
    CRITICAL FLOW AVERAGE VELOCITY(FEET/SEC.) =     5.06
    CRITICAL DEPTH(FEET) =     1.23
    CRITICAL FLOW PRESSURE + MOMENTUM(POUNDS) =          893.73
    AVERAGED CRITICAL FLOW VELOCITY HEAD(FEET) =       .398
    CRITICAL FLOW SPECIFIC ENERGY(FEET) =      1.632


**********DESCRIPTION OF RESULTS*********************************************
* 259+00                                                                    *
*                                                                           *
*                                                                           *
*****************************************************************************

*****************************************************************************
))))CHANNEL INPUT INFORMATION((((
-----------------------------------------------------------------------------
    NORMAL DEPTH(FEET) =   2.00
    CHANNEL Z(HORIZONTAL/VERTICAL) =    4.00
    BASEWIDTH(FEET) =     4.00
    CONSTANT CHANNEL SLOPE(FEET/FEET) =  .018200
    MANNINGS FRICTION FACTOR =  .0350
=============================================================================
    NORMAL-DEPTH FLOW INFORMATION:
-----------------------------------------------------------------------------
    ))))) NORMAL DEPTH FLOW(CFS) =    152.74
    FLOW TOP- WIDTH(FEET) =        20.00
    FLOW AREA(SQUARE FEET) =          24.00
    HYDRAULIC DEPTH(FEET) =     1.20
    FLOW AVERAGE VELOCITY(FEET/SEC.) =     6.36
    UNIFORM FROUDE NUMBER =    1.024
    PRESSURE + MOMENTUM(POUNDS) =         3048.47
    AVERAGED VELOCITY HEAD(FEET) =       .629
    SPECIFIC ENERGY(FEET) =      2.629
=============================================================================
    CRITICAL-DEPTH FLOW INFORMATION:
-----------------------------------------------------------------------------
    CRITICAL FLOW TOP-WIDTH(FEET) =        20.18
    CRITICAL FLOW AREA(SQUARE FEET) =          24.46
    CRITICAL FLOW HYDRAULIC DEPTH(FEET) =     1.21
    CRITICAL FLOW AVERAGE VELOCITY(FEET/SEC.) =     6.24
    CRITICAL DEPTH(FEET) =     2.02
    CRITICAL FLOW PRESSURE + MOMENTUM(POUNDS) =         3047.66
    AVERAGED CRITICAL FLOW VELOCITY HEAD(FEET) =       .605
    CRITICAL FLOW SPECIFIC ENERGY(FEET) =      2.628
```

```
**********DESCRIPTION OF RESULTS*****************************************
* 262+00                                                                *
*                                                                       *
*                                                                       *
*************************************************************************

*************************************************************************
))))CHANNEL INPUT INFORMATION((((
-------------------------------------------------------------------------
    NORMAL DEPTH(FEET) =   1.25
    CHANNEL Z(HORIZONTAL/VERTICAL) =    4.00
    BASEWIDTH(FEET) =     4.00
    CONSTANT CHANNEL SLOPE(FEET/FEET) =  .014000
    MANNINGS FRICTION FACTOR =  .0350
=========================================================================
    NORMAL-DEPTH FLOW INFORMATION:
-------------------------------------------------------------------------
    ))))) NORMAL DEPTH FLOW(CFS) =     48.15
    FLOW TOP- WIDTH(FEET) =        14.00
    FLOW AREA(SQUARE FEET) =          11.25
    HYDRAULIC DEPTH(FEET) =      .80
    FLOW AVERAGE VELOCITY(FEET/SEC.) =     4.28
    UNIFORM FROUDE NUMBER =     .841
    PRESSURE + MOMENTUM(POUNDS) =          756.79
    AVERAGED VELOCITY HEAD(FEET) =       .284
    SPECIFIC ENERGY(FEET) =      1.534
=========================================================================
    CRITICAL-DEPTH FLOW INFORMATION:
-------------------------------------------------------------------------
    CRITICAL FLOW TOP-WIDTH(FEET) =        13.16
    CRITICAL FLOW AREA(SQUARE FEET) =           9.83
    CRITICAL FLOW HYDRAULIC DEPTH(FEET) =      .75
    CRITICAL FLOW AVERAGE VELOCITY(FEET/SEC.) =     4.90
    CRITICAL DEPTH(FEET) =     1.15
    CRITICAL FLOW PRESSURE + MOMENTUM(POUNDS) =          745.75
    AVERAGED CRITICAL FLOW VELOCITY HEAD(FEET) =       .372
    CRITICAL FLOW SPECIFIC ENERGY(FEET) =      1.518


**********DESCRIPTION OF RESULTS*****************************************
* 264+00                                                                *
*                                                                       *
*                                                                       *
*************************************************************************

*************************************************************************
))))CHANNEL INPUT INFORMATION((((
-------------------------------------------------------------------------
    NORMAL DEPTH(FEET) =   1.00
    CHANNEL Z(HORIZONTAL/VERTICAL) =    4.00
    BASEWIDTH(FEET) =     2.00
    CONSTANT CHANNEL SLOPE(FEET/FEET) =  .010000
    MANNINGS FRICTION FACTOR =  .0350
=========================================================================
    NORMAL-DEPTH FLOW INFORMATION:
-------------------------------------------------------------------------
    ))))) NORMAL DEPTH FLOW(CFS) =     17.83
    FLOW TOP- WIDTH(FEET) =        10.00
    FLOW AREA(SQUARE FEET) =           6.00
    HYDRAULIC DEPTH(FEET) =      .60
    FLOW AVERAGE VELOCITY(FEET/SEC.) =     2.97
    UNIFORM FROUDE NUMBER =     .676
    PRESSURE + MOMENTUM(POUNDS) =          248.28
    AVERAGED VELOCITY HEAD(FEET) =       .137
    SPECIFIC ENERGY(FEET) =      1.137
=========================================================================
    CRITICAL-DEPTH FLOW INFORMATION:
-------------------------------------------------------------------------
    CRITICAL FLOW TOP-WIDTH(FEET) =         8.63
    CRITICAL FLOW AREA(SQUARE FEET) =           4.40
    CRITICAL FLOW HYDRAULIC DEPTH(FEET) =      .51
    CRITICAL FLOW AVERAGE VELOCITY(FEET/SEC.) =     4.05
    CRITICAL DEPTH(FEET) =      .83
    CRITICAL FLOW PRESSURE + MOMENTUM(POUNDS) =          230.08
    AVERAGED CRITICAL FLOW VELOCITY HEAD(FEET) =       .255
    CRITICAL FLOW SPECIFIC ENERGY(FEET) =      1.083
```

```
**********DESCRIPTION OF RESULTS*********************************************
* 268+00                                                                    *
*                                                                           *
*                                                                           *
*****************************************************************************

*****************************************************************************
))))CHANNEL INPUT INFORMATION((((
-----------------------------------------------------------------------------
    NORMAL DEPTH(FEET) =   1.50
    CHANNEL Z(HORIZONTAL/VERTICAL) =    4.00
    BASEWIDTH(FEET) =    20.00
    CONSTANT CHANNEL SLOPE(FEET/FEET) =  .020000
    MANNINGS FRICTION FACTOR =  .0350
=============================================================================
    NORMAL-DEPTH FLOW INFORMATION:
-----------------------------------------------------------------------------
    ))))) NORMAL DEPTH FLOW(CFS) =    265.15
    FLOW TOP- WIDTH(FEET) =        32.00
    FLOW AREA(SQUARE FEET) =          39.00
    HYDRAULIC DEPTH(FEET) =     1.22
    FLOW AVERAGE VELOCITY(FEET/SEC.) =     6.80
    UNIFORM FROUDE NUMBER =    1.085
    PRESSURE + MOMENTUM(POUNDS) =         5178.08
    AVERAGED VELOCITY HEAD(FEET) =       .718
    SPECIFIC ENERGY(FEET) =      2.218
=============================================================================
    CRITICAL-DEPTH FLOW INFORMATION:
-----------------------------------------------------------------------------
    CRITICAL FLOW TOP-WIDTH(FEET) =        32.60
    CRITICAL FLOW AREA(SQUARE FEET) =          41.41
    CRITICAL FLOW HYDRAULIC DEPTH(FEET) =     1.27
    CRITICAL FLOW AVERAGE VELOCITY(FEET/SEC.) =     6.40
    CRITICAL DEPTH(FEET) =     1.57
    CRITICAL FLOW PRESSURE + MOMENTUM(POUNDS) =         5161.96
    AVERAGED CRITICAL FLOW VELOCITY HEAD(FEET) =       .636
    CRITICAL FLOW SPECIFIC ENERGY(FEET) =      2.211


**********DESCRIPTION OF RESULTS*********************************************
* 269+50                                                                    *
*                                                                           *
*                                                                           *
*****************************************************************************

*****************************************************************************
))))CHANNEL INPUT INFORMATION((((
-----------------------------------------------------------------------------
    NORMAL DEPTH(FEET) =   1.25
    CHANNEL Z(HORIZONTAL/VERTICAL) =    4.00
    BASEWIDTH(FEET) =    20.00
    CONSTANT CHANNEL SLOPE(FEET/FEET) =  .006800
    MANNINGS FRICTION FACTOR =  .0350
=============================================================================
    NORMAL-DEPTH FLOW INFORMATION:
-----------------------------------------------------------------------------
    ))))) NORMAL DEPTH FLOW(CFS) =    111.67
    FLOW TOP- WIDTH(FEET) =        30.00
    FLOW AREA(SQUARE FEET) =          31.25
    HYDRAULIC DEPTH(FEET) =     1.04
    FLOW AVERAGE VELOCITY(FEET/SEC.) =     3.57
    UNIFORM FROUDE NUMBER =     .617
    PRESSURE + MOMENTUM(POUNDS) =         1910.75
    AVERAGED VELOCITY HEAD(FEET) =       .198
    SPECIFIC ENERGY(FEET) =      1.448
=============================================================================
    CRITICAL-DEPTH FLOW INFORMATION:
-----------------------------------------------------------------------------
    CRITICAL FLOW TOP-WIDTH(FEET) =        27.41
    CRITICAL FLOW AREA(SQUARE FEET) =          21.96
    CRITICAL FLOW HYDRAULIC DEPTH(FEET) =      .80
    CRITICAL FLOW AVERAGE VELOCITY(FEET/SEC.) =     5.09
    CRITICAL DEPTH(FEET) =      .93
    CRITICAL FLOW PRESSURE + MOMENTUM(POUNDS) =         1701.99
    AVERAGED CRITICAL FLOW VELOCITY HEAD(FEET) =       .402
    CRITICAL FLOW SPECIFIC ENERGY(FEET) =      1.328
```

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**********DESCRIPTION OF RESULTS*********************************************
* 273+00                                                                    *
*                                                                           *
*                                                                           *
*****************************************************************************

*****************************************************************************
))))CHANNEL INPUT INFORMATION((((
-----------------------------------------------------------------------------
    NORMAL DEPTH(FEET) =   2.50
    CHANNEL Z(HORIZONTAL/VERTICAL) =    4.00
    BASEWIDTH(FEET) =    10.00
    CONSTANT CHANNEL SLOPE(FEET/FEET) =  .009600
    MANNINGS FRICTION FACTOR =  .0350
=============================================================================
    NORMAL-DEPTH FLOW INFORMATION:
-----------------------------------------------------------------------------
    ))))) NORMAL DEPTH FLOW(CFS) =    288.45
    FLOW TOP- WIDTH(FEET) =        30.00
    FLOW AREA(SQUARE FEET) =          50.00
    HYDRAULIC DEPTH(FEET) =     1.67
    FLOW AVERAGE VELOCITY(FEET/SEC.) =     5.77
    UNIFORM FROUDE NUMBER =     .788
    PRESSURE + MOMENTUM(POUNDS) =         6474.86
    AVERAGED VELOCITY HEAD(FEET) =       .517
    SPECIFIC ENERGY(FEET) =      3.017
=============================================================================
    CRITICAL-DEPTH FLOW INFORMATION:
-----------------------------------------------------------------------------
    CRITICAL FLOW TOP-WIDTH(FEET) =        27.63
    CRITICAL FLOW AREA(SQUARE FEET) =          41.48
    CRITICAL FLOW HYDRAULIC DEPTH(FEET) =     1.50
    CRITICAL FLOW AVERAGE VELOCITY(FEET/SEC.) =     6.95
    CRITICAL DEPTH(FEET) =     2.20
    CRITICAL FLOW PRESSURE + MOMENTUM(POUNDS) =         6294.47
    AVERAGED CRITICAL FLOW VELOCITY HEAD(FEET) =       .751
    CRITICAL FLOW SPECIFIC ENERGY(FEET) =      2.955


**********DESCRIPTION OF RESULTS*********************************************
* 276+00                                                                    *
*                                                                           *
*                                                                           *
*****************************************************************************

*****************************************************************************
))))CHANNEL INPUT INFORMATION((((
-----------------------------------------------------------------------------
    NORMAL DEPTH(FEET) =   2.25
    CHANNEL Z(HORIZONTAL/VERTICAL) =    4.00
    BASEWIDTH(FEET) =    10.00
    CONSTANT CHANNEL SLOPE(FEET/FEET) =  .006000
    MANNINGS FRICTION FACTOR =  .0350
=============================================================================
    NORMAL-DEPTH FLOW INFORMATION:
-----------------------------------------------------------------------------
    ))))) NORMAL DEPTH FLOW(CFS) =    184.00
    FLOW TOP- WIDTH(FEET) =        28.00
    FLOW AREA(SQUARE FEET) =          42.75
    HYDRAULIC DEPTH(FEET) =     1.53
    FLOW AVERAGE VELOCITY(FEET/SEC.) =     4.30
    UNIFORM FROUDE NUMBER =     .614
    PRESSURE + MOMENTUM(POUNDS) =         4061.86
    AVERAGED VELOCITY HEAD(FEET) =       .288
    SPECIFIC ENERGY(FEET) =      2.538
=============================================================================
    CRITICAL-DEPTH FLOW INFORMATION:
-----------------------------------------------------------------------------
    CRITICAL FLOW TOP-WIDTH(FEET) =        23.84
    CRITICAL FLOW AREA(SQUARE FEET) =          29.27
    CRITICAL FLOW HYDRAULIC DEPTH(FEET) =     1.23
    CRITICAL FLOW AVERAGE VELOCITY(FEET/SEC.) =     6.29
    CRITICAL DEPTH(FEET) =     1.73
    CRITICAL FLOW PRESSURE + MOMENTUM(POUNDS) =         3605.88
    AVERAGED CRITICAL FLOW VELOCITY HEAD(FEET) =       .614
    CRITICAL FLOW SPECIFIC ENERGY(FEET) =      2.344
=============================================================================
```

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**********DESCRIPTION OF RESULTS*********************************************
* 277+75                                                                    *
*                                                                           *
*                                                                           *
*****************************************************************************

*****************************************************************************
))))CHANNEL INPUT INFORMATION((((
-----------------------------------------------------------------------------
    NORMAL DEPTH(FEET) =   1.75
    CHANNEL Z(HORIZONTAL/VERTICAL) =    4.00
    BASEWIDTH(FEET) =     5.00
    CONSTANT CHANNEL SLOPE(FEET/FEET) =  .016000
    MANNINGS FRICTION FACTOR =  .0350
=============================================================================
    NORMAL-DEPTH FLOW INFORMATION:
-----------------------------------------------------------------------------
    ))))) NORMAL DEPTH FLOW(CFS) =    118.77
    FLOW TOP- WIDTH(FEET) =        19.00
    FLOW AREA(SQUARE FEET) =          21.00
    HYDRAULIC DEPTH(FEET) =     1.11
    FLOW AVERAGE VELOCITY(FEET/SEC.) =     5.66
    UNIFORM FROUDE NUMBER =     .948
    PRESSURE + MOMENTUM(POUNDS) =         2225.43
    AVERAGED VELOCITY HEAD(FEET) =       .497
    SPECIFIC ENERGY(FEET) =      2.247
=============================================================================
    CRITICAL-DEPTH FLOW INFORMATION:
-----------------------------------------------------------------------------
    CRITICAL FLOW TOP-WIDTH(FEET) =        18.63
    CRITICAL FLOW AREA(SQUARE FEET) =          20.13
    CRITICAL FLOW HYDRAULIC DEPTH(FEET) =     1.08
    CRITICAL FLOW AVERAGE VELOCITY(FEET/SEC.) =     5.90
    CRITICAL DEPTH(FEET) =     1.70
    CRITICAL FLOW PRESSURE + MOMENTUM(POUNDS) =         2222.36
    AVERAGED CRITICAL FLOW VELOCITY HEAD(FEET) =       .541
    CRITICAL FLOW SPECIFIC ENERGY(FEET) =      2.244


**********DESCRIPTION OF RESULTS*********************************************
* 279+00                                                                    *
*                                                                           *
*                                                                           *
*****************************************************************************

*****************************************************************************
))))CHANNEL INPUT INFORMATION((((
-----------------------------------------------------------------------------
    NORMAL DEPTH(FEET) =   1.63
    CHANNEL Z(HORIZONTAL/VERTICAL) =    4.00
    BASEWIDTH(FEET) =      .00
    CONSTANT CHANNEL SLOPE(FEET/FEET) =  .009600
    MANNINGS FRICTION FACTOR =  .0350
=============================================================================
    NORMAL-DEPTH FLOW INFORMATION:
-----------------------------------------------------------------------------
    ))))) NORMAL DEPTH FLOW(CFS) =     37.49
    FLOW TOP- WIDTH(FEET) =        13.00
    FLOW AREA(SQUARE FEET) =          10.56
    HYDRAULIC DEPTH(FEET) =      .81
    FLOW AVERAGE VELOCITY(FEET/SEC.) =     3.55
    UNIFORM FROUDE NUMBER =     .694
    PRESSURE + MOMENTUM(POUNDS) =          614.93
    AVERAGED VELOCITY HEAD(FEET) =       .196
    SPECIFIC ENERGY(FEET) =      1.821
=============================================================================
    CRITICAL-DEPTH FLOW INFORMATION:
-----------------------------------------------------------------------------
    CRITICAL FLOW TOP-WIDTH(FEET) =        11.22
    CRITICAL FLOW AREA(SQUARE FEET) =           7.87
    CRITICAL FLOW HYDRAULIC DEPTH(FEET) =      .70
    CRITICAL FLOW AVERAGE VELOCITY(FEET/SEC.) =     4.76
    CRITICAL DEPTH(FEET) =     1.40
    CRITICAL FLOW PRESSURE + MOMENTUM(POUNDS) =          575.77
    AVERAGED CRITICAL FLOW VELOCITY HEAD(FEET) =       .352
    CRITICAL FLOW SPECIFIC ENERGY(FEET) =      1.755
```

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**********DESCRIPTION OF RESULTS*******************************************
* 282+00                                                                 *
*                                                                        *
*                                                                        *
**************************************************************************

**************************************************************************
))))CHANNEL INPUT INFORMATION((((
--------------------------------------------------------------------------
    NORMAL DEPTH(FEET) =   1.25
    CHANNEL Z(HORIZONTAL/VERTICAL) =    4.00
    BASEWIDTH(FEET) =       .00
    CONSTANT CHANNEL SLOPE(FEET/FEET) =  .011600
    MANNINGS FRICTION FACTOR =  .0350
==========================================================================
    NORMAL-DEPTH FLOW INFORMATION:
--------------------------------------------------------------------------
    ))))) NORMAL DEPTH FLOW(CFS) =     20.47
    FLOW TOP- WIDTH(FEET) =        10.00
    FLOW AREA(SQUARE FEET) =           6.25
    HYDRAULIC DEPTH(FEET) =      .63
    FLOW AVERAGE VELOCITY(FEET/SEC.) =     3.28
    UNIFORM FROUDE NUMBER =     .730
    PRESSURE + MOMENTUM(POUNDS) =          292.47
    AVERAGED VELOCITY HEAD(FEET) =       .167
    SPECIFIC ENERGY(FEET) =      1.417
==========================================================================
    CRITICAL-DEPTH FLOW INFORMATION:
--------------------------------------------------------------------------
    CRITICAL FLOW TOP-WIDTH(FEET) =         8.82
    CRITICAL FLOW AREA(SQUARE FEET) =           4.86
    CRITICAL FLOW HYDRAULIC DEPTH(FEET) =      .55
    CRITICAL FLOW AVERAGE VELOCITY(FEET/SEC.) =     4.21
    CRITICAL DEPTH(FEET) =     1.10
    CRITICAL FLOW PRESSURE + MOMENTUM(POUNDS) =          278.57
    AVERAGED CRITICAL FLOW VELOCITY HEAD(FEET) =       .275
    CRITICAL FLOW SPECIFIC ENERGY(FEET) =      1.378


**********DESCRIPTION OF RESULTS*******************************************
* 286+00                                                                 *
*                                                                        *
*                                                                        *
**************************************************************************

**************************************************************************
))))CHANNEL INPUT INFORMATION((((
--------------------------------------------------------------------------
    NORMAL DEPTH(FEET) =   2.00
    CHANNEL Z(HORIZONTAL/VERTICAL) =    4.00
    BASEWIDTH(FEET) =    20.00
    CONSTANT CHANNEL SLOPE(FEET/FEET) =  .003200
    MANNINGS FRICTION FACTOR =  .0350
==========================================================================
    NORMAL-DEPTH FLOW INFORMATION:
--------------------------------------------------------------------------
    ))))) NORMAL DEPTH FLOW(CFS) =    178.94
    FLOW TOP- WIDTH(FEET) =        36.00
    FLOW AREA(SQUARE FEET) =          56.00
    HYDRAULIC DEPTH(FEET) =     1.56
    FLOW AVERAGE VELOCITY(FEET/SEC.) =     3.20
    UNIFORM FROUDE NUMBER =     .451
    PRESSURE + MOMENTUM(POUNDS) =         4269.63
    AVERAGED VELOCITY HEAD(FEET) =       .159
    SPECIFIC ENERGY(FEET) =      2.159
==========================================================================
    CRITICAL-DEPTH FLOW INFORMATION:
--------------------------------------------------------------------------
    CRITICAL FLOW TOP-WIDTH(FEET) =        29.93
    CRITICAL FLOW AREA(SQUARE FEET) =          30.98
    CRITICAL FLOW HYDRAULIC DEPTH(FEET) =     1.04
    CRITICAL FLOW AVERAGE VELOCITY(FEET/SEC.) =     5.78
    CRITICAL DEPTH(FEET) =     1.24
    CRITICAL FLOW PRESSURE + MOMENTUM(POUNDS) =         3122.89
    AVERAGED CRITICAL FLOW VELOCITY HEAD(FEET) =       .518
    CRITICAL FLOW SPECIFIC ENERGY(FEET) =      1.759
```

```
**********DESCRIPTION OF RESULTS*********************************************
* 287+50                                                                    *
*                                                                           *
*                                                                           *
*****************************************************************************

*****************************************************************************
))))CHANNEL INPUT INFORMATION((((
-----------------------------------------------------------------------------
    NORMAL DEPTH(FEET) =   2.00
    CHANNEL Z(HORIZONTAL/VERTICAL) =    4.00
    BASEWIDTH(FEET) =    20.00
    CONSTANT CHANNEL SLOPE(FEET/FEET) =  .018800
    MANNINGS FRICTION FACTOR =  .0350
=============================================================================
    NORMAL-DEPTH FLOW INFORMATION:
-----------------------------------------------------------------------------
    ))))) NORMAL DEPTH FLOW(CFS) =    433.72
    FLOW TOP- WIDTH(FEET) =        36.00
    FLOW AREA(SQUARE FEET) =          56.00
    HYDRAULIC DEPTH(FEET) =     1.56
    FLOW AVERAGE VELOCITY(FEET/SEC.) =     7.74
    UNIFORM FROUDE NUMBER =    1.094
    PRESSURE + MOMENTUM(POUNDS) =         9671.25
    AVERAGED VELOCITY HEAD(FEET) =       .931
    SPECIFIC ENERGY(FEET) =      2.931
=============================================================================
    CRITICAL-DEPTH FLOW INFORMATION:
-----------------------------------------------------------------------------
    CRITICAL FLOW TOP-WIDTH(FEET) =        36.87
    CRITICAL FLOW AREA(SQUARE FEET) =          59.96
    CRITICAL FLOW HYDRAULIC DEPTH(FEET) =     1.63
    CRITICAL FLOW AVERAGE VELOCITY(FEET/SEC.) =     7.23
    CRITICAL DEPTH(FEET) =     2.11
    CRITICAL FLOW PRESSURE + MOMENTUM(POUNDS) =         9634.50
    AVERAGED CRITICAL FLOW VELOCITY HEAD(FEET) =       .812
    CRITICAL FLOW SPECIFIC ENERGY(FEET) =      2.921


**********DESCRIPTION OF RESULTS*********************************************
* 289+00                                                                    *
*                                                                           *
*                                                                           *
*****************************************************************************

*****************************************************************************
))))CHANNEL INPUT INFORMATION((((
-----------------------------------------------------------------------------
    NORMAL DEPTH(FEET) =   1.50
    CHANNEL Z(HORIZONTAL/VERTICAL) =    4.00
    BASEWIDTH(FEET) =     7.00
    CONSTANT CHANNEL SLOPE(FEET/FEET) =  .007600
    MANNINGS FRICTION FACTOR =  .0350
=============================================================================
    NORMAL-DEPTH FLOW INFORMATION:
-----------------------------------------------------------------------------
    ))))) NORMAL DEPTH FLOW(CFS) =     72.50
    FLOW TOP- WIDTH(FEET) =        19.00
    FLOW AREA(SQUARE FEET) =          19.50
    HYDRAULIC DEPTH(FEET) =     1.03
    FLOW AVERAGE VELOCITY(FEET/SEC.) =     3.72
    UNIFORM FROUDE NUMBER =     .647
    PRESSURE + MOMENTUM(POUNDS) =         1294.56
    AVERAGED VELOCITY HEAD(FEET) =       .215
    SPECIFIC ENERGY(FEET) =      1.715
=============================================================================
    CRITICAL-DEPTH FLOW INFORMATION:
-----------------------------------------------------------------------------
    CRITICAL FLOW TOP-WIDTH(FEET) =        16.47
    CRITICAL FLOW AREA(SQUARE FEET) =          13.89
    CRITICAL FLOW HYDRAULIC DEPTH(FEET) =      .84
    CRITICAL FLOW AVERAGE VELOCITY(FEET/SEC.) =     5.22
    CRITICAL DEPTH(FEET) =     1.18
    CRITICAL FLOW PRESSURE + MOMENTUM(POUNDS) =         1177.31
    AVERAGED CRITICAL FLOW VELOCITY HEAD(FEET) =       .423
    CRITICAL FLOW SPECIFIC ENERGY(FEET) =      1.607
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**********DESCRIPTION OF RESULTS*********************************************
* 290+70                                                                    *
*                                                                           *
*                                                                           *
*****************************************************************************

*****************************************************************************
))))CHANNEL INPUT INFORMATION((((
-----------------------------------------------------------------------------
    NORMAL DEPTH(FEET) =   1.75
    CHANNEL Z(HORIZONTAL/VERTICAL) =    4.00
    BASEWIDTH(FEET) =    10.00
    CONSTANT CHANNEL SLOPE(FEET/FEET) =  .012400
    MANNINGS FRICTION FACTOR =  .0350
=============================================================================
    NORMAL-DEPTH FLOW INFORMATION:
-----------------------------------------------------------------------------
    ))))) NORMAL DEPTH FLOW(CFS) =    160.39
    FLOW TOP- WIDTH(FEET) =        24.00
    FLOW AREA(SQUARE FEET) =          29.75
    HYDRAULIC DEPTH(FEET) =     1.24
    FLOW AVERAGE VELOCITY(FEET/SEC.) =     5.39
    UNIFORM FROUDE NUMBER =     .853
    PRESSURE + MOMENTUM(POUNDS) =         3077.13
    AVERAGED VELOCITY HEAD(FEET) =       .451
    SPECIFIC ENERGY(FEET) =      2.201
=============================================================================
    CRITICAL-DEPTH FLOW INFORMATION:
-----------------------------------------------------------------------------
    CRITICAL FLOW TOP-WIDTH(FEET) =        22.83
    CRITICAL FLOW AREA(SQUARE FEET) =          26.32
    CRITICAL FLOW HYDRAULIC DEPTH(FEET) =     1.15
    CRITICAL FLOW AVERAGE VELOCITY(FEET/SEC.) =     6.09
    CRITICAL DEPTH(FEET) =     1.60
    CRITICAL FLOW PRESSURE + MOMENTUM(POUNDS) =         3039.36
    AVERAGED CRITICAL FLOW VELOCITY HEAD(FEET) =       .577
    CRITICAL FLOW SPECIFIC ENERGY(FEET) =      2.180


**********DESCRIPTION OF RESULTS*********************************************
* 295+00                                                                    *
*                                                                           *
*                                                                           *
*****************************************************************************

*****************************************************************************
))))CHANNEL INPUT INFORMATION((((
-----------------------------------------------------------------------------
    NORMAL DEPTH(FEET) =   1.63
    CHANNEL Z(HORIZONTAL/VERTICAL) =    4.00
    BASEWIDTH(FEET) =     4.00
    CONSTANT CHANNEL SLOPE(FEET/FEET) =  .005000
    MANNINGS FRICTION FACTOR =  .0350
=============================================================================
    NORMAL-DEPTH FLOW INFORMATION:
-----------------------------------------------------------------------------
    ))))) NORMAL DEPTH FLOW(CFS) =     50.56
    FLOW TOP- WIDTH(FEET) =        17.00
    FLOW AREA(SQUARE FEET) =          17.06
    HYDRAULIC DEPTH(FEET) =     1.00
    FLOW AVERAGE VELOCITY(FEET/SEC.) =     2.96
    UNIFORM FROUDE NUMBER =     .521
    PRESSURE + MOMENTUM(POUNDS) =          976.90
    AVERAGED VELOCITY HEAD(FEET) =       .136
    SPECIFIC ENERGY(FEET) =      1.761
=============================================================================
    CRITICAL-DEPTH FLOW INFORMATION:
-----------------------------------------------------------------------------
    CRITICAL FLOW TOP-WIDTH(FEET) =        13.39
    CRITICAL FLOW AREA(SQUARE FEET) =          10.21
    CRITICAL FLOW HYDRAULIC DEPTH(FEET) =      .76
    CRITICAL FLOW AVERAGE VELOCITY(FEET/SEC.) =     4.95
    CRITICAL DEPTH(FEET) =     1.17
    CRITICAL FLOW PRESSURE + MOMENTUM(POUNDS) =          791.87
    AVERAGED CRITICAL FLOW VELOCITY HEAD(FEET) =       .381
    CRITICAL FLOW SPECIFIC ENERGY(FEET) =      1.555
```

```
**********DESCRIPTION OF RESULTS*********************************************
* 296+40                                                                    *
*                                                                           *
*                                                                           *
*****************************************************************************

*****************************************************************************
))))CHANNEL INPUT INFORMATION((((
-----------------------------------------------------------------------------
    NORMAL DEPTH(FEET) =   1.63
    CHANNEL Z(HORIZONTAL/VERTICAL) =    4.00
    BASEWIDTH(FEET) =     4.00
    CONSTANT CHANNEL SLOPE(FEET/FEET) =  .006000
    MANNINGS FRICTION FACTOR =  .0350
=============================================================================
    NORMAL-DEPTH FLOW INFORMATION:
-----------------------------------------------------------------------------
    ))))) NORMAL DEPTH FLOW(CFS) =     55.39
    FLOW TOP- WIDTH(FEET) =        17.00
    FLOW AREA(SQUARE FEET) =          17.06
    HYDRAULIC DEPTH(FEET) =     1.00
    FLOW AVERAGE VELOCITY(FEET/SEC.) =     3.25
    UNIFORM FROUDE NUMBER =     .571
    PRESSURE + MOMENTUM(POUNDS) =         1034.96
    AVERAGED VELOCITY HEAD(FEET) =       .164
    SPECIFIC ENERGY(FEET) =      1.789
=============================================================================
    CRITICAL-DEPTH FLOW INFORMATION:
-----------------------------------------------------------------------------
    CRITICAL FLOW TOP-WIDTH(FEET) =        13.83
    CRITICAL FLOW AREA(SQUARE FEET) =          10.96
    CRITICAL FLOW HYDRAULIC DEPTH(FEET) =      .79
    CRITICAL FLOW AVERAGE VELOCITY(FEET/SEC.) =     5.05
    CRITICAL DEPTH(FEET) =     1.23
    CRITICAL FLOW PRESSURE + MOMENTUM(POUNDS) =          885.45
    AVERAGED CRITICAL FLOW VELOCITY HEAD(FEET) =       .397
    CRITICAL FLOW SPECIFIC ENERGY(FEET) =      1.626
=============================================================================


**********DESCRIPTION OF RESULTS*********************************************
* 298+00                                                                    *
*                                                                           *
*                                                                           *
*****************************************************************************

*****************************************************************************
))))CHANNEL INPUT INFORMATION((((
-----------------------------------------------------------------------------
    NORMAL DEPTH(FEET) =   1.50
    CHANNEL Z(HORIZONTAL/VERTICAL) =    4.00
    BASEWIDTH(FEET) =     2.00
    CONSTANT CHANNEL SLOPE(FEET/FEET) =  .008400
    MANNINGS FRICTION FACTOR =  .0350
=============================================================================
    NORMAL-DEPTH FLOW INFORMATION:
-----------------------------------------------------------------------------
    ))))) NORMAL DEPTH FLOW(CFS) =     41.41
    FLOW TOP- WIDTH(FEET) =        14.00
    FLOW AREA(SQUARE FEET) =          12.00
    HYDRAULIC DEPTH(FEET) =      .86
    FLOW AVERAGE VELOCITY(FEET/SEC.) =     3.45
    UNIFORM FROUDE NUMBER =     .657
    PRESSURE + MOMENTUM(POUNDS) =          698.12
    AVERAGED VELOCITY HEAD(FEET) =       .185
    SPECIFIC ENERGY(FEET) =      1.685
=============================================================================
    CRITICAL-DEPTH FLOW INFORMATION:
-----------------------------------------------------------------------------
    CRITICAL FLOW TOP-WIDTH(FEET) =        11.89
    CRITICAL FLOW AREA(SQUARE FEET) =          8.59
    CRITICAL FLOW HYDRAULIC DEPTH(FEET) =      .72
    CRITICAL FLOW AVERAGE VELOCITY(FEET/SEC.) =     4.82
    CRITICAL DEPTH(FEET) =     1.24
    CRITICAL FLOW PRESSURE + MOMENTUM(POUNDS) =          639.60
    AVERAGED CRITICAL FLOW VELOCITY HEAD(FEET) =       .361
    CRITICAL FLOW SPECIFIC ENERGY(FEET) =      1.597
```

```
**********DESCRIPTION OF RESULTS*******************************************
* 303+00                                                                  *
*                                                                         *
*                                                                         *
***************************************************************************

***************************************************************************
))))CHANNEL INPUT INFORMATION((((
---------------------------------------------------------------------------
    NORMAL DEPTH(FEET) =   3.00
    CHANNEL Z(HORIZONTAL/VERTICAL) =    4.00
    BASEWIDTH(FEET) =     2.00
    CONSTANT CHANNEL SLOPE(FEET/FEET) =  .004000
    MANNINGS FRICTION FACTOR =  .0350
===========================================================================
    NORMAL-DEPTH FLOW INFORMATION:
---------------------------------------------------------------------------
    ))))) NORMAL DEPTH FLOW(CFS) =    152.40
    FLOW TOP- WIDTH(FEET) =        26.00
    FLOW AREA(SQUARE FEET) =          42.00
    HYDRAULIC DEPTH(FEET) =     1.62
    FLOW AVERAGE VELOCITY(FEET/SEC.) =     3.63
    UNIFORM FROUDE NUMBER =     .503
    PRESSURE + MOMENTUM(POUNDS) =         3879.57
    AVERAGED VELOCITY HEAD(FEET) =       .204
    SPECIFIC ENERGY(FEET) =      3.204
===========================================================================
    CRITICAL-DEPTH FLOW INFORMATION:
---------------------------------------------------------------------------
    CRITICAL FLOW TOP-WIDTH(FEET) =        19.81
    CRITICAL FLOW AREA(SQUARE FEET) =          24.27
    CRITICAL FLOW HYDRAULIC DEPTH(FEET) =     1.23
    CRITICAL FLOW AVERAGE VELOCITY(FEET/SEC.) =     6.28
    CRITICAL DEPTH(FEET) =     2.23
    CRITICAL FLOW PRESSURE + MOMENTUM(POUNDS) =         3081.10
    AVERAGED CRITICAL FLOW VELOCITY HEAD(FEET) =       .612
    CRITICAL FLOW SPECIFIC ENERGY(FEET) =      2.838
```

```
**********DESCRIPTION OF RESULTS*******************************************
* 307+00                                                                  *
*                                                                         *
*                                                                         *
***************************************************************************

***************************************************************************
))))CHANNEL INPUT INFORMATION((((
---------------------------------------------------------------------------
    NORMAL DEPTH(FEET) =   1.50
    CHANNEL Z(HORIZONTAL/VERTICAL) =    4.00
    BASEWIDTH(FEET) =      .00
    CONSTANT CHANNEL SLOPE(FEET/FEET) =  .004000
    MANNINGS FRICTION FACTOR =  .0350
===========================================================================
    NORMAL-DEPTH FLOW INFORMATION:
---------------------------------------------------------------------------
    ))))) NORMAL DEPTH FLOW(CFS) =     19.55
    FLOW TOP- WIDTH(FEET) =        12.00
    FLOW AREA(SQUARE FEET) =           9.00
    HYDRAULIC DEPTH(FEET) =      .75
    FLOW AVERAGE VELOCITY(FEET/SEC.) =     2.17
    UNIFORM FROUDE NUMBER =     .442
    PRESSURE + MOMENTUM(POUNDS) =          363.10
    AVERAGED VELOCITY HEAD(FEET) =       .073
    SPECIFIC ENERGY(FEET) =      1.573
===========================================================================
    CRITICAL-DEPTH FLOW INFORMATION:
---------------------------------------------------------------------------
    CRITICAL FLOW TOP-WIDTH(FEET) =         8.65
    CRITICAL FLOW AREA(SQUARE FEET) =           4.68
    CRITICAL FLOW HYDRAULIC DEPTH(FEET) =      .54
    CRITICAL FLOW AVERAGE VELOCITY(FEET/SEC.) =     4.18
    CRITICAL DEPTH(FEET) =     1.08
    CRITICAL FLOW PRESSURE + MOMENTUM(POUNDS) =          263.56
    AVERAGED CRITICAL FLOW VELOCITY HEAD(FEET) =       .271
    CRITICAL FLOW SPECIFIC ENERGY(FEET) =      1.353
```

```
**********DESCRIPTION OF RESULTS*****************************************
* 310+50                                                                *
*                                                                       *
*                                                                       *
*************************************************************************

*************************************************************************
))))CHANNEL INPUT INFORMATION((((
-------------------------------------------------------------------------
    NORMAL DEPTH(FEET) =   1.50
    CHANNEL Z(HORIZONTAL/VERTICAL) =    4.00
    BASEWIDTH(FEET) =      .00
    CONSTANT CHANNEL SLOPE(FEET/FEET) =  .009300
    MANNINGS FRICTION FACTOR =  .0350
=========================================================================
    NORMAL-DEPTH FLOW INFORMATION:
-------------------------------------------------------------------------
    ))))) NORMAL DEPTH FLOW(CFS) =     29.81
    FLOW TOP- WIDTH(FEET) =        12.00
    FLOW AREA(SQUARE FEET) =           9.00
    HYDRAULIC DEPTH(FEET) =      .75
    FLOW AVERAGE VELOCITY(FEET/SEC.) =     3.31
    UNIFORM FROUDE NUMBER =     .674
    PRESSURE + MOMENTUM(POUNDS) =          472.15
    AVERAGED VELOCITY HEAD(FEET) =       .170
    SPECIFIC ENERGY(FEET) =      1.670
=========================================================================
    CRITICAL-DEPTH FLOW INFORMATION:
-------------------------------------------------------------------------
    CRITICAL FLOW TOP-WIDTH(FEET) =        10.25
    CRITICAL FLOW AREA(SQUARE FEET) =           6.57
    CRITICAL FLOW HYDRAULIC DEPTH(FEET) =      .64
    CRITICAL FLOW AVERAGE VELOCITY(FEET/SEC.) =     4.54
    CRITICAL DEPTH(FEET) =     1.28
    CRITICAL FLOW PRESSURE + MOMENTUM(POUNDS) =          437.25
    AVERAGED CRITICAL FLOW VELOCITY HEAD(FEET) =       .320
    CRITICAL FLOW SPECIFIC ENERGY(FEET) =      1.601
```

```
**********DESCRIPTION OF RESULTS*****************************************
* 315+00                                                                *
*                                                                       *
*                                                                       *
*************************************************************************

*************************************************************************
))))CHANNEL INPUT INFORMATION((((
-------------------------------------------------------------------------
    NORMAL DEPTH(FEET) =   1.50
    CHANNEL Z(HORIZONTAL/VERTICAL) =    4.00
    BASEWIDTH(FEET) =      .00
    CONSTANT CHANNEL SLOPE(FEET/FEET) =  .006400
    MANNINGS FRICTION FACTOR =  .0350
=========================================================================
    NORMAL-DEPTH FLOW INFORMATION:
-------------------------------------------------------------------------
    ))))) NORMAL DEPTH FLOW(CFS) =     24.73
    FLOW TOP- WIDTH(FEET) =        12.00
    FLOW AREA(SQUARE FEET) =           9.00
    HYDRAULIC DEPTH(FEET) =      .75
    FLOW AVERAGE VELOCITY(FEET/SEC.) =     2.75
    UNIFORM FROUDE NUMBER =     .559
    PRESSURE + MOMENTUM(POUNDS) =          412.48
    AVERAGED VELOCITY HEAD(FEET) =       .117
    SPECIFIC ENERGY(FEET) =      1.617
=========================================================================
    CRITICAL-DEPTH FLOW INFORMATION:
-------------------------------------------------------------------------
    CRITICAL FLOW TOP-WIDTH(FEET) =         9.51
    CRITICAL FLOW AREA(SQUARE FEET) =           5.65
    CRITICAL FLOW HYDRAULIC DEPTH(FEET) =      .59
    CRITICAL FLOW AVERAGE VELOCITY(FEET/SEC.) =     4.38
    CRITICAL DEPTH(FEET) =     1.19
    CRITICAL FLOW PRESSURE + MOMENTUM(POUNDS) =          349.42
    AVERAGED CRITICAL FLOW VELOCITY HEAD(FEET) =       .297
    CRITICAL FLOW SPECIFIC ENERGY(FEET) =      1.486
```

```
**********DESCRIPTION OF RESULTS*********************************************
* 316+50                                                                    *
*                                                                           *
*                                                                           *
*****************************************************************************

*****************************************************************************
))))CHANNEL INPUT INFORMATION((((
-----------------------------------------------------------------------------
    NORMAL DEPTH(FEET) =   1.50
    CHANNEL Z(HORIZONTAL/VERTICAL) =    4.00
    BASEWIDTH(FEET) =      .00
    CONSTANT CHANNEL SLOPE(FEET/FEET) =  .011000
    MANNINGS FRICTION FACTOR =  .0350
=============================================================================
    NORMAL-DEPTH FLOW INFORMATION:
-----------------------------------------------------------------------------
    ))))) NORMAL DEPTH FLOW(CFS) =     32.42
    FLOW TOP- WIDTH(FEET) =        12.00
    FLOW AREA(SQUARE FEET) =           9.00
    HYDRAULIC DEPTH(FEET) =      .75
    FLOW AVERAGE VELOCITY(FEET/SEC.) =     3.60
    UNIFORM FROUDE NUMBER =     .733
    PRESSURE + MOMENTUM(POUNDS) =          507.12
    AVERAGED VELOCITY HEAD(FEET) =       .201
    SPECIFIC ENERGY(FEET) =      1.701
=============================================================================
    CRITICAL-DEPTH FLOW INFORMATION:
-----------------------------------------------------------------------------
    CRITICAL FLOW TOP-WIDTH(FEET) =        10.60
    CRITICAL FLOW AREA(SQUARE FEET) =           7.02
    CRITICAL FLOW HYDRAULIC DEPTH(FEET) =      .66
    CRITICAL FLOW AVERAGE VELOCITY(FEET/SEC.) =     4.62
    CRITICAL DEPTH(FEET) =     1.32
    CRITICAL FLOW PRESSURE + MOMENTUM(POUNDS) =          483.59
    AVERAGED CRITICAL FLOW VELOCITY HEAD(FEET) =       .332
    CRITICAL FLOW SPECIFIC ENERGY(FEET) =      1.656


**********DESCRIPTION OF RESULTS*********************************************
* 322+00                                                                    *
*                                                                           *
*                                                                           *
*****************************************************************************

*****************************************************************************
))))CHANNEL INPUT INFORMATION((((
-----------------------------------------------------------------------------
    NORMAL DEPTH(FEET) =   1.50
    CHANNEL Z(HORIZONTAL/VERTICAL) =    4.00
    BASEWIDTH(FEET) =      .00
    CONSTANT CHANNEL SLOPE(FEET/FEET) =  .013800
    MANNINGS FRICTION FACTOR =  .0350
=============================================================================
    NORMAL-DEPTH FLOW INFORMATION:
-----------------------------------------------------------------------------
    ))))) NORMAL DEPTH FLOW(CFS) =     36.31
    FLOW TOP- WIDTH(FEET) =        12.00
    FLOW AREA(SQUARE FEET) =           9.00
    HYDRAULIC DEPTH(FEET) =      .75
    FLOW AVERAGE VELOCITY(FEET/SEC.) =     4.03
    UNIFORM FROUDE NUMBER =     .821
    PRESSURE + MOMENTUM(POUNDS) =          564.73
    AVERAGED VELOCITY HEAD(FEET) =       .253
    SPECIFIC ENERGY(FEET) =      1.753
=============================================================================
    CRITICAL-DEPTH FLOW INFORMATION:
-----------------------------------------------------------------------------
    CRITICAL FLOW TOP-WIDTH(FEET) =        11.09
    CRITICAL FLOW AREA(SQUARE FEET) =           7.69
    CRITICAL FLOW HYDRAULIC DEPTH(FEET) =      .69
    CRITICAL FLOW AVERAGE VELOCITY(FEET/SEC.) =     4.72
    CRITICAL DEPTH(FEET) =     1.39
    CRITICAL FLOW PRESSURE + MOMENTUM(POUNDS) =          554.08
    AVERAGED CRITICAL FLOW VELOCITY HEAD(FEET) =       .346
    CRITICAL FLOW SPECIFIC ENERGY(FEET) =      1.733
```

```
**********DESCRIPTION OF RESULTS*****************************************
* STA 328                                                                *
*                                                                        *
*                                                                        *
**************************************************************************

**************************************************************************
))))CHANNEL INPUT INFORMATION((((
--------------------------------------------------------------------------
    CHANNEL Z(HORIZONTAL/VERTICAL) =    4.00
    BASEWIDTH(FEET) =     4.00
    CONSTANT CHANNEL SLOPE(FEET/FEET) =  .012500
    UNIFORM FLOW(CFS) =       45.00
    MANNINGS FRICTION FACTOR =  .0350
==========================================================================
    NORMAL-DEPTH FLOW INFORMATION:
--------------------------------------------------------------------------
    ))))) NORMAL DEPTH(FEET) =   1.24
    FLOW TOP- WIDTH(FEET) =        13.93
    FLOW AREA(SQUARE FEET) =          11.13
    HYDRAULIC DEPTH(FEET) =      .80
    FLOW AVERAGE VELOCITY(FEET/SEC.) =     4.04
    UNIFORM FROUDE NUMBER =     .797
    PRESSURE + MOMENTUM(POUNDS) =          704.15
    AVERAGED VELOCITY HEAD(FEET) =       .254
    SPECIFIC ENERGY(FEET) =      1.495
==========================================================================
    CRITICAL-DEPTH FLOW INFORMATION:
--------------------------------------------------------------------------
    CRITICAL FLOW TOP-WIDTH(FEET) =        12.84
    CRITICAL FLOW AREA(SQUARE FEET) =           9.31
    CRITICAL FLOW HYDRAULIC DEPTH(FEET) =      .72
    CRITICAL FLOW AVERAGE VELOCITY(FEET/SEC.) =     4.84
    CRITICAL DEPTH(FEET) =     1.11
    CRITICAL FLOW PRESSURE + MOMENTUM(POUNDS) =          686.41
    AVERAGED CRITICAL FLOW VELOCITY HEAD(FEET) =       .363
    CRITICAL FLOW SPECIFIC ENERGY(FEET) =      1.468


**********DESCRIPTION OF RESULTS*****************************************
* 330+00                                                                 *
*                                                                        *
*                                                                        *
**************************************************************************

**************************************************************************
))))CHANNEL INPUT INFORMATION((((
--------------------------------------------------------------------------
    NORMAL DEPTH(FEET) =   1.75
    CHANNEL Z(HORIZONTAL/VERTICAL) =    4.00
    BASEWIDTH(FEET) =     4.00
    CONSTANT CHANNEL SLOPE(FEET/FEET) =  .003800
    MANNINGS FRICTION FACTOR =  .0350
==========================================================================
    NORMAL-DEPTH FLOW INFORMATION:
--------------------------------------------------------------------------
    ))))) NORMAL DEPTH FLOW(CFS) =     51.86
    FLOW TOP- WIDTH(FEET) =        18.00
    FLOW AREA(SQUARE FEET) =          19.25
    HYDRAULIC DEPTH(FEET) =     1.07
    FLOW AVERAGE VELOCITY(FEET/SEC.) =     2.69
    UNIFORM FROUDE NUMBER =     .459
    PRESSURE + MOMENTUM(POUNDS) =         1098.89
    AVERAGED VELOCITY HEAD(FEET) =       .113
    SPECIFIC ENERGY(FEET) =      1.863
==========================================================================
    CRITICAL-DEPTH FLOW INFORMATION:
--------------------------------------------------------------------------
    CRITICAL FLOW TOP-WIDTH(FEET) =        13.51
    CRITICAL FLOW AREA(SQUARE FEET) =          10.40
    CRITICAL FLOW HYDRAULIC DEPTH(FEET) =      .77
    CRITICAL FLOW AVERAGE VELOCITY(FEET/SEC.) =     4.98
    CRITICAL DEPTH(FEET) =     1.19
    CRITICAL FLOW PRESSURE + MOMENTUM(POUNDS) =          816.97
    AVERAGED CRITICAL FLOW VELOCITY HEAD(FEET) =       .386
    CRITICAL FLOW SPECIFIC ENERGY(FEET) =      1.574
```

```
**********DESCRIPTION OF RESULTS*********************************************
* 331+00                                                                    *
*                                                                           *
*                                                                           *
*****************************************************************************

*****************************************************************************
))))CHANNEL INPUT INFORMATION((((
-----------------------------------------------------------------------------
    NORMAL DEPTH(FEET) =   1.00
    CHANNEL Z(HORIZONTAL/VERTICAL) =    4.00
    BASEWIDTH(FEET) =       .00
    CONSTANT CHANNEL SLOPE(FEET/FEET) =  .011200
    MANNINGS FRICTION FACTOR =  .0350
=============================================================================
    NORMAL-DEPTH FLOW INFORMATION:
-----------------------------------------------------------------------------
    ))))) NORMAL DEPTH FLOW(CFS) =     11.10
    FLOW TOP- WIDTH(FEET) =         8.00
    FLOW AREA(SQUARE FEET) =           4.00
    HYDRAULIC DEPTH(FEET) =      .50
    FLOW AVERAGE VELOCITY(FEET/SEC.) =     2.77
    UNIFORM FROUDE NUMBER =     .691
    PRESSURE + MOMENTUM(POUNDS) =          142.85
    AVERAGED VELOCITY HEAD(FEET) =       .119
    SPECIFIC ENERGY(FEET) =      1.119
=============================================================================
    CRITICAL-DEPTH FLOW INFORMATION:
-----------------------------------------------------------------------------
    CRITICAL FLOW TOP-WIDTH(FEET) =         6.90
    CRITICAL FLOW AREA(SQUARE FEET) =           2.97
    CRITICAL FLOW HYDRAULIC DEPTH(FEET) =      .43
    CRITICAL FLOW AVERAGE VELOCITY(FEET/SEC.) =     3.73
    CRITICAL DEPTH(FEET) =      .86
    CRITICAL FLOW PRESSURE + MOMENTUM(POUNDS) =          133.56
    AVERAGED CRITICAL FLOW VELOCITY HEAD(FEET) =       .217
    CRITICAL FLOW SPECIFIC ENERGY(FEET) =      1.078


**********DESCRIPTION OF RESULTS*********************************************
* STA 334+20                                                                *
*                                                                           *
*                                                                           *
*****************************************************************************

*****************************************************************************
))))CHANNEL INPUT INFORMATION((((
-----------------------------------------------------------------------------
    CHANNEL Z(HORIZONTAL/VERTICAL) =    4.00
    BASEWIDTH(FEET) =       .00
    CONSTANT CHANNEL SLOPE(FEET/FEET) =  .017000
    UNIFORM FLOW(CFS) =       25.00
    MANNINGS FRICTION FACTOR =  .0350
=============================================================================
    NORMAL-DEPTH FLOW INFORMATION:
-----------------------------------------------------------------------------
    ))))) NORMAL DEPTH(FEET) =   1.25
    FLOW TOP- WIDTH(FEET) =        10.03
    FLOW AREA(SQUARE FEET) =           6.28
    HYDRAULIC DEPTH(FEET) =      .63
    FLOW AVERAGE VELOCITY(FEET/SEC.) =     3.98
    UNIFORM FROUDE NUMBER =     .886
    PRESSURE + MOMENTUM(POUNDS) =          356.55
    AVERAGED VELOCITY HEAD(FEET) =       .246
    SPECIFIC ENERGY(FEET) =      1.499
=============================================================================
    CRITICAL-DEPTH FLOW INFORMATION:
-----------------------------------------------------------------------------
    CRITICAL FLOW TOP-WIDTH(FEET) =         9.55
    CRITICAL FLOW AREA(SQUARE FEET) =           5.70
    CRITICAL FLOW HYDRAULIC DEPTH(FEET) =      .60
    CRITICAL FLOW AVERAGE VELOCITY(FEET/SEC.) =     4.39
    CRITICAL DEPTH(FEET) =     1.19
    CRITICAL FLOW PRESSURE + MOMENTUM(POUNDS) =          354.02
    AVERAGED CRITICAL FLOW VELOCITY HEAD(FEET) =       .299
    CRITICAL FLOW SPECIFIC ENERGY(FEET) =      1.492
=============================================================================
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**********DESCRIPTION OF RESULTS*****************************************
* 338+50                                                                *
*                                                                       *
*                                                                       *
*************************************************************************

*************************************************************************
))))CHANNEL INPUT INFORMATION((((
-------------------------------------------------------------------------
    CHANNEL Z(HORIZONTAL/VERTICAL) =    4.00
    BASEWIDTH(FEET) =     3.50
    CONSTANT CHANNEL SLOPE(FEET/FEET) =  .044000
    UNIFORM FLOW(CFS) =       79.00
    MANNINGS FRICTION FACTOR =  .0350
=========================================================================
    NORMAL-DEPTH FLOW INFORMATION:
-------------------------------------------------------------------------
    ))))) NORMAL DEPTH(FEET) =   1.25
    FLOW TOP- WIDTH(FEET) =        13.46
    FLOW AREA(SQUARE FEET) =          10.56
    HYDRAULIC DEPTH(FEET) =      .78
    FLOW AVERAGE VELOCITY(FEET/SEC.) =     7.48
    UNIFORM FROUDE NUMBER =    1.488
    PRESSURE + MOMENTUM(POUNDS) =         1474.98
    AVERAGED VELOCITY HEAD(FEET) =       .868
    SPECIFIC ENERGY(FEET) =      2.114
=========================================================================
    CRITICAL-DEPTH FLOW INFORMATION:
-------------------------------------------------------------------------
    CRITICAL FLOW TOP-WIDTH(FEET) =        15.60
    CRITICAL FLOW AREA(SQUARE FEET) =          14.45
    CRITICAL FLOW HYDRAULIC DEPTH(FEET) =      .93
    CRITICAL FLOW AVERAGE VELOCITY(FEET/SEC.) =     5.47
    CRITICAL DEPTH(FEET) =     1.51
    CRITICAL FLOW PRESSURE + MOMENTUM(POUNDS) =         1375.00
    AVERAGED CRITICAL FLOW VELOCITY HEAD(FEET) =       .464
    CRITICAL FLOW SPECIFIC ENERGY(FEET) =      1.977
=========================================================================


**********DESCRIPTION OF RESULTS*****************************************
* 341+00                                                                *
*                                                                       *
*                                                                       *
*************************************************************************

*************************************************************************
))))CHANNEL INPUT INFORMATION((((
-------------------------------------------------------------------------
    NORMAL DEPTH(FEET) =   1.50
    CHANNEL Z(HORIZONTAL/VERTICAL) =    4.00
    BASEWIDTH(FEET) =     4.00
    CONSTANT CHANNEL SLOPE(FEET/FEET) =  .003800
    MANNINGS FRICTION FACTOR =  .0350
=========================================================================
    NORMAL-DEPTH FLOW INFORMATION:
-------------------------------------------------------------------------
    ))))) NORMAL DEPTH FLOW(CFS) =     37.04
    FLOW TOP- WIDTH(FEET) =        16.00
    FLOW AREA(SQUARE FEET) =          15.00
    HYDRAULIC DEPTH(FEET) =      .94
    FLOW AVERAGE VELOCITY(FEET/SEC.) =     2.47
    UNIFORM FROUDE NUMBER =     .449
    PRESSURE + MOMENTUM(POUNDS) =          738.82
    AVERAGED VELOCITY HEAD(FEET) =       .095
    SPECIFIC ENERGY(FEET) =      1.595
=========================================================================
    CRITICAL-DEPTH FLOW INFORMATION:
-------------------------------------------------------------------------
    CRITICAL FLOW TOP-WIDTH(FEET) =        12.00
    CRITICAL FLOW AREA(SQUARE FEET) =           8.00
    CRITICAL FLOW HYDRAULIC DEPTH(FEET) =      .67
    CRITICAL FLOW AVERAGE VELOCITY(FEET/SEC.) =     4.63
    CRITICAL DEPTH(FEET) =     1.00
    CRITICAL FLOW PRESSURE + MOMENTUM(POUNDS) =          540.29
    AVERAGED CRITICAL FLOW VELOCITY HEAD(FEET) =       .333
    CRITICAL FLOW SPECIFIC ENERGY(FEET) =      1.333
```

```
**********DESCRIPTION OF RESULTS*********************************************
* 343+00                                                                    *
*                                                                           *
*                                                                           *
*****************************************************************************

*****************************************************************************
))))CHANNEL INPUT INFORMATION((((
-----------------------------------------------------------------------------
    NORMAL DEPTH(FEET) =   1.50
    CHANNEL Z(HORIZONTAL/VERTICAL) =    4.00
    BASEWIDTH(FEET) =     2.00
    CONSTANT CHANNEL SLOPE(FEET/FEET) =  .003800
    MANNINGS FRICTION FACTOR =  .0350
=============================================================================
    NORMAL-DEPTH FLOW INFORMATION:
-----------------------------------------------------------------------------
    ))))) NORMAL DEPTH FLOW(CFS) =     27.85
    FLOW TOP- WIDTH(FEET) =        14.00
    FLOW AREA(SQUARE FEET) =          12.00
    HYDRAULIC DEPTH(FEET) =      .86
    FLOW AVERAGE VELOCITY(FEET/SEC.) =     2.32
    UNIFORM FROUDE NUMBER =     .442
    PRESSURE + MOMENTUM(POUNDS) =          546.47
    AVERAGED VELOCITY HEAD(FEET) =       .084
    SPECIFIC ENERGY(FEET) =      1.584
=============================================================================
    CRITICAL-DEPTH FLOW INFORMATION:
-----------------------------------------------------------------------------
    CRITICAL FLOW TOP-WIDTH(FEET) =        10.21
    CRITICAL FLOW AREA(SQUARE FEET) =           6.27
    CRITICAL FLOW HYDRAULIC DEPTH(FEET) =      .61
    CRITICAL FLOW AVERAGE VELOCITY(FEET/SEC.) =     4.44
    CRITICAL DEPTH(FEET) =     1.03
    CRITICAL FLOW PRESSURE + MOMENTUM(POUNDS) =          395.58
    AVERAGED CRITICAL FLOW VELOCITY HEAD(FEET) =       .307
    CRITICAL FLOW SPECIFIC ENERGY(FEET) =      1.333


**********DESCRIPTION OF RESULTS*********************************************
* 348+00                                                                    *
*                                                                           *
*                                                                           *
*****************************************************************************

*****************************************************************************
))))CHANNEL INPUT INFORMATION((((
-----------------------------------------------------------------------------
    NORMAL DEPTH(FEET) =   1.50
    CHANNEL Z(HORIZONTAL/VERTICAL) =    4.00
    BASEWIDTH(FEET) =     2.00
    CONSTANT CHANNEL SLOPE(FEET/FEET) =  .009800
    MANNINGS FRICTION FACTOR =  .0350
=============================================================================
    NORMAL-DEPTH FLOW INFORMATION:
-----------------------------------------------------------------------------
    ))))) NORMAL DEPTH FLOW(CFS) =     44.73
    FLOW TOP- WIDTH(FEET) =        14.00
    FLOW AREA(SQUARE FEET) =          12.00
    HYDRAULIC DEPTH(FEET) =      .86
    FLOW AVERAGE VELOCITY(FEET/SEC.) =     3.73
    UNIFORM FROUDE NUMBER =     .709
    PRESSURE + MOMENTUM(POUNDS) =          744.27
    AVERAGED VELOCITY HEAD(FEET) =       .216
    SPECIFIC ENERGY(FEET) =      1.716
=============================================================================
    CRITICAL-DEPTH FLOW INFORMATION:
-----------------------------------------------------------------------------
    CRITICAL FLOW TOP-WIDTH(FEET) =        12.25
    CRITICAL FLOW AREA(SQUARE FEET) =           9.13
    CRITICAL FLOW HYDRAULIC DEPTH(FEET) =      .75
    CRITICAL FLOW AVERAGE VELOCITY(FEET/SEC.) =     4.90
    CRITICAL DEPTH(FEET) =     1.28
    CRITICAL FLOW PRESSURE + MOMENTUM(POUNDS) =          702.11
    AVERAGED CRITICAL FLOW VELOCITY HEAD(FEET) =       .373
    CRITICAL FLOW SPECIFIC ENERGY(FEET) =      1.654
=============================================================================
```

```
**********DESCRIPTION OF RESULTS*********************************************
* 351+20                                                                    *
*                                                                           *
*                                                                           *
*****************************************************************************

*****************************************************************************
))))CHANNEL INPUT INFORMATION((((
-----------------------------------------------------------------------------
    NORMAL DEPTH(FEET) =   2.50
    CHANNEL Z(HORIZONTAL/VERTICAL) =    4.00
    BASEWIDTH(FEET) =     3.00
    CONSTANT CHANNEL SLOPE(FEET/FEET) =  .016200
    MANNINGS FRICTION FACTOR =  .0350
=============================================================================
    NORMAL-DEPTH FLOW INFORMATION:
-----------------------------------------------------------------------------
    ))))) NORMAL DEPTH FLOW(CFS) =    217.29
    FLOW TOP- WIDTH(FEET) =        23.00
    FLOW AREA(SQUARE FEET) =          32.50
    HYDRAULIC DEPTH(FEET) =     1.41
    FLOW AVERAGE VELOCITY(FEET/SEC.) =     6.69
    [illegible] =     .991
    PRESSURE + MOMENTUM(POUNDS) =         4700.42
    AVERAGED VELOCITY HEAD(FEET) =       .694
    SPECIFIC ENERGY(FEET) =      3.194
=============================================================================
    CRITICAL-DEPTH FLOW INFORMATION:
-----------------------------------------------------------------------------
    CRITICAL FLOW TOP-WIDTH(FEET) =        22.92
    CRITICAL FLOW AREA(SQUARE FEET) =          32.28
    CRITICAL FLOW HYDRAULIC DEPTH(FEET) =     1.41
    CRITICAL FLOW AVERAGE VELOCITY(FEET/SEC.) =     6.73
    CRITICAL DEPTH(FEET) =     2.49
    CRITICAL FLOW PRESSURE + MOMENTUM(POUNDS) =         4700.25
    AVERAGED CRITICAL FLOW VELOCITY HEAD(FEET) =       .704
    CRITICAL FLOW SPECIFIC ENERGY(FEET) =      3.194


**********DESCRIPTION OF RESULTS*********************************************
* 351+80                                                                    *
*                                                                           *
*                                                                           *
*****************************************************************************

*****************************************************************************
))))CHANNEL INPUT INFORMATION((((
-----------------------------------------------------------------------------
    NORMAL DEPTH(FEET) =    .75
    CHANNEL Z(HORIZONTAL/VERTICAL) =    4.00
    BASEWIDTH(FEET) =      .00
    CONSTANT CHANNEL SLOPE(FEET/FEET) =  .056800
    MANNINGS FRICTION FACTOR =  .0350
=============================================================================
    NORMAL-DEPTH FLOW INFORMATION:
-----------------------------------------------------------------------------
    ))))) NORMAL DEPTH FLOW(CFS) =     11.60
    FLOW TOP- WIDTH(FEET) =         6.00
    FLOW AREA(SQUARE FEET) =           2.25
    HYDRAULIC DEPTH(FEET) =      .38
    FLOW AVERAGE VELOCITY(FEET/SEC.) =     5.16
    UNIFORM FROUDE NUMBER =    1.484
    PRESSURE + MOMENTUM(POUNDS) =          151.04
    AVERAGED VELOCITY HEAD(FEET) =       .413
    SPECIFIC ENERGY(FEET) =      1.163
=============================================================================
    CRITICAL-DEPTH FLOW INFORMATION:
-----------------------------------------------------------------------------
    CRITICAL FLOW TOP-WIDTH(FEET) =         7.03
    CRITICAL FLOW AREA(SQUARE FEET) =           3.09
    CRITICAL FLOW HYDRAULIC DEPTH(FEET) =      .44
    CRITICAL FLOW AVERAGE VELOCITY(FEET/SEC.) =     3.76
    CRITICAL DEPTH(FEET) =      .88
    CRITICAL FLOW PRESSURE + MOMENTUM(POUNDS) =          140.91
    AVERAGED CRITICAL FLOW VELOCITY HEAD(FEET) =       .219
    CRITICAL FLOW SPECIFIC ENERGY(FEET) =      1.098
```

```
**********DESCRIPTION OF RESULTS*********************************************
* 354+00                                                                    *
*                                                                           *
*                                                                           *
*****************************************************************************

*****************************************************************************
))))CHANNEL INPUT INFORMATION((((
-----------------------------------------------------------------------------
    NORMAL DEPTH(FEET) =     .75
    CHANNEL Z(HORIZONTAL/VERTICAL) =    4.00
    BASEWIDTH(FEET) =       .00
    CONSTANT CHANNEL SLOPE(FEET/FEET) =  .010000
    MANNINGS FRICTION FACTOR =  .0350
=============================================================================
    NORMAL-DEPTH FLOW INFORMATION:
-----------------------------------------------------------------------------
    ))))) NORMAL DEPTH FLOW(CFS) =      4.87
    FLOW TOP- WIDTH(FEET) =         6.00
    FLOW AREA(SQUARE FEET) =            2.25
    HYDRAULIC DEPTH(FEET) =       .38
    FLOW AVERAGE VELOCITY(FEET/SEC.) =     2.16
    UNIFORM FROUDE NUMBER =     .623
    PRESSURE + MOMENTUM(POUNDS) =           55.51
    AVERAGED VELOCITY HEAD(FEET) =       .073
    SPECIFIC ENERGY(FEET) =       .823
=============================================================================
    CRITICAL-DEPTH FLOW INFORMATION:
-----------------------------------------------------------------------------
    CRITICAL FLOW TOP-WIDTH(FEET) =         4.97
    CRITICAL FLOW AREA(SQUARE FEET) =           1.54
    CRITICAL FLOW HYDRAULIC DEPTH(FEET) =      .31
    CRITICAL FLOW AVERAGE VELOCITY(FEET/SEC.) =     3.16
    CRITICAL DEPTH(FEET) =      .62
    CRITICAL FLOW PRESSURE + MOMENTUM(POUNDS) =           49.70
    AVERAGED CRITICAL FLOW VELOCITY HEAD(FEET) =       .155
    CRITICAL FLOW SPECIFIC ENERGY(FEET) =       .776
```

```
**********DESCRIPTION OF RESULTS*********************************************
* 358+00                                                                    *
*                                                                           *
*                                                                           *
*****************************************************************************

*****************************************************************************
))))CHANNEL INPUT INFORMATION((((
-----------------------------------------------------------------------------
    NORMAL DEPTH(FEET) =   3.00
    CHANNEL Z(HORIZONTAL/VERTICAL) =    4.00
    BASEWIDTH(FEET) =    10.00
    CONSTANT CHANNEL SLOPE(FEET/FEET) =  .009000
    MANNINGS FRICTION FACTOR =  .0350
=============================================================================
    NORMAL-DEPTH FLOW INFORMATION:
-----------------------------------------------------------------------------
    ))))) NORMAL DEPTH FLOW(CFS) =    407.79
    FLOW TOP- WIDTH(FEET) =        34.00
    FLOW AREA(SQUARE FEET) =           66.00
    HYDRAULIC DEPTH(FEET) =     1.94
    FLOW AVERAGE VELOCITY(FEET/SEC.) =     6.18
    UNIFORM FROUDE NUMBER =     .782
    PRESSURE + MOMENTUM(POUNDS) =         9937.10
    AVERAGED VELOCITY HEAD(FEET) =       .593
    SPECIFIC ENERGY(FEET) =      3.593
=============================================================================
    CRITICAL-DEPTH FLOW INFORMATION:
-----------------------------------------------------------------------------
    CRITICAL FLOW TOP-WIDTH(FEET) =        31.14
    CRITICAL FLOW AREA(SQUARE FEET) =          54.37
    CRITICAL FLOW HYDRAULIC DEPTH(FEET) =     1.75
    CRITICAL FLOW AVERAGE VELOCITY(FEET/SEC.) =     7.50
    CRITICAL DEPTH(FEET) =     2.64
    CRITICAL FLOW PRESSURE + MOMENTUM(POUNDS) =         9642.48
    AVERAGED CRITICAL FLOW VELOCITY HEAD(FEET) =       .874
    CRITICAL FLOW SPECIFIC ENERGY(FEET) =      3.516
```

```
**********DESCRIPTION OF RESULTS*********************************************
* 361+50                                                                    *
*                                                                           *
*                                                                           *
*****************************************************************************

*****************************************************************************
))))CHANNEL INPUT INFORMATION((((
-----------------------------------------------------------------------------
    NORMAL DEPTH(FEET) =    .75
    CHANNEL Z(HORIZONTAL/VERTICAL) =    4.00
    BASEWIDTH(FEET) =      .00
    CONSTANT CHANNEL SLOPE(FEET/FEET) =  .017100
    MANNINGS FRICTION FACTOR =  .0350
=============================================================================
    NORMAL-DEPTH FLOW INFORMATION:
-----------------------------------------------------------------------------
    ))))) NORMAL DEPTH FLOW(CFS) =      6.37
    FLOW TOP- WIDTH(FEET) =         6.00
    FLOW AREA(SQUARE FEET) =           2.25
    HYDRAULIC DEPTH(FEET) =      .38
    FLOW AVERAGE VELOCITY(FEET/SEC.) =     2.83
    UNIFORM FROUDE NUMBER =     .814
    PRESSURE + MOMENTUM(POUNDS) =           70.01
    AVERAGED VELOCITY HEAD(FEET) =       .124
    SPECIFIC ENERGY(FEET) =       .874
=============================================================================
    CRITICAL-DEPTH FLOW INFORMATION:
-----------------------------------------------------------------------------
    CRITICAL FLOW TOP-WIDTH(FEET) =         5.52
    CRITICAL FLOW AREA(SQUARE FEET) =           1.91
    CRITICAL FLOW HYDRAULIC DEPTH(FEET) =      .35
    CRITICAL FLOW AVERAGE VELOCITY(FEET/SEC.) =     3.34
    CRITICAL DEPTH(FEET) =      .69
    CRITICAL FLOW PRESSURE + MOMENTUM(POUNDS) =           68.57
    AVERAGED CRITICAL FLOW VELOCITY HEAD(FEET) =       .173
    CRITICAL FLOW SPECIFIC ENERGY(FEET) =       .864
```

```
**********DESCRIPTION OF RESULTS*********************************************
* 364+00                                                                    *
*                                                                           *
*                                                                           *
*****************************************************************************

*****************************************************************************
))))CHANNEL INPUT INFORMATION((((
-----------------------------------------------------------------------------
    NORMAL DEPTH(FEET) =   3.00
    CHANNEL Z(HORIZONTAL/VERTICAL) =    4.00
    BASEWIDTH(FEET) =     4.00
    CONSTANT CHANNEL SLOPE(FEET/FEET) =  .007800
    MANNINGS FRICTION FACTOR =  .0350
=============================================================================
    NORMAL-DEPTH FLOW INFORMATION:
-----------------------------------------------------------------------------
    ))))) NORMAL DEPTH FLOW(CFS) =    253.37
    FLOW TOP- WIDTH(FEET) =        28.00
    FLOW AREA(SQUARE FEET) =           48.00
    HYDRAULIC DEPTH(FEET) =     1.71
    FLOW AVERAGE VELOCITY(FEET/SEC.) =     5.28
    UNIFORM FROUDE NUMBER =     .710
    PRESSURE + MOMENTUM(POUNDS) =         5961.40
    AVERAGED VELOCITY HEAD(FEET) =       .433
    SPECIFIC ENERGY(FEET) =      3.433
=============================================================================
    CRITICAL-DEPTH FLOW INFORMATION:
-----------------------------------------------------------------------------
    CRITICAL FLOW TOP-WIDTH(FEET) =        24.51
    CRITICAL FLOW AREA(SQUARE FEET) =          36.56
    CRITICAL FLOW HYDRAULIC DEPTH(FEET) =     1.49
    CRITICAL FLOW AVERAGE VELOCITY(FEET/SEC.) =     6.93
    CRITICAL DEPTH(FEET) =     2.56
    CRITICAL FLOW PRESSURE + MOMENTUM(POUNDS) =         5626.37
    AVERAGED CRITICAL FLOW VELOCITY HEAD(FEET) =       .746
    CRITICAL FLOW SPECIFIC ENERGY(FEET) =      3.310
```

```
**********DESCRIPTION OF RESULTS*******************************************
* 368+00                                                                 *
*                                                                        *
*                                                                        *
**************************************************************************

**************************************************************************
))))CHANNEL INPUT INFORMATION((((
--------------------------------------------------------------------------
    NORMAL DEPTH(FEET) =   1.50
    CHANNEL Z(HORIZONTAL/VERTICAL) =    4.00
    BASEWIDTH(FEET) =     4.00
    CONSTANT CHANNEL SLOPE(FEET/FEET) =  .009200
    MANNINGS FRICTION FACTOR =  .0350
==========================================================================
    NORMAL-DEPTH FLOW INFORMATION:
--------------------------------------------------------------------------
    ))))) NORMAL DEPTH FLOW(CFS) =     57.63
    FLOW TOP- WIDTH(FEET) =        16.00
    FLOW AREA(SQUARE FEET) =          15.00
    HYDRAULIC DEPTH(FEET) =       .94
    FLOW AVERAGE VELOCITY(FEET/SEC.) =     3.84
    UNIFORM FROUDE NUMBER =     .699
    PRESSURE + MOMENTUM(POUNDS) =          990.67
    AVERAGED VELOCITY HEAD(FEET) =       .229
    SPECIFIC ENERGY(FEET) =      1.729
==========================================================================
    CRITICAL-DEPTH FLOW INFORMATION:
--------------------------------------------------------------------------
    CRITICAL FLOW TOP-WIDTH(FEET) =        14.04
    CRITICAL FLOW AREA(SQUARE FEET) =          11.32
    CRITICAL FLOW HYDRAULIC DEPTH(FEET) =      .81
    CRITICAL FLOW AVERAGE VELOCITY(FEET/SEC.) =     5.09
    CRITICAL DEPTH(FEET) =     1.26
    CRITICAL FLOW PRESSURE + MOMENTUM(POUNDS) =          929.57
    AVERAGED CRITICAL FLOW VELOCITY HEAD(FEET) =       .402
    CRITICAL FLOW SPECIFIC ENERGY(FEET) =      1.657


**********DESCRIPTION OF RESULTS*******************************************
* 371+00                                                                 *
*                                                                        *
*                                                                        *
**************************************************************************

**************************************************************************
))))CHANNEL INPUT INFORMATION((((
--------------------------------------------------------------------------
    NORMAL DEPTH(FEET) =   1.50
    CHANNEL Z(HORIZONTAL/VERTICAL) =    4.00
    BASEWIDTH(FEET) =       .00
    CONSTANT CHANNEL SLOPE(FEET/FEET) =  .009200
    MANNINGS FRICTION FACTOR =  .0350
==========================================================================
    NORMAL-DEPTH FLOW INFORMATION:
--------------------------------------------------------------------------
    ))))) NORMAL DEPTH FLOW(CFS) =     29.65
    FLOW TOP- WIDTH(FEET) =        12.00
    FLOW AREA(SQUARE FEET) =           9.00
    HYDRAULIC DEPTH(FEET) =       .75
    FLOW AVERAGE VELOCITY(FEET/SEC.) =     3.29
    UNIFORM FROUDE NUMBER =     .670
    PRESSURE + MOMENTUM(POUNDS) =          470.09
    AVERAGED VELOCITY HEAD(FEET) =       .169
    SPECIFIC ENERGY(FEET) =      1.669
==========================================================================
    CRITICAL-DEPTH FLOW INFORMATION:
--------------------------------------------------------------------------
    CRITICAL FLOW TOP-WIDTH(FEET) =        10.23
    CRITICAL FLOW AREA(SQUARE FEET) =           6.54
    CRITICAL FLOW HYDRAULIC DEPTH(FEET) =      .64
    CRITICAL FLOW AVERAGE VELOCITY(FEET/SEC.) =     4.53
    CRITICAL DEPTH(FEET) =     1.28
    CRITICAL FLOW PRESSURE + MOMENTUM(POUNDS) =          434.43
    AVERAGED CRITICAL FLOW VELOCITY HEAD(FEET) =       .319
    CRITICAL FLOW SPECIFIC ENERGY(FEET) =      1.598
```

NORMAL DEPTH FOR TRAPEZOIDAL CHANNELS
CHANNEL 376+00

DISCHARGE IS = 346 CFS
BOTTOM WIDTH IS = 10 FT
SLOPE IS = .0036 FT/FT
SIDE SLOPE (Z1) = 10
SIDE SLOPE (Z2) = 4
MANNING'S N = .035
TOP WIDTH IS = 51.96 FT
AREA IS = 92.85 SQ FT
WETTED PERIMETER IS = 52.48 FT
HYDRAULIC RADIUS IS = 1.77 FT
NORMAL DEPTH IS = 3 FT
VELOCITY IS = 3.73 FPS
FROUDE NUMBER IS = .49

```
**********DESCRIPTION OF RESULTS*******************************************
* 379+00                                                                 *
*                                                                        *
*                                                                        *
**************************************************************************

**************************************************************************
))))CHANNEL INPUT INFORMATION((((
--------------------------------------------------------------------------
    NORMAL DEPTH(FEET) =   2.25
    CHANNEL Z(HORIZONTAL/VERTICAL) =    4.00
    BASEWIDTH(FEET) =     4.00
    CONSTANT CHANNEL SLOPE(FEET/FEET) =  .003600
    MANNINGS FRICTION FACTOR =  .0350
==========================================================================
    NORMAL-DEPTH FLOW INFORMATION:
--------------------------------------------------------------------------
    ))))) NORMAL DEPTH FLOW(CFS) =     88.61
    FLOW TOP- WIDTH(FEET) =        22.00
    FLOW AREA(SQUARE FEET) =          29.25
    HYDRAULIC DEPTH(FEET) =     1.33
    FLOW AVERAGE VELOCITY(FEET/SEC.) =     3.03
    UNIFORM FROUDE NUMBER =     .463
    PRESSURE + MOMENTUM(POUNDS) =         2099.73
    AVERAGED VELOCITY HEAD(FEET) =       .143
    SPECIFIC ENERGY(FEET) =      2.393
==========================================================================
    CRITICAL-DEPTH FLOW INFORMATION:
--------------------------------------------------------------------------
    CRITICAL FLOW TOP-WIDTH(FEET) =        16.45
    CRITICAL FLOW AREA(SQUARE FEET) =          15.90
    CRITICAL FLOW HYDRAULIC DEPTH(FEET) =      .97
    CRITICAL FLOW AVERAGE VELOCITY(FEET/SEC.) =     5.57
    CRITICAL DEPTH(FEET) =     1.56
    CRITICAL FLOW PRESSURE + MOMENTUM(POUNDS) =         1572.11
    AVERAGED CRITICAL FLOW VELOCITY HEAD(FEET) =       .482
    CRITICAL FLOW SPECIFIC ENERGY(FEET) =      2.038
```

```
**********DESCRIPTION OF RESULTS*********************************************
* 381+00                                                                    *
*                                                                           *
*                                                                           *
*****************************************************************************

*****************************************************************************
))))CHANNEL INPUT INFORMATION((((
-----------------------------------------------------------------------------
    NORMAL DEPTH(FEET) =   1.25
    CHANNEL Z(HORIZONTAL/VERTICAL) =    4.00
    BASEWIDTH(FEET) =      .00
    CONSTANT CHANNEL SLOPE(FEET/FEET) =  .001000
    MANNINGS FRICTION FACTOR =  .0350
=============================================================================
    NORMAL-DEPTH FLOW INFORMATION:
-----------------------------------------------------------------------------
    ))))) NORMAL DEPTH FLOW(CFS) =      6.01
    FLOW TOP- WIDTH(FEET) =        10.00
    FLOW AREA(SQUARE FEET) =           6.25
    HYDRAULIC DEPTH(FEET) =      .63
    FLOW AVERAGE VELOCITY(FEET/SEC.) =      .96
    UNIFORM FROUDE NUMBER =     .214
    PRESSURE + MOMENTUM(POUNDS) =          173.70
    AVERAGED VELOCITY HEAD(FEET) =       .014
    SPECIFIC ENERGY(FEET) =      1.264
=============================================================================
    CRITICAL-DEPTH FLOW INFORMATION:
-----------------------------------------------------------------------------
    CRITICAL FLOW TOP-WIDTH(FEET) =         5.41
    CRITICAL FLOW AREA(SQUARE FEET) =           1.83
    CRITICAL FLOW HYDRAULIC DEPTH(FEET) =      .34
    CRITICAL FLOW AVERAGE VELOCITY(FEET/SEC.) =     3.29
    CRITICAL DEPTH(FEET) =      .68
    CRITICAL FLOW PRESSURE + MOMENTUM(POUNDS) =           64.01
    AVERAGED CRITICAL FLOW VELOCITY HEAD(FEET) =       .168
    CRITICAL FLOW SPECIFIC ENERGY(FEET) =       .844


**********DESCRIPTION OF RESULTS*********************************************
* 384+00                                                                    *
*                                                                           *
*                                                                           *
*****************************************************************************

*****************************************************************************
))))CHANNEL INPUT INFORMATION((((
-----------------------------------------------------------------------------
    NORMAL DEPTH(FEET) =   1.00
    CHANNEL Z(HORIZONTAL/VERTICAL) =    4.00
    BASEWIDTH(FEET) =      .00
    CONSTANT CHANNEL SLOPE(FEET/FEET) =  .004000
    MANNINGS FRICTION FACTOR =  .0350
=============================================================================
    NORMAL-DEPTH FLOW INFORMATION:
-----------------------------------------------------------------------------
    ))))) NORMAL DEPTH FLOW(CFS) =      6.63
    FLOW TOP- WIDTH(FEET) =         8.00
    FLOW AREA(SQUARE FEET) =           4.00
    HYDRAULIC DEPTH(FEET) =      .50
    FLOW AVERAGE VELOCITY(FEET/SEC.) =     1.66
    UNIFORM FROUDE NUMBER =     .413
    PRESSURE + MOMENTUM(POUNDS) =          104.50
    AVERAGED VELOCITY HEAD(FEET) =       .043
    SPECIFIC ENERGY(FEET) =      1.043
=============================================================================
    CRITICAL-DEPTH FLOW INFORMATION:
-----------------------------------------------------------------------------
    CRITICAL FLOW TOP-WIDTH(FEET) =         5.62
    CRITICAL FLOW AREA(SQUARE FEET) =           1.97
    CRITICAL FLOW HYDRAULIC DEPTH(FEET) =      .35
    CRITICAL FLOW AVERAGE VELOCITY(FEET/SEC.) =     3.36
    CRITICAL DEPTH(FEET) =      .70
    CRITICAL FLOW PRESSURE + MOMENTUM(POUNDS) =           72.01
    AVERAGED CRITICAL FLOW VELOCITY HEAD(FEET) =       .176
    CRITICAL FLOW SPECIFIC ENERGY(FEET) =       .878
=============================================================================
```

```
**********DESCRIPTION OF RESULTS*********************************************
* 394+00                                                                    *
*                                                                           *
*                                                                           *
*****************************************************************************

*****************************************************************************
))))CHANNEL INPUT INFORMATION((((
-----------------------------------------------------------------------------
    NORMAL DEPTH(FEET) =   1.25
    CHANNEL Z(HORIZONTAL/VERTICAL) =    4.00
    BASEWIDTH(FEET) =      .00
    CONSTANT CHANNEL SLOPE(FEET/FEET) =  .016000
    MANNINGS FRICTION FACTOR =  .0350
=============================================================================
    NORMAL-DEPTH FLOW INFORMATION:
-----------------------------------------------------------------------------
    ))))) NORMAL DEPTH FLOW(CFS) =     24.05
    FLOW TOP- WIDTH(FEET) =        10.00
    FLOW AREA(SQUARE FEET) =           6.25
    HYDRAULIC DEPTH(FEET) =      .63
    FLOW AVERAGE VELOCITY(FEET/SEC.) =     3.85
    UNIFORM FROUDE NUMBER =     .858
    PRESSURE + MOMENTUM(POUNDS) =          341.77
    AVERAGED VELOCITY HEAD(FEET) =       .230
    SPECIFIC ENERGY(FEET) =      1.480
=============================================================================
    CRITICAL-DEPTH FLOW INFORMATION:
-----------------------------------------------------------------------------
    CRITICAL FLOW TOP-WIDTH(FEET) =         9.41
    CRITICAL FLOW AREA(SQUARE FEET) =           5.54
    CRITICAL FLOW HYDRAULIC DEPTH(FEET) =      .59
    CRITICAL FLOW AVERAGE VELOCITY(FEET/SEC.) =     4.34
    CRITICAL DEPTH(FEET) =     1.18
    CRITICAL FLOW PRESSURE + MOMENTUM(POUNDS) =          337.86
    AVERAGED CRITICAL FLOW VELOCITY HEAD(FEET) =       .293
    CRITICAL FLOW SPECIFIC ENERGY(FEET) =      1.469
```

```
**********DESCRIPTION OF RESULTS*********************************************
* 400+00                                                                    *
*                                                                           *
*                                                                           *
*****************************************************************************

*****************************************************************************
))))CHANNEL INPUT INFORMATION((((
-----------------------------------------------------------------------------
    NORMAL DEPTH(FEET) =   1.50
    CHANNEL Z(HORIZONTAL/VERTICAL) =    4.00
    BASEWIDTH(FEET) =     4.00
    CONSTANT CHANNEL SLOPE(FEET/FEET) =  .005000
    MANNINGS FRICTION FACTOR =  .0350
=============================================================================
    NORMAL-DEPTH FLOW INFORMATION:
-----------------------------------------------------------------------------
    ))))) NORMAL DEPTH FLOW(CFS) =     42.48
    FLOW TOP- WIDTH(FEET) =        16.00
    FLOW AREA(SQUARE FEET) =          15.00
    HYDRAULIC DEPTH(FEET) =      .94
    FLOW AVERAGE VELOCITY(FEET/SEC.) =     2.83
    UNIFORM FROUDE NUMBER =     .516
    PRESSURE + MOMENTUM(POUNDS) =          794.79
    AVERAGED VELOCITY HEAD(FEET) =       .125
    SPECIFIC ENERGY(FEET) =      1.625
=============================================================================
    CRITICAL-DEPTH FLOW INFORMATION:
-----------------------------------------------------------------------------
    CRITICAL FLOW TOP-WIDTH(FEET) =        12.59
    CRITICAL FLOW AREA(SQUARE FEET) =           8.91
    CRITICAL FLOW HYDRAULIC DEPTH(FEET) =      .71
    CRITICAL FLOW AVERAGE VELOCITY(FEET/SEC.) =     4.77
    CRITICAL DEPTH(FEET) =     1.07
    CRITICAL FLOW PRESSURE + MOMENTUM(POUNDS) =          639.60
    AVERAGED CRITICAL FLOW VELOCITY HEAD(FEET) =       .353
    CRITICAL FLOW SPECIFIC ENERGY(FEET) =      1.427
```

```
**********DESCRIPTION OF RESULTS*********************************************
* 403+00                                                                    *
*                                                                           *
*                                                                           *
*****************************************************************************

*****************************************************************************
))))CHANNEL INPUT INFORMATION((((
-----------------------------------------------------------------------------
    NORMAL DEPTH(FEET) =   1.25
    CHANNEL Z(HORIZONTAL/VERTICAL) =    4.00
    BASEWIDTH(FEET) =      .00
    CONSTANT CHANNEL SLOPE(FEET/FEET) =  .013400
    MANNINGS FRICTION FACTOR =  .0350
=============================================================================
    NORMAL-DEPTH FLOW INFORMATION:
-----------------------------------------------------------------------------
    ))))) NORMAL DEPTH FLOW(CFS) =     22.01
    FLOW TOP- WIDTH(FEET) =        10.00
    FLOW AREA(SQUARE FEET) =           6.25
    HYDRAULIC DEPTH(FEET) =      .63
    FLOW AVERAGE VELOCITY(FEET/SEC.) =     3.52
    UNIFORM FROUDE NUMBER =     .785
    PRESSURE + MOMENTUM(POUNDS) =          312.64
    AVERAGED VELOCITY HEAD(FEET) =       .192
    SPECIFIC ENERGY(FEET) =      1.442
=============================================================================
    CRITICAL-DEPTH FLOW INFORMATION:
-----------------------------------------------------------------------------
    CRITICAL FLOW TOP-WIDTH(FEET) =         9.07
    CRITICAL FLOW AREA(SQUARE FEET) =           5.14
    CRITICAL FLOW HYDRAULIC DEPTH(FEET) =      .57
    CRITICAL FLOW AVERAGE VELOCITY(FEET/SEC.) =     4.28
    CRITICAL DEPTH(FEET) =     1.13
    CRITICAL FLOW PRESSURE + MOMENTUM(POUNDS) =          303.76
    AVERAGED CRITICAL FLOW VELOCITY HEAD(FEET) =       .285
    CRITICAL FLOW SPECIFIC ENERGY(FEET) =      1.418


**********DESCRIPTION OF RESULTS*********************************************
* 407+00                                                                    *
*                                                                           *
*                                                                           *
*****************************************************************************

*****************************************************************************
))))CHANNEL INPUT INFORMATION((((
-----------------------------------------------------------------------------
    NORMAL DEPTH(FEET) =   2.25
    CHANNEL Z(HORIZONTAL/VERTICAL) =    4.00
    BASEWIDTH(FEET) =     4.00
    CONSTANT CHANNEL SLOPE(FEET/FEET) =  .014600
    MANNINGS FRICTION FACTOR =  .0350
=============================================================================
    NORMAL-DEPTH FLOW INFORMATION:
-----------------------------------------------------------------------------
    ))))) NORMAL DEPTH FLOW(CFS) =    178.45
    FLOW TOP- WIDTH(FEET) =        22.00
    FLOW AREA(SQUARE FEET) =          29.25
    HYDRAULIC DEPTH(FEET) =     1.33
    FLOW AVERAGE VELOCITY(FEET/SEC.) =     6.10
    UNIFORM FROUDE NUMBER =     .932
    PRESSURE + MOMENTUM(POUNDS) =         3689.33
    AVERAGED VELOCITY HEAD(FEET) =       .578
    SPECIFIC ENERGY(FEET) =      2.828
=============================================================================
    CRITICAL-DEPTH FLOW INFORMATION:
-----------------------------------------------------------------------------
    CRITICAL FLOW TOP-WIDTH(FEET) =        21.42
    CRITICAL FLOW AREA(SQUARE FEET) =          27.69
    CRITICAL FLOW HYDRAULIC DEPTH(FEET) =     1.29
    CRITICAL FLOW AVERAGE VELOCITY(FEET/SEC.) =     6.45
    CRITICAL DEPTH(FEET) =     2.18
    CRITICAL FLOW PRESSURE + MOMENTUM(POUNDS) =         3680.57
    AVERAGED CRITICAL FLOW VELOCITY HEAD(FEET) =       .645
    CRITICAL FLOW SPECIFIC ENERGY(FEET) =      2.823
=============================================================================
```

NATURAL CHANNEL VELOCITY CALCULATIONS

NATURAL CHANNELS

NORMAL DEPTH FOR TRAPEZOIDAL CHANNELS
CHANNEL 129+55

DISCHARGE IS = 277 CFS
BOTTOM WIDTH IS = 0 FT
SLOPE IS = .01 FT/FT
SIDE SLOPE (Z1) = 176
SIDE SLOPE (Z2) = 156
MANNING'S N = .035
TOP WIDTH IS = 278.17 FT
AREA IS = 116.54 SQ FT
WETTED PERIMETER IS = 278.18 FT
HYDRAULIC RADIUS IS = .42 FT
NORMAL DEPTH IS = .84 FT
VELOCITY IS = 2.38 FPS
FROUDE NUMBER IS = .65

NORMAL DEPTH FOR TRAPEZOIDAL CHANNELS
CHANNEL 136+90

DISCHARGE IS = 284 CFS
BOTTOM WIDTH IS = 0 FT
SLOPE IS = .019 FT/FT
SIDE SLOPE (Z1) = 30.7
SIDE SLOPE (Z2) = 19.3
MANNING'S N = .035
TOP WIDTH IS = 76.27 FT
AREA IS = 58.17 SQ FT
WETTED PERIMETER IS = 76.33 FT
HYDRAULIC RADIUS IS = .76 FT
NORMAL DEPTH IS = 1.53 FT
VELOCITY IS = 4.88 FPS
FROUDE NUMBER IS = .99

NORMAL DEPTH FOR TRAPEZOIDAL CHANNELS
CHANNEL 142+48

DISCHARGE IS = 63 CFS
BOTTOM WIDTH IS = 80 FT
SLOPE IS = .014 FT/FT
SIDE SLOPE (Z1) = 26.7
SIDE SLOPE (Z2) = 78.3
MANNING'S N = .035
TOP WIDTH IS = 112.88 FT
AREA IS = 30.2 SQ FT
WETTED PERIMETER IS = 112.89 FT
HYDRAULIC RADIUS IS = .27 FT
NORMAL DEPTH IS = .31 FT
VELOCITY IS = 2.09 FPS
FROUDE NUMBER IS = .71

NORMAL DEPTH FOR TRAPEZOIDAL CHANNELS
CHANNEL 161+67

DISCHARGE IS = 1067 CFS
BOTTOM WIDTH IS = 0 FT
SLOPE IS = .014 FT/FT
SIDE SLOPE (Z1) = 21.1
SIDE SLOPE (Z2) = 68.3
MANNING'S N = .035
TOP WIDTH IS = 190.74 FT
AREA IS = 203.47 SQ FT
WETTED PERIMETER IS = 190.8 FT
HYDRAULIC RADIUS IS = 1.07 FT
NORMAL DEPTH IS = 2.13 FT
VELOCITY IS = 5.24 FPS
FROUDE NUMBER IS = .89

CROSS SECTION ID NUMBER IS 1

171+20

NUMBER OF CROSS SECTION COORDINATE POINTS IS 10

COORDINATE ID NO.	STATION X(I)	ELEVATION Y(I)
1	0.00	17.00
2	20.00	17.50
3	40.00	17.00
4	43.00	16.00
5	68.00	15.00
6	74.00	14.90
7	80.00	15.00
8	94.00	15.30
9	108.00	15.00
10	125.00	15.30

WATER SURFACE ELEV FT	AREA SQ FT	WETTED PERIMETER FT	TOP WIDTH FT	HYD RADIUS FT	HYD DEPTH FT	SECTION FACTOR FT	CRITICAL FLOW CFS
15.30	12.1	64.5	64.5	0.2	0.2	4.0	29.6

Q = 23 cfs

V = 1.9 fps

NORMAL DEPTH FOR TRAPEZOIDAL CHANNELS
CHANNEL 172+93

DISCHARGE IS = 369 CFS
BOTTOM WIDTH IS = 0 FT
SLOPE IS = .015 FT/FT
SIDE SLOPE (Z1) = 76.3
SIDE SLOPE (Z2) = 16.3
MANNING'S N = .035
TOP WIDTH IS = 129.25 FT
AREA IS = 90.21 SQ FT
WETTED PERIMETER IS = 129.31 FT
HYDRAULIC RADIUS IS = .7 FT
NORMAL DEPTH IS = 1.4 FT
VELOCITY IS = 4.09 FPS
FROUDE NUMBER IS = .86

NORMAL DEPTH FOR TRAPEZOIDAL CHANNELS
CHANNEL 195+10

DISCHARGE IS = 1820 CFS
BOTTOM WIDTH IS = 13 FT
SLOPE IS = .015 FT/FT
SIDE SLOPE (Z1) = 14.6
SIDE SLOPE (Z2) = 20.8
MANNING'S N = .035
TOP WIDTH IS = 129.78 FT
AREA IS = 235.49 SQ FT
WETTED PERIMETER IS = 129.97 FT
HYDRAULIC RADIUS IS = 1.81 FT
NORMAL DEPTH IS = 3.3 FT
VELOCITY IS = 7.73 FPS
FROUDE NUMBER IS = 1.01

NORMAL DEPTH FOR TRAPEZOIDAL CHANNELS
CHANNEL 197+68

DISCHARGE IS = 756 CFS
BOTTOM WIDTH IS = 0 FT
SLOPE IS = .005 FT/FT
SIDE SLOPE (Z1) = 16.6
SIDE SLOPE (Z2) = 17.9
MANNING'S N = .035
TOP WIDTH IS = 112.16 FT
AREA IS = 182.33 SQ FT
WETTED PERIMETER IS = 112.35 FT
HYDRAULIC RADIUS IS = 1.62 FT
NORMAL DEPTH IS = 3.25 FT
VELOCITY IS = 4.15 FPS
FROUDE NUMBER IS = .57

NORMAL DEPTH FOR TRAPEZOIDAL CHANNELS
CHANNEL 225+19

DISCHARGE IS = 450 CFS
BOTTOM WIDTH IS = 0 FT
SLOPE IS = .016 FT/FT
SIDE SLOPE (Z1) = 19
SIDE SLOPE (Z2) = 90
MANNING'S N = .035
TOP WIDTH IS = 152.32 FT
AREA IS = 106.43 SQ FT
WETTED PERIMETER IS = 152.36 FT
HYDRAULIC RADIUS IS = .7 FT
NORMAL DEPTH IS = 1.4 FT
VELOCITY IS = 4.23 FPS
FROUDE NUMBER IS = .89

NORMAL DEPTH FOR TRAPEZOIDAL CHANNELS
CHANNEL 227+85

DISCHARGE IS = 200 CFS
BOTTOM WIDTH IS = 0 FT
SLOPE IS = .009 FT/FT
SIDE SLOPE (Z1) = 116
SIDE SLOPE (Z2) = 18
MANNING'S N = .035
TOP WIDTH IS = 142.42 FT
AREA IS = 75.69 SQ FT
WETTED PERIMETER IS = 142.46 FT
HYDRAULIC RADIUS IS = .53 FT
NORMAL DEPTH IS = 1.06 FT
VELOCITY IS = 2.64 FPS
FROUDE NUMBER IS = .64

NORMAL DEPTH FOR TRAPEZOIDAL CHANNELS
CHANNEL 230+27

DISCHARGE IS = 280 CFS
BOTTOM WIDTH IS = 0 FT
SLOPE IS = .017 FT/FT
SIDE SLOPE (Z1) = 35
SIDE SLOPE (Z2) = 15
MANNING'S N = .035
TOP WIDTH IS = 77.46 FT
AREA IS = 60.01 SQ FT
WETTED PERIMETER IS = 77.54 FT
HYDRAULIC RADIUS IS = .77 FT
NORMAL DEPTH IS = 1.55 FT
VELOCITY IS = 4.67 FPS
FROUDE NUMBER IS = .93

NORMAL DEPTH FOR TRAPEZOIDAL CHANNELS
CHANNEL 243+74

DISCHARGE IS = 136 CFS
BOTTOM WIDTH IS = 11 FT
SLOPE IS = .01 FT/FT
SIDE SLOPE (Z1) = 9.2
SIDE SLOPE (Z2) = 4.6
MANNING'S N = .035
TOP WIDTH IS = 31.68 FT
AREA IS = 31.99 SQ FT
WETTED PERIMETER IS = 31.93 FT
HYDRAULIC RADIUS IS = 1 FT
NORMAL DEPTH IS = 1.5 FT
VELOCITY IS = 4.25 FPS
FROUDE NUMBER IS = .75

CROSS SECTION ID NUMBER IS 1

253+94

NUMBER OF CROSS SECTION COORDINATE POINTS IS 11

COORDINATE ID NO.	STATION X(I)	ELEVATION Y(I)
1	0.00	85.00
2	20.00	84.00
3	28.00	82.90
4	36.00	84.00
5	44.00	84.10
6	58.50	84.00
7	64.00	84.60
8	68.00	84.00
9	76.00	83.00
10	88.00	84.00
11	102.00	85.00

WATER SURFACE ELEV FT	AREA SQ FT	WETTED PERIMETER FT	TOP WIDTH FT	HYD RADIUS FT	HYD DEPTH FT	SECTION FACTOR FT	CRITICAL FLOW CFS	
83.92	16.0	33.5	33.2	0.5	0.5	9.8	63.2	**Q = 70 cfs** **V = 4.4 fps**

266+50

CROSS SECTION ID NUMBER IS 1

266+50

NUMBER OF CROSS SECTION COORDINATE POINTS IS 22

COORDINATE ID NO.	STATION X(I)	ELEVATION Y(I)
1	0.00	95.80
2	26.00	95.00
3	34.00	94.70
4	42.00	95.00
5	47.00	95.30
6	55.00	95.00
7	60.00	95.00
8	66.00	95.10
9	75.00	95.00
10	80.00	95.10
11	85.00	95.00
12	90.00	94.00
13	97.00	93.60
14	114.00	94.00
15	133.00	95.00
16	140.00	95.30
17	146.00	95.30
18	161.00	95.70
19	177.00	95.00
20	184.00	94.80
21	194.00	95.00
22	200.00	95.80

WATER SURFACE ELEV FT	AREA SQ FT	WETTED PERIMETER FT	TOP WIDTH FT	HYD RADIUS FT	HYD DEPTH FT	SECTION FACTOR FT	CRITICAL FLOW CFS	
95.80	173.0	200.3	200.0	0.9	0.9	156.8	912.6	**Q = 1575 cfs**
94.80	31.9	48.7	48.5	0.7	0.7	24.1	147.1	**V = 9.1 fps**

NORMAL DEPTH FOR TRAPEZOIDAL CHANNELS

CHANNEL 271+21

DISCHARGE IS = 534 CFS
BOTTOM WIDTH IS = 26 FT
SLOPE IS = .018 FT/FT
SIDE SLOPE (Z1) = 38.6
SIDE SLOPE (Z2) = 51.4
MANNING'S N = .035
TOP WIDTH IS = 143.9 FT
AREA IS = 111.29 SQ FT
WETTED PERIMETER IS = 143.93 FT
HYDRAULIC RADIUS IS = .77 FT
NORMAL DEPTH IS = 1.31 FT
VELOCITY IS = 4.8 FPS
FROUDE NUMBER IS = .96

CROSS SECTION ID NUMBER IS 1

285+00

NUMBER OF CROSS SECTION COORDINATE POINTS IS 12

COORDINATE ID NO.	STATION X(I)	ELEVATION Y(I)
1	0.00	9.00
2	28.00	8.00
3	85.00	6.60
4	104.00	8.00
5	116.00	9.00
6	124.00	9.00
7	133.00	8.00
8	148.00	6.30
9	153.00	7.00
10	163.00	8.00
11	184.00	8.50
12	214.00	9.00

WATER SURFACE ELEV FT	AREA SQ FT	WETTED PERIMETER FT	TOP WIDTH FT	HYD RADIUS FT	HYD DEPTH FT	SECTION FACTOR FT	CRITICAL FLOW CFS	
8.44	133.1	146.4	146.0	0.9	0.9	125.0	721.4	Q = 688 cfs V = 5.2 fps

NORMAL DEPTH FOR TRAPEZOIDAL CHANNELS

CHANNEL 289+26

DISCHARGE IS = 115 CFS
BOTTOM WIDTH IS = 0 FT
SLOPE IS = .011 FT/FT
SIDE SLOPE (Z1) = 27.5
SIDE SLOPE (Z2) = 22.5
MANNING'S N = .035
TOP WIDTH IS = 60.2 FT
AREA IS = 36.24 SQ FT
WETTED PERIMETER IS = 60.25 FT
HYDRAULIC RADIUS IS = .6 FT
NORMAL DEPTH IS = 1.2 FT
VELOCITY IS = 3.17 FPS
FROUDE NUMBER IS = .72

NORMAL DEPTH FOR TRAPEZOIDAL CHANNELS
CHANNEL 292+09

DISCHARGE IS = 61 CFS
BOTTOM WIDTH IS = 0 FT
SLOPE IS = .014 FT/FT
SIDE SLOPE (Z1) = 5.3
SIDE SLOPE (Z2) = 6.6
MANNING'S N = .035
TOP WIDTH IS = 18.56 FT
AREA IS = 14.47 SQ FT
WETTED PERIMETER IS = 18.82 FT
HYDRAULIC RADIUS IS = .77 FT
NORMAL DEPTH IS = 1.56 FT
VELOCITY IS = 4.22 FPS
FROUDE NUMBER IS = .84

NORMAL DEPTH FOR TRAPEZOIDAL CHANNELS
CHANNEL 300+31

DISCHARGE IS = 52 CFS
BOTTOM WIDTH IS = 0 FT
SLOPE IS = .016 FT/FT
SIDE SLOPE (Z1) = 8
SIDE SLOPE (Z2) = 6
MANNING'S N = .035
TOP WIDTH IS = 18.85 FT
AREA IS = 12.69 SQ FT
WETTED PERIMETER IS = 19.05 FT
HYDRAULIC RADIUS IS = .67 FT
NORMAL DEPTH IS = 1.35 FT
VELOCITY IS = 4.1 FPS
FROUDE NUMBER IS = .88

NORMAL DEPTH FOR TRAPEZOIDAL CHANNELS
CHANNEL 312+17

DISCHARGE IS = 168 CFS
BOTTOM WIDTH IS = 4 FT
SLOPE IS = .016 FT/FT
SIDE SLOPE (Z1) = 5
SIDE SLOPE (Z2) = 5.5
MANNING'S N = .035
TOP WIDTH IS = 24.88 FT
AREA IS = 28.72 SQ FT
WETTED PERIMETER IS = 25.26 FT
HYDRAULIC RADIUS IS = 1.14 FT
NORMAL DEPTH IS = 1.99 FT
VELOCITY IS = 5.85 FPS
FROUDE NUMBER IS = .96

NORMAL DEPTH FOR TRAPEZOIDAL CHANNELS
CHANNEL 316+70

DISCHARGE IS = 112 CFS
BOTTOM WIDTH IS = 5 FT
SLOPE IS = .046 FT/FT
SIDE SLOPE (Z1) = 3.8
SIDE SLOPE (Z2) = 8.1
MANNING'S N = .035
TOP WIDTH IS = 19.45 FT
AREA IS = 14.85 SQ FT
WETTED PERIMETER IS = 19.68 FT
HYDRAULIC RADIUS IS = .75 FT
NORMAL DEPTH IS = 1.21 FT
VELOCITY IS = 7.54 FPS
FROUDE NUMBER IS = 1.52

NORMAL DEPTH FOR TRAPEZOIDAL CHANNELS
CHANNEL 326+15

DISCHARGE IS = 36 CFS
BOTTOM WIDTH IS = 0 FT
SLOPE IS = .02 FT/FT
SIDE SLOPE (Z1) = 5
SIDE SLOPE (Z2) = 15
MANNING'S N = .035
TOP WIDTH IS = 19.67 FT
AREA IS = 9.67 SQ FT
WETTED PERIMETER IS = 19.8 FT
HYDRAULIC RADIUS IS = .49 FT
NORMAL DEPTH IS = .98 FT
VELOCITY IS = 3.72 FPS
FROUDE NUMBER IS = .94

NORMAL DEPTH FOR TRAPEZOIDAL CHANNELS
CHANNEL 327+20

DISCHARGE IS = 360 CFS
BOTTOM WIDTH IS = 0 FT
SLOPE IS = .014 FT/FT
SIDE SLOPE (Z1) = 5.3
SIDE SLOPE (Z2) = 43
MANNING'S N = .035
TOP WIDTH IS = 86.41 FT
AREA IS = 77.3 SQ FT
WETTED PERIMETER IS = 86.6 FT
HYDRAULIC RADIUS IS = .89 FT
NORMAL DEPTH IS = 1.79 FT
VELOCITY IS = 4.66 FPS
FROUDE NUMBER IS = .87

NORMAL DEPTH FOR TRAPEZOIDAL CHANNELS
CHANNEL 329+20

DISCHARGE IS = 300 CFS
BOTTOM WIDTH IS = 0 FT
SLOPE IS = .014 FT/FT
SIDE SLOPE (Z1) = 16.7
SIDE SLOPE (Z2) = 47.5
MANNING'S N = .035
TOP WIDTH IS = 96.38 FT
AREA IS = 72.34 SQ FT
WETTED PERIMETER IS = 96.44 FT
HYDRAULIC RADIUS IS = .75 FT
NORMAL DEPTH IS = 1.5 FT
VELOCITY IS = 4.15 FPS
FROUDE NUMBER IS = .84

NORMAL DEPTH FOR TRAPEZOIDAL CHANNELS
CHANNEL 334+00

DISCHARGE IS = 739 CFS
BOTTOM WIDTH IS = 0 FT
SLOPE IS = .011 FT/FT
SIDE SLOPE (Z1) = 14
SIDE SLOPE (Z2) = 8.3
MANNING'S N = .035
TOP WIDTH IS = 73.08 FT
AREA IS = 119.74 SQ FT
WETTED PERIMETER IS = 73.39 FT
HYDRAULIC RADIUS IS = 1.63 FT
NORMAL DEPTH IS = 3.28 FT
VELOCITY IS = 6.17 FPS
FROUDE NUMBER IS = .85

NORMAL DEPTH FOR TRAPEZOIDAL CHANNELS

CHANNEL 336+40

DISCHARGE IS = 250 CFS
BOTTOM WIDTH IS = 0 FT
SLOPE IS = .013 FT/FT
SIDE SLOPE (Z1) = 7.2
SIDE SLOPE (Z2) = 10.5
MANNING'S N = .035
TOP WIDTH IS = 40.85 FT
AREA IS = 47.15 SQ FT
WETTED PERIMETER IS = 41.12 FT
HYDRAULIC RADIUS IS = 1.15 FT
NORMAL DEPTH IS = 2.31 FT
VELOCITY IS = 5.3 FPS
FROUDE NUMBER IS = .87

350+10

NUMBER OF CROSS SECTION COORDINATE POINTS IS 11

COORDINATE ID NO.	STATION X(I)	ELEVATION Y(I)
1	0.00	49.40
2	20.00	49.00
3	44.00	48.00
4	58.00	46.40
5	66.00	48.00
6	76.00	48.20
7	84.00	48.00
8	92.00	46.80
9	99.00	48.00
10	108.00	49.00
11	126.00	49.40

WATER SURFACE ELEV FT	AREA SQ FT	WETTED PERIMETER FT	TOP WIDTH FT	HYD RADIUS FT	HYD DEPTH FT	SECTION FACTOR FT	CRITICAL FLOW CFS	
47.51	11.6	24.4	24.1	0.5	0.5	7.1	45.8	Q = 52 cfs V = 4.5 fps

NORMAL DEPTH FOR TRAPEZOIDAL CHANNELS

CHANNEL 356+00

DISCHARGE IS = 120 CFS
BOTTOM WIDTH IS = 0 FT
SLOPE IS = .011 FT/FT
SIDE SLOPE (Z1) = 14.1
SIDE SLOPE (Z2) = 43.7
MANNING'S N = .035
TOP WIDTH IS = 66.97 FT
AREA IS = 38.8 SQ FT
WETTED PERIMETER IS = 67.03 FT
HYDRAULIC RADIUS IS = .58 FT
NORMAL DEPTH IS = 1.16 FT
VELOCITY IS = 3.09 FPS
FROUDE NUMBER IS = .72

NORMAL DEPTH FOR TRAPEZOIDAL CHANNELS

CHANNEL 360+35

DISCHARGE IS = 1031 CFS
BOTTOM WIDTH IS = 78 FT
SLOPE IS = .01 FT/FT
SIDE SLOPE (Z1) = 10.6
SIDE SLOPE (Z2) = 11.7
MANNING'S N = .035
TOP WIDTH IS = 119.33 FT
AREA IS = 182.87 SQ FT
WETTED PERIMETER IS = 119.5 FT
HYDRAULIC RADIUS IS = 1.53 FT
NORMAL DEPTH IS = 1.85 FT
VELOCITY IS = 5.64 FPS
FROUDE NUMBER IS = .8

NORMAL DEPTH FOR TRAPEZOIDAL CHANNELS

CHANNEL 363+00

DISCHARGE IS = 61 CFS
BOTTOM WIDTH IS = 8 FT
SLOPE IS = .012 FT/FT
SIDE SLOPE (Z1) = 2.8
SIDE SLOPE (Z2) = 5.7
MANNING'S N = .035
TOP WIDTH IS = 17.83 FT
AREA IS = 14.93 SQ FT
WETTED PERIMETER IS = 18.13 FT
HYDRAULIC RADIUS IS = .82 FT
NORMAL DEPTH IS = 1.16 FT
VELOCITY IS = 4.09 FPS
FROUDE NUMBER IS = .79

CROSS SECTION ID NUMBER IS 1

374+50

NUMBER OF CROSS SECTION COORDINATE POINTS IS 9

COORDINATE ID NO.	STATION X(I)	ELEVATION Y(I)
1	0.00	64.30
2	14.00	64.00
3	56.00	63.00
4	78.00	64.00
5	96.00	62.80
6	124.00	63.70
7	154.00	63.00
8	170.00	63.20
9	186.00	64.30

WATER SURFACE ELEV FT	AREA SQ FT	WETTED PERIMETER FT	TOP WIDTH FT	HYD RADIUS FT	HYD DEPTH FT	SECTION FACTOR FT	CRITICAL FLOW CFS	
64.30	155.4	186.1	186.0	0.8	0.8	137.8	806.0	**Q = 610 cfs** **V = 3.9 fps**

NORMAL DEPTH FOR TRAPEZOIDAL CHANNELS

CHANNEL 382+80

DISCHARGE IS = 83 CFS
BOTTOM WIDTH IS = 0 FT
SLOPE IS = .013 FT/FT
SIDE SLOPE (Z1) = 8.1
SIDE SLOPE (Z2) = 9.4
MANNING'S N = .035
TOP WIDTH IS = 26.83 FT
AREA IS = 20.56 SQ FT
WETTED PERIMETER IS = 27 FT
HYDRAULIC RADIUS IS = .76 FT
NORMAL DEPTH IS = 1.53 FT
VELOCITY IS = 4.04 FPS
FROUDE NUMBER IS = .81

NORMAL DEPTH FOR TRAPEZOIDAL CHANNELS

CHANNEL 386+00

DISCHARGE IS = 330 CFS
BOTTOM WIDTH IS = 0 FT
SLOPE IS = .013 FT/FT
SIDE SLOPE (Z1) = 3.7
SIDE SLOPE (Z2) = 14
MANNING'S N = .035
TOP WIDTH IS = 45.37 FT
AREA IS = 58.14 SQ FT
WETTED PERIMETER IS = 45.8 FT
HYDRAULIC RADIUS IS = 1.27 FT
NORMAL DEPTH IS = 2.56 FT
VELOCITY IS = 5.68 FPS
FROUDE NUMBER IS = .88

NORMAL DEPTH FOR TRAPEZOIDAL CHANNELS
CHANNEL 397+60

DISCHARGE IS = 31 CFS
BOTTOM WIDTH IS = 0 FT
SLOPE IS = .02 FT/FT
SIDE SLOPE (Z1) = 15
SIDE SLOPE (Z2) = 15
MANNING'S N = .035
TOP WIDTH IS = 23.93 FT
AREA IS = 9.54 SQ FT
WETTED PERIMETER IS = 23.98 FT
HYDRAULIC RADIUS IS = .4 FT
NORMAL DEPTH IS = .8 FT
VELOCITY IS = 3.25 FPS
FROUDE NUMBER IS = .91

NORMAL DEPTH FOR TRAPEZOIDAL CHANNELS
CHANNEL 398+60

DISCHARGE IS = 31 CFS
BOTTOM WIDTH IS = 0 FT
SLOPE IS = .026 FT/FT
SIDE SLOPE (Z1) = 5.8
SIDE SLOPE (Z2) = 10.6
MANNING'S N = .035
TOP WIDTH IS = 15.64 FT
AREA IS = 7.46 SQ FT
WETTED PERIMETER IS = 15.77 FT
HYDRAULIC RADIUS IS = .47 FT
NORMAL DEPTH IS = .95 FT
VELOCITY IS = 4.16 FPS
FROUDE NUMBER IS = 1.06

CROSS SECTION ID NUMBER IS 1

404+40

NUMBER OF CROSS SECTION COORDINATE POINTS IS 7

COORDINATE ID NO.	STATION X(I)	ELEVATION Y(I)
1	0.00	83.00
2	8.00	82.00
3	21.00	82.90
4	30.00	82.90
5	44.00	81.70
6	50.00	82.00
7	62.00	82.60

WATER SURFACE ELEV FT	AREA SQ FT	WETTED PERIMETER FT	TOP WIDTH FT	HYD RADIUS FT	HYD DEPTH FT	SECTION FACTOR FT	CRITICAL FLOW CFS	
								Q 46 cfs
82.55	14.8	39.4	39.3	0.4	0.4	7.7	51.7	V 3.11 fps

HEC-1 RUNOFF
SUMMARY PRINTOUTS

```
*************************************
*                                   *
*  FLOOD HYDROGRAPH PACKAGE  (HEC-1) *
*           FEBRUARY 1981           *
*          REVISED 14 JUN 85        *
*                                   *
* RUN DATE JAN 14, 1987  TIME 03:22 PM *
*                                   *
*************************************
```

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

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

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

THE DEFINITIONS OF VARIABLES -RTIMP- AND -RTIOR- HAVE CHANGED FROM THOSE USED WITH THE 1973-STYLE INPUT STRUCTURE. THE DEFINITION OF -AMSKK- ON RM-CARD WAS CHANGED WITH REVISIONS DATED 28 SEP 81. THE VERSION RELEASED 31JAN85 CONTAINS NEW OPTIONS ON RL AND BA RECORDS, AND ADDS THE HL RECORD. SEE JANUARY 1985 INPUT DESCRIPTION FOR NEW DEFINITIONS.

```
  LINE          ID.......1.......2.......3.......4.......5.......6.......7.......8.......9......10
    1           ID      WHITE TANKS SOUTH 8
*** FREE ***
    2           IT       6  6JUN86    1200     200
    3           IO       4

    4           KK     DA4
    5           BA    0.43
    6           PH       0       0    0.70    1.39    2.43
    7           LS       0      86
    8           UD    0.63
    9           ZZ
```

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

OPERATION	STATION	PEAK FLOW	TIME OF PEAK	AVERAGE FLOW FOR MAXIMUM PERIOD 6-HOUR	24-HOUR	72-HOUR	BASIN AREA	MAXIMUM STAGE	TIME OF MAX STAGE
HYDROGRAPH AT	DA4	330.	1.30	55.	16.	16.	0.43		

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

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

  1           ID      WHITE TANKS SOUTH 8
*** FREE ***
  2           IT       3 18JUL86    1200     200
  3           IO       4

  4           KK    DA8A
  5           BA    0.79
  6           PH       0       0    0.70    1.39    2.43
  7           LS       0      93
  8           UD    0.10

  9           KK    DA8AR
 10           RK   20600   0.022   0.045

 11           KK    DA6A
 12           BA    1.17
 13           LS       0      86
 14           UD    1.04

 15           KK    DA8B
 16           BA    3.46
 17           LS       0      86
 18           UD    1.20

 19           KK    CP8.1
 20           HC       3

 21           KK    DIV6A
 22           DT    DIV8B
 23           DI       0    5000
 24           DQ       0    3250

 25           KK   DIV6AR
 26           RK    3600  0.0119   0.045

 27           KK    DA6B
 28           BA    0.53
 29           LS       0      86
 30           UD    0.46

 31           KK    CP6.1
 32           HC       2

 33           KK    DIV6B
 34           DT    DIV8D
 35           DI       0    5000
 36           DQ       0    2500

 37           KK   DIV6BR
 38           RK    2400  0.0129   0.045
```



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

 39           KK    DA6C
 40           BA    0.06
 41           LS       0      86
 42           UD    0.23

 43           KK    CP6.2
 44           HC       2
 45           ZZ
```

SCHEMATIC DIAGRAM OF STREAM NETWORK

```
INPUT
 LINE      (V) ROUTING          (---)) DIVERSION OR PUMP FLOW

  NO.      (.) CONNECTOR        ((---) RETURN OF DIVERTED OR PUMPED FLOW
   5         DA8A
               V
               V
  10        DA8AR
               .
               .
  12           .        DA6A
               .          .
               .          .
  16           .          .       DA8B
               .          .         .
               .          .         .
  20        CP8.1......................
               .
               .
  23           .-------)   DIV8B
  22        DIV6A
               V
               V
  26       DIV6AR
               .
               .
  28           .        DA6B
               .          .
               .          .
  32        CP6.1............
               .
               .
  35           .-------)   DIV8D
  34        DIV6B
               V
               V
  38       DIV6BR
               .
               .
  40           .        DA6C
               .          .
               .          .
  44        CP6.2............
```

(***) RUNOFF ALSO COMPUTED AT THIS LOCATION

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

OPERATION	STATION	PEAK FLOW	TIME OF PEAK	AVERAGE FLOW FOR MAXIMUM PERIOD 6-HOUR	24-HOUR	72-HOUR	BASIN AREA	MAXIMUM STAGE	TIME OF MAX STAGE
HYDROGRAPH AT	DA8A	2398.	.65	145.	87.	87.	.79		
ROUTED TO	DA8AR	1153.	.95	145.	87.	87.	.79		
HYDROGRAPH AT	DA6A	601.	1.65	148.	89.	89.	1.17		
HYDROGRAPH AT	DA8B	1530.	1.80	429.	258.	258.	3.46		
3 COMBINED AT	CP8.1	2329.	1.65	721.	435.	435.	5.42		
DIVERSION TO	DIV8B	1514.	1.65	469.	283.	283.	5.42		
HYDROGRAPH AT	DIV6A	815.	1.65	252.	152.	152.	5.42		
ROUTED TO	DIV6AR	813.	1.70	252.	152.	152.	5.42		
HYDROGRAPH AT	DA6B	522.	1.10	67.	41.	41.	.53		
2 COMBINED AT	CP6.1	1155.	1.15	319.	193.	193.	5.95		
DIVERSION TO	DIV8D	577.	1.15	160.	96.	96.	5.95		
HYDROGRAPH AT	DIV6B	577.	1.15	160.	96.	96.	5.95		
ROUTED TO	DIV6BR	576.	1.20	160.	96.	96.	5.95		
HYDROGRAPH AT	DA6C	90.	.80	8.	5.	5.	.06		
2 COMBINED AT	CP6.2	610.	1.15	167.	101.	101.	6.01		

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

```
        LINE          ID.......1.......2.......3.......4.......5.......6.......7.......8.......9......10
          1           ID      WHITE TANKS SOUTH 8
*** FREE ***
                      *DIAGRAM
          2           IT       3 18JUL86    1200     200
          3           IO       4

          4           KK    DA8A
          5           BA    0.79
          6           PH       0       0    0.70    1.39    2.43
          7           LS       0      93
          8           UD    0.10

          9           KK   DA8AR
         10           RK   20600   0.022   0.045

         11           KK    DA6A
         12           BA    1.17
         13           LS       0      86
         14           UD    1.04

         15           KK    DA8B
         16           BA    3.46
         17           LS       0      86
         18           UD    1.20

         19           KK   CP8.1
         20           HC       3

         21           KK   DIV6A
         22           DT   DIV8B
         23           DI       0    5000
         24           DQ       0    3250

         25           KK  DIV6AR
         26           RK    3600  0.0119   0.045

         27           KK    DA6B
         28           BA    0.53
         29           LS       0      86
         30           UD    0.46

         31           KK   CP6.1
         32           HC       2

         33           KK   DIV8D
         34           DT   DIV6B
         35           DI       0    5000
         36           DQ       0    2500

         37           KK  DIV8DR
         38           RK    3150  0.0098   0.045
```

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

  39          KK    DA8D
  40          BA    0.20
  41          LS       0      86
  42          UD    0.34

  43          KK  CP8D.1
  44          HC       2

  45          KK    DA8A
  46          BA    0.79
  47          LS       0      93
  48          UD    0.10

  49          KK    DA8R
  50          RK   20600   0.022   0.045

  51          KK    DA6A
  52          BA    1.17
  53          LS       0      86
  54          UD    1.04

  55          KK    DA8B
  56          BA    3.46
  57          LS       0      86
  58          UD    1.20

  59          KK   CP9.1
  60          HC       3

  61          KK   DIV8B
  62          DT   DIV6A
  63          DI       0    5000
  64          DQ       0    1750

  65          KK  DIV8BR
  66          RK    2200  0.0123   0.045

  67          KK    DA8C
  68          BA    0.21
  69          LS       0      86
  70          UD    0.34

  71          KK   CP8.2
  72          HC       2

  73          KK   DIV8D
  74          DT   DIV8E
  75          DI       0    5000
  76          DQ       0    3500
```



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

  77          KK  DIV8DR
  78          RK    4150  0.0108   0.045

  79          KK    CP8D
  80          HC       2
  81          ZZ
```

SCHEMATIC DIAGRAM OF STREAM NETWORK

```
INPUT
 LINE      (V) ROUTING          (--->) DIVERSION OR PUMP FLOW

  NO.      (.) CONNECTOR        (<---) RETURN OF DIVERTED OR PUMPED FLOW
   4         DA8A
                V
                V
   9        DA8AR
                .
                .
  11            .        DA6A
                .           .
                .           .
  15            .           .        DA8B
                .           .           .
                .           .           .
  19        CP8.1.......................
                .
                .
  22            .-------)   DIV8B
  21        DIV6A
                V
                V
  25       DIV6AR
                .
                .
  27            .        DA6B
                .           .
                .           .
  31        CP6.1............
                .
                .
  34            .-------)   DIV6B
  33        DIV8D
                V
                V
  37       DIV8DR
                .
                .
  39            .        DA8D
                .           .
                .           .
  43       CP8D.1............
                .
                .
  45            .        DA8A
                .           V
                .           V
  49            .        DA8R
                .           .
                .           .
  51            .           .        DA6A
                .           .           .
                .           .           .
  55            .           .           .        DA8B
                .           .           .           .
                .           .           .           .
  59            .       CP8.1........................
                .           .
                .           .
  62            .           .-------)   DIV6A
  61            .       DIV8B
                .           V
                .           V
  65            .      DIV8BR
                .           .
                .           .
  67            .           .        DA8C
                .           .           .
                .           .           .
  71            .       CP8.2............
                .           .
                .           .
  74            .           .-------)   DIV8E
  73            .       DIV8D
                .           V
                .           V
  77            .      DIV8DR
                .           .
                .           .
  79        CP8D............
```

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

OPERATION	STATION	PEAK FLOW	TIME OF PEAK	AVERAGE FLOW FOR MAXIMUM PERIOD 6-HOUR	24-HOUR	72-HOUR	BASIN AREA	MAXIMUM STAGE	TIME OF MAX STAG
HYDROGRAPH AT	DA8A	2398.	0.65	145.	87.	87.	0.79		
ROUTED TO	DA8AR	1153.	0.95	145.	87.	87.	0.79		
HYDROGRAPH AT	DA6A	601.	1.65	148.	89.	89.	1.17		
HYDROGRAPH AT	DA8B	1530.	1.80	429.	258.	258.	3.46		
3 COMBINED AT	CP8.1	2329.	1.65	721.	435.	435.	5.42		
DIVERSION TO	DIV8B	1514.	1.65	469.	283.	283.	5.42		
HYDROGRAPH AT	DIV6A	815.	1.65	252.	152.	152.	5.42		
ROUTED TO	DIV6AR	813.	1.70	252.	152.	152.	5.42		
HYDROGRAPH AT	DA6B	522.	1.10	67.	41.	41.	0.53		
2 COMBINED AT	CP6.1	1155.	1.15	319.	193.	193.	5.95		
DIVERSION TO	DIV6B	577.	1.15	160.	96.	96.	5.95		
HYDROGRAPH AT	DIV8D	577.	1.15	160.	96.	96.	5.95		
ROUTED TO	DIV8DR	574.	1.25	160.	96.	96.	5.95		
HYDROGRAPH AT	DA8D	240.	0.95	25.	15.	15.	0.20		
2 COMBINED AT	CP8D.1	738.	1.15	185.	112.	112.	6.15		
HYDROGRAPH AT	DA8A	2398.	0.65	145.	87.	87.	0.79		
ROUTED TO	DA8R	1153.	0.95	145.	87.	87.	0.79		
HYDROGRAPH AT	DA6A	601.	1.65	148.	89.	89.	1.17		
HYDROGRAPH AT	DA8B	1530.	1.80	429.	258.	258.	3.46		
3 COMBINED AT	CP8.1	2329.	1.65	721.	435.	435.	5.42		
DIVERSION TO	DIV6A	815.	1.65	252.	152.	152.	5.42		
HYDROGRAPH AT	DIV8B	1514.	1.65	469.	283.	283.	5.42		
ROUTED TO	DIV8BR	1512.	1.70	468.	283.	283.	5.42		
HYDROGRAPH AT	DA8C	252.	0.95	27.	16.	16.	0.21		
2 COMBINED AT	CP8.2	1538.	1.65	495.	299.	299.	5.63		
DIVERSION TO	DIV8E	1076.	1.65	347.	209.	209.	5.63		
HYDROGRAPH AT	DIV8D	461.	1.65	149.	90.	90.	5.63		
ROUTED TO	DIV8DR	461.	1.70	148.	90.	90.	5.63		
2 COMBINED AT	CP8D	1151.	1.15	333.	201.	201.	11.78		

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

```
LINE          ID.......1.......2.......3.......4.......5.......6.......7.......8.......9......10
  1           ID     WHITE TANKS SOUTH 8
              *DIAGRAM
*** FREE ***
  2           IT       3 18JUL86    1200     200
  3           IO       4

  4           KK    DA8A
  5           BA    0.79
  6           PH       0       0    0.70    1.39    2.43
  7           LS       0      93
  8           UD    0.10

  9           KK   DA8AR
 10           RK   20600   0.922   0.045

 11           KK    DA6A
 12           BA    1.17
 13           LS       0      86
 14           UD    1.04

 15           KK    DA8B
 16           BA    3.46
 17           LS       0      86
 18           UD    1.20

 19           KK   CP8.1
 20           HC       3

 21           KK   DIV8B
 22           DT   DIV6A
 23           DI       0    5000
 24           DQ       0    1750

 25           KK  DIV8BR
 26           RK    2200  0.0123   0.045

 27           KK    DA8C
 28           BA    0.21
 29           LS       0      86
 30           UD    0.34

 31           KK   CP8.2
 32           HC       2

 33           KK   DIV8E
 34           DT   DIV8C
 35           DI       0    5000
 36           DQ       0    1500

 37           KK  DIV8ER
 38           RK    4800  0.0119   0.045
```



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

 39           KK    DA8E
 40           BA    0.24
 41           LS       0      86
 42           UD    0.36

 43           KK    DA11
 44           BA    0.57
 45           LS       0      86
 46           UD    0.58

 47           KK    CP11
 48           HC       3

 49           KK   DIV8E
 50           DT   DIV11
 51           DI       0    5000
 52           DQ       0    2500
 53           ZZ
```

SCHEMATIC DIAGRAM OF STREAM NETWORK

```
INPUT
LINE      (V) ROUTING          (--->) DIVERSION OR PUMP FLOW

NO.       (.) CONNECTOR        ((---) RETURN OF DIVERTED OR PUMPED FLOW
  4         DA8A
               V
               V
  9        DA8AR
               .
               .
 11            .        DA6A
               .           .
               .           .
 15            .           .        DA8B
               .           .           .
               .           .           .
 19       CP8.1.......................
               .
               .
 22            .-------)   DIV6A
 21       DIV8B
               V
               V
 25      DIV8BR
               .
               .
 27            .        DA8C
               .           .
               .           .
 31       CP8.2............
               .
               .
 34            .-------)   DIV8C
 33       DIV8E
               V
               V
 37      DIV8ER
               .
               .
 39            .        DA8E
               .           .
               .           .
 43            .           .        DA11
               .           .           .
               .           .           .
 47        CP11........................
               .
               .
 50            .-------)   DIV11
 49       DIV8E
```

(***) RUNOFF ALSO COMPUTED AT THIS LOCATION

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

OPERATION	STATION	PEAK FLOW	TIME OF PEAK	AVERAGE FLOW FOR MAXIMUM PERIOD 6-HOUR	24-HOUR	72-HOUR	BASIN AREA	MAXIMUM STAGE	TIME OF MAX STAGE
HYDROGRAPH AT	DA8A	2398.	0.65	145.	87.	87.	0.79		
ROUTED TO	DA8AR	1153.	0.95	145.	87.	87.	0.79		
HYDROGRAPH AT	DA6A	601.	1.65	148.	89.	89.	1.17		
HYDROGRAPH AT	DA8B	1530.	1.80	429.	258.	258.	3.46		
3 COMBINED AT	CP8.1	2329.	1.65	721.	435.	435.	5.42		
DIVERSION TO	DIV6A	815.	1.65	252.	152.	152.	5.42		
HYDROGRAPH AT	DIV8B	1514.	1.65	469.	283.	283.	5.42		
ROUTED TO	DIV8BR	1512.	1.70	468.	283.	283.	5.42		
HYDROGRAPH AT	DA8C	252.	0.95	27.	16.	16.	0.21		
2 COMBINED AT	CP8.2	1538.	1.65	495.	299.	299.	5.63		
DIVERSION TO	DIV8C	461.	1.65	149.	90.	90.	5.63		
HYDROGRAPH AT	DIV8E	1076.	1.65	347.	209.	209.	5.63		
ROUTED TO	DIV8ER	1073.	1.75	346.	209.	209.	5.63		
HYDROGRAPH AT	DA8E	278.	0.95	31.	18.	18.	0.24		
HYDROGRAPH AT	DA11	478.	1.20	72.	44.	44.	0.57		
3 COMBINED AT	CP11	1649.	1.20	449.	271.	271.	6.44		
DIVERSION TO	DIV11	824.	1.20	225.	136.	136.	6.44		
HYDROGRAPH AT	DIV8E	824.	1.20	225.	136.	136.	6.44		

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

```
          LINE          ID.......1.......2.......3.......4.......5.......6.......7.......8.......9......10
            1           ID      SOUTH TANKS SOUTH 8
*** FREE ***
            2           II        3 17JUN86    1200     200
            3           IO        4

            4           KK     CP13
            5           BA     0.16
            6           PH        0       0    0.70    1.39    2.43
            7           LS        0      86
            8           UD     0.42
            9           ZZ
```

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

OPERATION	STATION	PEAK FLOW	TIME OF PEAK	AVERAGE FLOW FOR MAXIMUM PERIOD 6-HOUR	24-HOUR	72-HOUR	BASIN AREA	MAXIMUM STAGE	TIME OF MAX STAG
HYDROGRAPH AT	CP13	168.	1.05	20.	12.	12.	0.16		

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

```
         LINE          ID.......1.......2.......3.......4.......5.......6.......7.......8.......9......10
            1          ID      SOUTH TANKS SOUTH 8
*** FREE ***
            2          IT       3 19JUN86    1200     200
            3          IO       4

            4          KK    CP16
            5          BA    1.35
            6          PH       0       0    0.70    1.39    2.43
            7          LS       0      86
            8          UD    0.88
            9          ZZ
```

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

OPERATION	STATION	PEAK FLOW	TIME OF PEAK	AVERAGE FLOW FOR MAXIMUM PERIOD 6-HOUR	24-HOUR	72-HOUR	BASIN AREA	MAXIMUM STAGE	TIME OF MAX STAG
HYDROGRAPH AT	CP16	803.	1.50	170.	103.	103.	1.35		

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

```
LINE          ID.......1.......2.......3.......4.......5.......6.......7.......8.......9......10
  1           ID      WHITE TANKS SOUTH 8
*** FREE ***
  2           IT       3 24JUN86    1200     200
  3           IO       4

  4           KK   CP18A
  5           BA    1.43
  6           PH       0       0    0.70    1.39    2.43
  7           LS       0      93
  8           UD    0.22

  9           KK    18AR    ROUTE CP18A TO CP18
 10           RK   36200  0.0186   0.045

 11           KK   CP18B
 12           BA    2.98
 13           LS       0      86
 14           UD    1.68

 15           KK    CP18
 16           HC       2
 17           ZZ
```

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

OPERATION	STATION	PEAK FLOW	TIME OF PEAK	AVERAGE FLOW FOR MAXIMUM PERIOD 6-HOUR	24-HOUR	72-HOUR	BASIN AREA	MAXIMUM STAGE	TIME OF MAX STAG
HYDROGRAPH AT	CP18A	3095.	0.75	261.	157.	157.	1.43		
ROUTED TO	18AR	1635.	1.40	261.	158.	158.	1.43		
HYDROGRAPH AT	CP18B	965.	2.30	367.	224.	224.	2.98		
2 COMBINED AT	CP18	2109.	1.50	629.	381.	381.	4.41		

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

SCHEMATIC DIAGRAM OF STREAM NETWORK

```
INPUT
 LINE      (V) ROUTING          (---)) DIVERSION OR PUMP FLOW

 NO.       (.) CONNECTOR        ((---) RETURN OF DIVERTED OR PUMPED FLOW
   5        CP18A
               V
               V
  10         18AR
               .
               .
  12           .       CP18B
               .          .
               .          .
  16        CP18............
```

(***) RUNOFF ALSO COMPUTED AT THIS LOCATION

```
         LINE          ID.......1.......2.......3.......4.......5.......6.......7.......8.......9......10
           1           ID     WHITE TANKS SOUTH 8
*** FREE ***
           2           IT       3 26JUN86    1200     200
           3           IO       4

           4           KK    CP21
           5           BA    1.88
           6           PH       0       0    0.70    1.39    2.45
           7           LS       0      86
           8           UD    1.29
           9           ZZ
```

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

OPERATION	STATION	PEAK FLOW	TIME OF PEAK	AVERAGE FLOW FOR MAXIMUM PERIOD 6-HOUR	24-HOUR	72-HOUR	BASIN AREA	MAXIMUM STAGE	TIME OF MAX STAGE
HYDROGRAPH AT	CP21	788.	1.90	236.	142.	142.	1.88		

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

```
                    LINE          ID.......1.......2.......3.......4.......5.......6.......7.......8.......9......10
                      1           ID     WHITE TANKS SOUTH 8
                                  *DIAGRAM
*** FREE ***
                      2           IT       3 02JUL86    1200     200
                      3           IO       4

                      4           KK   CP24A
                      5           BA    2.18
                      6           PH       0       0    0.70    1.39    2.43
                      7           LS       0      93
                      8           UD    0.33

                      9           KK    24AR    ROUTE CP24A TO CP24*1
                     10           RK   29400  0.0197   0.045

                     11           KK   CP24B
                     12           BA    2.75
                     13           LS       0      86
                     14           UD    1.34

                     15           KK  CP24*1    COMBINED FLOW BEFORE SPLIT
                     16           HC       2

                     17           KK SPLIT24
                     18           DT   DIV27
                     19           DI       0    1000    2000    3000    4000
                     20           DQ       0     300     600     900    1200

                     21           KK    24SR    ROUTE SPLIT24 TO CP24*2
                     22           RK   11100  0.0131   0.045

                     23           KK   CP24C
                     24           BA    0.65
                     25           LS       0      86
                     26           UD    0.50

                     27           KK  CP24*2
                     28           HC       2

                     29           KKSPLIT24*2
                     30           DT   DIV25
                     31           DI       0    1000    2000    3000
                     32           DQ       0     150     300     450

                     33           KK  24*2SR
                     34           RK    2100  0.0131   0.045

                     35           KK   CP24D
                     36           BA    0.09
                     37           LS       0      86
                     38           UD    0.10
```



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

                     39           KK  CP24*3
                     40           HC       2

                     41           KKSPLIT24*3
                     42           DT   DIV24
                     43           DI       0    1000    2000    3000
                     44           DQ       0     870    1740    2610

                     45           KK    CP23
                     46           BA    0.90
                     47           LS       0      86
                     48           UD    0.99

                     49           KK  CP23*1
                     50           HC       2
                     51           ZZ
```

SCHEMATIC DIAGRAM OF STREAM NETWORK

```
INPUT
 LINE      (V) ROUTING          (--->) DIVERSION OR PUMP FLOW

 NO.       (.) CONNECTOR        ((---) RETURN OF DIVERTED OR PUMPED FLOW
  4         CP24A
                V
                V
  9          24AR
                .
                .
 11             .       CP24B
                .           .
                .           .
 15        CP24*1............
                .
                .
 18             .-------)   DIV27
 17       SPLIT24
                V
                V
 21          24SR
                .
                .
 23             .       CP24C
                .           .
                .           .
 27        CP24*2............
                .
                .
 30             .-------)   DIV25
 29      SPLIT24*
                V
                V
 33        24*2SR
                .
                .
 35             .       CP24D
                .           .
                .           .
 39        CP24*3............
                .
                .
 42             .-------)   DIV24
 41      SPLIT24*
                .
                .
 45             .        CP23
                .           .
                .           .
 49        CP23*1............
```

(***) RUNOFF ALSO COMPUTED AT THIS LOCATION

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

OPERATION	STATION	PEAK FLOW	TIME OF PEAK	AVERAGE FLOW FOR MAXIMUM PERIOD 6-HOUR	24-HOUR	72-HOUR	BASIN AREA	MAXIMUM STAGE	TIME OF MAX STA
HYDROGRAPH AT	CP24A	3758.	0.90	396.	239.	239.	2.18		
ROUTED TO	24AR	2616.	1.35	396.	239.	239.	2.18		
HYDROGRAPH AT	CP24B	1105.	1.95	342.	207.	207.	2.75		
2 COMBINED AT	CP24*1	3297.	1.40	738.	446.	446.	4.93		
DIVERSION TO	DIV27	989.	1.40	221.	134.	134.	4.93		
HYDROGRAPH AT	SPLIT24	2308.	1.40	517.	312.	312.	4.93		
ROUTED TO	24SR	2189.	1.60	516.	312.	312.	4.93		
HYDROGRAPH AT	CP24C	605.	1.10	82.	50.	50.	0.65		
2 COMBINED AT	CP24*2	2468.	1.55	598.	362.	362.	5.58		
DIVERSION TO	DIV25	370.	1.55	90.	54.	54.	5.58		
HYDROGRAPH AT	SPLIT24*	2098.	1.55	508.	308.	308.	5.58		
ROUTED TO	24*2SR	2092.	1.55	508.	308.	308.	5.58		
HYDROGRAPH AT	CP24D	195.	0.65	11.	7.	7.	0.09		
2 COMBINED AT	CP24*3	2092.	1.55	519.	315.	315.	5.67		
DIVERSION TO	DIV24	1820.	1.55	451.	274.	274.	5.67		
HYDROGRAPH AT	SPLIT24*	272.	1.55	67.	41.	41.	5.67		
HYDROGRAPH AT	CP23	484.	1.60	114.	69.	69.	0.90		
2 COMBINED AT	CP23*1	756.	1.60	181.	110.	110.	6.57		

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

```
LINE          ID.......1.......2.......3.......4.......5.......6.......7.......8.......9......10
   1          ID      WHITE TANKS SOUTH 8
*** FREE ***
   2          IT       3 02JUL86    1200     200
   3          IO       4

   4          KK   CP24A
   5          BA    2.18
   6          PH       0       0    0.70    1.39    2.43
   7          LS       0      93
   8          UD    0.33

   9          KK    24AR    ROUTE CP24A TO CP24*1
  10          RK   29400  0.0197   0.045

  11          KK   CP24B
  12          BA    2.75
  13          LS       0      86
  14          UD    1.34

  15          KK  CP24*1    COMBINED FLOW BEFORE SPLIT
  16          HC       2

  17          KK SPLIT24
  18          DT   DIV27
  19          DI       0    1000    2000    3000    4000
  20          DQ       0     300     600     900    1200

  21          KK    24SR    ROUTE SPLIT24 TO CP24*2
  22          RK   11100  0.0131   0.045

  23          KK   CP24C
  24          BA    0.65
  25          LS       0      86
  26          UD    0.50

  27          KK  CP24*2
  28          HC       2

  29          KK   DIV25
  30          DTSPLIT24.2
  31          DI       0    1000    2000    3000
  32          DQ       0     850    1700    2550

  33          KK  DIV25R
  34          RK    3200  0.0104   0.040

  35          KK    CP25
  36          BA    0.07
  37          LS       0      86
  38          UD    0.22
```



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

  39          KK  CP25*1
  40          HC       2
  41          ZZ
```

SCHEMATIC DIAGRAM OF STREAM NETWORK

```
INPUT
 LINE      (V) ROUTING          (---}) DIVERSION OR PUMP FLOW

 NO.       (.) CONNECTOR        ({---) RETURN OF DIVERTED OR PUMPED FLOW
  5         CP24A
                V
                V
 10          24AR
                .
                .
 12             .       CP24B
                .          .
                .          .
 16        CP24*1............
                .
                .
 19             .-------)   DIV27
 18       SPLIT24
                V
                V
 22          24SR
                .
                .
 24             .       CP24C
                .          .
                .          .
 28        CP24*2............
                .
                .
 31             .-------)SPLT24.2
 30         DIV25
                V
                V
 34        DIV25R
                .
                .
 36             .       CP25
                .          .
                .          .
 40        CP25*1............
```

(***) RUNOFF ALSO COMPUTED AT THIS LOCATION

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

OPERATION	STATION	PEAK FLOW	TIME OF PEAK	AVERAGE FLOW FOR MAXIMUM PERIOD 6-HOUR	24-HOUR	72-HOUR	BASIN AREA	MAXIMUM STAGE	TIME OF MAX STAGE
HYDROGRAPH AT	CP24A	3758.	0.90	396.	239.	239.	2.18		
ROUTED TO	24AR	2616.	1.35	396.	239.	239.	2.18		
HYDROGRAPH AT	CP24B	1105.	1.95	342.	207.	207.	2.75		
2 COMBINED AT	CP24*1	3297.	1.40	738.	446.	446.	4.93		
DIVERSION TO	DIV27	989.	1.40	221.	134.	134.	4.93		
HYDROGRAPH AT	SPLIT24	2308.	1.40	517.	312.	312.	4.93		
ROUTED TO	24SR	2189.	1.60	516.	312.	312.	4.93		
HYDROGRAPH AT	CP24C	605.	1.10	82.	50.	50.	0.65		
2 COMBINED AT	CP24*2	2468.	1.55	598.	362.	362.	5.58		
DIVERSION TO	SPLT24.2	2098.	1.55	508.	308.	308.	5.58		
HYDROGRAPH AT	DIV25	370.	1.55	90.	54.	54.	5.58		
ROUTED TO	DIV25R	367.	1.60	90.	54.	54.	5.58		
HYDROGRAPH AT	CP25	107.	0.80	9.	5.	5.	0.07		
2 COMBINED AT	CP25*1	369.	1.60	98.	60.	60.	5.65		

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

```
LINE          ID.......1.......2.......3.......4.......5.......6.......7.......8.......9......10
  1           ID      WHITE TANKS SOUTH 8
*** FREE ***
  2           IT       3 08JUL86    1200     200
  3           IO       4

  4           KK   CP24A
  5           BA    2.18
  6           PH       0       0    0.79    1.39    2.43
  7           LS       0      93
  8           UD    0.33

  9           KK    24AR   ROUTE CP24A TO CP24*1
 10           RK   29400  0.0197   0.045

 11           KK   CP24B
 12           BA    2.75
 13           LS       0      86
 14           UD    1.34

 15           KK  CP24*1
 16           HC       2

 17           KK DIV28.1
 18           DT SPLIT24
 19           DI       0    4000
 20           DQ       0    2800

 21           KK  DIV28R   ROUTE DIV28.1 TO CP28A
 22           RK   10100  0.0139   0.045

 23           KK   CP28A
 24           BA    1.03
 25           LS       0      86
 26           UD    1.21

 27           KK  CP28*1
 28           HC       2

 29           KK DIV28.2
 30           DT SPLIT31
 31           DI       0    4000
 32           DQ       0    1320

 33           KKDIV28.2R
 34           RK    6250  0.0096   0.040

 35           KK   CP28B
 36           BA    0.38
 37           LS       0      86
 38           UD    0.61
```



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

 39           KK    CP27
 40           BA    0.12
 41           LS       0      86
 42           UD    0.40

 43           KK  CP28*3
 44           HC       3
 45           ZZ
```

SCHEMATIC DIAGRAM OF STREAM NETWORK

```
INPUT
 LINE      (V) ROUTING          (---)) DIVERSION OR PUMP FLOW

 NO.       (.) CONNECTOR        ((---) RETURN OF DIVERTED OR PUMPED FLOW
  5         CP24A
                V
                V
 10          24AR
                .
                .
 12             .       CP24B
                .          .
                .          .
 15         CP24*1............
                .
                .
 19             .-------) SPLIT24
 16        DIV28.1
                V
                V
 22         DIV28R
                .
                .
 24             .       CP28A
                .          .
                .          .
 28         CP28*1............
                .
                .
 31             .-------) SPLIT31
 30        DIV28.2
                V
                V
 34       DIV28.2R
                .
                .
 38             .       CP28B
                .          .
                .          .
 40             .          .       CP27
                .          .          .
                .          .          .
 44         CP28*3......................
```

(***) RUNOFF ALSO COMPUTED AT THIS LOCATION

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

OPERATION	STATION	PEAK FLOW	TIME OF PEAK	AVERAGE FLOW FOR MAXIMUM PERIOD 6-HOUR	24-HOUR	72-HOUR	BASIN AREA	MAXIMUM STAGE	TIME OF MAX STAGE
HYDROGRAPH AT	CP24A	3758.	0.90	396.	239.	239.	2.18		
ROUTED TO	24AR	2616.	1.35	396.	239.	239.	2.18		
HYDROGRAPH AT	CP24B	1185.	1.75	342.	207.	207.	2.75		
2 COMBINED AT	CP24*1	3297.	1.40	738.	446.	446.	4.93		
DIVERSION TO	SPLIT24	2308.	1.40	517.	312.	312.	4.93		
HYDROGRAPH AT	DIV28.1	989.	1.40	221.	134.	134.	4.93		
ROUTED TO	DIV28R	922.	1.60	221.	134.	134.	4.93		
HYDROGRAPH AT	CP28A	462.	1.85	130.	79.	79.	1.03		
2 COMBINED AT	CP28*1	1363.	1.65	351.	212.	212.	5.96		
DIVERSION TO	SPLIT31	450.	1.65	116.	70.	70.	5.96		
HYDROGRAPH AT	DIV28.2	913.	1.65	235.	142.	142.	5.96		
ROUTED TO	DIV28.2R	903.	1.75	235.	142.	142.	5.96		
HYDROGRAPH AT	CP28B	307.	1.25	48.	29.	29.	0.38		
HYDROGRAPH AT	CP27	150.	1.00	15.	9.	9.	0.12		
3 COMBINED AT	CP28*3	1967.	1.70	298.	181.	181.	6.46		

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

```
LINE          ID.......1.......2.......3.......4.......5.......6.......7.......8.......9......10
   1          ID      WHITE TANKS SOUTH 8
** FREE ***
   2          IT       3 08JUL86    1200     200
   3          IO       4

   4          KK    CP24A
   5          BA     2.18
   6          PH        0       0    0.70    1.39    2.43
   7          LS        0      93
   8          UD     0.33

   9          KK     24AR   ROUTE CP24A TO CP24*1
  10          RK    29400  0.0197   0.045

  11          KK    CP24B
  12          BA     2.75
  13          LS        0      86
  14          UD     1.34

  15          KK   CP24*1
  16          HC        2

  17          KK DIV28.1
  18          DT SPLIT24
  19          DI        0    4000
  20          DQ        0    2800

  21          KK   DIV28R   ROUTE DIV28.1 TO CP28A
  22          RK    10100  0.0139   0.045

  23          KK    CP28A
  24          BA     1.03
  25          LS        0      86
  26          UD     1.21

  27          KK   CP28*1
  28          HC        2

  29          KK DIV31.1
  30          DT SPL28.2
  31          DI        0    4000
  32          DQ        0    2680

  33          KKDIV31.1R
  34          RK     6400  0.0109   0.045

  35          KK      31A
  36          BA     0.16
  37          LS        0      86
  38          UD     0.45
```



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

  39          KK   CP31.1
  40          HC        2

  41          KK    DIV30
  42          DT SPL31.2
  43          DI        0    4000
  44          DQ        0    1600

  45          KK   DIV30R
  46          RK     1350   0.011   0.045

  47          KK     CP30
  48          BA    0.116
  49          LS        0      86
  50          UD     0.33

  51          KK   CP30.1
  52          HC        2
  53          ZZ
```

SCHEMATIC DIAGRAM OF STREAM NETWORK

```
INPUT
 LINE      (V) ROUTING          (---)) DIVERSION OR PUMP FLOW

 NO.       (.) CONNECTOR        ((---) RETURN OF DIVERTED OR PUMPED FLOW
  5         CP24A
                 V
                 V
 10          24A3
                 .
                 .
 12              .       CP24B
                 .           .
                 .           .
 15        CP24*1............
                 .
                 .
 19              .-------) SPLIT24
 18       DIV28.1
                 V
                 V
 22        DIV28R
                 .
                 .
 24              .       CP28A
                 .           .
                 .           .
 26        CP28+1............
                 .
                 .
 31              .-------) SPL38.2
 30       DIV31.1
                 V
                 V
 34      DIV31.1R
                 .
                 .
 36              .         31A
                 .           .
                 .           .
 40        CP31.1............
                 .
                 .
 43              .-------) SPL31.3
 42        DIV30
                 V
                 V
 45        DIV30R
                 .
                 .
 48              .        CP30
                 .           .
                 .           .
 52        CP30.1............
```

(***) RUNOFF ALSO COMPUTED AT THIS LOCATION

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

OPERATION	STATION	PEAK FLOW	TIME OF PEAK	AVERAGE FLOW FOR MAXIMUM PERIOD 6-HOUR	24-HOUR	72-HOUR	BASIN AREA	MAXIMUM STAGE	TIME OF MAX STAGE
HYDROGRAPH AT	CP24A	3758.	0.90	396.	239.	239.	2.18		
ROUTED TO	24AR	2616.	1.35	396.	239.	239.	2.18		
HYDROGRAPH AT	CP24B	1105.	1.95	342.	207.	207.	2.75		
2 COMBINED AT	CP24*1	3297.	1.40	738.	446.	446.	4.93		
DIVERSION TO	SPLIT24	2308.	1.40	517.	312.	312.	4.93		
HYDROGRAPH AT	DIV28.1	989.	1.40	221.	134.	134.	4.93		
ROUTED TO	DIV28R	922.	1.60	221.	134.	134.	4.93		
HYDROGRAPH AT	CP28A	462.	1.85	130.	79.	79.	1.03		
2 COMBINED AT	CP28*1	1363.	1.65	351.	212.	212.	5.96		
DIVERSION TO	SPL28.2	913.	1.65	235.	142.	142.	5.96		
HYDROGRAPH AT	DIV31.1	450.	1.65	116.	70.	70.	5.96		
ROUTED TO	DIV31.1R	438.	1.85	116.	70.	70.	5.96		
HYDROGRAPH AT	31A	161.	1.05	20.	12.	12.	0.16		
2 COMBINED AT	CP31.1	463.	1.80	136.	82.	82.	6.12		
DIVERSION TO	SPL31.2	185.	1.80	54.	33.	33.	6.12		
HYDROGRAPH AT	DIV30	278.	1.80	81.	49.	49.	6.12		
ROUTED TO	DIV30R	277.	1.80	81.	49.	49.	6.12		
HYDROGRAPH AT	CP30	141.	0.90	15.	9.	9.	0.12		
2 COMBINED AT	CP30.1	284.	1.80	96.	58.	58.	6.24		

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

```
LINE          ID.......1.......2.......3.......4.......5.......6.......7.......8.......9......10
  1           ID      WHITE TANKS SOUTH 8
* FREE ***
  2           IT       3 08JUL86    1200     200
  3           IO       4

  4           KK   CP24A
  5           BA    2.18
  6           PH       0       0    0.70    1.39    2.43
  7           LS       0      93
  8           UD    0.33

  9           KK    24AR   ROUTE CP24A TO CP24*1
 10           RK   29400  0.0197   0.045

 11           KK   CP24B
 12           BA    2.75
 13           LS       0      86
 14           UD    1.34

 15           KK  CP24*1
 16           HC       2

 17           KK DIV28.1
 18           DT SPLIT24
 19           DI       0    4000
 20           DQ       0    2800

 21           KK  DIV28R   ROUTE DIV28.1 TO CP28A
 22           RK   10100  0.0139   0.045

 23           KK   CP28A
 24           BA    1.03
 25           LS       0      86
 26           UD    1.21

 27           KK  CP28*1
 28           HC       2

 29           KK DIV31.1
 30           DT SPL28.2
 31           DI       0    4000
 32           DQ       0    2680

 33           KKDIV31.1R
 34           RK    6400  0.0109   0.045

 35           KK   CP31A
 36           BA    0.16
 37           LS       0      86
 38           UD    0.45
```



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

 39           KK  CP31.1
 40           HC       2

 41           KK DIV31.2
 42           DT   SPL30
 43           DI       0    4000
 44           DQ       0    1600

 45           KKDIV31.2R
 46           RK    1900  0.0105   0.045

 47           KK   CP31B
 48           BA  0.0026
 49           LS       0      86
 50           UD    0.16

 51           KK  CP31.2
 52           HC       2
 53           ZZ
```

SCHEMATIC DIAGRAM OF STREAM NETWORK

```
INPUT
 LINE     (V) ROUTING          (---)) DIVERSION OR PUMP FLOW

 NO.      (.) CONNECTOR        ((---) RETURN OF DIVERTED OR PUMPED FLOW
  5        CP24A
              V
              V
 10         24AR
              .
              .
 12           .       CP24B
              .          .
              .          .
 15       CP24*.............
              .
              .
 19           .-------) SPLIT34
 18      DIV28.1
              V
              V
 22       DIV28R
              .
              .
 24           .       CP28A
              .          .
              .          .
 28       CP28*1............
              .
              .
 31           .-------) SPL28.2
 30      DIV31.1
              V
              V
 34     DIV31.1R
              .
              .
 35           .       CP31A
              .          .
              .          .
 40       CP31.1............
              .
              .
 43           .-------)   SPL30
 42      DIV31.2
              V
              V
 46     DIV31.2R
              .
              .
 43           .       CP31B
              .          .
              .          .
 52       CP31.2............
```

(***) RUNOFF ALSO COMPUTED AT THIS LOCATION

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

OPERATION	STATION	PEAK FLOW	TIME OF PEAK	AVERAGE FLOW FOR MAXIMUM PERIOD 6-HOUR	24-HOUR	72-HOUR	BASIN AREA	MAXIMUM STAGE	TIME OF MAX STAGE
HYDROGRAPH AT	CP24A	3758.	0.90	396.	239.	239.	2.18		
ROUTED TO	24AR	2616.	1.35	396.	239.	239.	2.18		
HYDROGRAPH AT	CP24B	1105.	1.95	342.	207.	207.	2.75		
2 COMBINED AT	CP24*1	3297.	1.40	738.	446.	446.	4.93		
DIVERSION TO	SPLIT24	2308.	1.40	517.	312.	312.	4.93		
HYDROGRAPH AT	DIV28.1	989.	1.40	221.	134.	134.	4.93		
ROUTED TO	DIV28R	922.	1.60	221.	134.	134.	4.93		
HYDROGRAPH AT	CP28A	462.	1.85	130.	79.	79.	1.03		
2 COMBINED AT	CP28*1	1363.	1.65	351.	212.	212.	5.96		
DIVERSION TO	SPL28.2	913.	1.65	235.	142.	142.	5.96		
HYDROGRAPH AT	DIV31.1	450.	1.65	116.	70.	70.	5.96		
ROUTED TO	DIV31.1R	438.	1.85	116.	70.	70.	5.96		
HYDROGRAPH AT	CP31A	161.	1.05	20.	12.	12.	0.16		
2 COMBINED AT	CP31.1	463.	1.80	136.	82.	82.	6.12		
DIVERSION TO	SPL30	185.	1.80	54.	33.	33.	6.12		
HYDROGRAPH AT	DIV31.2	278.	1.80	81.	49.	49.	6.12		
ROUTED TO	DIV31.2R	277.	1.85	81.	49.	49.	6.12		
HYDROGRAPH AT	CP31B	5.	0.70	0.	0.	0.	0.00		
2 COMBINED AT	CP31.2	277.	1.85	82.	50.	50.	6.12		

** NORMAL END OF HEC-1 ***

```
                    ID.......1.......2.......3.......4.......5.......6.......7.......8.......9.......10
LINE
  1                 ID      WHITE TANKS SOUTH S
                    *DIAGRAM
*** FREE ***
  2                 IT       3 15JUL86    1200     200
  3                 IO       4

  4                 KK    DA33
  5                 BA   0.295
  6                 PH       0       0    0.70    1.39    2.43
  7                 LS       0      86
  8                 UD    0.48

  9                 KK   DA33R
 10                 RK    3100  0.0092   0.015                      6       3

 11                 KK    DA34
 12                 BA    0.15
 13                 LS       0      86
 14                 UD    0.35

 15                 KK    CP34
 16                 HC       2

 17                 KK   CP34R
 18                 RK    2100  0.0092   0.015                      8       3

 19                 KK    DA35
 20                 BA   0.062
 21                 LS       0      86
 22                 UD    0.35

 23                 KK    CP35
 24                 HC       2

 25                 KK   CP35R
 26                 RK    1000  0.0092   0.015                      0       3

 27                 KK    DA36
 28                 BA   0.064
 29                 LS       0      86
 30                 UD    0.31

 31                 KK   DA37A
 32                 BA    2.44
 33                 LS       0      86
 34                 UD    1.62

 35                 KK   DIV36
 36                 DT  DIV37B
 37                 DI       0    5000
 38                 DQ       0    1500
```



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

 39                 KK  DIV36R
 40                 RK    4200  0.0096   0.015

 41                 KK    CP36
 42                 HC       3

 43                 KK   CP36R
 44                 RK    2300  0.0092   0.015                     15       3

 45                 KK   DA37B
 46                 BA    0.21
 47                 LS       0      86
 48                 UD    0.41

 49                 KK  DIV37B
 50                 DR  DIV37B

 51                 KK DIV37BR
 52                 RK    6400  0.0092   0.045

 53                 KK   CP37B
 54                 HC       3
 55                 ZZ
```

SCHEMATIC DIAGRAM OF STREAM NETWORK

```
INPUT
LINE      (V) ROUTING          (---)) DIVERSION OR PUMP FLOW

NO.       (.) CONNECTOR        ((---) RETURN OF DIVERTED OR PUMPED FLOW
  1         DA33
              V
              V
  9        DA33R
              .
              .
 11           .        DA34
              .          .
              .          .
 15        CP34............
              V
              V
 17       CP34R
              .
              .
 19           .        DA35
              .          .
              .          .
 23        CP35............
              V
              V
 25       CP35R
              .
              .
 27           .        DA36
              .          .
              .          .
 31           .          .       DA37A
              .          .          .
              .          .          .
 33           .          .          .-------> DIV37B
 35           .          .       DIV36
              .          .          V
              .          .          V
 39           .          .      DIV36R
              .          .          .
              .          .          .
 41        CP36.......................
              V
              V
 43       CP36R
              .
              .
 45           .       DA37B
              .          .
              .          .
 50           .          .          .<------- DIV37B
 49           .          .      DIV37B
              .          .          V
              .          .          V
 51           .          .     DIV37BR
              .          .          .
              .          .          .
 53       CP37B.......................
```

(***) RUNOFF ALSO COMPUTED AT THIS LOCATION

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

OPERATION	STATION	PEAK FLOW	TIME OF PEAK	AVERAGE FLOW FOR MAXIMUM PERIOD 6-HOUR	24-HOUR	72-HOUR	BASIN AREA	MAXIMUM STAGE	TIME OF MAX STAGE
HYDROGRAPH AT	DA33	284.	1.10	38.	23.	23.	0.30		
ROUTED TO	DA33R	282.	1.15	38.	23.	23.	0.30		
HYDROGRAPH AT	DA34	177.	0.95	19.	12.	12.	0.15		
2 COMBINED AT	CP34	435.	1.05	57.	34.	34.	0.44		
ROUTED TO	CP34R	432.	1.10	57.	34.	34.	0.44		
HYDROGRAPH AT	DA35	73.	0.95	8.	5.	5.	0.06		
2 COMBINED AT	CP35	499.	1.05	65.	39.	39.	0.51		
ROUTED TO	CP35R	496.	1.10	65.	39.	39.	0.51		
HYDROGRAPH AT	DA36	81.	0.90	8.	5.	5.	0.06		
HYDROGRAPH AT	DA37A	822.	2.25	303.	184.	184.	2.44		
DIVERSION TO	DIV37B	247.	2.25	91.	55.	55.	2.44		
HYDROGRAPH AT	DIV36	575.	2.25	212.	129.	129.	2.44		
ROUTED TO	DIV36R	575.	2.30	212.	129.	129.	2.44		
3 COMBINED AT	CP36	658.	1.15	284.	173.	173.	3.01		
ROUTED TO	CP36R	658.	1.15	284.	173.	173.	3.01		
HYDROGRAPH AT	DA37B	224.	1.00	27.	16.	16.	0.21		
HYDROGRAPH AT	DIV37B	247.	2.25	91.	55.	55.	0.00		
ROUTED TO	DIV37BR	243.	2.45	90.	55.	55.	0.00		
3 COMBINED AT	CP37B	881.	1.10	400.	244.	244.	3.22		

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