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PROPOSED CHANNEL IMPROVEMENTS REPORT
AGUA FRIA CHANNEL
McDOWELL ROAD TO THOMAS ROAD
FOR
MARICOPA COUNTY FLOOD CONTROL
MARICOPA COUNTY, ARIZONA

Registered Professional Engineer (Civil)
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Date Signed 3/31/83
ARIZONA, U.S.A.

DIBBLE AND ASSOCIATES
CONSULTING ENGINEERS
PHOENIX, ARIZONA

March 31, 1983

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Registered Professional Engineer
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I. RECOMMENDATION

It is recommended that the scope of work be modified to include bank protection as an acceptable solution to the river channel improvements.

The recommended channel section for a 91,000 CFS flow is a 1100 foot bottom width channel with 3 to 1 riprap protected sloped banks on a gradient of 0.0016'/, utilizing a Manning's n of 0.020. The estimated cost of constructing a channel with the above characteristics is approximately $4,600,000.

II. INTRODUCTION

The Flood Control District of Maricopa County proposes to improve the existing Agua Fria River by construction of a channel from the I-10 Bridge, south of McDowell Road to Thomas Road. The scope of this report includes the necessary hydraulic and geotechnical analysis for establishing an unlined river channel. The scope includes the design of a channel section for the 100 year design flow of 91,000 CFS with 1100 foot bottom width and 3 to 1 side slopes. The channel is confined to a right-of-way width of 1260 feet and should match existing elevations at the upstream and downstream limits of this reach.

At the upstream limit of this project near Thomas Road, a lined channel is being investigated by others.

At the downstream limit of the project, near McDowell Road, the Maricopa County Highway Department is relocating McDowell Road to accomodate a bridge crossing the proposed channel.

III. DISCUSSION

A. UNLINED CHANNEL

The hydraulic analysis and geotechnical investigation prepared to study the proposed channel improvements of the Agua Fria River Channel between the proposed new bridge site for McDowell Road to Thomas Road are included in this report as Appendix 1 and 2 respectively. From the HEC-2 computer analysis, included in the hydraulic report, the existing river has average simulated velocities of 4.8 FPS, resulting in a Froude Number of 0.28 (Appendix 1, Page 9). For the type of natural fined grained materials found in this reach of the river, a Froude Number of 0.30 or less is generally considered the upper limit for unlined banks. A channel with a gradient of 0.0002'/, is required to maintain a Froude Number of 0.30. This flat slope requires that three 4-foot high drop structures can be constructed to enable the channel gradelines to meet existing conditions at the termini. A Froude Number of less than 0.30 is obtained for this slope under normal depth conditions. However, the length between drop structures is not sufficient to allow the flow to reach normal depth. A HEC-2 computer run was made for this slope and the results are added as an attachment to the initial hydraulic report (Appendix 1, Attachment 7.5).

B. LINED CHANNEL

Other gradients steeper than 0.0002'/, were investigated; however, all require that the channel be protected with lining. Channel conditions for a slope of 0.0016'/,, which approximately meets with existing ground at the I-10 Bridge and Thomas Road are included in Appendix 1, Attachment 7.4, along with the HEC-2 computer analysis. The velocities and depths obtained for these conditions are not within acceptable limits for an unlined channel.

Constructing an unprotected bank channel within a 1260 foot right-of-way for this reach of river is not feasible with acceptable engineering criteria.

The improvement of the existing channel to a uniform cross-section and slope with existing materials reduces the composite Manning's n, estimated in excess of 0.035, under existing conditions, to 0.018 (Appendix 1, Page 5). Foreign materials should be introduced into the improved channel surface to establish a Manning's n in the 0.020 range. Riprap blankets or drop structures spaced periodically along the channel bottom can be provided to obtain the desired roughness and to stabilize the channel gradeline.

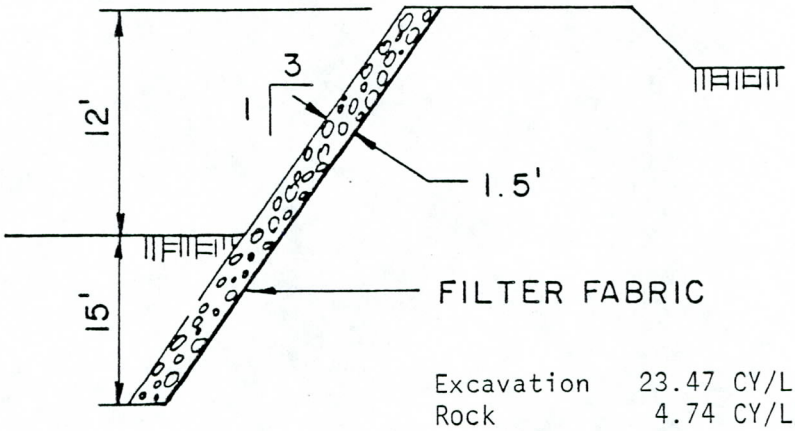
C. BANK PROTECTION

Since local bank protection, mass backfills, slope stabilization, or measures other than total bank protection will not adequately accommodate the 91,000 CFS flow based on the hydraulic and scour analysis for flows in excess of 5000 CFS (Appendix 1, Page 13), alternate channel treatment for bank protection of both sides is discussed herein for your consideration.

The natural fine grained soils lend themselves to a soil cement type of erosion protection. As discussed in Appendix 2, Page 6 - Geotechnical Investigation Report, the cement content for estimating purposes is 12%.

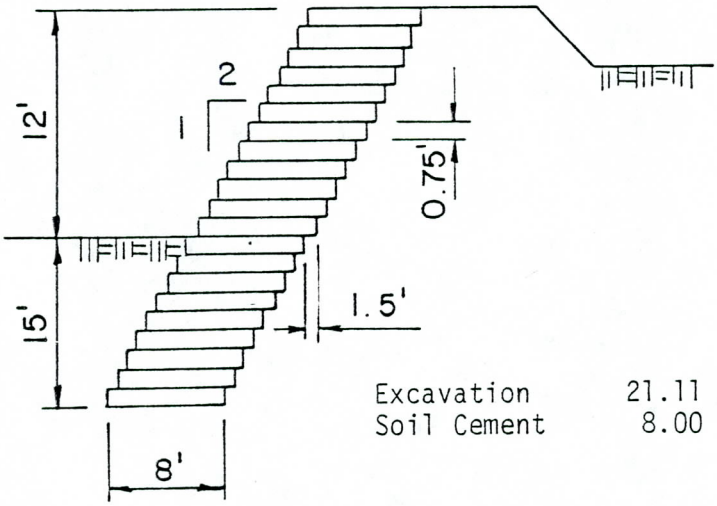
An alternate bank protection material could be imported dumped rock riprap. Location of potential quarry sites has not been fully investigated, however, rock has recently been available from a quarry site within nine miles of the project site.

Cost comparisons for these two types of bank protection appear on the following page. For the channel cost estimates the riprap bank protection alternate is used.



Excavation	23.47 CY/LF @ $ 1.00 =		$ 23.47
Rock	4.74 CY/LF @ $20.00 =		$ 94.80
	TOTAL		$118.27/LF

DUMPED RIPRAP



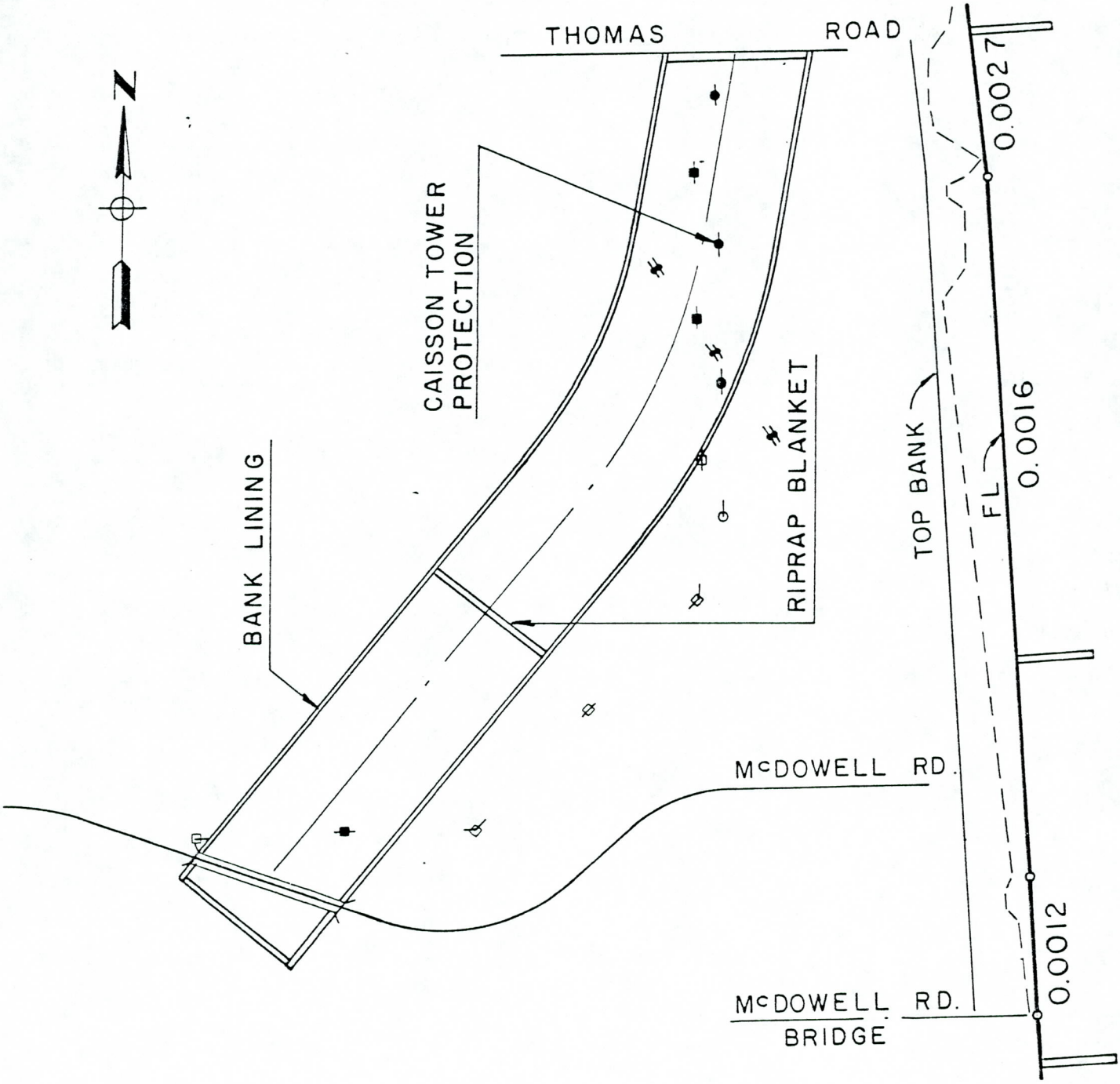
Excavation	21.11 CY/LF @	$ 1.00 =	$ 21.11
Soil Cement	8.00 CY/LF @	$ 30.00 =	$ 240.00
	TOTAL		$ 261.11/LF

SOIL CEMENT

BANK PROTECTION COMPARISONS

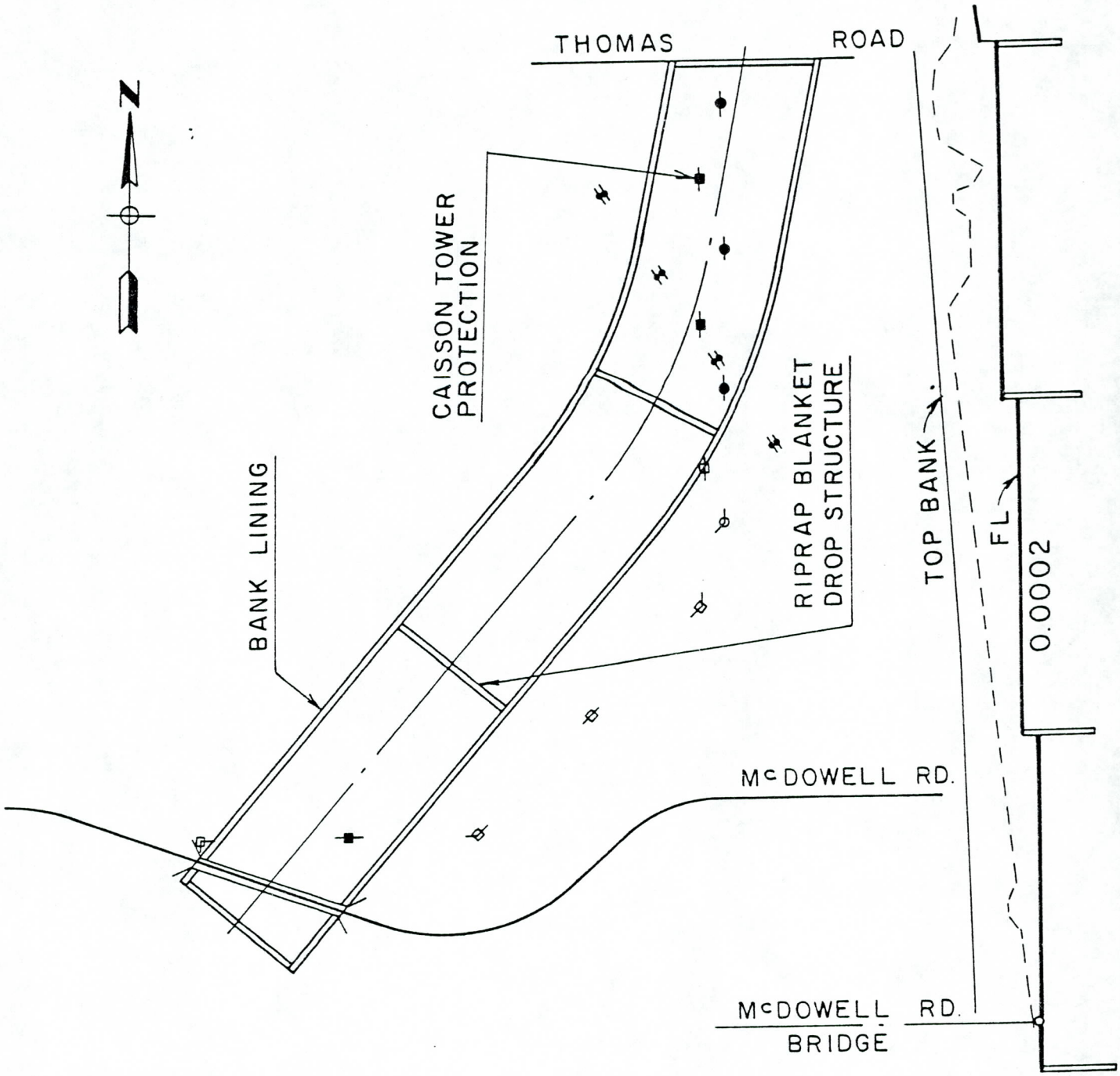
D. SCHEMATICS

For the design flows of 91,000 CFS each alternate gradeline investigated requires protected banks and riprap dikes across the channel to create roughness and provide drops in the channel. The following four drawings depict the channel schematics and details for the Steep Gradient Channel, S = 0.0016'/, and the Flat Gradient Channel, S = 0.0002'/,.



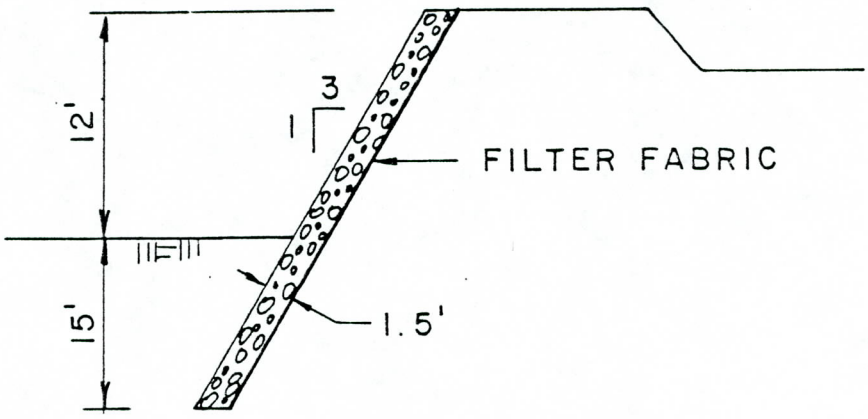
STEEP GRADIENT CHANNEL

S = 0.0016

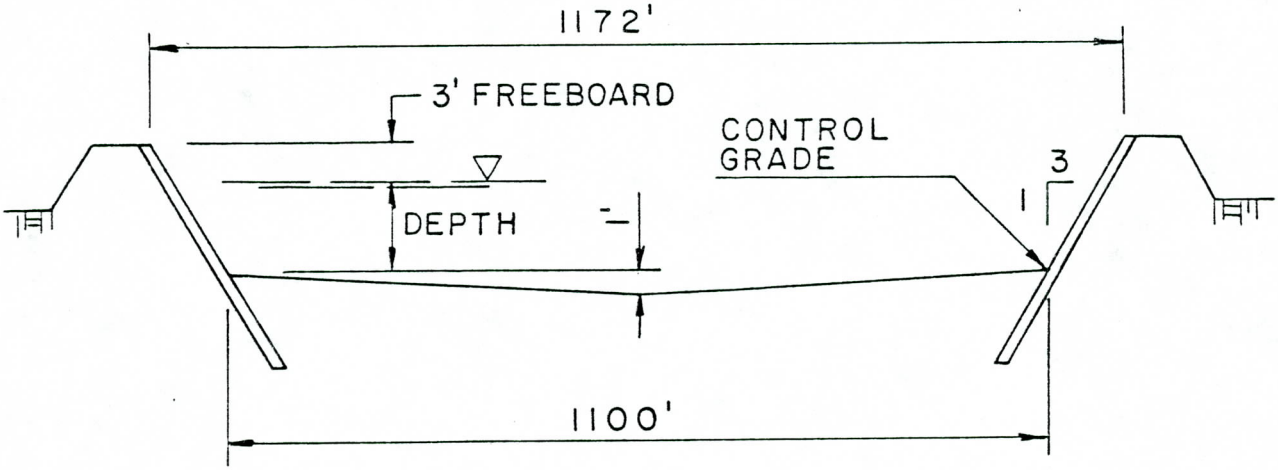


FLAT GRADIENT CHANNEL

S=0.0002

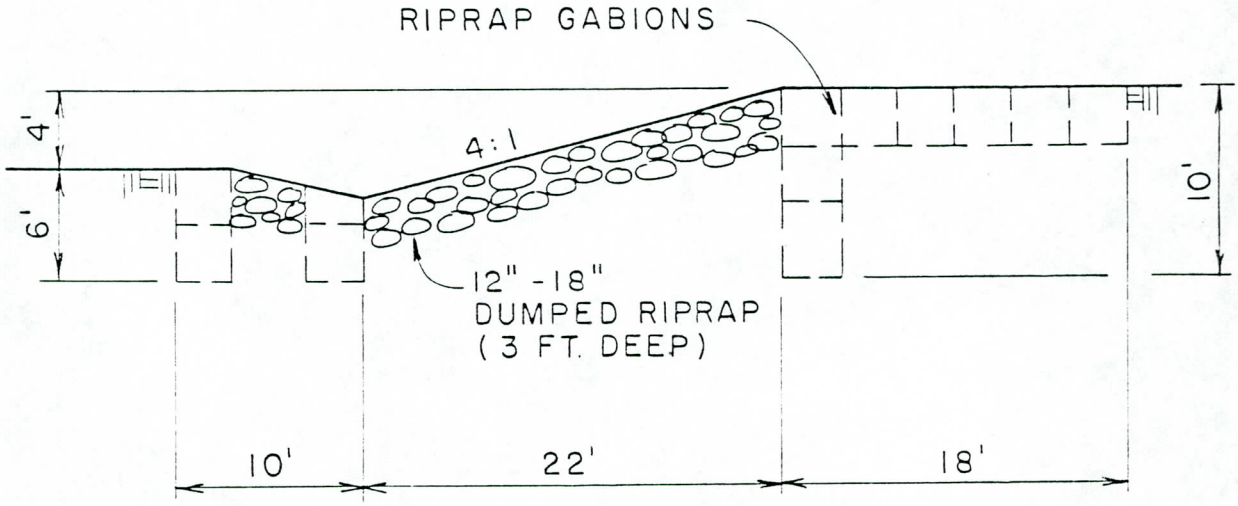


RIPRAP BANK PROTECTION

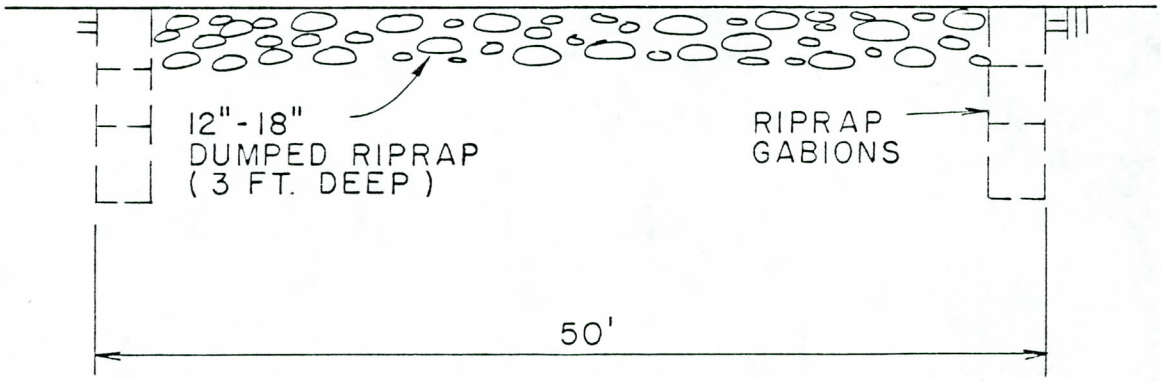


TYPICAL CHANNEL SECTION

CHANNEL DETAILS



DROP STRUCTURE



RIPRAP BLANKET

CHANNEL DETAILS

D. UTILITIES

There are three separate overhead power lines owned by Tucson Electric Power Company, Salt River Project, and the U.S. Department of Energy, which have towers located within the proposed channel. For a flow of 91,000 CFS, scour at the towers is estimated at 20 feet below grade (Appendix 1, Page 7.6-3); therefore, sheet piling caissons around each tower for a depth of 30 feet below the flow line have been used to estimate costs. The Tucson Electric Power Company has suggested additional piling with a concrete cap at each tower leg for tower protection. This configuration may be slightly cheaper in cost. A protective system will be adopted in final plan preparation.

Underground utilities within the project consist of a Mountain Bell Telephone cable in McDowell Road, a Southern Pacific fuel oil line in Thomas Road and a City of Avondale waterline in Thomas Road. Underground utilities will be lowered below the proposed gradeline.

E. COST ESTIMATES

Preliminary construction cost estimates are tabulated below for the two channel alternates:

PRELIMINARY COST ESTIMATE

STEEP GRADIENT CHANNEL

S=0.0016 @ n = 0.020

ITEM NO.	ITEM	QUANTITY	UNIT COST	TOTAL
1.	Mass Excavation & Levees	850,000 CY	$ 1.00	$ 850,000
2.	Cutoff Excavation	329,000 CY	1.00	329,000
3.	Riprap Bank Protection	66,000 CY	20.00	1,320,000
4.	Tower Caissons	70,000 SF	15.00	1,050,000
5.	Riprap Blanket	3 EA	280,000.00	840,000
6.	Watermain Protection or Relocation	1,400 LF	50.00	70,000
7.	Gas Pipe Protection or Relocation	1,400 LF	50.00	70,000
8.	Telephone Cable Protection or Relocation	1,400 LF	20.00	28,000
		TOTAL		$ 4,557,000
			USE	$ 4,600,000

FLAT GRADIENT CHANNEL

S= 0.0002 @ n = 0.020

ITEM NO.	ITEM	QUANTITY	UNIT COST	TOTAL
1.	Mass Excavation & Levees	1,635,000 CY	1.00	$ 1,635,000
2.	Cutoff Excavation	329,000 CY	1.00	329,000
3.	Riprap Bank Protection	73,000 CY	20.00	1,460,000
4.	Riprap Blanket	1 EA	280,000,00	280,000
5.	Riprap Drop Structures	3 EA	425,000.00	1,275,000
6.	Tower Caissons	70,000 SF	15.00	1,050,000
7.	Watermain Protection or Relocation	1,400 LF	50.00	70,000
8.	Gas Pipe Protection or Relocation	1,400 LF	50.00	70,000
9.	Telephone Cable Protection or Relocation	1,400 LF	20.00	28,000
			TOTAL	$ 6,197,000
			USE	$ 6,200,000

IV. CONCLUSION

To establish a channel in the designated right-of-way width of 1260 feet which will convey a design flow of 91,000 CFS the banks must be protected and the channel stabilized by imported materials to provide gradient checks.

The recommended channel section for a 91,000 CFS flow is a 1100 foot bottom width channel with 3 to 1 riprap protected sloped banks on a gradient of 0.0016'/, utilizing a Manning's n of 0.020. The estimated cost of constructing a channel with the above characteristics is approximately $4,600,000.

HYDRAULIC ANALYSIS

APPENDIX 1

HYDRAULIC ANALYSIS
OF
AGUA FRIA CHANNEL
MCDOWELL ROAD TO THOMAS ROAD
MARICOPA COUNTY, ARIZONA

Prepared for
Dibble and Associates
Phoenix, Arizona

Registered Professional Engineer
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I. Introduction

1.1 General

Presented in this report is our analysis of hydraulic conditions of the proposed Agua Fria Channel including the proposed McDowell Road Bridge, from McDowell Road to Thomas Road, for 91,000 cfs.

Mathematical hydraulic modeling techniques were employed utilizing the HEC-2 computer program for the analysis of the existing conditions, and the channel, with the proposed bridge improvements at McDowell Road.

1.2 Available Information

The analysis presented in this report is based on the following information:

1. Aerial photographs by Kenney Aerial Mapping dated 1/21/81 and 2/20/80.
2. 1" = 100', 2' C.I. contour maps by Kenney Aerial Mapping, based on 1/21/81 conditions.
3. 1" = 200', 2' C.I. contour maps, by M.C.F.C.D. and U.S. Army Corps of Engineers, dated April 20, 1982.
4. Digitized crossections based on 4/20/82 M.C.F.C.D. Maps as digitized by Dibble and Associates.
5. Proposed channel profile and crossection by Dibble and Associates.
6. Proposed bridge improvements by Hoffman-Miller Engineers.
7. Preliminary and Final Geotechnical Investigation Reports by Sergent Hauskins and Beckwith, 1982.

8. Preliminary Report - McDowell Road Bridge at the Agua Fria River - 100,000 cfs Bridge Feasibility, April, 1981 by SCI Consulting Engineers, Inc.

9. Design discharge of 91,000 cfs by M.C.F.C.D.

10. "HEC-2 Water Surface Profiles", U.S. Army Corps of Engineers, 1976.

11. FHA, U.S. Department of Transportation (1975), Highways in the River Environment, Hydraulic and Environmental Design Considerations.

12. Leopold, Bagnold, Wolman and Brush (1960) Flow Resistance in Sinuous or Irregular Channels, Geological Survey Prof. Paper 282-D.

13. Culbertson, Young and Brice (1967) Scour Fill in Alluvial Channels with Particular Reference to Bridge Sites, U.S. Geological Survey, Open File Report.

14. Henderson, (1966) Open Channel Flow, Macmillan.

II. Site Description

2.1 Geomorphology

Agua Fria River is a braided river with significant meanders of its thalweg in places. Generally, braided rivers are considered as aggrading in their natural undistrubed state. Where mans activities may modify such streams their fluvial characterisitics may be modified. This was apparently the case at the Indian School Road Bridge crossing. The construction of the bridge and an associated downstream gravel mining operation has modified a short reach of the stream into a degrading mode. The Simons and Li Report estimated a total general regional scour and local scour of 30+ feet at the

Indian School Road Bridge which may have occurred in the 1980 flood. The bridge failed due to scour at two of its piers. These piers were supported by spread footings placed 25 feet below the streambed.

Boring information developed by Sergent Hauskins & Beckwith Consulting Geotechnical Engineers indicates that materials in the area of the proposed bridge and proposed realigned channel are generally fine sands and sandy silts with some traces of gravel. The D_{50} size is on the order of 0.3 to 0.4 mm with the largest size being generally less than 1/4 inch. Materials of this nature generally exist at the proposed bridge alignment to a depth of about 25 feet where gravel and other hard material prevent augering.

Visual inspection of the site and study of aerial photographs taken during the February 1980 flood indicate that the Agua Fria River, in the vicinity of McDowell Road is a wide meander which probably extends as far east as it can or has extended historically. Just downstream from McDowell Road there is a sharp "dog leg" to the west suggesting that the river may be difficult to control and realign in this area.

Currently, there is a gravel mining operation several hundred feet north of McDowell Road and in the main meander of the Agua Fria River channel. The proposed realignment of the river is to the west of the gravel operation.

According to the Simons and Li Report, which reviewed the general geomorphology of the Agua Fria River and its tributaries upstream, no new major changes are expected in the future due to modification by man. Consequently, major regime changes are not anticipated or evaluated as part of this project.

2.2 Hydrology

The largest recorded flow in the river, since the construction of the Lake Pleasant dam in 1927, was the 66,000 cfs released on February 20, 1980. The maximum discharge of record prior to the dam construction is 105,000 cfs that occurred in January, 1916, and November 1919, and is the greatest since 1889.

The U.S. Army Corps of Engineers published on March 4, 1981 the following discharges for the Agua Fria River at the McDowell Road:

10 year	-	16,000 cfs
25 year	-	49,000 cfs
50 year	-	69,000 cfs
100 year	-	91,000 cfs
S.P.F.	-	137,000 cfs
500 year	-	182,000 cfs

The 100 year discharge of 91,000 cfs was selected by the FLOOD CONTROL DISTRICT of MARICOPA COUNTY as the design discharge for this project.

III. Flow Resistance Coefficient

For the purpose of the HEC-2 backwater analysis, the following Mannings "n" values were used:

a. I-10 to McDowell Road (Downstream of the proposed bridge). The channel is expected to remain in its existing condition with westerly overbank n = 0.045, channel n = 0.035, easterly overbank n = 0.040.

b. Underneath the proposed McDowell Road Bridge and upstream inside the proposed new 1100' bottom earthlined channel, n = 0.018.

IV. Scour Analysis

4.1 General and Local Scour

There are two types of scour that may occur: general regional scour and local scour. General regional scour is most often associated with bridge crossing constriction. Local scour is induced by the bridge piers.

Assuming the proposed rechannelization occurs before the bridge is built or occurs simultaneously, general regional scour will be zero since no constriction of flow will occur. The average cross-sectional sediment entrainment power will remain constant along the channel in the vicinity of the bridge. Additionally, the proposed channel slope, from 1000 feet upstream of the bridge to I-10 (1300 feet downstream), when realigned, is about the same as the existing regional slope of the Agua Fria River channel (i.e. 0.0011). As indicated previously, the existing Agua Fria River channel is assumed to be aggrading. The new section in the vicinity of the proposed McDowell Road Bridge crossing will probably be in equilibrium over a long-term period.

However, the river channel is generally unstable due to its ability to entrain the fine soil particles in the area. Without significant bank protection of the proposed channel realignment, short-term meanders may develop during severe or even moderate flooding. The thalweg will probably change locations frequently. Assuming the bridge abutments are properly protected by rip rap, the proposed bridge will act as a permanent structure, pinning the river at the same location. Any meanders that develop will probably do so upstream with the result that flow might pass the bridge at an angle. If the thalweg is say on one side of the bridge, flow will be concentrated at this side while the other side is actually experiencing sedimentation, like on the inside of a river bend. To account for such a possibility, a reduction in flow area will be assumed. Making such an assumption the following formula may be used (Culbertson, Young, and Brice, 1967):

$$\frac{y_2}{y_1} = \left(\frac{b_1}{b_2}\right)^{0.64}$$

where y_2 is the depth of flow at bridge, y_1 is the upstream depth, b_2 is the water surface width at the bridge, and b_1 is the upstream water surface width. This equation is derived from Manning's equation, continuity, and DuBoy's bedload formula. It is generally applicable where the width of construction is 25 percent, or less, as verified by a large amount of data assembled by Griffith. Thus, assume a

25 percent constriction (which is considered reasonably conservative).

$$y_2 = (9.23)(1.25)^{0.64} = 10.65 \text{ ft.}$$

Where the upstream depth is estimated using the design 100-year discharge and the HEC-2 computer model. The computed depth at the bridge using the HEC-2 model is 9.40 feet, thus estimated equilibrium general scour is:

$$y_s = 10.65 - 9.40 = 1.25 \text{ ft.}$$

Local scour at the bridge piers is caused by a "horseshoe" shaped vortex which forms on the downstream side of a pier. This type of scour is a major factor in most bridge failures (e.g. the Indian School Road Bridge). Procedures recommended by FHA (1975) are well documented and are appropriate to this analysis. Local scour at cylindrical piers can be estimated from the emperical formula:

$$Y_s = 2.0\ y_1 \left(\frac{a}{y_1}\right)^{0.65} F_1^{0.43}$$

Where y_s is the scour at one bridge pier, y_1 is the upstream depth, a is the pier diameter, and F_1 is the upstream Froude Number. This equation was developed from a large number of laboratory studies of cylindrical piers placed in material sizes very similar to those found at the proposed bridge site. Thus for one pier:

$$y_s = (2.0)(9.23)\left(\frac{5}{9.23}\right)^{0.65} (0.54)^{0.43} = 9.51 \text{ ft.}$$

For two piers oriented parallel to the flow, a correction reduction is recommented (FHA Manual); thus:

$$y_s = (9.51)(0.9) = 8.56 \text{ ft.}$$

which represents the average equilibrium local scour at a pier group during the design discharge. The instantaneous scour may be 1.3 times the equilibrium scour (FHA Manual); hence:

$$Y_s = (1.3)(8.56) = 11.13 \text{ ft.}$$

As mentioned previously, there is the possibility of thalweg meander such that flow may be at an angle to the pier group alignment. Assuming a 15° skew angle to the flow, the FHA manual suggests a correction factor of 1.5: thus:

$$Y_s = (1.5)(11.13) = 16.69 \text{ ft.}$$

The total scour estimated for the bridge crossing is the sum of local and general regional scour; i.e.

$$Y_s = 16.69 + 1.25 = 17.94 \text{ ft.}$$

It is believed that this estimate is conservative with a safety factor of about 1.5. The proposed pier depth of 20 ft. is adequate with a safety factor of 1.7. The I-10 bridge piers were constructed to a depth of 26 feet (from streambed to spread footing) where apparently denser material is encountered.

4.2 Channel Stability

As was previously stated, the Agua Fria River in the general area of the project site is unstable. Usually extensive flood control work is required to permanently train such rivers.

Simulation using the HEC-2 computer program with a design discharge of 91,000 cfs indicated that the unmodified flood plain north of I-10 is quite extensive, being over a mile wide just north of the existing McDowell Road. Average simulated velocities are about 4.8 fps and the resulting Froude No. is about 0.28, which according to Leopold et al (1960), indicates a meandering tendency. Under existing undisturbed conditions, the fine grained bed materials can be entrained and eroded. Local armoring, which was visually observed, will only increase the tendency for meander development and the promotion of large scale eddies.

Simulations using the HEC-2 computer program for the proposed rechannelization of the Agua Fria River indicate that average velocities may be on the order of 9.2 fps with a corresponding Froude No. of 0.53. Large velocities arise from the fact that the flow length has been decreased by straightening the channel from Thomas Road extension to I-10. Average invert slopes have been increased from 0.0011 (undisturbed existing thalweg) to 0.00155 (minimum 0.0012 and maximum 0.0027). Increased velocities will undoubtedly entrain and erode the proposed earthlined channel. Some bottom erosion will occur; however, the most likely erosion will be the bank materials. In other words, the river will attempt to restore its "equilibrium slope" by cutting into banks and establish large meanders. If one assumes that

essentially a sine wave shaped meander pattern will develop between McDowell and Thomas Roads, a sine function amplitude of about 1400 feet will be required to restore a slope of 0.0011. This means that the Agua Fria River will potentially erode a minimum 850 feet on each side of the proposed channel banks. On the east, this would place the river bank in its existing channel. Such a possibility is fairly likely even at much lesser flows than the design flow of 91,000 cfs.

It is concluded from this analysis that the proposed earth-lined rechannelization of the Agua Fria River is not a practical and functional design. Moreover, if a large meander were to develop immediately upstream of the proposed McDowell Road Bridge, a severe skew of the flow may result, endangering the bridge abutments and possibly the piers. Furthermore, head cutting would probably be initiated, extending upstream and possibly jeopardizing upstream structures.

4.3 Channel Maintenance

The question regarding the degree of maintenance required to maintain the proposed realigned Agua Fria River channel is very difficult to answer since very little research has been conducted upon frequency distribution of factors that affect the geomorphic process. From previous studies, we have some analysis of flood frequency for the site. Table I presents discharges for various recurrence intervals and the resulting theoretical hydraulic calculations using the

TABLE I

THEORETICAL HYDRAULIC CALCULATIONS USING HEC2
FOR PROPOSED EARTH LINED CHANNEL
1000 FEET UPSTREAM FROM MCDOWELL ROAD BRIDGE

Recurrence Interval, Years	Discharge, cfs	Average Velocity, fps	Flow Depth, ft.	Froude No.
10	16,000	5.37	3.19	0.53
25	49,000	7.47	6.39	0.52
50	69,000	8.41	7.84	0.53
100	91,000	9.29	9.23	0.54

the HEC-2 computer model. As can be seen, there is no change in the Froude No. for the various frequency levels of flooding. We can conclude that the Froude No. would be the same for smaller events. Such a Froude No. suggests that there is a strong tendency for the channel to meander.

Leopold et al (1964) discusses frequency concepts related to geomorphic processes and concludes that small and intermediate flood events are responsible for most of the sediment transport in streams. Scanty data that they were able to obtain, suggests that 80 to 95 percent of a stream's total sediment transport resulted from events that occurred one day per year. Although major flooding events are important in modifying the fluvial regime of rivers, they occur so infrequently that over a long period of time they have only a minor effect on the total sediment moved. Short term, frequent events, although they have shorter durations, tend to move the bulk of all sediment transported.

This is expected to be the case with the Agua Fria River. The River is an ephemeral stream in the vicinity of the project site, flowing only in response to occasional local thunderstorms or infrequent general winter storms. During periods of moderate storm rainfalls, intermediate to low runoff events will result in rapid modification of the proposed realigned Agua Fria River. The rate that the channel will be modified can not be determined. However, it can be stated that with any moderate runoff event lasting for several days, substantial reworking of the channel will result, prior

to reaching the peak discharge of the storm event. Sediment entrainment primarily occurs during the rising limb of the flood hydrograph and not at the peak. Sedimentation, particularly in long term aggrading streams, occurs on the falling limb of the flood hydrograph. It is conceivable that during an average runoff year, the realigned Agua Fria River channel may be substantially modified so that a slope similar to its natural slope would be established.

In order to establish the upper limit Q beyond which shifting and meander of the proposed unlined channel would occur, we estimate that a single event 24 hour storm with a peak discharge of 5,000 cfs might be accommodated without major bank erosion. Larger particles of the parent materials would not be entrained and some armoring would be expected for 5,000 cfs or less. Meandering would occur over the 1,100 feet invert of the realigned channel but would mostly be contained within the proposed channel for the hypothetical single event storm.

A succession of such events over a winter period would, however, result in major shifting and modification of the proposed realigned channel. If the channel were repaired and restored after each event (say less than a peak Q of 5,000 cfs), it might be possible to operate with the proposed channel for an unknown period of time. Larger events or a succession of small events in rapid order so that the channel could not be restored, of course, would defeat a concept of restoration.

It is necessary to point out that the above estimates were made with approximate methods. If the unlined presently proposed channel was to be considered , a more definitive analysis would be required with a significant expansion of the original scope of this study.

V. Mathematical Model

5.1 Methodology

The water surface profiles and bridge losses were computed with the aide of the HEC-2 computer program, developed in the Hydrologic Engineering Center, Corps of Engineers, Davis, California, by Bill S. Eichert. The computational procedure is similar to Method 1, Backwater Curves in River Channels, Engineering Manual 1110-2-1409, U.S. Army Corps of Engineers, 7 December 1959.

This method applies Bernoulli's Theorem for the total energy at each cross section and Manning's formula for the friction head loss between cross sections. In the program, average friction slope for a reach between two cross sections is determined in terms of the average of the conveyances at the two ends of the reach. Other losses are computed using one of several methods. The critical water surface elevation corresponding to the minimum specific energy is computed using an iterative process. The energy losses caused by bridges are computed in two parts. First, the losses due to expansion and contraction of the cross section on the upstream and downstream side of the structure are computed,

then secondly the special routine computes losses through the structure for low flow, weir flow and pressure flow or for any combination of these. The type of flow is determined by a series comparisons. First, the energy grade line elevations are computed assuming alternately low flow and pressure flow control. The higher energy grade line elevation determines the appropriate type of flow. If pressure flow appears to control and the energy grade line is above the minimum top of roadway elevation, then a combination of pressure flow and weir flow exists. If the energy gradient is below the minimum top of roadway, then pressure flow alone controls. If a low flow appears to control, and the corresponding energy gradient elevation is above the minimum top of roadway elevation, then a combination of low flow under the bridge and weir flow over the roadway approach exists. If the energy elevation is below the minimum top of roadway, then low flow controls.

5.2 Assumptions

a. The starting elevation for the water surface profile computation was obtained from the A.D.O.T. to be 979.91 at the I-10 Bridge, from their analysis of 100,000 cfs flow.

b. The I-10 Bridge opening was assumed to be 1500' wide.

c. No dyking between I-10 and McDowell Road.

d. Debris width = 1/2 pier diameter on each side of the piers.

TABLE II

HEC-2 RESULTS

SUMMARY

Q = 91,000 CFS

Sec. No.	Existing Cond. W/O I-10 Bridge	I-10 Bridge + Channel Improv. Only	I-10 Bridge Channel + Bridge Improvements
5.55	79.9/9.3*	79.9/9.9	79.90/9.9
5.82	82.3/7.6	83.5/7.2	83.48/7.2
5.85	-	85.16/9.3	85.16/9.3
Bridge	-	-	84.92/9.22
5.86	-	85.25/8.7	85.50/8.5 + 0.25
6.33	85.44/7.9	85.78/9.5	85.97/9.3 + 0.19
6.71	88.59/12.8	86.67/11.3	86.78/11.1 + 0.11
6.96	91.96/8.3	88.42/11.8	88.43/11.8 + 0.01
7.12	93.9/7.2	89.91/11.8	89.91/11.8 + 0
7.36	96.4/12.0	91.90/11.9	91.90/11.9 + 0
7.65	99.78/8.8	93.71/13.7	93.69/13.7 + 0
7.89	102.81/6.6	100.37/10.3	100.39/10.3

* H.G.L. Elevation/Velocity (fps)

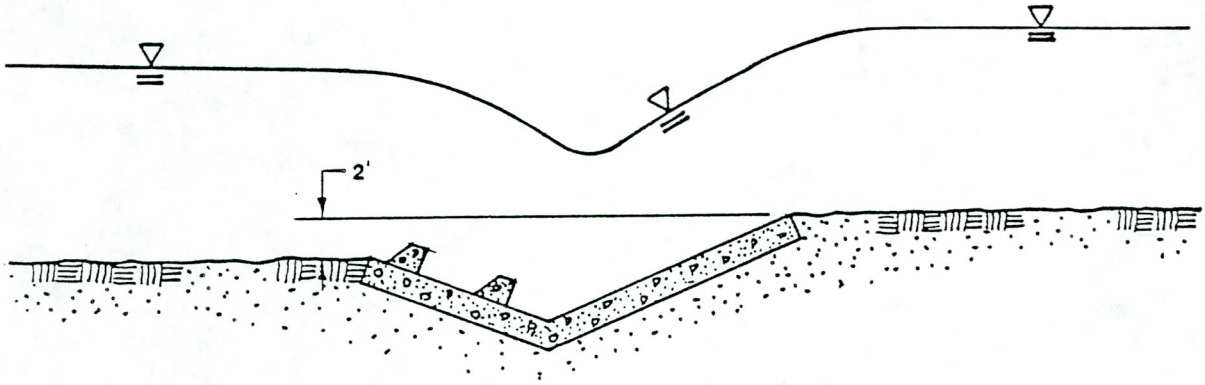
VI. Suggested Alternative Designs

Assuming the proposed alignment of the McDowell Road is fixed, alternatives for rechannelization of Agua Fria River range from complete lining to accepting the likely consequence of the proposed earth structure. Even a thin walled concrete channel would be a marginal design considering soils of the region. Differential settlement and possibly localized groundwater might jeopardize such an approach. Assuming such a design were feasible, total 1982 project costs might exceed $30 million

The most feasible alternative from an economic standpoint is probably one that can utilize an earthlined channel. To do this, however, will require substantial reduction in the velocity from that anticipated in the proposed channel. There are two basic ways to achieve this: (1) enlarge and lengthen the channel or (2) enlarge and decrease the slope of the channel. The first method would essentially be to force meanders in the channel where the engineer wants them and hope they will remain stable. This method is not recommended. The second method is recommended, and consists of constructing drop structures in the channel invert. Local bank rip rap will be required to maintain the integrity of the drop structures. Only two drop structures should be required two feet in height to achieve the desired slope. Flow area would have to be increased by about 20% (e.g. widen proposed channel to 1300 feet). Drop structures need not be massive vertical type structures but could be prone as shown on the attached sketch.

They could be constructed from large angular blocks and gunnited as well as constructed from concrete. Stilling blocks are advisable on the downstream apron to ensure that flows return to a tranquil state.

The proposed alternative would probably not exceed a 1982 project cost of $8 million. Further, conceptual as well as detailed studies are required to firm up alternatives and their costs.

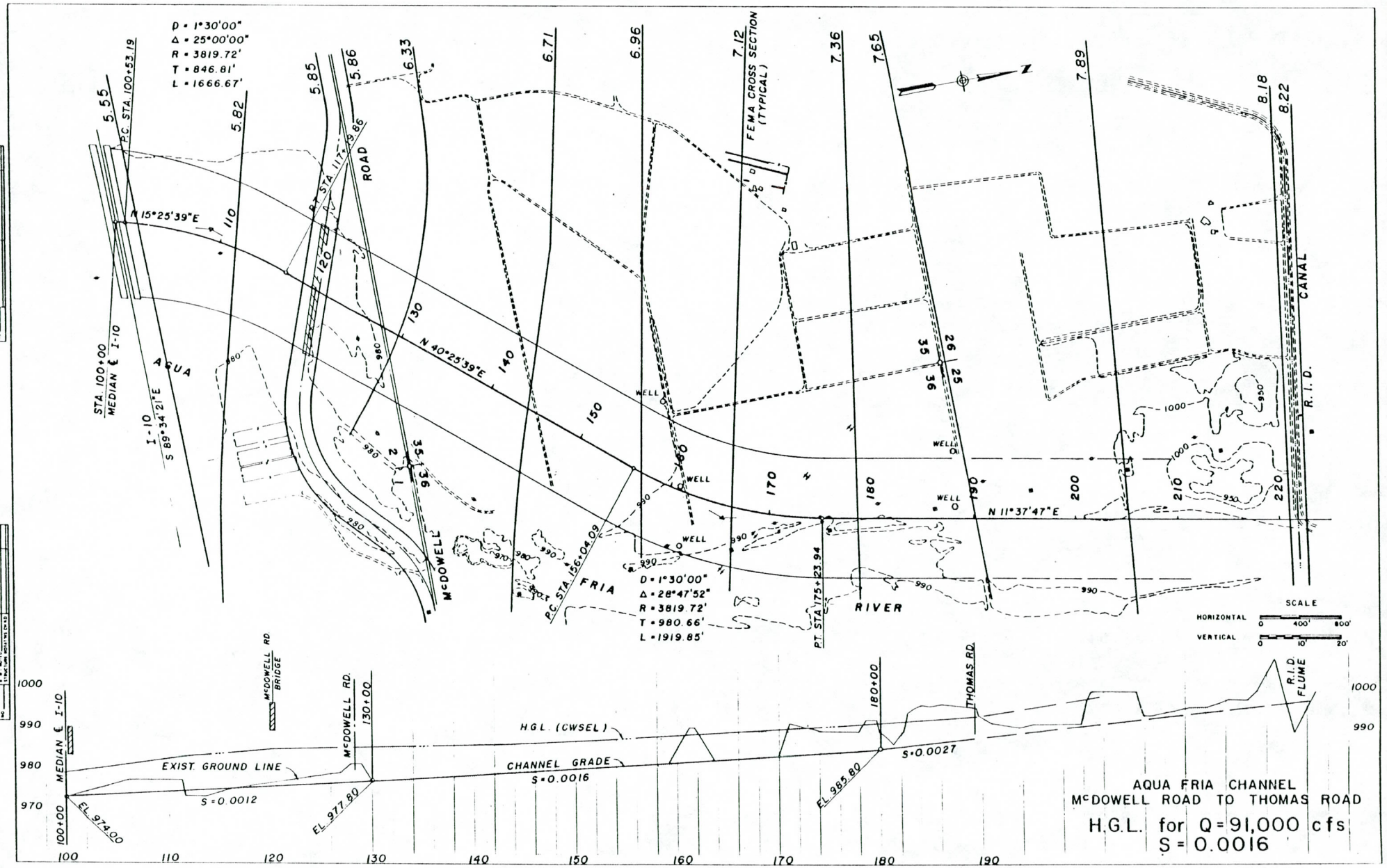


SCHEMATIC DIAGRAM OF PRONE DROP STRUCTURE

Lowry & Associates

ATTACHMENT 7.1

PLAN AND PROFILE S=0.0016'/'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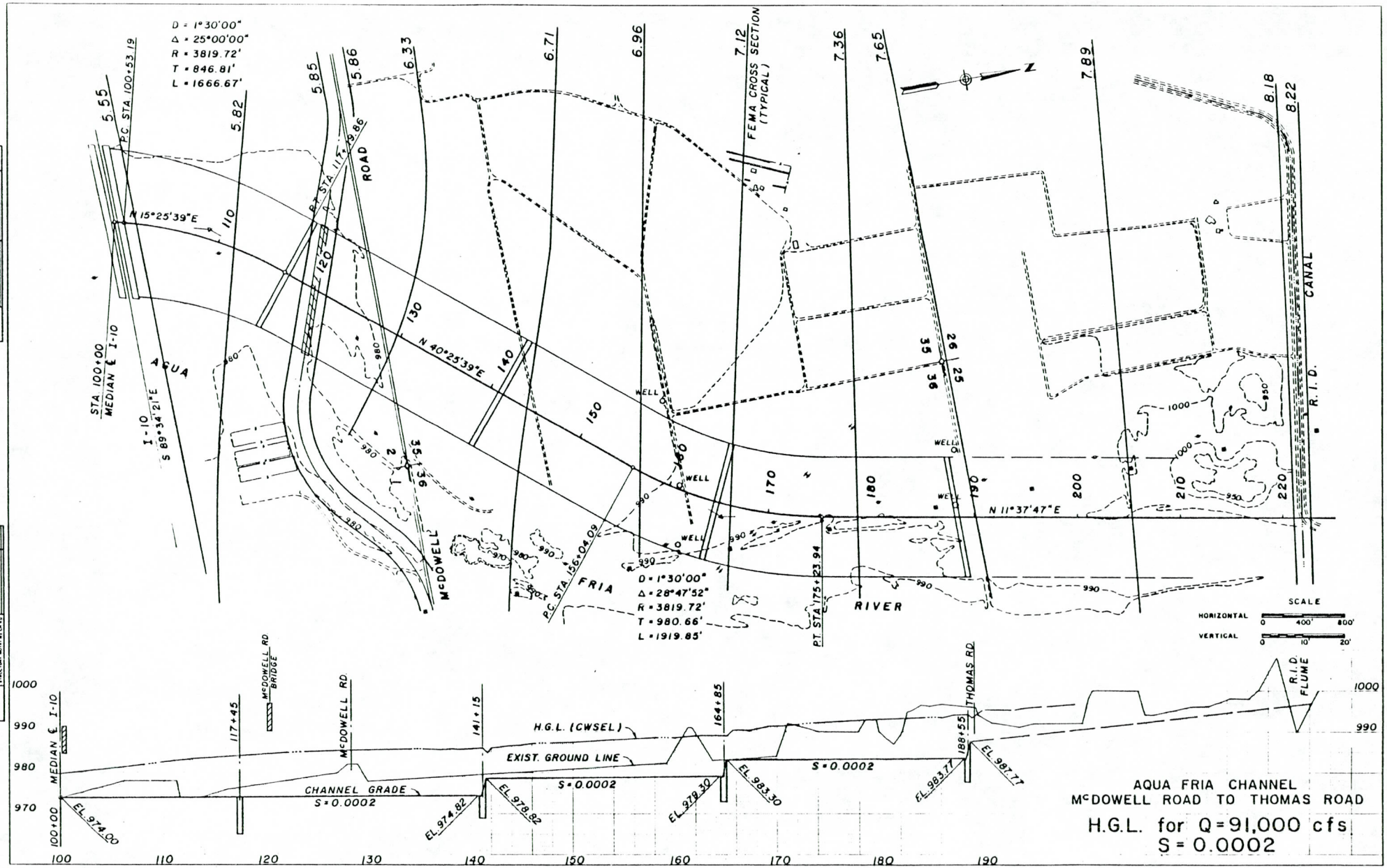
Δ = 25°00'00"
R = 3819.72'
T = 846.81'
L = 1666.67'
P.C. STA. 100+53.19
STA. 100+00
MEDIAN ℄ I-10
N 15°25'39"E
S 89°34'21"E
I-10
AQUA
FRIA
RIVER
McDOWELL
ROAD
P.T. STA. 117+53.86
N 40°25'39"E
N 11°37'47"E
P.C. STA. 156+04.09
D = 1°30'00"
Δ = 28°47'52"
R = 3819.72'
T = 980.66'
L = 1919.85'
PT. STA. 175+23.94
FEMA CROSS SECTION (TYPICAL)
WELL
R.I.D. CANAL
SCALE
HORIZONTAL 0 400' 800'
VERTICAL 0 10' 20'
McDOWELL RD. BRIDGE
McDOWELL RD. 130+00
180+00
THOMAS RD.
R.I.D. FLUME
HGL (CWSEL)
EXIST. GROUND LINE
CHANNEL GRADE
S = 0.0016
S = 0.0012
S = 0.0027
EL. 974.00
EL. 977.80
EL. 985.80
AQUA FRIA CHANNEL
McDOWELL ROAD TO THOMAS ROAD
H.G.L. for Q = 91,000 cfs
S = 0.0016

ATTACHMENT 7.2

PLAN AND PROFILE S=0.0002'/,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Δ = 25°00'00"
R = 3819.72'
T = 846.81'
L = 1666.67'
P.C. STA. 100+53.19
STA 100+00
MEDIAN ℄ I-10
N 15°25'39"E
S 89°34'21"E
I-10
AQUA
FRIA
RIVER
McDOWELL
ROAD
P.T. STA. 117+19.86
N 40°25'39"E
N 11°37'47"E
P.C. STA. 156+04.09
P.T. STA. 175+23.94
D = 1°30'00"
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R = 3819.72'
T = 980.66'
L = 1919.85'
FEMA CROSS SECTION (TYPICAL)
WELL
R.I.D. CANAL
SCALE
HORIZONTAL 0 400' 800'
VERTICAL 0 10' 20'
MEDIAN ℄ I-10
McDOWELL RD BRIDGE
McDOWELL RD.
THOMAS RD.
R.I.D. FLUME
H.G.L. (CWSEL)
EXIST. GROUND LINE
CHANNEL GRADE
S = 0.0002
EL 974.00
EL 974.82
EL 978.82
EL 978.30
EL 983.30
EL 983.77
EL 987.77
AQUA FRIA CHANNEL
McDOWELL ROAD TO THOMAS ROAD
H.G.L. for Q = 91,000 cfs
S = 0.0002

ATTACHMENT 7.3

HEC-2 RESULTS FOR
EXISTING CONDITIONS
Q 100 = 91,000 cfs

```
****A  END  JOB 1004  #SWC02A  AGUA FRIA RIVER  ROOM HOLD  1.07.03 PM 26 APR 82  R17.PR1  SYS H168  JOB 1004  END  A****
****A  END  JOB 1004  #SWC02A  AGUA FRIA RIVER  ROOM HOLD  1.07.03 PM 26 APR 82  R17.PR1  SYS H168  JOB 1004  END  A****
****A  END  JOB 1004  #SWC02A  AGUA FRIA RIVER  ROOM HOLD  1.07.03 PM 26 APR 82  R17.PR1  SYS H168  JOB 1004  END  A****
****A  END  JOB 1004  #SWC02A  AGUA FRIA RIVER  ROOM HOLD  1.07.03 PM 26 APR 82  R17.PR1  SYS H168  JOB 1004  END  A****
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****A  END  JOB 1004  #SWC02A  AGUA FRIA RIVER  ROOM HOLD  1.07.03 PM 26 APR 82  R17.PR1  SYS H168  JOB 1004  END  A****
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**********************************************
 HEC2 RELEASE DATED NOV 76 UPDATED APR  1980
 ERROR CORR -  01,02,03,04
 MODIFICATION -  50,51,52,53,54
**********************************************

T1      AGUA FRIA CHANNEL * I-10 TO INDIAN SCHOOL ROAD *
T2      EXISTING CONDITIONS *  FOR 1981 CONTOURS *
T3      Q=91000 CFS

J1  ICHECK   INQ     NINV    IDIR    STRT    METRIC  HVINS   Q       WSEL    FQ

     0.      0.      0.      0.   0.0        0.0     0.0   91000.  979.900   0.0

J2  NPROF    IPLOT   PRFVS   XSECV   XSECH   FN      ALLDC   IDW     CHNIM   ITRACE

    1.000   10.000   0.0     0.0     0.0     0.0     0.0     0.0     0.0    15.000

J3  VARIABLE CODES FOR SUMMARY PRINTOUT

   120.000   0.0     0.0     0.0     0.0     0.0     0.0     0.0     0.0     0.0

NC    0.045   0.040   0.035   0.100   0.300   0.0     0.0     0.0     0.0     0.0

X1    5.550  29.000 10000.000 10000.000   0.0     0.0     0.0     0.0     0.0     0.0
GR  990.000 8400.000  988.000 8500.000  986.000 8650.000  984.000 8900.000  982.000 9070.000
GR  980.000 9210.000  980.000 9280.000  978.000 9300.000  976.000 9310.000  974.000 9320.000
GR  972.000 9325.000  970.000 9330.000  968.000 9340.000  968.000 9410.000  970.000 9420.000
GR  972.000 9690.000  972.000 9800.000  970.000 9820.000  972.000 9940.000  973.000 10000.000
GR  974.000 10170.000 976.000 10760.000 978.000 11830.000 980.000 12560.000 980.000 13210.000
GR  980.000 14380.000 982.000 14570.000 984.000 14700.000 986.000 14950.000   0.0     0.0

X1    5.820  35.000 10000.000 10000.000 1050.000 900.000 1000.000   0.0     0.0     0.0
GR  990.000 8140.000  988.000 8420.000  986.000 8700.000  984.000 9040.000  982.000 9050.000
GR  980.000 9060.000  978.000 9065.000  976.000 9070.000  974.000 9080.000  972.000 9090.000
GR  970.000 9110.000  968.000 9115.000  966.000 9130.000  966.000 9160.000  968.000 9180.000
GR  970.000 9190.000  972.000 9210.000  974.000 9220.000  974.000 9280.000  972.000 9340.000
GR  972.000 9770.000  973.000 10000.000 974.000 10100.000 976.000 10340.000 978.000 10350.000
GR  980.000 11100.000 980.000 11650.000 980.000 12000.000 982.000 12630.000 980.000 13040.000
GR  980.000 14070.000 982.000 14260.000 984.000 14460.000 986.000 14630.000 987.000 15200.000

X1    6.330  42.000 10000.000 10000.000 2000.000 1600.000 1800.000   0.0     0.0     0.0
GR  994.000 6690.000  992.000 7090.000  990.000 7320.000  988.000 7410.000  986.000 7630.000
GR  984.000 7650.000  982.000 8090.000  982.000 9700.000  982.000 10000.000 982.000 10220.000
GR  982.000 10460.000 980.000 10480.000 982.000 10620.000 982.000 10990.000 980.000 11010.000
GR  978.000 11020.000 978.000 11050.000 980.000 11060.000 982.000 11070.000 982.000 11110.000
GR  980.000 11315.000 978.000 11320.000 976.000 11350.000 976.000 11480.000 978.000 11570.000
GR  980.000 11590.000 982.000 11650.000 984.000 11690.000 986.000 11710.000 986.000 11730.000
GR  984.000 11735.000 982.000 11740.000 980.000 11750.000 980.000 11780.000 982.000 11840.000
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GR	984.000	11900.000	982.000	12440.000	982.000	13420.000	984.000	13435.000	986.000	13460.000
GR	988.000	13700.000	990.000	13950.000	0.0	0.0	0.0	0.0	0.0	0.0
X1	6.710	44.000	10000.000	10000.000	1100.000	1300.000	1600.000	0.0	0.0	0.0
GR	994.000	6200.000	992.000	6220.000	990.000	6860.000	988.000	6890.000	986.000	6940.000
GR	986.000	8080.000	985.000	8085.000	986.000	8090.000	986.000	8520.000	985.000	8730.000
GR	986.000	9740.000	986.000	10000.000	986.000	10880.000	986.000	11020.000	988.000	11050.000
GR	990.000	11060.000	990.000	11090.000	988.000	11095.000	988.000	11180.000	990.000	11185.000
GR	990.000	11200.000	988.000	11210.000	986.000	11215.000	986.000	11240.000	984.000	11250.000
GR	982.000	11255.000	980.000	11280.000	978.000	11300.000	976.000	11330.000	974.000	11360.000
GR	974.000	11420.000	976.000	11430.000	978.000	11440.000	978.000	11500.000	980.000	11510.000
GR	982.000	11720.000	984.000	11725.000	986.000	11730.000	988.000	11740.000	988.000	11820.000
GR	990.000	12430.000	992.000	12640.000	994.000	12770.000	996.000	12970.000	0.0	0.0
X1	6.960	26.000	10000.000	10000.000	900.000	1300.000	1300.000	0.0	0.0	0.0
GR	994.000	5700.000	992.000	6100.000	990.000	6500.000	988.000	6560.000	988.000	7160.000
GR	988.000	9130.000	989.000	10000.000	990.000	10280.000	990.000	10770.000	990.000	10845.000
GR	992.000	10850.000	992.000	10890.000	990.000	10900.000	988.000	10910.000	986.000	10930.000
GR	986.000	10950.000	984.000	10960.000	982.000	10970.000	982.000	11080.000	982.000	11260.000
GR	984.000	11340.000	986.000	11350.000	988.000	11360.000	990.000	11370.000	992.000	11430.000
GR	994.000	11680.000	996.000	11920.000	998.000	12215.000	0.0	0.0	0.0	0.0
X1	7.120	26.000	10000.000	10000.000	950.000	900.000	920.000	0.0	0.0	0.0
GR	1000.000	5000.000	998.000	5510.000	996.000	5930.000	994.000	6250.000	992.000	6810.000
GR	990.000	6880.000	988.000	6900.000	988.000	7130.000	990.000	8610.000	992.000	9920.000
GR	992.000	10000.000	992.000	10300.000	990.000	10370.000	990.000	10480.000	988.000	10490.000
GR	986.000	10510.000	984.000	10840.000	984.000	10950.000	986.000	11120.000	988.000	11125.000
GR	990.000	11130.000	990.000	11200.000	992.000	11220.000	994.000	11400.000	996.000	11430.000
GR	998.000	11680.000	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
X1	7.360	41.000	10000.000	10000.000	1100.000	1250.000	1250.000	0.0	0.0	0.0
GR	1004.000	4940.000	1002.000	5630.000	1000.000	6060.000	998.000	6110.000	996.000	6500.000
GR	994.000	7100.000	994.000	9250.000	996.000	9860.000	996.000	9880.000	994.000	9900.000
GR	992.000	9910.000	992.000	9960.000	992.000	10000.000	992.000	10060.000	990.000	10070.000
GR	988.000	10090.000	986.000	10110.000	986.000	10130.000	988.000	10150.000	990.000	10160.000
GR	996.000	10170.000	990.000	10190.000	988.000	10200.000	986.000	10215.000	984.000	10235.000
GR	984.000	10310.000	982.000	10325.000	984.000	10340.000	986.000	10370.000	986.000	10400.000
GR	988.000	10470.000	990.000	10540.000	990.000	10710.000	990.000	10740.000	992.000	10810.000
GR	993.000	11000.000	994.000	11110.000	994.000	11400.000	996.000	11450.000	998.000	11470.000
GR	1000.000	11830.000	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
X1	7.650	15.000	10000.000	10000.000	850.000	1200.000	1150.000	0.0	0.0	0.0
GR	1002.000	5860.000	1000.000	5990.000	1000.000	6240.000	998.000	6780.000	996.000	7190.000
GR	998.000	9090.000	998.000	9970.000	997.000	10000.000	996.000	10010.000	994.000	10020.000
GR	992.000	10070.000	992.000	10310.000	992.000	10520.000	990.000	10620.000	990.000	10930.000

X1	7.885	32.000	10000.000	10000.000	1750.000	1450.000	1500.000	0.0	0.0	0.0
GR	1017.000	5550.000	1012.000	5620.000	1010.000	5640.000	1008.000	6150.000	1010.000	6350.000
GR	1010.000	6400.000	1008.000	6550.000	1006.000	6680.000	1004.000	6810.000	1002.000	6850.000
GR	1000.000	7240.000	1000.000	6620.000	998.000	8660.000	998.000	8930.000	1000.000	9170.000
GR	1000.000	9620.000	998.000	9630.000	1000.000	9950.000	1000.000	10000.000	1000.000	10010.000
GR	998.000	10020.000	996.000	10030.000	994.000	10040.000	994.000	10100.000	994.000	10150.000
GR	992.000	10490.000	992.000	10790.000	990.000	10800.000	990.000	10820.000	996.000	10840.000
GR	990.000	10860.000	990.000	11050.000	0.0	0.0	0.0	0.0	0.0	0.0
X1	8.180	37.000	10000.000	10000.000	1650.000	1550.000	1580.000	0.0	0.0	0.0
GR	1013.500	6430.000	1010.000	6520.000	1010.000	6630.000	1012.000	6890.000	1010.000	6910.000
GR	1010.000	7320.000	1008.000	7330.000	1006.000	7340.000	1004.000	7360.000	1002.000	8410.000
GR	1004.000	8420.000	1004.000	8430.000	1002.000	8600.000	1004.000	8660.000	1006.000	8684.000
GR	1006.000	9370.000	1008.000	9390.000	1000.000	9450.000	1000.000	9560.000	999.000	9570.000
GR	1000.000	9580.000	1002.000	9585.000	1004.000	9680.000	1006.000	9760.000	1006.000	9970.000
GR	1005.000	10000.000	1004.000	10060.000	1002.000	10070.000	1000.000	10100.000	998.000	10160.000
GR	996.000	10170.000	994.000	10180.000	994.000	10400.000	996.000	10520.000	998.000	10550.000
GR	1000.000	10600.000	1000.000	11000.000	0.0	0.0	0.0	0.0	0.0	0.0
X1	8.190	40.000	9730.000	10090.000	50.000	50.000	50.000	0.0	0.0	0.0
X3	10.000	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
GR	1018.000	6900.000	1018.000	7000.000	1010.000	7000.102	1007.500	7180.000	1006.000	7360.000
GR	1004.000	7540.000	1004.000	8080.000	1005.000	8260.000	1004.700	8440.000	1004.000	8540.000
GR	1005.500	8620.000	1005.000	8800.000	1004.000	8980.000	1005.000	9340.000	1005.000	9600.000
GR	1004.000	9730.000	1001.000	9880.000	996.000	9950.000	995.000	10000.000	1003.000	10090.000
GR	1003.000	10220.000	1004.000	10310.000	1004.000	10600.000	1003.000	10810.000	1002.000	11000.000
GR	1005.500	11100.000	1003.000	11190.000	1003.500	11360.000	1003.000	11540.000	1003.000	11810.000
GR	1004.000	11900.000	1004.700	12090.000	1003.500	12260.000	1003.500	12440.000	1003.000	12610.000
GR	1003.000	12800.000	1005.500	12900.000	1006.000	12960.000	1018.000	12960.102	1018.000	13100.000
SB	1.050	15.500	2.700	0.0	6000.000	1100.000	22150.000	0.0	993.000	993.000
X1	8.200	0.0	0.0	0.0	15.000	15.000	15.000	0.0	0.0	0.0
X2	0.0	0.0	1.000	0.0	0.0	0.0	0.0	0.0	0.0	0.0
X3	10.000	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
BT	6.000	6900.000	1018.000	0.0	7000.000	1018.000	0.0	7000.102	1017.000	1010.000
BT	12960.000	1014.000	1007.000	12960.102	1018.000	0.0	13100.000	1018.000	0.0	0.0
X1	8.210	23.000	5550.000	5610.000	50.000	50.000	50.000	0.0	0.0	0.0
GR	1012.000	2500.000	1008.000	2770.000	1004.000	3690.000	1003.000	4000.000	1004.000	4700.000
GR	1005.000	5000.000	1004.000	5330.000	1000.000	5340.000	1000.000	5420.000	1002.000	5500.000
GR	1000.000	5550.000	996.000	5610.000	995.000	5630.000	996.000	5650.000	1000.000	5700.000
GR	1004.000	6430.000	1004.000	6630.000	1003.000	7300.000	1004.000	7460.000	1004.000	8400.000
GR	1008.000	8560.000	1012.000	8670.000	1016.000	9810.000	0.0	0.0	0.0	0.0

X1	8.215	35.000	10000.000	10000.000	80.000	80.000	80.000	0.0	0.0	0.0
GR	1013.700	6370.000	1011.500	6660.000	1010.000	6870.000	1006.000	6930.000	1008.000	7050.000
GR	1006.000	7240.000	1008.000	7300.000	1010.000	7330.000	1010.000	7350.000	1008.000	7370.000
GR	1006.000	7380.000	1004.000	7450.000	1004.000	8440.000	1006.000	9160.000	1004.000	9270.000
GR	1002.000	9480.000	1000.000	9550.000	1000.000	9570.000	990.000	9620.000	980.000	9640.000
GR	980.000	9920.000	990.000	9960.000	1000.000	9960.000	1000.000	10000.000	1000.000	10180.000
GR	998.000	10180.000	996.000	10200.000	996.000	10480.000	996.000	10560.000	1000.000	10570.000
GR	1010.000	10630.000	1010.000	10670.000	1020.000	10690.000	1010.000	10840.000	1010.000	10960.000
X1	8.410	37.000	10000.000	10000.000	950.000	1000.000	1000.000	0.0	0.0	0.0
GR	1016.000	6860.000	1018.000	7150.000	1018.000	7330.000	1016.000	7400.000	1014.000	7420.000
GR	1012.000	7440.000	1010.000	7460.000	1008.000	7480.000	1006.000	7490.000	1006.000	9220.000
GR	1004.000	9400.000	1002.000	9420.000	1002.000	9470.000	1004.000	9510.000	1006.000	9540.000
GR	1008.000	9600.000	1010.000	9610.000	1016.000	9625.000	1016.000	9660.000	1010.000	9670.000
GR	1006.000	9700.000	1000.000	9730.000	998.000	9750.000	997.000	9950.000	999.000	10000.000
GR	1000.000	10060.000	1010.000	10090.000	1010.000	10140.000	1000.000	10160.000	1000.000	10570.000
GR	1010.000	10590.000	1010.000	10620.000	1000.000	10650.000	990.000	10700.000	980.000	10750.000
GR	978.000	10880.000	980.000	11000.000	0.0	0.0	0.0	0.0	0.0	0.0
X1	8.500	26.000	10000.000	10000.000	450.000	490.000	480.000	0.0	0.0	0.0
GR	1020.000	6700.000	1018.000	6730.000	1016.000	7000.000	1014.000	7040.000	1012.000	7115.000
GR	1010.000	7200.000	1010.000	7280.000	1008.000	7290.000	1006.000	7360.000	1006.000	8880.000
GR	1008.000	9090.000	1010.000	9200.000	1008.000	9300.000	1008.000	9650.000	1010.000	9670.000
GR	1010.000	9730.000	1008.000	9900.000	1008.000	10000.000	1010.000	10010.000	1000.000	10130.000
GR	998.000	10300.000	998.000	10470.000	1000.000	10660.000	1000.000	10770.000	1010.000	10830.000
GR	1010.000	10860.000	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
EJ	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0

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    SECNO     DEPTH     CWSEL     CRIWS     WSELK     EG        HV        HL        OLOSS    BANK ELEV
    Q         QLOB      OCH       QROB      ALOB      ACH       AROB      VOL       TWA    LEFT/RIGHT
    TIME      VLOB      VCH       VROB      XNL       XNCH      XNR       WTN       ELMIN       SSTA
    SLOPE     XLOBL     XLCH      XLOBR     ITRIAL    IDC       ICONT     CORAR     TOPWID      ENDST

 *PROF 1

 CCHV=   0.100 CEHV=   0.300
 *SECNO 5.550
      5.55     11.90    979.90       0.0    979.90    980.67      0.77       0.0       0.0    973.00
    91000.    49639.        0.    41361.     6038.        0.     7741.        0.        0.    973.00
       0.0      8.22       0.0      5.34     0.045     0.035     0.040       0.0    968.00   9281.00
  0.003420        0.        0.        0.         0         0         0       0.0   3242.46  12523.46

 FLOW DISTRIBUTION FOR SECNO=      5.55          CWSEL=    979.90

 STA=    9281.    9410.    9690.    9800.    9840.   10000.   10170.   10760.   11830.   12523.
   PER Q=     11.4     23.0      7.3      3.2      9.5      9.0     19.9     15.1      1.5
    AREA=   1117.0   2512.0    869.0    356.0   1184.0   1088.0   2890.9   3102.9    658.8
     VEL=      9.3      8.3      7.7      8.3      7.3      7.5      6.3      4.4      2.1

 *SECNO 5.820
      5.82     16.32   982.32       0.0       0.0    982.69      0.38      1.98      0.04    973.00
    91000.    56163.        0.    34817.     9746.        0.    11274.      387.       91.    973.00
      0.06      5.76       0.0      3.09     0.045     0.035     0.040     0.035    966.00   9048.41
  0.001315     1050.     1000.      900.         3         0         0       0.0   5243.25  14291.66

 FLOW DISTRIBUTION FOR SECNO=      5.82          CWSEL=    982.32

 STA=    9048.    9115.    9160.    9190.    9280.    9340.    9770.   10000.   10100.   10340.   11100.   11650.   12630.
   PER Q=      3.0      6.0      3.4      4.7      3.3     27.7     13.6      5.6      9.8      8.4      3.3      3.6
    AREA=    515.6    719.2    439.5    818.5    559.0   4436.1   2257.8    881.7   1756.0   2540.6   1274.1   1640.3
     VEL=      5.3      7.6      7.1      5.3      5.3      5.7      5.5      5.7      5.1      3.0      2.4      2.0
 STA=   12630.   14070.   14292.
   PER Q=      7.1      0.4
    AREA=   2925.9    255.2
     VEL=      2.2      1.6

 *SECNO 6.330

 3265 DIVIDED FLOW

      6.33      9.44   985.44       0.0       0.0    985.75      0.31      3.05      0.01    982.00
    91000.    26951.        0.    64049.     7654.        0.    13247.     1236.      308.    982.00
      0.17      3.52       0.0      4.84     0.045     0.035     0.040     0.035    976.00   7635.60
  0.002325     2000.     1800.     1600.         3         0         0       0.0   5790.39  13453.00
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   SECNO     DEPTH     CWSEL     CRIWS     WSELK     EG        HV        HL        OLOSS    BANK ELEV
   Q         QLOB      QCH       QROB      ALOB      ACH       AROB      VOL       TWA    LEFT/RIGHT
   TIME      VLOB      VCH       VROB      XNL       XNCH      XNR       WTN       ELMIN       SSTA
   SLOPE     XLOBL     XLCH      XLOBR     ITRIAL    IDC       ICONT     CORAR     TOPWID      ENDST

FLOW DISTRIBUTION FOR SECNO=      6.33          CWSEL=    985.44

STA=    7636.    8090.    9700.   10000.   10220.   10460.   10620.   10990.   11060.   11315.   11480.   11570.   11780.
  PER Q=     3.4     22.1      4.1      3.4      3.7      3.8      5.7      3.0      5.7     13.1      6.2      3.9
   AREA=  1083.9   5538.0   1031.9    756.7    825.5    710.4   1272.7    440.8   1092.1   1512.6    759.6    725.5
    VEL=     2.9      3.6      3.6      4.1      4.1      4.8      4.1      6.2      4.7      7.9      7.4      4.9
STA=   11780.   12440.   13420.   13453.
  PER Q=     6.6     15.1      0.2
   AREA=  1730.2   3371.0     49.6
    VEL=     3.5      4.1      2.8

*SECNO 6.710

3265 DIVIDED FLOW

     6.71    14.59   988.59      0.0      0.0   989.26     0.67     3.40     0.11   986.00
    91000.   32209.       0.   58791.    8576.       0.    7632.    1753.     458.   986.00
     0.22     3.76      0.0     7.70    0.045    0.035    0.040    0.038   974.00  6881.13
 0.003310     1100.    1600.    1300.        2        0        0      0.0  5052.98 12000.25

FLOW DISTRIBUTION FOR SECNO=      6.71          CWSEL=    988.59

STA=    6881.    8080.    8620.    9740.   10000.   10880.   11280.   11330.   11360.   11420.   11440.   11500.   11720.
  PER Q=    11.9      5.5     15.3      2.7     10.1      4.3      6.2      5.4     12.3      3.2      7.2     15.5
   AREA=  3035.9   1404.1   3461.9    673.7   2280.1    789.7    539.5    407.7    875.5    251.8    635.5   1690.0
    VEL=     3.6      3.6      4.0      3.6      4.0      4.9     10.5     12.2     12.8     11.5     10.3      8.3
STA=   11720.   12000.
  PER Q=     0.5
   AREA=   162.4
    VEL=     2.7

*SECNO 6.960

3265 DIVIDED FLOW

     6.96     9.96   991.96      0.0      0.0   992.35     0.40     3.07     0.03   989.00
    91000.   52736.       0.   38264.   13745.       0.    6028.    2187.     580.   989.00
     0.29     3.84      0.0     6.35    0.045    0.035    0.040    0.039   982.00  6108.19
 0.002329      900.    1300.    1300.        1        0        0      0.0  5280.27 11428.77
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   SECNO     DEPTH     CWSEL     CRIWS     WSELK     EG        HV        HL        OLOSS    BANK ELEV
   Q         QLOB      QCH       QROB      ALOB      ACH       AROB      VOL       TWA    LEFT/RIGHT
   TIME      VLOB      VCH       VROB      XNL       XNCH      XNR       WTN       ELMIN      SSTA
   SLOPE     XLOBL     XLCH      XLOBR     ITRIAL    IDC       ICONT     CORAR     TOPWID     ENDST

FLOW DISTRIBUTION FOR SECNO=      6.96          CWSEL=    991.96

STA=    6108.    7160.    9130.   10000.   10770.   10970.   11080.   11260.   11340.   11429.
  PER Q=     11.7     34.2     12.1      5.4      3.2     10.0     16.3      6.1      1.0
   AREA=   2936.8   7799.3   3009.4   1648.5    568.4   1095.5   1792.6    716.7    206.3
    VEL=      3.6      4.0      3.6      3.0      5.1      8.3      8.3      7.7      4.4

*SECNO 7.120
     7.12     9.87   993.87      0.0      0.0   994.23     0.36     1.87     0.00   992.00
   91000.   47217.       0.   43783.   13234.       0.    7431.    2621.     691.   992.00
     0.34     3.57      0.0     5.89    0.045    0.035    0.040    0.038   984.00  6288.00
 0.001769     950.     920.     900.        2        0        0      0.0  5099.78 11387.78

FLOW DISTRIBUTION FOR SECNO=      7.12          CWSEL=    993.87

STA=    6288.    7130.    8610.    9920.   10000.   10480.   10840.   10950.   11120.   11388.
  PER Q=      8.4     31.5     11.6      0.3      3.9     22.6      8.6     11.1      1.9
   AREA=   2133.1   7199.1   3752.2    149.1   1184.8   3111.1   1085.1   1506.9    542.8
    VEL=      3.6      4.0      2.8      2.1      3.0      6.6      7.2      6.7      3.2

*SECNO 7.360
     7.36    14.39   996.39      0.0      0.0   997.19     0.80     2.82     0.13   992.00
   91000.   23775.       0.   67225.    7300.       0.    8301.    3106.     824.   992.00
     0.39     3.26      0.0     8.10    0.045    0.035    0.040    0.038   982.00  6423.94
 0.003339     1100.    1250.    1250.        2        0        0      0.0  5029.96 11453.90

FLOW DISTRIBUTION FOR SECNO=      7.36          CWSEL=    996.39

STA=    6424.    9250.    9960.   10000.   10090.   10130.   10190.   10235.   10310.   10340.   10370.   10400.   10470.
  PER Q=     21.5      3.7      1.0      3.4      4.3      3.1      4.8     11.7      5.3      4.1      3.5      6.9
   AREA=   5987.4   1136.9    175.6    465.1    395.6    363.4    442.6    929.3    401.7    341.7    311.7    657.3
    VEL=      3.3      3.0      5.1      6.6      9.9      7.8      9.9     11.5     12.0     10.9     10.2      9.6
STA=   10470.   10540.   10710.   10810.   11000.   11400.   11454.
  PER Q=      4.6      8.8      4.3      4.3      4.4      0.2
   AREA=    517.3   1086.3    569.0    739.1   1011.0     70.3
    VEL=      8.1      7.4      6.9      5.3      4.0      2.7

*SECNO 7.650
3280 CROSS SECTION      7.65 EXTENDED      9.78 FEET

     7.65     9.78   999.78      0.0      0.0  1000.56     0.77     3.37     0.00   997.00
   91000.   27087.       0.   63913.    8473.       0.    7827.    3482.     928.   997.00
     0.44     3.20      0.0     8.17    0.045    0.035    0.040    0.038   990.00  6300.25
 0.002808     850.    1150.    1200.        2        0        0      0.0  4629.75 10930.00
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   SECNO     DEPTH     CWSEL     CRIWS     WSELK     EG        HV        HL        QLOSS    BANK ELEV
   Q         QLOB      QCH       QROB      ALOB      ACH       AROB      VOL       TWA    LEFT/RIGHT
   TIME      VLOB      VCH       VROB      XNL       XNCH      XNR       WTN       ELMIN       SSTA
   SLOPE     XLOBL     XLCH      XLOBR     ITRIAL    IDC       ICONT     CORAR     TOPWID      ENDST

FLOW DISTRIBUTION FOR SECNO=      7.65          CWSEL=    999.78

STA=    6300.    7190.    9090.    9970.   10000.   10070.   10310.   10520.   10620.   10930.
  PER Q=     5.1     20.0      4.4      0.2      3.1     15.9     13.9      8.1     29.4
   AREA=  1564.8   5276.0   1563.6     68.3    419.4   1866.4   1633.1    877.7   3030.8
    VEL=     3.0      3.5      2.6      3.0      6.7      7.7      7.7      8.4      8.8

*SECNO 7.885
3280 CROSS SECTION      7.89 EXTENDED      12.81 FEET

     7.89    12.81  1002.81      0.0      0.0  1003.27     0.46     2.68     0.03  1000.00
   91000.   23843.       0.   67157.    9618.       0.    10950.    4158.    1099.  1000.00
     0.52     2.48      0.0     6.13    0.045    0.035    0.040    0.037   990.00  6833.80
 0.001189    1750.    1500.    1450.        3        0        0      0.0  4216.20 11050.00

FLOW DISTRIBUTION FOR SECNO=      7.89          CWSEL=   1002.81

STA=    6834.    8620.    8930.    9620.    9950.   10000.   10100.   10490.   10790.   10840.   11050.
  PER Q=    11.0      5.1      5.9      3.8      0.4      4.1     24.2     22.3      4.1     19.2
   AREA=  4590.1   1451.1   2178.8   1257.3    140.5    731.0   3775.9   3243.0    570.5   2630.1
    VEL=     2.2      3.2      2.5      2.8      2.3      5.1      5.8      6.3      6.5      6.6

*SECNO 8.180

3265 DIVIDED FLOW

3280 CROSS SECTION      8.18 EXTENDED      5.43 FEET

3301 HV CHANGED MORE THAN HVINS

     8.18    11.42  1005.42      0.0      0.0  1006.70     1.28     3.19     0.25  1005.00
   91000.   18473.       0.   72527.    4289.       0.     7297.    4746.    1227.  1005.00
     0.57     4.31      0.0     9.94    0.045    0.035    0.040    0.037   994.00  7345.73
 0.004194    1650.    1580.    1550.        2        0        0      0.0  2671.94 11000.00

FLOW DISTRIBUTION FOR SECNO=      8.18          CWSEL=   1005.42

STA=    7346.    8410.    9450.    9560.   10000.   10160.   10400.   10520.   10600.   11000.
  PER Q=    10.8      3.0      4.3      2.1      4.7     35.9     15.8      5.7     17.6
   AREA=  2558.1    719.3    596.9    414.6    598.2   2702.4   1251.2    574.1   2170.6
    VEL=     3.9      3.8      6.6      4.6      7.2     12.1     11.5      9.0      7.4
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   SECNO      DEPTH      CWSEL      CRIWS      WSELK      EG         HV         HL         VLOSS    BANK ELEV
   Q          QLOB       QCH        QROB       ALOB       ACH        AROB       VOL        TWA    LEFT/RIGHT
   TIME       VLOB       VCH        VROB       XNL        XNCH       XNR        WTN        ELMIN       SSTA
   SLOPE      XLOBL      XLCH       XLOBR      ITRIAL     IDC        ICONT      CORAR      TOPWID      ENDST

*SECNO 8.190
3685 20 TRIALS ATTEMPTED WSEL,CWSEL
3693 PROBABLE MINIMUM SPECIFIC ENERGY
3720 CRITICAL DEPTH ASSUMED
      8.19      11.23   1006.23   1006.23       0.0    1007.27       1.04       0.27       0.02   1004.00
    91000.     15688.    27676.    47636.      3948.     2287.      7736.      4760.      1232.   1003.00
      0.57       3.97     12.10      6.16     0.045     0.035      0.040      0.037     995.00   7332.52
  0.006914        50.       50.       50.        20         6          0        0.0    5627.48  12960.00

FLOW DISTRIBUTION FOR SECNO=      8.19          CWSEL=    1006.23

STA=     7333.     8080.     8540.     9340.     9730.    10090.    10220.    10600.    10810.    11000.    11360.    11540.    11810.
  PER Q=      7.0       3.1       5.0       2.1      30.4       3.1       5.4       3.8       5.8       6.1       3.8       6.5
   AREA=   1428.0     747.4    1228.2     544.3    2287.4     419.8     892.0     573.1     708.5     932.4     536.2     871.8
    VEL=      4.4       3.8       3.7       3.5      12.1       6.7       5.5       6.0       7.4       5.9       6.4       6.7
STA=    11810.    12090.    12440.    12610.    12800.    12960.
  PER Q=      3.5       5.3       3.6       4.5       1.1
   AREA=    602.6     853.2     506.4     613.5     226.6
    VEL=      5.2       5.6       6.4       6.7       4.5

SPECIAL BRIDGE

SB  XK        XKOR      COFQ      RDLEN     BWC       BWP       BAREA     SS        ELCHU     ELCHD
     1.05     15.50      2.70       0.0   6000.00   1100.00   22150.00      0.0    993.00    993.00

*SECNO 8.200
CLASS A LOW FLOW

3420 BRIDGE W.S.=    1006.22 BRIDGE VELOCITY=,      1.41      CALCULATED CHANNEL AREA=,     64764.

 EGPRS      EGLWC      H3        QWEIR     QPR       BAREA     TRAPEZOID      ELLC      ELTRD
                                                                  AREA
     0.0    1007.41     0.54        0.    91000.    22150.     83300.     1010.00   1014.00

      8.20      11.77   1006.77       0.0       0.0   1007.41       0.64       0.14       0.0   1004.00
    91000.     18725.    23933.    48342.     5265.     2483.      9292.      4766.      1234.   1003.00
      0.57       3.56      9.64      5.20     0.045     0.035      0.040      0.037     995.00   7267.48
  0.003936        15.       15.       15.         0         0          0        0.0    5692.53  12960.00

FLOW DISTRIBUTION FOR SECNO=      8.20          CWSEL=    1006.77
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   SECNO     DEPTH     CWSEL     CRIWS     WSELK     EG        HV        HL        OLOSS   BANK ELEV
   Q         QLOB      QCH       QROB      ALOB      ACH       AROB      VOL       TWA   LEFT/RIGHT
   TIME      VLOB      VCH       VROB      XNL       XNCH      XNR       WTN       ELMIN       SSTA
   SLOPE     XLOBL     XLCH      XLOBR     ITRIAL    IDC       ICONT     CORAR     TOPWID      ENDST

STA=    7267.     8080.     8540.     8980.     9340.     9730.    10090.    10220.    10600.    10810.    11000.    11360.    11540.
  PER Q=      7.8       3.8       3.0       3.2       2.7      26.3       3.0       5.7       3.9       5.5       6.2       3.8
   AREA=   1850.8     996.7     844.2     817.6     755.7    2482.6     490.2    1098.0     686.9     811.5    1127.6     633.8
    VEL=      3.8       3.5       3.3       3.6       3.2       9.6       5.6       4.7       5.1       6.1       5.0       5.4
STA=   11540.    11810.    12090.    12440.    12610.    12800.    12960.
  PER Q=      6.3       3.8       5.6       3.5       4.4       1.4
   AREA=   1018.2     754.4    1042.9     598.6     716.5     313.4
    VEL=      5.6       4.6       4.9       5.4       5.6       3.9

*SECNO 8.210
     8.21     12.24   1007.24       0.0       0.0   1007.59      0.35      0.15      0.03   1000.00
    91000.   30050.     4904.    56046.     8150.      554.    11761.     4787.     1240.    996.00
     0.57      3.69      8.85      4.77     0.045     0.035     0.040     0.037    995.00   2945.10
 0.002246       50.       50.       50.         2         0         0       0.0   5584.45   8529.55

FLOW DISTRIBUTION FOR SECNO=      8.21          CWSEL=   1007.24

STA=    2945.     4000.     4700.     5330.     5420.     5550.     5610.     5650.     5700.     6430.     7300.     8400.     8530.
  PER Q=      7.7      10.8       5.8       4.0       4.7       5.4       4.7       3.9      22.3      14.4      15.7       0.6
   AREA=   2365.4    2617.1    1725.4     631.5     811.0     554.3     469.5     461.9    3824.3    3152.7    3642.6     209.8
    VEL=      2.9       3.8       3.1       5.7       5.3       8.8       9.1       7.7       5.3       4.2       3.9       2.4

*SECNO 8.215

3265 DIVIDED FLOW

     8.22     27.42   1007.42       0.0       0.0   1007.67      0.24      0.07      0.01   1000.00
    91000.   69965.        0.    21035.    17275.        0.     5848.     4827.     1248.   1000.00
     0.58      4.05       0.0      3.60     0.045     0.035     0.040     0.037    980.00   7104.54
 0.000435       80.       80.       80.         2         0         0       0.0   3419.77  10614.55

FLOW DISTRIBUTION FOR SECNO=      8.22          CWSEL=   1007.42

STA=    7105.     8440.     9480.     9620.     9920.     9960.    10000.    10160.    10480.    10560.    10615.
  PER Q=      6.1       4.6       4.1      55.4       5.3       1.4       3.8      15.3       3.4       0.6
   AREA=   3692.3    2941.8    1219.5    8127.4     897.0     397.0    1188.0    3575.9     834.0     249.6
    VEL=      1.5       1.4       3.1       6.2       5.4       3.1       2.9       3.9       3.7       2.3

*SECNO 8.410
```

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SECNO      DEPTH     CWSEL     CRIWS     WSELK     EG        HV        HL        OLOSS     BANK ELEV
Q          QLOB      QCH       QROB      ALOB      ACH       AROB      VOL       TWA     LEFT/RIGHT
TIME       VLOB      VCH       VROB      XNL       XNCH      XNR       WTN       ELMIN       SSTA
SLOPE      XLOBL     XLCH      XLOBR     ITRIAL    IDC       ICONT     CORAR     TOPWID      ENDST

3265 DIVIDED FLOW

3280 CROSS SECTION       8.41 EXTENDED      27.74 FEET

     8.41     29.73  1007.73       0.0       0.0   1008.19      0.46      0.46      0.07    999.00
    91000.   15052.       0.    75948.     7061.        0.    12922.     5308.     1323.    999.00
     0.63      2.13      0.0      5.88     0.045     0.035     0.040     0.037    978.00   7481.32
 0.000507      950.    1000.     1000.         2         0         0       0.0   3521.10  11000.00

FLOW DISTRIBUTION FOR SECNO=       8.41          CWSEL=    1007.73

STA=     7481.     9220.     9750.     9950.    10000.    10570.    10700.    10750.    10880.    11000.
  PER Q=     3.5       3.3       7.9       1.8      13.6       3.5       8.3      32.2      25.9
   AREA=  3009.3    1518.4    2047.0     486.8    3815.1     786.3    1136.8    3735.6    3448.2
    VEL=     1.1       2.0       3.5       3.4       3.2       4.0       6.6       7.9       6.8

*SECNO 8.500

3265 DIVIDED FLOW

3301 HV CHANGED MORE THAN HVINS

3685 20 TRIALS ATTEMPTED WSEL,CWSEL
3693 PROBABLE MINIMUM SPECIFIC ENERGY
3720 CRITICAL DEPTH ASSUMED
     8.50     10.05  1008.05  1008.05       0.0   1010.00      1.95      0.59      0.45   1008.00
    91000.   13534.       0.    77466.     3431.        0.     6435.     5471.     1356.   1008.00
     0.64      3.94      0.0     12.04     0.045     0.035     0.040     0.037    998.00   7289.75
 0.005908      450.     480.      490.        20        14         0       0.0   3045.25  10818.29
```

ATTACHMENT 7.4

HEC-2 RESULTS FOR REVISED
CONDITIONS WITH BRIDGE
AND CHANNEL S = 0.0016'/'
Q 10 = 16,000 cfs
Q 25 = 49,000 cfs
Q 50 = 69,000 cfs
Q100 = 91,000 cfs
SUMMARY

```
*****************************************
  HEC2 RELEASE DATED NOV 76 UPDATED APR  1980
  ERROR CORR -  01,02,03,04
  MODIFICATION -  50,51,52,53,54
*****************************************

T1       AGUA FRIA CHANNEL * I-10 TO INDIAN SHCOOL ROAD *
T2 IMPROVED CHANNEL W/ N-VALUE=.018  WITH MCDOWELL RD BRIDGE
T3       1100 BOTTOM WIDTH 3:1 SIDE SLOPES Q10

J1  ICHECK     INQ       NINV      IDIR      STRT      METRIC    HVINS     Q         WSEL      FQ

      0.        2.        0.        0.   0.005000     0.0       0.0       0.     979.900    0.0

J2  NPROF     IPLOT     PRFVS     XSECV     XSECH     FN        ALLDC     IBW       CHNIM     ITRACE

    1.000     0.0      -1.000     0.0       0.0       0.0       0.0       0.0       0.0       0.0

J3  VARIABLE CODES FOR SUMMARY PRINTOUT

  120.000     0.0       0.0       0.0       0.0       0.0       0.0       0.0       0.0       0.0

QT      4.000  16000.000  49000.000  69000.000  91000.000      0.0       0.0       0.0       0.0       0.0
NC      0.045      0.040      0.035      0.100      0.300      0.0       0.0       0.0       0.0       0.0

X1      5.550     29.000  10000.000  10000.000      0.0       0.0       0.0       0.0       0.0       0.0
X3      0.0        0.0     1500.000      0.0       0.0       0.0       0.0       0.0       0.0       0.0
GR    990.000   8400.000   988.000   8500.000   986.000   8650.000   984.000   8900.000   982.000   9070.000
GR    980.000   9210.000   980.000   9280.000   978.000   9300.000   976.000   9310.000   974.000   9320.000
GR    972.000   9325.000   970.000   9330.000   968.000   9340.000   968.000   9410.000   970.000   9420.000
GR    972.000   9690.000   972.000   9800.000   970.000   9820.000   972.000   9840.000   973.000  10000.000
GR    974.000  10170.000   976.000  10760.000   978.000  11830.000   980.000  12560.000   980.000  13210.000
GR    980.000  14380.000   982.000  14570.000   984.000  14700.000   986.000  14950.000     0.0       0.0

X1      5.820     35.000  10000.000  10000.000  1050.000   900.000  1000.000     0.0       0.0       0.0
GR    990.000   8140.000   988.000   8420.000   986.000   8700.000   984.000   9040.000   982.000   9050.000
GR    980.000   9060.000   978.000   9065.000   976.000   9070.000   974.000   9080.000   972.000   9090.000
GR    970.000   9110.000   968.000   9115.000   966.000   9130.000   966.000   9160.000   968.000   9180.000
GR    970.000   9190.000   972.000   9210.000   974.000   9220.000   974.000   9280.000   972.000   9340.000
GR    972.000   9770.000   973.000  10000.000   974.000  10100.000   976.000  10340.000   978.000  10350.000
GR    980.000  11100.000   980.000  11650.000   980.000  12000.000   982.000  12630.000   980.000  13040.000
GR    980.000  14070.000   982.000  14260.000   984.000  14460.000   986.000  14630.000   987.000  15200.000

X1      5.850      5.000  10000.000  10000.000   820.000   820.000   820.000     0.0       0.0       0.0
GR    986.450   9414.000   976.450   9450.000   975.450  10000.000   976.450  10550.000   986.450  10586.000
SB      1.050      1.600      2.600   1500.000  1100.000    90.000  11276.000     3.760   975.520   975.450
NC      0.018      0.018      0.018      0.100      0.300      0.0       0.0       0.0       0.0       0.0
```

X1	5.860	5.000	10000.000	10000.000	61.300	61.300	61.300	0.0	0.0	0.0
X2	0.0	0.0	1.000	986.640	990.000	0.0	0.0	1.330	0.0	0.0
GR	986.520	9414.000	976.520	9450.000	975.520	10000.000	976.520	10550.000	986.520	10586.000
X1	6.330	5.000	10000.000	10000.000	1100.000	930.000	1020.000	0.0	0.0	0.0
GR	990.640	9414.000	977.740	9450.000	976.740	10000.000	977.740	10550.000	990.640	10586.000
X1	6.710	5.000	10000.000	10000.000	1290.000	1290.000	1290.000	0.0	0.0	0.0
GR	992.700	9414.000	979.960	9450.000	978.960	10000.000	979.960	10550.000	992.700	10586.000
X1	6.960	5.000	10000.000	10000.000	1280.000	1280.000	1280.000	0.0	0.0	0.0
GR	994.750	9414.000	982.010	9450.000	981.010	10000.000	982.010	10550.000	994.751	10586.000
X1	7.120	5.000	10000.000	10000.000	950.000	950.000	950.000	0.0	0.0	0.0
GR	996.270	9414.000	983.530	9450.000	982.530	10000.000	983.530	10550.000	996.271	10586.000
X1	7.360	5.000	10000.000	10000.000	1250.000	1250.000	1250.000	0.0	0.0	0.0
GR	998.270	9414.000	985.530	9450.000	984.530	10000.000	985.530	10550.000	998.271	10586.000
X1	7.650	5.000	10000.000	10000.000	1150.000	1150.000	1150.000	0.0	0.0	0.0
GR	1000.100	9414.000	988.230	9450.000	987.230	10000.000	988.230	10550.000	1000.110	10586.000
NC	0.045	0.040	0.035	0.100	0.300	0.0	0.0	0.0	0.0	0.0
X1	7.885	32.000	10000.000	10000.000	1750.000	1450.000	1500.000	0.0	0.0	0.0
X3	0.0	0.0	0.0	6850.000	0.0	11040.000	0.0	0.0	0.0	0.0
GR	1017.000	5550.000	1012.000	5620.000	1010.000	5640.000	1008.000	6150.000	1010.000	6350.000
GR	1010.000	6400.000	1008.000	6550.000	1006.000	6680.000	1004.000	6810.000	1002.000	6850.000
GR	1000.000	7240.000	1000.000	8620.000	998.000	8660.000	998.000	8930.000	1000.000	9170.000
GR	1000.000	9620.000	998.000	9630.000	1000.000	9950.000	1000.000	10000.000	1000.000	10010.000
GR	998.000	10020.000	996.000	10030.000	994.000	10040.000	994.000	10100.000	994.000	10150.000
GR	992.000	10490.000	992.000	10790.000	990.000	10800.000	990.000	10820.000	996.000	10840.000
GR	990.000	10860.000	990.000	11050.000	0.0	0.0	0.0	0.0	0.0	0.0
X1	8.180	37.000	10000.000	10000.000	1650.000	1550.000	1500.000	0.0	0.0	0.0
X3	0.0	0.0	0.0	7350.000	0.0	10990.000	0.0	0.0	0.0	0.0
GR	1013.500	6430.000	1010.000	6520.000	1010.000	6630.000	1012.000	6890.000	1010.000	6910.000
GR	1010.000	7320.000	1008.000	7330.000	1006.000	7340.000	1004.000	7360.000	1002.000	8410.000
GR	1004.000	8420.000	1004.000	8430.000	1002.000	8600.000	1004.000	8660.000	1006.000	8684.000
GR	1006.000	9370.000	1008.000	9390.000	1000.000	9450.000	1000.000	9560.000	999.000	9570.000
GR	1000.000	9580.000	1002.000	9585.000	1004.000	9680.000	1006.000	9760.000	1006.000	9970.000
GR	1005.000	10000.000	1004.000	10060.000	1002.000	10070.000	1000.000	10100.000	998.000	10160.000
GR	996.000	10170.000	994.000	10180.000	994.000	10400.000	996.000	10520.000	998.000	10550.000
GR	1000.000	10600.000	1000.000	11000.000	0.0	0.0	0.0	0.0	0.0	0.0

X1	6.190	40.000	9730.000	10090.000	50.000	50.000	50.000	0.0	0.0	0.0
X3	10.000	0.0	0.0	7350.000	0.0	12950.000	0.0	0.0	0.0	0.0
GR	1018.000	6900.000	1018.000	7000.000	1010.000	7000.102	1007.500	7180.000	1006.000	7360.000
GR	1004.000	7540.000	1004.000	8080.000	1005.000	8260.000	1004.700	8440.000	1004.000	8540.000
GR	1005.500	8620.000	1005.000	8800.000	1004.000	8980.000	1005.000	9340.000	1005.000	9600.000
GR	1004.000	9730.000	1001.000	9880.000	996.000	9950.000	995.000	10000.000	1003.000	10090.000
GR	1003.000	10220.000	1004.000	10310.000	1004.000	10600.000	1003.000	10810.000	1002.000	11000.000
GR	1005.500	11100.000	1003.000	11190.000	1003.500	11360.000	1003.000	11540.000	1003.000	11810.000
GR	1004.000	11900.000	1004.700	12090.000	1003.500	12260.000	1003.500	12440.000	1003.000	12610.000
GR	1003.000	12800.000	1005.500	12900.000	1006.000	12960.000	1018.000	12960.102	1018.000	13100.000
SB	1.050	15.500	2.700	0.0	6000.000	1100.000	22150.000	0.0	993.000	993.000

X1	8.200	0.0	0.0	0.0	15.000	15.000	15.000	0.0	0.0	0.0
X2	0.0	0.0	1.000	0.0	0.0	0.0	0.0	0.0	0.0	0.0
X3	10.000	0.0	0.0	7280.000	0.0	12950.000	0.0	0.0	0.0	0.0
BT	6.000	6900.000	1018.000	0.0	7000.000	1018.000	0.0	7000.102	1017.000	1010.000
BT	12960.000	1014.000	1007.000	12960.102	1018.000	0.0	13100.000	1018.000	0.0	0.0

X1	8.210	23.000	5550.000	5610.000	50.000	50.000	50.000	0.0	0.0	0.0
X3	0.0	0.0	0.0	2950.000	0.0	8500.000	0.0	0.0	0.0	0.0
GR	1012.000	2500.000	1008.000	2770.000	1004.000	3690.000	1003.000	4000.000	1004.000	4700.000
GR	1005.000	5000.000	1004.000	5330.000	1000.000	5340.000	1000.000	5420.000	1002.000	5500.000
GR	1000.000	5550.000	996.000	5610.000	995.000	5630.000	996.000	5650.000	1000.000	5700.000
GR	1004.000	6430.000	1004.000	6630.000	1003.000	7300.000	1004.000	7460.000	1004.000	8400.000
GR	1008.000	8560.000	1012.000	8670.000	1016.000	9810.000	0.0	0.0	0.0	0.0

X1	8.215	35.000	10000.000	10000.000	80.000	80.000	80.000	0.0	0.0	0.0
X3	0.0	0.0	0.0	7110.000	0.0	10600.000	0.0	0.0	0.0	0.0
GR	1013.700	6370.000	1011.500	6660.000	1010.000	6870.000	1008.000	6930.000	1008.000	7050.000
GR	1006.000	7240.000	1008.000	7300.000	1010.000	7330.000	1010.000	7350.000	1008.000	7370.000
GR	1006.000	7380.000	1004.000	7450.000	1004.000	8440.000	1006.000	9160.000	1004.000	9270.000
GR	1002.000	9480.000	1000.000	9550.000	1000.000	9570.000	990.000	9620.000	980.000	9640.000
GR	980.000	9920.000	990.000	9960.000	1000.000	9980.000	1000.000	10000.000	1000.000	10160.000
GR	998.000	10180.000	996.000	10200.000	996.000	10480.000	998.000	10560.000	1000.000	10570.000
GR	1010.000	10630.000	1010.000	10670.000	1020.000	10690.000	1010.000	10840.000	1010.000	10960.000

X1	8.410	37.000	10000.000	10000.000	950.000	1000.000	1000.000	0.0	0.0	0.0
X3	0.0	0.0	0.0	7500.000	0.0	10990.000	0.0	0.0	0.0	0.0
GR	1016.000	6860.000	1018.000	7150.000	1018.000	7330.000	1016.000	7400.000	1014.000	7420.000
GR	1012.000	7440.000	1010.000	7460.000	1008.000	7480.000	1006.000	7490.000	1006.000	9220.000
GR	1004.000	9400.000	1002.000	9420.000	1002.000	9470.000	1004.000	9510.000	1006.000	9540.000
GR	1008.000	9600.000	1010.000	9610.000	1016.000	9625.000	1016.000	9660.000	1010.000	9670.000
GR	1006.000	9700.000	1000.000	9730.000	998.000	9750.000	997.000	9950.000	999.000	10000.000
GR	1000.000	10060.000	1010.000	10090.000	1010.000	10140.000	1000.000	10160.000	1000.000	10570.000
GR	1010.000	10590.000	1010.000	10620.000	1000.000	10650.000	990.000	10700.000	980.000	10750.000
GR	978.000	10880.000	980.000	11000.000	0.0	0.0	0.0	0.0	0.0	0.0
EJ	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0

```
SECNO     DEPTH     CWSEL     CRIWS     WSELK     EG        HV        HL        OLOSS     BANK ELEV
Q         QLOB      QCH       QROB      ALOB      ACH       AROB      VOL       TWA     LEFT/RIGHT
TIME      VLOB      VCH       VROB      XNL       XNCH      XNR       WTN       ELMIN       SSTA
SLOPE     XLOBL     XLCH      XLOBR     ITRIAL    IDC       ICONT     CORAR     TOPWID      ENDST

*PROF 1

CCHV=   0.100 CEHV=   0.300
*SECNO 5.550

3470 ENCROACHMENT STATIONS=    9250.0    10750.0  TYPE=      2  TARGET=     1500.000
     5.55      6.88    974.88      0.0    979.90    975.40      0.53       0.0       0.0    973.00
   16000.    15067.        0.     933.     2529.        0.      348.        0.        0.    973.00
      0.0      5.96       0.0     2.68     0.045     0.035     0.040       0.0    968.00   9315.61
 0.004984        0.        0.       0.         0         0         6       0.0   1113.31  10428.92

*SECNO 5.820

3470 ENCROACHMENT STATIONS=    9250.0    10750.0  TYPE=      0  TARGET=     1500.000
     5.82      5.49    977.49      0.0       0.0    977.66      0.17      2.22      0.04    973.00
   16000.    13296.        0.    2704.     3883.        0.     1002.       91.       25.    973.00
      0.09      3.42       0.0     2.70     0.045     0.035     0.040     0.034    972.00   9250.00
 0.001193     1050.     1000.     900.         4         0         0       0.0   1097.46  10347.45

*SECNO 5.850

3470 ENCROACHMENT STATIONS=    9250.0    10750.0  TYPE=      0  TARGET=     1500.000
     5.85      3.56    979.01      0.0       0.0    979.36      0.35      1.65      0.05    975.45
   16000.     7529.        0.    8471.     1697.        0.     1697.      169.       46.    975.45
      0.14      4.44       0.0     4.99     0.045     0.035     0.040     0.034    975.45   9440.77
 0.004081      820.      820.     820.         3         0         0       0.0   1118.46  10559.23


SPECIAL BRIDGE

SR   XK        XKOR      COFQ      RDLEN     BWC       BWP       BAREA     SS        ELCHU     ELCHD
     1.05      1.60      2.60    1500.00   1100.00     90.00  11276.00     3.76    975.52    975.45

CCHV=   0.100 CEHV=   0.300
*SECNO 5.860
CLASS A LOW FLOW

3420 BRIDGE W.S.=    978.99 BRIDGE VELOCITY=,      4.46      CALCULATED CHANNEL AREA=,      3551.
```

SECNO	DEPTH	CWSEL	CRIWS	WSELK	EG	HV	HL	OLOSS	BANK ELEV
Q	OLOB	OCH	OROB	ALOB	ACH	AROB	VOL	TWA	LEFT/RIGHT
TIME	VLOB	VCH	VROB	XNL	XNCH	XNR	WTN	ELMIN	SSTA
SLOPE	XLOBL	XLCH	XLOBR	ITRIAL	IDC	ICONT	CORAR	TOPWID	ENDST

X above J-10

EGPRS	EGLWC	H3	QWEIR	QPR	BAREA	TRAPEZOID AREA	ELLC	ELTRD
0.0	979.44	0.09	0.	16000.	11276.	11696.	986.64	990.00

3470 ENCROACHMENT STATIONS= 9250.0 10750.0 TYPE= 0 TARGET= 1500.000

5.86	3.58	979.10	0.0	0.0	979.44	0.34	0.08	0.0	975.52
16000.	8000.	0.	8000.	1705.	0.	1705.	174.	48.	975.52
0.14	4.69	0.0	4.69	0.018	0.018	0.018	0.034	975.52	9440.71
0.000725	61.	61.	61.	0	0	0	0.0	1118.57	10559.28

*SECNO 6.330

3470 ENCROACHMENT STATIONS= 9250.0 10750.0 TYPE= 0 TARGET= 1500.000

6.33	3.19	979.93	0.0	0.0	980.38	0.45	0.91	0.03	976.74
16000.	8000.	0.	8000.	1489.	0.	1489.	248.	74.	976.74
0.19	5.37	0.0	5.37	0.018	0.018	0.018	0.028	976.74	9443.87
0.001133	1100.	1020.	930.	3	0	0	0.0	1112.25	10556.12

*SECNO 6.710

3470 ENCROACHMENT STATIONS= 9250.0 10750.0 TYPE= 0 TARGET= 1500.000

6.71	2.76	981.72	0.0	0.0	982.36	0.64	1.92	0.06	978.96
16000.	8000.	0.	8000.	1247.	0.	1247.	329.	107.	978.96
0.25	6.41	0.0	6.41	0.018	0.018	0.018	0.025	978.96	9445.03
0.002043	1290.	1290.	1290.	2	0	0	0.0	1109.94	10554.97

*SECNO 6.960

3470 ENCROACHMENT STATIONS= 9250.0 10750.0 TYPE= 0 TARGET= 1500.000

6.96	3.01	984.02	0.0	0.0	984.54	0.51	2.17	0.01	981.01
16000.	8000.	0.	8000.	1390.	0.	1390.	407.	139.	981.01
0.31	5.76	0.0	5.76	0.018	0.018	0.018	0.024	981.01	9444.30
0.001425	1280.	1280.	1280.	2	0	0	0.0	1111.40	10555.70

*SECNO 7.120

```
SECNO      DEPTH      CWSEL      CRIWS      WSELK      EG         HV         HL         QLOSS      BANK ELEV
Q          QLOB       QCH        QROB       ALOB       ACH        AROB       VOL        TWA     LEFT/RIGHT
TIME       VLOB       VCH        VROB       XNL        XNCH       XNR        WTN        ELMIN       SSTA
SLOPE      XLOPL      XLCH       XLOBR      ITRIAL     IDC        ICONT      CORAR      TOPWID      ENDST

3470 ENCROACHMENT STATIONS=    9250.0    10750.0  TYPE=      0  TARGET=    1500.000
     7.12       2.92     985.45       0.0       0.0     986.01       0.56       1.46       0.01     982.53
   16000.      8000.         0.     8000.     1329.         0.     1329.       466.       164.     982.53
     0.35       6.02        0.0      6.02     0.018      0.018      0.018      0.023     982.53    9444.61
 0.001654       950.       950.      950.         2          0          0        0.0    1110.78   10555.39

*SECNO 7.360

3470 ENCROACHMENT STATIONS=    9250.0    10750.0  TYPE=      0  TARGET=    1500.000
     7.36       2.94     987.47       0.0       0.0     988.02       0.54       2.01       0.00     984.53
   16000.      8000.         0.     8000.     1353.         0.     1353.       543.       195.     984.53
     0.41       5.91        0.0      5.91     0.018      0.018      0.018      0.022     984.53    9444.49
 0.001560      1250.      1250.     1250.         1          0          0        0.0    1111.02   10555.51

*SECNO 7.650

3470 ENCROACHMENT STATIONS=    9250.0    10750.0  TYPE=      0  TARGET=    1500.000
     7.65       2.50     989.73       0.0       0.0     990.55       0.82       2.45       0.08     987.23
   16000.      8000.         0.     8000.     1103.         0.     1103.       608.       225.     987.23
     0.46       7.25        0.0      7.25     0.018      0.018      0.018      0.021     987.23    9445.45
 0.003069      1150.      1150.     1150.         2          0          0        0.0    1109.09   10554.54

CCHV=    0.100 CEHV=    0.300
*SECNO 7.885

3265 DIVIDED FLOW

3280 CROSS SECTION        7.89 EXTENDED        5.28 FEET

3470 ENCROACHMENT STATIONS=    6850.0    11040.0  TYPE=      1  TARGET=    4190.000
     7.89       5.28     995.28       0.0       0.0     995.70       0.42       5.11       0.04    1000.00
   16000.         0.         0.    16000.         0.         0.     3093.       700.       262.    1000.00
     0.54        0.0        0.0      5.17     0.045      0.035      0.040      0.023     990.00   10033.61
 0.003672      1750.      1500.     1450.         3          0          0        0.0    1001.57   11040.00

*SECNO 8.180
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end of Rd improved

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   SECNO     DEPTH     CWSEL     CRIWS     WSELK     EG        HV        HL        OLOSS    BANK ELEV
   Q         QLOB      QCH       QROB      ALOB      ACH       AROB      VOL       TWA    LEFT/RIGHT
   TIME      VLOB      VCH       VROB      XNL       XNCH      XNR       WTN       ELMIN      SSTA
   SLOPE     XLOBL     XLCH      XLOBR     ITRIAL    IDC       ICONT     CORAR     TOPWID     ENDST

3265 DIVIDED FLOW

3280 CROSS SECTION       8.18 EXTENDED       0.42 FEET

3470 ENCROACHMENT STATIONS=     7350.0    10990.0  TYPE=      1  TARGET=     3640.000
     8.18      6.42  1000.42      0.0       0.0   1001.01     0.59      5.26      0.05  1005.00
   16000.       80.        0.   15920.       65.        0.   2573.      802.      298.   1005.00
     0.41      1.23       0.0      6.19     0.045     0.035   0.040     0.025    994.00  9446.87
 0.003144     1650.     1580.     1550.         2         0       0       0.0   1030.43 10990.00

*SECNO 8.190

3265 DIVIDED FLOW

3685 20 TRIALS ATTEMPTED WSEL,CWSEL
3693 PROBABLE MINIMUM SPECIFIC ENERGY
3720 CRITICAL DEPTH ASSUMED

3470 ENCROACHMENT STATIONS=     7350.0    12950.0  TYPE=      1  TARGET=     5600.000
     8.19      9.14  1004.14  1004.14       0.0   1004.74     0.60      0.18      0.00  1004.00
   16000.       48.    11133.    4819.       87.      1536.   2000.      806.      301.   1003.00
     0.41      0.55      7.25     2.41     0.045     0.035   0.040     0.025    995.00  7527.34
 0.004223       50.       50.       50.        20        12       0       0.0   3496.56 12845.62


SPECIAL BRIDGE

SB  XK        XKOR      COFQ      RDLEN     BWC       BWP       BAREA     SS        ELCHU     ELCHD
     1.05     15.50      2.70       0.0   6000.00   1100.00  22150.00      0.0    993.00    993.00

*SECNO 8.200

3265 DIVIDED FLOW

CLASS A LOW FLOW

3420 BRIDGE W.S.=   1004.13 BRIDGE VELOCITY=,      0.29      CALCULATED CHANNEL AREA=,    54560.
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SECNO	DEPTH	CWSEL	CRIWS	WSELK	EG	HV	HL	OLOSS	BANK ELEV
Q	QLOB	QCH	QROB	ALOB	ACH	AROB	VOL	TWA	LEFT/RIGHT
TIME	VLOB	VCH	VROB	XNL	XNCH	XNR	WTN	ELMIN	SSTA
SLOPE	XLOBL	XLCH	XLOBR	ITRIAL	IDC	ICONT	CORAR	TOPWID	ENDST

EGPRS	EGLWC	H3	QWEIR	QPR	BAREA	TRAPEZOID AREA	ELLC	ELTRD
0.0	1004.78	0.25	0.	16000.	22150.	83300.	1010.00	1014.00

3470 ENCROACHMENT STATIONS= 7280.0 12950.0 TYPE= 1 TARGET= 5670.000

8.20	9.39	1004.39	0.0	0.0	1004.78	0.39	0.05	0.0	1004.00
16000.	244.	9990.	5766.	294.	1624.	2616.	807.	302.	1003.00
0.61	0.83	6.15	2.20	0.045	0.035	0.040	0.025	995.00	7505.20
0.002821	15.	15.	15.	0	0	0	0.0	3903.57	12855.47

*SECNO 8.210

3265 DIVIDED FLOW

3470 ENCROACHMENT STATIONS= 2950.0 8500.0 TYPE= 1 TARGET= 5550.000

8.21	9.79	1004.79	0.0	0.0	1004.89	0.09	0.07	0.03	1000.00
16000.	4042.	1876.	10082.	2486.	408.	4748.	814.	307.	996.00
0.62	1.63	4.60	2.12	0.045	0.035	0.040	0.025	995.00	3506.96
0.000915	50.	50.	50.	2	0	0	0.0	4796.21	8431.83

*SECNO 8.215

3265 DIVIDED FLOW

3470 ENCROACHMENT STATIONS= 7110.0 10600.0 TYPE= 1 TARGET= 3490.000

8.22	24.88	1004.88	0.0	0.0	1004.90	0.02	0.01	0.01	1000.00
16000.	12743.	0.	3257.	10757.	0.	4303.	835.	314.	1000.00
0.64	1.18	0.0	0.76	0.045	0.035	0.040	0.025	980.00	7419.21
0.000027	80.	80.	80.	2	0	0	0.0	2715.05	10599.27

*SECNO 8.410

3265 DIVIDED FLOW

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SECNO     DEPTH     CWSEL     CRIWS     WSELK     EG        HV        HL        OLOSS     BANK ELEV
Q         QLOB      QCH       QROB      ALOB      ACH       AROB      VOL       TWA     LEFT/RIGHT
TIME      VLOB      VCH       VROB      XNL       XNCH      XNR       WTN       ELMIN       SSTA
SLOPE     XLOBL     XLCH      XLOBR     ITRIAL    IDC       ICONT     CORAR     TOPWID      ENDST

3280 CROSS SECTION      8.41 EXTENDED     24.90 FEET

3470 ENCROACHMENT STATIONS=    7500.0    10990.0  TYPE=      1  TARGET=     3490.000
     8.41     26.90  1004.90      0.0       0.0   1004.93      0.03      0.03      0.00    999.00
   16000.     1494.       0.   14506.     2305.       0.   10170.     1143.      359.    999.00
     0.84      0.65      0.0     1.43     0.045     0.035     0.040     0.026    978.00   9318.84
 0.000033      950.    1000.    1000.         2         0         0       0.0   1358.20  10990.00
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*************************************************
  HEC2 RELEASE DATED NOV 76 UPDATED APR  1980
  ERROR CORR -  01,02,03,04
  MODIFICATION -  50,51,52,53,54
*************************************************

T1       AGUA FRIA CHANNEL * I-10 TO INDIAN SHCOOL ROAD *
T2 IMPROVED CHANNEL W/ N-VALUE=.018  WITH MCDOWELL RD BRIDGE
T3       1100 BOTTOM WIDTH 311 SIDE SLOPES 025

J1  ICHECK     INQ       NINV      IDIR      STRT      METRIC    HVINS     Q         WSEL      FQ
       0.       3.        0.        0.  0.005000       0.0       0.0       0.   979.900     0.0

J2  NPROF     IPLOT     PRFVS     XSECV     XSECH      FN       ALLDC     IBW      CHNIM    ITRACE
    2.000       0.0    -1.000       0.0       0.0       0.0       0.0       0.0       0.0       0.0
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   SECNO      DEPTH      CWSEL      CRIWS      WSELK      EG         HV         HL         OLOSS    BANK ELEV
   Q          QLOB       QCH        QROB       ALOB       ACH        AROB       VOL        TWA    LEFT/RIGHT
   TIME       VLOB       VCH        VROB       XNL        XNCH       XNR        WTN        ELMIN       SSTA
   SLOPE      XLOBL      XLCH       XLOBR      ITRIAL     IDC        ICONT      CORAR      TOPWID      ENDST

*PROF 2

CCHV=   0.100 CEHV=   0.300
*SECNO 5.550

3470 ENCROACHMENT STATIONS=    9250.0    10750.0  TYPE=      2  TARGET=     1500.000
     5.55       9.63    977.63       0.0     979.90    978.54       0.91        0.0        0.0     973.00
   49000.     36543.        0.    12457.      4432.        0.      2238.         0.         0.     973.00
      0.0       8.24       0.0      5.57      0.045      0.035      0.040        0.0     968.00    9301.84
 0.004997         0.        0.        0.          0          0          4        0.0    1448.16   10750.00

*SECNO 5.820

3470 ENCROACHMENT STATIONS=    9250.0    10750.0  TYPE=      0  TARGET=     1500.000
     5.82       8.83    980.83       0.0        0.0    981.26       0.43       2.67       0.05     973.00
   49000.     35498.        0.    13501.      6390.        0.      3091.       185.        33.     973.00
      0.05       5.56       0.0      4.37      0.045      0.035      0.040      0.035     972.00    9250.00
 0.001633      1050.     1000.      900.          3          0          0        0.0    1500.00   10750.00

*SECNO 5.850

3470 ENCROACHMENT STATIONS=    9250.0    10750.0  TYPE=      0  TARGET=     1500.000
     5.85       6.98    982.43       0.0        0.0    983.15       0.72       1.80       0.09     975.45
   49000.     23059.        0.    25941.      3626.        0.      3626.       343.        58.     975.45
      0.09       6.36       0.0      7.15      0.045      0.035      0.040      0.035     975.45    9428.48
 0.003118       820.      820.      820.          2          0          0        0.0    1143.03   10571.51

SPECIAL BRIDGE

SB   XK         XKOR       COFQ       RDLEN      BWC        BWP        BAREA      SS         ELCHU      ELCHD
     1.05       1.60       2.60    1500.00    1100.00      90.00   11276.00       3.76     975.52     975.45

CCHV=   0.100 CEHV=   0.300
*SECNO 5.860
CLASS A LOW FLOW

3420 BRIDGE W.S.=    982.33 BRIDGE VELOCITY=,      6.92      CALCULATED CHANNEL AREA=,      7047.
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SECNO     DEPTH     CWSEL     CRIWS     WSELK     EG        HV        HL        OLOSS     BANK ELEV
Q         QLOB      QCH       QROB      ALOB      ACH       AROB      VOL       TWA     LEFT/RIGHT
TIME      VLOB      VCH       VROB      XNL       XNCH      XNR       WTN       ELMIN       SSTA
SLOPE     XLOBL     XLCH      XLOBR     ITRIAL    IDC       ICONT     CORAR     TOPWID      ENDST

EGPRS     EGLWC     H3        QWEIR     QPR       BAREA     TRAPEZOID     ELLC      ELTRD
                                                                AREA
  0.0     983.29    0.18      0.        49000.    11276.    11696.        986.64    990.00

3470 ENCROACHMENT STATIONS=   9250.0   10750.0  TYPE=     0  TARGET=    1500.000
     5.86      7.09    982.61    0.0       0.0     983.29    0.68      0.15      0.0       975.52
   49000.    24500.       0.   24500.    3692.        0.    3692.     353.       59.      975.52
     0.09      6.64      0.0     6.64    0.018      0.018    0.018    0.034    975.52    9428.07
 0.000531      61.       61.     61.       0         0        0       0.0     1143.86   10571.93

*SECNO 6.330

3470 ENCROACHMENT STATIONS=   9250.0   10750.0  TYPE=     0  TARGET=    1500.000
     6.33      6.39    983.13    0.0       0.0     984.00    0.87      0.65      0.05      976.74
   49000.    24500.       0.   24500.    3279.        0.    3279.     516.       86.      976.74
     0.13      7.47      0.0     7.47    0.018      0.018    0.018    0.029    976.74    9434.96
 0.000778    1100.     1020.    930.       3         0        0       0.0     1130.07   10565.04

*SECNO 6.710

3470 ENCROACHMENT STATIONS=   9250.0   10750.0  TYPE=     0  TARGET=    1500.000
     6.71      5.23    984.19    0.0       0.0     985.54    1.35      1.40      0.14      978.96
   49000.    24500.       0.   24500.    2629.        0.    2629.     691.      119.      978.96
     0.17      9.32      0.0     9.32    0.018      0.018    0.018    0.025    978.96    9438.04
 0.001617    1290.     1290.    1290.       2         0        0       0.0     1123.93   10561.96

*SECNO 6.960

3470 ENCROACHMENT STATIONS=   9250.0   10750.0  TYPE=     0  TARGET=    1500.000
     6.96      5.25    986.26    0.0       0.0     987.60    1.34      2.06      0.00      981.01
   49000.    24500.       0.   24500.    2636.        0.    2636.     845.      152.      981.01
     0.20      9.29      0.0     9.29    0.018      0.018    0.018    0.024    981.01    9438.00
 0.001601    1280.     1280.    1280.       2         0        0       0.0     1124.00   10562.00

*SECNO 7.120
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SECNO     DEPTH     CWSEL     CRIWS     WSELK     EG        HV        HL        OLOSS     BANK ELEV
Q         QLOB      QCH       QROB      ALOB      ACH       AROB      VOL       TWA     LEFT/RIGHT
TIME      VLOB      VCH       VROB      XNL       XNCH      XNR       WTN       ELMIN       SSTA
SLOPE     XLOBL     XLCH      XLOBR     ITRIAL    IDC       ICONT     CORAR     TOPWID      ENDST

3470 ENCROACHMENT STATIONS=    9250.0    10750.0  TYPE=      0  TARGET=    1500.000
     7.12      5.25    987.78      0.0       0.0    989.12      1.33      1.52      0.00    982.53
   49000.    24500.        0.   24500.     2643.        0.     2643.      961.      177.    982.53
     0.23      9.27       0.0      9.27     0.018     0.018     0.018     0.023    982.53   9437.96
 0.001589      950.      950.      950.         0         0         0       0.0   1124.07  10562.03

*SECNO 7.360

3470 ENCROACHMENT STATIONS=    9250.0    10750.0  TYPE=      0  TARGET=    1500.000
     7.36      5.24    989.77      0.0       0.0    991.11      1.34      1.99      0.00    984.53
   49000.    24500.        0.   24500.     2636.        0.     2636.     1112.      209.    984.53
     0.27      9.30       0.0      9.30     0.018     0.018     0.018     0.022    984.53   9438.00
 0.001603     1250.     1250.     1250.         0         0         0       0.0   1124.00  10562.00

*SECNO 7.650

3301 HV CHANGED MORE THAN HVINS

3470 ENCROACHMENT STATIONS=    9250.0    10750.0  TYPE=      0  TARGET=    1500.000
     7.65      4.55    991.78      0.0       0.0    993.63      1.85      2.36      0.15    987.23
   49000.    24500.        0.   24500.     2247.        0.     2247.     1241.      239.    987.23
     0.30     10.90       0.0     10.90     0.018     0.018     0.018     0.021    987.23   9439.23
 0.002722     1150.     1150.     1150.         2         0         0       0.0   1121.53  10560.76

CCHV=   0.100 CEHV=   0.300
*SECNO 7.885
3280 CROSS SECTION       7.89 EXTENDED       7.99 FEET

3301 HV CHANGED MORE THAN HVINS

3470 ENCROACHMENT STATIONS=    6850.0    11040.0  TYPE=      1  TARGET=    4190.000
     7.89      7.99    997.99      0.0       0.0    999.08      1.09      5.38      0.08   1000.00
   49000.        0.        0.   49000.        0.        0.     5843.     1421.      276.   1000.00
     0.35       0.0       0.0      8.39     0.045     0.035     0.040     0.023    990.00  10020.03
 0.004761     1750.     1500.     1450.         2         0         0       0.0   1019.96  11040.00
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SECNO     DEPTH     CWSEL     CRIWS     WSELK     EG        HV        HL        OLOSS     BANK ELEV
0         QLOB      QCH       QROB      ALOB      ACH       APOB      VOL       TWA     LEFT/RIGHT
TIME      VLOB      VCH       VROB      XNL       XNCH      XNR       WTN       ELMIN       SSTA
SLOPE     XLOBL     XLCH      XLOBR     ITRIAL    IDC       ICONT     CORAR     TOPWID      ENDST

*SECNO 8.180

3265 DIVIDED FLOW

3280 CROSS SECTION        8.18 EXTENDED        4.00 FEET

3470 ENCROACHMENT STATIONS=     7350.0    10990.0  TYPE=      1  TARGET=     3640.000
     8.18     10.00   1004.00      0.0       0.0   1004.79      0.79      5.68      0.03   1005.00
    49000.    5079.       0.    43921.     1990.       0.     5860.     1667.      340.   1005.00
      0.41     2.55      0.0      7.50     0.045     0.035     0.040     0.025    994.00   7360.18
 0.002889    1650.    1580.     1550.         2         0         0       0.0   2479.76  10990.00

*SECNO 8.190

3265 DIVIDED FLOW

3685 20 TRIALS ATTEMPTED WSEL,CWSEL
3693 PROBABLE MINIMUM SPECIFIC ENERGY
3720 CRITICAL DEPTH ASSUMED

3470 ENCROACHMENT STATIONS=     7350.0    12950.0  TYPE=      1  TARGET=     5600.000
     8.19     10.39   1005.39   1005.39       0.0   1006.19      0.80      0.20      0.00   1004.00
    49000.    4968.    19809.    24143.     1984.     1987.     5361.     1676.      345.   1003.00
      0.41     2.50     10.01      4.50     0.045     0.035     0.040     0.025    995.00   7414.55
 0.005712      50.       50.       50.        20         9         0       0.0   5430.45  12895.75

SPECIAL BRIDGE

SR   XK        XKOR      COFQ      RDLEN     BWC       BWP       BAREA     SS        ELCHU     ELCHD
     1.05      15.50     2.70      0.0       6000.00   1100.00   22150.00  0.0       993.00    993.00

*SECNO 8.200
CLASS A LOW FLOW

3420 BRIDGE W.S.=    1005.39 BRIDGE VELOCITY=,       0.81      CALCULATED CHANNEL AREA=,     60709.

EGPRS     EGLWC     H3        QWEIR     QPR       BAREA     TRAPEZOID     ELLC      ELTRD
                                                            AREA
  0.0     1006.26   0.37      0.        49000.    22150.    83300.        1010.00   1014.00
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   SECNO     DEPTH     CWSEL     CRIWS     WSELK     EG        HV        HL        OLOSS    BANK ELEV
   Q         QLOB      QCH       QROB      ALOB      ACH       AROB      VOL       TWA    LEFT/RIGHT
   TIME      VLOB      VCH       VROB      XNL       XNCH      XNR       WTN       ELMIN       SSTA
   SLOPE     XLOBL     XLCH      XLOBR     ITRIAL    IDC       ICONT     CORAR     TOPWID      ENDST

3470 ENCROACHMENT STATIONS=    7280.0    12950.0  TYPE=      1  TARGET=    5670.000
      8.20     10.76  1005.76      0.0       0.0   1006.26      0.50      0.07       0.0   1004.00
    49000.     6644.    17345.   25011.     2835.     2119.     6393.     1680.      347.   1003.00
      0.41      2.34      8.19     3.91     0.045     0.035     0.040     0.025    995.00   7381.62
  0.003507       15.       15.      15.         0         0         0       0.0   5549.56  12931.18

*SECNO 8.210

3470 ENCROACHMENT STATIONS=    2950.0     8500.0  TYPE=      1  TARGET=    5550.000
      8.21     11.20  1006.20      0.0       0.0   1006.41      0.21      0.12      0.03   1000.00
    49000.    14956.     3422.   30621.     5576.      492.     8758.     1695.      353.    996.00
      0.42      2.68      6.95     3.50     0.045     0.035     0.040     0.025    995.00   3183.32
  0.001626       50.       50.      50.         2         0         0       0.0   5304.79   8488.11

*SECNO 8.215

3265 DIVIDED FLOW

3470 ENCROACHMENT STATIONS=    7110.0    10600.0  TYPE=      1  TARGET=    3490.000
      8.22     26.35  1006.35      0.0       0.0   1006.45      0.10      0.03      0.01   1000.00
    49000.    38049.        0.   10951.    14326.        0.     5183.     1727.      361.   1000.00
      0.43      2.66       0.0     2.11     0.045     0.035     0.040     0.025    980.00   7207.08
  0.000172       80.       80.      80.         2         0         0       0.0   3265.04  10600.00

*SECNO 8.410

3265 DIVIDED FLOW

3280 CROSS SECTION      8.41 EXTENDED      26.47 FEET

3470 ENCROACHMENT STATIONS=    7500.0    10990.0  TYPE=      1  TARGET=    3490.000
      8.41     28.47  1006.47      0.0       0.0   1006.66      0.19      0.19      0.03    999.00
    49000.     5970.        0.   43030.     4024.        0.    11529.     2118.      433.    999.00
      0.51      1.48       0.0     3.73     0.045     0.035     0.040     0.026    978.00   7500.00
  0.000217       950.     1000.    1000.         2         0         0       0.0   3232.32  10990.00
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*****************************************
 HEC2 RELEASE DATED NOV 76 UPDATED APR  1980
 ERROR CORR -  01,02,03,04
 MODIFICATION -  50,51,52,53,54
*****************************************

T1       AGUA FRIA CHANNEL * I-10 TO INDIAN SHCOOL ROAD *
T2 IMPROVED CHANNEL W/ N-VALUE=.018  WITH MCDOWELL RD BRIDGE
T3       1100 BOTTOM WIDTH 3:1 SIDE SLOPES 050

J1  ICHECK     INQ       NINV      IDIR      STRT      METRIC    HVINS     Q         WSEL      FQ
       0.       4.        0.        0.  0.005000      0.0       0.0       0.   979.900     0.0

J2  NPROF     IPLOT     PRFVS     XSECV     XSECH     FN        ALLDC     IBW       CHNIM     ITRACE
     3.000     0.0      -1.000     0.0       0.0       0.0       0.0       0.0       0.0       0.0
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```
   SECNO     DEPTH     CWSEL     CRIWS     WSELK     EG        HV        HL        OLOSS    BANK ELEV
   O         OLOB      OCH       OROB      ALOB      ACH       AROB      VOL       TWA    LEFT/RIGHT
   TIME      VLOB      VCH       VROB      XNL       XNCH      XNR       WTN       ELMIN       SSTA
   SLOPE     XLOPL     XLCH      XLOBR     ITRIAL    IDC       ICONT     CORAR     TOPWID      ENDST

*PROF 3

CCHV=   0.100 CEHV=   0.300
*SECNO 5.550

3470 ENCROACHMENT STATIONS=    9250.0    10750.0  TYPE=     2  TARGET=    1500.000
     5.55     10.78    978.78      0.0    979.90    979.90      1.12       0.0       0.0    973.00
   69000.    47804.        0.   21196.     5242.        0.    3103.        0.        0.    973.00
     0.0      9.12       0.0      6.83     0.045     0.035     0.040       0.0    968.00   9292.16
 0.004990       0.        0.        0.         0         0         4       0.0   1457.84  10750.00

*SECNO 5.820

3301 HV CHANGED MORE THAN HVINS

3470 ENCROACHMENT STATIONS=    9250.0    10750.0  TYPE=     0  TARGET=    1500.000
     5.82     10.19    982.19      0.0       0.0    982.76      0.57      2.81      0.05    973.00
   69000.    47463.        0.   21537.     7409.        0.    4111.      227.       33.    973.00
     0.05      6.41       0.0      5.24     0.045     0.035     0.040     0.035    972.00   9250.00
 0.001796     1050.     1000.      900.         3         0         0       0.0   1500.00  10750.00

*SECNO 5.850

3470 ENCROACHMENT STATIONS=    9250.0    10750.0  TYPE=     0  TARGET=    1500.000
     5.85      8.39    983.84      0.0       0.0    984.79      0.95      1.92      0.11    975.45
   69000.    32471.        0.   36529.     4438.        0.    4438.      419.       58.    975.45
     0.08      7.32       0.0      8.23     0.045     0.035     0.040     0.035    975.45   9423.39
 0.003183      820.      820.      820.         2         0         0       0.0   1153.21  10576.60

SPECIAL BRIDGE

SB  XK        XKOR      COFQ      RDLEN     BWC       BWP       BAREA     SS        ELCHU     ELCHD
     1.05      1.60      2.60   1500.00   1100.00     90.00  11276.00      3.76    975.52    975.45

CCHV=   0.100 CEHV=   0.300
*SECNO 5.860
CLASS A LOW FLOW
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   SECNO     DEPTH     CWSEL     CRIWS     WSELK     EG        HV        HL        OLOSS   BANK ELEV
   Q         QLOB      QCH       QROB      ALOB      ACH       AROB      VOL       TWA   LEFT/RIGHT
   TIME      VLOB      VCH       VROB      XNL       XNCH      XNR       WTN       ELMIN     SSTA
   SLOPE     XLOBL     XLCH      XLOBR     ITRIAL    IDC       ICONT     CORAR     TOPWID    ENDST

3420 BRIDGE W.S.=    983.68 BRIDGE VELOCITY=,      8.09      CALCULATED CHANNEL AREA=,     8490.

 EGPRS      EGLWC       H3       QWEIR       QPR       BAREA   TRAPEZOID      ELLC      ELTRD
                                                                  AREA
    0.0     984.99     0.25         0.    69000.     11276.    11696.      986.64     990.00


3470 ENCROACHMENT STATIONS=    9250.0    10750.0  TYPE=      0  TARGET=     1500.000
     5.86      8.57   984.09      0.0       0.0    984.99     0.90      0.20      0.0    975.52
   69000.    34500.       0.   34500.     4544.       0.    4544.      432.      60.    975.52
     0.08      7.59      0.0     7.59     0.018     0.018    0.018     0.034   975.52   9422.73
 0.000532       61.      61.      61.         0         0        0       0.0  1154.54  10577.27

•SECNO 6.330

3470 ENCROACHMENT STATIONS=    9250.0    10750.0  TYPE=      0  TARGET=     1500.000
     6.33      7.84   984.58      0.0       0.0    985.68     1.10      0.63      0.06    976.74
   69000.    34500.       0.   34500.     4104.       0.    4104.      633.      86.    976.74
     0.11      8.41      0.0     8.41     0.018     0.018    0.018     0.029   976.74   9430.90
 0.000736     1100.    1020.     930.         3         0        0       0.0  1138.19  10569.09

•SECNO 6.710

3301 HV CHANGED MORE THAN HVINS

3470 ENCROACHMENT STATIONS=    9250.0    10750.0  TYPE=      0  TARGET=     1500.000
     6.71      6.53   985.49      0.0       0.0    987.13     1.64      1.29      0.16    978.96
   69000.    34500.       0.   34500.     3361.       0.    3361.      854.     120.    978.96
     0.15     10.27      0.0    10.27     0.018     0.018    0.018     0.025   978.96   9434.37
 0.001424     1290.    1290.    1290.         2         0        0       0.0  1131.26  10565.63

•SECNO 6.960

3470 ENCROACHMENT STATIONS=    9250.0    10750.0  TYPE=      0  TARGET=     1500.000
     6.96      6.33   987.34      0.0       0.0    989.09     1.75      1.93      0.03    981.01
   69000.    34500.       0.   34500.     3247.       0.    3247.     1048.     153.    981.01
     0.18     10.62      0.0    10.62     0.018     0.018    0.018     0.024   981.01   9434.93
 0.001594     1280.    1280.    1280.         2         0        0       0.0  1130.13  10565.06
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   SECNO      DEPTH      CWSEL      CRIWS      WSELK      EG         HV         HL         QLOSS    BANK ELEV
   Q          QLOB       QCH        QROB       ALOB       ACH        AROB       VOL        TWA    LEFT/RIGHT
   TIME       VLOB       VCH        VROB       XNL        XNCH       XNR        WTN        ELMIN       SSTA
   SLOPE      XLOBL      XLCH       XLOBR      ITRIAL     IDC        ICONT      CORAR      TOPWID      ENDST

*SECNO 7.120

3470 ENCROACHMENT STATIONS=     9250.0    10750.0  TYPE=      0  TARGET=     1500.000
      7.12       6.32     988.85       0.0       0.0     990.61       1.76       1.52       0.00     982.53
    69000.     34500.         0.    34500.     3242.         0.     3242.      1190.       178.     982.53
      0.20      10.64        0.0     10.64     0.018      0.018      0.018      0.023     982.53    9434.96
  0.001603       950.       950.      950.         2          0          0        0.0    1130.07   10565.04

*SECNO 7.360

3470 ENCROACHMENT STATIONS=     9250.0    10750.0  TYPE=      0  TARGET=     1500.000
      7.36       6.33     990.86       0.0       0.0     992.62       1.76       2.01       0.00     984.53
    69000.     34500.         0.    34500.     3241.         0.     3241.      1376.       210.     984.53
      0.24      10.65        0.0     10.65     0.018      0.018      0.018      0.022     984.53    9434.96
  0.001605      1250.      1250.     1250.         0          0          0        0.0    1130.07   10565.03

*SECNO 7.650

3301 HV CHANGED MORE THAN HVINS

3470 ENCROACHMENT STATIONS=     9250.0    10750.0  TYPE=      0  TARGET=     1500.000
      7.65       5.53     992.76    992.67       0.0     995.12       2.37       2.32       0.18     987.23
    69000.     34500.         0.    34500.     2795.         0.     2795.      1535.       240.     987.23
      0.26      12.34        0.0     12.34     0.018      0.018      0.018      0.021     987.23    9436.27
  0.002621       1150.      1150.     1150.         4         11          0        0.0    1127.44   10563.71

CCHV=    0.100 CEHV=    0.300
*SECNO 7.885

3265 DIVIDED FLOW

3280 CROSS SECTION        7.89 EXTENDED        9.18 FEET

3301 HV CHANGED MORE THAN HVINS

3470 ENCROACHMENT STATIONS=     6850.0    11040.0  TYPE=      1  TARGET=     4190.000
      7.89       9.18     999.18       0.0       0.0    1000.59       1.41       5.38       0.10    1000.00
    69000.      1175.         0.    67825.       530.         0.     7056.      1766.       291.    1000.00
      0.31       2.21        0.0      9.61     0.045      0.035      0.040      0.023     990.00    8636.41
  0.004973      1750.      1500.     1450.         3          0          0        0.0    1655.55   11040.00
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   SECNO     DEPTH     CWSEL     CRIWS     WSELK     EG        HV        HL        OLOSS    BANK ELEV
   Q         QLOB      QCH       QROB      ALOB      ACH       AROB      VOL       TWA    LEFT/RIGHT
   TIME      VLOB      VCH       VROB      XNL       XNCH      XNR       WTN       ELMIN       SSTA
   SLOPE     XLOBL     XLCH      XLOBR     ITRIAL    IDC       ICONT     CORAR     TOPWID      ENDST

*SECNO 8.180

3265 DIVIDED FLOW

3280 CROSS SECTION       8.18 EXTENDED       5.32 FEET


3301 HV CHANGED MORE THAN HVINS


3470 ENCROACHMENT STATIONS=     7350.0    10990.0  TYPE=      1  TARGET=     3640.000
       8.18     11.32  1005.32      0.0       0.0   1006.10      0.79      5.45      0.06  1005.00
     69000.    13595.       0.    55405.     4108.       0.     7135.     2106.      370.   1005.00
       0.37      3.31      0.0     7.76     0.045     0.035     0.040     0.025    994.00   7350.00
  0.002596     1650.     1580.    1550.         2         0         0       0.0   2648.00  10990.00


*SECNO 8.190
3685 20 TRIALS ATTEMPTED WSEL,CWSEL
3693 PROBABLE MINIMUM SPECIFIC ENERGY
3720 CRITICAL DEPTH ASSUMED

3470 ENCROACHMENT STATIONS=     7350.0    12950.0  TYPE=      1  TARGET=     5600.000
       8.19     10.74  1005.74  1005.74       0.0   1006.76      1.02      0.20      0.07  1004.00
     69000.     9229.    24606.   35164.     2786.     2111.     6333.     2119.      374.   1003.00
       0.37      3.31     11.66     5.55     0.045     0.035     0.040     0.025    995.00   7383.51
  0.007143       50.       50.      50.        20         9         0       0.0   5545.15  12928.66


SPECIAL BRIDGE

SB   XK        XKOR      COFQ      RDLEN     BWC       BWP       BAREA     SG        ELCHU     ELCHD
      1.05     15.50      2.70       0.0   6000.00   1100.00  22150.00      0.0     993.00    993.00

*SECNO 8.200
CLASS A LOW FLOW

3420 BRIDGE W.S.=    1005.73 BRIDGE VELOCITY=,       1.11      CALCULATED CHANNEL AREA=,     62383.

  EGPRS     EGLWC      H3       QWEIR     QPR       BAREA   TRAPEZOID      ELLC      ELTRD
                                                             AREA
      0.0   1006.85    0.54        0.   69000.    22150.    83300.     1010.00   1014.00
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   SECNO      DEPTH      CWSEL      CRIWS      WSELK      EG         HV         HL         CLOSS    BANK ELEV
   Q          QLOB       QCH        QROB       ALOB       ACH        AROB       VOL        TWA    LEFT/RIGHT
   TIME       VLOB       VCH        VROB       XNL        XNCH       XNR        WTN        ELMIN      SSTA
   SLOPE      XLOBL      XLCH       XLOBR      ITRIAL     IDC        ICONT      CORAR      TOPWID     ENDST

3470 ENCROACHMENT STATIONS=    7280.0    12950.0  TYPE=      1  TARGET=    5670.000
      8.20      11.27   1006.27      0.0       0.0   1006.85      0.57       0.09       0.0   1004.00
    69000.     12113.    20708.   36179.     4057.     2304.     7863.      2124.      376.   1003.00
      0.37       2.99      8.99     4.60     0.045     0.035     0.040      0.025    995.00   7327.06
  0.003780        15.       15.      15.         0         0         0        0.0   5622.94  12950.00

*SECNO 8.210

3470 ENCROACHMENT STATIONS=    2950.0     8500.0  TYPE=      1  TARGET=    5550.000
      8.21      11.73   1006.73      0.0       0.0   1007.01      0.28       0.13       0.03   1000.00
    69000.     22015.     4176.  42809.     6865.      524.    10291.      2142.      383.    996.00
      0.38       3.21      7.97     4.16     0.045     0.035     0.040      0.025    995.00   3061.20
  0.001964        50.       50.      50.         2         0         0        0.0   5438.79   8500.00

*SECNO 8.215

3265 DIVIDED FLOW

3470 ENCROACHMENT STATIONS=    7110.0    10600.0  TYPE=      1  TARGET=    3490.000
      8.22      26.90   1006.90      0.0       0.0   1007.07      0.16       0.05       0.01   1000.00
    69000.     53265.        0.   15735.    15834.        0.     5518.      2178.      391.   1000.00
      0.38       3.36       0.0     2.85     0.045     0.035     0.040      0.025    980.00   7154.03
  0.000290        80.       80.      80.         2         0         0        0.0   3337.64  10600.00

*SECNO 8.410

3265 DIVIDED FLOW

3280 CROSS SECTION      8.41 EXTENDED      27.11 FEET

3470 ENCROACHMENT STATIONS=    7500.0    10990.0  TYPE=      1  TARGET=    3490.000
      8.41      29.11   1007.11      0.0       0.0   1007.43      0.32       0.32       0.05    999.00
    69000.      9956.        0.   59044.     5544.        0.    12092.      2613.      464.    999.00
      0.44       1.80       0.0     4.80     0.045     0.035     0.040      0.026    978.00   7500.00
  0.000363       950.     1000.    1000.         2         0         0        0.0   3262.79  10990.00
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*************************************************
  HEC2 RELEASE DATED NOV 76 UPDATED APR  1980
  ERROR CORR -  01,02,03,04
  MODIFICATION -  50,51,52,53,54
*************************************************

T1       AGUA FRIA CHANNEL * I-10 TO INDIAN SHCOOL ROAD *
T2 IMPROVED CHANNEL W/ N-VALUE=.018  WITH MCDOWELL RD BRIDGE
T3       1100 BOTTOM WIDTH 311 SIDE SLOPES Q100

J1  ICHECK    INQ       NINV      IDIR      STRT      METRIC    HVINS     Q         WSEL      FQ
       0.       5.        0.        0.   0.0            0.0       0.0       0.   979.900     0.0

J2  NPROF     IPLOT     PRFVS     XSECV     XSECH     FN        ALLDC     IBW       CHNIM     ITRACE
    15.000     0.0      -1.000     0.0       0.0       0.0       0.0       0.0       0.0       0.0
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```
   SECNO     DEPTH     CWSEL     CRIWS     WSELK     EG        HV        HL        OLOSS    BANK ELEV
   Q         QLOB      QCH       QROB      ALOB      ACH       AROB      VOL       TWA    LEFT/RIGHT
   TIME      VLOB      VCH       VROB      XNL       XNCH      XNR       WTN       ELMIN       SSTA
   SLOPE     XLOBL     XLCH      XLOBR     ITRIAL    IDC       ICONT     CORAR     TOPWID      ENDST

*PROF 4

CCHV=   0.100 CEHV=   0.300
*SECNO 5.550

3470 ENCROACHMENT STATIONS=    9250.0    10750.0  TYPE=     2  TARGET=    1500.000
     5.55     11.90    979.90      0.0    979.90    981.23      1.33       0.0       0.0    973.00
   91000.    59732.        0.   31268.     6038.        0.     3940.        0.        0.    973.00
     0.0      9.89       0.0      7.94     0.045     0.035     0.040       0.0    968.00   9281.00
 0.004952       0.        0.       0.         0         0         0       0.0   1469.00  10750.00

*SECNO 5.820

3301 HV CHANGED MORE THAN HVINS

3470 ENCROACHMENT STATIONS=    9250.0    10750.0  TYPE=     0  TARGET=    1500.000
     5.82     11.48    983.48      0.0       0.0    984.20      0.72      2.91      0.06    973.00
   91000.    60138.        0.   30862.     8372.        0.     5074.      267.       33.    973.00
     0.04      7.18       0.0      6.08     0.045     0.035     0.040     0.035    972.00   9250.00
 0.001912     1050.     1000.     900.         3         0         0       0.0   1500.00  10750.00

*SECNO 5.850

3470 ENCROACHMENT STATIONS=    9250.0    10750.0  TYPE=     0  TARGET=    1500.000
     5.85      9.71    985.16      0.0       0.0    986.36      1.20      2.02      0.14    975.45
   91000.    42824.        0.   48176.     5203.        0.     5203.      491.       58.    975.45
     0.07      8.23       0.0      9.26     0.045     0.035     0.040     0.035    975.45   9418.64
 0.003287      820.      820.      820.         2         0         0       0.0   1162.72  10581.36

SPECIAL BRIDGE

SB   XK        XKOR      COFO      RDLEN     BWC       BWP       BAREA     SS        ELCHU     ELCHD
     1.05      1.60      2.60    1500.00   1100.00     90.00  11276.00     3.76    976.62    976.46

CCHV=   0.100 CEHV=   0.300
*SECNO 5.860
CLASS A LOW FLOW
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   SECNO     DEPTH     CWSEL     CRIWS     WSELK     EG        HV        HL        OLOSS    BANK ELEV
   Q         QLOB      QCH       QROB      ALOB      ACH       AROB      VOL       TWA    LEFT/RIGHT
   TIME      VLOB      VCH       VROB      XNL       XNCH      XNR       WTN       ELMIN       SSTA
   SLOPE     XLOBL     XLCH      XLOBR     ITRIAL    IDC       ICONT     CORAR     TOPWID      ENDST

3420 BRIDGE W.S.=    984.92 BRIDGE VELOCITY=,      9.22      CALCULATED CHANNEL AREA=,     9826.

 EGPRS      EGLWC       H3       QWEIR       QPR       BAREA   TRAPEZOID      ELLC      ELTRD
                                                                  AREA
     0.0     986.62     0.34        0.     91000.     11276.    11696.      986.64     990.00


3470 ENCROACHMENT STATIONS=     9250.0    10750.0  TYPE=      0  TARGET=     1500.000
     5.86      9.98   985.50      0.0       0.0     986.62      1.12      0.26      0.0     975.52
    91000.   45500.       0.   45500.     5359.        0.     5359.      506.       60.     975.52
     0.07      8.49      0.0      8.49     0.018     0.018     0.018     0.034    975.52   9417.67
 0.000539       61.      61.       61.         0         0         0       0.0   1164.65  10582.32

*SECNO 6.330

3470 ENCROACHMENT STATIONS=     9250.0    10750.0  TYPE=      0  TARGET=     1500.000
     6.33      9.23   985.97      0.0       0.0     987.31      1.34      0.63      0.07     976.74
    91000.   45500.       0.   45500.     4896.        0.     4896.      745.       87.     976.74
     0.10      9.29      0.0      9.29     0.018     0.018     0.018     0.029    976.74   9427.03
 0.000716     1100.    1020.     930.         3         0         0       0.0   1145.94  10572.97

*SECNO 6.710

3301 HV CHANGED MORE THAN HVINS

3470 ENCROACHMENT STATIONS=     9250.0    10750.0  TYPE=      0  TARGET=     1500.000
     6.71      7.82   986.78      0.0       0.0     988.70      1.92      1.21      0.17     978.96
    91000.   45500.       0.   45500.     4092.        0.     4092.     1011.      121.     978.96
     0.13     11.12      0.0     11.12     0.018     0.018     0.018     0.025    978.96   9430.72
 0.001293     1290.    1290.     1290.         0         0         0       0.0   1138.55  10569.27

*SECNO 6.960

3470 ENCROACHMENT STATIONS=     9250.0    10750.0  TYPE=      0  TARGET=     1500.000
     6.96      7.42   988.43      0.0       0.0     990.58      2.15      1.81      0.07     981.01
    91000.   45500.       0.   45500.     3868.        0.     3868.     1245.      154.     981.01
     0.16     11.76      0.0     11.76     0.018     0.018     0.018     0.024    981.01   9431.84
 0.001557     1280.    1280.     1280.         2         0         0       0.0   1136.32  10568.16
```

```
   SECNO      DEPTH      CWSEL      CRIWS      WSELK      EG         HV         HL         OLOSS     BANK ELEV
   Q          QLOB       QCH        QROB       ALOB       ACH        AROB       VOL        TWA     LEFT/RIGHT
   TIME       VLOB       VCH        VROB       XNL        XNCH       XNR        WTN        ELMIN       SSTA
   SLOPE      XLOBL      XLCH       XLOBR      ITRIAL     IDC        ICONT      CORAR      TOPWID      ENDST

*SECNO 7.120

3470 ENCROACHMENT STATIONS=     9250.0    10750.0  TYPE=      0  TARGET=     1500.000
     7.12       7.38    989.91      0.0       0.0     992.09      2.18       1.50       0.01     982.53
   91000.     45500.        0.   45500.     3841.        0.     3841.      1413.       179.     982.53
     0.18      11.85       0.0    11.85     0.018      0.018     0.018      0.023     982.53    9431.97
 0.001594       950.      950.     950.         2          0         0        0.0    1136.05   10568.02

*SECNO 7.360

3470 ENCROACHMENT STATIONS=     9250.0    10750.0  TYPE=      0  TARGET=     1500.000
     7.36       7.37    991.90      0.0       0.0     994.09      2.18       2.00       0.00     984.53
   91000.     45500.        0.   45500.     3836.        0.     3836.      1634.       211.     984.53
     0.21      11.86       0.0    11.86     0.018      0.018     0.018      0.022     984.53    9432.00
 0.001601      1250.     1250.    1250.         2          0         0        0.0    1136.00   10568.00

*SECNO 7.650

3301 HV CHANGED MORE THAN HVINS

3470 ENCROACHMENT STATIONS=     9250.0    10750.0  TYPE=      0  TARGET=     1500.000
     7.65       6.46    993.69   993.66       0.0     996.60      2.91       2.30       0.22     987.23
   91000.     45500.        0.   45500.     3326.        0.     3326.      1823.       241.     987.23
     0.24      13.68       0.0    13.68     0.018      0.018     0.018      0.022     987.23    9433.43
 0.002568      1150.     1150.    1150.         4         11         0        0.0    1133.13   10566.56

CCHV=    0.100 CFHV=    0.300
*SECNO 7.885
3280 CROSS SECTION        7.89 EXTENDED       10.38 FEET

3301 HV CHANGED MORE THAN HVINS

3470 ENCROACHMENT STATIONS=     6850.0    11040.0  TYPE=      1  TARGET=     4190.000
     7.89      10.39   1000.39   998.84       0.0    1001.92      1.54       5.19       0.14    1000.00
   91000.      5812.        0.   85188.     2223.        0.     8299.      2128.       336.    1000.00
     0.28       2.61       0.0    10.26     0.045      0.035     0.040      0.023     990.00    7165.20
 0.004649      1750.     1500.    1450.         6         11         0        0.0    3874.80   11040.00
```

```
SECNO     DEPTH     CWSEL     CRIWS     WSELK     EG        HV        HL        QLOSS     BANK ELEV
Q         QLOB      QCH       QROB      ALOB      ACH       AROB      VOL       TWA     LEFT/RIGHT
TIME      VLOB      VCH       VROB      XNL       XNCH      XNR       WTN       ELMIN       SSTA
SLOPE     XLOPL     XLCH      XLORR     ITRIAL    IDC       ICONT     CORAR     TOPWID      ENDST

*SECNO 8.180

3265 DIVIDED FLOW

3280 CROSS SECTION      8.18 EXTENDED      6.39 FEET

3301 HV CHANGED MORE THAN HVINS

3470 ENCROACHMENT STATIONS=    7350.0    10990.0  TYPE=     1  TARGET=    3640.000
     8.18     12.39  1006.39     0.0       0.0   1007.22     0.83      5.23      0.07   1005.00
   91000.    23832.       0.   67168.    6288.       0.    8199.     2582.      476.   1005.00
     0.34      3.79      0.0     8.19     0.045     0.035    0.040     0.025    994.00   7350.00
 0.002510     1650.    1580.    1550.         2         0        0       0.0   3611.88  10990.00

*SECNO 8.190

3470 ENCROACHMENT STATIONS=    7350.0    12950.0  TYPE=     1  TARGET=    5600.000
     8.19     11.74  1006.74     0.0       0.0   1007.39     0.66      0.16      0.02   1004.00
   91000.    18589.   24085.   48326.    5179.    2474.    9214.     2600.      481.   1003.00
     0.34      3.59      9.74     5.24     0.045     0.035    0.040     0.025    995.00   7350.00
 0.004033       50.      50.      50.         2         0        0       0.0   5600.00  12950.00

SPECIAL BRIDGE

SR   XK        XKOR      COFQ      RDLEN     BWC       BWP       BAREA     SS        ELCHU     ELCHD
     1.05      15.50     2.70      0.0       6000.00   1100.00   22150.00  0.0       993.00    993.00

*SECNO 8.200
CLASS A LOW FLOW

3420 BRIDGE W.S.=   1006.72 BRIDGE VELOCITY=,      1.35      CALCULATED CHANNEL AREA=,    67233.

 EGPRS     EGLVC     H3        QWEIR     QPR       BAREA     TRAPEZOID AREA    ELLC      ELTRD
 0.0       1007.54   0.26      0.        91000.    22150.    83300.            1010.00   1014.00

3470 ENCROACHMENT STATIONS=    7280.0    12950.0  TYPE=     1  TARGET=    5670.000
     8.20     11.99  1006.99     0.0       0.0   1007.54     0.54      0.14      0.0    1004.00
   91000.    19768.   22730.   48502.    5809.    2563.    9920.     2606.      483.   1003.00
     0.34      3.40      8.87     4.89     0.045     0.035    0.040     0.025    995.00   7280.00
 0.003194       15.      15.      15.         0         0        0       0.0   5670.00  12950.00
```

```
   SECNO     DEPTH     CWSEL     CRIWS     WSELK     EG        HV        HL        OLOSS    BANK ELEV
   Q         QLOB      QCH       QROB      ALOB      ACH       AROB      VOL       TWA    LEFT/RIGHT
   TIME      VLOB      VCH       VROB      XNL       XNCH      XNR       WTN       ELMIN       SSTA
   SLOPE     XLOBL     XLCH      XLOBR     ITRIAL    IDC       ICONT     CORAR     TOPWID      ENDST

 *SECNO 8.210

 3470 ENCROACHMENT STATIONS=    2950.0    8500.0  TYPE=     1  TARGET=    5550.000
      8.21     12.35  1007.35     0.0       0.0   1007.68     0.33      0.13      0.02  1000.00
    91000.    30291.    4780.   55929.     8449.     561.   12082.     2629.      490.    996.00
      0.35      3.58     8.52     4.63     0.045     0.035    0.040     0.025   995.00  2950.00
  0.002048      50.      50.      50.         2         0        0       0.0  5550.00  8500.00

 *SECNO 8.215

 3265 DIVIDED FLOW

 3470 ENCROACHMENT STATIONS=    7110.0   10600.0  TYPE=     1  TARGET=    3490.000
      8.22     27.52  1007.52     0.0       0.0   1007.76     0.24      0.06      0.01  1000.00
    91000.    69916.       0.   21084.    17544.       0.    5887.     2670.      498.   1000.00
      0.35      3.99      0.0     3.58     0.045     0.035    0.040     0.025   980.00  7110.00
  0.000423      80.      80.      80.         2         0        0       0.0  3403.23 10600.00

 *SECNO 8.410

 3265 DIVIDED FLOW

 3280 CROSS SECTION       8.41 EXTENDED      27.82 FEET

 3470 ENCROACHMENT STATIONS=    7500.0   10990.0  TYPE=     1  TARGET=    3490.000
      8.41     29.82  1007.82     0.0       0.0   1008.28     0.46      0.46      0.07   999.00
    91000.    15715.       0.   75285.     7246.       0.   12721.     3154.      572.    999.00
      0.41      2.17      0.0     5.92     0.045     0.035    0.040     0.026   978.00  7500.00
  0.000519     950.    1000.    1000.         2         0        0       0.0  3296.55 10990.00
```

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*****************************************
  HEC2 RELEASE DATED NOV 76 UPDATED APR  1980
  ERROR CORR -  01,02,03,04
  MODIFICATION -  50,51,52,53,54
*****************************************
```

NOTE- ASTERISK (*) AT LEFT OF CROSS-SECTION NUMBER INDICATES MESSAGE IN SUMMARY OF ERRORS LIST

1100 BOTTOM WIDTH 311 SI

SUMMARY PRINTOUT TABLE 120

SECNO	CWSEL	EG	VCH	10K*S	DEPTH	TOPWID	CLSTA	AW	STCHL	XLREL	STCHR	RREL
5.550	974.88	975.40	0.0	49.84	6.88	1113.31	0.0	0.01	10000.00	973.00	10000.00	973.00
5.550	977.63	978.54	0.0	49.97	9.63	1448.16	0.0	0.01	10000.00	973.00	10000.00	973.00
5.550	978.78	979.90	0.0	49.90	10.78	1457.84	0.0	0.01	10000.00	973.00	10000.00	973.00
5.550	979.90	981.23	0.0	49.52	11.90	1469.00	0.0	0.01	10000.00	973.00	10000.00	973.00
5.820	977.49	977.66	0.0	11.93	5.49	1097.46	0.0	0.01	10000.00	973.00	10000.00	973.00
5.820	980.83	981.26	0.0	16.33	8.83	1500.00	0.0	0.01	10000.00	973.00	10000.00	973.00
5.820	982.19	982.76	0.0	17.86	10.19	1500.00	0.0	0.01	10000.00	973.00	10000.00	973.00
5.820	983.48	984.20	0.0	19.12	11.48	1500.00	0.0	0.01	10000.00	973.00	10000.00	973.00
5.850	979.01	979.35	0.0	40.81	3.56	1118.46	0.0	0.01	10000.00	975.45	10000.00	975.45
5.850	982.43	983.15	0.0	31.18	6.98	1143.03	0.0	0.01	10000.00	975.45	10000.00	975.45
5.850	983.84	984.79	0.0	31.83	8.39	1153.21	0.0	0.01	10000.00	975.45	10000.00	975.45
5.850	985.16	986.36	0.0	32.87	9.71	1162.72	0.0	0.01	10000.00	975.45	10000.00	975.45
5.860	979.10	979.44	0.0	7.25	3.58	1118.57	0.0	0.01	10000.00	975.52	10000.00	975.52
5.860	982.61	983.29	0.0	5.31	7.09	1143.86	0.0	0.01	10000.00	975.52	10000.00	975.52
5.860	984.09	984.99	0.0	5.32	8.57	1154.54	0.0	0.01	10000.00	975.52	10000.00	975.52
5.860	985.50	986.62	0.0	5.39	9.98	1164.65	0.0	0.01	10000.00	975.52	10000.00	975.52
6.330	979.93	980.38	0.0	11.33	3.19	1112.25	0.0	0.01	10000.00	976.74	10000.00	976.74
6.330	983.13	984.00	0.0	7.78	6.39	1130.07	0.0	0.01	10000.00	976.74	10000.00	976.74
6.330	984.58	985.68	0.0	7.36	7.84	1138.19	0.0	0.01	10000.00	976.74	10000.00	976.74
6.330	985.97	987.31	0.0	7.16	9.23	1145.94	0.0	0.01	10000.00	976.74	10000.00	976.74
6.710	981.72	982.36	0.0	20.43	2.76	1109.94	0.0	0.01	10000.00	978.96	10000.00	978.96
6.710	984.19	985.54	0.0	16.17	5.23	1123.93	0.0	0.01	10000.00	978.96	10000.00	978.96
6.710	985.49	987.13	0.0	14.24	6.53	1131.26	0.0	0.01	10000.00	978.96	10000.00	978.96
6.710	986.78	988.70	0.0	12.93	7.82	1138.55	0.0	0.01	10000.00	978.96	10000.00	978.96
6.960	984.02	984.54	0.0	14.25	3.01	1111.40	0.0	0.01	10000.00	981.01	10000.00	981.01
6.960	986.26	987.60	0.0	16.01	5.25	1124.00	0.0	0.01	10000.00	981.01	10000.00	981.01
6.960	987.34	989.09	0.0	15.94	6.33	1130.13	0.0	0.01	10000.00	981.01	10000.00	981.01
6.960	988.43	990.58	0.0	15.57	7.42	1136.32	0.0	0.01	10000.00	981.01	10000.00	981.01

SECNO	CWSEL	EG	VCH	10K*S	DEPTH	TOPWID	CLSTA	BW	STCHL	XLBEL	STCHR	RBEL
7.120	985.45	986.01	0.0	16.54	2.92	1110.78	0.0	0.01	10000.00	982.53	10000.00	982.53
7.120	987.78	989.12	0.0	15.89	5.25	1124.07	0.0	0.01	10000.00	982.53	10000.00	982.53
7.120	988.85	990.61	0.0	16.03	6.32	1130.07	0.0	0.01	10000.00	982.53	10000.00	982.53
7.120	989.91	992.09	0.0	15.94	7.38	1136.05	0.0	0.01	10000.00	982.53	10000.00	982.53
7.360	987.47	988.02	0.0	15.60	2.94	1111.02	0.0	0.01	10000.00	984.53	10000.00	984.53
7.360	989.77	991.11	0.0	16.03	5.24	1124.00	0.0	0.01	10000.00	984.53	10000.00	984.53
7.360	990.86	992.62	0.0	16.05	6.33	1130.07	0.0	0.01	10000.00	984.53	10000.00	984.53
7.360	991.90	994.09	0.0	16.01	7.37	1136.00	0.0	0.01	10000.00	984.53	10000.00	984.53
7.650	989.73	990.55	0.0	30.69	2.50	1109.09	0.0	0.01	10000.00	987.23	10000.00	987.23
7.650	991.78	993.63	0.0	27.22	4.55	1121.53	0.0	0.01	10000.00	987.23	10000.00	987.23
7.650	992.76	995.12	0.0	26.21	5.53	1127.44	0.0	0.01	10000.00	987.23	10000.00	987.23
7.650	993.69	996.60	0.0	25.68	6.46	1133.13	0.0	0.01	10000.00	987.23	10000.00	987.23
7.885	995.28	995.70	0.0	36.72	5.28	1001.57	0.0	0.01	10000.00	1000.00	10000.00	1000.00
7.885	997.99	999.08	0.0	47.61	7.99	1019.96	0.0	0.01	10000.00	1000.00	10000.00	1000.00
7.885	999.18	1000.59	0.0	49.73	9.18	1655.55	0.0	0.01	10000.00	1000.00	10000.00	1000.00
7.885	1000.39	1001.92	0.0	46.49	10.39	3874.80	0.0	0.01	10000.00	1000.00	10000.00	1000.00
8.180	1000.42	1001.01	0.0	31.44	6.42	1030.43	0.0	0.01	10000.00	1005.00	10000.00	1005.00
8.180	1004.00	1004.79	0.0	28.89	10.00	2479.76	0.0	0.01	10000.00	1005.00	10000.00	1005.00
8.180	1005.32	1006.10	0.0	25.86	11.32	2648.00	0.0	0.01	10000.00	1005.00	10000.00	1005.00
8.180	1006.39	1007.22	0.0	25.10	12.39	3611.88	0.0	0.01	10000.00	1005.00	10000.00	1005.00
* 8.190	1004.14	1004.74	7.25	42.23	9.14	3496.56	0.0	0.01	9730.00	1004.00	10090.00	1003.00
* 8.190	1005.39	1006.19	10.01	57.12	10.39	5430.45	0.0	0.01	9730.00	1004.00	10090.00	1003.00
* 8.190	1005.74	1006.76	11.66	71.43	10.74	5545.15	0.0	0.01	9730.00	1004.00	10090.00	1003.00
8.190	1006.74	1007.39	9.74	40.33	11.74	5600.00	0.0	0.01	9730.00	1004.00	10090.00	1003.00
8.200	1004.39	1004.78	6.15	28.21	9.39	3903.57	0.0	0.01	9730.00	1004.00	10090.00	1003.00
8.200	1005.76	1006.26	8.19	35.07	10.76	5549.56	0.0	0.01	9730.00	1004.00	10090.00	1003.00
8.200	1006.27	1006.65	8.99	37.80	11.27	5622.94	0.0	0.01	9730.00	1004.00	10090.00	1003.00
8.200	1006.99	1007.54	8.87	31.94	11.99	5670.00	0.0	0.01	9730.00	1004.00	10090.00	1003.00
8.210	1004.79	1004.89	4.60	9.15	9.79	4796.21	0.0	0.01	5550.00	1000.00	5610.00	996.00
8.210	1006.20	1006.41	6.95	16.26	11.20	5304.79	0.0	0.01	5550.00	1000.00	5610.00	996.00
8.210	1006.73	1007.01	7.97	19.64	11.73	5438.79	0.0	0.01	5550.00	1000.00	5610.00	996.00
8.210	1007.35	1007.68	8.52	20.48	12.35	5550.00	0.0	0.01	5550.00	1000.00	5610.00	996.00
8.215	1004.88	1004.90	0.0	0.27	24.88	2715.05	0.0	0.01	10000.00	1000.00	10000.00	1000.00
8.215	1006.35	1006.45	0.0	1.72	26.35	3265.04	0.0	0.01	10000.00	1000.00	10000.00	1000.00
8.215	1006.90	1007.07	0.0	2.90	26.90	3337.64	0.0	0.01	10000.00	1000.00	10000.00	1000.00
8.215	1007.52	1007.76	0.0	4.23	27.52	3403.23	0.0	0.01	10000.00	1000.00	10000.00	1000.00
8.410	1004.90	1004.93	0.0	0.33	26.90	1358.20	0.0	0.01	10000.00	999.00	10000.00	999.00
8.410	1006.47	1006.66	0.0	2.17	28.47	3232.32	0.0	0.01	10000.00	999.00	10000.00	999.00
8.410	1007.11	1007.43	0.0	3.63	29.11	3262.79	0.0	0.01	10000.00	999.00	10000.00	999.00
8.410	1007.82	1008.28	0.0	5.19	29.82	3296.55	0.0	0.01	10000.00	999.00	10000.00	999.00

SUMMARY OF ERRORS

```
CAUTION  SECNO=   8.190  PROFILE= 1  CRITICAL DEPTH ASSUMED
CAUTION  SECNO=   8.190  PROFILE= 1  PROBABLE MINIMUM SPECIFIC ENERGY
CAUTION  SECNO=   8.190  PROFILE= 1  20 TRIALS ATTEMPTED TO BALANCE WSEL
CAUTION  SECNO=   8.190  PROFILE= 2  CRITICAL DEPTH ASSUMED
CAUTION  SECNO=   8.190  PROFILE= 2  PROBABLE MINIMUM SPECIFIC ENERGY
CAUTION  SECNO=   8.190  PROFILE= 2  20 TRIALS ATTEMPTED TO BALANCE WSEL
CAUTION  SECNO=   8.190  PROFILE= 3  CRITICAL DEPTH ASSUMED
CAUTION  SECNO=   8.190  PROFILE= 3  PROBABLE MINIMUM SPECIFIC ENERGY
CAUTION  SECNO=   8.190  PROFILE= 3  20 TRIALS ATTEMPTED TO BALANCE WSEL
```

ATTACHMENT 7.5

HEC-2 RESULTS FOR REVISED
CONDITIONS WITH BRIDGE
AND CHANNEL S = 0.0002'/,

Q 10 = 16,000 cfs
Q 25 = 49,000 cfs
Q 50 = 69,000 cfs
Q100 = 91,000 cfs
SUMMARY

```
x     x  xxxxxxx   xxxxx            xxxxx
x     x  x        x     x          x     x
x     x  x        x                      x
xxxxxxx  xxxx     x        xxxxx    xxxxx
x     x  x        x                x
x     x  x        x     x          x
x     x  xxxxxxx   xxxxx            xxxxxxx
```

Final Run Jan. 4, 1983

Drop structures + n = .022 (channel)

n = .050 (at drops)

```
*****************************************
HEC2 RELEASE DATED NOV 76 UPDATED APR 1980
ERROR CORR - 01,02,03,04
MODIFICATION - 50,51,52,53,54
*****************************************

T1      AGUA FRIA CHANNEL * I-10 TO INDIAN SHCOOL ROAD *
T2 IMPROVED CHANNEL W/ N-VALUE=.022  WITH MCDOWELL RD BRIDGE
T3      1100 BOTTOM WIDTH 3:1 SIDE SLOPES Q10 *FINAL*

J1  ICHECK    INQ       NINV      IDIR      STRT      METRIC    HVINS     Q         WSEL      FQ
       0.       2.        0.        0.  0.000200       0.0       0.0       0.   986.400     0.0
J2  NPROF     IPLOT     PRFVS     XSECV     XSECH     FN        ALLDC     IBW       CHNIM     ITRACE
     1.000      0.0    -1.000       0.0       0.0       0.0       0.0       0.0       0.0       0.0
J3  VARIABLE CODES FOR SUMMARY PRINTOUT
   120.000      0.0       0.0       0.0       0.0       0.0       0.0       0.0       0.0       0.0

QT      4.000  16000.000  49000.000  69000.000  91000.000       0.0       0.0       0.0       0.0       0.0
NC      0.050      0.050     0.050       0.0       0.0       0.0       0.0       0.0       0.0       0.0

X1  14150.000      5.000  10000.000  10000.000     50.000    50.000    50.000       0.0       0.0       0.0
GR    998.820   9390.000    978.820   9450.000    978.820 10000.000   978.820  10550.000   998.820  10610.000
NC      0.022      0.022     0.022       0.0       0.0       0.0       0.0       0.0       0.0       0.0

X1 142000.000      0.0   10000.000  10000.000     50.000    50.000    50.000       0.0     0.007       0.0

X1 143000.000      0.0   10000.000  10000.000    100.000   100.000   100.000       0.0     0.020       0.0

X1 143800.000      0.0   10000.000  10000.000     80.000    80.000    80.000       0.0     0.016       0.0

X1 145000.000      0.0   10000.000  10000.000    120.000   120.000   120.000       0.0     0.024       0.0

X1 146000.000      0.0   10000.000  10000.000    100.000   100.000   100.000       0.0     0.020       0.0

X1 148000.000      0.0   10000.000  10000.000    200.000   200.000   200.000       0.0     0.040       0.0
```

X1	150000.000	0.0	10000.000	10000.000	200.000	200.000	200.000	0.0	0.040	0.0
X1	156300.000	0.0	10000.000	10000.000	630.000	630.000	630.000	0.0	0.026	0.0
X1	158000.000	0.0	10000.000	10000.000	170.000	170.000	170.000	0.0	0.034	0.0
X1	160000.000	0.0	10000.000	10000.000	200.000	200.000	200.000	0.0	0.040	0.0
X1	161000.000	0.0	10000.000	10000.000	100.000	100.000	100.000	0.0	0.020	0.0
X1	162000.000	0.0	10000.000	10000.000	100.000	100.000	100.000	0.0	0.020	0.0
X1	163000.000	0.0	10000.000	10000.000	100.000	100.000	100.000	0.0	0.020	0.0
X1	164000.000	0.0	10000.000	10000.000	100.000	100.000	100.000	0.0	0.020	0.0
X1	164500.000	5.000	10000.000	10000.000	50.000	50.000	50.000	0.0	0.0	0.0
GR	999.300	9390.000	979.300	9450.000	979.300	10000.000	979.300	10550.000	999.300	10610.000
NC	0.050	0.050	0.050	0.0	0.0	0.0	0.0	0.0	0.0	0.0
X1	165000.000	0.0	10000.000	10000.000	50.000	50.000	50.000	0.0	4.000	0.0
NC	0.022	0.022	0.022	0.0	0.0	0.0	0.0	0.0	0.0	0.0
X1	165400.000	0.0	10000.000	10000.000	40.000	40.000	40.000	0.0	0.008	0.0
X1	166000.000	0.0	10000.000	10000.000	60.000	60.000	60.000	0.0	0.012	0.0
X1	167200.000	9.000	10000.000	10000.000	120.000	120.000	120.000	0.0	0.0	0.0
GR	1003.000	9390.000	983.340	9450.000	983.340	10000.000	983.340	10050.000	1003.340	10050.000
GR	1003.000	10120.000	983.340	10120.000	983.340	10550.000	1003.340	10610.000	0.0	0.0
X1	168900.000	0.0	10000.000	10000.000	170.000	170.000	170.000	0.0	0.034	0.0
X1	170600.000	0.0	10000.000	10000.000	170.000	170.000	170.000	0.0	0.034	0.0

X1	173300.000	0.0	10000.000	10000.000	270.000	270.000	270.000	0.0	0.054	0.0
X1	176000.000	0.0	10000.000	10000.000	270.000	270.000	270.000	0.0	0.054	0.0
X1	180000.000	0.0	10000.000	10000.000	400.000	400.000	400.000	0.0	0.080	0.0
X1	184000.000	5.000	10000.000	10000.000	400.000	400.000	400.000	0.0	0.0	0.0
GR	1004.000	9390.000	983.680	9450.000	983.680	10000.000	983.680	10550.000	1003.680	10610.000
X1	185000.000	0.0	10000.000	10000.000	100.000	100.000	100.000	0.0	0.020	0.0
X1	186000.000	9.000	10000.000	10000.000	100.000	100.000	100.000	0.0	0.0	0.0
GR	1003.700	9390.000	983.720	9450.000	983.720	10000.000	983.720	10050.000	1003.720	10050.000
GR	1003.700	10120.000	983.720	10120.000	983.720	10550.000	1003.720	10610.000	0.0	0.0
X1	187000.000	5.000	10000.000	10000.000	100.000	100.000	100.000	0.0	0.0	0.0
GR	1003.700	9390.000	983.740	9450.000	983.740	10000.000	983.740	10550.000	1003.740	10610.000
X1	188500.000	5.000	10000.000	10000.000	150.000	150.000	150.000	0.0	0.0	0.0
GR	1003.800	9390.000	983.770	9450.000	983.770	10000.000	983.770	10550.000	1003.770	10610.000
X1	189000.000	0.0	10000.000	10000.000	50.000	50.000	50.000	0.0	4.000	0.0
NC	0.050	0.050	0.050	0.0	0.0	0.0	0.0	0.0	0.0	0.0
X1	189500.000	0.0	10000.000	10000.000	50.000	50.000	50.000	0.0	0.125	0.0
NC	0.022	0.022	0.022	0.0	0.0	0.0	0.0	0.0	0.0	0.0
X1	190000.000	0.0	10000.000	10000.000	50.000	50.000	50.000	0.0	0.125	0.0
X1	191000.000	0.0	10000.000	10000.000	100.000	100.000	100.000	0.0	0.250	0.0
X1	192000.000	0.0	10000.000	10000.000	100.000	100.000	100.000	0.0	0.250	0.0
X1	193000.000	0.0	10000.000	10000.000	100.000	100.000	100.000	0.0	0.250	0.0

X1	194000.000	0.0	10000.000	10000.000	100.000	100.000	100.000	0.0	0.250	0.0
X1	196000.000	0.0	10000.000	10000.000	200.000	200.000	200.000	0.0	0.500	0.0
X1	198000.000	0.0	10000.000	10000.000	200.000	200.000	200.000	0.0	0.500	0.0
EJ	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0

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    SECNO     DEPTH     CWSEL     CRIWS     WSELK     EG        HV        HL        OLOSS     BANK ELEV
    Q         QLOB      QCH       QROB      ALOB      ACH       AROB      VOL       TWA     LEFT/RIGHT
    TIME      VLOB      VCH       VROB      XNL       XNCH      XNR       WTN       ELMIN       SSTA
    SLOPE     XLOBL     XLCH      XLOBR     ITRIAL    IDC       ICONT     CORAR     TOPWID      ENDST

*PROF 1

*SECNO 14150.000
 14150.00      8.28    987.10       0.0    986.40    987.14      0.05       0.0       0.0    978.82
    16000.     8000.       0.     8000.     4656.        0.     4656.        0.        0.    978.82
      0.0      1.72       0.0      1.72     0.050     0.050     0.050       0.0    978.82   9425.16
 0.000203       50.       50.       50.         0         0         3       0.0   1149.67  10574.83

*SECNO 142000.000
142000.00      8.28    987.10       0.0       0.0    987.15      0.05      0.00       0.0    978.83
    16000.     8000.       0.     8000.     4658.        0.     4658.       11.        1.    978.83
      0.01      1.72       0.0      1.72     0.022     0.022     0.022     0.022    978.83   9425.15
 0.000039       50.       50.       50.         0         0         0       0.0   1149.69  10574.84

*SECNO 143000.000
143000.00      8.26    987.11       0.0       0.0    987.15      0.05      0.00       0.0    978.85
    16000.     8000.       0.     8000.     4650.        0.     4650.       32.        4.    978.85
      0.02      1.72       0.0      1.72     0.022     0.022     0.022     0.022    978.85   9425.20
 0.000039      100.      100.      100.         0         0         0       0.0   1149.61  10574.80

*SECNO 143800.000
143800.00      8.25    987.11       0.0       0.0    987.15      0.05      0.00       0.0    978.86
    16000.     8000.       0.     8000.     4637.        0.     4637.       49.        6.    978.86
      0.04      1.73       0.0      1.73     0.022     0.022     0.022     0.022    978.86   9425.26
 0.000040       80.       80.       80.         0         0         0       0.0   1149.48  10574.73

*SECNO 145000.000
145000.00      8.23    987.11       0.0       0.0    987.16      0.05      0.00       0.0    978.89
    16000.     8000.       0.     8000.     4626.        0.     4626.       75.        9.    978.89
      0.06      1.73       0.0      1.73     0.022     0.022     0.022     0.022    978.89   9425.32
 0.000040      120.      120.      120.         0         0         0       0.0   1149.36  10574.68

*SECNO 146000.000
146000.00      8.21    987.12       0.0       0.0    987.16      0.05      0.00       0.0    978.91
    16000.     8000.       0.     8000.     4617.        0.     4617.       96.       12.    978.91
      0.07      1.73       0.0      1.73     0.022     0.022     0.022     0.022    978.91   9425.37
 0.000040      100.      100.      100.         0         0         0       0.0   1149.26  10574.63
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SECNO	DEPTH	CWSEL	CRIWS	WSELK	EG	HV	HL	OLOSS	BANK ELEV
Q	QLOB	QCH	QROB	ALOB	ACH	AROB	VOL	TWA	LEFT/RIGHT
TIME	VLOB	VCH	VROB	XNL	XNCH	XNR	WTN	ELMIN	SSTA
SLOPE	XLOBL	XLCH	XLOBR	ITRIAL	IDC	ICONT	CORAR	TOPWID	ENDST
*SECNO 148000.000									
148000.00	8.18	987.12	0.0	0.0	987.17	0.05	0.01	0.0	978.95
16000.	8000.	0.	8000.	4599.	0.	4598.	138.	17.	978.95
0.10	1.74	0.0	1.74	0.022	0.022	0.022	0.022	978.95	9425.46
0.000041	200.	200.	200.	0	0	0	0.0	1149.07	10574.54
*SECNO 150000.000									
150000.00	8.15	987.13	0.0	0.0	987.18	0.05	0.01	0.0	978.99
16000.	8000.	0.	8000.	4580.	0.	4580.	180.	22.	978.99
0.14	1.75	0.0	1.75	0.022	0.022	0.022	0.022	978.99	9425.56
0.000041	200.	200.	200.	0	0	0	0.0	1148.88	10574.44
*SECNO 156300.000									
156300.00	8.15	987.16	0.0	0.0	987.21	0.05	0.03	0.0	979.01
16000.	8000.	0.	8000.	4580.	0.	4580.	313.	39.	979.01
0.24	1.75	0.0	1.75	0.022	0.022	0.022	0.022	979.01	9425.56
0.000042	630.	630.	630.	0	0	0	0.0	1148.88	10574.44
*SECNO 158000.000									
158000.00	8.12	987.16	0.0	0.0	987.21	0.05	0.01	0.0	979.05
16000.	8000.	0.	8000.	4564.	0.	4564.	348.	44.	979.05
0.26	1.75	0.0	1.75	0.022	0.022	0.022	0.022	979.05	9425.64
0.000042	170.	170.	170.	0	0	0	0.0	1148.71	10574.36
*SECNO 160000.000									
160000.00	8.09	987.17	0.0	0.0	987.22	0.05	0.01	0.0	979.09
16000.	8000.	0.	8000.	4546.	0.	4546.	390.	49.	979.09
0.29	1.76	0.0	1.76	0.022	0.022	0.022	0.022	979.09	9425.73
0.000043	200.	200.	200.	0	0	0	0.0	1148.53	10574.26
*SECNO 161000.000									
161000.00	8.07	987.18	0.0	0.0	987.23	0.05	0.00	0.0	979.11
16000.	8000.	0.	8000.	4537.	0.	4537.	411.	51.	979.11
0.31	1.76	0.0	1.76	0.022	0.022	0.022	0.022	979.11	9425.78
0.000043	100.	100.	100.	0	0	0	0.0	1148.43	10574.21

SECNO	DEPTH	CWSEL	CRIWS	WSELK	EG	HV	HL	OLOSS	BANK ELEV
Q	QLOB	QCH	QROB	ALOB	ACH	AROB	VOL	TWA	LEFT/RIGHT
TIME	VLOB	VCH	VROB	XNL	XNCH	XNP	WTN	ELMIN	SSTA
SLOPE	XLOBL	XLCH	XLOBR	ITRIAL	IDC	ICONT	CORAR	TOPWID	ENDST
*SECNO 162000.000									
162000.00	8.06	987.18	0.0	0.0	987.23	0.05	0.00	0.0	979.12
16000.	8000.	0.	8000.	4528.	0.	4528.	432.	54.	979.12
0.33	1.77	0.0	1.77	0.022	0.022	0.022	0.022	979.12	9425.83
0.000043	100.	100.	100.	0	0	0	0.0	1148.33	10574.16
*SECNO 163000.000									
163000.00	8.04	987.18	0.0	0.0	987.23	0.05	0.00	0.0	979.14
16000.	8000.	0.	8000.	4519.	0.	4519.	453.	57.	979.14
0.34	1.77	0.0	1.77	0.022	0.022	0.022	0.022	979.14	9425.88
0.000043	100.	100.	100.	0	0	0	0.0	1148.24	10574.12
*SECNO 164000.000									
164000.00	8.02	987.19	0.0	0.0	987.24	0.05	0.00	0.0	979.16
16000.	8000.	0.	8000.	4510.	0.	4510.	473.	59.	979.16
0.36	1.77	0.0	1.77	0.022	0.022	0.022	0.022	979.16	9425.93
0.000044	100.	100.	100.	0	0	0	0.0	1148.14	10574.07
*SECNO 164500.000									
164500.00	7.89	987.19	0.0	0.0	987.24	0.05	0.00	0.0	979.30
16000.	8000.	0.	8000.	4433.	0.	4433.	484.	61.	979.30
0.37	1.80	0.0	1.80	0.022	0.022	0.022	0.022	979.30	9426.33
0.000046	50.	50.	50.	0	0	0	0.0	1147.34	10573.67
*SECNO 165000.000									
165000.00	3.71	987.01	0.0	0.0	987.25	0.23	0.01	0.0	983.30
16000.	8000.	0.	8000.	2064.	0.	2064.	491.	62.	983.30
0.37	3.88	0.0	3.88	0.050	0.050	0.050	0.022	983.30	9438.86
0.002981	50.	50.	50.	2	0	0	0.0	1122.29	10561.14
*SECNO 165400.000									
165400.00	3.75	987.06	0.0	0.0	987.29	0.23	0.04	0.0	983.31
16000.	8000.	0.	8000.	2090.	0.	2090.	495.	63.	983.31
0.37	3.83	0.0	3.83	0.022	0.022	0.022	0.022	983.31	9438.71
0.000554	40.	40.	40.	1	0	0	0.0	1122.57	10561.28

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    SECNO      DEPTH     CWSEL     CRIWS     WSELK      EG        HV        HL      OLOSS    BANK ELEV
    Q          QLOB      QCH       QROB      ALOB       ACH       AROB      VOL      TWA    LEFT/RIGHT
    TIME       VLOB      VCH       VROB      XNL        XNCH      XNR       WTN      ELMIN      SSTA
    SLOPE      XLOBL     XLCH      XLOBR     ITRIAL     IDC       ICONT     CORAR    TOPWID     ENDST

 *SECNO 166000.000
 166000.00     3.78    987.10      0.0       0.0     987.32      0.23      0.03      0.0     983.32
    16000.    8000.       0.     8000.     2099.        0.     2099.      501.      65.     983.32
      0.38     3.81      0.0      3.81     0.022     0.022     0.022     0.022   983.32    9438.66
  0.000545     60.       60.      60.         2         0         0       0.0   1122.67   10561.33

 *SECNO 167200.000

 3265 DIVIDED FLOW

 167200.00     3.80    987.14      0.0       0.0     987.39      0.25      0.07      0.0     983.34
    16000.    8581.       0.     7419.     2111.        0.     1845.      512.      68.     983.34
      0.38    4.07       0.0      4.02     0.022     0.022     0.022     0.022   983.34    9438.41
  0.000616     120.      120.     120.         2         0         0       0.0   1052.98   10561.39

 *SECNO 168900.000

 3265 DIVIDED FLOW

 168900.00     3.87    987.25      0.0       0.0     987.49      0.24      0.10      0.0     983.37
    16000.    8582.       0.     7418.     2151.        0.     1879.      528.      72.     983.37
      0.40     3.99      0.0      3.95     0.022     0.022     0.022     0.022   983.37    9438.19
  0.000579     170.      170.     170.         1         0         0       0.0   1053.41   10561.61

 *SECNO 170600.000

 3265 DIVIDED FLOW

 170600.00     3.95    987.35      0.0       0.0     987.59      0.24      0.10      0.0     983.41
    16000.    8582.       0.     7418.     2192.        0.     1916.      543.      76.     983.41
      0.41     3.92      0.0      3.87     0.022     0.022     0.022     0.022   983.41    9437.96
  0.000544     170.      170.     170.         0         0         0       0.0   1053.86   10561.82

 *SECNO 173300.000

 3265 DIVIDED FLOW

 173300.00     4.04    987.51      0.0       0.0     987.73      0.22      0.14      0.0     983.46
    16000.    8583.       0.     7417.     2248.        0.     1965.      569.      82.     983.46
      0.43     3.82      0.0      3.77     0.022     0.022     0.022     0.022   983.46    9437.66
  0.000500     270.      270.     270.         0         0         0       0.0   1054.46   10562.12
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     SECNO      DEPTH      CWSEL      CRIWS      WSELK      EG         HV         HL         OLOSS     BANK ELEV
     Q          QLOB       QCH        QROB       ALOB       ACH        AROB       VOL        TWA    LEFT/RIGHT
     TIME       VLOB       VCH        VROB       XNL        XNCH       XNR        WTN        ELMIN       SSTA
     SLOPE      XLOBL      XLCH       XLOBR      ITRIAL     IDC        ICONT      CORAR      TOPWID      ENDST

 *SECNO 176000.000

 3265 DIVIDED FLOW

 176000.00      4.13     987.65       0.0        0.0      987.86       0.21       0.13       0.0      983.52
    16000.      8584.       0.      7416.      2298.        0.       2008.      596.       89.      983.52
      0.45      3.74       0.0      3.69      0.022      0.022      0.022      0.022     983.52   9437.39
  0.000466      270.      270.      270.        0          0          0        0.0     1055.00  10562.39

 *SECNO 180000.000

 3265 DIVIDED FLOW

 180000.00      4.24     987.83       0.0        0.0      988.04       0.20       0.18       0.0      983.60
    16000.      8585.       0.      7415.      2361.        0.       2063.      636.       99.      983.60
      0.48      3.64       0.0      3.59      0.022      0.022      0.022      0.022     983.60   9437.05
  0.000426      400.      400.      400.        0          0          0        0.0     1055.68  10562.73

 *SECNO 184000.000
 184000.00      4.34     988.02       0.0        0.0      988.19       0.17       0.15       0.0      983.68
    16000.      8000.       0.      8000.      2411.        0.       2411.      678.      109.      983.68
      0.51      3.32       0.0      3.32      0.022      0.022      0.022      0.022     983.68   9437.20
  0.000345      400.      400.      400.        0          0          0        0.0     1125.79  10563.00

 *SECNO 185000.000
 185000.00      4.36     988.06       0.0        0.0      988.22       0.17       0.03       0.0      983.70
    16000.      8000.       0.      8000.      2425.        0.       2425.      689.      111.      983.70
      0.52      3.30       0.0      3.30      0.022      0.022      0.022      0.022     983.70   9437.13
  0.000338      100.      100.      100.        0          0          0        0.0     1125.94  10563.07

 *SECNO 186000.000

 3265 DIVIDED FLOW

 186000.00      4.35     988.07       0.0        0.0      988.26       0.19       0.04       0.0      983.72
    16000.      8586.       0.      7414.      2419.        0.       2115.      700.      114.      983.72
      0.53      3.55       0.0      3.51      0.022      0.022      0.022      0.022     983.72   9436.94
  0.000393      100.      100.      100.        2          0          0        0.0     1056.10  10563.04
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     SECNO      DEPTH      CWSEL      CRIWS      WSELK      EG         HV         HL         OLOSS     RANK ELEV
     Q          QLOB       QCH        QROB       ALOB       ACH        AROB       VOL        TWA     LEFT/RIGHT
     TIME       VLOB       VCH        VROB       XNL        XNCH       XNR        WTN        ELMIN       SSTA
     SLOPE      XLOBL      XLCH       XLOBR      ITRIAL     IDC        ICONT      CORAR      TOPWID      ENDST

 *SECNO 187000.000
 187000.00      4.39     988.13        0.0        0.0     988.30       0.17       0.04        0.0     983.74
    16000.      8000.        0.      8000.      2443.        0.      2443.       711.       116.     983.74
      0.54      3.27        0.0       3.27      0.022      0.022      0.022      0.022     983.74    9436.80
  0.000330      100.       100.       100.          2          0          0        0.0    1126.37   10563.17

 *SECNO 188500.000
 188500.00      4.41     988.18        0.0        0.0     988.35       0.16       0.05        0.0     983.77
    16000.      8000.        0.      8000.      2457.        0.      2457.       726.       120.     983.77
      0.55      3.26        0.0       3.26      0.022      0.022      0.022      0.022     983.77    9436.78
  0.000324      150.       150.       150.          0          0          0        0.0    1126.46   10563.24

 *SECNO 189000.000

 3301 HV CHANGED MORE THAN HVINS

 3685 20 TRIALS ATTEMPTED WSEL+CWSEL
 3693 PROBABLE MINIMUM SPECIFIC ENERGY
 3720 CRITICAL DEPTH ASSUMED
 189000.00      1.67     989.64     989.64        0.0     990.57       0.93       0.04        0.0     987.77
    16000.      8000.        0.      8000.      1033.        0.      1033.       732.       121.     987.77
      0.55      7.75        0.0       7.75      0.022      0.022      0.022      0.022     987.77    9444.40
  0.005737       50.        50.        50.         20         14          0        0.0    1111.20   10555.60

 *SECNO 189500.000
 189500.00      2.55     990.45        0.0        0.0     990.95       0.50       0.38        0.0     987.90
    16000.      8000.        0.      8000.      1411.        0.      1411.       735.       123.     987.90
      0.55      5.67        0.0       5.67      0.050      0.050      0.050      0.022     987.90    9442.37
  0.010519       50.        50.        50.          3          0          0        0.0    1115.27   10557.64

 *SECNO 190000.000
 190000.00      2.65     990.67        0.0        0.0     991.13       0.46       0.18        0.0     988.02
    16000.      8000.        0.      8000.      1467.        0.      1467.       738.       124.     988.02
      0.56      5.45        0.0       5.45      0.022      0.022      0.022      0.022     988.02    9442.06
  0.001788       50.        50.        50.          2          0          0        0.0    1115.88   10557.95

 *SECNO 191000.000
 191000.00      2.55     990.82        0.0        0.0     991.32       0.50       0.19        0.0     988.27
    16000.      8000.        0.      8000.      1413.        0.      1413.       744.       126.     988.27
      0.56      5.66        0.0       5.66      0.022      0.022      0.022      0.022     988.27    9442.36
  0.002026      100.       100.       100.          3          0          0        0.0    1115.30   10557.65
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   SECNO      DEPTH     CWSEL     CRIWS     WSELK     EG        HV        HL        OLOSS    BANK ELEV
   O          QLOB      QCH       QROB      ALOB      ACH       AROB      VOL       TWA    LEFT/RIGHT
   TIME       VLOB      VCH       VROB      XNL       XNCH      XNR       WTN       ELMIN       SSTA
   SLOPE      XLOBL     XLCH      XLOBR     ITRIAL    IDC       ICONT     CORAR     TOPWID      ENDST

 *SECNO 192000.000
 192000.00     2.49    991.01       0.0       0.0    991.53      0.52      0.21       0.0    988.52
    16000.     8000.        0.     8000.     1379.        0.     1379.      751.      129.    988.52
      0.57      5.80       0.0      5.80     0.022     0.022     0.022     0.022    988.52   9442.54
  0.002194      100.      100.      100.         0         0         0       0.0   1114.94  10557.47

 *SECNO 193000.000
 193000.00     2.44    991.21       0.0       0.0    991.75      0.54      0.23       0.0    988.77
    16000.     8000.        0.     8000.     1355.        0.     1355.      757.      132.    988.77
      0.57      5.90       0.0      5.90     0.022     0.022     0.022     0.022    988.77   9442.67
  0.002328      100.      100.      100.         0         0         0       0.0   1114.67  10557.34

 *SECNO 194000.000
 194000.00     2.42    991.44       0.0       0.0    991.99      0.55      0.24       0.0    989.02
    16000.     8000.        0.     8000.     1340.        0.     1340.      763.      134.    989.02
      0.58      5.97       0.0      5.97     0.022     0.022     0.022     0.022    989.02   9442.75
  0.002419      100.      100.      100.         0         0         0       0.0   1114.51  10557.26

 *SECNO 196000.000
 196000.00     2.40    991.92       0.0       0.0    992.48      0.57      0.49       0.0    989.52
    16000.     8000.        0.     8000.     1324.        0.     1324.      776.      139.    989.52
      0.59      6.04       0.0      6.04     0.022     0.022     0.022     0.022    989.52   9442.83
  0.002512      200.      200.      200.         0         0         0       0.0   1114.34  10557.18

 *SECNO 198000.000
 198000.00     2.40    992.42       0.0       0.0    992.99      0.57      0.50       0.0    990.02
    16000.     8000.        0.     8000.     1324.        0.     1324.      788.      144.    990.02
      0.59      6.04       0.0      6.04     0.022     0.022     0.022     0.022    990.02   9442.84
  0.002517      200.      200.      200.         0         0         0       0.0   1114.34  10557.17
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*****************************************
HEC2 RELEASE DATED NOV 76 UPDATED APR 1980
ERROR CORR - 01,02,03,04
MODIFICATION - 50,51,52,53,54
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T1      AGUA FRIA CHANNEL * I-10 TO INDIAN SHCOOL ROAD *
T2 IMPROVED CHANNEL W/ N-VALUE=.022  WITH MCDOWELL RD BRIDGE
T3      1100 BOTTOM WIDTH 3:1 SIDE SLOPES 025 *FINAL*
```

J1	ICHECK	INQ	NINV	IDIR	STRT	METRIC	HVINS	Q	WSEL	FQ
	0.	3.	0.	0.	0.000200	0.0	0.0	0.	986.400	0.0
J2	NPROF	IPLOT	PRFVS	XSECV	XSECH	FN	ALLDC	IBW	CHNIM	ITRACE
	2.000	0.0	-1.000	0.0	0.0	0.0	0.0	0.0	0.0	0.0

```
SECNO      DEPTH     CWSEL     CRIWS     WSELK     EG        HV        HL        OLOSS     BANK ELEV
Q          QLOB      QCH       QROB      ALOB      ACH       AROB      VOL       TWA     LEFT/RIGHT
TIME       VLOB      VCH       VROB      XNL       XNCH      XNP       WTN       ELMIN       SSTA
SLOPE      XLOBL     XLCH      XLOBR     ITRIAL    IDC       ICONT     CORAR     TOPWID      ENDST

*PROF 2

*SECNO 14150.000
14150.00    16.14    994.96     0.0     986.40    995.07     0.11      0.0       0.0     978.82
49000.     24500.      0.     24500.     9266.      0.      9266.       0.        0.     978.82
  0.0       2.64     0.0       2.64     0.050     0.050     0.050     0.0     978.82   9401.59
0.000201     50.      50.       50.       0         0         5       0.0    1196.82  10598.41

*SECNO 142000.000
142000.00   16.13    994.96     0.0       0.0     995.07     0.11      0.00      0.0     978.83
49000.     24500.      0.     24500.     9268.      0.      9268.      21.        1.     978.83
  0.01      2.64     0.0       2.64     0.022     0.022     0.022     0.022   978.83   9401.58
0.000039     50.      50.       50.       0         0         0       0.0    1196.84  10598.42

*SECNO 143000.000
143000.00   16.12    994.96     0.0       0.0     995.07     0.11      0.00      0.0     978.85
49000.     24500.      0.     24500.     9259.      0.      9259.      64.        4.     978.85
  0.02      2.65     0.0       2.65     0.022     0.022     0.022     0.022   978.85   9401.62
0.000039    100.     100.      100.       0         0         0       0.0    1196.75  10598.37

*SECNO 143800.000
143800.00   16.10    994.97     0.0       0.0     995.08     0.11      0.00      0.0     978.86
49000.     24500.      0.     24500.     9246.      0.      9246.      98.        6.     978.86
  0.02      2.65     0.0       2.65     0.022     0.022     0.022     0.022   978.86   9401.69
0.000039     80.      80.       80.       0         0         0       0.0    1196.62  10598.31

*SECNO 145000.000
145000.00   16.08    994.97     0.0       0.0     995.08     0.11      0.00      0.0     978.89
49000.     24500.      0.     24500.     9235.      0.      9234.     149.       10.     978.89
  0.04      2.65     0.0       2.65     0.022     0.022     0.022     0.022   978.89   9401.75
0.000039    120.     120.      120.       0         0         0       0.0    1196.50  10598.25

*SECNO 146000.000
146000.00   16.07    994.97     0.0       0.0     995.08     0.11      0.00      0.0     978.91
49000.     24500.      0.     24500.     9225.      0.      9225.     191.       12.     978.91
  0.05      2.66     0.0       2.66     0.022     0.022     0.022     0.022   978.91   9401.79
0.000039    100.     100.      100.       0         0         0       0.0    1196.41  10598.20
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     SECNO      DEPTH      CWSEL      CRIWS      WSELK      EG         HV         HL         OLOSS     BANK ELEV
     Q          QLOB       QCH        QROB       ALOB       ACH        AROB       VOL        TWA     LEFT/RIGHT
     TIME       VLOB       VCH        VROB       XNL        XNCH       XNR        WTN        ELMIN       SSTA
     SLOPE      XLOBL      XLCH       XLOBR      ITRIAL     IDC        ICONT      CORAR      TOPWID      ENDST

 *SECNO 148000.000
 148000.00     16.04     994.98       0.0        0.0      995.09       0.11       0.01       0.0      978.95
    49000.     24500.        0.     24500.      9206.        0.       9206.       276.        18.     978.95
      0.07       2.66       0.0       2.66      0.022      0.022      0.022      0.022     978.95    9401.89
  0.000040      200.       200.       200.          0          0          0        0.0    1196.21   10598.11

 *SECNO 150000.000
 150000.00     16.00     994.99       0.0        0.0      995.10       0.11       0.01       0.0      978.99
    49000.     24500.        0.     24500.      9186.        0.       9186.       360.        23.     978.99
      0.09       2.67       0.0       2.67      0.022      0.022      0.022      0.022     978.99    9401.99
  0.000040      200.       200.       200.          0          0          0        0.0    1196.02   10598.01

 *SECNO 156300.000
 156300.00     16.00     995.01       0.0        0.0      995.12       0.11       0.03       0.0      979.01
    49000.     24500.        0.     24500.      9185.        0.       9185.       626.        41.     979.01
      0.15       2.67       0.0       2.67      0.022      0.022      0.022      0.022     979.01    9401.99
  0.000040      630.       630.       630.          0          0          0        0.0    1196.01   10598.00

 *SECNO 158000.000
 158000.00     15.97     995.02       0.0        0.0      995.13       0.11       0.01       0.0      979.05
    49000.     24500.        0.     24500.      9169.        0.       9169.       697.        45.     979.05
      0.17       2.67       0.0       2.67      0.022      0.022      0.022      0.022     979.05    9402.07
  0.000040      170.       170.       170.          0          0          0        0.0    1195.85   10597.92

 *SECNO 160000.000
 160000.00     15.94     995.03       0.0        0.0      995.14       0.11       0.01       0.0      979.09
    49000.     24500.        0.     24500.      9150.        0.       9150.       782.        51.     979.09
      0.19       2.68       0.0       2.68      0.022      0.022      0.022      0.022     979.09    9402.17
  0.000040      200.       200.       200.          0          0          0        0.0    1195.65   10597.82

 *SECNO 161000.000
 161000.00     15.93     995.03       0.0        0.0      995.14       0.11       0.00       0.0      979.11
    49000.     24500.        0.     24500.      9140.        0.       9140.       824.        54.     979.11
      0.20       2.68       0.0       2.68      0.022      0.022      0.022      0.022     979.11    9402.22
  0.000041      100.       100.       100.          0          0          0        0.0    1195.56   10597.78
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SECNO	DEPTH	CWSEL	CRIWS	WSELK	EG	HV	HL	QLOSS	BANK ELEV
Q	QLOB	QCH	QROB	ALOB	ACH	AROB	VOL	TWA	LEFT/RIGHT
TIME	VLOB	VCH	VROB	XNL	XNCH	XNR	WTN	ELMIN	SSTA
SLOPE	XLOBL	XLCH	XLOBR	ITRIAL	IDC	ICONT	CORAR	TOPWID	ENDST
*SECNO 162000.000									
162000.00	15.91	995.04	0.0	0.0	995.15	0.11	0.00	0.0	979.12
49000.	24500.	0.	24500.	9131.	0.	9131.	866.	56.	979.12
0.21	2.68	0.0	2.68	0.022	0.022	0.022	0.022	979.12	9402.27
0.000041	100.	100.	100.	0	0	0	0.0	1195.46	10597.73
*SECNO 163000.000									
163000.00	15.89	995.04	0.0	0.0	995.15	0.11	0.00	0.0	979.14
49000.	24500.	0.	24500.	9121.	0.	9121.	907.	59.	979.14
0.22	2.69	0.0	2.69	0.022	0.022	0.022	0.022	979.14	9402.31
0.000041	100.	100.	100.	0	0	0	0.0	1195.37	10597.68
*SECNO 164000.000									
164000.00	15.86	995.04	0.0	0.0	995.16	0.11	0.00	0.0	979.16
49000.	24500.	0.	24500.	9111.	0.	9111.	949.	62.	979.16
0.23	2.69	0.0	2.69	0.022	0.022	0.022	0.022	979.16	9402.36
0.000041	100.	100.	100.	0	0	0	0.0	1195.27	10597.63
*SECNO 164500.000									
164500.00	15.74	995.04	0.0	0.0	995.16	0.11	0.00	0.0	979.30
49000.	24500.	0.	24500.	9031.	0.	9031.	970.	63.	979.30
0.24	2.71	0.0	2.71	0.022	0.022	0.022	0.022	979.30	9402.77
0.000042	50.	50.	50.	0	0	0	0.0	1194.46	10597.23
*SECNO 165000.000									
165000.00	11.65	994.95	0.0	0.0	995.16	0.21	0.01	0.0	983.30
49000.	24500.	0.	24500.	6610.	0.	6610.	988.	65.	983.30
0.24	3.71	0.0	3.71	0.050	0.050	0.050	0.022	983.30	9415.05
0.000603	50.	50.	50.	2	0	0	0.0	1169.89	10584.95
*SECNO 165400.000									
165400.00	11.65	994.96	0.0	0.0	995.17	0.21	0.01	0.0	983.31
49000.	24500.	0.	24500.	6613.	0.	6613.	1000.	66.	983.31
0.25	3.70	0.0	3.70	0.022	0.022	0.022	0.022	983.31	9415.04
0.000117	40.	40.	40.	0	0	0	0.0	1169.92	10584.96

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    SECNO      DEPTH      CWSEL      CRIWS      WSELK      EG         HV         HL         OLOSS      BANK ELEV
    Q          QLOB       QCH        QROB       ALOB       ACH        AROB       VOL        TWA      LEFT/RIGHT
    TIME       VLOB       VCH        VROB       XNL        XNCH       XNR        WTN        ELMIN        SSTA
    SLOPE      XLOBL      XLCH       XLOBR      ITRIAL     IOC        ICONT      CORAR      TOPWID       ENDST

 *SECNO 166000.000
 166000.00     11.64     994.96       0.0        0.0      995.18      0.21       0.01       0.0      983.32
    49000.     24500.       0.      24500.      6612.        0.      6612.      1018.       67.      983.32
      0.25      3.71       0.0       3.71      0.022      0.022      0.022      0.022    983.32    9415.04
  0.000117      60.        60.       60.         1          0          0        0.0     1169.91   10584.95

 *SECNO 167200.000

 3265 DIVIDED FLOW

 167200.00     11.61     994.95       0.0        0.0      995.19      0.24       0.02       0.0      983.34
    49000.     26490.       0.      22510.      6590.        0.      5774.      1054.       70.      983.34
      0.26      4.02       0.0       3.90      0.022      0.022      0.022      0.022    983.34    9414.57
  0.000138      120.       120.      120.         2          0          0        0.0     1100.25   10584.82

 *SECNO 168900.000

 3265 DIVIDED FLOW

 168900.00     11.60     994.97       0.0        0.0      995.22      0.24       0.02       0.0      983.37
    49000.     26490.       0.      22510.      6583.        0.      5768.      1102.       75.      983.37
      0.27      4.02       0.0       3.90      0.022      0.022      0.022      0.022    983.37    9414.61
  0.000139      170.       170.      170.         0          0          0        0.0     1100.18   10584.79

 *SECNO 170600.000

 3265 DIVIDED FLOW

 170600.00     11.59     994.99       0.0        0.0      995.24      0.24       0.02       0.0      983.41
    49000.     26490.       0.      22510.      6578.        0.      5763.      1150.       79.      983.41
      0.28      4.03       0.0       3.91      0.022      0.022      0.022      0.022    983.41    9414.64
  0.000139      170.       170.      170.         0          0          0        0.0     1100.12   10584.76

 *SECNO 173300.000

 3265 DIVIDED FLOW

 173300.00     11.57     995.03       0.0        0.0      995.28      0.25       0.04       0.0      983.46
    49000.     26489.       0.      22511.      6568.        0.      5754.      1227.       86.      983.46
      0.30      4.03       0.0       3.91      0.022      0.022      0.022      0.022    983.46    9414.69
  0.000140      270.       270.      270.         0          0          0        0.0     1100.02   10584.71
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SECNO      DEPTH     CWSEL     CRIWS     WSELK     EG        HV        HL        QLOSS     BANK ELEV
Q          QLOB      QCH       QROB      ALOB      ACH       AROB      VOL       TWA     LEFT/RIGHT
TIME       VLOB      VCH       VROB      XNL       XNCH      XNR       WTN       ELMIN       SSTA
SLOPE      XLOBL     XLCH      XLOBR     ITRIAL    IDC       ICONT     CORAR     TOPWID      ENDST

*SECNO 176000.000

3265 DIVIDED FLOW

176000.00    11.55    995.07      0.0       0.0    995.31      0.25      0.04       0.0    983.52
   49000.   26489.        0.   22511.     6558.        0.     5746.     1303.       93.    983.52
     0.32     4.04       0.0      3.92     0.022     0.022     0.022     0.022    983.52   9414.74
 0.000140     270.      270.      270.         0         0         0       0.0   1099.92  10584.66

*SECNO 180000.000

3265 DIVIDED FLOW

180000.00    11.53    995.12      0.0       0.0    995.37      0.25      0.06       0.0    983.60
   49000.   26488.        0.   22512.     6544.        0.     5733.     1416.      103.    983.60
     0.35     4.05       0.0      3.93     0.022     0.022     0.022     0.022    983.60   9414.81
 0.000141     400.      400.      400.         0         0         0       0.0   1099.77  10584.58

*SECNO 184000.000
184000.00    11.53    995.21      0.0       0.0    995.42      0.22      0.05       0.0    983.68
   49000.   24496.        0.   24504.     6535.        0.     6538.     1532.      113.    983.68
     0.38     3.75       0.0      3.75     0.022     0.022     0.022     0.022    983.68   9415.97
 0.000121     400.      400.      400.         2         0         0       0.0   1168.61  10584.57

*SECNO 185000.000
185000.00    11.52    995.22      0.0       0.0    995.44      0.22      0.01       0.0    983.70
   49000.   24496.        0.   24504.     6531.        0.     6534.     1562.      116.    983.70
     0.39     3.75       0.0      3.75     0.022     0.022     0.022     0.022    983.70   9415.99
 0.000121     100.      100.      100.         0         0         0       0.0   1168.57  10584.55

*SECNO 186000.000

3265 DIVIDED FLOW

186000.00    11.48    995.20      0.0       0.0    995.45      0.25      0.01       0.0    983.72
   49000.   26483.        0.   22517.     6511.        0.     5707.     1591.      118.    983.72
     0.39     4.07       0.0      3.95     0.022     0.022     0.022     0.022    983.72   9415.53
 0.000143     100.      100.      100.         2         0         0       0.0   1098.91  10584.43
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    SECNO      DEPTH      CWSEL      CRIWS      WSELK      EG         HV         HL         QLOSS      BANK ELEV
    Q          QLOB       QCH        QROB       ALOB       ACH        AROB       VOL        TWA     LEFT/RIGHT
    TIME       VLOB       VCH        VROB       XNL        XNCH       XNR        WTN        ELMIN       SSTA
    SLOPE      XLOBL      XLCH       XLOBR      ITRIAL     IDC        ICONT      CORAR      TOPWID      ENDST

 *SECNO 187000.000
 187000.00     11.50     995.24       0.0        0.0      995.46      0.22       0.01       0.0      983.74
    49000.    24501.        0.      24499.     6525.        0.      6525.      1620.      121.      983.74
      0.40      3.75       0.0       3.75      0.022      0.022      0.022      0.022    983.74    9415.42
  0.000122     100.       100.      100.         2          0          0        0.0     1169.08   10584.50

 *SECNO 188500.000
 188500.00     11.49     995.26       0.0        0.0      995.48      0.22       0.02       0.0      983.77
    49000.    24500.        0.      24500.     6519.        0.      6519.      1665.      125.      983.77
      0.41      3.76       0.0       3.76      0.022      0.022      0.022      0.022    983.77    9415.57
  0.000122     150.       150.      150.         0          0          0        0.0     1168.90   10584.47

 *SECNO 189000.000
 189000.00      7.14     994.91       0.0        0.0      995.49      0.58       0.01       0.0      987.77
    49000.    24500.        0.      24500.     4005.        0.      4005.      1677.      126.      987.77
      0.41      6.12       0.0       6.12      0.022      0.022      0.022      0.022    987.77    9428.61
  0.000605      50.        50.       50.         2          0          0        0.0     1142.82   10571.43

 *SECNO 189500.000
 189500.00      7.06     994.95       0.0        0.0      995.55      0.60       0.06       0.0      987.90
    49000.    24500.        0.      24500.     3958.        0.      3958.      1686.      128.      987.90
      0.42      6.19       0.0       6.19      0.050      0.050      0.050      0.022    987.90    9428.85
  0.003251      50.        50.       50.         2          0          0        0.0     1142.33   10571.18

 *SECNO 190000.000
 190000.00      6.98     995.00       0.0        0.0      995.61      0.61       0.06       0.0      988.02
    49000.    24500.        0.      24500.     3914.        0.      3914.      1695.      129.      988.02
      0.42      6.26       0.0       6.26      0.022      0.022      0.022      0.022    988.02    9429.08
  0.000653      50.        50.       50.         2          0          0        0.0     1141.87   10570.95

 *SECNO 191000.000
 191000.00      6.76     995.03       0.0        0.0      995.68      0.65       0.07       0.0      988.27
    49000.    24500.        0.      24500.     3788.        0.      3788.      1713.      132.      988.27
      0.42      6.47       0.0       6.47      0.022      0.022      0.022      0.022    988.27    9429.74
  0.000727     100.       100.      100.         2          0          0        0.0     1140.54   10570.29
```

SECNO Q TIME SLOPE	DEPTH QLOB VLOB XLOBL	CWSEL QCH VCH XLCH	CRIWS QROB VROB XLOBR	WSELK ALOB XNL ITRIAL	EG ACH XNCH IDC	HV AROB XNR ICONT	HL VOL WTN CORAR	QLOSS TWA ELMIN TOPWID	BANK ELEV LEFT/RIGHT SSTA ENDST
*SECNO 192000.000									
192000.00	6.54	995.06	0.0	0.0	995.76	0.69	0.08	0.0	988.52
49000.	24500.	0.	24500.	3663.	0.	3663.	1730.	134.	988.52
0.43	6.69	0.0	6.69	0.022	0.022	0.022	0.022	988.52	9430.40
0.000812	100.	100.	100.	2	0	0	0.0	1139.23	10569.63
*SECNO 193000.000									
193000.00	6.33	995.10	0.0	0.0	995.84	0.74	0.09	0.0	988.77
49000.	24500.	0.	24500.	3542.	0.	3542.	1747.	137.	988.77
0.43	6.92	0.0	6.92	0.022	0.022	0.022	0.022	988.77	9431.04
0.000907	100.	100.	100.	2	0	0	0.0	1137.96	10568.99
*SECNO 194000.000									
194000.00	6.12	995.14	0.0	0.0	995.94	0.79	0.10	0.0	989.02
49000.	24500.	0.	24500.	3424.	0.	3425.	1763.	139.	989.02
0.43	7.15	0.0	7.15	0.022	0.022	0.022	0.022	989.02	9431.65
0.001014	100.	100.	100.	2	0	0	0.0	1136.72	10568.37
*SECNO 196000.000									
196000.00	5.74	995.26	0.0	0.0	996.16	0.91	0.23	0.0	989.52
49000.	24500.	0.	24500.	3205.	0.	3205.	1793.	145.	989.52
0.44	7.64	0.0	7.64	0.022	0.022	0.022	0.022	989.52	9432.81
0.001262	200.	200.	200.	2	0	0	0.0	1134.40	10567.21
*SECNO 198000.000									
198000.00	5.40	995.42	0.0	0.0	996.44	1.03	0.28	0.0	990.02
49000.	24500.	0.	24500.	3011.	0.	3012.	1822.	150.	990.02
0.45	8.14	0.0	8.14	0.022	0.022	0.022	0.022	990.02	9433.84
0.001550	200.	200.	200.	2	0	0	0.0	1132.35	10566.19

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*****************************************
HEC2 RELEASE DATED NOV 76 UPDATED APR 1980
ERROR CORR -  01,02,03,04
MODIFICATION -  50,51,52,53,54
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T1      AGUA FRIA CHANNEL * I-10 TO INDIAN SHCOOL ROAD *
T2 IMPROVED CHANNEL W/ N-VALUE=.022  WITH MCDOWELL RD BRIDGE
T3      1100 BOTTOM WIDTH 3:1 SIDE SLOPES Q100*FINAL*
```

J1	ICHECK	INQ	NINV	IDIR	STRT	METRIC	HVINS	Q	WSEL	FQ
	0.	4.	0.	0.	0.000200	0.0	0.0	0.	986.400	0.0

J2	NPROF	IPLOT	PRFVS	XSECV	XSECH	FN	ALLDC	IBW	CHNIM	ITRACE
	3.000	0.0	-1.000	0.0	0.0	0.0	0.0	0.0	0.0	0.0

```
   SECNO      DEPTH      CWSEL      CRIWS      WSELK      EG         HV         HL         OLOSS     BANK ELEV
   Q          QLOB       QCH        QROB       ALOB       ACH        AROB       VOL        TWA     LEFT/RIGHT
   TIME       VLOB       VCH        VROB       XNL        XNCH       XNR        WTN        ELMIN        SSTA
   SLOPE      XLOBL      XLCH       XLOBR      ITRIAL     IDC        ICONT      COPAR      TOPWID       ENDST

*PROF 3

*SECNO 14150.000
 14150.00     19.69     998.51       0.0     986.40     998.65       0.14       0.0        0.0     978.82
    69000.    34500.        0.     34500.     11409.        0.     11409.        0.         0.     978.82
       0.0      3.02       0.0       3.02      0.050      0.050      0.050       0.0     978.82    9390.94
  0.000203       50.       50.        50.          0          0          5       0.0    1218.11   10609.05

*SECNO 142000.000
 142000.00     19.68     998.51       0.0        0.0     998.65       0.14      0.00        0.0     978.83
    69000.    34500.        0.     34500.     11411.        0.     11411.       26.         1.     978.83
       0.00      3.02       0.0       3.02      0.022      0.022      0.022     0.022     978.83    9390.93
  0.000039       50.       50.        50.          0          0          0       0.0    1218.14   10609.07

*SECNO 143000.000
 143000.00     19.67     998.51       0.0        0.0     998.66       0.14      0.00        0.0     978.85
    69000.    34500.        0.     34500.     11402.        0.     11402.       79.         4.     978.85
       0.01      3.03       0.0       3.03      0.022      0.022      0.022     0.022     978.85    9390.97
  0.000039      100.      100.      100.          0          0          0       0.0    1218.05   10609.02

*SECNO 143800.000
 143800.00     19.65     998.52       0.0        0.0     998.66       0.14      0.00        0.0     978.86
    69000.    34500.        0.     34500.     11389.        0.     11389.      120.         6.     978.86
       0.02      3.03       0.0       3.03      0.022      0.022      0.022     0.022     978.86    9391.04
  0.000039       80.       80.       80.          0          0          0       0.0    1217.93   10608.96

*SECNO 145000.000
 145000.00     19.63     998.52       0.0        0.0     998.66       0.14      0.00        0.0     978.89
    69000.    34500.        0.     34500.     11377.        0.     11377.      183.        10.     978.89
       0.03      3.03       0.0       3.03      0.022      0.022      0.022     0.022     978.89    9391.09
  0.000040      120.      120.      120.          0          0          0       0.0    1217.81   10608.90

*SECNO 146000.000
 146000.00     19.62     998.52       0.0        0.0     998.67       0.14      0.00        0.0     976.91
    69000.    34500.        0.     34500.     11367.        0.     11367.      235.        13.     978.91
       0.04      3.04       0.0       3.04      0.022      0.022      0.022     0.022     978.91    9391.14
  0.000040      100.      100.      100.          0          0          0       0.0    1217.71   10608.85
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   SECNO      DEPTH      CWSEL      CRIWS      WSELK      EG         HV         HL         QLOSS     BANK ELEV
   Q          QLOB       QCH        QROB       ALOB       ACH        AROB       VOL        TWA    LEFT/RIGHT
   TIME       VLOB       VCH        VROB       XNL        XNCH       XNR        WTN        ELMIN       SSTA
   SLOPE      XLOBL      XLCH       XLOBR      ITRIAL     IDC        ICONT      CORAR      TOPWID      ENDST

 *SECNO 148000.000
 148000.00     19.59    998.53       0.0        0.0     998.68       0.14       0.01       0.0     978.95
    69000.    34500.        0.    34500.     11348.        0.     11348.      340.        18.     978.95
      0.06      3.04       0.0      3.04      0.022      0.022      0.022      0.022     978.95    9391.24
  0.000040      200.      200.      200.          0          0          0        0.0    1217.52   10608.75

 *SECNO 150000.000
 150000.00     19.55    998.54       0.0        0.0     998.68       0.14       0.01       0.0     978.99
    69000.    34500.        0.    34500.     11328.        0.     11328.      444.        24.     978.99
      0.08      3.05       0.0      3.05      0.022      0.022      0.022      0.022     978.99    9391.34
  0.000040      200.      200.      200.          0          0          0        0.0    1217.32   10608.66

 *SECNO 156300.000
 156300.00     19.55    998.56       0.0        0.0     998.71       0.14       0.03       0.0     979.01
    69000.    34500.        0.    34500.     11327.        0.     11327.      771.        41.     979.01
      0.14      3.05       0.0      3.05      0.022      0.022      0.022      0.022     979.01    9391.34
  0.000040      630.      630.      630.          0          0          0        0.0    1217.32   10608.66

 *SECNO 158000.000
 158000.00     19.52    998.57       0.0        0.0     998.71       0.14       0.01       0.0     979.05
    69000.    34500.        0.    34500.     11310.        0.     11310.      860.        46.     979.05
      0.15      3.05       0.0      3.05      0.022      0.022      0.022      0.022     979.05    9391.43
  0.000040      170.      170.      170.          0          0          0        0.0    1217.14   10608.57

 *SECNO 160000.000
 160000.00     19.49    998.58       0.0        0.0     998.72       0.14       0.01       0.0     979.09
    69000.    34500.        0.    34500.     11291.        0.     11291.      964.        52.     979.09
      0.17      3.06       0.0      3.06      0.022      0.022      0.022      0.022     979.09    9391.52
  0.000041      200.      200.      200.          0          0          0        0.0    1216.96   10608.48

 *SECNO 161000.000
 161000.00     19.48    998.58       0.0        0.0     998.73       0.15       0.00       0.0     979.11
    69000.    34500.        0.    34500.     11281.        0.     11281.     1015.        55.     979.11
      0.18      3.06       0.0      3.06      0.022      0.022      0.022      0.022     979.11    9391.57
  0.000041      100.      100.      100.          0          0          0        0.0    1216.86   10608.43
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    SECNO      DEPTH     CWSEL     CRIWS     WSELK     EG        HV        HL        OLOSS     BANK ELEV
    Q          OLOB      OCH       ORUB      ALOB      ACH       AROB      VOL       TWA     LEFT/RIGHT
    TIME       VLOB      VCH       VROB      XNL       XNCH      XNR       WTN       ELMIN       SSTA
    SLOPE      XLOBL     XLCH      XLOBR     ITRIAL    IDC       ICONT     CORAR     TOPWID      ENDST

 *SECNO 162000.000
 162000.00     19.46    998.59      0.0       0.0     998.73      0.15      0.00      0.0      979.12
    69000.    34500.       0.    34500.    11271.       0.    11271.     1067.      57.      979.12
      0.19      3.06      0.0      3.06     0.022     0.022     0.022     0.022   979.12     9391.62
  0.000041      100.     100.     100.         0         0         0       0.0  1216.76    10608.38

 *SECNO 163000.000
 163000.00     19.44    998.59      0.0       0.0     998.73      0.15      0.00      0.0      979.14
    69000.    34500.       0.    34500.    11262.       0.    11261.     1119.      60.      979.14
      0.20      3.06      0.0      3.06     0.022     0.022     0.022     0.022   979.14     9391.66
  0.000041      100.     100.     100.         0         0         0       0.0  1216.67    10608.33

 *SECNO 164000.000
 164000.00     19.43    998.59      0.0       0.0     998.74      0.15      0.00      0.0      979.16
    69000.    34500.       0.    34500.    11252.       0.    11252.     1171.      63.      979.16
      0.21      3.07      0.0      3.07     0.022     0.022     0.022     0.022   979.16     9391.71
  0.000041      100.     100.     100.         0         0         0       0.0  1216.57    10608.28

 *SECNO 164500.000
 164500.00     19.29    998.59      0.0       0.0     998.74      0.15      0.00      0.0      979.30
    69000.    34500.       0.    34500.    11170.       0.    11170.     1196.      64.      979.30
      0.21      3.09      0.0      3.09     0.022     0.022     0.022     0.022   979.30     9392.11
  0.000042       50.      50.      50.         0         0         0       0.0  1215.77    10607.88

 *SECNO 165000.000
 165000.00     15.20    998.50      0.0       0.0     998.75      0.24      0.01      0.0      983.30
    69000.    34500.       0.    34500.     8708.       0.     8707.     1219.      66.      983.30
      0.21      3.96      0.0      3.96     0.050     0.050     0.050     0.022   983.30     9404.39
  0.000487       50.      50.      50.         2         0         0       0.0  1191.21    10595.60

 *SECNO 165400.000
 165400.00     15.20    998.51      0.0       0.0     998.75      0.24      0.01      0.0      983.31
    69000.    34500.       0.    34500.     8709.       0.     8709.     1235.      67.      983.31
      0.22      3.96      0.0      3.96     0.022     0.022     0.022     0.022   983.31     9404.39
  0.000094       40.      40.      40.         0         0         0       0.0  1191.22    10595.61
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   SECNO     DEPTH     CWSEL     CRIWS     WSELK     EG        HV        HL        OLOSS     BANK ELEV
   Q         OLOB      OCH       OROB      ALOB      ACH       AROB      VOL       TWA     LEFT/RIGHT
   TIME      VLOB      VCH       VROB      XNL       XNCH      XNR       WTN       ELMIN       SSTA
   SLOPE     XLOBL     XLCH      XLOBR     ITRIAL    IDC       ICONT     CORAR     TOPWID      ENDST

*SECNO 166000.000
166000.00    15.19    998.51      0.0       0.0     998.76      0.24      0.01      0.0     983.32
   69000.    34500.      0.    34500.     8707.       0.     8707.     1259.      68.     983.32
     0.22     3.96      0.0     3.96     0.022     0.022     0.022     0.022   983.32   9404.40
 0.000094     60.       60.     60.        1         0         0       0.0    1191.20  10595.60

*SECNO 167200.000

3265 DIVIDED FLOW

167200.00    15.15    998.49      0.0       0.0     998.77      0.28      0.01      0.0     983.34
   69000.    37424.      0.    31575.     8684.       0.     7617.     1306.      72.     983.34
     0.23     4.31      0.0     4.15     0.022     0.022     0.022     0.022   983.34   9403.76
 0.000112     120.      120.    120.        2         0         0       0.0    1121.70  10595.45

*SECNO 168900.000

3265 DIVIDED FLOW

168900.00    15.14    998.51      0.0       0.0     998.79      0.28      0.02      0.0     983.37
   69000.    37424.      0.    31576.     8674.       0.     7608.     1369.      76.     983.37
     0.24     4.31      0.0     4.15     0.022     0.022     0.022     0.022   983.37   9403.81
 0.000112     170.      170.    170.        0         0         0       0.0    1121.59  10595.40

*SECNO 170600.000

3265 DIVIDED FLOW

170600.00    15.12    998.53      0.0       0.0     998.81      0.28      0.02      0.0     983.41
   69000.    37423.      0.    31576.     8666.       0.     7601.     1433.      80.     983.41
     0.25     4.32      0.0     4.15     0.022     0.022     0.022     0.022   983.41   9403.85
 0.000113     170.      170.    170.        0         0         0       0.0    1121.51  10595.36

*SECNO 173300.000

3265 DIVIDED FLOW

173300.00    15.10    998.56      0.0       0.0     998.84      0.28      0.03      0.0     983.46
   69000.    37423.      0.    31577.     8651.       0.     7588.     1533.      87.     983.46
     0.27     4.33      0.0     4.16     0.022     0.022     0.022     0.022   983.46   9403.92
 0.000113     270.      270.    270.        0         0         0       0.0    1121.37  10595.29
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SECNO      DEPTH     CWSEL     CRIWS     WSELK     EG        HV        HL        OLOSS     BANK ELEV
Q          QLOB      QCH       QROB      ALOB      ACH       AROB      VOL       TWA     LEFT/RIGHT
TIME       VLOB      VCH       VROB      XNL       XNCH      XNR       WTN       ELMIN       SSTA
SLOPE      XLOBL     XLCH      XLOBR     ITRIAL    IDC       ICONT     CORAR     TOPWID      ENDST

*SECNO 176000.000

3265 DIVIDED FLOW

176000.00    15.07    998.59      0.0       0.0    998.87      0.28      0.03       0.0    983.52
   69000.    37422.       0.    31578.     8637.       0.     7576.     1634.       94.    983.52
     0.29      4.33      0.0      4.17     0.022     0.022     0.022     0.022    983.52   9404.00
 0.000114      270.     270.      270.         0         0         0       0.0   1121.22  10595.21

*SECNO 180000.000

3265 DIVIDED FLOW

180000.00    15.04    998.63      0.0       0.0    998.92      0.28      0.05       0.0    983.60
   69000.    37421.       0.    31579.     8616.       0.     7557.     1783.      105.    983.60
     0.31      4.34      0.0      4.18     0.022     0.022     0.022     0.022    983.60   9404.11
 0.000115      400.     400.      400.         0         0         0       0.0   1121.00  10595.11

*SECNO 184000.000
184000.00    15.03    998.71      0.0       0.0    998.96      0.25      0.04       0.0    983.68
   69000.    34493.       0.    34507.     8596.       0.     8604.     1936.      115.    983.68
     0.34      4.01      0.0      4.01     0.022     0.022     0.022     0.022    983.68   9405.62
 0.000098      400.     400.      400.         2         0         0       0.0   1189.45  10595.08

*SECNO 185000.000
185000.00    15.02    998.72      0.0       0.0    998.97      0.25      0.01       0.0    983.70
   69000.    34493.       0.    34507.     8593.       0.     8598.     1975.      118.    983.70
     0.35      4.01      0.0      4.01     0.022     0.022     0.022     0.022    983.70   9405.65
 0.000098      100.     100.      100.         0         0         0       0.0   1189.40  10595.05

*SECNO 186000.000

3265 DIVIDED FLOW

186000.00    14.97    998.69      0.0       0.0    998.98      0.29      0.01       0.0    983.72
   69000.    37411.       0.    31589.     8571.       0.     7523.     2014.      121.    983.72
     0.35      4.36      0.0      4.20     0.022     0.022     0.022     0.022    983.72   9405.04
 0.000117      100.     100.      100.         2         0         0       0.0   1119.87  10594.91
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   SECNO      DEPTH     CWSEL     CRIWS     WSELK     EG        HV        HL        OLOSS     BANK ELEV
   Q          QLOB      QCH       QROB      ALOB      ACH       AROB      VOL       TWA     LEFT/RIGHT
   TIME       VLOB      VCH       VROB      XNL       XNCH      XNR       WTN       ELMIN        SSTA
   SLOPE      XLOBL     XLCH      XLOBR     ITRIAL    IOC       ICONT     CORAP     TOPWID       ENDST

 *SECNO 187000.000
 187000.00    15.00    998.74      0.0       0.0     998.99     0.25      0.01      0.0      983.74
    69000.    34501.      0.     34499.     8586.       0.      8586.     2052.     123.      983.74
      0.36      4.02     0.0       4.02     0.022     0.022     0.022     0.022   983.74    9404.92
  0.000099     100.     100.      100.        2         0         0       0.0    1190.07   10594.99

 *SECNO 188500.000
 188500.00    14.98    996.75      0.0       0.0     999.00     0.25      0.01      0.0      983.77
    69000.    34499.      0.     34501.     8577.       0.      8578.     2111.     127.      983.77
      0.37      4.02     0.0       4.02     0.022     0.022     0.022     0.022   983.77    9405.12
  0.000099     150.     150.      150.        0         0         0       0.0    1189.83   10594.95

 *SECNO 189000.000
 189000.00    10.74    998.51      0.0       0.0     999.01     0.50      0.01      0.0      987.77
    69000.    34500.      0.     34500.     6081.       0.      6081.     2128.     129.      987.77
      0.37      5.67     0.0       5.67     0.022     0.022     0.022     0.022   987.77    9417.82
  0.000304     50.      50.       50.        2         0         0       0.0    1164.40   10582.22

 *SECNO 189500.000
 189500.00    10.63    998.53      0.0       0.0     999.04     0.51      0.03      0.0      987.90
    69000.    34500.      0.     34500.     6013.       0.      6013.     2142.     130.      987.90
      0.37      5.74     0.0       5.74     0.050     0.050     0.050     0.022   987.90    9418.17
  0.001631     50.      50.       50.        0         0         0       0.0    1163.71   10581.87

 *SECNO 190000.000
 190000.00    10.53    998.55      0.0       0.0     999.07     0.52      0.03      0.0      988.02
    69000.    34500.      0.     34500.     5958.       0.      5958.     2155.     131.      988.02
      0.38      5.79     0.0       5.79     0.022     0.022     0.022     0.022   988.02    9418.46
  0.000325     50.      50.       50.        2         0         0       0.0    1163.13   10581.59

 *SECNO 191000.000
 191000.00    10.29    998.56      0.0       0.0     999.10     0.55      0.03      0.0      988.27
    69000.    34500.      0.     34500.     5817.       0.      5818.     2182.     134.      988.27
      0.38      5.93     0.0       5.93     0.022     0.022     0.022     0.022   988.27    9419.18
  0.000352     100.     100.      100.        2         0         0       0.0    1161.66   10580.86
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SECNO	DEPTH	CWSEL	CRIWS	WSELK	EG	HV	HL	OLOSS	BANK ELEV
Q	QLOB	QCH	QROB	ALOB	ACH	AROB	VOL	TWA	LEFT/RIGHT
TIME	VLOB	VCH	VROB	XNL	XNCH	XNR	WTN	ELMIN	SSTA
SLOPE	XLOBL	XLCH	XLOBR	ITRIAL	IDC	ICONT	CORAR	TOPWID	ENDST
*SECNO 192000.000									
192000.00	10.05	998.57	0.0	0.0	999.14	0.57	0.04	0.0	988.52
69000.	34500.	0.	34500.	5677.	0.	5678.	2209.	137.	988.52
0.39	6.08	0.0	6.08	0.022	0.022	0.022	0.022	988.52	9419.90
0.000381	100.	100.	100.	2	0	0	0.0	1160.24	10580.14
*SECNO 193000.000									
193000.00	9.81	998.58	0.0	0.0	999.18	0.60	0.04	0.0	988.77
69000.	34500.	0.	34500.	5539.	0.	5539.	2234.	139.	988.77
0.39	6.23	0.0	6.23	0.022	0.022	0.022	0.022	988.77	9420.62
0.000413	100.	100.	100.	2	0	0	0.0	1158.80	10579.42
*SECNO 194000.000									
194000.00	9.57	998.59	0.0	0.0	999.22	0.63	0.04	0.0	989.02
69000.	34500.	0.	34500.	5401.	0.	5401.	2260.	142.	989.02
0.40	6.39	0.0	6.39	0.022	0.022	0.022	0.022	989.02	9421.33
0.000449	100.	100.	100.	2	0	0	0.0	1157.37	10578.71
*SECNO 196000.000									
196000.00	9.10	998.62	0.0	0.0	999.32	0.70	0.10	0.0	989.52
69000.	34500.	0.	34500.	5128.	0.	5128.	2308.	147.	989.52
0.40	6.73	0.0	6.73	0.022	0.022	0.022	0.022	989.52	9422.74
0.000532	200.	200.	200.	2	0	0	0.0	1154.55	10577.29
*SECNO 198000.000									
198000.00	8.63	998.65	0.0	0.0	999.44	0.78	0.12	0.0	990.02
69000.	34500.	0.	34500.	4861.	0.	4861.	2354.	153.	990.02
0.41	7.10	0.0	7.10	0.022	0.022	0.022	0.022	990.02	9424.13
0.000634	200.	200.	200.	2	0	0	0.0	1151.77	10575.90

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*****************************************
 HEC2 RELEASE DATED NOV 76 UPDATED APR  1980
 ERROR CORR -  01,02,03,04
 MODIFICATION -  50,51,52,53,54
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T1      AGUA FRIA CHANNEL * I-10 TO INDIAN SHCOOL ROAD *
T2 IMPROVED CHANNEL W/ N-VALUE=.022  WITH MCDOWELL RD BRIDGE
T3      1100 BOTTOM WIDTH 3:1 SIDE SLOPES 050 *FINAL*
```

J1	ICHECK	INQ	NINV	IDIR	STRT	METRIC	HVINS	Q	WSEL	FQ
	0.	5.	0.	0.	0.0	0.0	0.0	0.	986.400	0.0

J2	NPROF	IPLOT	PRFVS	XSECV	XSECH	FN	ALLDC	IBW	CHNIM	ITRACE
	15.000	0.0	-1.000	0.0	0.0	0.0	0.0	0.0	0.0	0.0

SECNO / Q / TIME / SLOPE	DEPTH / QLOB / VLOB / XLOBL	CWSEL / QCH / VCH / XLCH	CPIWS / QROB / VROB / XLOBR	WSELK / ALOB / XNL / ITRIAL	EG / ACH / XNCH / IDC	HV / AROB / XNR / ICONT	HL / VOL / WTN / CORAR	OLOSS / TWA / ELMIN / TOPWID	BANK ELEV LEFT/RIGHT / SSTA / ENDST
*PROF 4									
*SECNO 14150.000									
14150.00	7.58	986.40	0.0	986.40	988.18	1.78	0.0	0.0	978.82
91000.	45500.	0.	45500.	4255.	0.	4255.	0.	0.	978.82
0.0	10.69	0.0	10.69	0.050	0.050	0.050	0.0	978.82	9427.26
0.008833	50.	50.	50.	0	0	0	0.0	1145.48	10572.74
*SECNO 142000.000									
142000.00	7.85	986.67	0.0	0.0	988.33	1.65	0.15	0.0	978.83
91000.	45500.	0.	45500.	4408.	0.	4408.	10.	1.	978.83
0.00	10.32	0.0	10.32	0.022	0.022	0.022	0.022	978.83	9426.46
0.001522	50.	50.	50.	2	0	0	0.0	1147.08	10573.54
*SECNO 143000.000									
143000.00	8.06	986.91	0.0	0.0	988.47	1.56	0.15	0.0	978.85
91000.	45500.	0.	45500.	4534.	0.	4534.	30.	4.	978.85
0.00	10.04	0.0	10.04	0.022	0.022	0.022	0.022	978.85	9425.80
0.001388	100.	100.	100.	2	0	0	0.0	1148.39	10574.20
*SECNO 143800.000									
143800.00	8.21	987.07	0.0	0.0	988.58	1.51	0.11	0.0	978.86
91000.	45500.	0.	45500.	4616.	0.	4616.	47.	6.	978.86
0.01	9.86	0.0	9.86	0.022	0.022	0.022	0.022	978.86	9425.37
0.001308	80.	80.	80.	2	0	0	0.0	1149.25	10574.62
*SECNO 145000.000									
145000.00	8.41	987.29	0.0	0.0	988.73	1.44	0.15	0.0	978.89
91000.	45500.	0.	45500.	4730.	0.	4730.	73.	9.	978.89
0.01	9.62	0.0	9.62	0.022	0.022	0.022	0.022	978.89	9424.78
0.001207	120.	120.	120.	2	0	0	0.0	1150.44	10575.22
*SECNO 146000.000									
146000.00	8.55	987.46	0.0	0.0	988.85	1.39	0.12	0.0	978.91
91000.	45500.	0.	45500.	4815.	0.	4815.	95.	12.	978.91
0.01	9.45	0.0	9.45	0.022	0.022	0.022	0.022	978.91	9424.34
0.001139	100.	100.	100.	2	0	0	0.0	1151.32	10575.66

SECNO	DEPTH	CWSEL	CRIWS	WSELK	EG	HV	HL	QLOSS	BANK ELEV
Q	QLOB	QCH	QROB	ALOB	ACH	AROB	VOL	TWA	LEFT/RIGHT
TIME	VLOB	VCH	VROB	XNL	XNCH	XNR	WTN	ELMIN	SSTA
SLOPE	XLOBL	XLCH	XLOBR	ITRIAL	IDC	ICONT	CORAR	TOPWID	ENDST
*SECNO 148000.000									
148000.00	8.81	987.76	0.0	0.0	989.06	1.30	0.22	0.0	978.95
91000.	45500.	0.	45500.	4964.	0.	4964.	140.	17.	978.95
0.02	9.17	0.0	9.17	0.022	0.022	0.022	0.022	978.95	9423.56
0.001030	200.	200.	200.	2	0	0	0.0	1152.88	10576.44
*SECNO 150000.000									
150000.00	9.04	988.02	0.0	0.0	989.26	1.24	0.20	0.0	978.99
91000.	45500.	0.	45500.	5093.	0.	5093.	186.	22.	978.99
0.03	8.93	0.0	8.93	0.022	0.022	0.022	0.022	978.99	9422.89
0.000947	200.	200.	200.	2	0	0	0.0	1154.22	10577.11
*SECNO 156300.000									
156300.00	9.71	988.72	0.0	0.0	989.79	1.07	0.53	0.0	979.01
91000.	45500.	0.	45500.	5480.	0.	5480.	339.	39.	979.01
0.05	8.30	0.0	8.30	0.022	0.022	0.022	0.022	979.01	9420.88
0.000745	630.	630.	630.	2	0	0	0.0	1158.24	10579.12
*SECNO 158000.000									
158000.00	9.82	988.87	0.0	0.0	989.91	1.05	0.12	0.0	979.05
91000.	45500.	0.	45500.	5543.	0.	5543.	382.	44.	979.05
0.05	8.21	0.0	8.21	0.022	0.022	0.022	0.022	979.05	9420.55
0.000717	170.	170.	170.	0	0	0	0.0	1158.89	10579.45
*SECNO 160000.000									
160000.00	9.95	989.04	0.0	0.0	990.05	1.02	0.14	0.0	979.09
91000.	45500.	0.	45500.	5621.	0.	5621.	433.	49.	979.09
0.06	8.09	0.0	8.09	0.022	0.022	0.022	0.022	979.09	9420.15
0.000685	200.	200.	200.	2	0	0	0.0	1159.70	10579.85
*SECNO 161000.000									
161000.00	10.01	989.11	0.0	0.0	990.12	1.01	0.07	0.0	979.11
91000.	45500.	0.	45500.	5650.	0.	5650.	459.	52.	979.11
0.06	8.05	0.0	8.05	0.022	0.022	0.022	0.022	979.11	9420.00
0.000674	100.	100.	100.	0	0	0	0.0	1160.00	10580.00

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    SECNO     DEPTH     CWSEL     CRIWS     WSELK     EG        HV        HL        QLOSS     BANK ELEV
    Q         QLOB      QCH       QROB      ALOB      ACH       AROB      VOL       TWA     LEFT/RIGHT
    TIME      VLOB      VCH       VROB      XNL       XNCH      XNB       WTN       ELMIN       SSTA
    SLOPE     XLOBL     XLCH      XLOBR     ITRIAL    IGC       ICONT     CORAR     TOPWID      ENDST

 *SECNO 162000.000
 162000.00    10.07    989.19      0.0       0.0     990.19      0.99      0.07      0.0     979.12
    91000.    45500.       0.    45500.    5686.        0.    5686.      485.       54.     979.12
      0.07      8.00      0.0      8.00    0.022     0.022     0.022     0.022    979.12   9419.81
  0.000660      100.     100.      100.        1         0         0       0.0   1160.37  10580.18

 *SECNO 163000.000
 163000.00    10.12    989.27      0.0       0.0     990.25      0.98      0.07      0.0     979.14
    91000.    45500.       0.    45500.    5716.        0.    5716.      511.       57.     979.14
      0.07      7.96      0.0      7.96    0.022     0.022     0.022     0.022    979.14   9419.66
  0.000648      100.     100.      100.        0         0         0       0.0   1160.68  10580.34

 *SECNO 164000.000
 164000.00    10.18    989.34      0.0       0.0     990.32      0.97      0.06      0.0     979.16
    91000.    45500.       0.    45500.    5748.        0.    5748.      538.       60.     979.16
      0.07      7.92      0.0      7.92    0.022     0.022     0.022     0.022    979.16   9419.49
  0.000637      100.     100.      100.        0         0         0       0.0   1161.01  10580.50

 *SECNO 164500.000
 164500.00    10.05    989.35      0.0       0.0     990.35      1.00      0.03      0.0     979.30
    91000.    45500.       0.    45500.    5681.        0.    5681.      551.       61.     979.30
      0.07      8.01      0.0      8.01    0.022     0.022     0.022     0.022    979.30   9419.84
  0.000662       50.      50.       50.        2         0         0       0.0   1160.32  10580.16

 *SECNO 165000.000

 3301 HV CHANGED MORE THAN HVINS

 3685 20 TRIALS ATTEMPTED WSEL,CWSEL
 3693 PROBABLE MINIMUM SPECIFIC ENERGY
 3720 CRITICAL DEPTH ASSUMED
 165000.00     5.94    989.24    989.24       0.0     992.16      2.92      0.09      0.0     983.30
    91000.    45500.       0.    45500.    3319.        0.    3319.      561.       62.     983.30
      0.08     13.71      0.0     13.71    0.050     0.050     0.050     0.022    983.30   9432.19
  0.020043       50.      50.       50.       20        11         0       0.0   1135.62  10567.81

 *SECNO 165400.000
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SECNO      DEPTH     CWSEL     CRIWS     WSELK     EG        HV        HL        OLOSS     BANK ELEV
Q          OLOB      OCH       OROB      ALOB      ACH       AROH      VOL       TWA     LEFT/RIGHT
TIME       VLOB      VCH       VROB      XNL       XNCH      XNR       WTN       ELMIN       SSTA
SLOPE      XLOBL     XLCH      XLOBR     ITRIAL    IDC       ICONT     CORAR     TOPWID      ENDST

3301 HV CHANGED MORE THAN HVINS

165400.00     6.92    990.23       0.0       0.0    992.36      2.14      0.21       0.0    983.31
   91000.   45500.        0.   45500.     3879.        0.     3879.      568.       63.    983.31
     0.08    11.73       0.0     11.73     0.022     0.022     0.022     0.022    983.31   9429.23
 0.002319      40.       40.       40.         2         0         0       0.0   1141.54  10570.77

*SECNO 166000.000
166000.00     7.21    990.53       0.0       0.0    992.49      1.96      0.13       0.0    983.32
   91000.   45500.        0.   45500.     4051.        0.     4051.      579.       65.    983.32
     0.08    11.23       0.0     11.23     0.022     0.022     0.022     0.022    983.32   9428.33
 0.002010      60.       60.       60.         2         0         0       0.0   1143.34  10571.67

*SECNO 167200.000

3265 DIVIDED FLOW

167200.00     7.14    990.48       0.0       0.0    992.76      2.28      0.26       0.0    983.34
   91000.   48979.        0.   42021.     4009.        0.     3507.      600.       68.    983.34
     0.08    12.22       0.0     11.98     0.022     0.022     0.022     0.022    983.34   9428.19
 0.002413     120.      120.      120.         2         0         0       0.0   1073.25  10571.44

*SECNO 168900.000

3265 DIVIDED FLOW

168900.00     7.85    991.22       0.0       0.0    993.10      1.88      0.35       0.0    983.37
   91000.   49014.        0.   41985.     4411.        0.     3860.      631.       72.    983.37
     0.08    11.11       0.0     10.88     0.022     0.022     0.022     0.022    983.37   9426.04
 0.001763     170.      170.      170.         3         0         0       0.0   1077.50  10573.55

*SECNO 170600.000

3265 DIVIDED FLOW

170600.00     8.29    991.70       0.0       0.0    993.38      1.68      0.27       0.0    983.41
   91000.   49036.        0.   41964.     4663.        0.     4081.      664.       76.    983.41
     0.09    10.52       0.0     10.28     0.022     0.022     0.022     0.022    983.41   9424.70
 0.001471     170.      170.      170.         2         0         0       0.0   1080.16  10574.86
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    SECNO      DEPTH     CWSEL     CRIWS     WSELK     EG        HV        HL        QLOSS     BANK ELEV
    Q          GLOB      OCH       GROB      ALOB      ACH       AROB      VOL       TWA     LEFT/RIGHT
    TIME       VLOB      VCH       VROB      XNL       XNCH      XNP       WTN       ELMIN       SSTA
    SLOPE      XLOBL     XLCH      XLOBR     ITRIAL    IOC       ICONT     CORAR     TOPWID      ENDST

 *SECNO 173300.000

 3265 DIVIDED FLOW

 173300.00      6.78    992.24       0.0       0.0    993.74      1.49      0.36       0.0    983.46
    91000.    49061.        0.    41939.     4947.        0.     4331.      720.       83.    983.46
      0.10      9.92       0.0      9.68     0.022     0.022     0.022     0.022    983.46   9423.20
  0.001212      270.      270.      270.         2         0         0       0.0   1083.14  10576.34

 *SECNO 176000.000

 3265 DIVIDED FLOW

 176000.00      9.15    992.67       0.0       0.0    994.04      1.37      0.30       0.0    983.52
    91000.    49079.        0.    41921.     5162.        0.     4519.      779.       90.    983.52
      0.11      9.51       0.0      9.28     0.022     0.022     0.022     0.022    983.52   9422.06
  0.001055      270.      270.      270.         2         0         0       0.0   1085.39  10577.46

 *SECNO 180000.000

 3265 DIVIDED FLOW

 180000.00      9.59    993.18       0.0       0.0    994.43      1.25      0.39       0.0    983.60
    91000.    49100.        0.    41900.     5414.        0.     4740.      870.      100.    983.60
      0.12      9.07       0.0      8.64     0.022     0.022     0.022     0.022    983.60   9420.73
  0.000903      400.      400.      400.         2         0         0       0.0   1088.03  10578.76

 *SECNO 184000.000
 184000.00     10.06    993.74       0.0       0.0    994.74      0.99      0.31       0.0    983.68
    91000.    45494.        0.    45506.     5685.        0.     5687.      969.      110.    983.68
      0.13      8.00       0.0      8.00     0.022     0.022     0.022     0.022    983.68   9420.28
  0.000659      400.      400.      400.         2         0         0       0.0   1159.91  10580.19

 *SECNO 185000.000
 185000.00     10.12    993.82       0.0       0.0    994.80      0.98      0.07       0.0    983.70
    91000.    45494.        0.    45506.     5718.        0.     5721.      995.      113.    983.70
      0.13      7.96       0.0      7.95     0.022     0.022     0.022     0.022    983.70   9420.11
  0.000647      100.      100.      100.         0         0         0       0.0   1160.25  10580.36
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     SECNO      DEPTH      CWSEL      CRIWS      WSELK      EG         HV         HL         QLOSS      BANK ELEV
     Q          QLOB       QCH        QROB       ALOB       ACH        AROB       VOL        TWA     LEFT/RIGHT
     TIME       VLOB       VCH        VROB       XNL        XNCH       XNR        WTN        ELMIN        SSTA
     SLOPE      XLOBL      XLCH       XLOBR      ITRIAL     IDC        ICONT      CORAR      TOPWID       ENDST

 *SECNO 186000.000

 3265 DIVIDED FLOW

 186000.00     10.01     993.73      0.0        0.0       994.67      1.14       0.07       0.0       983.72
    91000.     49114.      0.      41886.     5658.        0.      4957.      1020.      115.       983.72
      0.14      8.68      0.0       8.45      0.022      0.022      0.022      0.022    983.72     9419.93
  0.000781     100.      100.      100.         2          0          0         0.0     1090.11    10580.04

 *SECNO 187000.000
 187000.00     10.25     993.99      0.0        0.0       994.94      0.96       0.07       0.0       983.74
    91000.     45501.      0.      45499.     5793.        0.      5793.      1046.      118.       983.74
      0.14      7.85      0.0       7.85      0.022      0.022      0.022      0.022    983.74     9419.20
  0.000621     100.      100.      100.         2          0          0         0.0     1161.54    10580.73

 *SECNO 188500.000
 188500.00     10.32     994.09      0.0        0.0       995.04      0.94       0.09       0.0       983.77
    91000.     45499.      0.      45501.     5836.        0.      5836.      1086.      122.       983.77
      0.15      7.80      0.0       7.80      0.022      0.022      0.022      0.022    983.77     9419.08
  0.000606     150.      150.      150.         0          0          0         0.0     1161.88    10580.96

 *SECNO 189000.000

 3301 HV CHANGED MORE THAN HVINS

 3685 20 TRIALS ATTEMPTED WSFL,CWSEL
 3693 PROBABLE MINIMUM SPECIFIC ENERGY
 3720 CRITICAL DEPTH ASSUMED
 189000.00      5.93     993.70     993.70      0.0       996.63      2.93       0.06       0.0       987.77
    91000.     45500.      0.      45500.     3314.        0.      3314.      1096.      123.       987.77
      0.15     13.73      0.0      13.73      0.022      0.022      0.022      0.022    987.77     9432.23
  0.003896      50.       50.       50.         20         11          0         0.0     1135.55    10567.79

 *SECNO 189500.000

 3301 HV CHANGED MORE THAN HVINS

 189500.00      6.90     994.79      0.0        0.0       996.94      2.15       0.32       0.0       987.90
    91000.     45500.      0.      45500.     3867.        0.      3868.      1104.      125.       987.90
      0.15     11.76      0.0      11.76      0.050      0.050      0.050      0.022    987.90     9429.32
  0.012098      50.       50.       50.          5          0          0         0.0     1141.38    10570.70
```

SECNO	DEPTH	CWSEL	CRIWS	WSELK	EG	HV	HL	OLOSS	RANK ELEV
Q	QLOB	QCH	QROB	ALOB	ACH	AROB	VOL	TWA	LEFT/RIGHT
TIME	VLOB	VCH	VROB	XNL	XNCH	XNR	WTN	ELMIN	SSTA
SLOPE	XLOBL	XLCH	XLOBR	ITRIAL	IOC	ICONT	CORAR	TOPWID	ENDST
*SECNO 190000.000									
190000.00	7.11	995.13	0.0	0.0	997.15	2.02	0.21	0.0	988.02
91000.	45500.	0.	45500.	3989.	0.	3989.	1113.	126.	988.02
0.15	11.41	0.0	11.41	0.022	0.022	0.022	0.022	988.02	9428.69
0.002115	50.	50.	50.	2	0	0	0.0	1142.65	10571.34
*SECNO 191000.000									
191000.00	7.03	995.30	0.0	0.0	997.37	2.07	0.22	0.0	988.27
91000.	45500.	0.	45500.	3942.	0.	3942.	1132.	129.	988.27
0.15	11.54	0.0	11.54	0.022	0.022	0.022	0.022	988.27	9428.93
0.002199	100.	100.	100.	3	0	0	0.0	1142.16	10571.10
*SECNO 192000.000									
192000.00	6.96	995.48	0.0	0.0	997.59	2.11	0.22	0.0	988.52
91000.	45500.	0.	45500.	3902.	0.	3902.	1150.	131.	988.52
0.16	11.66	0.0	11.66	0.022	0.022	0.022	0.022	988.52	9429.14
0.002275	100.	100.	100.	2	0	0	0.0	1141.74	10570.88
*SECNO 193000.000									
193000.00	6.92	995.69	0.0	0.0	997.82	2.13	0.23	0.0	988.77
91000.	45500.	0.	45500.	3883.	0.	3883.	1167.	134.	988.77
0.16	11.72	0.0	11.72	0.022	0.022	0.022	0.022	988.77	9429.24
0.002311	100.	100.	100.	1	0	0	0.0	1141.54	10570.79
*SECNO 194000.000									
194000.00	6.86	995.88	0.0	0.0	998.06	2.17	0.23	0.0	989.02
91000.	45500.	0.	45500.	3846.	0.	3846.	1185.	136.	989.02
0.16	11.83	0.0	11.83	0.022	0.022	0.022	0.022	989.02	9429.44
0.002385	100.	100.	100.	2	0	0	0.0	1141.15	10570.59
*SECNO 196000.000									
196000.00	6.82	996.34	0.0	0.0	998.54	2.19	0.48	0.0	989.52
91000.	45500.	0.	45500.	3828.	0.	3828.	1220.	142.	989.52
0.16	11.89	0.0	11.89	0.022	0.022	0.022	0.022	989.52	9429.53
0.002422	200.	200.	200.	0	0	0	0.0	1140.97	10570.50

```
 SECNO     DEPTH     CWSEL     CRIWS     WSELK     EG        HV        HL        OLOSS     BANK ELEV
 Q         QLOB      QCH       QROB      ALOB      ACH       AROB      VOL       TWA     LEFT/RIGHT
 TIME      VLOB      VCH       VROB      XNL       XNCH      XNR       WTN       ELMIN       SSTA
 SLOPE     XLOBL     XLCH      XLOBR     ITRIAL    IDC       ICONT     CORAR     TOPWID      ENDST

*SECNO 198000.000
198000.00     6.79    996.81       0.0       0.0    999.03      2.22      0.49       0.0    990.02
   91000.   45500.        0.   45500.     3809.        0.     3809.     1256.      147.    990.02
     0.17     11.95       0.0     11.95     0.022     0.022     0.022     0.022    990.02   9429.63
 0.002463     200.      200.      200.         1         0         0       0.0   1140.76  10570.39
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HEC2 RELEASE DATED NOV 76 UPDATED APR  1980
ERROR CORR -  01,02,03,04
MODIFICATION -  50,51,52,53,54
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NOTE- ASTERISK (*) AT LEFT OF CROSS-SECTION NUMBER INDICATES MESSAGE IN SUMMARY OF ERRORS LIST

1100 BOTTOM WIDTH 311 SI

SUMMARY PRINTOUT TABLE 120

SECNO	CWSEL	FG	VCH	10K*S	DEPTH	TOPWID	CLSTA	BW	STCHL	XLBEL	STCHR	RBEL
14150.000	987.10	987.14	0.0	2.03	8.28	1149.67	0.0	0.01	10000.00	978.82	10000.00	978.82
14150.000	994.96	995.07	0.0	2.01	16.14	1196.82	0.0	0.01	10000.00	978.82	10000.00	978.82
14150.000	998.51	998.65	0.0	2.03	19.69	1218.11	0.0	0.01	10000.00	978.82	10000.00	978.82
14150.000	986.40	988.18	0.0	88.33	7.58	1145.48	0.0	0.01	10000.00	978.82	10000.00	978.82
142000.000	987.10	987.15	0.0	0.39	8.28	1149.69	0.0	0.01	10000.00	978.83	10000.00	978.83
142000.000	994.96	995.07	0.0	0.39	16.13	1196.84	0.0	0.01	10000.00	978.83	10000.00	978.83
142000.000	998.51	998.65	0.0	0.39	19.68	1218.14	0.0	0.01	10000.00	978.83	10000.00	978.83
142000.000	986.67	986.33	0.0	15.22	7.85	1147.08	0.0	0.01	10000.00	978.83	10000.00	978.83
143000.000	987.11	987.15	0.0	0.39	8.26	1149.61	0.0	0.01	10000.00	978.85	10000.00	978.85
143000.000	994.96	995.07	0.0	0.39	16.12	1196.75	0.0	0.01	10000.00	978.85	10000.00	978.85
143000.000	998.51	998.66	0.0	0.39	19.67	1218.05	0.0	0.01	10000.00	978.85	10000.00	978.85
143000.000	986.91	988.47	0.0	13.88	8.06	1148.39	0.0	0.01	10000.00	978.85	10000.00	978.85
143800.000	987.11	987.15	0.0	0.40	8.25	1149.48	0.0	0.01	10000.00	978.86	10000.00	978.86
143800.000	994.97	995.08	0.0	0.39	16.10	1196.62	0.0	0.01	10000.00	978.86	10000.00	978.86
143800.000	998.52	998.66	0.0	0.39	19.65	1217.93	0.0	0.01	10000.00	978.86	10000.00	978.86
143800.000	987.07	988.58	0.0	13.08	8.21	1149.25	0.0	0.01	10000.00	978.86	10000.00	978.86
145000.000	987.11	987.16	0.0	0.40	8.23	1149.36	0.0	0.01	10000.00	978.89	10000.00	978.89
145000.000	994.97	995.08	0.0	0.39	16.08	1196.50	0.0	0.01	10000.00	978.89	10000.00	978.89
145000.000	998.52	998.66	0.0	0.40	19.63	1217.81	0.0	0.01	10000.00	978.89	10000.00	978.89
145000.000	987.29	988.73	0.0	12.07	8.41	1150.44	0.0	0.01	10000.00	978.89	10000.00	978.89
146000.000	987.12	987.16	0.0	0.40	8.21	1149.26	0.0	0.01	10000.00	978.91	10000.00	978.91
146000.000	994.97	995.08	0.0	0.39	16.07	1196.41	0.0	0.01	10000.00	978.91	10000.00	978.91
146000.000	998.52	998.67	0.0	0.40	19.62	1217.71	0.0	0.01	10000.00	978.91	10000.00	978.91
146000.000	987.46	988.85	0.0	11.39	8.55	1151.32	0.0	0.01	10000.00	978.91	10000.00	978.91
148000.000	987.12	987.17	0.0	0.41	8.18	1149.07	0.0	0.01	10000.00	978.95	10000.00	978.95
148000.000	994.98	995.09	0.0	0.40	16.04	1196.21	0.0	0.01	10000.00	978.95	10000.00	978.95
148000.000	998.53	998.68	0.0	0.40	19.59	1217.52	0.0	0.01	10000.00	978.95	10000.00	978.95
148000.000	987.76	989.06	0.0	10.30	8.81	1152.88	0.0	0.01	10000.00	978.95	10000.00	978.95

SECNO	CWSEL	EG	VCH	10K*S	DEPTH	TOPWID	CLSTA	BW	STCHL	XLBEL	STCHR	RBEL
150000.000	987.13	987.18	0.0	0.41	8.15	1148.88	0.0	0.01	10000.00	978.99	10000.00	978.99
150000.000	994.99	995.10	0.0	0.40	16.00	1196.02	0.0	0.01	10000.00	978.99	10000.00	978.99
150000.000	998.54	998.68	0.0	0.40	19.55	1217.32	0.0	0.01	10000.00	978.99	10000.00	978.99
150000.000	988.02	989.26	0.0	9.47	9.04	1154.22	0.0	0.01	10000.00	978.99	10000.00	978.99
156300.000	987.16	987.21	0.0	0.42	8.15	1148.88	0.0	0.01	10000.00	979.01	10000.00	979.01
156300.000	995.01	995.12	0.0	0.40	16.00	1196.01	0.0	0.01	10000.00	979.01	10000.00	979.01
156300.000	998.56	998.71	0.0	0.40	19.55	1217.32	0.0	0.01	10000.00	979.01	10000.00	979.01
156300.000	988.72	989.79	0.0	7.45	9.71	1158.24	0.0	0.01	10000.00	979.01	10000.00	979.01
158000.000	987.16	987.21	0.0	0.42	8.12	1148.71	0.0	0.01	10000.00	979.05	10000.00	979.05
158000.000	995.02	995.13	0.0	0.40	15.97	1195.85	0.0	0.01	10000.00	979.05	10000.00	979.05
158000.000	998.57	998.71	0.0	0.40	19.52	1217.14	0.0	0.01	10000.00	979.05	10000.00	979.05
158000.000	988.87	989.91	0.0	7.17	9.82	1158.89	0.0	0.01	10000.00	979.05	10000.00	979.05
160000.000	987.17	987.22	0.0	0.43	8.09	1148.53	0.0	0.01	10000.00	979.09	10000.00	979.09
160000.000	995.03	995.14	0.0	0.40	15.94	1195.65	0.0	0.01	10000.00	979.09	10000.00	979.09
160000.000	998.58	998.72	0.0	0.41	19.49	1216.96	0.0	0.01	10000.00	979.09	10000.00	979.09
160000.000	989.04	990.05	0.0	6.85	9.95	1159.70	0.0	0.01	10000.00	979.09	10000.00	979.09
161000.000	987.18	987.23	0.0	0.43	8.07	1148.43	0.0	0.01	10000.00	979.11	10000.00	979.11
161000.000	995.03	995.14	0.0	0.41	15.93	1195.56	0.0	0.01	10000.00	979.11	10000.00	979.11
161000.000	998.58	998.73	0.0	0.41	19.48	1216.86	0.0	0.01	10000.00	979.11	10000.00	979.11
161000.000	989.11	990.12	0.0	6.74	10.01	1160.00	0.0	0.01	10000.00	979.11	10000.00	979.11
162000.000	987.18	987.23	0.0	0.43	8.06	1148.33	0.0	0.01	10000.00	979.12	10000.00	979.12
162000.000	995.04	995.15	0.0	0.41	15.91	1195.46	0.0	0.01	10000.00	979.12	10000.00	979.12
162000.000	998.59	998.73	0.0	0.41	19.46	1216.76	0.0	0.01	10000.00	979.12	10000.00	979.12
162000.000	989.19	990.19	0.0	6.60	10.07	1160.37	0.0	0.01	10000.00	979.12	10000.00	979.12
163000.000	987.18	987.23	0.0	0.43	8.04	1148.24	0.0	0.01	10000.00	979.14	10000.00	979.14
163000.000	995.04	995.15	0.0	0.41	15.89	1195.37	0.0	0.01	10000.00	979.14	10000.00	979.14
163000.000	998.59	998.73	0.0	0.41	19.44	1216.67	0.0	0.01	10000.00	979.14	10000.00	979.14
163000.000	989.27	990.25	0.0	6.48	10.12	1160.68	0.0	0.01	10000.00	979.14	10000.00	979.14
164000.000	987.19	987.24	0.0	0.44	8.02	1148.14	0.0	0.01	10000.00	979.16	10000.00	979.16
164000.000	995.04	995.16	0.0	0.41	15.88	1195.27	0.0	0.01	10000.00	979.16	10000.00	979.16
164000.000	998.59	998.74	0.0	0.41	19.43	1216.57	0.0	0.01	10000.00	979.16	10000.00	979.16
164000.000	989.34	990.32	0.0	6.37	10.18	1161.01	0.0	0.01	10000.00	979.16	10000.00	979.16
164500.000	987.19	987.24	0.0	0.46	7.89	1147.34	0.0	0.01	10000.00	979.30	10000.00	979.30
164500.000	995.04	995.16	0.0	0.42	15.74	1194.46	0.0	0.01	10000.00	979.30	10000.00	979.30
164500.000	998.59	998.74	0.0	0.42	19.29	1215.77	0.0	0.01	10000.00	979.30	10000.00	979.30
164500.000	989.35	990.35	0.0	6.62	10.05	1160.32	0.0	0.01	10000.00	979.30	10000.00	979.30
165000.000	987.01	987.25	0.0	29.81	3.71	1122.29	0.0	0.01	10000.00	983.30	10000.00	983.30
165000.000	994.95	995.16	0.0	6.03	11.65	1169.89	0.0	0.01	10000.00	983.30	10000.00	983.30
165000.000	998.50	998.75	0.0	4.87	15.20	1191.21	0.0	0.01	10000.00	983.30	10000.00	983.30
165000.000	989.24	992.16	0.0	200.43	5.94	1135.62	0.0	0.01	10000.00	983.30	10000.00	983.30

SECNO	CWSEL	EG	VCH	10K*S	DEPTH	TOPWID	CLSTA	BW	STCHL	XLBEL	STCHR	RBEL
165400.000	987.06	987.29	0.0	5.54	3.75	1122.57	0.0	0.01	10000.00	983.31	10000.00	983.31
165400.000	994.96	995.17	0.0	1.17	11.65	1169.92	0.0	0.01	10000.00	983.31	10000.00	983.31
165400.000	998.51	998.75	0.0	0.94	15.20	1191.22	0.0	0.01	10000.00	983.31	10000.00	983.31
165400.000	990.23	992.36	0.0	23.19	6.92	1141.54	0.0	0.01	10000.00	983.31	10000.00	983.31
166000.000	987.10	987.32	0.0	5.45	3.78	1122.67	0.0	0.01	10000.00	983.32	10000.00	983.32
166000.000	994.96	995.18	0.0	1.17	11.64	1169.91	0.0	0.01	10000.00	983.32	10000.00	983.32
166000.000	998.51	998.76	0.0	0.94	15.19	1191.20	0.0	0.01	10000.00	983.32	10000.00	983.32
166000.000	990.53	992.49	0.0	20.10	7.21	1143.34	0.0	0.01	10000.00	983.32	10000.00	983.32
167200.000	987.14	987.39	0.0	6.16	3.80	1052.98	0.0	0.01	10000.00	983.34	10000.00	983.34
167200.000	994.95	995.19	0.0	1.38	11.61	1100.25	0.0	0.01	10000.00	983.34	10000.00	983.34
167200.000	998.49	998.77	0.0	1.12	15.15	1121.70	0.0	0.01	10000.00	983.34	10000.00	983.34
167200.000	990.48	992.76	0.0	24.13	7.14	1073.25	0.0	0.01	10000.00	983.34	10000.00	983.34
168900.000	987.25	987.49	0.0	5.79	3.87	1053.41	0.0	0.01	10000.00	983.37	10000.00	983.37
168900.000	994.97	995.22	0.0	1.39	11.60	1100.18	0.0	0.01	10000.00	983.37	10000.00	983.37
168900.000	998.51	998.79	0.0	1.12	15.14	1121.59	0.0	0.01	10000.00	983.37	10000.00	983.37
168900.000	991.22	993.10	0.0	17.63	7.85	1077.50	0.0	0.01	10000.00	983.37	10000.00	983.37
170600.000	987.35	987.59	0.0	5.44	3.95	1053.86	0.0	0.01	10000.00	983.41	10000.00	983.41
170600.000	994.99	995.24	0.0	1.39	11.59	1100.12	0.0	0.01	10000.00	983.41	10000.00	983.41
170600.000	998.53	998.81	0.0	1.13	15.12	1121.51	0.0	0.01	10000.00	983.41	10000.00	983.41
170600.000	991.69	993.38	0.0	14.71	8.29	1080.16	0.0	0.01	10000.00	983.41	10000.00	983.41
173300.000	987.51	987.73	0.0	5.00	4.04	1054.46	0.0	0.01	10000.00	983.46	10000.00	983.46
173300.000	995.03	995.28	0.0	1.40	11.57	1100.02	0.0	0.01	10000.00	983.46	10000.00	983.46
173300.000	998.56	998.84	0.0	1.13	15.10	1121.37	0.0	0.01	10000.00	983.46	10000.00	983.46
173300.000	992.24	993.74	0.0	12.12	8.78	1083.14	0.0	0.01	10000.00	983.46	10000.00	983.46
176000.000	987.65	987.86	0.0	4.66	4.13	1055.00	0.0	0.01	10000.00	983.52	10000.00	983.52
176000.000	995.07	995.31	0.0	1.40	11.55	1099.92	0.0	0.01	10000.00	983.52	10000.00	983.52
176000.000	998.59	998.87	0.0	1.14	15.07	1121.22	0.0	0.01	10000.00	983.52	10000.00	983.52
176000.000	992.67	994.04	0.0	10.55	9.15	1085.39	0.0	0.01	10000.00	983.52	10000.00	983.52
180000.000	987.83	988.04	0.0	4.26	4.24	1055.68	0.0	0.01	10000.00	983.60	10000.00	983.60
180000.000	995.12	995.37	0.0	1.41	11.53	1099.77	0.0	0.01	10000.00	983.60	10000.00	983.60
180000.000	998.63	998.92	0.0	1.15	15.04	1121.00	0.0	0.01	10000.00	983.60	10000.00	983.60
180000.000	993.18	994.43	0.0	9.03	9.59	1088.03	0.0	0.01	10000.00	983.60	10000.00	983.60
184000.000	988.02	988.19	0.0	3.45	4.34	1125.79	0.0	0.01	10000.00	983.68	10000.00	983.68
184000.000	995.21	995.42	0.0	1.21	11.53	1168.61	0.0	0.01	10000.00	983.68	10000.00	983.68
184000.000	998.71	998.96	0.0	0.98	15.03	1189.45	0.0	0.01	10000.00	983.68	10000.00	983.68
184000.000	993.74	994.74	0.0	6.59	10.06	1159.91	0.0	0.01	10000.00	983.68	10000.00	983.68
185000.000	988.06	988.22	0.0	3.38	4.36	1125.94	0.0	0.01	10000.00	983.70	10000.00	983.70
185000.000	995.22	995.44	0.0	1.21	11.52	1168.57	0.0	0.01	10000.00	983.70	10000.00	983.70
185000.000	998.72	998.97	0.0	0.98	15.02	1189.40	0.0	0.01	10000.00	983.70	10000.00	983.70
185000.000	993.82	994.80	0.0	6.47	10.12	1160.25	0.0	0.01	10000.00	983.70	10000.00	983.70

SECNO	C*SEL	EG	VCH	10K*S	DEPTH	TOPWID	CLSTA	BW	STCHL	XLBEL	STCHR	RBEL
186000.000	988.07	988.26	0.0	3.93	4.35	1056.10	0.0	0.01	10000.00	983.72	10000.00	983.72
186000.000	995.20	995.45	0.0	1.43	11.48	1098.91	0.0	0.01	10000.00	983.72	10000.00	983.72
186000.000	998.69	998.98	0.0	1.17	14.97	1119.87	0.0	0.01	10000.00	983.72	10000.00	983.72
186000.000	993.73	994.87	0.0	7.81	10.01	1090.11	0.0	0.01	10000.00	983.72	10000.00	983.72
187000.000	988.13	988.30	0.0	3.30	4.39	1126.37	0.0	0.01	10000.00	983.74	10000.00	983.74
187000.000	995.24	995.46	0.0	1.22	11.50	1169.08	0.0	0.01	10000.00	983.74	10000.00	983.74
187000.000	998.74	998.99	0.0	0.99	15.00	1190.07	0.0	0.01	10000.00	983.74	10000.00	983.74
187000.000	993.99	994.94	0.0	6.21	10.25	1161.54	0.0	0.01	10000.00	983.74	10000.00	983.74
188500.000	988.18	988.35	0.0	3.24	4.41	1126.46	0.0	0.01	10000.00	983.77	10000.00	983.77
188500.000	995.26	995.48	0.0	1.22	11.49	1168.90	0.0	0.01	10000.00	983.77	10000.00	983.77
188500.000	998.75	999.00	0.0	0.99	14.98	1189.83	0.0	0.01	10000.00	983.77	10000.00	983.77
188500.000	994.09	995.04	0.0	6.06	10.32	1161.88	0.0	0.01	10000.00	983.77	10000.00	983.77
* 189000.000	989.64	990.57	0.0	57.37	1.87	1111.20	0.0	0.01	10000.00	987.77	10000.00	987.77
189000.000	994.91	995.49	0.0	6.05	7.14	1142.82	0.0	0.01	10000.00	987.77	10000.00	987.77
189000.000	998.51	999.01	0.0	3.04	10.74	1164.40	0.0	0.01	10000.00	987.77	10000.00	987.77
* 189000.000	993.70	996.63	0.0	38.96	5.93	1135.55	0.0	0.01	10000.00	987.77	10000.00	987.77
189500.000	990.45	990.95	0.0	105.19	2.55	1115.27	0.0	0.01	10000.00	987.90	10000.00	987.90
189500.000	994.95	995.55	0.0	32.51	7.06	1142.33	0.0	0.01	10000.00	987.90	10000.00	987.90
189500.000	998.53	999.04	0.0	16.31	10.63	1163.71	0.0	0.01	10000.00	987.90	10000.00	987.90
189500.000	994.79	996.94	0.0	120.98	6.90	1141.38	0.0	0.01	10000.00	987.90	10000.00	987.90
190000.000	990.67	991.13	0.0	17.88	2.65	1115.88	0.0	0.01	10000.00	988.02	10000.00	988.02
190000.000	995.00	995.61	0.0	6.53	6.98	1141.87	0.0	0.01	10000.00	988.02	10000.00	988.02
190000.000	998.55	999.07	0.0	3.25	10.53	1163.13	0.0	0.01	10000.00	988.02	10000.00	988.02
190000.000	995.13	997.15	0.0	21.15	7.11	1142.65	0.0	0.01	10000.00	988.02	10000.00	988.02
191000.000	990.82	991.32	0.0	20.26	2.55	1115.30	0.0	0.01	10000.00	988.27	10000.00	988.27
191000.000	995.03	995.68	0.0	7.27	6.76	1140.54	0.0	0.01	10000.00	988.27	10000.00	988.27
191000.000	998.56	999.10	0.0	3.52	10.29	1161.68	0.0	0.01	10000.00	988.27	10000.00	988.27
191000.000	995.30	997.37	0.0	21.99	7.03	1142.16	0.0	0.01	10000.00	988.27	10000.00	988.27
192000.000	991.01	991.53	0.0	21.94	2.49	1114.94	0.0	0.01	10000.00	988.52	10000.00	988.52
192000.000	995.06	995.76	0.0	6.12	6.54	1139.23	0.0	0.01	10000.00	988.52	10000.00	988.52
192000.000	998.57	999.14	0.0	3.81	10.05	1160.24	0.0	0.01	10000.00	988.52	10000.00	988.52
192000.000	995.48	997.59	0.0	22.75	6.96	1141.74	0.0	0.01	10000.00	988.52	10000.00	988.52
193000.000	991.21	991.75	0.0	23.28	2.44	1114.67	0.0	0.01	10000.00	988.77	10000.00	988.77
193000.000	995.10	995.84	0.0	9.07	6.33	1137.96	0.0	0.01	10000.00	988.77	10000.00	988.77
193000.000	998.58	999.18	0.0	4.13	9.81	1158.80	0.0	0.01	10000.00	988.77	10000.00	988.77
193000.000	995.69	997.82	0.0	23.11	6.92	1141.54	0.0	0.01	10000.00	988.77	10000.00	988.77
194000.000	991.44	991.99	0.0	24.19	2.42	1114.51	0.0	0.01	10000.00	989.02	10000.00	989.02
194000.000	995.14	995.94	0.0	10.14	6.12	1136.72	0.0	0.01	10000.00	989.02	10000.00	989.02
194000.000	998.59	999.22	0.0	4.49	9.57	1157.37	0.0	0.01	10000.00	989.02	10000.00	989.02
194000.000	995.88	996.06	0.0	23.85	6.86	1141.15	0.0	0.01	10000.00	989.02	10000.00	989.02

SECNO	CWSEL	EG	VCH	10K*S	DEPTH	TOPWID	CLSTA	AW	STCHL	XLBEL	STCHR	RBEL
196000.000	991.92	992.48	0.0	25.12	2.40	1114.34	0.0	0.01	10000.00	989.52	10000.00	989.52
196000.000	995.26	996.16	0.0	12.62	5.74	1134.40	0.0	0.01	10000.00	989.52	10000.00	989.52
196000.000	998.62	999.32	0.0	5.32	9.10	1154.55	0.0	0.01	10000.00	989.52	10000.00	989.52
196000.000	996.34	998.54	0.0	24.22	6.82	1140.97	0.0	0.01	10000.00	989.52	10000.00	989.52
198000.000	992.42	992.99	0.0	25.17	2.40	1114.34	0.0	0.01	10000.00	990.02	10000.00	990.02
198000.000	995.42	996.44	0.0	15.50	5.40	1132.35	0.0	0.01	10000.00	990.02	10000.00	990.02
198000.000	998.65	999.44	0.0	6.34	8.63	1151.77	0.0	0.01	10000.00	990.02	10000.00	990.02
198000.000	996.81	999.03	0.0	24.63	6.79	1140.76	0.0	0.01	10000.00	990.02	10000.00	990.02

SUMMARY OF ERRORS

```
CAUTION  SECNO=*********  PROFILE= 4  CRITICAL DEPTH ASSUMED
CAUTION  SECNO=*********  PROFILE= 4  PROBABLE MINIMUM SPECIFIC ENERGY
CAUTION  SECNO=*********  PROFILE= 4  20 TRIALS ATTEMPTED TO BALANCE WSEL

CAUTION  SECNO=*********  PROFILE= 1  CRITICAL DEPTH ASSUMED
CAUTION  SECNO=*********  PROFILE= 1  PROBABLE MINIMUM SPECIFIC ENERGY
CAUTION  SECNO=*********  PROFILE= 1  20 TRIALS ATTEMPTED TO BALANCE WSEL
CAUTION  SECNO=*********  PROFILE= 4  CRITICAL DEPTH ASSUMED
CAUTION  SECNO=*********  PROFILE= 4  PROBABLE MINIMUM SPECIFIC ENERGY
CAUTION  SECNO=*********  PROFILE= 4  20 TRIALS ATTEMPTED TO BALANCE WSEL
```

ATTACHMENT 7.6

ADDITIONAL SCOUR ANALYSIS

7.6 ADDITIONAL SCOUR ANALYSIS

Purpose

The purpose of this attachment is to provide additional scour analysis information on general bottom scour for the steep channel, with hardened sides and local scour at channel obstacles.

Channel Bottom Scour for Steep Slope and Side Bank Protection

According to the FHA manual (Ref. 1) and other sources, this type of scour is difficult to evaluate since very little data is available on the subject. If side slopes are protected and channel bottom control structures are utilized, it is apparent that bottom materials will be entrained and transported out of the reach of rivers under consideration. Thus there is a need to determine how deep below the proposed channel invert such structures as bank protection should extend in order to be safe from undercutting and possible destruction.

The FHA manual presents a recommended formula based upon data obtained by the Corps of Engineers as follows:

$$Y_s = 4\ Y\ F^{0.33}$$

where Y_s equals the scour depth, Y equals the unmodified flow depth, and F equals the Froude No. Because of armoring, this equation may be reduced by as much as 50 percent (FHA manual).

The above equation may be approximately solved by assuming that a Froude No. of 0.18 may ultimately be established for an assumed design discharge of 91,000 cfs. For the proposed channel geometry, these numbers yield a depth of about 19 feet which means that the scour depth would be about 9 feet. Entering a Froude No. of 0.18 and a depth of 10 feet into the above equation (and reducing the result by 50 percent as is recommended) yields a scour depth of about 11 feet. This means that the original assumption of a Froude No. of 0.18 was a little off. Without going through further trial-and-error efforts, assume a scour depth of 10 feet. I would recommend that structures such as side slope protection and channel drop structures be protected to a depth of 15 feet which should insure their safety.

Local Scour at Electric Tower Supports - Steep Slope

Assume tower supports are circular in shape, constructed of sheet piling or cassons, 70 feet in diameter. While other shapes may be preferable to streamline flows, they are not recommended because of the possiblilty flows may be skewed. A skewed flow could approach the structure at an angle and local scour conditions would be worse than for a circular structure.

Very little information is available on such structures. Although there is a great deal of information on piers, there is virtually no information on large diameter structures. As indicated in my previous memorandom, very little general scour is anticipated; however for the steep slope alternatives there may be some channel bottom bed material movement as was estimated above. Local scour may be approximated by using an emperical formula that is widely used to compute local scour at obstruction to flow caused by structures perpendicular and attached to channel banks (such as a groin). This formula, given in the FHA manual, is

$$\frac{y_s}{y_1} = 1.1 \left(\frac{a}{y_1}\right)^{0.40} F_1^{0.33}$$

where y_s is the scour depth, y_1 is the undisturbed flow depth, "a" is a characteristic length (such as length of obstruction) and F_1 is the undisturbed Froude No. From the previous HEC2 computer analysis y_1 and F_1 are on the average about 9.4 feet and 0.53, respectively. Using these parameters in the above formula yields an equilibrium scour of

$$y_s = 14.2 \text{ feet}$$

which assumes "a" equal 35 feet (one half of the diameter of the proposed cassons). That is, it is assumed that two horseshoe shaped vortecies will develop on the downstream side of the casson. Instantaneous scour may be 1.3 times as great as the equilibrium local scour (FHA manual) and hence

$$y_s = 18.4 \text{ Feet}$$

Consequently, assume scour depth of 20 feet below the designed invert.

General and Local Scour - Flat Slope

The HEC2 model simulations for 91,000 cfs for the flat slope alternative (slope equal 0.0002), indicates a depth of about 10.5 feet and a velocity of about 8.7 fps at the proposed McDowell Road bridge. This results in a Froude No. of about 0.47. Immediately upstream from the bridge depths are slightly deeper and velocities are slightly less. Similar to my previous analysis, assume a skew to the flow such that the flowage way under the bridge is obstructed.

Thus

$$\frac{y_2}{y_1} = \left(\frac{b_1}{b_2}\right)^{0.64}$$

where y_2 is depth at bridge, b_2 is flow width at bridge and the subscript 1 refers to above bridge. Assume a 25 percent reduction in flow; therefore

$$y_2 = (10.5)(1.25)^{0.64} = 12.1 \text{ feet}$$

Thus general scour from a partial bridge constriction is

$$y_s = 12.1 - 10.5 = 1.6 \text{ feet}$$

about the same as the previous analysis for a steep slope.

Again similar to my previous memorandum, equilibrium local scour is evaluated by

$$y_s = 2.0\, y_1 \left(\frac{a}{y_1}\right)^{0.65} F_1^{\;0.43}$$

where y_s is the scour, y_1 the upstream water depth, F_1 the upstream Froude No. and "a" is the pier diameter. Thus

$$y_s = 2.0(10.5)\left(\frac{5}{10.5}\right)^{0.65} (.47)^{0.43} = 9.37 \text{ feet}$$

slightly less than previously estimated for the steeper slope. Accounting for instantaneous scour, pier grouping, and the possibility of flow skew results is a scour depth estimate of

$$y_s = 16.45 \text{ feet}$$

somewhat less than previously estimated for the steeper slope.

Total scour is the sum of the two or 18.1 feet. Thus, assume a scour of 20 feet which has a safety factor of about 1.8.

Local Scour at Electric Tower Supports - Flat Slope

Making the same assumption as made above for the steeper sloped channel, the same formula is used as before. In the vicinity of the towers the HEC2 model indicates depths of flow are about 8.9 feet and velocities are about 9.6 fps for a discharge of 91,000 cfs. Using these variables in the formula

$$y_s = (8.9)(1.1)\left(\frac{35}{8.9}\right)^{0.40} (0.57)^{0.33} = 14.0 \text{ feet}$$

which is about the same equilibrium local scour as calculated for the steep slope. Instantaneous local scour will therefore be about 18.3 feet. Consequently, assume a scour depth of about 20 feet.

General Channel Stability and Scour - Flat Slope

A similar analysis can be made as was done for the steep slope option. Making the same assumptions as before approximately 15 feet of localized scour should be allowed for at drop structures or near bank protection.

The presence of drop structures will prevent a general scouring of bed materials; however, localized scour is still a possibility. Because of significant drawdown curve effects, velocities are high in many sections of the channel profile (HEC2 studies). As a result some form of bank protection will be required throughout much of the reach under study. With adequate bank protection, the channel will remain stable.

TECHNICAL REFERENCES

1. FHA, U.S. Department of Transportation, (1975), Highways in the River Environment, Hydraulic and Environmental Design Considerations.

2. Leopold, Bagnold, Wolman and Brush, (1960), Flow Resistance in Sinuous or Irregular Channels, Geological Survey Prof. Paper 282-D.

3. Culbertson, Young and Brice, (1967), Scour Fill in Alluvial Channels with Particular Reference to Bridge Sites, U.S. Geological Survey, Open-file report.

4. Henderson, (1966), Open Channel Flow, Macmillan.

5. Leopold, Wolman and Miller, (1964), Fluvial Processes in Geomorphology, Freedman and Co.

GEOTECHNICAL INVESTIGATION REPORT

APPENDIX 2

SERGENT, HAUSKINS & BECKWITH

GEOTECHNICAL INVESTIGATION REPORT

Channelization - Agua Fria River

Thomas Road & I-10

Maricopa County, Arizona

SHB Job No. E82-49

Consulting Geotechnical Engineers

PHOENIX • ALBUQUERQUE • SANTA FE • SALT LAKE CITY

SERGENT, HAUSKINS & BECKWITH CONSULTING GEOTECHNICAL ENGINEERS

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RALPH E. WEEKS, P.G.

June 8, 1982

Dibble & Associates
Consulting Engineers
3625 North 16th Street
Phoenix, Arizona 85016

SHB Job No. E82-49

Attention: Kent M. Dibble, P.E.

Re: Channelization -
Agua Fria River
Thomas Road & I-10
Maricopa County, Arizona

Gentlemen,

Our Geotechnical Investigation Report on the referenced project is herewith submitted. The report includes results of test drilling, laboratory analysis and recommended criteria for channel embankment design and earthwork elements of the project.

Should any questions arise concerning this report, we would be pleased to discuss them with you.

Respectfully submitted,
Sergent, Hauskins & Beckwith Engineers

By Norman H. Wetz
Norman H. Wetz, P.E.

Reviewed by George H. Beckwith
George H. Beckwith, P.E.

Registered Professional Engineer (Civil) CERTIFICATE NO. 5638 GEORGE H. BECKWITH Date Signed 6-8-82 ARIZONA, U.S.A.

Copies: Addressee (5)

REPLY TO: 3940 W. CLARENDON, PHOENIX, ARIZONA 85019

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SHB Job No. E82-49

Channelization -
Agua Fria River
Thomas Road & I-10
Maricopa County, Arizona
SHB Job No. E82-49

1. INTRODUCTION

This report is submitted pursuant to a geotechnical investigation made by this firm of the site of the proposed channelization of the Agua Fria River between Thomas Road and I-10 located in Maricopa County, Arizona. The object of this investigation was to evaluate the physical properties of the subsoils underlying the site to provide recommendations for the design of channel embankments and other earthwork elements of the project.

2. PROJECT DESCRIPTION

Preliminary details of the proposed construction were provided by Kent M. Dibble, P.E., of Dibble & Associates Consulting Engineers.

The proposed channel will have a bottom width of approximately 1,100 feet and a depth of 12 feet. The inside slopes of the proposed embankment are anticipated to be approximately 3:1 (horizontal to vertical) and outside slopes of 2:1 on the west bank and 6:1 on the east bank. The anticipated crest width of the embankments will be 16 feet. It is understood that cuts of 3 to 9 feet will be involved below existing grade. It is anticipated that erosion protection measures will be needed to resist water velocities of approximately 8 to 9 feet per second.

Should details involved in final design vary significantly from those as outlined, this firm should be notified for review and possible revision of recommendations.

3. INVESTIGATION

3.1 Subsurface Exploration

Fourteen exploratory borings were drilled to depths of 7½ to 26 feet below existing grade. Standard penetration testing and open-end drive sampling were performed at selected intervals in the borings. The results of the field investigation are presented in Appendix A, which includes a brief description of drilling and sampling equipment and procedures, a site plan showing the boring locations and logs of the test borings. The field investigation was supervised by Michael R. Hulpke, staff engineering geologist, of this firm.

3.2 Laboratory Analysis

Moisture content determinations were made on selected tube samples recovered, while dry densities were determined for selected 2.42 inch diameter open-end drive samples. The results of these tests are shown on the boring logs.

Grain-size analysis, Atterberg Limits, direct shear, moisture-density relationship and permeability tests

were performed on selected samples. The results of these tests are presented in Appendix B, along with a brief description of testing procedures.

4. SITE CONDITIONS & GEOTECHNICAL PROFILE

4.1 Site Conditions

The proposed channel will extend through the Agua Fria channel with the center portion being located in cultivated fields that have a grain crop. A majority of the existing river channel is void of vegetative cover.

4.2 Geotechnical Profile

Sandy silts and silty sands extend from the surface to depths of about 1½ to 8 feet below existing grade. These soils are generally moderately firm to firm. This stratum is not present in the borings in the existing Agua Fria River channel, including borings 1, 9, 10 and 14. Relatively clean sands with varying amounts of silt and gravel underlie the surface stratum and extended the full depths of the borings. The relative density of these soils varies from loose to dense with the majority being medium dense.

4.3 Soil Moisture & Groundwater Conditions

No free groundwater was encountered in the borings and soil moisture contents were relatively low throughout their extent.

5. DISCUSSION & RECOMMENDATIONS

5.1 Analysis of Results

With the present alignment and proposed cut grades, it appears that the majority of the soils in both the cut areas and embankments will consist of relatively clean sands with varying fractions of silt and gravel. The recommendations and analysis were based on the use of on-site materials being utilized in the fill slopes and the exposure of native soils in the bottom of the channel. Recommendations for embankment slopes, erosion protection measures, and guide specifications for site grading are given in the following sections of this report.

5.2 Embankment Slopes

The stability of embankments were analyzed utilizing methods outlined by Hoek and Bray (1)*. Two cases were analyzed, one where the slopes would be entirely dry, which would apply to the slopes a majority of the time, and the case during high flows when embankments would be partially saturated.

Factors of safety of approximately 1.6 for dry conditions and 0.84 for partially saturated conditions were

*Numbers in parentheses correspond to references listed at end of report.

calculated for 2:1 slopes. Factors of safety of 2.5 for dry conditions and 1.2 for saturated conditions were calculated for 3:1 slopes. Thus, it is recommended that slopes be no steeper than 3:1 for both interior and exterior slopes of the embankment constructed of native materials. If soil-cement is chosen as an erosion protection measure, the treated slopes could be steepened. This is discussed in Section 5.3.

5.3 Erosion Protection

Two alternatives for erosion protection, riprap or soil-cement, are recommended for consideration in the following sections.

5.3.1 Riprap

In order to stabilize the inside slopes of the channel, rock lining was analyzed utilizing methods outlined by Stephenson (2). Assuming an average flow velocity of 8 to 9 feet per second, a rock lining consisting of 6 inch diameter rock with a thickness of 12 inches was determined. Where higher flows occur, it may be necessary to increase the size of the rock and the thickness. The rock lining could be placed loose or be placed in wire baskets in the form of Gabion or Reno mattresses. For estimation purposes, it should be assumed that an 18 inch thickness would be necessary for rock lining and a 12 inch thickness would be necessary for the hand-placed Gabion or Reno

mattresses. The use of the Reno mattresses improves the stability of the rock-fill against scouring or rolling down the banks, thus, reducing maintenance. Filter fabric is recommended to be placed between the embankment soils and the rock riprap.

5.3.2 Soil-Cement

Soil-cement is recommended as an alternative for erosion protection on the inside slopes of the channel. Two types of construction could be utilized for lining the channel slope. The embankments could be built of native material and the upper 12 inches of soil on the inside slopes would be soil-cement. This would require a slope of 4:1, or flatter, to facilitate proper construction of soil-cement. The other method would consist of constructing an embankment in 6 to 8 inch lifts with the inside width of 6 feet consisting of soil-cement. Inside slopes for this type of construction could be steepened to 1:1. The soil-cement would greatly enhance the engineering properties of the native soils and would allow a safe slope at 1:1.

For estimation purposes, the cement contact of soil-cement should be 12 percent. Exact cement content should be determined in accordance with ASTM D558, D559 and D560 from the on-site soils to be used for soil-cement treatment. Shrinkage cracks and some maintenance should be expected with the use of soil-cement.

5.4 Site Grading & Earthwork Recommendations

5.4.1 Surface Preparation

All vegetation, debris and any existing man-made fill should be removed from the areas to receive structural fill.

The upper 6 inches of exposed native soils beneath cut surfaces in the areas where structural fill is to be placed should be scarified, brought to within 2 percent of the optimum moisture content and compacted to at least 95 percent of maximum dry density as determined by ASTM D698.

5.4.2 Structural Fill

All structural fill required to bring the embankments to required elevations should be free of excessive vegetation, debris and deleterious material, and contain no particles larger than 6 inches in diameter. This material should contain at least 50 percent or more sand and gravel by weight (no more than 50 percent by weight should pass the no. 200 sieve). It should have a plasticity index of no more than 6 when tested by ASTM D423 and D424.

All structural fill should be compacted to a minimum of 95 percent of maximum dry density determined in accordance with ASTM D698. This would apply for

soil-cement as well as the structural fill. Moisture content during compaction shall be maintained within the limits of 1 percent below to 3 percent above optimum moisture content.

REFERENCES

1. Hoek E. and Bray, J.W., "Rock Slope Engineering", The Gresham Press, London, U.K., Revised 3rd Edition, 1981.

2. Stephenson, David, "Rockfill In Hydraulic Engineering", Developments In Geotechnical Engineering, Volume 27, Elsevier Scientific Publishing Co., 1979.

GEOTECHNICAL INVESTIGATION REPORT

APPENDIX A

TEST DRILLING EQUIPMENT & PROCEDURES

Drilling Equipment Truck-mounted CME-55 drill rigs powered with 4 or 6 cylinder Ford industrial engines are used in advancing test borings. The 4 cylinder and 6 cylinder engines are capable of delivering about 4,350 and 6,500 foot/pounds torque to the drill spindle, respectively. The spindle is advanced with twin hydraulic rams capable of exerting 12,000 pounds downward force. Drilling through soil or softer rock is performed with 6 1/2 O.D., 3 1/4 I.D. hollow stem auger or 4 1/2 inch continuous flight auger. Carbide insert teeth are normally used on the auger bits so they can often penetrate rock or very strongly cemented soils which require blasting or very heavy equipment for excavation. Where refusal is experienced in auger drilling, the holes are sometimes advanced with tricone gear bits and NX rods using water or air as a drilling fluid.

Sampling Procedures Dynamically driven tube samples are usually obtained at selected intervals in the borings by the ASTM D1586 procedure. In many cases, 2" O.D., 1 3/8" I.D. samplers are used to obtain the standard penetration resistance. "Undisturbed" samples of firmer soils are often obtained with 3" O.D. samplers lined with 2.42" I.D. brass rings. The driving energy is generally recorded as the number of blows of a 140 pound 30 inch free fall drop hammer required to advance the samplers in 6 inch increments. However, in stratified soils, driving resistance is sometimes recorded in 2 or 3 inch increments so that soil changes and the presence of scattered gravel or cemented layers can be readily detected and the realistic penetration values obtained for consideration in design. These values are expressed in blows per foot on the logs. "Undisturbed" sampling of softer soils is sometimes performed with thin walled Shelby tubes (ASTM D1587). Where samples of rock are required, they are obtained by NX diamond core drilling (ASTM D2113). Tube samples are labeled and placed in watertight containers to maintain field moisture contents for testing. When necessary for testing, larger bulk samples are taken from auger cuttings.

Continuous Penetration Tests Continuous penetration tests are performed by driving a 2" O.D. blunt nosed penetrometer adjacent to or in the bottom of borings. The penetrometer is attached to 1 5/8" O.D. drill rods to provide clearance to minimize side friction so that penetration values are as nearly as possible a measure of end resistance. Penetration values are recorded as the number of blows of a 140 pound 30 inch free fall drop hammer required to advance the penetrometer in one foot increments or less.

Boring Records Drilling operations are directed by our field engineer or geologist who examines soil recovery and prepares boring logs. Soils are visually classified in accordance with the Unified Soil Classification System (ASTM D2487) with appropriate group symbols being shown on the logs.

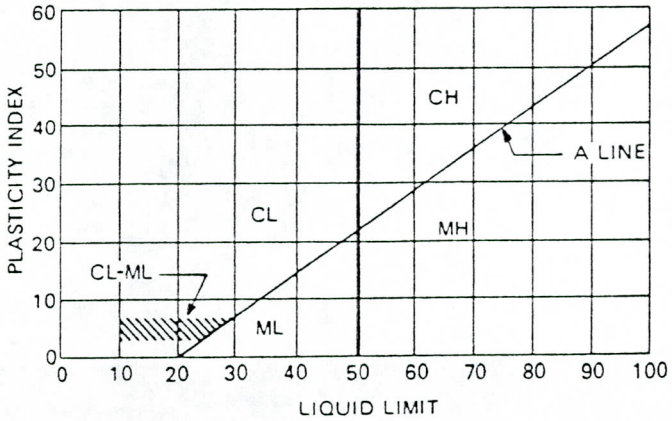
UNIFIED SOIL CLASSIFICATION SYSTEM

Soils are visually classified by the Unified Soil Classification system on the boring logs presented in this report. Grain-size analysis and Atterberg Limits Tests are often performed on selected samples to aid in classification. The classification system is briefly outlined on this chart. For a more detailed description of the system, see "The Unified Soil Classification System" Corp of Engineers, US Army Technical Memorandum No. 3-357 (Revised April 1960) or ASTM Designation: D2487-66T.

MAJOR DIVISIONS				GRAPHIC SYMBOL	GROUP SYMBOL	TYPICAL NAMES
COARSE-GRAINED SOILS (Less than 50% passes No. 200 sieve)	GRAVELS (50% or less of coarse fraction passes No. 4 sieve)	CLEAN GRAVELS (Less than 5% passes No. 200 sieve)			GW	Well graded gravels, gravel-sand mixtures, or sand-gravel-cobble mixtures.
					GP	Poorly graded gravels, gravel-sand mixtures, or sand-gravel-cobble mixtures.
		GRAVELS WITH FINES (More than 12% passes No. 200 sieve)	Limits plot below "A" line & hatched zone on plasticity chart		GM	Silty gravels, gravel-sand-silt mixtures.
			Limits plot above "A" line & hatched zone on plasticity chart		GC	Clayey gravels, gravel-sand-clay mixtures.
	SANDS (More than 50% of coarse fraction passes No. 4 sieve)	CLEAN SANDS (Less than 5% passes No. 200 seive)			SW	Well graded sands, gravelly sands.
					SP	Poorly graded sands, gravelly sands.
		SANDS WITH FINES (More than 12% passes No. 200 sieve)	Limits plot below "A" line & hatched zone on plasticity chart		SM	Silty sands, sand-silt mixtures.
			Limits plot above "A" line & hatched zone on plasticity chart		SC	Clayey sands, sand-clay mixtures.
FINE-GRAINED SOILS (50% or more passes No. 200 sieve)	SILTS (LIMITS PLOT BELOW "A" LINE & HATCHED ZONE ON PLASTICITY CHART)	SILTS OF LOW PLASTICITY (Liquid Limit Less Than 50)			ML	Inorganic silts, clayey silts with slight plasticity.
		SILTS OF HIGH PLASTICITY (Liquid Limit More Than 50)			MH	Inorganic silts, micaceous or diatomaceous silty soils, elastic silts.
	CLAYS (LIMITS PLOT ABOVE "A" LINE & HATCHED ZONE ON PLASTICITY CHART)	CLAYS OF LOW PLASTICITY (Liquid Limit Less Than 50)			CL	Inorganic clays of low to medium plasticity, gravelly clays, sandy clays, silty clays, lean clays.
		CLAYS OF HIGH PLASTICITY (Liquid Limit More Than 50)			CH	Inorganic clays of high plasticity, fat clays, sandy clays of high plasticity.

NOTE: Coarse grained soils with between 5% & 12% passing the No. 200 sieve and fine grained soils with limits plotting in the hatched zone on the plasticity chart to have double symbol.

PLASTICITY CHART



DEFINITIONS OF SOIL FRACTIONS

SOIL COMPONENT	PARTICLE SIZE RANGE
Cobbles	Above 3 in.
Gravel	3 in. to No. 4 sieve
Coarse gravel	3 in. to ¾ in.
Fine gravel	¾ in. to No. 4 sieve
Sand	No. 4 to No. 200
Coarse	No. 4 to No. 10
Medium	No. 10 to No. 40
Fine	No. 40 to No. 200
Fines (silt or clay)	Below No. 200 sieve

TERMINOLOGY USED TO DESCRIBE THE RELATIVE DENSITY, CONSISTENCY OR FIRMNESS OF SOILS

The terminology used on the boring logs to describe the relative density, consistency or firmness of soils relative to the standard penetration resistance is presented below. The standard penetration resistance (N) in blows per foot is obtained by the ASTM D1586 procedure using 2" O.D., 1 3/8" I.D. samplers.

1. Relative Density. Terms for description of relative density of cohesionless, uncemented sands and sand-gravel mixtures.

N	Relative Density
0-4	Very loose
5-10	Loose
11-30	Medium dense
31-50	Dense
50+	Very dense

2. Relative Consistency. Terms for description of clays which are saturated or near saturation.

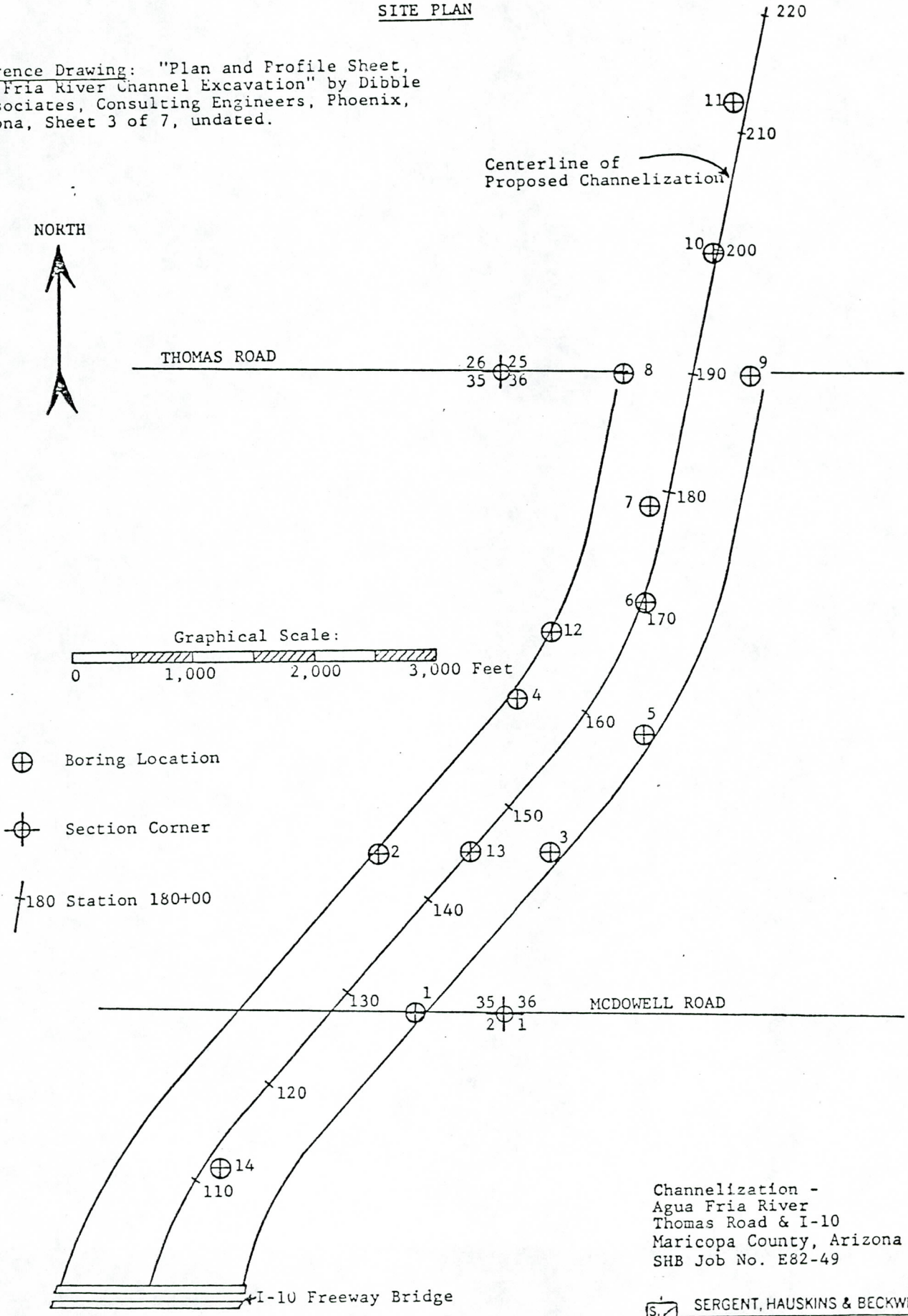
N	Relative Consistency	Remarks
0-2	Very soft	Easily penetrated several inches with fist.
3-4	Soft	Easily penetrated several inches with thumb.
5-8	Medium stiff	Can be penetrated several inches with thumb with moderate effort.
9-15	Stiff	Readily indented with thumb, but penetrated only with great effort.
16-30	Very stiff	Readily indented with thumbnail.
30+	Hard	Indented only with difficulty by thumbnail.

3. Relative Firmness. Terms for description of partially saturated and/or cemented soils which commonly occur in the Southwest including clays, cemented granular materials, silts and silty and clayey granular soils.

N	Relative Firmness
0-4	Very soft
5-8	Soft
9-15	Moderately firm
16-30	Firm
31-50	Very firm
50+	Hard

SITE PLAN

Reference Drawing: "Plan and Profile Sheet, Agua Fria River Channel Excavation" by Dibble & Associates, Consulting Engineers, Phoenix, Arizona, Sheet 3 of 7, undated.



Channelization -
Agua Fria River
Thomas Road & I-10
Maricopa County, Arizona
SHB Job No. E82-49

SERGENT, HAUSKINS & BECKWITH
CONSULTING GEOTECHNICAL ENGINEERS
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PROJECT Channelization - Agua Fria River

JOB NO. E82-49 DATE 4-30-82

LOG OF TEST BORING NO. 1

RIG TYPE CME-55

BORING TYPE 6½" Hollow Stem Auger

SURFACE ELEV.

DATUM

Depth in Feet	Continuous Penetration Resistance	Graphical Log	Sample	Sample Type	Blows per foot 140 lb. 30" free-fall drop hammer	Dry Density Lbs. per cu. ft.	Moisture Content Per Cent of Dry Wt.	Unified Soil Classification	REMARKS	VISUAL CLASSIFICATION
0			X	S	14				moist	SAND, some silt & gravel, predominantly fine to medium, nonplastic, brown
			X	S	9			SP-SM	medium dense to loose	
5			X	S	19					
10			X	S	17			SM	slightly moist to moist medium dense	SILTY SAND, some gravel, traces of clay, nonplastic to low plasticity, brown
15			X	S	42			SW-SM	moist dense	SAND, some silt & gravel, well graded, nonplastic, brown
20										Stopped auger at 14'6" Stopped sampler at 16'

GROUND WATER

DEPTH	HOUR	DATE
	none	

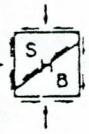
SAMPLE TYPE

A – Auger cuttings. B – Block sample

S – 2" O.D. 1.38" I.D. tube sample.

U – 3" O.D. 2.42" I.D. tube sample.

T – 3" O.D. thin-walled Shelby tube.



A-5

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JOB NO. E82-49 DATE 4-29-82

LOG OF TEST BORING NO. 2

RIG TYPE CME-55

BORING TYPE 6½" Hollow Stem Auger

SURFACE ELEV.

DATUM

Depth in Feet	Continuous Penetration Resistance	Graphical Log	Sample	Sample Type	Blows per foot 140 lb. 30" free-fall drop hammer	Dry Density Lbs. per cu. ft.	Moisture Content Per Cent of Dry Wt.	Unified Soil Classification	REMARKS	VISUAL CLASSIFICATION
0			X	S	13			ML	moist moderately firm	SANDY SILT, low plasticity to nonplastic, brown
			X	S	18					
5			X	S	15				moist medium dense to very dense	SAND, some silt, trace of gravel, predominantly fine to medium, nonplastic, brown to light brown
								SP		
10			X	S	17					
15				U	100/8" (no recovery)					
20										Stopped auger at 14'6" Sampler refused at 15'2"

GROUND WATER

DEPTH	HOUR	DATE
	none	

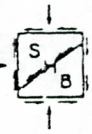
SAMPLE TYPE

A – Auger cuttings. B – Block sample

S – 2" O.D. 1.38" I.D. tube sample.

U – 3" O.D. 2.42" I.D. tube sample.

T – 3" O.D. thin-walled Shelby tube.



A-6

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JOB NO. E82-49 DATE 4-29-82

LOG OF TEST BORING NO. 3

RIG TYPE CME-55

BORING TYPE 6½" Hollow Stem Auger

SURFACE ELEV.

DATUM

Depth in Feet	Continuous Penetration Resistance	Graphical Log	Sample	Sample Type	Blows per foot 140 lb. 30" free-fall drop hammer	Dry Density Lbs. per cu. ft.	Moisture Content Per Cent of Dry Wt.	Unified Soil Classification	REMARKS	VISUAL CLASSIFICATION
0			X	S	12			SM	moist medium dense	SILTY SAND, predominantly fine, nonplastic, brown
			X	U	31	93	9			
5			X	S	9			SP	moist dense to loose	SAND, some silt & gravel, predominantly fine to medium, nonplastic, brown
10			X	S	23					
15			X	S	27			SW-SM	moist medium dense	SAND, some silt & gravel, nonplastic, brown to reddish-brown
20										Stopped auger at 14'6" Stopped sampler at 16'

GROUND WATER

DEPTH	HOUR	DATE
	none	

SAMPLE TYPE

A – Auger cuttings. B – Block sample

S – 2" O.D. 1.38" I.D. tube sample.

U – 3" O.D. 2.42" I.D. tube sample.

T – 3" O.D. thin-walled Shelby tube.

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PROJECT Channelization - Agua Fria River

JOB NO. E82-49 DATE 4-29-82

LOG OF TEST BORING NO. 4

RIG TYPE CME-55

BORING TYPE 6½" Hollow Stem Auger

SURFACE ELEV.

DATUM

Depth in Feet	Continuous Penetration Resistance	Graphical Log	Sample	Sample Type	Blows per foot 140 lb. 30" free-fall drop hammer	Dry Density Lbs. per cu. ft.	Moisture Content Per Cent of Dry Wt.	Unified Soil Classification	REMARKS	VISUAL CLASSIFICATION
0			X	S	16			ML	moist firm	SANDY SILT, low plasticity to nonplastic, brown
			X	S	11			SP-SM	moist medium dense	SAND, some silt, predominantly fine to medium, nonplastic, brown
5			X	S	14					
								SW-SM	moist medium dense	SAND, considerable gravel, some silt, well graded, nonplastic, brown
10			X	S	12		6			
								SP-SM	moist medium dense	SAND, some silt & gravel, predominantly fine to medium, nonplastic, reddish-brown to brown
15			X	S	23		7			
20										Stopped auger at 14'6" Stopped sampler at 16'

GROUND WATER

DEPTH	HOUR	DATE
	none	

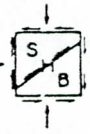
SAMPLE TYPE

A – Auger cuttings. B – Block sample

S – 2" O.D. 1.38" I.D. tube sample.

U – 3" O.D. 2.42" I.D. tube sample.

T – 3" O.D. thin-walled Shelby tube.



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JOB NO. E82-49 DATE 4-29-82

LOG OF TEST BORING NO. 5

RIG TYPE CME-55

BORING TYPE 6½" Hollow Stem Auger

SURFACE ELEV.

DATUM

Depth in Feet	Continuous Penetration Resistance	Graphical Log	Sample	Sample Type	Blows per foot 140 lb. 30" free-fall drop hammer	Dry Density Lbs. per cu. ft.	Moisture Content Per Cent of Dry Wt.	Unified Soil Classification	REMARKS	VISUAL CLASSIFICATION
0			X	S	14			ML	dry moderately firm	SANDY SILT, low plasticity to nonplastic, light brown to tan
			X	S	23(no recovery)					
5			X	S	25			SP-SM	slightly moist to moist medium dense	SAND, some to considerable silt, predominantly fine, nonplastic, light brown to tan
10			X	S	26			SW-SM	moist medium dense to dense	SAND, some silt & gravel, well graded, nonplastic, brown
15			X	S	34					
20										Stopped auger at 14'6" Stopped sampler at 16'

GROUND WATER

DEPTH	HOUR	DATE
	none	

SAMPLE TYPE

A – Auger cuttings. B – Block sample

S – 2" O.D. 1.38" I.D. tube sample.

U – 3" O.D. 2.42" I.D. tube sample.

T – 3" O.D. thin-walled Shelby tube.

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JOB NO. E82-49 DATE 4-29-82

LOG OF TEST BORING NO. 6

RIG TYPE CME-55

BORING TYPE 6½" Hollow Stem Auger

SURFACE ELEV.

DATUM

Depth in Feet	Continuous Penetration Resistance	Graphical Log	Sample	Sample Type	Blows per foot 140 lb. 30" free-fall drop hammer	Dry Density Lbs. per cu. ft.	Moisture Content Per Cent of Dry Wt.	Unified Soil Classification	REMARKS	VISUAL CLASSIFICATION
0			X	S	14		13	ML	moist moderately firm	SANDY SILT, nonplastic, dark brown
			X	S	40			SM		
5			X	S	21		6	SP-SM	moist very firm	SILTY SAND, trace of gravel, predominantly fine, low plasticity to nonplastic, brown to dark brown note: some thin sandy silt lenses
10			X	S	13			SW		
								SC	moist medium dense	SAND, considerable silt, predominantly fine, nonplastic, brown to light brown
15			X	S	14					
20									moist medium dense	SAND, some silt & gravel, well graded, nonplastic, brown to light brown
									moist moderately firm	CLAYEY SAND, trace of gravel, predominantly medium, low plasticity to nonplastic, reddish-brown
										Stopped auger at 14'6" Stopped sampler at 16'

GROUND WATER

DEPTH	HOUR	DATE
	none	

SAMPLE TYPE

A – Auger cuttings. B – Block sample

S – 2" O.D. 1.38" I.D. tube sample.

U – 3" O.D. 2.42" I.D. tube sample.

T – 3" O.D. thin-walled Shelby tube.

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JOB NO. E82-49 DATE 4-29-82

LOG OF TEST BORING NO. 7

RIG TYPE CME-55

BORING TYPE 6½" Hollow Stem Auger

SURFACE ELEV.

DATUM

Depth in Feet	Continuous Penetration Resistance	Graphical Log	Sample	Sample Type	Blows per foot 140 lb. 30" free-fall drop hammer	Dry Density Lbs. per cu. ft.	Moisture Content Per Cent of Dry Wt.	Unified Soil Classification	REMARKS	VISUAL CLASSIFICATION
0			X	S	17			SM	dry to moist firm	SILTY SAND, predominantly fine, nonplastic, brown
			X	S	46			ML	moist very firm	SANDY SILT, low plasticity to nonplastic, brown
5			X	S	20			SP	moist medium dense	SAND, some silt, trace of gravel, predominantly fine to medium, nonplastic, light brown
10			X	S	31			SW	moist to very moist dense	SAND, some silt & gravel, well graded, nonplastic, light brown
15			X	S	34					
20										Stopped auger at 14'6" Stopped sampler at 16'

GROUND WATER

DEPTH	HOUR	DATE
	none	

SAMPLE TYPE

A – Auger cuttings. B – Block sample

S – 2" O.D. 1.38" I.D. tube sample.

U – 3" O.D. 2.42" I.D. tube sample.

T – 3" O.D. thin-walled Shelby tube.

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JOB NO. E82-49 DATE 4-29-82

LOG OF TEST BORING NO. 8

RIG TYPE CME-55

BORING TYPE 6½" Hollow Stem Auger

SURFACE ELEV.

DATUM

Depth in Feet	Continuous Penetration Resistance	Graphical Log	Sample	Sample Type	Blows per foot 140 lb. 30" free-fall drop hammer	Dry Density Lbs. per cu. ft.	Moisture Content Per Cent of Dry Wt.	Unified Soil Classification	REMARKS	VISUAL CLASSIFICATION
0			X	S	24			SM	moist firm	SILTY SAND, predominantly fine, nonplastic, brown
			X	S	21		13	ML	moist firm to hard	SANDY SILT, low plasticity to nonplastic, brown
5			X	U	77 (no recovery)					
								SP-SM	moist medium dense	SAND, some silt & gravel, predominantly fine to medium, nonplastic, light brown to brown
10			X	S	19					
								SM-SW	moist very dense	SAND, considerable silt, some gravel, well graded, nonplastic, light brown
15			X	S	40					
20										Stopped auger at 14'6" Stopped sampler at 16'

GROUND WATER

DEPTH	HOUR	DATE
	none	

SAMPLE TYPE

A – Auger cuttings. B – Block sample

S – 2" O.D. 1.38" I.D. tube sample.

U – 3" O.D. 2.42" I.D. tube sample.

T – 3" O.D. thin-walled Shelby tube.

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Channelization -
PROJECT Agua Fria River

JOB NO. E82-49 DATE 4-30-82

LOG OF TEST BORING NO. 9

RIG TYPE CME-55

BORING TYPE 6½" Hollow Stem Auger

SURFACE ELEV.

DATUM

Depth in Feet	Continuous Penetration Resistance	Graphical Log	Sample	Sample Type	Blows per foot 140 lb. 30" free-fall drop hammer	Dry Density Lbs. per cu. ft.	Moisture Content Per Cent of Dry Wt.	Unified Soil Classification	REMARKS	VISUAL CLASSIFICATION
0			X	S	14			SP	slightly moist	SAND, some silt & gravel, predominantly fine to medium, nonplastic, brown
			X	S	9				medium dense to loose	
5			X	S	8			SW	slightly moist	SAND, some silt & gravel, well graded, nonplastic, brown
				S	50/0"				loose to very dense	note: trace of cobbles below 7'
10										Auger refused at 7'6" Sampler refused at 7'6"

GROUND WATER

DEPTH	HOUR	DATE
	none	

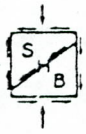
SAMPLE TYPE

A – Auger cuttings. B – Block sample

S – 2" O.D. 1.38" I.D. tube sample.

U – 3" O.D. 2.42" I.D. tube sample.

T – 3" O.D. thin-walled Shelby tube.



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JOB NO. E82-49 DATE 4-30-82

LOG OF TEST BORING NO. 10

RIG TYPE CME-55

BORING TYPE 6½" Hollow Stem Auger

SURFACE ELEV.

DATUM

Depth in Feet	Continuous Penetration Resistance	Graphical Log	Sample	Sample Type	Blows per foot 140 lb. 30" free-fall drop hammer	Dry Density Lbs. per cu. ft.	Moisture Content Per Cent of Dry Wt.	Unified Soil Classification	REMARKS	VISUAL CLASSIFICATION
0			X	S	4				dry to moist	SAND, some fine gravel, trace of silt, predominantly fine to medium, nonplastic, light brown
			X	S	9			SP	very loose to medium dense	
5			X	S	18		3			
									moist to very moist	SAND, considerable silt & gravel, some cobbles, well graded, nonplastic, brown
10				S	50/2"			SW-SM	very dense	
15			X	S	50/2"					
20										Stopped auger at 14'6" Sampler refused at 15'2"

GROUND WATER

DEPTH	HOUR	DATE
	none	

SAMPLE TYPE

A – Auger cuttings. B – Block sample

S – 2" O.D. 1.38" I.D. tube sample.

U – 3" O.D. 2.42" I.D. tube sample.

T – 3" O.D. thin-walled Shelby tube.

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PROJECT Channelization - Agua Fria River

JOB NO. E82-49 DATE 4-30-82

LOG OF TEST BORING NO. 11

RIG TYPE CME-55

BORING TYPE 6½" Hollow Stem Auger

SURFACE ELEV.

DATUM

Depth in Feet	Continuous Penetration Resistance	Graphical Log	Sample	Sample Type	Blows per foot 140 lb. 30" free-fall drop hammer	Dry Density Lbs. per cu. ft.	Moisture Content Per Cent of Dry Wt.	Unified Soil Classification	REMARKS	VISUAL CLASSIFICATION
0			X	S	26				slightly moist	SILTY SAND, predominantly fine, nonplastic, brown
			X	S	12			SM	firm to very firm	
5			X	U	48		8			
10			X	S	20			SP	moist medium dense to dense	SAND, some silt & gravel, predominantly fine to medium, nonplastic, brown
15			X	S	35					
20			X	S	37			SM	moist very firm to hard	SILTY SAND, considerable gravel, trace of clay, well graded, nonplastic to low plasticity, brown
25			X	S	72					
30										Stopped auger at 24'6" Stopped sampler at 26'

GROUND WATER

DEPTH	HOUR	DATE
	none	

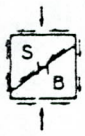
SAMPLE TYPE

A – Auger cuttings. B – Block sample

S – 2" O.D. 1.38" I.D. tube sample.

U – 3" O.D. 2.42" I.D. tube sample.

T – 3" O.D. thin-walled Shelby tube.



A-15

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PROJECT Channelization - Agua Fria River

JOB NO. E82-49 DATE 4-29-82

LOG OF TEST BORING NO. 12

RIG TYPE CME-55

BORING TYPE 6½" Hollow Stem Auger

SURFACE ELEV.

DATUM

Depth in Feet	Continuous Penetration Resistance	Graphical Log	Sample	Sample Type	Blows per foot 140 lb. 30" free-fall drop hammer	Dry Density Lbs. per cu. ft.	Moisture Content Per Cent of Dry Wt.	Unified Soil Classification	REMARKS	VISUAL CLASSIFICATION
0			X	S	12			ML	moist moderately firm	SANDY SILT, low plasticity to nonplastic, brown
			X	U	32	102	8			
5			X	S	12			SP	moist medium dense	SAND, some silt, trace of gravel, predominantly fine, nonplastic, light brown
10			X	S	18			SW	moist medium dense	SAND, some silt & gravel, well graded, nonplastic, brown to light brown
15			X	S	50/5½"			SW-SM	moist very dense	SAND, considerable gravel, some silt, well graded, nonplastic to low plasticity, brown

Stopped auger at 14'6"
Sampler refused at 14'11½"

GROUND WATER

DEPTH	HOUR	DATE
	none	

SAMPLE TYPE

A – Auger cuttings. B – Block sample
S – 2" O.D. 1.38" I.D. tube sample.
U – 3" O.D. 2.42" I.D. tube sample.
T – 3" O.D. thin-walled Shelby tube.

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PROJECT Channelization - Agua Fria River

JOB NO. E82-49 DATE 4-29-82

LOG OF TEST BORING NO. 13

RIG TYPE CME-55

BORING TYPE 6½" Hollow Stem Auger

SURFACE ELEV.

DATUM

Depth in Feet	Continuous Penetration Resistance	Graphical Log	Sample	Sample Type	Blows per foot 140 lb. 30" free-fall drop hammer	Dry Density Lbs. per cu. ft.	Moisture Content Per Cent of Dry Wt.	Unified Soil Classification	REMARKS	VISUAL CLASSIFICATION
0			X	S	16		12	ML	moist to saturated	SANDY SILT, nonplastic, brown
			X	S	7		30		firm	
5			X	S	10		5	SP	very moist to moist loose	SAND, some silt & gravel, predominantly fine to medium, nonplastic, brown to light brown
10			X	S	7		4			
15			X	S	19			SW	moist medium dense	SAND, some gravel, trace of clay, well graded, nonplastic to low plasticity, brown
20										Stopped auger at 14'6" Stopped sampler at 16'

GROUND WATER

DEPTH	HOUR	DATE
	none	

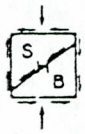
SAMPLE TYPE

A – Auger cuttings. B – Block sample

S – 2" O.D. 1.38" I.D. tube sample.

U – 3" O.D. 2.42" I.D. tube sample.

T – 3" O.D. thin-walled Shelby tube.



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PROJECT Channelization - Agua Fria River

JOB NO. E82-49 DATE 4-30-82

LOG OF TEST BORING NO. 14

RIG TYPE CME-55

BORING TYPE 6½" Hollow Stem Auger

SURFACE ELEV.

DATUM

Depth in Feet	Continuous Penetration Resistance	Graphical Log	Sample	Sample Type	Blows per foot 140 lb. 30" free-fall drop hammer	Dry Density Lbs. per cu. ft.	Moisture Content Per Cent of Dry Wt.	Unified Soil Classification	REMARKS	VISUAL CLASSIFICATION
0			X	S	7				dry to moist	SAND, some silt, predominantly fine to medium, nonplastic, light brown
			X	S	7		21	SP-SM	loose to medium dense	
5			X	S	14					
10			X	S	46			SM	very moist very firm	SILTY SAND, some gravel, trace of clay, predominantly fine to medium, nonplastic to low plasticity, dark brown
15			X	S	41					
20										Stopped auger at 14'6" Stopped sampler at 16'

GROUND WATER

DEPTH	HOUR	DATE
	none	

SAMPLE TYPE

A – Auger cuttings. B – Block sample

S – 2" O.D. 1.38" I.D. tube sample.

U – 3" O.D. 2.42" I.D. tube sample.

T – 3" O.D. thin-walled Shelby tube.

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GEOTECHNICAL INVESTIGATION REPORT

APPENDIX B

LABORATORY TESTING PROCEDURES

Consolidation Tests Soiltest or Clockhouse apparatus of the "floating-ring" type are employed for the one-dimensional consolidation tests. They are designed to receive one inch high 2.5 inch O.D. brass liner rings with soil specimens as secured in the field. Procedures for the tests generally are those outlined in ASTM D2435. Loads are applied in several increments to the upper surface of the test specimen and the resulting deformations are recorded at selected time intervals for each increment. For soils which are essentially saturated, each increment of load is maintained until the deformation versus log of time curve indicates completion of primary consolidation. For partially saturated soils, each increment of load is maintained until the rate of deformation is equal or less than 1/10,000 inch per hour. Applied loads are such that each new increment is equal to the total previously applied loading. Porous stones are placed in contact with the top and bottom of the specimens to permit free addition or expulsion of water. For partially saturated soils, the tests are normally performed at in situ moisture conditions until consolidation is complete under stresses approximately equal to those which will be imposed by the combined overburden and foundation loads. The samples are then submerged to show the effect of moisture increase and the tests continued under higher loadings. Generally, the tests are continued to about twice the anticipated curve due to overburden and structural loads with a rebound curve then being established by releasing loads.

Expansion Tests The same type of consolidometer apparatus described above is used in expansion testing. Undisturbed samples contained in brass liner rings are placed in the consolidometers, subjected to appropriate surcharge loads and submerged. The loads are maintained until the expansion versus log of time curve indicates the completion of "primary swell".

Direct Shear Tests Direct shear tests are run using a Clockhouse or Soiltest apparatus of the strain-control of approximately 0.05 inches per minute. The machine is designed to receive one of the one inch high 2.42 inch diameter specimens obtained by tube sampling. Generally, each sample is sheared under a normal load equivalent to the effective overburden pressure at the point of sampling. In some instances, samples are sheared at several normal loads to obtain the cohesion and angle of internal friction. When necessary, samples are saturated and/or consolidated before shearing in order to approximate the anticipated controlling field loading conditions.

TABULATION OF TEST RESULTS

Job No. E82-49

W/O 1

HOLE NO	DEPTH	UNIFIED CLASS	L.L.	P.I.	SIEVE ANALYSIS-ACCUM % PASSING #200	#100	#40	#16	#10	#4	.25"	.375"	.75"	1"	1.5"	2"	LAB NO
4	9.5'-11'	SW-SM	-	NP	6	8	21	54	65	73	74	77	84	87	100		2-49-18
4	14.5'-16'	SP-SM	-	NP	7	8	23	53	64	81	86	92	100				2-49-19
6	0.5'-2'		-	NP													2-49-24
6	4.5'-6'		NA	-	9	19	79	97	98	100							2-49-26
8	2.5'-4'	ML	-	NP	61	79	94	99	99	100							2-49-35
10	4.5'-6'	SP	-	NP	2	4	22	68	84	96	98	100					2-49-43
11	4.5'-5.5'	SM	-	NP	48	65	92	98	99	99	100						2-49-48
13	0.5'-2'	ML	-	NP	56	79	97	99	100								2-49-58
14	2.5'-4'	SP-SM	-	NP	6	13	57	97	99	99	100						2-49-64

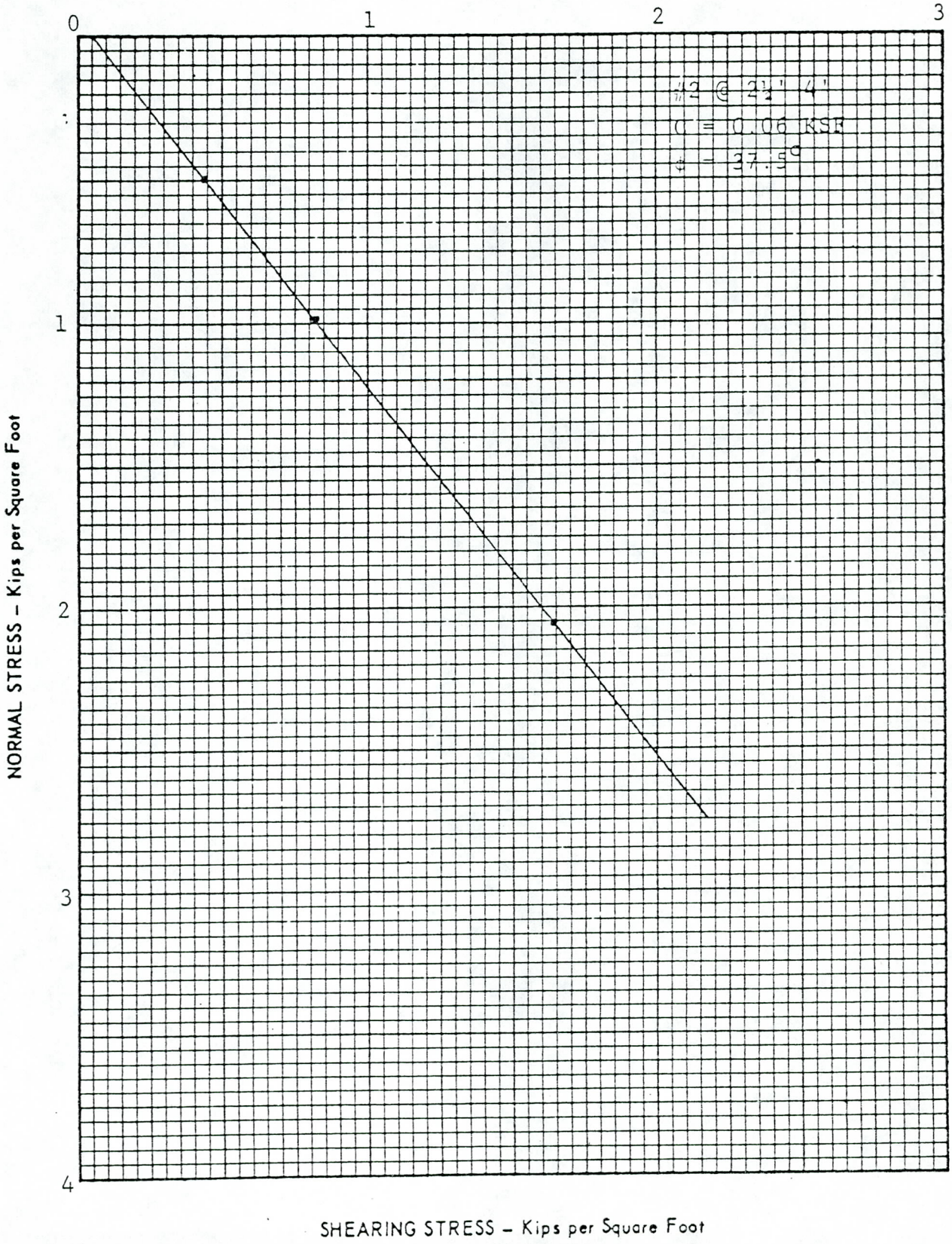
TABULATION OF TEST RESULTS

Job No. E82-49
W/O 2

HOLE NO	DEPTH	UNIFIED CLASS	L.L.	P.I.	SIEVE ANALYSIS-ACCUM % PASSING #200	#100	#40	#16	#10	#4	.25"	.375"	.75"	1"	1.5"	2"	LAB NO
4	1'-2'	SM	-	NP	47	67	88	95	96	97	97	97	97	100			2-49-68
9	1'-2'	SP-SM	-	NP	5	9	36	64	72	81	83	86	92	95	99	100	2-49-69

SUMMARY OF DIRECT SHEAR TESTS

PROJECT Channelization - Agua Fria River JOB NO. E82-49-7



SOIL MOISTURE CONDITION

O – INSITU
● – SUBMERGED

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REPORT ON LABORATORY TESTS

DATE _____

PROJECT Channelization - Agua Fria River JOB NO. E82-49
LOCATION Thomas Road & I-10, Maricopa County, AZ LAB NO. 2-49-7
SAMPLE #2 @ 2½'-4'

DIRECT SHEAR TESTS

IN SITU - POINT NO. 1 (= ± 0.50 KSF)

INITIAL MOISTURE CONTENT	4.3	%
DRY DENSITY (PCF)	100.6	
SUBMERGED		
FINAL MOISTURE CONTENT	19.7	%
MAXIMUM VERTICAL DEFORMATION @ T MAX.	(+).007	INCHES
SHEARING STRESS, T MAX.	0.44	KSF

IN SITU - POINT NO. 2 (= ± 1.00KSF)

INITIAL MOISTURE CONTENT	3.8	%
DRY DENSITY (PCF)	101.9	
SUBMERGED		
FINAL MOISTURE CONTENT	18.9	%
MAXIMUM VERTICAL DEFORMATION @ T MAX.	(+).008	INCHES
SHEARING STRESS, T MAX.	0.81	KSF

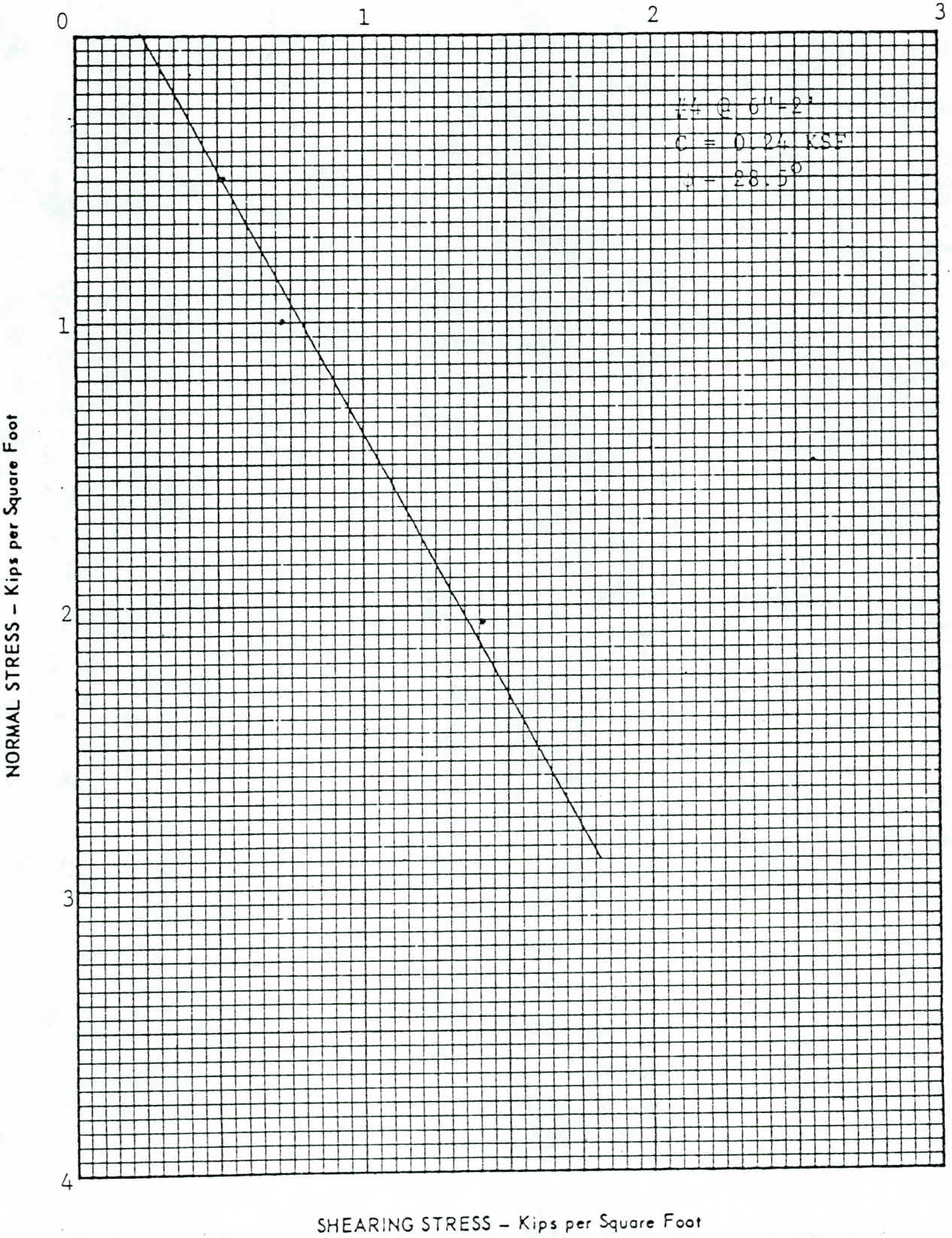
IN SITU - POINT NO. 3 (= ± 2.06 KSF)

INITAL MOISTURE CONTENT	3.6	%
DRY DENSITY (PCF)	101.7	
SUBMERGED		
FINAL MOISTURE CONTENT	19.4	%
MAXIMUM VERTICAL DEFORMATION @ T MAX.	(+).003	INCHES
SHEARING STRESS, T MAX.	1.64	KSF

REMOLDED TO Est. 95 % OF Max. γ Dry

SUMMARY OF DIRECT SHEAR TESTS

PROJECT Channelization - Agua Fria River **JOB NO.** E82-49-15



SOIL MOISTURE CONDITION

o – INSITU
● – SUBMERGED

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REPORT ON LABORATORY TESTS

DATE _____

PROJECT Channelization - Agua Fria River JOB NO. E82-49
LOCATION Thomas Road & I-10, Maricopa County, AZ LAB NO. 2-49-15
SAMPLE #4 @ 6"-2' W/O No. 1

DIRECT SHEAR TESTS

IN SITU - POINT No. 1 (= ± 0.50 KSF)

INITIAL MOISTURE CONTENT	8.2	%
DRY DENSITY (PCF)	110.6	
SUBMERGED		
FINAL MOISTURE CONTENT	17.9	%
MAXIMUM VERTICAL DEFORMATION @ T MAX.	(+).001	INCHES
SHEARING STRESS, T MAX.	0.51	KSF

IN SITU - POINT No. 2 (= ± 1.00 KSF)

INITIAL MOISTURE CONTENT	7.8	%
DRY DENSITY (PCF)	108.5	
SUBMERGED		
FINAL MOISTURE CONTENT	17.5	%
MAXIMUM VERTICAL DEFORMATION @ T MAX.	( ).000	INCHES
SHEARING STRESS, T MAX.	0.72	KSF

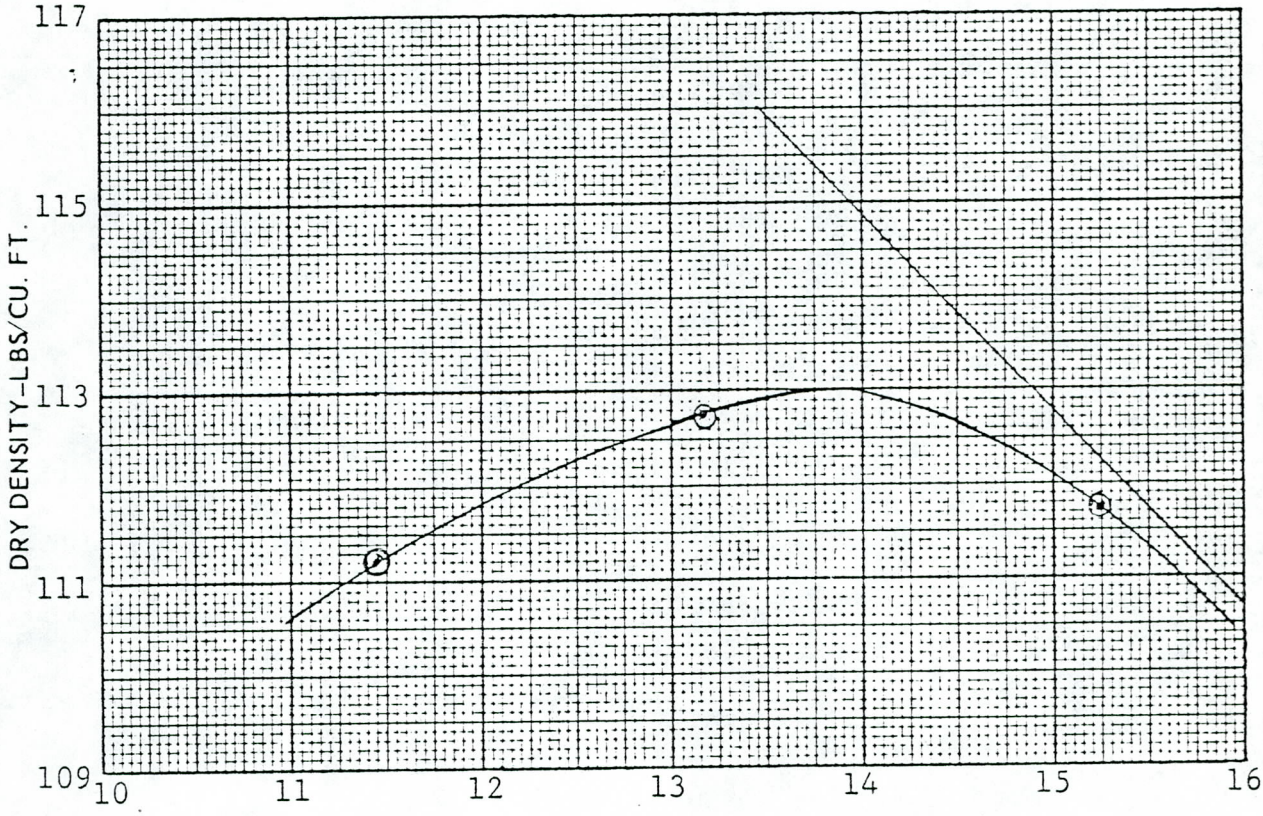
IN SITU - POINT No. 3 (= ± 2.06 KSF)

INITAL MOISTURE CONTENT	7.8	%
DRY DENSITY (PCF)	110.5	
SUBMERGED		
FINAL MOISTURE CONTENT	17.3	%
MAXIMUM VERTICAL DEFORMATION @ T MAX.	( ).000	INCHES
SHEARING STRESS, T MAX.	1.41	KSF

REMOLDED TO Est. 95 % OF Max. γ Dry

SUMMARY OF MOISTURE DENSITY RELATIONSHIP TESTS

PROJECT Channelization - Agua Fria River JOB NO. E82-49



CURVE	SOURCE	OPTIMUM MOISTURE CONTENT % DRY WT.	MAXIMUM DRY DENSITY LBS./CU. FT.	TEST DESIGNATION	TEST METHOD	LAB NO.
A	Boring #4 @ 1'-2'	13.8	113.0	D698	A	2-49-68

MOISTURE-DENSITY RELATIONSHIP TEST METHOD DATA

AASHTO T99 and ASTM D698 (Standard Proctor)

METHOD	MATERIAL	MOLD		NO. OF LAYERS	BLOWS PER LAYER	HAMMER WEIGHT	HEIGHT OF FALL	COMPACTIVE EFFORT FT. LBS/CU. FT.
		DIAMETER	HEIGHT					
A	-#4	4"	4.58"	3	25	5.5 LBS.	12"	12,375
B	-#4	6"	4.58"	3	56	5.5 LBS.	12"	12,317
C	-3/4	4"	4.58"	3	25	5.5 LBS.	12"	12,375
D	-3/4	6"	4.58"	3	56	5.5 LBS.	12"	12,317

AASHTO T180 and ASTM D1557 (Modified Proctor)

METHOD	MATERIAL	MOLD		NO. OF LAYERS	BLOWS PER LAYER	HAMMER WEIGHT	HEIGHT OF FALL	COMPACTIVE EFFORT FT. LBS/CU. FT.
		DIAMETER	HEIGHT					
A	-#4	4"	4.58"	5	25	10.0 LBS.	18"	56,250
B	-#4	6"	4.58"	5	56	10.0 LBS.	18"	55,986
C	-3/4	4"	4.58"	5	25	10.0 LBS.	18"	56,250
D	-3/4	6"	4.58"	5	56	10.0 LBS.	18"	55,986

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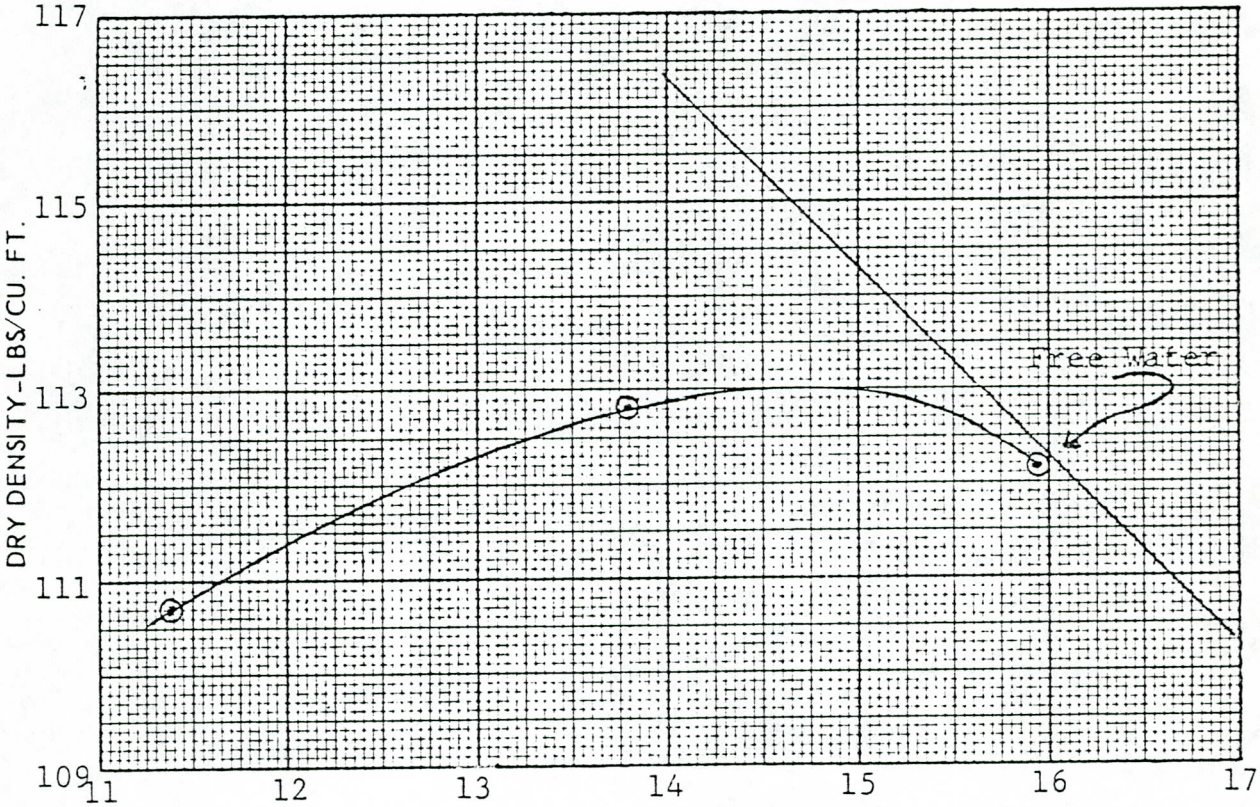
SUMMARY OF MOISTURE DENSITY RELATIONSHIP TESTS

PROJECT Channelization - Agua Fria River JOB NO. E82-49



CURVE	SOURCE	OPTIMUM MOISTURE CONTENT % DRY WT.	MAXIMUM DRY DENSITY LBS/CU. FT.	TEST DESIGNATION	TEST METHOD	LAB NO.
B	Boring #9 @ 1'-2'	14.8	113.0	D698	A	2-49-69

MOISTURE-DENSITY RELATIONSHIP TEST METHOD DATA

AASHTO T99 and ASTM D698 (Standard Proctor)

METHOD	MATERIAL	MOLD		NO. OF LAYERS	BLOWS PER LAYER	HAMMER WEIGHT	HEIGHT OF FALL	COMPACTIVE EFFORT FT. LBS/CU. FT.
		DIAMETER	HEIGHT					
A	-#4	4"	4.58"	3	25	5.5 LBS.	12"	12,375
B	-#4	6"	4.58"	3	56	5.5 LBS.	12"	12,317
C	-3/4	4"	4.58"	3	25	5.5 LBS.	12"	12,375
D	-3/4	6"	4.58"	3	56	5.5 LBS.	12"	12,317

AASHTO T180 and ASTM D1557 (Modified Proctor)

METHOD	MATERIAL	MOLD		NO. OF LAYERS	BLOWS PER LAYER	HAMMER WEIGHT	HEIGHT OF FALL	COMPACTIVE EFFORT FT. LBS/CU. FT.
		DIAMETER	HEIGHT					
A	-#4	4"	4.58"	5	25	10.0 LBS.	18"	56,250
B	-#4	6"	4.58"	5	56	10.0 LBS.	18"	55,986
C	-3/4	4"	4.58"	5	25	10.0 LBS.	18"	56,250
D	-3/4	6"	4.58"	5	56	10.0 LBS.	18"	55,986

REPORT ON LABORATORY TESTS

DATE _____

PROJECT Channelization - Agua Fria River JOB NO. E82-49

LOCATION Thomas Road & I-10; Maricopa County, AZ LAB NO. 2-49-68

PERMEABILITY TEST
(Pressurized Permeameter)

Sample Boring #4 @ 1'-2'

Remolded to Density of 109.4 PCF at 13.0 %

Diameter 4.920 cm Length 5.08 cm Area 19.01 cm^2 Vol. 96.62 cc

W_s 169.4 grms. w_o 13.0 % w_f 16.9 % G_s _____ V_s _____ cc

Void Ratio _____ Dry Density _____ PCF Trials _____ days

Pressure (PSI)	Head (inches)	Q (cc)	Time (min.)	K (cm/sec)	K (ft/yr)	Remarks
F.H.	48.8	52	1080	1.7×10^{-6}	2	Input "Q"
		10	1080	3.3×10^{-7}	0.3	Output "Q"
	47.8	94	2916	1.2×10^{-6}	1.2	Input "Q"
		16	2916	3.3×10^{-7}	0.3	Output "Q"
	46.5	147	6918	8.0×10^{-7}	0.8	Input "Q"
5	185.9	113	1650	6.4×10^{-7}	0.7	Input "Q"
		73	1650	4.2×10^{-7}	0.4	Output "Q"
5	185.7	71	1463	4.6×10^{-7}	0.5	Input "Q"
		46	1463	3.0×10^{-7}	0.3	Output "Q"
5	182.6	56	1474	3.6×10^{-7}	04	Input "Q"
		33	1474	2.0×10^{-7}	0.2	Output "Q"

REPORT ON LABORATORY TESTS

DATE _____

PROJECT Channelization - Agua Fria River JOB NO. E82-49

LOCATION Thomas Road & I-10; Maricopa County, AZ LAB NO. 2-49-69

PERMEABILITY TEST
(Pressurized Permeameter)

Sample Boring #9 @ 1'-2'

Remolded to Density of 108.5 PCF at 14.9 %

Diameter 4.92 cm Length 5.08 cm Area 19.01 cm^2 Vol. 96.62 cc

W_s 168.0 grms. w_o 14.9 % w_f 18.0 % G_s _____ V_s _____ cc

Void Ratio _____ Dry Density _____ PCF Trials _____ days

Pressure (PSI)	Head (inches)	Q (cc)	Time (min.)	K (cm/sec)	K (ft/yr)	Remarks
F.H.	42.5	195	8	1.0×10^{-3}	1040	Input ≠ Output
	42.3	290	26	4.6×10^{-4}	479	
	42.9	265	41	2.6×10^{-4}	273	
	40.1	380	132	1.3×10^{-4}	130	
	43.5	240	135	7.2×10^{-5}	74	
	43.4	280	311	3.6×10^{-5}	38	
	40.6	400	383	4.5×10^{-5}	47	
Constant =	66.0	920	1213	2.0×10^{-5}	21	
	66.0	760	1463	1.4×10^{-5}	15	