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DESIGN AND HYDRAULIC STUDY
FOR
REEMS ROAD BRIDGE
ESTRELLA DEVELOPMENT PROJECT

COE & VAN LOO
CONSULTING ENGINEERS INC
ENGINEERING • PLANNING
4550 NORTH 12TH STREET
PHOENIX, ARIZONA 85014
PHONE (602) 264-6831

80.0-00-2-06/87

DESIGN AND HYDRAULIC STUDY
FOR
REEMS ROAD BRIDGE
ESTRELLA DEVELOPMENT PROJECT

January, 1987
Revised June, 1987

Prepared For:
Amcor Investments Corporation
2735 East Camelback Road
Phoenix, Arizona 85016
(602) 957-7171

Prepared By:
Coe & Van Loo
Consulting Engineers, Inc.
4550 North 12th Street
Phoenix, Arizona 85014
(602) 264-6831

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P.E. COE, P.E. (1915-1977)
H.W. VAN LOO, P.E.

JOHN B. NELSON, P.E., L.S.
RONALD J. MLNARIK, R.L.A.
KELLY HOUSE, P.E.
DAVID L. MAGUIRE, R.L.A.
ASHOK C. PATEL, P.E., L.S.
KARL HIRLINGER, P.E.
RICHARD ALCOCER, L.S.
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E.H. McDONIE, P.E.
JACK LEAVITT, P.E., L.S.

June 12, 1987

City of Goodyear
119 N. Litchfield Road
Goodyear, AZ 85338

Attn: Mr. Glenn Bush, P.E.
Civil Engineer

Re: Reems Road Bridge over Gila River

Dear Mr. Bush:

With this letter, we are submitting four copies of the Final "Design and Hydraulic Study for Reems Road Bridge, Estrella Development Project."

The hydraulic analysis on Gila River was performed utilizing topographic mapping furnished by the Flood Control District of Maricopa County (FCDMC). All work was performed as per Federal Emergency and Management Agency Guidelines.

It should be noted that the Preliminary Report was previously submitted to both the City of Goodyear and the FCDMC, and subsequently approved either verbally or by a letter by these agencies. ??

This submittal incorporates:

1. Some modifications to HEC-2 modeling as recommended by the FCDMC, Goodyear, and Dames and Moore.

2. Reems Road approaches (BT cards) as per the final design.

3. Some modifications to Floodway Limit Line along Vineyard Avenue per input from Cella Barr Associates.

It is recommended that the HEC-2 analysis be reviewed and after its approval be incorporated into the FEMA restudy.

Should you have any questions regarding this submittal, please feel free to call.

Very truly yours,

COE & VAN LOO
Consulting Engineers, Inc.

Ashok C. Patel, P.E. L.S
Senior Vice President

ACP/ls
CVL-2-0117

Enclosures

CC: Doug Plasencia, FCDMC
Jim Farney, ACRED
Larry Tysiac, A-N West

CVL

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Registered Professional Engineer (Civil)
CERTIFICATE NO.
10512
ASHOK C. PATEL
Date Signed 6/12/89
ARIZONA, U.S.A.

LIST OF PLATES

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1	Vicinity Map
2	Area of Study Map
3	Bridge Cross Section
4	Proposed Bridge Configuration
5	HEC-2 Cross Sections
6-7	Spur Dike Cross Sections
8	Backwater Profile
9	Gila River Floodplain Delineation

Registered Professional Engineer (Civil)
CERTIFICATE NO.
10502
ASHOK C.
PATEL
Date Signed 6/12/87
ARIZONA, U.S.A.

SUMMARY OF PERTINENT DATA
REEMS ROAD CROSSING
GILA RIVER

Design Flow (100-year peak)	250,000 CFS
100-year Maximum Water Surface Elevation, Section 377.7	908.7 MSL
Bridge Length, Superstructure	2169.67 Ft.
Number of Spans	18
Pier Span	120.67 Ft.
Pier Type	5-Foot Diameter, Circular Piers
Minimum Low Chord @ Abutments	912.16 MSL
Estimated Maximum Scour with Riprap Blankets:	
Piers	19 Ft.
South Spur Dike	20 Ft.
North Spur Dike	23 Ft.
Recommended Design Scour Depth @ Piers	25 Ft.
Spur Dike Data:	
North U/S Length	300 Ft.
South U/S Length	100 Ft.
North & South D/S Length	100 Ft.
Top of Dikes	912.0 MSL
Recommended Minimum Approach Elevation	
North Approach	910.5 MSL
South Approach	910.25 MSL

1.0 INTRODUCTION

This report is a summary of the hydraulic analysis for the proposed Reems Road Bridge Crossing over the Gila River, a part of the Estrella Improvement Project. This analysis forms the basis for a design of the spur dike & erosion protection at the piers. It also includes detailed backwater analysis of approximately 1.5 miles of Gila River to substantiate that the bridge meets Federal Emergency and Management Guidelines (FEMA).

2.0 DESIGN BACKGROUND

2.1 Background and Design Parameters

In the hydraulic analysis, topographical data flown in 1984 of 1-inch to 400-feet, 4-foot contour intervals was used in conjunction with digitized cross sections furnished by the Maricopa County Flood Control District (MCFCD). This data was used as the basis for the determination of hydraulic cross-sections to analyze backwater depths, velocities, and critical flow under the natural as well as proposed bridge conditions, including the floodway. The bridge was sized such that it's backwater effects in a **floodway condition** would not cause a rise in the natural water surface greater than 1-foot, per (FEMA) Guidelines. The flow was then modeled for both the current natural condition as well as an encroachment condition due to the placement of the bridge and approaches. The resulting U.S. Army Corps of Engineers HEC-2 analysis can be seen as Appendix C. The hydraulic analysis extends about 3/4 of a mile in both the upstream and downstream directions from the proposed site of the bridge.

For the hydraulic analysis, a model of the bridge was based on the design. Bridge overtopping data (as provided on the BT cards) has been

based on the bridge and approach designs. For multiple profile runs with the 500-year flood, appropriate modeling will also be required to check the effect of the canal on the north bank.

2.2 Gila Basin Description

The Gila River upstream of the site extends 450 miles into New Mexico, and encompasses nearly all the southern portion of Arizona. The Salt River, the largest tributary, joins the Gila five miles upstream of the proposed site.

Based upon data taken approximately 21 miles downstream of the subject site (below Gillaspy Dam), the greatest peak discharge of modern record was 178,000 cfs in February of 1980. (Ref. 8). The estimated 100-year event as determined by the U.S. Army Corps of Engineers is 250,000 cfs (Appendix A). This value was used in the determination of design features included in this report.

2.3 Proposed Bridge Crossing

The proposed crossing is located approximately 4900 feet downstream of the existing Bullard Avenue crossing and approximately 5 miles upstream of Tuthill bridge. The Bullard Avenue bridge, constructed in 1982, spans 1808 feet, and was designed for flows of 250,000 cfs for the piers and 200,000 cfs for the abutments. The Tuthill bridge, constructed in 1980, spans 1770 feet, and was designed for a flow of 250,000 cfs.

The proposed bridge will be constructed of precast, prestressed concrete beams designed under AASHTO HS20-44 loading conditions, over dual drilled pier supports. These supports may extend to bedrock, should it be found within an economically feasible distance from the surface. Seventeen pairs of piers are proposed, approximately 120 feet

apart for a total span width of 2169.67 feet (See Plate 4). The piers will be laterally spaced approximately 22 feet apart. A typical cross section can be seen as Plate 3 of this report.

The deck consists of cast-in-place concrete, with a dual lane, 36-foot roadway. A 4-foot pedestrian walkway is proposed, bringing the overall width (including concrete barrier guardrails) to 44-feet.

2.4 Channelization

For this bridge, there is no channelization planned. However, confinement of the Gila River will occur through the diversion of all flows under the bridge. Two pair of upstream and downstream spur dikes will be used for this purpose.

3.0 SCOUR PROTECTION

3.1 Scour Overview

Several methods were used in the determination of depths of scour for both the spur dikes and piers. Primarily based on the method as described in the Federal Highway Administration technical reference manual (Ref. 11), the scour depths were calculated based upon values derived from the HEC-2 analysis, such as depth of flow and velocities. In determining the projected width of the piers, a value of 8-feet, accounting for the proposed 5-foot pier width and 3 feet of debris was used. In the case of the dikes, the projected upstream width was used as a conservative value.

Manning's "n" values used in determining the flow conditions of 0.055, 0.055, and 0.032 for the right overbank, left overbank, and channel, respectively, were selected based on U.S. Soil Conservation Service guidelines and field investigations.

Where possible, velocities and depths of flow closest to the area of concern were used. For example, due to channel configuration, the actual velocities and depths of flow nearest to the spur dikes were significantly different from the maximum or average values derived from the HEC-2 analysis for the section. Thus, values from the HEC-2 flow distribution table were used in the determination of scour depths.

Hydraulic cross-sections seen in Plate 5 were taken from data supplied by the Maricopa County Flood Control District. As the actual location of the bridge (section 377.7) was close to one of the existing cross-sections (section 380) and no discernible modifications to the channel were observed between these two stations it was assumed that the data for to section 380 would be adequate for this analysis. Thus, all data describing sections 377.7 and 376.9 are identical in physical description to section 380 in the HEC-2 analysis.

3.2 Determination of the Depth of Scour → Note: flows are critical.

Total scour was determined from local, general and longterm aggradation/degradation.

3.2.1 Local Scour Around Piers and Toes of Spur Dikes

Local scour is caused by the vortex of water resulting from a pileup of fluid on the upstream edge of the pier or obstruction. Subsequently, the flow accelerates around the nose of the obstruction and achieves velocities sufficient to erode the material within this region. When the sediment transport rate out of the region exceeds the transport rate into the region from upstream sources, a hole develops. As this hole increases in depth, the vortex's strength and thus its ability to transport

sediment out is reduced to the point where equilibrium is re-established and scouring ceases.

In such a dynamic condition as the Gila River, changes in flow direction can be expected. Thus, a circular pier is felt to be the most desirable configuration. The toe of the spur dikes, with their elliptical shapes (as further discussed in Section 4.2), should be oriented in the most direct line paralleling the flow to minimize their projected area and streamline the flow around the structures.

To reduce the depth of scour about both points, an armor layer of riprap is proposed (see Section 3.3). It is anticipated that the placement of riprap bedding about these critical areas could reduce the scour depths by as much as 60%. Local scour was calculated to be 17-feet at the piers, 20- and 27-feet at the top of the left and right upstream dikes respectively. When reduced by 50% due to armoring protection, the values of 9-feet for the piers, and 10-feet and 14-feet for the south and north spur dikes were then used.

3.2.2 General Scour

General scour is expected in the crossing area due to contractions in the flow area as a result of forcing the entire flow of the river under the bridge. This will result in an increase in velocity and shear stress, and hence the water's ability to transport sediment will also be increased, resulting in added scouring effects. With this increase in energy, additional erosion and transportation of bed material is expected. Calculations based on the Federal Highway Administration's

guidelines (Ref. 11) reveal a maximum amount of generalized scour due to the constriction in the flow area to be 8-feet.

This value was calculated based on the theory of conservation of energy. Given a base flow of 250,000 cfs and a known width and depth, this method assumes that for a given reduction in width (in order to maintain energy equilibrium with the section upstream of the constriction), a proportional increase in depth downstream and at the crossing will occur. This method was used as a basis for a qualitative estimate of the maximum theoretical depth due to its inherent assumption that there will be no other losses or conversion of energy, except for that of depth of flow (static water head). This is felt to be a conservative estimate, since some of the energy change due to constriction will also be absorbed in transition losses, increased velocity head, and losses due to turbulence. This value may be overly conservative, as it is reasonable to assume that the river channel will achieve an equilibrium state long before this depth is ever reached, due to natural armoring processes (see 3.2.4) and the natural slope of the river bed. Furthermore, an 8-foot depth in the area near the crossing would imply that the river channel would be forced into an adverse slope condition for a considerable length downstream.

With these parameters and the maximum theoretical value obtained, it is estimated that the depth to scour due to constriction in the flow area is approximately 5-feet.

3.2.3 Degradation and Aggradation

Degradation and aggradation is anticipated over a long period of time due to a general lowering or raising of the river bed. For purposes of this study, a qualitative analysis was performed based on historical records of changes in the bed at the site of the bridge, and known major hydrologic events which occurred.

Data from 1957 quadrangle mapping, 1979 Maricopa County Flood Studies, and 1984 flow topography was analyzed with known events (such as a 100-year event, which occured in 1980) to estimate this depth to be 5-feet.

3.2.4 Total Scour

Combining all three expected types of erosion resulted in an expected depth of scour of 19-feet at the base of the piers, 20-feet at the toe of the south spur dike, and 23-feet at the toe of the north spur dike.

However, there are a number of parameters which may have a positive impact on the amount of general and local scour:

1) A natural phenomenon known as the "armoring process", which will allow stabilization of the degrading river bed. Soil borings on two bridges in the vicinity of the proposed crossing suggest that the river bed consists of silts, sand, gravel and cobble. As the fine material in the river bed is washed away due to higher than normal velocities (as a result of the constriction in the flow area), the remaining larger, more dense bed material will remain, forming a protective "armor" layer on the surface of the now reduced channel bed. It is likely that the existence of sand and gravel will enhance the natural armoring process.

2) General scour was calculated based on the immediate impact created by the bridge condition. However, as urban growth continues in the future, it is very likely that the floodway fringe district (the overbank area outside of the floodway line) will be replaced by urbanization. As a result, the magnitude of general scour will be reduced significantly in the area of the proposed crossing, as the reduction in depth of the channel bed will be distributed throughout the entire river channel encroached by development.

3) Local scour around the piers will also be reduced due to the natural armoring process described above. During the scouring process, the conveyance area will be increased, in turn reducing the scouring velocity and tractive stress on the riverbed. Consequently, an equilibrium condition will occur and the local scouring will be stabilized.

4) The 100-year flood peak used for the hydraulic design of the proposed bridge is 250,000 cfs. It is very likely that the proposed upgrade of Waddell Dam on the Agua Fria River and a potential dam located on the Verde River (Cliff Dam) may have a positive impact on the 100-year flood peak. This in turn will reduce the amount of total scour estimated for the design.

Not any more!

3.3 Rip-Rap Protection Proposed

To provide protection and reduce the effective depth of scour, riprap bedding along the toe of the spur dikes and at the base of the piers is proposed. It is felt that the inclusion of these features can reduce the depth of scour by as much as 50-60%; a conservative figure

of 50% was used to determine the depth at which the protection should be placed.

In conjunction with the riprap bedding and apron, riprap lining along the faces of the spur dikes is proposed. A filter fabric with cushion placed between the riprap and embankment material will protect the dikes from loss of fine embankment material through the voids of the riprap stones, thereby ensuring stability of the structure. The construction of spur dikes will minimize flow and velocity on the landside upstream of the dike, permitting the growth of vegetation, thus further stabilizing this area.

4.0 SPUR DIKE DESIGN

4.1 Design Parameters

In the calculation of spur dike lengths, Ls, the Federal Highways Administration's Hydraulics of Bridge Waterways (Ref. 13) design method was used. As a function of the overbank (Qf) flow, it was necessary to utilize the HEC-2 data from the current, natural conditions, and extrapolate overbank flow values. This was due to the initial assumption in the proposed bridge HEC-2 analysis that all flow at or less than the 100-year event would be diverted and passed under the crossing. Additionally, the discharge in 100-feet of stream adjacent to the abutment (Q-100') was calculated based on extrapolated values of the HEC-2 flow distribution results. Together, the values of Q-100' and Qf were used to form a ratio by which the value of Ls, as related to the average velocity of the flow through the bridge, could be determined. The recommended length of the north upstream spur dike is 300-feet; all others should be 100-feet.

These findings were weighed with a qualitative analysis of the anticipated future conditions of the approaches, including the impact of raising Vineyard Road and the potential for migration of flow to the north.

In the area of the south spur dike, consideration was given to the anticipated impact on the flow due to the raising of Vineyard road. This road runs parallel to the Gila River and intersects Reems Road at approximate station 8810 of river cross-section 377.7. To reach the abutment on the south side, Vineyard Road is expected to be raised to elevation 917 (approx.), with a 2% grade over 500 feet. The raised road will then behave very similar to that of a spur dike; trapping "dead" flow against the south abutment and forming a natural cushion from which the remaining flow must divert around and back into the main channel. For this reason, flows were modified from the existing natural run to develop the south spur dike of 100-feet.

4.2 Overview of Designs

The proposed designs call for spur dikes whose alignments conform to the standard elliptical shape of 2.5:1 major to minor axis ratio. The dikes are composed of common compacted fill material, protected both upstream and downstream by riprap protection over a filter bed or filter fabric liner. At the upstream toe of each dike, the riprap apron extends down to approximately one-half the estimated unprotected scour depth.

Both the U.S. Soil Conservation Service and Los Angeles County Flood Control District standards were applied in the calculation of freeboard for the riprap protection of the spur dikes. These methods recommended a minimum 2- to 3-feet of freeboard above the 100-year

water surface elevation. As this is considered an integral factor in maintaining the integrity of the structures, a value of 3.3 feet was used to increase the overall factor of safety. 100-foot elliptical sections downstream of the bridge were also included to assure that all flows and degradation of the river channel would occur away from the bridge piers, approach ramps, and spur dikes. F.B.

4.3 Discussion of Spur Dike Typical Sections

A top width of 12' is included for operation and maintenance purposes. Although some freeboard is desirable, it is anticipated that both sides of the dike will become inundated, thereby minimizing the impact of overtopping. Thus, a freeboard height of 3.3-feet is included, raising the crown elevation of the spur dikes to 912.0 feet.

Riprap bedding is increased from 17 feet to 27 feet at the upstream toe around the points where the radius of curvature is at a minimum, as this is where an increased depth of scour is anticipated due to the curvilinear flow around these points. There is no toe bedding along the landside.

using apron instead of toe down!

5.0 CONCLUSION AND RECOMMENDATIONS

5.1 Bridge Structure

From the analysis of the scour about the base of the piers, a depth of 19-feet was determined. For purposes of design, a depth of 25-feet is recommended.

Note!

Three sizes of riprap protection of the spur dikes is recommended. In the critical areas around the nose of the spur dikes, a 22- to 24-inch D50 is suggested. In the spur dike areas adjacent to the flow of the main channel where streamlined flows are expected, a

smaller D50 of 21-inches may be used. For the landside of spur dike slopes, an unlined 3:1 slope is recommended. In all these cases where riprap bedding is required, a thickness of 1.5 to 2 times the D50 size should be used.

Within the scope of the work and the limited data available on gradation of the material used for the embankment of the spur dikes, a more detailed analysis for size distribution could not be performed. The filter fabric should be selected based upon the size distribution of the fill material for the embankment.

Efforts should be made to ensure that the minor flows currently occurring near the north abutment are restricted and diverted back into the main channel. This can be accomplished by minor grading of the river bed upstream.

The structural designer should review the contents of this report and make necessary adjustments to the structural elements as more refined data becomes available.

5.2 Gila River Floodplain

The HEC-2 analysis performed in conjunction with the bridge design was in accordance with FEMA Guidelines. The analysis has been closely coordinated with the City of Goodyear and MCFCD. Preliminary submittals have been reviewed and subsequently approved by both agencies. It is recommended that the final analysis presented in this report be renewed and adopted for the FEMA restudy.

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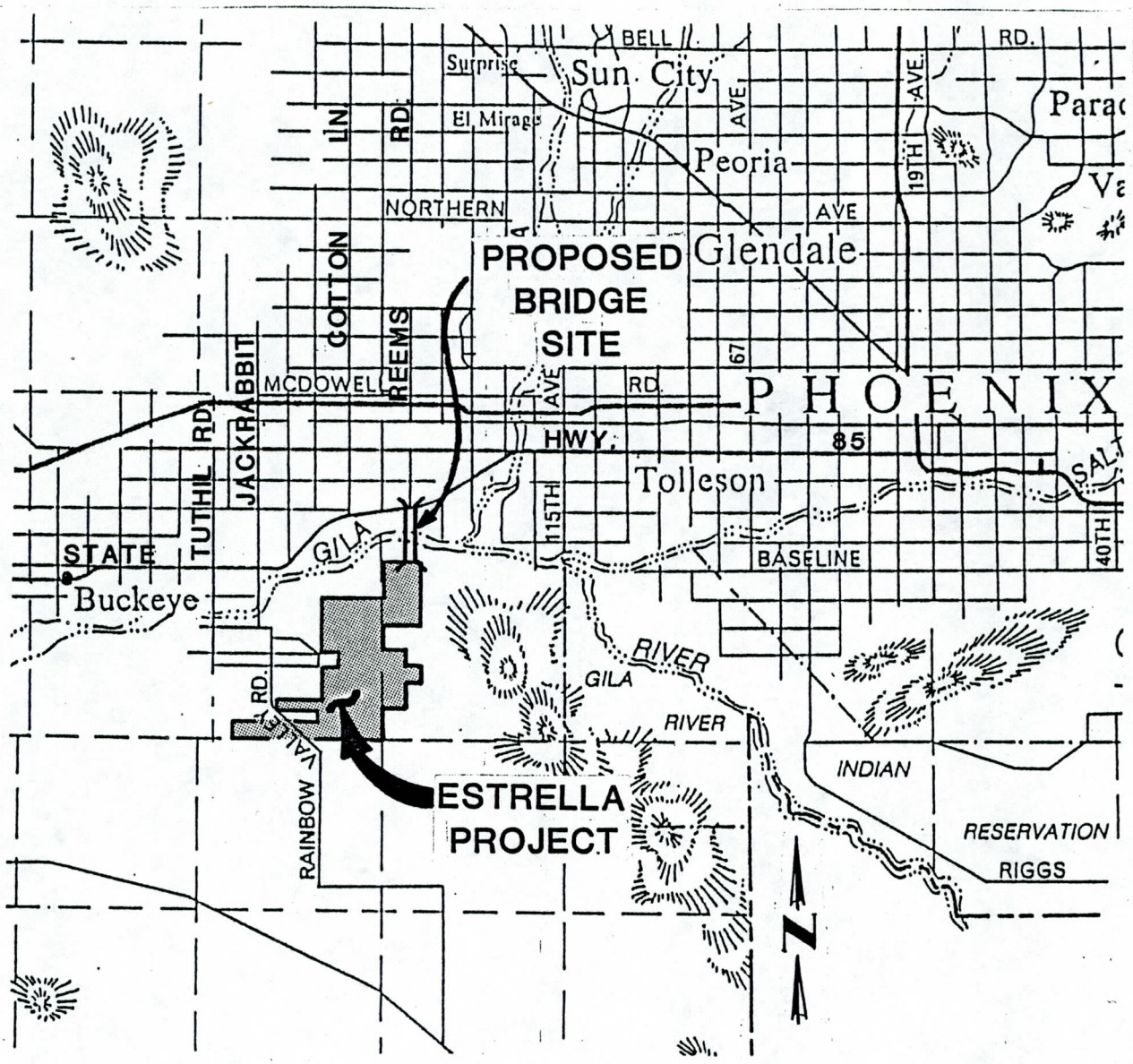
PLATES



VICINITY MAP

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PLATE

1

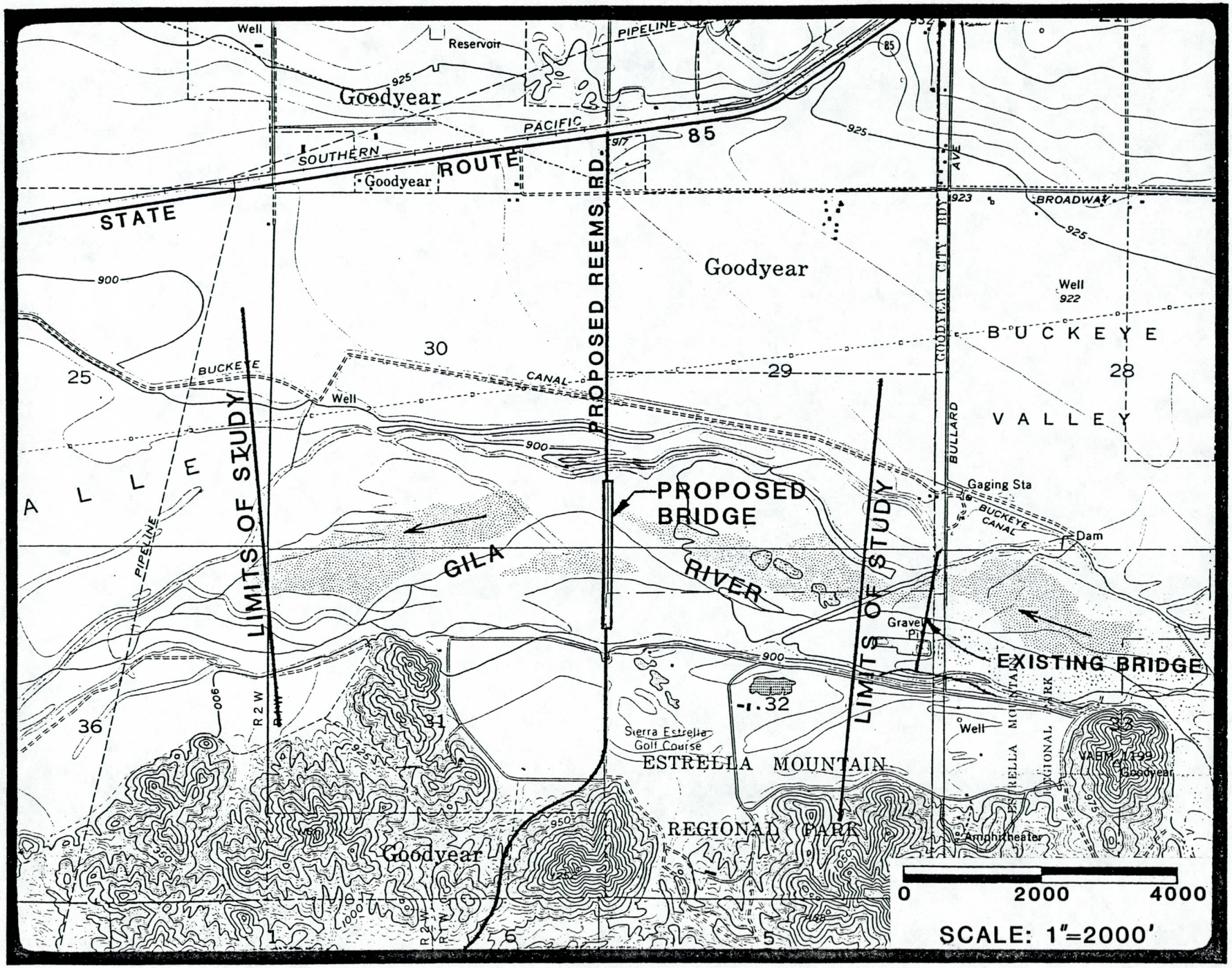
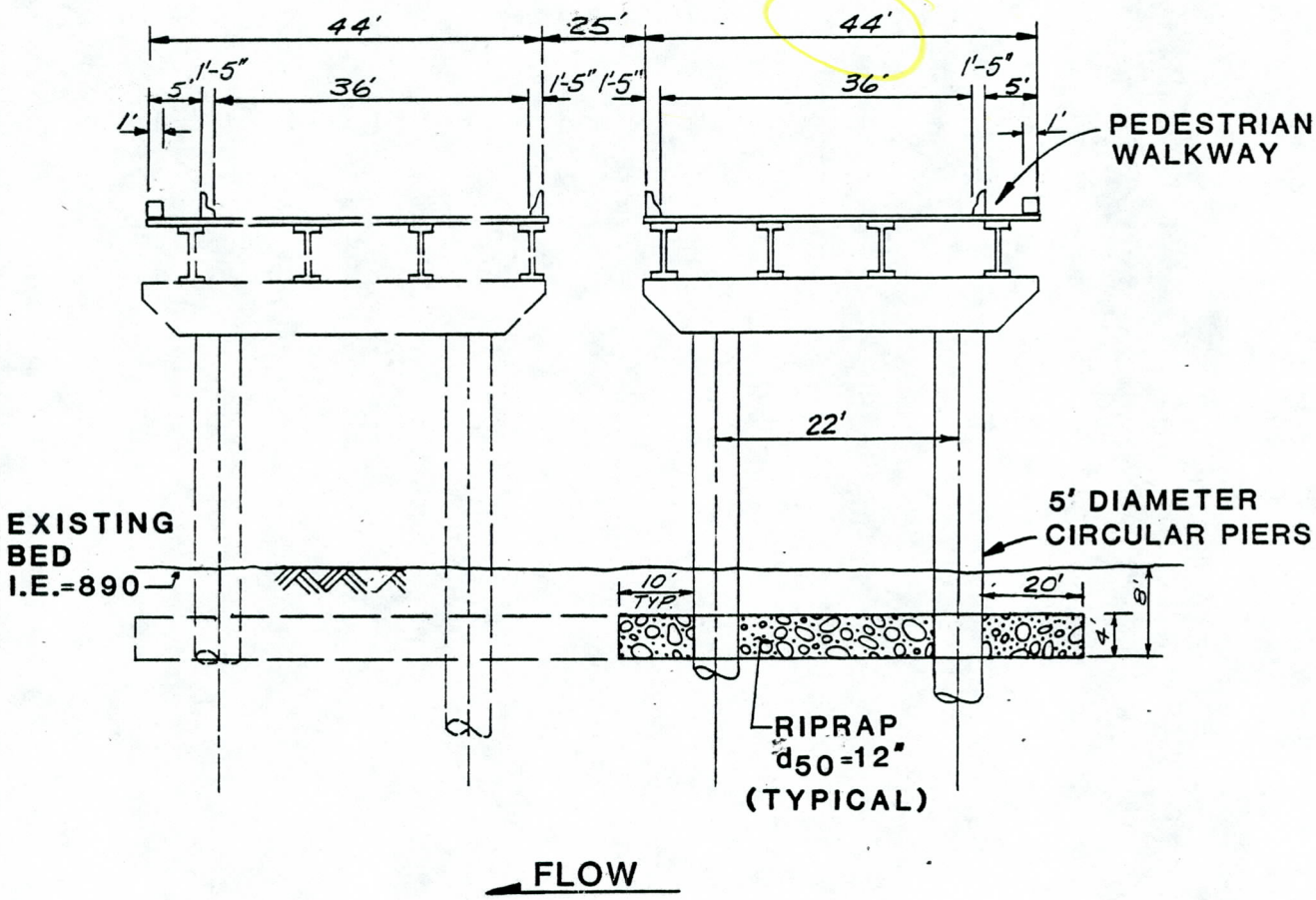


PLATE 2

AREA OF STUDY MAP



PHASE II

2 LANES OF TRAFFIC/
ONEWAY ON EACH BRIDGE

PHASE I

2-WAY TRAFFIC
ON EAST BRIDGE

CROSS SECTION
GILA RIVER BRIDGE
REEMS ROAD

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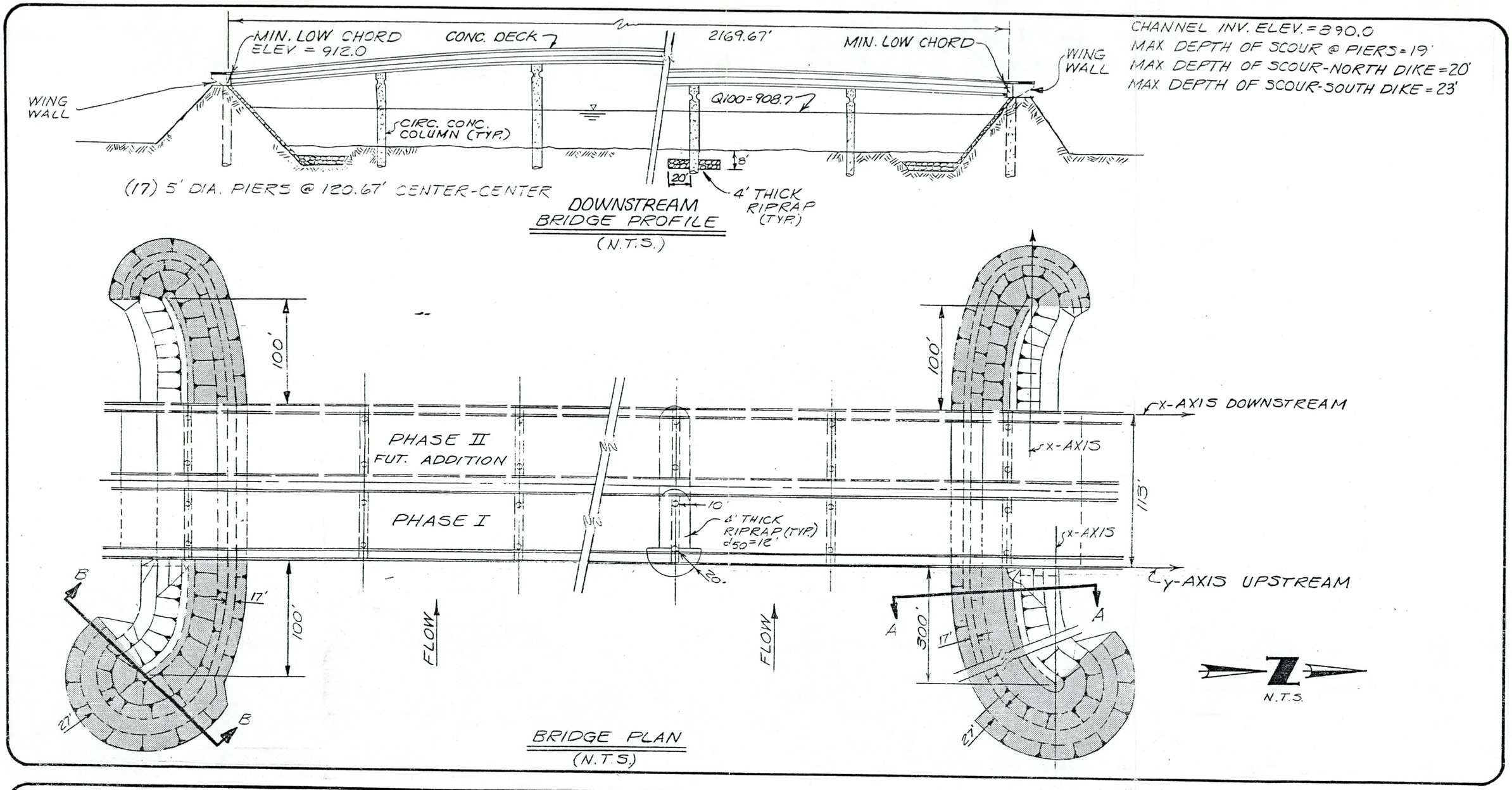
PLATE

3



PROPOSED BRIDGE CONFIGURATION

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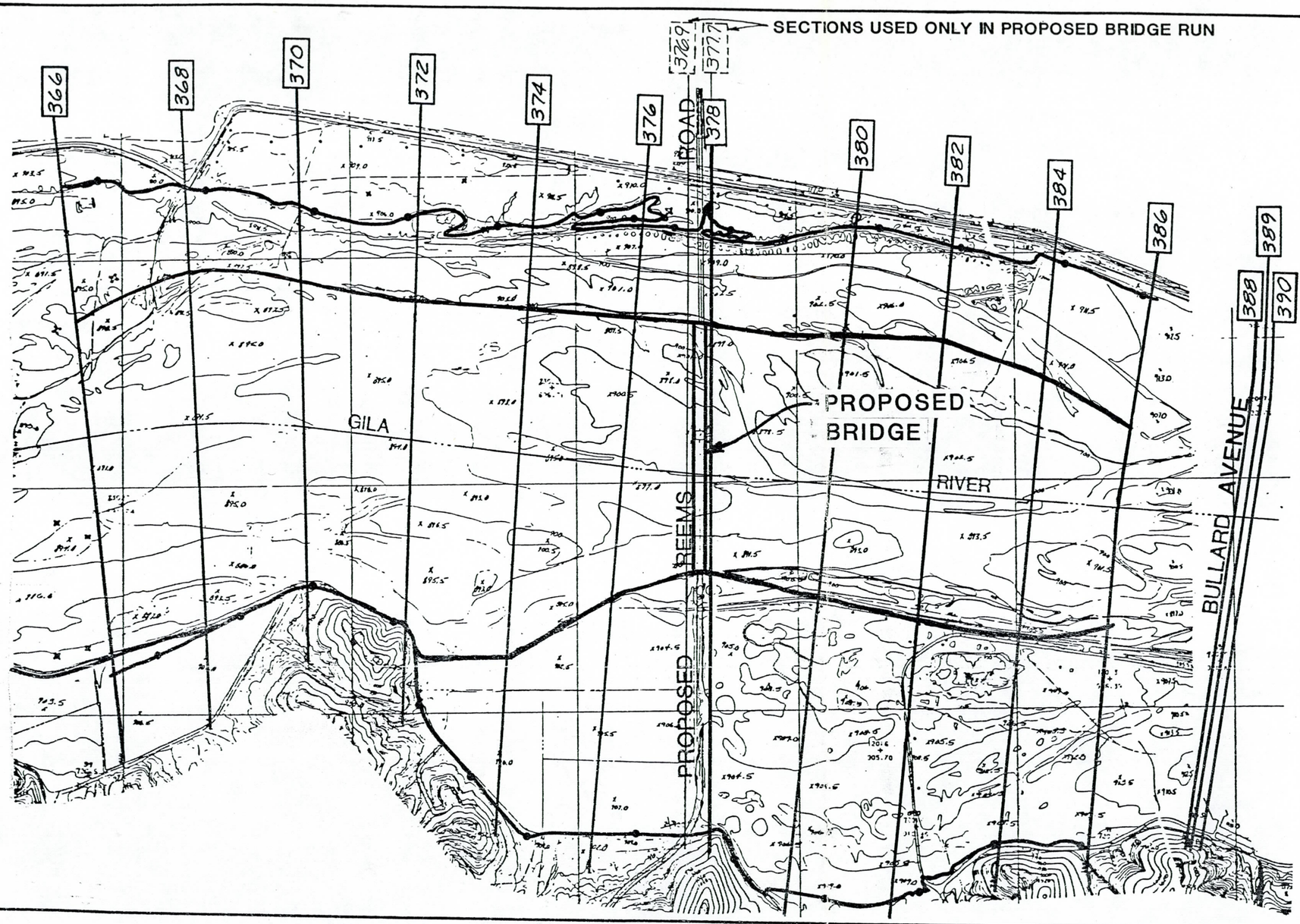
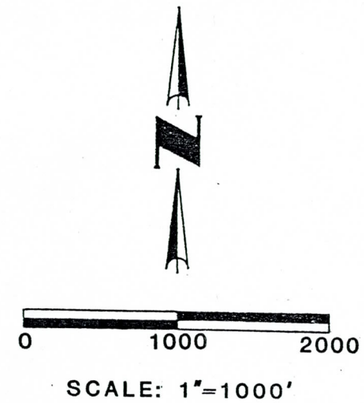
Highway Engineering

PLATE

4





LEGEND

- CONTROL LINE
- 100-YEAR FLOOD LIMITS
- FLOODWAY LIMITS

HEC-2 CROSS-SECTIONS

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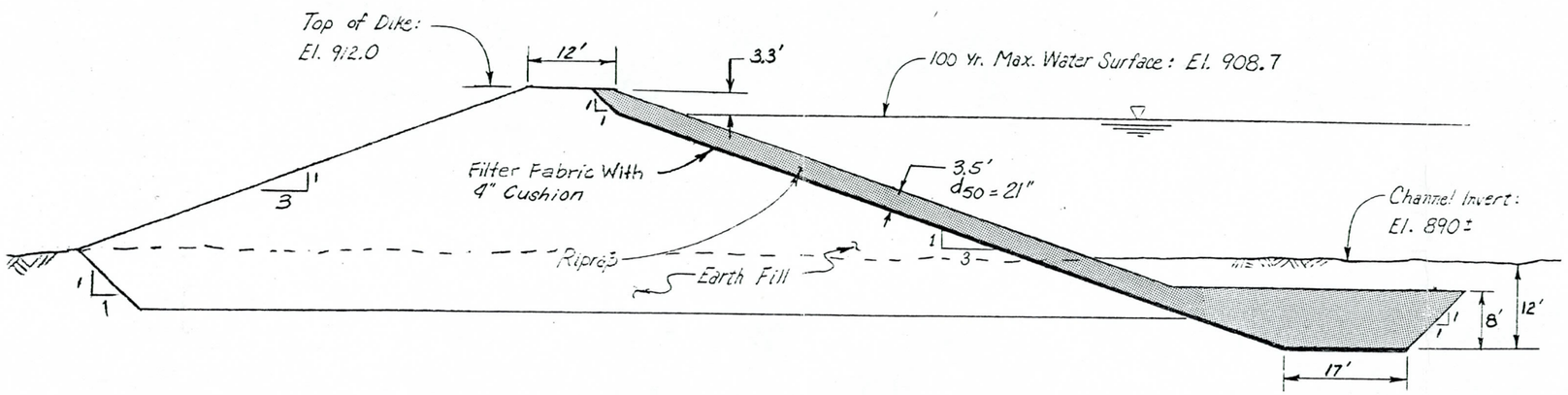
PLATE 5



SECTION A-A

TYPICAL SPUR DIKE SECTION

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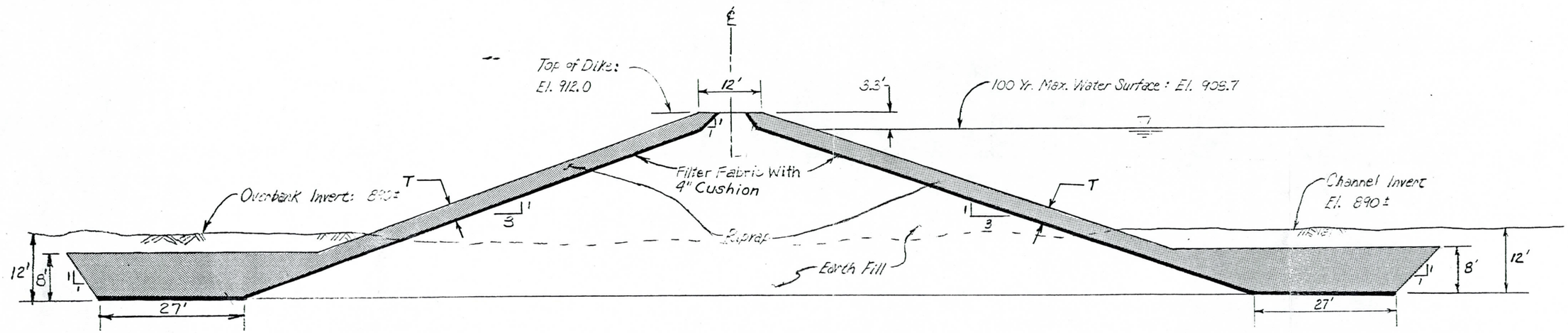
PLATE
6



T = THICKNESS OF RIPRAP

RECOMMENDED

d_{50}	thickness
21"	3.5' (min.)
24"	3.0' (min.)

SECTION B-B

TYPICAL SPUR DIKE NOSE SECTION

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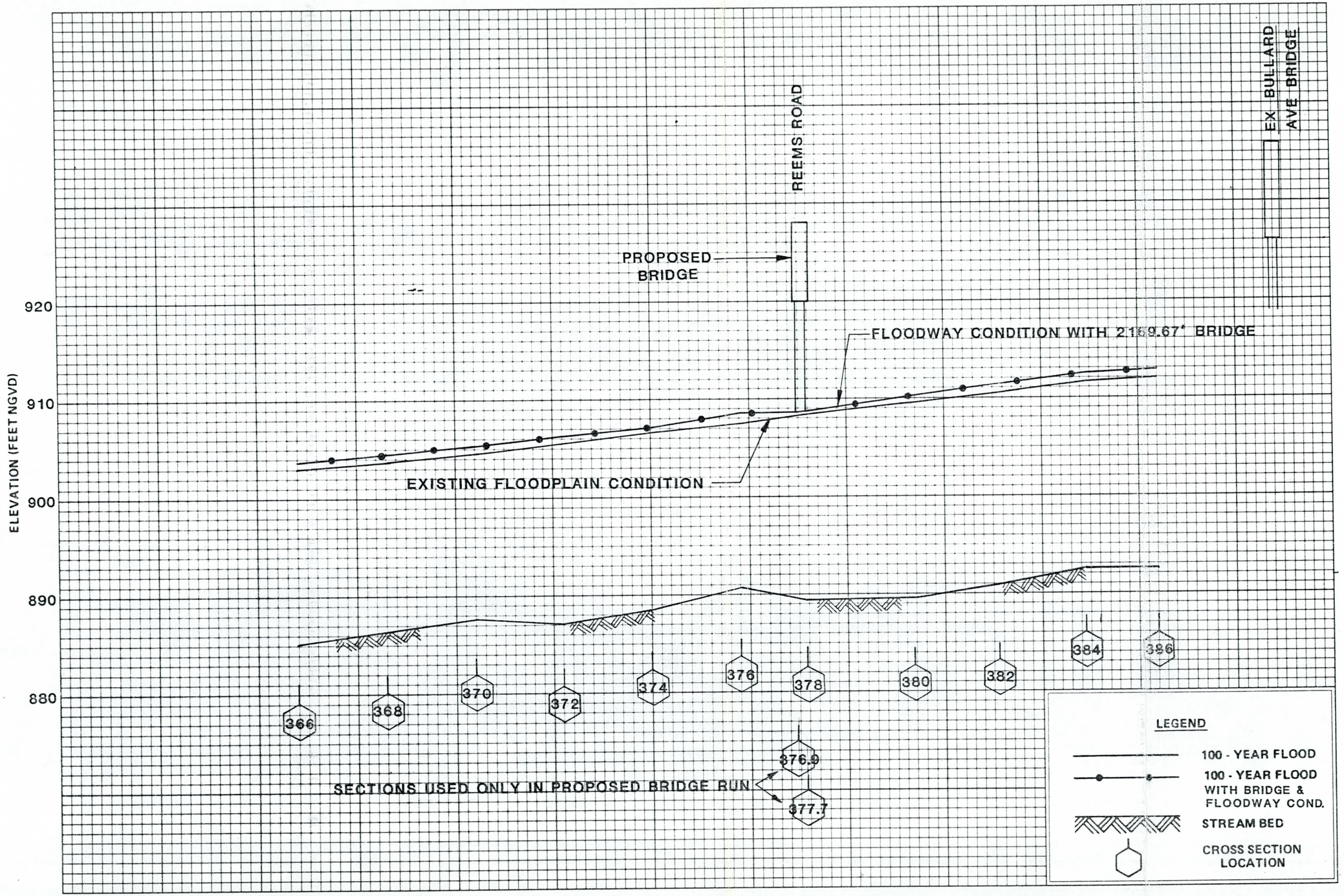
PLATE
7



FLOOD PROFILES

ESTRELLA

FEDERAL EMERGENCY MANAGEMENT AGENCY
FLOODPLAIN STUDY FOR GILA RIVER
AT REEMS RD. SITE
HEC-2 ANALYSIS PRIOR TO
AND AFTER BRIDGE CONST.

PLATE 8

APPENDIX A

U.S.C.O.E. HYDROLOGY FOR FLOOD INSURANCE STUDIES

— SECTION —
PRELIMINARY
By..... Date 5-31-85
SUBJECT TO REVISION (R)

HYDROLOGY FOR FLOOD INSURANCE STUDIES
MARICOPA COUNTY STREAMS, ARIZONA
JUNE 1983
REVISED MAY 1985

1. References.

a. "Gila River Basin, New River and Phoenix City Streams, Arizona, Design Memorandum No. 2, Hydrology, Part 1", October 1974.

b. "Gila River Basin, Phoenix, Arizona and Vicinity (including New River), Design Memorandum No. 2, Hydrology, Part 2", April 1982.

c. "Gila River Basin, New River and Phoenix City Streams, Arizona, Adobe Dam (including Skunk Creek to the Arizona Canal), Design Memorandum No. 3, General Design Memorandum-Phase II, Project Design-Part 2", April 1979.

d. "Gila River and Tributaries, Central Arizona Water Control Study, Hydrology", May 1982.

(R) e. "Gila River Basin, Phoenix, Arizona and Vicinity (including New River), New River Dam (including New River to Skunk Creek), Design Memorandum No. 3, General Design Memorandum - Phase II, Project Design - Part 3", November 1982.

2. General.

a. Hydrologic studies as described in this report were made to determine the present condition SPF, 500-year, 100-year, 50-year, and 10-year flood peak discharges for flood insurance studies for selected streams in Maricopa County, Arizona. Drainage boundaries and concentration point locations for
(R) the study streams--Scatter Wash, Skunk Creek, the New River, the Agua Fria River, the Salt River, and the Gila River—are shown on plates 1 through 3. Schematic flow diagrams are shown on plates 4 and 5. Peak discharges are
(R) given in table 1. The 1985 revision to this report incorporates the New River
(R) in the scope of work, but does not update any values on the other streams.

b. The required peak discharges were taken, where appropriate, directly
(R) from references 1b through 1e, as noted in table 1. Where revisions or additional concentration points were required, the basic criteria and procedures discussed in the references were used. A brief description of the study area and procedures used to develop the peak discharges given in table 1 follows.

3. Physiography and Topography. The study area is located in the Phoenix region. The mountains above about 3000 feet are characterized by rugged terrain and steep gradients, while the lower areas consist of fairly flat valley land. A brief description of the physical characteristics of the major watercourses in the study area follows.

TABLE 1 (Cont'd)

PRESENT CONDITION
PEAK DISCHARGES

Concentration Point	Location	Drainage Area (mi^2)	10-Year Flood (ft^3/s)	50-Year Flood (ft^3/s)	100-Year Flood (ft^3/s)	500-Year Flood (ft^3/s)	SPF (ft^3/s)
(R)	SALT RIVER(6):						
109	At Gilbert Rd.	12,593	100,000	170,000	230,000	345,000	292,000
110	At Tempe Bridge	12,783	93,000	160,000	215,000	330,000	289,000
111	At Central Ave.	12,831	91,000	155,000	200,000	325,000	285,000
112	At 67th Ave.	12,913	90,000	150,000	190,000	315,000	283,000
113	Above Gila River	12,962	85,000	145,000	185,000	310,000	281,000
(R)	GILA RIVER(6)						
1215	Below Agua Fria River	41,902	95,000	200,000	250,000	360,000	312,000

(1) Discharges taken from Ref. 1c.

(R) (2) Revision due to typographical error.

(R) (3) Flows determined in this revised report.

(4) Discharges taken from Ref. 1e.

(R) (5) 50-Year through Standard Project Flood Peak Discharges taken from Ref. 1b; 10-Year Flood developed in this report.

(R) (6) Discharges taken from Ref. 1d.

TABLE 2

PEAK DISCHARGES FOR FEBRUARY 1980

(Provisional Data from U.S. Geological Survey as of March 1981, Subject to Revision)

Station Gate	Stream-Gaging Stations	Peak of record through 1-80 Date	Peak of record through 1-80 Discharge (ft^3/s)	Drainage area (mi^2)	Date	Time	Gage Height (ft)	Discharge (ft^3/s)
09390500	Show Low Creek near Lakeside	12-18-78	5,550	68.6	2-15-80	2100	5.90	1,900
09424470	Kirkland Creek near Kirkland	3-1-78	7,890	109	2-19-80	2130	9.20	8,440*
09424900	Santa Maria River near Bagdad	3-1-78	24,600	1,210	2-15-80		6.84	18,500
09479500	Gila River near Laveen	1-2-41	11,900	20,615	2-23-80	0830	7.49	514
09489000	Santa Cruz River near Laveen	9-29-62	9,200	533	2-20-80	0430	8.36	115
09489100	Black River near Maverick	12-18-78	14,400	315	2-15-80		5.72	3,400
09489700	Big Bonito Creek near Fort Apache	12-18-78	4,510	119	2-15-80		8.19	3,360
09490500	Black River near Fort Apache (100 yr) 58,000, (50 yr) 35,000	12-18-78	40,200	1,232	2-15-80		24.00	40,000
09492400	East Fork White River nr Ft. Apache	12-18-78	751	38.8	2-15-80		2.65	280
09494000	White River near Ft. Apache	12-18-78	14,600	632	2-15-80	1900	12.24	8,400
09496500	Carrizo Creek near Show Low	12-18-78	19,400[a]	439	2-14-80	1815	7.26	4,300
09497500	Salt River near Chrysotile	12-18-78	70,400[b]	2,849	2-15-80	2000	16.2	60,000

SOURCE: Ref. 8

PEAK DISCHARGES FOR FEBRUARY 1980 (Continued)

	Stream-Gaging Stations	Peak of record through 1-80 Date	Peak of record through 1-80 Discharge	Drainage area (mi^2)	Date	Time	Ght (ft)	Discharge (ft^3/s)
09497800	Cibecue Creek near Chrysotile	9- 2-77	22,200	295	2-20-80		11.67	10,600
09497980	Cherry Creek near Globe	1-17-79	15,700	200	2-15-80		13.8	8,100
09498500	Salt River near Roosevelt	3-14-41	117,000	4,306	2-15-80		28.2	85,000
09498870	Rye Creek near Gisela	9- 5-70	44,400	122	2-19-80	2300	5.75	4,550
09499000	Tonto Creek above Gun Creek, near Roosevelt	1-17-79	55,800	675	2-15-80	1500	17.00	55,800[c]
09502000	Salt River below Stewart Mountain Dam	1-18-79	65,000	6,232	2-16-80	2000	25.24	64,000
09504500	Oak Creek near Cornville	12-19-78	29,000	357	2-20-80			30,000*
09505550	Verde River below Camp Verde	12-19-78	47,000	4,670	2-15-80	0400	19.3	50,000*
09507980	East Verde River near Childs	9- 5-70	23,500	328	2-20-80	0130	15.1	14,100
09508000	Verde River below East Verde River, near Childs	3- 3-78	110,000	5,610	2-15-80	1400	25.26	74,600
09508300	Wet Bottom Creek near Childs	3- 1-78	6,660	36.4	2-19-80	2130	16.0	6,830*
09508500	Verde River below Tangle Creek, above Horsehoe Dam	12-19-78	94,000	5,872	2-15-80	1530	21.41	94,800*
09510000	Verde River below Bartlett Dam	3- 2-78	101,000[d]	6,185	2-15-80	1830	25.5	104,000

PEAK DISCHARGES FOR FEBRUARY 1980 (Continued)

	Stream-Gaging Stations	Peak of record through 1-80 Date	Peak of record through 1-80 Discharge	Drainage area (mi^2)	Date	Time	Ght (ft)	Discharge (ft^3/s)
09510200	Sycamore Creek near Fort McDowell	9- 5-70	24,200	164	2-15-80	1245	11.42	10,400
09511300	Verde River near Scottsdale	3- 2-78	96,000	6,600				
09512100	Indian Bend Wash at Scottsdale	6-22-72	21,000[e]	62[e]	2-20-80	0200	1.38	103
09512170	Salt River at Jointhead Dam, Phoenix	12-19-78	140,000	13,500	2-16-80	1200	9.30	170,000*
09512400	Cave Creek at Phoenix	12-19-67	4,080	252	2-19-80	2100	4.46	326
09512500	Agua Fria River near Mayer	9- 5-70	19,800	588	2-19-80	2130	15.76	33,100*
09512800	Agua Fria River near Rock Springs	12-18-78	52,800	1,130	2-19-80	2400	28.15	59,500*
09513650	Agua Fria River at Grand Ave., at El Mirage	12-19-78	58,400	1,637[f]	2-20-80		10.14	41,800
09513780	New River near Rock Springs	9- 5-70	18,600	67.3	2-19-80	2000	10.26	16,300
09513800	New River at New River	9- 5-70	19,500	83.3	2-19-80	2030	11.50	15,000
09513835	New River at Bell Road, near Peoria	12-19-67	14,600	187	2-20-80	0200	9.4	9,400
09513860	Skunk Creek near Pheonix	8- 1-64	11,500	64.6	2-20-80	0200	7.6	1,210
09513970	Agua Fria River at Avondale	12-19-78	29,300	2,013[f]	2-20-80	0800	6.77	44,200*
09515500	Hassayampa River at Box Damsite, near Wickenburg	9- 5-70	58,000	417	2-19-80	2300	18.9	24,900

PEAK DISCHARGES FOR FEBRUARY 1980 (Continued)

	Stream-Gaging Stations	Peak of record through 1-80 Date	Peak of record through 1-80 Discharge	Drainage area (mi^2)	Date	Time	Ght (ft)	Discharge (ft^3/s)
09517000	Hassayampa River near Arlington	9- 5-70	39,000	1,470	2-20-80	0600	4.9	9,500
09519502	Gila River below Gillespie Dam	12-20-78	125,000[g]	49,650	2-16-80	1800	18.81	178,000*

* Indicates new peak discharge of record.

a Prior to modern record: about 23,000 ft^3/s on 12-30-65.

b Prior to modern record: 74,000 ft^3/s before 1924, believed to be 1-19-16.

c Ties previous peak discharge of record.

d Prior to modern record: probably more than 150,000 ft^3/s on 2-24-1891.

e Drainage area prior to October 1975 was 139 mi^2. Upper portion of basin was cut off in October 1975 by construction of diversion canal and detention dike.

f Includes 1,459 mi^2 above Lake Pleasant.

g Prior to modern record: an estimated 250,000 ft^3/s in February 1891.

APPENDIX B

COMPUTER ANALYSIS
-NATURAL CONDITION

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*****************************************************
*  WATER SURFACE PROFILES                           *
*  VERSION OF NOVEMBER 1976                         *
*  UPDATED MAY 1984                                 *
*                                                   *
*  RUN DATE FRI, JUN 12 1987 TIME 14:24:12          *
*****************************************************
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****************************************
*  U.S. ARMY CORPS OF ENGINEERS        *
*  THE HYDROLOGIC ENGINEERING CENTER   *
*  609 SECOND STREET, SUITE D          *
*  DAVIS, CALIFORNIA 95616             *
*  (916) 440-2105 (FTS) 448-2105       *
****************************************
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```
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
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THIS RUN EXECUTED FRI, JUN 12 1987 14:24:43

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*************************************************
  HEC2 RELEASE DATED NOV 76 UPDATED MAY  1984
  ERROR CORR -  01,02,03,04,05,06
  MODIFICATION -  50,51,52,53,54,55,56
*************************************************

C
T1      12-30-86  ESTRELLA MT. RANCH - AMCOR, FINAL SUBMITAL UPDATED 6-12-87.
T2      REEMS ROAD BRIDGE ANALYSIS
T3      GILA RIVER EXISTING CONDITIONS

J1  ICHECK    INQ       NINV      IDIR      STRT      METRIC    HVINS     Q         WSEL      FQ

      0.       3.        0.        0.  0.000701      0.00      0.0       0.   903.030    0.000

J2  NPROF     IPLOT     PRFVS     XSECV     XSECH     FN        ALLDC     IBW       CHNIM     ITRACE

    -1.000    0.000     0.000     0.000     0.000     0.000    -1.000    0.000     0.000     15.000

J3  VARIABLE CODES FOR SUMMARY PRINTOUT

    150.000   0.000     0.000     0.000     0.000     0.000     0.000     0.000     0.000     0.000

NC      0.055      0.055      0.032      0.100      0.300      0.000      0.000      0.000      0.000      0.000
QT      2.000 250000.000 250000.000      0.000      0.000      0.000      0.000      0.000      0.000      0.000
ET    366.000      0.000      9.100      0.000      0.000      0.000      0.000      0.000   7100.000  12500.000
            ALL SECTIONS LOOKING DOWNSTREAM
            CHANNEL STATIONS ARE FROM LEFT TO RIGHT WITH CONTROL LINE STATION
            10,000.
            THE 100-YEAR FLOOD PEAK (250,000) IS BASED ON THE ARMY CORPS OF
            ENGINEERS (COE) HYDROLOGY, MAY 1985.
            TOPO PROVIDED BY MARICOPA COUNTY FLOOD CONTROL DISTRICT (MCFCD)
            PHOTO DATE 3-28-84.   AERIAL MAPPING CO. #83039
            COOPER AERIAL SURVEY CO. #830339.
            CROSS SECTIONS DIGITIZED FROM AERIAL PHOTOS FURNISHED BY MCFCD.
            REACH LENGTHS ON X1 CARDS HAVE BEEN UPDATED 6-87.
X1    366.000     73.000   8088.000  11014.000      0.000      0.000      0.000      0.000      0.000      0.000
GR    907.400   7073.000    910.400   7084.000    909.600   7110.000    907.300   7120.000    905.300   7134.000
GR    905.800   7221.000    902.400   8059.000    892.800   8088.000    892.800   8215.000    888.500   8245.000
GR    889.100   8471.000    886.500   8579.000    886.500   8657.000    885.100   8660.000    885.100   8860.000
GR    888.500   8907.000    891.300   9083.000    893.800   9198.000    892.600   9288.000    889.500   9395.000
GR    891.100   9675.000    890.500   9889.000    888.000   9942.000    890.600  10000.000    892.100  10259.000
GR    893.100  10432.000    889.800  10449.000    889.800  10485.000    891.900  10508.000    891.900  10563.000
GR    891.000  10609.000    894.300  10627.000    896.900  10802.000    897.400  10841.000    897.400  11014.000
GR    896.600  11232.000    895.400  11342.000    893.600  11445.000    894.800  11496.000    893.100  11539.000
GR    893.100  11627.000    897.800  11641.000    897.400  11693.000    894.400  11751.000    896.600  11814.000
GR    896.900  11916.000    896.300  12166.000    903.800  12195.000    904.100  12325.000    904.100  12511.000
GR    911.100  12540.000    905.900  12548.000    905.900  12565.000    898.300  12581.000    898.300  12605.000
GR    906.600  12618.000    906.600  12642.000    902.900  12656.000    902.400  13070.000    902.100  13955.000
GR    901.300  13968.000    903.600  15239.000    905.300  15273.000    905.300  15299.000    903.800  15309.000
GR    903.800  15375.000    902.900  15429.000    905.400  15436.000    905.400  15445.000    903.900  15456.000
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GR	906.900	15484.000	907.400	15550.000	908.100	15645.000	0.000	0.000	0.000	0.000
ET	368.000	0.000	9.100	0.000	0.000	0.000	0.000	0.000	7400.000	12300.000
X1	368.000	74.000	8153.000	11327.000	900.000	1100.000	960.000	0.000	0.000	0.000
GR	911.400	7197.000	913.800	7233.000	914.400	7261.000	908.800	7287.000	908.300	7678.000
GR	906.300	8153.000	895.100	8174.000	895.000	8220.000	892.600	8229.000	891.100	8363.000
GR	893.000	8376.000	895.000	8473.000	892.500	8546.000	889.800	8562.000	889.100	8614.000
GR	886.500	8629.000	886.500	8881.000	888.000	8927.000	891.600	9051.000	894.500	9060.000
GR	896.000	9182.000	896.300	9273.000	894.000	9324.000	894.300	9387.000	892.600	9440.000
GR	894.800	9573.000	892.100	9784.000	891.800	10000.000	889.500	10330.000	889.000	10420.000
GR	894.400	10439.000	894.400	10589.000	896.100	10721.000	894.900	11092.000	891.600	11169.000
GR	891.600	11189.000	892.400	11211.000	893.800	11303.000	896.600	11327.000	893.100	11368.000
GR	895.400	11416.000	896.300	11525.000	892.600	11547.000	897.300	11589.000	899.400	11786.000
GR	900.600	11947.000	897.300	11971.000	896.400	12048.000	900.300	12062.000	900.900	12101.000
GR	897.300	12107.000	897.300	12145.000	903.100	12154.000	904.400	12217.000	911.600	12253.000
GR	911.600	12306.000	906.100	12320.000	905.400	12409.000	905.400	12511.000	903.100	12519.000
GR	905.100	14091.000	905.800	14122.000	903.100	14131.000	903.600	14759.000	904.800	15257.000
GR	905.800	15313.000	906.100	15347.000	904.800	15362.000	902.600	15444.000	905.800	15477.000
GR	906.400	15490.000	909.300	15508.000	906.900	15530.000	906.100	15584.000	0.000	0.000
ET	370.000	0.000	9.100	0.000	0.000	0.000	0.000	0.000	8530.000	12100.000
X1	370.000	67.000	8569.000	11272.000	930.000	1000.000	940.000	0.000	0.000	0.000
GR	940.900	7865.000	940.100	7901.000	922.100	7941.000	928.100	8009.000	935.900	8098.000
GR	943.900	8175.000	945.600	8222.000	938.400	8289.000	918.600	8435.000	921.900	8485.000
GR	925.100	8529.000	916.100	8569.000	892.500	8604.000	892.500	8633.000	888.300	8643.000
GR	887.600	8959.000	891.600	8981.000	894.000	9072.000	893.100	9168.000	891.300	9215.000
GR	896.000	9256.000	895.600	9323.000	896.300	9466.000	895.000	9669.000	893.800	9783.000
GR	892.600	9964.000	892.300	10000.000	894.000	10089.000	893.500	10280.000	891.500	10615.000
GR	894.400	10689.000	895.900	10857.000	895.300	11122.000	896.400	11149.000	896.400	11194.000
GR	893.600	11222.000	892.900	11256.000	897.800	11272.000	897.800	11471.000	892.800	11494.000
GR	895.800	11534.000	896.800	11597.000	896.600	11701.000	899.600	11748.000	903.600	11846.000
GR	905.800	12003.000	906.600	12126.000	905.600	12213.000	911.300	12272.000	909.400	12316.000
GR	909.300	12490.000	906.900	12641.000	911.800	12664.000	911.800	12694.000	901.300	12703.000
GR	901.300	12735.000	898.600	12740.000	898.600	12765.000	903.600	12770.000	903.600	12785.000
GR	905.400	12798.000	907.800	14132.000	905.900	14156.000	906.900	15143.000	908.100	15184.000
GR	907.300	15207.000	906.400	15434.000	0.000	0.000	0.000	0.000	0.000	0.000
ET	372.000	0.000	9.100	0.000	0.000	0.000	0.000	0.000	8280.000	11788.000
X1	372.000	76.000	8290.000	11187.000	900.000	1060.000	950.000	0.000	0.000	0.000
GR	913.800	7493.000	910.800	7506.000	931.400	7558.000	928.400	7591.000	941.400	7620.000
GR	957.400	7699.000	957.400	7723.000	923.800	7856.000	948.900	7909.000	972.800	7973.000
GR	961.800	8009.000	959.100	8045.000	962.800	8090.000	964.300	8152.000	952.400	8186.000
GR	949.600	8231.000	949.600	8290.000	887.500	8386.000	887.000	8511.000	889.300	8557.000
GR	890.300	8589.000	894.800	8630.000	893.100	8681.000	894.600	8813.000	895.300	8852.000
GR	893.600	8975.000	893.600	9014.000	893.600	9143.000	895.600	9210.000	897.300	9346.000
GR	895.600	9452.000	895.100	9570.000	895.000	9867.000	893.100	10000.000	893.600	10168.000
GR	893.600	10395.000	895.100	10417.000	895.800	10505.000	895.800	10631.000	892.800	10683.000
GR	892.500	10833.000	893.600	10970.000	895.600	11061.000	894.600	11140.000	903.300	11187.000
GR	900.300	11257.000	897.600	11303.000	897.300	11633.000	895.100	11660.000	898.300	11713.000
GR	900.600	11762.000	909.300	11788.000	905.400	11824.000	900.300	11837.000	901.300	11959.000
GR	906.300	11971.000	908.600	12129.000	910.600	12223.000	910.100	12540.000	914.400	12589.000
GR	917.300	12621.000	914.100	12625.000	915.600	12647.000	902.800	12662.000	898.900	12666.000
GR	898.900	12692.000	905.900	12699.000	905.900	12715.000	911.800	12722.000	909.900	12748.000
GR	911.400	12766.000	908.600	12777.000	908.300	12959.000	908.800	15080.000	909.100	15207.000

GR	910.800	15455.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
ET	374.000	0.000	9.100	0.000	0.000	0.000	0.000	0.000	6900.000	11940.000
X1	374.000	84.000	8193.000	11300.000	900.000	1010.000	950.000	0.000	0.000	0.000
GR	960.800	6651.000	922.600	6841.000	904.600	6917.000	905.600	6978.000	904.800	6988.000
GR	903.600	7918.000	901.900	8193.000	888.100	8223.000	889.800	8271.000	890.800	8404.000
GR	895.300	8425.000	889.600	8466.000	891.300	8566.000	891.000	8600.000	889.100	8604.000
GR	890.300	8847.000	895.300	8924.000	895.500	8999.000	897.800	9120.000	900.000	9310.000
GR	898.500	9364.000	893.500	9399.000	894.500	9687.000	897.500	9722.000	899.500	9857.000
GR	894.600	9964.000	896.600	10000.000	893.000	10150.000	896.800	10161.000	897.800	10344.000
GR	898.100	10532.000	897.000	10730.000	896.100	10874.000	897.300	10938.000	894.600	11046.000
GR	892.800	11118.000	889.500	11148.000	889.300	11185.000	892.100	11202.000	888.500	11268.000
GR	901.100	11300.000	900.300	11445.000	898.100	11536.000	899.600	11578.000	896.600	11740.000
GR	897.600	11806.000	905.600	11825.000	905.300	11864.000	900.800	11888.000	900.800	11904.000
GR	908.400	11940.000	907.100	11962.000	909.100	12051.000	910.900	12139.000	910.400	12292.000
GR	909.900	12418.000	912.300	12525.000	920.800	12559.000	916.300	12565.000	917.300	12579.000
GR	903.900	12596.000	901.600	12609.000	902.400	12640.000	906.400	12647.000	908.100	12664.000
GR	915.400	12675.000	913.400	12701.000	912.600	12785.000	910.100	12811.000	910.300	13040.000
GR	911.800	13064.000	911.900	13082.000	910.100	13094.000	910.800	14000.000	912.300	14094.000
GR	912.300	14226.000	912.400	14362.000	911.100	14433.000	911.100	14806.000	911.800	15233.000
GR	912.600	15384.000	913.900	15436.000	913.100	15449.000	912.800	15591.000	0.000	0.000
ET	376.000	0.000	9.100	0.000	0.000	0.000	0.000	0.000	6760.000	12043.000
X1	376.000	71.000	8826.000	11028.000	910.000	1000.000	950.000	0.000	0.000	0.000
GR	913.400	6431.000	909.100	6545.000	901.000	6567.000	901.600	6643.000	901.800	6715.000
GR	905.600	6734.000	907.900	6755.000	907.900	6775.000	906.400	6784.000	906.300	7409.000
GR	904.600	8033.000	902.900	8206.000	903.600	8742.000	903.400	8826.000	893.300	8864.000
GR	890.800	8887.000	890.800	9275.000	893.800	9348.000	895.100	9591.000	896.600	9759.000
GR	895.100	9780.000	894.100	9876.000	897.600	9887.000	897.100	10000.000	896.000	10068.000
GR	899.600	10090.000	899.000	10256.000	899.500	10517.000	899.600	10592.000	899.300	10729.000
GR	896.300	10890.000	896.100	11028.000	894.800	11229.000	892.400	11270.000	892.400	11321.000
GR	901.900	11344.000	902.900	11475.000	899.600	11540.000	900.100	11649.000	897.100	11669.000
GR	897.100	11707.000	906.900	11738.000	906.100	12017.000	908.100	12043.000	904.800	12076.000
GR	901.300	12090.000	901.300	12105.000	909.800	12133.000	906.100	12180.000	906.300	12325.000
GR	909.100	12470.000	911.900	12513.000	911.600	12528.000	912.600	12560.000	902.800	12574.000
GR	902.800	12599.000	905.800	12603.000	905.900	12621.000	912.800	12640.000	913.100	12676.000
GR	910.600	12700.000	911.300	12883.000	910.900	14227.000	912.300	14247.000	910.600	14264.000
GR	911.800	14568.000	913.800	15276.000	914.100	15535.000	914.100	15588.000	913.400	15656.000
GR	914.300	15797.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
ET	378.000	0.000	9.100	0.000	0.000	0.000	0.000	0.000	6700.000	11971.000
X1	378.000	91.000	9138.000	11016.000	860.000	540.000	710.000	0.000	0.000	0.000
GR	937.900	6690.000	913.100	6792.000	907.400	6811.000	905.800	6854.000	904.900	7104.000
GR	906.400	7302.000	902.400	7533.000	906.800	7893.000	904.600	8108.000	903.300	8178.000
GR	904.800	8213.000	903.400	8234.000	902.600	8308.000	904.800	8348.000	903.800	8386.000
GR	905.900	8448.000	905.100	8476.000	902.900	8632.000	904.800	8687.000	901.100	8791.000
GR	902.300	8829.000	899.000	8882.000	898.300	8942.000	900.600	9020.000	897.300	9062.000
GR	899.500	9085.000	897.100	9104.000	899.800	9138.000	891.000	9158.000	890.600	9357.000
GR	891.500	9388.000	889.500	9414.000	889.800	9471.000	893.800	9856.000	895.600	9899.000
GR	899.300	10000.000	900.500	10186.000	899.300	10317.000	897.600	10556.000	899.500	10639.000
GR	899.100	10728.000	896.300	10858.000	897.100	10884.000	895.100	10925.000	896.000	11016.000
GR	895.300	11104.000	897.000	11163.000	894.800	11199.000	897.000	11233.000	894.800	11243.000
GR	893.800	11281.000	902.400	11304.000	901.000	11345.000	902.400	11370.000	900.500	11403.000
GR	901.300	11500.000	902.800	11620.000	900.300	11702.000	900.100	11754.000	907.300	11772.000

GR	908.800	11942.000	911.600	11971.000	908.800	12011.000	902.600	12024.000	902.600	12043.000
GR	910.900	12068.000	909.800	12115.000	908.900	12166.000	910.400	12303.000	911.100	12398.000
GR	914.600	12477.000	906.900	12486.000	906.900	12507.000	902.400	12514.000	902.400	12535.000
GR	906.300	12541.000	906.300	12560.000	915.600	12573.000	914.600	12627.000	911.600	12646.000
GR	911.600	12799.000	911.100	13017.000	912.600	13029.000	910.800	13038.000	913.400	14329.000
GR	914.600	14343.000	913.900	14374.000	916.600	15377.000	917.300	15647.000	917.600	15693.000
GR	917.100	15997.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
ET	380.000	0.000	9.100	0.000	0.000	0.000	0.000	0.000	6291.000	12171.000
X1	380.000	88.000	9011.000	10856.000	960.000	1420.000	1170.000	0.000	0.000	0.000
GR	932.600	5670.000	938.300	5836.000	924.300	6064.000	926.100	6137.000	914.800	6192.000
GR	908.600	6215.000	908.800	6248.000	914.300	6291.000	909.900	6366.000	907.900	6675.000
GR	904.100	6872.000	907.100	6978.000	905.800	7066.000	908.300	7106.000	904.800	7177.000
GR	902.400	7263.000	907.900	7580.000	907.300	7673.000	908.800	7866.000	907.100	8081.000
GR	904.800	8113.000	906.800	8256.000	904.800	8798.000	904.300	8897.000	906.400	8968.000
GR	903.300	9011.000	901.000	9034.000	901.800	9055.000	895.600	9077.000	897.600	9134.000
GR	902.300	9178.000	889.500	9265.000	889.500	9366.000	889.500	9432.000	891.100	9445.000
GR	890.100	9492.000	890.100	9582.000	893.600	9839.000	896.300	9946.000	896.800	10000.000
GR	900.300	10223.000	899.800	10334.000	901.100	10532.000	899.000	10663.000	897.600	10735.000
GR	901.600	10856.000	899.300	10969.000	900.300	10995.000	899.100	11106.000	899.600	11132.000
GR	896.000	11181.000	895.000	11216.000	901.600	11277.000	902.400	11374.000	903.900	11585.000
GR	902.100	11628.000	901.800	11680.000	903.100	11725.000	900.500	11767.000	901.500	11808.000
GR	909.900	11941.000	910.600	12000.000	910.300	12151.000	912.300	12171.000	909.600	12196.000
GR	904.400	12238.000	904.400	12265.000	913.800	12286.000	910.100	12335.000	909.600	12400.000
GR	903.300	12415.000	902.800	12442.000	908.400	12448.000	908.400	12466.000	912.900	12474.000
GR	912.900	12508.000	912.300	12567.000	912.900	13065.000	914.400	13077.000	914.400	13099.000
GR	912.400	13106.000	915.600	14396.000	916.600	14471.000	918.600	15048.000	919.100	15580.000
GR	920.300	15705.000	921.800	15766.000	921.300	16006.000	0.000	0.000	0.000	0.000
ET	382.000	0.000	9.100	0.000	0.000	0.000	0.000	0.000	6200.000	11786.000
X1	382.000	96.000	8874.000	10941.000	910.000	890.000	910.000	0.000	0.000	0.000
GR	940.600	5345.000	935.100	5499.000	935.600	5536.000	936.400	5589.000	933.600	5709.000
GR	926.800	5830.000	918.400	6228.000	908.100	6438.000	908.800	6456.000	908.100	6531.000
GR	909.100	6676.000	904.400	6762.000	906.600	6841.000	906.800	7123.000	910.100	7155.000
GR	903.100	7308.000	905.900	7463.000	904.300	7631.000	907.300	7869.000	905.300	8000.000
GR	906.600	8157.000	905.400	8235.000	907.400	8372.000	909.800	8433.000	911.400	8545.000
GR	908.900	8602.000	911.100	8683.000	909.900	8812.000	911.100	8838.000	909.400	8855.000
GR	910.300	8874.000	897.300	8944.000	902.300	9051.000	901.600	9073.000	898.100	9146.000
GR	897.300	9207.000	894.100	9254.000	891.600	9417.000	892.800	9469.000	891.300	9483.000
GR	891.000	9600.000	892.300	9646.000	897.100	9854.000	898.600	10000.000	902.400	10248.000
GR	899.300	10339.000	900.500	10410.000	899.600	10497.000	901.600	10783.000	900.800	10887.000
GR	906.100	10941.000	904.400	10974.000	905.600	11016.000	903.300	11038.000	905.300	11083.000
GR	903.100	11123.000	905.600	11173.000	905.900	11217.000	903.600	11234.000	905.100	11266.000
GR	902.100	11315.000	904.400	11397.000	905.100	11573.000	899.100	11621.000	899.800	11736.000
GR	913.100	11786.000	911.900	11825.000	912.600	11868.000	910.900	11930.000	911.100	12000.000
GR	914.800	12066.000	909.900	12098.000	905.600	12126.000	905.600	12166.000	915.900	12191.000
GR	914.300	12232.000	911.800	12243.000	913.600	12291.000	912.800	12311.000	912.800	12330.000
GR	905.100	12339.000	905.100	12370.000	908.400	12374.000	909.100	12391.000	915.600	12402.000
GR	915.400	12419.000	912.300	12427.000	912.300	12480.000	913.400	13138.000	916.900	14465.000
GR	918.400	14481.000	918.600	14556.000	920.300	15775.000	920.900	15849.000	922.900	15878.000
GR	922.900	16115.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000

X1	384.000	85.000	8803.000	10859.000	950.000	950.000	950.000	0.000	0.000	0.000
GR	947.900	6570.000	974.600	6777.000	909.300	6921.000	909.400	6969.000	906.400	7014.000
GR	905.800	7050.000	908.800	7205.000	907.300	7227.000	908.800	7244.000	906.600	7288.000
GR	909.100	7342.000	907.400	7378.000	910.800	7441.000	904.600	7505.000	905.300	7588.000
GR	910.100	7739.000	907.600	7898.000	908.400	7941.000	906.600	7982.000	907.300	8034.000
GR	904.100	8067.000	907.400	8142.000	906.100	8174.000	908.300	8197.000	908.600	8323.000
GR	908.100	8426.000	901.800	8479.000	908.600	8742.000	907.600	8767.000	909.800	8803.000
GR	903.600	8855.000	900.600	8949.000	895.100	9000.000	895.100	9050.000	897.300	9074.000
GR	894.000	9093.000	895.500	9204.000	895.500	9457.000	897.300	9513.000	892.800	9622.000
GR	894.600	9648.000	893.000	9685.000	892.600	9805.000	893.500	9845.000	897.800	10000.000
GR	899.300	10099.000	902.800	10293.000	901.000	10426.000	902.100	10450.000	899.500	10529.000
GR	903.600	10552.000	898.800	10569.000	897.800	10639.000	905.100	10680.000	903.600	10764.000
GR	905.300	10859.000	904.800	10967.000	905.800	11016.000	902.300	11104.000	901.600	11165.000
GR	906.100	11228.000	899.600	11304.000	905.300	11366.000	904.900	11544.000	910.900	12000.000
GR	910.800	12147.000	914.900	12172.000	915.800	12212.000	904.600	12233.000	904.600	12266.000
GR	909.100	12271.000	909.100	12284.000	916.100	12297.000	916.300	12320.000	913.100	12330.000
GR	914.800	13216.000	915.900	13252.000	918.600	14547.000	919.300	14601.000	920.400	14738.000
GR	922.100	15050.000	922.300	15356.000	923.600	15823.000	923.900	15943.000	924.100	16188.000
X1	386.000	67.000	9007.000	10732.000	820.000	950.000	800.000	0.000	0.000	0.000
GR	919.800	6770.000	914.400	6824.000	915.900	6842.000	914.300	6857.000	917.600	6909.000
GR	912.600	6968.000	913.100	7004.000	910.800	7080.000	907.800	7255.000	908.800	7317.000
GR	909.800	7469.000	912.800	7628.000	911.400	7681.000	909.600	7737.000	911.100	7767.000
GR	909.800	7808.000	909.800	7992.000	911.100	8026.000	908.800	8064.000	905.400	8151.000
GR	909.300	8238.000	910.300	8288.000	909.400	8465.000	907.300	8513.000	907.300	8659.000
GR	908.800	8691.000	907.300	8728.000	909.800	8770.000	902.100	8858.000	904.600	8938.000
GR	904.400	9007.000	896.100	9036.000	894.500	9073.000	897.500	9225.000	898.600	9287.000
GR	899.500	9463.000	895.300	9737.000	894.100	9901.000	892.500	9919.000	893.500	10000.000
GR	899.600	10069.000	897.800	10127.000	900.300	10146.000	896.100	10171.000	896.100	10331.000
GR	907.800	10404.000	904.300	10611.000	908.600	10732.000	906.300	10748.000	911.900	11136.000
GR	911.900	11873.000	917.900	11943.000	920.800	12031.000	913.300	12076.000	912.600	12092.000
GR	913.100	12318.000	914.100	12500.000	914.100	12500.000	915.400	13292.000	916.600	13330.000
GR	918.300	13339.000	918.900	14617.000	919.300	14651.000	920.300	14902.000	922.100	15942.000
GR	922.900	16016.000	922.600	16262.000	0.000	0.000	0.000	0.000	0.000	0.000
EJ	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000

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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

CRITICAL DEPTH TO BE CALCULATED AT ALL CROSS SECTIONS

CCHV=   0.100 CEHV=   0.300
*SECNO 366.000
3710 WSEL ASSUMED BASED ON MIN DIFF

3470 ENCROACHMENT STATIONS=    7100.0   12500.0  TYPE=     1  TARGET=    5400.000
            ALL SECTIONS LOOKING DOWNSTREAM
            CHANNEL STATIONS ARE FROM LEFT TO RIGHT WITH CONTROL LINE STATION
            10,000.
            THE 100-YEAR FLOOD PEAK (250,000) IS BASED ON THE ARMY CORPS OF
            ENGINEERS (COE) HYDROLOGY, MAY 1985.
            TOPO PROVIDED BY MARICOPA COUNTY FLOOD CONTROL DISTRICT (MCFCD)
            PHOTO DATE 3-28-84.   AERIAL MAPPING CO. #83039
            COOPER AERIAL SURVEY CO. #830339.
            CROSS SECTIONS DIGITIZED FROM AERIAL PHOTOS FURNISHED BY MCFCD.
            REACH LENGTHS ON X1 CARDS HAVE BEEN UPDATED 6-87.
   366.00    17.93   903.03   897.03     0.00   903.63     0.60     0.00     0.00   892.80
  250000.     352.  227425.   22223.     206.   35230.    8293.       0.       0.   897.40
     0.00    1.71     6.46     2.68    0.055    0.032    0.055    0.000   885.10  7903.72
 0.000701      0.       0.       0.        0       18        0     0.00  4288.30 12192.02


FLOW DISTRIBUTION FOR SECNO=    366.00          CWSEL=    903.03

STA=    7904.    8088.   11014.   11445.   11814.   12192.
  PER Q=      0.1     91.0      3.1      3.5      2.3
   AREA=    206.4  35230.3   2966.4   2991.0   2335.6
    VEL=      1.7      6.5      2.6      2.9      2.4

*SECNO 368.000
3710 WSEL ASSUMED BASED ON MIN DIFF

3470 ENCROACHMENT STATIONS=    7400.0   12300.0  TYPE=     1  TARGET=    4900.000
   368.00    17.23   903.73   898.24     0.00   904.39     0.66     0.74     0.02   906.30
  250000.       0.  236096.   13904.       0.   35321.    5059.     948.      95.   896.60
     0.04     0.00     6.68     2.75    0.000    0.032    0.055    0.000   886.50  8157.83
 0.000834     900.     960.    1100.        0       23        0     0.00  4026.27 12184.10
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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=    368.00          CWSEL=    903.73

STA=    8158.   11327.   11786.   12184.
  PER Q=      94.4       4.0       1.6
   AREA=   35321.4    3306.8    1752.4
    VEL=       6.7       3.0       2.3

*SECNO 370.000
3710 WSEL ASSUMED BASED ON MIN DIFF

3470 ENCROACHMENT STATIONS=    8530.0   12100.0  TYPE=      1  TARGET=    3570.000
   370.00     16.86    904.46    899.73      0.00    905.41      0.94      0.94      0.08    916.10
  250000.        0.   236562.   13438.        0.    29677.    3869.     1752.      175.    897.80
     0.08      0.00      7.97      3.47     0.000     0.032     0.055     0.000    887.60   8586.26
 0.001201      930.      940.     1000.         0        19         0      0.00   3321.08  11907.34

FLOW DISTRIBUTION FOR SECNO=    370.00          CWSEL=    904.46

STA=    8586.   11272.   11471.   11494.   11534.   11597.   11701.   11748.   11846.   11907.
  PER Q=      94.6       1.8       0.3       0.7       0.8       1.2       0.4       0.2       0.0
   AREA=   29676.6    1325.2     210.7     406.4     514.1     807.0     298.9     280.2      26.4
    VEL=       8.0       3.3       4.0       4.4       3.8       3.7       3.2       1.9       0.5

*SECNO 372.000

3470 ENCROACHMENT STATIONS=    8280.0   11788.0  TYPE=      1  TARGET=    3508.000
   372.00     18.66    905.66    900.12      0.00    906.42      0.76      1.00      0.02    949.60
  250000.        0.   236090.   13911.        0.    32878.    4359.     2534.      250.    903.30
     0.11      0.00      7.18      3.19     0.000     0.032     0.055     0.000    887.00   8357.93
 0.000911      900.      950.     1060.         2        19         0      0.00   3419.18  11777.11

FLOW DISTRIBUTION FOR SECNO=    372.00          CWSEL=    905.66

STA=    8358.   11187.   11257.   11303.   11633.   11660.   11713.   11762.   11777.
  PER Q=      94.4       0.2       0.4       3.6       0.4       0.7       0.3       0.0
   AREA=   32878.1     269.9     308.5    2708.1     255.3     474.7     304.1      38.2
    VEL=       7.2       2.0       2.9       3.3       3.6       3.5       2.8       1.5

*SECNO 374.000

3470 ENCROACHMENT STATIONS=    6900.0   11940.0  TYPE=      1  TARGET=    5040.000
```

```
   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

   374.00    18.50     906.60    900.76    0.00      907.21    0.60      0.77      0.02     901.90
  250000.    4899.     233399.   11702.    3409.     36403.    4258.     3425.     342.     901.10
     0.16    1.44      6.41      2.75      0.055     0.032     0.055     0.000     888.10   6908.54
 0.000719    900.      950.      1010.     2         20        0         0.00      5022.95  11931.49

FLOW DISTRIBUTION FOR SECNO=    374.00          CWSEL=    906.60

STA=    6909.    8193.    11300.    11740.    11931.
  PER Q=      2.0      93.4      3.6      1.1
   AREA=   3409.4   36403.0   3233.0   1025.2
    VEL=      1.4      6.4      2.8      2.7

*SECNO 376.000

3470 ENCROACHMENT STATIONS=    6760.0    12043.0  TYPE=     1  TARGET=    5283.000
   376.00    16.45    907.25    902.53    0.00      908.22    0.98      0.90      0.11     903.40
  250000.    9504.    210757.   29740.    4744.     24912.    6688.     4304.     454.     896.10
     0.19    2.00      8.46      4.45      0.055     0.032     0.055     0.000     890.80   6778.92
 0.001309    910.      950.      1000.     2         14        0         0.00      5252.98  12031.90

FLOW DISTRIBUTION FOR SECNO=    376.00          CWSEL=    907.25

STA=    6779.    8742.    8826.    11028.    11229.    11321.    11669.    12032.
  PER Q=      3.5      0.3      84.3      4.8      3.0      3.1      1.0
   AREA=   4429.7    314.7   24912.3   2371.0   1316.6   2235.9    764.9
    VEL=      2.0      2.4      8.5      5.1      5.8      3.5      3.1

*SECNO 378.000

3470 ENCROACHMENT STATIONS=    6700.0    11971.0  TYPE=     1  TARGET=    5271.000
   378.00    18.69    908.19    903.21    0.00      909.07    0.88      0.84      0.01     899.80
  250000.    26461.   196433.   27106.    9972.     23591.    6735.     4928.     542.     896.00
     0.22    2.65      8.33      4.02      0.055     0.032     0.055     0.000     889.50   6808.37
 0.001103    860.      710.      540.      2         15        0         0.00      5064.23  11872.61

FLOW DISTRIBUTION FOR SECNO=    378.00          CWSEL=    908.19

STA=    6808.    8108.    8829.    9062.    9138.    11016.    11163.    11304.    11702.    11873.
  PER Q=      3.1      3.2      3.1      1.2      78.6      3.5      3.3      3.3      0.7
   AREA=   3982.6   3203.8   2041.3   744.1   23590.7   1813.5   1742.8   2638.3   540.8
    VEL=      1.9      2.5      3.8      4.1      8.3      4.8      4.8      3.2      3.1
```

```
   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 380.000

3470 ENCROACHMENT STATIONS=    6291.0    12171.0  TYPE=     1  TARGET=    5880.000
   380.00     19.94    909.44    904.41      0.00    910.34      0.90      1.26      0.01    903.30
  250000.    16340.   202761.   30898.     7999.    24323.     8530.     6018.      677.    901.60
     0.26      2.34      8.34     3.62     0.055     0.032     0.055     0.000    889.50   6438.96
 0.001036      960.     1170.    1420.         2        16         0      0.00   5494.56  11933.52

FLOW DISTRIBUTION FOR SECNO=    380.00          CWSEL=    909.44

STA=    6439.    7580.    8968.    9011.   10856.   11106.   11277.   11680.   11934.
  PER Q=      3.1      3.2      0.2     81.1      3.6      3.6      3.4      1.8
   AREA=   3680.0   4122.3    196.8  24323.2   2344.6   1998.1   2710.3   1477.5
    VEL=      2.1      2.0      2.4      8.3      3.9      4.5      3.1      3.0

*SECNO 382.000

3265 DIVIDED FLOW

3710 WSEL ASSUMED BASED ON MIN DIFF

3470 ENCROACHMENT STATIONS=    6200.0    11786.0  TYPE=     1  TARGET=    5586.000
   382.00     19.40    910.40    905.82      0.00    911.33      0.93      0.99      0.01    910.30
  250000.    19256.   211705.   19038.     8135.    25402.     5631.     6851.      788.    906.10
     0.30      2.37      8.33     3.38     0.055     0.032     0.055     0.000    891.00   6391.08
 0.001137      910.      910.     890.         0        19         0      0.00   5169.11  11775.85

FLOW DISTRIBUTION FOR SECNO=    382.00          CWSEL=    910.40

STA=    6391.    7463.    8157.    8874.   10941.   11397.   11736.   11776.
  PER Q=      3.5      3.3      0.9     84.7      3.4      4.0      0.2
   AREA=   3800.3   3221.8   1112.9  25402.1   2767.0   2652.5    211.2
    VEL=      2.3      2.5      2.1      8.3      3.1      3.8      2.7

*SECNO 384.000

3265 DIVIDED FLOW

   384.00     18.89    911.49    906.08      0.00    912.31      0.82      0.96      0.01    909.80
  250000.    17940.   212148.   19912.     7965.    27135.     7132.     7738.      902.    905.30
     0.33      2.25      7.82     2.79     0.055     0.032     0.055     0.000    892.60   6916.18
 0.000910      950.      950.     950.         2        19         0      0.00   5303.37  12288.43
```

```
   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=    384.00          CWSEL=    911.49

STA=    6916.     7898.     8742.     8803.    10859.    11228.    12000.    12288.
  PER Q=      3.0       4.0       0.1      84.9       3.4       4.2       0.4
   AREA=   3652.8    4127.0     185.0   27135.1    2715.9    3989.7     426.5
    VEL=      2.1       2.5       1.7       7.8       3.1       2.6       2.1

*SECNO 386.000

3265 DIVIDED FLOW

3301 HV CHANGED MORE THAN HVINS

   386.00     19.47    911.97    907.39      0.00    913.43      1.46      0.93      0.19    904.40
  250000.    17404.   230013.     2583.     6295.    22811.     1241.     8423.     1000.    908.60
     0.36      2.76     10.08      2.08     0.055     0.032     0.055     0.000    892.50   7041.24
 0.001511      820.      800.      950.         2        15         0      0.00   4757.49  11873.85

FLOW DISTRIBUTION FOR SECNO=    386.00          CWSEL=    911.97

STA=    7041.     8659.     9007.    10732.    11874.
  PER Q=      3.8       3.2      92.0       1.0
   AREA=   4144.9    2150.0   22810.9    1241.1
    VEL=      2.3       3.7      10.1       2.1
```

PROFILE FOR STREAM GILA RIVER EXISTING COND

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

```
ELEVATION   885.      890.      895.      900.      905.      910.      915.      920.      925.      930.
   SECNO   CUMDIS
366.00       0.  I         .     L   .   CR    .     WE  .     M   .         .         .         .         .
            100.  I         .       L .   CR    .     WE  .     M   .         .         .         .         .
            200.  .I        .         .L  RC    .     W E .    M    .         .         .         .         .
            300.  .I        .         .   LC    .     W E .    M    .         .         .         .         .
            400.  .I        .         .   RC L  .      WE .    M    .         .         .         .         .
            500.  . I       .         .   RC    L      WE .   M     .         .         .         .         .
            600.  . I       .         .   R C   . L    WE .   M     .         .         .         .         .
            700.  . I       .         .   R C   .    L WE .  M      .         .         .         .         .
            800.  .  I      .         .  R  C   .      WLE.  M      .         .         .         .         .
            900.  .  I      .         .  R  C   .      W E.LM      .         .         .         .         .
368.00     1000.  .  I      .         .  R  C   .      W E. ML     .         .         .         .         .
           1100.  .  I      .         .  R   C  .       WE. M  L   .         .         .         .         .
           1200.  .  I      .         .   R  C  .       WE. M    L .         .         .         .         .
           1300.  .   I     .         .   R  C  .       WE. M      L.         .         .         .         .
           1400.  .   I     .         .   R   C .       W E M       .L        .         .         .         .
           1500.  .   I     .         .   R   C .       W E  M      .  L      .         .         .         .
           1600.  .   I     .         .    R  C .       W E  M      .    L    .         .         .         .
           1700.  .    I    .         .    R   C.        WE  M      .      L  .         .         .         .
           1800.  .    I    .         .    R   C.        W.E M      .        L.         .         .         .
370.00     1900.  .    I    .         .     R  C.        W.E M      .         . L       .         .         .
           2000.  .    I    .         .      R  C        W.E  M     .         .        L.         .         .
           2100.  .    I    .         .       R C        W.E   M    .         .         .    L    .         .
           2200.  .    I    .         .        RC         WE    M   .         .         .      L  .         .
           2300.  .    I    .         .         C         W E    M  .         .         .         L         .
           2400.  .    I    .         .         CR        W E    M  .         .         .         .      L  .
           2500.  .   I     .         .         C  R      W E     M .         .         .         .         L
           2600.  .   I     .         .         C   R     .WE      M.         .         .         .         L
           2700.  .   I     .         .         C    R    .W E      M         .         .         .         L
           2800.  .   I     .         .         C     R   .W E     .M         .         .         .         L
372.00     2900.  .   I     .         .         C      R  .W E     . M        .         .         .         L
           3000.  .   I     .         .         C     R   . WE     . M        .         .         .         L
           3100.  .   I     .         .         .C    R   . WE     . M        .         .         .         L
           3200.  .    I    .         .         .C   R    . WE     .  M       .         .         .        L.
           3300.  .    I    .         .         .C   R    . W E    .  M       .         .        L.         .
           3400.  .    I    .         .         .C  R     . W E    .   M      .         .      L.           .
           3500.  .    I    .         .         .C  R     .  WE    .   M      .        L.         .         .
           3600.  .     I   .         .         .C R      .  WE    .    M   L.         .         .         .
           3700.  .     I   .         .         .C R      .  WE   L.    M    .         .         .         .
374.00     3800.  .     I   .         .         . C L     .  WE    .     M   .         .         .         .
           3900.  .      I  .         .         .RC L     .  W E   .     M   .         .         .         .
           4000.  .      I  .         .         R C L     .  W E   .     M   .         .         .         .
           4100.  .       I .         .        R.  C L    .   WE   .      M  .         .         .         .
           4200.  .       I .         .       R .  C L    .   WE   .      M  .         .         .         .
           4300.  .        I.         .      R  .  C L    .   WE   .      M  .         .         .         .
           4400.  .         I         .     R   .   C L   .   W E  .      M  .         .         .         .
           4500.  .         I         .    R    .   C L   .   W E  .       M .         .         .         .
           4600.  .         .I        .   R     .    CL   .   W E  .       M .         .         .         .
           4700.  .         .I        .  R      .    C L  .   W E  .       M .         .         .         .
376.00     4800.  .         . I       . R       .    C L  .    WE  .        M.         .         .         .
           4900.  .         .I        . R       .    CL   .    W E .        M.         .         .         .
           5000.  .         .I        . R       .    C    .    W E .         M         .         .         .
           5100.  .         .I        . R       .   L C   .    W E .         .M        .         .         .
           5200.  .         I         . R       .  L  C   .     WE .         . M       .         .         .
           5300.  .         I         . R       . L   C   .     W E .         .  M      .         .         .
           5400.  .         I         . R       .     C   .     W E .         .  M      .         .         .
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```
378.00  5500.  .   I.        . R       L     C   .     W E .       .  M     .         .         .         .
        5600.  .   I.        .  R      L      C  .      WE .       .   M    .         .         .         .
        5700.  .   I.        .   R     .L     C  .      W E.       .    M   .         .         .         .
        5800.  .   I.        .    R    .L     C  .      W E.       .    M   .         .         .         .
        5900.  .   I.        .     R   . L    C  .      W E.       .     M  .         .         .         .
        6000.  .   I.        .      R  .  L   C  .      W E.       .      M .         .         .         .
        6100.  .   I.        .       R .  L    C .       WE.       .       M.         .         .         .
        6200.  .   I.        .        R.   L   C .       W E       .       M.         .         .         .
        6300.  .   I.        .         R   L   C .       W E       .        M         .         .         .
        6400.  .   I.        .         .R   L  C .       W E       .        .M        .         .         .
        6500.  .   I.        .         . R   L C .       W E       .        .M        .         .         .
        6600.  .   I.        .         .  R  L  C.        W.E      .         . M      .         .         .
380.00  6700.  .   I.        .         .  R   L C.        W.E      .         .  M     .         .         .
        6800.  .   I.        .         .   R   LC.        W.E      .         .  M     .         .         .
        6900.  .    I        .         .    R   CL        W.E      .         .  M     .         .         .
        7000.  .    I        .         .     R   CL       W.E      .         .   M    .         .         .
        7100.  .    I        .         .      R  C  L      W E      .         .   M    .         .         .
        7200.  .    .I       .         .       R C   L     W E      .         .   M    .         .         .
        7300.  .    .I       .         .        R.C    L   W E      .         .    M   .         .         .
        7400.  .    .I       .         .         RC     L  W E      .         .    M   .         .         .
        7500.  .    . I      .         .         .C       L.WE      .         .    M   .         .         .
382.00  7600.  .    . I      .         .         . C       .W E      .         .     M  .         .         .
        7700.  .    . I      .         .         . C       LW E      .         .     M  .         .         .
        7800.  .    .  I     .         .         . C       LW E      .         .     M  .         .         .
        7900.  .    .  I     .         .         . C       LW E      .         .      M .         .         .
        8000.  .    .  I     .         .         . C       L WE      .         .      M .         .         .
        8100.  .    .   I    .         .         .RC       L W E     .         .      M .         .         .
        8200.  .    .   I    .         .         .RC       L W E     .         .      M .         .         .
        8300.  .    .   I    .         .         .RC       L W E     .         .       M.         .         .
        8400.  .    .    I   .         .         .RC       L  WE     .         .       M.         .         .
384.00  8500.  .    .    I   .         .         .RC       L  W E    .         .       M.         .         .
        8600.  .    .    I   .         .         .RC      L .  W E   .         .      M .         .         .
        8700.  .    .    I   .         .         . RC    L  .  W E   .         .    M   .         .         .
        8800.  .    .    I   .         .         .  C  L   .  W E    .         .   M    .         .         .
        8900.  .    .    I   .         .         .  CL     .  W  E   .         .  M     .         .         .
        9000.  .    .    I   .         .         .  LCR    .   W E   .         . M      .         .         .
        9100.  .    .    I   .         .         . L C R   .   W E   .         . M      .         .         .
        9200.  .    .    I   .         .         L   C R   .   W  E  .         .M       .         .         .
386.00  9300.  .    .    I   .         .         L.   C R  .   W  E  .         M        .         .         .
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THIS RUN EXECUTED FRI, JUN 12 1987 14:25:03

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**************************************************
  HEC2 RELEASE DATED NOV 76 UPDATED MAY  1984
  ERROR CORR -  01,02,03,04,05,06
  MODIFICATION -  50,51,52,53,54,55,56
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NOTE- ASTERISK (*) AT LEFT OF CROSS-SECTION NUMBER INDICATES MESSAGE IN SUMMARY OF ERRORS LIST

GILA RIVER EXISTING COND

SUMMARY PRINTOUT TABLE 150

	SECNO	XLCH	ELTRD	ELLC	ELMIN	Q	CWSEL	CRIWS	EG	10K*S	VCH	AREA	.01K
*	366.000	0.00	0.00	0.00	885.10	250000.00	903.03	897.03	903.63	7.01	6.46	43729.73	94444.58
*	368.000	960.00	0.00	0.00	886.50	250000.00	903.73	898.24	904.39	8.34	6.68	40380.53	86579.25
*	370.000	940.00	0.00	0.00	887.60	250000.00	904.46	899.73	905.41	12.01	7.97	33545.46	72145.73
	372.000	950.00	0.00	0.00	887.00	250000.00	905.66	900.12	906.42	9.11	7.18	37236.98	82824.22
	374.000	950.00	0.00	0.00	888.10	250000.00	906.60	900.76	907.21	7.19	6.41	44070.68	93236.25
	376.000	950.00	0.00	0.00	890.80	250000.00	907.25	902.53	908.22	13.09	8.46	36345.06	69111.41
	378.000	710.00	0.00	0.00	889.50	250000.00	908.19	903.21	909.07	11.03	8.33	40297.75	75288.37
	380.000	1170.00	0.00	0.00	889.50	250000.00	909.44	904.41	910.34	10.36	8.34	40852.88	77655.59
*	382.000	910.00	0.00	0.00	891.00	250000.00	910.40	905.82	911.33	11.37	8.33	39167.74	74138.45
	384.000	950.00	0.00	0.00	892.60	250000.00	911.49	906.08	912.31	9.10	7.82	42231.89	82873.52
	386.000	800.00	0.00	0.00	892.50	250000.00	911.97	907.39	913.43	15.11	10.08	30346.86	64308.42

GILA RIVER EXISTING COND

SUMMARY PRINTOUT TABLE 150

	SECNO	Q	CWSEL	DIFWSP	DIFWSX	DIFKWS	TOPWID	XLCH
*	366.000	250000.00	903.03	0.00	0.00	0.00	4288.30	0.00
*	368.000	250000.00	903.73	0.00	0.70	0.00	4026.27	960.00
*	370.000	250000.00	904.46	0.00	0.74	0.00	3321.08	940.00
	372.000	250000.00	905.66	0.00	1.19	0.00	3419.18	950.00
	374.000	250000.00	906.60	0.00	0.95	0.00	5022.95	950.00
	376.000	250000.00	907.25	0.00	0.64	0.00	5252.98	950.00
	378.000	250000.00	908.19	0.00	0.94	0.00	5064.23	710.00
	380.000	250000.00	909.44	0.00	1.25	0.00	5434.56	1170.00
*	382.000	250000.00	910.40	0.00	0.96	0.00	5169.11	910.00
	384.000	250000.00	911.49	0.00	1.09	0.00	5303.37	950.00
	386.000	250000.00	911.97	0.00	0.48	0.00	4757.49	800.00

SUMMARY OF ERRORS AND SPECIAL NOTES

```
CAUTION  SECNO=   366.000  PROFILE= 1  WSEL ASSUMED BASED ON MIN DIFF
CAUTION  SECNO=   368.000  PROFILE= 1  WSEL ASSUMED BASED ON MIN DIFF
CAUTION  SECNO=   370.000  PROFILE= 1  WSEL ASSUMED BASED ON MIN DIFF
CAUTION  SECNO=   382.000  PROFILE= 1  WSEL ASSUMED BASED ON MIN DIFF
```

APPENDIX C

COMPUTER ANALYSIS
-PROPOSED FLOODWAY CONDITION
WITH BRIDGE

```
*****************************************************
*  WATER SURFACE PROFILES                           *
*  VERSION OF NOVEMBER 1976                         *
*  UPDATED MAY 1984                                 *
*                                                   *
*  RUN DATE FRI, JUN 12 1987 TIME 14:25:07          *
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****************************************
*  U.S. ARMY CORPS OF ENGINEERS        *
*  THE HYDROLOGIC ENGINEERING CENTER   *
*  609 SECOND STREET, SUITE D          *
*  DAVIS, CALIFORNIA 95616             *
*  (916) 440-2105 (FTS) 448-2105       *
****************************************
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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
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THIS RUN EXECUTED FRI, JUN 12 1987 14:25:18

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**************************************************
  HEC2 RELEASE DATED NOV 76 UPDATED MAY  1984
  ERROR CORR -  01,02,03,04,05,06
  MODIFICATION -  50,51,52,53,54,55,56
**************************************************
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C
T1      12-30-86  ESTRELLA MT. RANCH - AMCOR, FINAL SUBMITTAL UPDATED 6-12-87.
T2      REEMS ROAD BRIDGE ANALYSIS
T3      GILA RIVER FLOODWAY ANALYSIS

J1  ICHECK    INQ       NINV      IDIR      STRT      METRIC    HVINS     Q         WSEL      FQ

       0.       3.       0.        0.  0.000701      0.00      0.0       0.   903.030    0.000

J2  NPROF     IPLOT     PRFVS     XSECV     XSECH     FN        ALLDC     IBW       CHNIM     ITRACE

    -1.000    0.000     0.000     0.000     0.000     0.000    -1.000    0.000     0.000    15.000

J3  VARIABLE CODES FOR SUMMARY PRINTOUT

   150.000    0.000     0.000     0.000     0.000     0.000     0.000    0.000     0.000     0.000

NC      0.055     0.055     0.032     0.100     0.300     0.000     0.000     0.000     0.000     0.000
QT      2.000 250000.000 250000.000 0.000     0.000     0.000     0.000     0.000     0.000     0.000
ET    366.000     0.000     9.100     0.000     0.000     0.000     0.000     0.000  8088.000 11014.000
          ALL SECTIONS LOOKING DOWNSTREAM
          CHANNEL STATIONS ARE FROM LEFT TO RIGHT WITH CONTROL LINE STATION
          10,000.
          THE 100-YEAR FLOOD PEAK (250,000) IS BASED ON THE ARMY CORPS OF
          ENGINEERS (COE) HYDROLOGY, MAY 1985.
          TOPO PROVIDED BY MARICOPA COUNTY FLOOD CONTROL DISTRICT (MCFCD)
          PHOTO DATE 3-28-84.   AERIAL MAPPING CO. #83039
          COOPER AERIAL SURVEY CO. #830339.
          CROSS SECTIONS DIGITIZED FROM AERIAL PHOTOS FURNISHED BY MCFCD.
          METHOD 1 ENCROACHMENT USES STATIONS FROM METHOD 4 ENCROACHMENT.
          REACH LENGTHS ON X1 CARDS HAVE BEEN UPDATED 6-87.
               NOTE:
                    FOR MULTI-PROFILE RUNS W/500 YEAR FLOOD,
                    APPROPRIATE MODELLING WILL BE REQUIRED TO CHECK THE
                    EFFECT OF THE CANAL LOCATED ON THE NORTH BANK.

                    BRIDGE OVERTOPPING DATA (AS PROVIDED ON THE BT CARDS)
                    HAS BEEN BASED ON DESIGN DATA.

                    BRIDGE MODEL BASED ON (17) 5-FOOT DIAMETER PIERS
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UPDATED 1-21-87 & 6-12-87

X1	366.000	73.000	8088.000	11014.000	0.000	0.000	0.000	0.000	0.000	0.000
GR	907.400	7073.000	910.400	7084.000	909.600	7110.000	907.300	7120.000	905.300	7134.000
GR	905.800	7221.000	902.400	8059.000	892.800	8088.000	892.800	8215.000	888.500	8245.000
GR	889.100	8471.000	886.500	8579.000	886.500	8657.000	885.100	8660.000	885.100	8860.000
GR	888.500	8907.000	891.300	9083.000	893.800	9198.000	892.600	9288.000	889.500	9395.000
GR	891.100	9675.000	890.500	9889.000	888.000	9942.000	890.600	10000.000	892.100	10259.000
GR	893.100	10432.000	889.800	10449.000	889.800	10485.000	891.900	10508.000	891.900	10563.000
GR	891.000	10609.000	894.300	10627.000	896.900	10802.000	897.400	10841.000	897.400	11014.000
GR	896.600	11232.000	895.400	11342.000	893.600	11445.000	894.800	11496.000	893.100	11539.000
GR	893.100	11627.000	897.800	11641.000	897.400	11693.000	894.400	11751.000	896.600	11814.000
GR	896.900	11916.000	896.300	12166.000	903.800	12195.000	904.100	12325.000	904.100	12511.000
GR	911.100	12540.000	905.900	12548.000	905.900	12565.000	898.300	12581.000	898.300	12605.000
GR	906.600	12618.000	906.600	12642.000	902.900	12656.000	902.400	13070.000	902.100	13955.000
GR	901.300	13968.000	903.600	15239.000	905.300	15273.000	905.300	15299.000	903.800	15309.000
GR	903.800	15375.000	902.900	15429.000	905.400	15436.000	905.400	15445.000	903.900	15456.000
GR	906.900	15484.000	907.400	15550.000	908.100	15645.000	0.000	0.000	0.000	0.000
ET	368.000	0.000	9.100	0.000	0.000	0.000	0.000	0.000	8153.000	11327.000
X1	368.000	74.000	8153.000	11327.000	900.000	1100.000	960.000	0.000	0.000	0.000
GR	911.400	7197.000	913.800	7233.000	914.400	7261.000	908.800	7287.000	908.300	7678.000
GR	906.300	8153.000	895.100	8174.000	895.300	8220.000	892.600	8229.000	891.100	8363.000
GR	893.000	8376.000	895.000	8473.000	892.500	8546.000	889.800	8562.000	889.100	8614.000
GR	886.500	8629.000	886.500	8881.000	888.000	8927.000	891.600	9051.000	894.500	9060.000
GR	896.000	9182.000	896.300	9273.000	894.000	9324.000	894.300	9387.000	892.600	9440.000
GR	894.800	9573.000	892.100	9784.000	891.800	10000.000	889.500	10330.000	889.000	10420.000
GR	894.400	10439.000	894.400	10589.000	896.100	10721.000	894.900	11092.000	891.600	11169.000
GR	891.600	11189.000	892.400	11211.000	893.800	11303.000	896.600	11327.000	893.100	11368.000
GR	895.400	11416.000	896.300	11525.000	892.600	11547.000	897.300	11589.000	899.400	11786.000
GR	900.600	11947.000	897.300	11971.000	896.400	12048.000	900.300	12062.000	900.900	12101.000
GR	897.300	12107.000	897.300	12145.000	903.100	12154.000	904.400	12217.000	911.600	12253.000
GR	911.600	12306.000	906.100	12320.000	905.400	12409.000	905.400	12511.000	903.100	12519.000
GR	905.100	14091.000	905.800	14122.000	903.100	14131.000	903.600	14759.000	904.800	15257.000
GR	905.800	15313.000	906.100	15347.000	904.800	15362.000	902.600	15444.000	905.800	15477.000
GR	906.400	15490.000	909.300	15508.000	906.900	15530.000	906.100	15584.000	0.000	0.000
ET	370.000	0.000	9.100	0.000	0.000	0.000	0.000	0.000	8569.000	11272.000
X1	370.000	67.000	8569.000	11272.000	930.000	1000.000	940.000	0.000	0.000	0.000
GR	940.900	7865.000	940.100	7901.000	922.100	7941.000	928.100	8009.000	935.900	8098.000
GR	943.900	8175.000	945.600	8222.000	938.400	8289.000	918.600	8435.000	921.900	8485.000
GR	925.100	8529.000	916.100	8569.000	892.500	8604.000	892.500	8633.000	888.300	8643.000
GR	887.600	8959.000	891.600	8981.000	894.000	9072.000	893.100	9168.000	891.300	9215.000
GR	896.000	9256.000	895.600	9323.000	896.300	9466.000	895.000	9669.000	893.800	9783.000
GR	892.600	9964.000	892.300	10000.000	894.000	10089.000	893.500	10280.000	891.500	10615.000
GR	894.400	10689.000	895.900	10857.000	895.300	11122.000	896.400	11149.000	896.400	11194.000
GR	893.600	11222.000	892.900	11256.000	897.800	11272.000	897.800	11471.000	892.800	11494.000
GR	895.800	11534.000	896.800	11597.000	896.600	11701.000	899.600	11748.000	903.600	11846.000
GR	905.800	12003.000	906.600	12126.000	905.600	12213.000	911.300	12272.000	909.400	12316.000
GR	909.300	12490.000	906.900	12641.000	911.800	12664.000	911.800	12694.000	901.300	12703.000
GR	901.300	12735.000	898.600	12740.000	898.600	12765.000	903.600	12770.000	903.600	12785.000
GR	905.400	12798.000	907.800	14132.000	905.900	14156.000	906.900	15143.000	908.100	15184.000
GR	907.300	15207.000	906.400	15434.000	0.000	0.000	0.000	0.000	0.000	0.000

ET	372.000	0.000	9.100	0.000	0.000	0.000	0.000	0.000	8290.000	11187.000
X1	372.000	76.000	8290.000	11187.000	900.000	1060.000	950.000	0.000	0.000	0.000
GR	913.800	7493.000	910.800	7506.000	931.400	7558.000	928.400	7591.000	941.400	7620.000
GR	957.400	7699.000	957.400	7723.000	923.800	7856.000	948.900	7909.000	972.800	7973.000
GR	961.800	8009.000	959.100	8045.000	962.800	8090.000	964.300	8152.000	952.400	8186.000
GR	949.600	8231.000	949.600	8290.000	887.500	8386.000	887.000	8511.000	889.300	8557.000
GR	890.300	8589.000	894.800	8630.000	893.100	8681.000	894.600	8813.000	895.300	8852.000
GR	893.600	8975.000	893.600	9014.000	893.600	9143.000	895.600	9210.000	897.300	9346.000
GR	895.600	9452.000	895.100	9570.000	895.000	9867.000	893.100	10000.000	893.600	10168.000
GR	893.600	10395.000	895.100	10417.000	895.800	10505.000	895.800	10631.000	892.800	10683.000
GR	892.500	10833.000	893.600	10970.000	895.600	11061.000	894.600	11140.000	903.300	11187.000
GR	900.300	11257.000	897.600	11303.000	897.300	11633.000	895.100	11660.000	898.300	11713.000
GR	900.600	11762.000	909.300	11788.000	905.400	11824.000	900.300	11837.000	901.300	11959.000
GR	906.300	11971.000	908.600	12129.000	910.600	12223.000	910.100	12540.000	914.400	12589.000
GR	917.300	12621.000	914.100	12625.000	915.600	12647.000	902.800	12662.000	898.900	12666.000
GR	898.900	12692.000	905.900	12699.000	905.900	12715.000	911.800	12722.000	909.900	12748.000
GR	911.400	12766.000	908.600	12777.000	908.300	12959.000	908.800	15080.000	909.100	15207.000
GR	910.800	15455.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
ET	374.000	0.000	9.100	0.000	0.000	0.000	0.000	0.000	8193.000	11300.000
X1	374.000	84.000	8193.000	11300.000	900.000	1010.000	950.000	0.000	0.000	0.000
GR	960.800	6651.000	922.600	6841.000	904.600	6917.000	905.600	6978.000	904.800	6988.000
GR	903.600	7918.000	901.900	8193.000	888.100	8223.000	889.800	8271.000	890.800	8404.000
GR	895.300	8425.000	889.600	8466.000	891.300	8566.000	891.000	8600.000	889.100	8604.000
GR	890.300	8847.000	895.300	8924.000	895.500	8999.000	897.800	9120.000	900.000	9310.000
GR	898.500	9364.000	893.500	9399.000	894.500	9687.000	897.500	9722.000	899.500	9857.000
GR	894.600	9964.000	896.600	10000.000	893.000	10150.000	896.800	10161.000	897.800	10344.000
GR	898.100	10532.000	897.000	10730.000	896.100	10874.000	897.300	10938.000	894.600	11046.000
GR	892.800	11118.000	889.500	11148.000	889.300	11185.000	892.100	11202.000	888.500	11268.000
GR	901.100	11300.000	900.300	11445.000	898.100	11536.000	899.600	11578.000	896.600	11740.000
GR	897.600	11806.000	905.600	11825.000	905.300	11864.000	900.800	11888.000	900.800	11904.000
GR	908.400	11940.000	907.100	11962.000	909.100	12051.000	910.900	12139.000	910.400	12292.000
GR	909.900	12418.000	912.300	12525.000	920.800	12559.000	916.300	12565.000	917.300	12579.000
GR	903.900	12596.000	901.600	12609.000	902.400	12640.000	906.400	12647.000	908.100	12664.000
GR	915.400	12675.000	913.400	12701.000	912.600	12785.000	910.100	12811.000	910.300	13040.000
GR	911.800	13064.000	911.900	13082.000	910.100	13094.000	910.800	14000.000	912.300	14094.000
GR	912.300	14226.000	912.400	14362.000	911.100	14433.000	911.100	14806.000	911.800	15233.000
GR	912.600	15384.000	913.900	15436.000	913.100	15449.000	912.800	15591.000	0.000	0.000
ET	376.000	0.000	9.100	0.000	0.000	0.000	0.000	0.000	8826.000	11243.000
X1	376.000	71.000	8826.000	11028.000	910.000	1000.000	950.000	0.000	0.000	0.000
GR	913.400	6431.000	909.100	6545.000	901.000	6567.000	901.600	6643.000	901.800	6715.000
GR	905.600	6734.000	907.900	6755.000	907.900	6775.000	906.400	6784.000	906.300	7409.000
GR	904.600	8033.000	902.900	8206.000	903.600	8742.000	903.400	8826.000	893.300	8864.000
GR	890.800	8887.000	890.800	9275.000	893.800	9348.000	895.100	9591.000	896.600	9759.000
GR	895.100	9780.000	894.100	9876.000	897.600	9887.000	897.100	10000.000	896.000	10068.000
GR	899.600	10090.000	899.000	10256.000	899.500	10517.000	899.600	10592.000	899.300	10729.000
GR	896.300	10890.000	896.100	11028.000	894.800	11229.000	892.400	11270.000	892.400	11321.000
GR	901.900	11344.000	902.900	11475.000	899.600	11540.000	900.100	11649.000	897.100	11669.000
GR	897.100	11707.000	906.900	11738.000	906.100	12017.000	908.100	12043.000	904.800	12076.000
GR	901.300	12090.000	901.300	12105.000	909.800	12133.000	906.100	12180.000	906.300	12325.000
GR	909.100	12470.000	911.900	12513.000	911.600	12528.000	912.600	12560.000	902.800	12574.000
GR	902.800	12599.000	905.800	12603.000	905.900	12621.000	912.800	12640.000	913.100	12676.000

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GR     910.600  12700.000    911.300   12883.000    910.900   14227.000    912.300   14247.000    910.600   14264.000
GR     911.800  14568.000    913.800   15276.000    914.100   15535.000    914.100   15588.000    913.400   15656.000
GR     914.300  15797.000      0.000       0.000      0.000       0.000      0.000       0.000      0.000       0.000

NC       0.055      0.055      0.032       0.300      0.500       0.000      0.000       0.000      0.000       0.000
ET     376.900      0.000      9.100       0.000      0.000       0.000      0.000       0.000   9151.000   11321.000
            SPECIAL BRIDGE ROUTINE USED AT REEMS ROAD (2170 FT.)
            SPECIAL BRIDGE TRAPEZOID USES SAME BOTTOM ELEV. AS NATURAL CHANNEL.
X1     376.900     91.000   9138.000   11016.000    750.000     430.000    600.000       0.000      0.000       0.000
GR     937.900   6690.000    913.100    6792.000    907.400    6811.000    905.800    6854.000    904.900    7104.000
GR     906.400   7302.000    902.400    7533.000    906.800    7893.000    904.600    8108.000    903.300    8178.000
GR     904.800   8213.000    903.400    8234.000    902.600    8308.000    904.800    8348.000    903.800    8386.000
GR     905.900   8448.000    905.100    8476.000    902.900    8632.000    904.800    8687.000    901.100    8791.000
GR     902.300   8829.000    899.000    8882.000    898.300    8942.000    900.600    9020.000    897.300    9062.000
GR     899.500   9085.000    897.100    9104.000    899.800    9138.000    891.000    9158.000    890.600    9357.000
GR     891.500   9388.000    889.700    9414.000    889.800    9471.000    893.800    9856.000    895.600    9899.000
GR     899.300  10000.000    900.500   10186.000    899.300   10317.000    897.600   10556.000    899.500   10639.000
GR     899.100  10728.000    896.300   10858.000    897.100   10884.000    895.100   10925.000    896.000   11016.000
GR     895.300  11104.000    897.000   11163.000    894.800   11199.000    897.000   11233.000    894.800   11243.000
GR     893.800  11281.000    902.400   11304.000    901.000   11345.000    902.400   11370.000    900.500   11403.000
GR     901.300  11500.000    902.800   11620.000    900.300   11702.000    900.100   11754.000    907.300   11772.000
GR     908.800  11942.000    911.600   11971.000    908.800   12011.000    902.600   12024.000    902.600   12043.000
GR     910.900  12068.000    909.800   12115.000    908.900   12166.000    910.400   12303.000    911.100   12398.000
GR     914.600  12477.000    906.900   12486.000    906.900   12507.000    902.400   12514.000    902.400   12535.000
GR     906.300  12541.000    906.300   12560.000    915.600   12573.000    914.600   12627.000    911.600   12646.000
GR     911.600  12799.000    911.100   13017.000    912.600   13029.000    910.800   13038.000    913.400   14329.000
GR     914.600  14343.000    913.900   14374.000    916.600   15377.000    917.300   15647.000    917.600   15693.000
GR     917.100  15997.000      0.000       0.000      0.000       0.000      0.000       0.000      0.000       0.000

ET     377.700      0.000      9.100       0.000      0.000       0.000      0.000       0.000   9151.000   11321.000
SB       1.050      1.200      2.700       0.000    724.000      85.000  55508.797      37.690    889.500     889.700
X1     377.700     91.000   9138.000   11016.000    110.000     110.000    110.000       0.000      0.000       0.000
X2       0.000      0.000      1.000     917.500    910.500       0.000      0.000       1.330      0.000       0.000
BT      27.000   6225.000    916.500       0.000   6445.000     913.600      0.000    6645.000    913.300       0.000
BT    7190.000    914.400      0.000    7505.000    913.700       0.000   7755.000     911.600      0.000    8335.000
BT     910.800      0.000   9150.000     919.400      0.000    9151.000    922.000     912.200   9492.000     925.000
BT     915.100   9855.000    926.800     916.900  10215.000     927.400    917.500   10575.000    926.800     916.900
BT   10937.000    925.000    915.100   11297.000    922.000     912.000  11298.000     919.400      0.000   12188.000
BT     910.500      0.000  12397.000     910.900      0.000   12653.000    914.000       0.000  12938.000     910.800
BT       0.000  13668.000    911.900       0.000  14323.000     910.600      0.000   15593.000    913.200       0.000
BT   15793.000    915.000      0.000   16393.000    916.600       0.000  16503.000     917.600      0.000   16533.000
BT     917.900      0.000      0.000       0.000      0.000       0.000      0.000       0.000      0.000       0.000
GR     937.900   6690.000    913.100    6792.000    907.400    6811.000    905.800    6854.000    904.900    7104.000
GR     906.400   7302.000    902.400    7533.000    906.800    7893.000    904.600    8108.000    903.300    8178.000
GR     904.800   8213.000    903.400    8234.000    902.600    8308.000    904.800    8348.000    903.800    8386.000
GR     905.900   8448.000    905.100    8476.000    902.900    8632.000    904.800    8687.000    901.100    8791.000
GR     902.300   8829.000    899.000    8882.000    898.300    8942.000    900.600    9020.000    897.300    9062.000
GR     899.500   9085.000    897.100    9104.000    899.800    9138.000    891.000    9158.000    890.600    9357.000
GR     891.500   9388.000    889.500    9414.000    889.800    9471.000    893.800    9856.000    895.600    9899.000
GR     899.300  10000.000    900.500   10186.000    899.300   10317.000    897.600   10556.000    899.500   10639.000
GR     899.100  10728.000    896.300   10858.000    897.100   10884.000    895.100   10925.000    896.000   11016.000
GR     895.300  11104.000    897.000   11163.000    894.800   11199.000    897.000   11233.000    894.800   11243.000
GR     893.800  11281.000    902.400   11304.000    901.000   11345.000    902.400   11370.000    900.500   11403.000
GR     901.300  11500.000    902.800   11620.000    900.300   11702.000    900.100   11754.000    907.300   11772.000
```

GR	908.800	11942.000	911.600	11971.000	908.800	12011.000	902.600	12024.000	902.600	12043.000
GR	910.900	12068.000	909.800	12115.000	908.900	12166.000	910.400	12303.000	911.100	12398.000
GR	914.600	12477.000	906.900	12486.000	906.900	12507.000	902.400	12514.000	902.400	12535.000
GR	906.300	12541.000	906.300	12560.000	915.600	12573.000	914.600	12627.000	911.600	12646.000
GR	911.600	12799.000	911.100	13017.000	912.600	13029.000	910.800	13038.000	913.400	14329.000
GR	914.600	14343.000	913.900	14374.000	916.600	15377.000	917.300	15647.000	917.600	15693.000
GR	917.100	15997.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
NC	0.055	0.055	0.032	0.100	0.300	0.000	0.000	0.000	0.000	0.000
ET	380.000	0.000	9.100	0.000	0.000	0.000	0.000	0.000	9000.000	11300.000
X1	380.000	88.000	9011.000	10856.000	960.000	1420.000	1170.000	0.000	0.000	0.000
GR	932.600	5670.000	938.300	5836.000	924.300	6064.000	926.100	6137.000	914.800	6192.000
GR	908.600	6215.000	908.800	6248.000	914.300	6291.000	909.900	6366.000	907.900	6675.000
GR	904.100	6872.000	907.100	6978.000	905.800	7066.000	908.300	7106.000	904.800	7177.000
GR	902.400	7263.000	907.900	7580.000	907.300	7673.000	908.800	7866.000	907.100	8081.000
GR	904.800	8113.000	906.800	8256.000	904.800	8798.000	904.300	8897.000	906.400	8968.000
GR	903.300	9011.000	901.000	9034.000	901.800	9055.000	895.600	9077.000	897.600	9134.000
GR	902.300	9178.000	889.500	9265.000	889.500	9366.000	889.500	9432.000	891.100	9445.000
GR	890.100	9492.000	890.100	9582.000	893.600	9839.000	896.300	9946.000	896.800	10000.000
GR	900.300	10223.000	899.800	10334.000	901.100	10532.000	899.000	10663.000	897.600	10735.000
GR	901.600	10856.000	899.300	10969.000	900.300	10995.000	899.100	11106.000	899.600	11132.000
GR	896.000	11181.000	895.000	11216.000	901.600	11277.000	902.400	11374.000	903.900	11585.000
GR	902.100	11628.000	901.800	11680.000	903.100	11725.000	900.500	11767.000	901.500	11808.000
GR	909.900	11941.000	910.600	12000.000	910.300	12151.000	912.300	12171.000	909.600	12196.000
GR	904.400	12238.000	904.400	12265.000	913.800	12286.000	910.100	12335.000	909.600	12400.000
GR	903.300	12415.000	902.800	12442.000	908.400	12448.000	908.400	12466.000	912.900	12474.000
GR	912.900	12508.000	912.300	12567.000	912.900	13065.000	914.400	13077.000	914.400	13099.000
GR	912.400	13106.000	915.600	14396.000	916.600	14471.000	918.600	15048.000	919.100	15580.000
GR	920.300	15705.000	921.800	15766.000	921.300	16006.000	0.000	0.000	0.000	0.000
ET	382.000	0.000	9.100	0.000	0.000	0.000	0.000	0.000	8874.000	11300.000
X1	382.000	93.000	8874.000	10941.000	910.000	890.000	910.000	0.000	0.000	0.000
GR	940.600	5345.000	935.100	5499.000	935.600	5536.000	936.400	5589.000	933.600	5709.000
GR	926.800	5830.000	918.400	6228.000	908.100	6438.000	908.800	6456.000	908.100	6531.000
GR	909.100	6676.000	904.400	6762.000	906.600	6841.000	906.800	7123.000	910.100	7155.000
GR	903.100	7308.000	905.900	7463.000	904.300	7631.000	907.300	7869.000	905.300	8000.000
GR	906.600	8157.000	905.400	8235.000	907.400	8372.000	909.800	8433.000	911.400	8545.000
GR	908.900	8602.000	911.100	8683.000	909.900	8812.000	911.100	8838.000	909.400	8855.000
GR	910.300	8874.000	897.300	8944.000	902.300	9051.000	901.600	9073.000	898.100	9146.000
GR	897.300	9207.000	894.100	9254.000	891.600	9417.000	892.800	9469.000	891.300	9483.000
GR	891.000	9600.000	892.300	9646.000	897.100	9854.000	898.600	10000.000	902.400	10248.000
GR	899.300	10339.000	900.500	10410.000	899.600	10497.000	901.600	10783.000	900.800	10887.000
GR	906.100	10941.000	904.400	10974.000	905.600	11016.000	903.300	11038.000	905.300	11083.000
GR	903.100	11123.000	905.600	11173.000	905.900	11217.000	903.600	11234.000	905.100	11266.000
GR	902.100	11315.000	904.400	11397.000	905.100	11573.000	899.100	11621.000	899.800	11736.000
GR	913.100	11786.000	911.900	11825.000	912.600	11868.000	910.900	11930.000	911.100	12000.000
GR	914.800	12066.000	909.900	12098.000	905.600	12126.000	905.600	12166.000	915.900	12191.000
GR	914.300	12232.000	911.900	12243.000	913.600	12291.000	912.800	12311.000	912.800	12330.000
GR	905.100	12339.000	905.100	12370.000	908.400	12374.000	909.100	12391.000	915.600	12402.000
GR	915.400	12419.000	912.300	12427.000	912.300	12480.000	913.400	13138.000	916.900	14465.000
GR	918.400	14481.000	918.600	14556.000	920.300	15775.000	0.000	0.000	0.000	0.000

ET	384.000	0.000	9.100	0.000	0.000	0.000	0.000	0.000	8803.000	11090.000
X1	384.000	85.000	8803.000	10859.000	950.000	950.000	950.000	0.000	0.000	0.000
GR	947.900	6570.000	974.600	6777.000	909.300	6921.000	909.400	6969.000	906.400	7014.000
GR	905.800	7050.000	908.800	7205.000	907.300	7227.000	908.800	7244.000	906.600	7288.000
GR	909.100	7342.000	907.400	7378.000	910.800	7441.000	904.600	7505.000	905.300	7588.000
GR	910.100	7739.000	907.600	7898.000	908.400	7941.000	906.600	7982.000	907.300	8034.000
GR	904.100	8067.000	907.400	8142.000	906.100	8174.000	908.300	8197.000	908.600	8323.000
GR	908.100	8426.000	901.800	8479.000	908.600	8742.000	907.600	8767.000	909.800	8803.000
GR	903.600	8855.000	900.600	8949.000	895.100	9000.000	895.100	9050.000	897.300	9074.000
GR	894.000	9093.000	895.500	9204.000	895.500	9457.000	897.300	9513.000	892.800	9622.000
GR	894.600	9648.000	893.000	9685.000	892.600	9805.000	893.500	9845.000	897.800	10000.000
GR	899.300	10099.000	902.800	10293.000	901.000	10426.000	902.100	10450.000	899.500	10529.000
GR	900.600	10552.000	898.800	10569.000	897.800	10639.000	905.100	10680.000	903.600	10764.000
GR	905.300	10859.000	904.800	10967.000	905.800	11016.000	902.300	11104.000	901.600	11165.000
GR	906.100	11228.000	899.600	11304.000	905.300	11366.000	904.900	11544.000	910.900	12000.000
GR	910.800	12147.000	914.900	12172.000	915.800	12212.000	904.600	12233.000	904.600	12266.000
GR	909.100	12271.000	909.100	12284.000	916.100	12297.000	916.300	12320.000	913.100	12330.000
GR	914.800	13216.000	915.900	13252.000	918.600	14547.000	919.300	14601.000	920.400	14738.000
GR	922.100	15050.000	922.300	15356.000	923.600	15823.000	923.900	15943.000	924.100	16188.000
ET	386.000	0.000	9.100	0.000	0.000	0.000	0.000	0.000	9007.000	10732.000
X1	386.000	67.000	9007.000	10732.000	820.000	950.000	800.000	0.000	0.000	0.000
GR	919.800	6770.000	914.400	6824.000	915.900	6842.000	914.300	6857.000	917.600	6909.000
GR	912.600	6968.000	913.100	7004.000	910.800	7080.000	907.800	7255.000	908.800	7317.000
GR	909.800	7469.000	912.800	7628.000	911.400	7681.000	909.600	7737.000	911.100	7767.000
GR	909.800	7808.000	909.800	7992.000	911.100	8026.000	908.800	8064.000	905.400	8151.000
GR	909.300	8238.000	910.300	8288.000	909.400	8465.000	907.300	8513.000	907.300	8659.000
GR	908.800	8691.000	907.300	8728.000	909.800	8770.000	902.100	8858.000	904.600	8938.000
GR	904.400	9007.000	896.100	9036.000	894.500	9073.000	897.500	9225.000	898.600	9287.000
GR	899.500	9463.000	895.300	9737.000	894.100	9901.000	892.500	9919.000	893.500	10000.000
GR	899.600	10069.000	897.800	10127.000	900.300	10146.000	896.100	10171.000	896.100	10331.000
GR	907.800	10404.000	904.300	10611.000	908.600	10732.000	906.300	10748.000	911.900	11136.000
GR	911.900	11873.000	917.900	11943.000	920.800	12031.000	913.300	12076.000	912.600	12092.000
GR	913.100	12318.000	914.100	12500.000	914.100	12500.000	915.400	13292.000	916.600	13330.000
GR	918.300	13339.000	918.900	14617.000	919.300	14651.000	920.300	14902.000	922.100	15942.000
GR	922.900	16016.000	922.600	16262.000	0.000	0.000	0.000	0.000	0.000	0.000
EJ	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000

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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

CRITICAL DEPTH TO BE CALCULATED AT ALL CROSS SECTIONS

CCHV=    0.100 CEHV=    0.300
*SECNO 366.000
3710 WSEL ASSUMED BASED ON MIN DIFF

3470 ENCROACHMENT STATIONS=    8088.0    11014.0  TYPE=     1  TARGET=    2926.000
            ALL SECTIONS LOOKING DOWNSTREAM
            CHANNEL STATIONS ARE FROM LEFT TO RIGHT WITH CONTROL LINE STATION
            10,000.
            THE 100-YEAR FLOOD PEAK (250,000) IS BASED ON THE ARMY CORPS OF
            ENGINEERS (COE) HYDROLOGY, MAY 1985.
            TOPO PROVIDED BY MARICOPA COUNTY FLOOD CONTROL DISTRICT (MCFCD)
            PHOTO DATE 3-28-84.   AERIAL MAPPING CO. #83039
            COOPER AERIAL SURVEY CO. #830339.
            CROSS SECTIONS DIGITIZED FROM AERIAL PHOTOS FURNISHED BY MCFCD.
            METHOD 1 ENCROACHMENT USES STATIONS FROM METHOD 4 ENCROACHMENT.
            REACH LENGTHS ON X1 CARDS HAVE BEEN UPDATED 6-87.
                 NOTE:
                      FOR MULTI-PROFILE RUNS W/500 YEAR FLOOD,
                      APPROPRIATE MODELLING WILL BE REQUIRED TO CHECK THE
                      EFFECT OF THE CANAL LOCATED ON THE NORTH BANK.

                      BRIDGE OVERTOPPING DATA (AS PROVIDED ON THE BT CARDS)
                      HAS BEEN BASED ON DESIGN DATA.

                      BRIDGE MODEL BASED ON (17) 5-FOOT DIAMETER PIERS

                                 UPDATED 1-21-87 & 6-12-87

   366.00    18.64   903.74   896.81     0.00   904.44     0.70     0.00     0.00   892.80
  250000.       0.  250000.       0.       0.    37303.       0.       0.       0. 100000.00
     0.00     0.00     6.70     0.00    0.000    0.032    0.000    0.000   885.10  8088.00
 0.000705       0.       0.       0.        0       19        3     0.00  2926.00 11014.00


FLOW DISTRIBUTION FOR SECNO=    366.00          CWSEL=    903.74

STA=    8088.   11014.
  PER Q=    100.0
   AREA=  37303.0
    VEL=      6.7
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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 368.000

3470 ENCROACHMENT STATIONS=    8153.0    11327.0  TYPE=      1  TARGET=     3174.000
   368.00     17.95    904.45   898.28      0.00    905.14     0.68      0.70      0.00    906.30
  250000.        0.   250000.      0.        0.     37645.      0.       826.      67. 100000.00
     0.04      0.00      6.64     0.00     0.000     0.032    0.000     0.000    886.50  8156.46
 0.000759     900.      960.    1100.         2        14        0      0.00   3170.54 11327.00

FLOW DISTRIBUTION FOR SECNO=    368.00          CWSEL=    904.45

STA=    8156.   11327.
  PER Q=    100.0
   AREA=  37645.5
    VEL=      6.6

*SECNO 370.000

3470 ENCROACHMENT STATIONS=    8569.0    11272.0  TYPE=      1  TARGET=     2703.000
   370.00     17.50    905.10   899.76      0.00    906.09     0.98      0.86      0.09    916.10
  250000.        0.   250000.      0.        0.     31401.      0.      1571.     130. 100000.00
     0.07      0.00      7.96     0.00     0.000     0.032    0.000     0.000    887.60  8585.31
 0.001116     930.      940.    1000.         2        19        0      0.00   2686.69 11272.00

FLOW DISTRIBUTION FOR SECNO=    370.00          CWSEL=    905.10

STA=    8585.   11272.
  PER Q=    100.0
   AREA=  31401.5
    VEL=      8.0

*SECNO 372.000

3470 ENCROACHMENT STATIONS=    8290.0    11187.0  TYPE=      1  TARGET=     2897.000
   372.00     19.22    906.22   900.13      0.00    907.04     0.82      0.93      0.02    949.60
  250000.        0.   250000.      0.        0.     34475.      0.      2289.     191. 100000.00
     0.11      0.00      7.25     0.00     0.000     0.032    0.000     0.000    887.00  8357.06
 0.000874     900.      950.    1060.         2        19        0      0.00   2829.94 11187.00

FLOW DISTRIBUTION FOR SECNO=    372.00          CWSEL=    906.22

STA=    8357.   11187.
  PER Q=    100.0
   AREA=  34474.7
    VEL=      7.3
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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 374.000

3470 ENCROACHMENT STATIONS=    8193.0    11300.0  TYPE=      1  TARGET=     3107.000
   374.00     19.03    907.13    900.64      0.00    907.80      0.67      0.75      0.01    901.90
  250000.        0.   250000.        0.        0.     38040.        0.     3080.      255. 100000.00
     0.15      0.00      6.57      0.00     0.000     0.032     0.000     0.000    888.10   8193.00
 0.000716      900.      950.     1010.         2        23         0      0.00   3107.00  11300.00

FLOW DISTRIBUTION FOR SECNO=    374.00          CWSEL=    907.13

STA=    8193.   11300.
  PER Q=     100.0
   AREA=   38039.6
    VEL=       6.6

*SECNO 376.000

3301 HV CHANGED MORE THAN HVINS

3470 ENCROACHMENT STATIONS=    8826.0    11243.0  TYPE=      1  TARGET=     2417.000
   376.00     16.87    907.67    902.84      0.00    908.91      1.25      0.94      0.17    903.40
  250000.        0.   235893.    14107.        0.     25843.     2642.     3807.      316.    896.10
     0.18      0.00      9.13      5.34     0.000     0.032     0.055     0.000    890.80   8826.00
 0.001454      910.      950.     1000.         2        14         0      0.00   2417.00  11243.00

FLOW DISTRIBUTION FOR SECNO=    376.00          CWSEL=    907.67

STA=    8826.   11028.   11229.   11243.
  PER Q=      94.4      5.4      0.3
   AREA=   25843.5   2456.0    185.9
    VEL=       9.1      5.5      3.7

CCHV=    0.300 CEHV=    0.500
*SECNO 376.900

3470 ENCROACHMENT STATIONS=    9151.0    11321.0  TYPE=      1  TARGET=     2170.000
            SPECIAL BRIDGE ROUTINE USED AT REEMS ROAD (2170 FT.)
            SPECIAL BRIDGE TRAPEZOID USES SAME BOTTOM ELEV. AS NATURAL CHANNEL.
   376.90     18.77    908.47    903.19      0.00    909.81      1.35      0.85      0.05100000.00
  250000.        0.   229557.    20443.        0.     23956.     3745.     4181.      346.    896.00
     0.20      0.00      9.58      5.46     0.000     0.032     0.055     0.000    889.70   9151.00
 0.001431      750.      600.      430.         2        15         0      0.00   2170.00  11321.00
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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=    376.90          CWSEL=    908.47

STA=     9151.   11016.   11104.   11163.   11199.   11233.   11243.   11281.   11304.   11321.
  PER Q=     91.8      2.5      1.6      1.0      0.9      0.3      1.3      0.4      0.1
   AREA=  23956.0   1127.8    726.7    452.4    427.3    125.7    538.3    238.4    108.1
    VEL=      9.6      5.6      5.4      5.5      5.5      5.4      6.0      4.7      2.8

SPECIAL BRIDGE

SB  XK        XKOR      COFQ      RDLEN     BWC       BWP       BAREA     SS        ELCHU     ELCHD
     1.05      1.20      2.70      0.00    724.00     85.00   55508.80   37.69    889.50    889.70

*SECNO 377.700
CLASS A LOW FLOW

3420 BRIDGE W.S.=    908.12 BRIDGE VELOCITY=,     10.09      CALCULATED CHANNEL AREA=,    24975.

 EGPRS      EGLWC      H3        QWEIR     QLOW      BAREA   TRAPEZOID      ELLC      ELTRD
                                                              AREA
      0.00    909.97     0.20        0.   250000.    55509.    47441.     917.50    910.50

3710 WSEL ASSUMED BASED ON MIN DIFF
3720 CRITICAL DEPTH ASSUMED

3470 ENCROACHMENT STATIONS=    9151.0   11321.0  TYPE=     1  TARGET=    2170.000
   377.70    19.16   908.66     0.00      0.00   909.97     1.31      0.16     0.00100000.00
  250000.       0.  229554.   20446.        0.   24331.     3805.     4252.      352.    896.00
     0.20     0.00     9.43     5.37     0.000     0.032    0.055     0.000   889.50   9151.00
 0.001359     110.     110.     110.         0         0        0      0.00  2170.00  11321.00

FLOW DISTRIBUTION FOR SECNO=    377.70          CWSEL=    908.66

STA=     9151.   11016.   11104.   11163.   11199.   11233.   11243.   11281.   11304.   11321.
  PER Q=     91.8      2.5      1.6      1.0      0.9      0.3      1.3      0.4      0.1
   AREA=  24331.2   1145.2    738.3    459.5    433.9    127.6    545.8    243.0    111.4
    VEL=      9.4      5.5      5.4      5.4      5.4      5.4      5.9      4.6      2.8

CCHV=   0.100 CEHV=   0.300
*SECNO 380.000

3470 ENCROACHMENT STATIONS=    9000.0   11300.0  TYPE=     1  TARGET=    2300.000
   380.00    20.79   910.29   904.13      0.00   911.41     1.13      1.43      0.02    903.30
  250000.     167.  228347.   21486.        72.   25908.     4902.     5069.      414.    901.60
     0.24     2.30     8.81     4.38     0.055     0.032    0.055     0.000   889.50   9000.00
 0.001065     960.    1170.    1420.         2        19        0      0.00  2300.00  11300.00
```

why specs. are different? (912.16)

we are at critical depth

what happened here?

```
   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=    380.00          CWSEL=    910.29

STA=    9000.    9011.   10856.   10969.   10995.   11106.   11132.   11181.   11216.   11277.   11300.
  PER Q=      0.1     91.3      1.8      0.5      2.0      0.5      1.2      1.1      1.3      0.2
   AREA=     72.5  25907.9   1111.5    272.7   1175.1    284.4    611.8    517.5    731.2    197.6
    VEL=      2.3      8.8      4.0      4.2      4.3      4.3      4.7      5.3      4.6      3.0

*SECNO 382.000

3470 ENCROACHMENT STATIONS=    8874.0   11300.0  TYPE=     1  TARGET=    2426.000
   382.00    20.26   911.26   905.75     0.00   912.46     1.20     1.02     0.02   910.30
  250000.       0.  242316.    7684.       0.   27171.    2370.    5699.     463.   906.10
     0.27     0.00     8.92     3.24    0.000    0.032    0.055    0.000   891.00  8874.00
 0.001191     910.     910.     890.        2       19        0     0.00  2426.00 11300.00

FLOW DISTRIBUTION FOR SECNO=    382.00          CWSEL=    911.26

STA=    8874.   10941.   10974.   11016.   11038.   11083.   11123.   11173.   11217.   11234.   11266.   11300.
  PER Q=     96.9      0.2      0.3      0.2      0.4      0.4      0.5      0.3      0.1      0.3      0.3
   AREA=  27171.4    198.2    262.8    149.8    313.1    282.3    345.4    242.3    110.6    221.0    244.7
    VEL=      8.9      3.1      3.2      3.3      3.4      3.4      3.4      2.9      3.2      3.4      3.0

*SECNO 384.000

3470 ENCROACHMENT STATIONS=    8803.0   11090.0  TYPE=     1  TARGET=    2287.000
   384.00    19.81   912.41   905.96     0.00   913.49     1.08     1.02     0.01   909.80
  250000.       0.  244528.    5472.       0.   29025.    1741.    6356.     514.   905.30
     0.30     0.00     8.42     3.14    0.000    0.032    0.055    0.000   892.60  8803.00
 0.000968     950.     950.     950.        2       14        0     0.00  2287.00 11090.00

FLOW DISTRIBUTION FOR SECNO=    384.00          CWSEL=    912.41

STA=    8803.   10859.   10967.   11016.   11090.
  PER Q=     97.8      1.0      0.4      0.7
   AREA=  29025.2    794.5    348.2    597.8
    VEL=      8.4      3.2      3.1      3.1

*SECNO 386.000

3301 HV CHANGED MORE THAN HVINS
```

```
   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=    9007.0    10732.0  TYPE=      1  TARGET=     1725.000
   386.00     20.46    912.96    907.25      0.00    914.58     1.61      0.93      0.16    904.40
  250000.        0.   250000.        0.        0.   24522.       0.     6867.      552. 100000.00
     0.32      0.00     10.20      0.00     0.000     0.032    0.000     0.000    892.50   9007.00
 0.001417      820.      800.      950.         2        19        0      0.00   1725.00  10732.00


FLOW DISTRIBUTION FOR SECNO=    386.00          CWSEL=    912.96

STA=    9007.   10732.
  PER Q=    100.0
   AREA=  24521.6
    VEL=     10.2
```

PROFILE FOR STREAM GILA RIVER FLOODWAY ANAL

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

```
ELEVATION   885.      890.      895.      900.      905.      910.      915.      920.      925.      930.
   SECNO    CUMDIS
 366.00       0.  I         .     L   .   C     .      W E.     M   .         .         .         .         .         R
             100.  I         .       L .   C     .       WE.     M   .         .         .         .         .         R
             200.  .I        .         .L  C     .       WE.    M    .         .         .         .         .         R
             300.  .I        .         .   LC    .       WE.    M    .         .         .         .         .         R
             400.  .I        .         .    C L  .       WE.    M    .         .         .         .         .         R
             500.  . I       .         .    C    L       W E   M     .         .         .         .         .         R
             600.  . I       .         .    C     . L    W E   M     .         .         .         .         .         R
             700.  . I       .         .     C    .    L  WE  M      .         .         .         .         .         R
             800.  .  I      .         .     C    .       LWE  M     .         .         .         .         .         R
             900.  .  I      .         .     C    .        WELM      .         .         .         .         .         R
 368.00     1000.  .  I      .         .      C   .        WE ML     .         .         .         .         .         R
            1100.  .  I      .         .      C   .        WE M  L   .         .         .         .         .         R
            1200.  .  I      .         .      C   .        W.EM    L .         .         .         .         .         R
            1300.  .   I     .         .       C  .        W.EM      L.        .         .         .         .         R
            1400.  .   I     .         .       C  .        W.EM       .L       .         .         .         .         R
            1500.  .   I     .         .       C  .         WE M       .  L     .         .         .         .         R
            1600.  .   I     .         .       C  .         WE M       .    L   .         .         .         .         R
            1700.  .    I    .         .        C.          W EM       .     L  .         .         .         .         R
            1800.  .    I    .         .        C.          W EM       .      L.        .         .         .         R
 370.00     1900.  .    I    .         .         C          W EM       .       . L      .         .         .         R
            2000.  .    I    .         .         C          W E M      .        .      L.         .         .         R
            2100.  .    I    .         .         C          .W E M     .        .       .    L    .         .         R
            2200.  .    I    .         .         C          .W E  M    .        .       .         .  L      .         R
            2300.  .    I    .         .         C          .W E   M   .        .       .         .         L         R
            2400.  .    I    .         .         C          .W E   M   .        .       .         .         .      L  R
            2500.  .   I     .         .         C          . WE    M .        .       .         .         .         L
            2600.  .   I     .         .         C          . W E    M.        .       .         .         .         L
            2700.  .   I     .         .         C          . W E     M        .       .         .         .         L
            2800.  .   I     .         .         C          . W E     .M       .       .         .         .         L
 372.00     2900.  .   I     .         .         C          . W E     . M      .       .         .         .         L
            3000.  .   I     .         .         C          .  WE     . M      .       .         .         .         L
            3100.  .   I     .         .         C          .  WE     . M      .       .         .         .         L
            3200.  .    I    .         .         .C         .  W E    .  M     .       .         .         .        LR
            3300.  .    I    .         .         .C         .  W E    .  M     .       .         .         L.        R
            3400.  .    I    .         .         .C         .  W E    .   M    .       .         .    L.   .         R
            3500.  .    I    .         .         .C         .   WE    .   M    .       .      L.         .         .         R
            3600.  .     I   .         .         .C         .   WE    .    M   L.      .         .         .         R
            3700.  .     I   .         .         .C         .   WE   L.    M    .       .         .         .         R
 374.00     3800.  .     I   .         .         .C  L      .   W E   .     M   .       .         .         .         R
            3900.  .      I  .         .         . C L      .   W E   .     M   .       .         .         .         R
            4000.  .      I  .         .         . C L      .   W E   .     M   .       .         .         .         R
            4100.  .       I .         .         .  C L     .    WE   .      M  .       .         .         .         R
            4200.  .       I .         .         .  C L     .    W E  .      M  .       .         .         .         R
            4300.  .        I.         .         .   CL     .    W E  .      M  .       .         .         .         R
            4400.  .         I         .         .   C L    .    W E  .      M  .       .         .         .         R
            4500.  .         I         .         .    CL    .    W E  .       M .       .         .         .         R
            4600.  .         .I        .         .    CL    .    W E  .       M .       .         .         .         R
            4700.  .         .I        .         .    C L   .    W  E .       M .       .         .         .         R
 376.00     4800.  .         . I       . R       .     CL   .    W  E .        M.       .         .         .         .
            4900.  .         .I        . R       .     C    .     W E .        M       .         .         .         L
            5000.  .         .I        . R       .     C    .     W E .        M       .         .         .         L
            5100.  .         .I        . R       .     C    .     W  E.       .M       .         .         .         L
            5200.  .         I         . R       .     C    .     W  E.        . M     .         .         .         L
            5300.  .         I         . R       .     C    .      W E.        .  M    .         .         .         L
 376.80     5400.            I         . R       .     C    .      W  E                M
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377.70  5500.  C   I.        . R       .         .     W  E       .  M    .        .        .        L
        5600.  C   I.        .  R      .         .      W E       .   M   .        .        .        L
        5700.  C   I.        .   R     .         .      W E       .    M  .        .        .        L
        5800.  C   I.        .    R    .         .      W .E      .    M  .        .        .        L
        5900.  C   I.        .     R   .         .      W .E      .     M .        .        .        L
        6000.  C   I.        .      R  .         .       W.E      .      M.        .        .        L
        6100.  C   I.        .       R .         .       W.E      .      M.        .        .        L
        6200.  C   I.        .        R.         .       W. E     .      M.        .        .        L
        6300.  C   I.        .         R         .        W E     .       M        .        .        L
        6400.  C   I.        .          .R       .        W E     .       .M       .        .        L
        6500.  C   I.        .           . R     .        W E     .       .M       .        .        L
        6600.  C   I.        .            .  R   .        W  E    .        . M     .        .        L
380.00  6700.  .   I.        .            .  R  LC .        .W E    .         .  M   .        .        .
        6800.  .   I.        .            .   R LC.        .W E    .         . M    .        .        .
        6900.  .    I        .            .    R CL        .W E    .         . M    .        .        .
        7000.  .    I        .            .     R C.L      .W  E   .         . M    .        .        .
        7100.  .    I        .            .      R C  L    .W  E   .         . M    .        .        .
        7200.  .   .I        .            .       R C   L   . W E  .         . M    .        .        .
        7300.  .   .I        .            .        RC     L  . W E .         .M     .        .        .
        7400.  .   .I        .            .         RC     L . W E .         .M     .        .        .
        7500.  .   . I       .            .         .C       L. W  E .       .M     .        .        .
382.00  7600.  .   . I       .            .          . C     .L W E  .       .M     .        .        .
        7700.  .   . I       .            .          . C      L  W E .       .M     .        .        .
        7800.  .   .  I      .            .          . C      L  W E .       . M    .        .        .
        7900.  .   .  I      .            .          . C      L  W  E .      .  M   .        .        .
        8000.  .   .  I      .            .          . C      L  W  E .      .   M  .        .        .
        8100.  .   .   I     .            .          .RC      L   W E .      .    M .        .        .
        8200.  .   .   I     .            .          .RC      L   W E .      .    M .        .        .
        8300.  .   .   I     .            .          .RC      L   W E .      .     M .       .        .
        8400.  .   .    I    .            .          .RC      L   W  E .     .      M .      .        .
384.00  8500.  .   .    I    .            .          .RC      L    W E .     .       M .     .        .
        8600.  .   .    I    .            .          . C     L . W E .      .       M .     .        R
        8700.  .   .    I    .            .          .  C   L . W  E .      .      M  .     .        R
        8800.  .   .    I    .            .          .  C  L. W  E .        .      M  .     .        R
        8900.  .   .    I    .            .          .  CL   . W  E .       .      M  .     .        R
        9000.  .   .    I    .            .          .  LC   .  W E .       .     M   .     .        R
        9100.  .   .    I    .            .          . L C   .  W  E.       .     M   .     .        R
        9200.  .   .    I    .            .          L   C   .  W  E.       .    M    .     .        R
386.00  9300.  .   .    I    .            .         L.    C  .  W  E.       .    M    .     .        R
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THIS RUN EXECUTED FRI, JUN 12 1987 14:25:38

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*****************************************************
  HEC2 RELEASE DATED NOV 76 UPDATED MAY  1984
  ERROR CORR -  01,02,03,04,05,06
  MODIFICATION -  50,51,52,53,54,55,56
*****************************************************
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NOTE- ASTERISK (*) AT LEFT OF CROSS-SECTION NUMBER INDICATES MESSAGE IN SUMMARY OF ERRORS LIST

GILA RIVER FLOODWAY ANAL

SUMMARY PRINTOUT TABLE 150

	SECNO	XLCH	ELTRD	ELLC	ELMIN	Q	CWSEL	CRIWS	EG	10K*S	VCH	AREA	.01K
*	366.000	0.00	0.00	0.00	885.10	250000.00	903.74	896.81	904.44	7.05	6.70	37302.96	94135.17
	368.000	960.00	0.00	0.00	886.50	250000.00	904.45	898.28	905.14	7.59	6.64	37645.48	90746.89
	370.000	940.00	0.00	0.00	887.60	250000.00	905.10	899.76	906.09	11.16	7.96	31401.46	74851.84
	372.000	950.00	0.00	0.00	887.00	250000.00	906.22	900.13	907.04	8.74	7.25	34474.69	84569.39
	374.000	950.00	0.00	0.00	888.10	250000.00	907.13	900.64	907.80	7.16	6.57	38039.55	93439.20
	376.000	950.00	0.00	0.00	890.80	250000.00	907.67	902.84	908.91	14.54	9.13	28485.37	65556.91
	376.900	600.00	0.00	0.00	889.70	250000.00	908.47	903.19	909.81	14.31	9.58	27700.65	66092.31
*	377.700	110.00	910.50	917.50	889.50	250000.00	908.66	0.00	909.97	13.59	9.43	28135.86	67822.25
	380.000	1170.00	0.00	0.00	889.50	250000.00	910.29	904.13	911.41	10.65	8.81	30882.23	76603.27
	382.000	910.00	0.00	0.00	891.00	250000.00	911.26	905.75	912.46	11.91	8.92	29541.65	72443.34
	384.000	950.00	0.00	0.00	892.60	250000.00	912.41	905.96	913.49	9.68	8.42	30765.75	80371.55
	386.000	800.00	0.00	0.00	892.50	250000.00	912.96	907.25	914.58	14.17	10.20	24521.65	66415.37

GILA RIVER FLOODWAY ANAL

SUMMARY PRINTOUT TABLE 150

	SECNO	Q	CWSEL	DIFWSP	DIFWSX	DIFKWS	TOPWID	XLCH
*	366.000	250000.00	903.74	0.00	0.00	0.00	2926.00	0.00
	368.000	250000.00	904.45	0.00	0.72	0.00	3170.54	960.00
	370.000	250000.00	905.10	0.00	0.65	0.00	2686.69	940.00
	372.000	250000.00	906.22	0.00	1.12	0.00	2829.94	950.00
	374.000	250000.00	907.13	0.00	0.91	0.00	3107.00	950.00
	376.000	250000.00	907.67	0.00	0.54	0.00	2417.00	950.00
	376.900	250000.00	908.47	0.00	0.80	0.00	2170.00	600.00
*	377.700	250000.00	908.66	0.00	0.20	0.00	2170.00	110.00
	380.000	250000.00	910.29	0.00	1.62	0.00	2300.00	1170.00
	382.000	250000.00	911.26	0.00	0.97	0.00	2426.00	910.00
	384.000	250000.00	912.41	0.00	1.15	0.00	2287.00	950.00
	386.000	250000.00	912.96	0.00	0.56	0.00	1725.00	800.00

SUMMARY OF ERRORS AND SPECIAL NOTES

```
CAUTION  SECNO=   366.000  PROFILE= 1  WSEL ASSUMED BASED ON MIN DIFF

CAUTION  SECNO=   377.700  PROFILE= 1  CRITICAL DEPTH ASSUMED
CAUTION  SECNO=   377.700  PROFILE= 1  WSEL ASSUMED BASED ON MIN DIFF
```

APPENDIX D

DESIGN CALCULATIONS

DESIGN CALCULATIONS

	Item	Pages	References
1.	Scour Summary	1	11, 7
	1.1 Local Scour	2-3	11
	1.2 General Scour	4-5	11
	1.3 Aggradation/Degradation	6	10
2.	Spur Dike Design Flow Process	7	13
	2.1 Overbank & Q-100 Dist'n	8-12	6, HEC-2 Runs
	2.2 Determination of Ls	13	13
	2.3 Spur Dike Centerline Eqn's	14	13
3.	Riprap Protection		
	3.1 Freeboard	15	3, 9
	3.2 Sizing	16-17	1, 12
	3.3 Filters, Grout Option	18	1, 13

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LANDSCAPE ARCHITECTURE

Project REEMS ROAD CROSSING
Project No. 1074-01
Sheet No. 1a of 18
Calculated by RC TOY Date 6/11/87
Checked by _____ Date _____

DESIGN RECOMMENDATIONS:

FOR DESIGN DEPTHS ABOUT TOE OF SPUR DIKES, A BEDDING DEPTH OF 12' IS RECOMMENDED. DESIGN OF THE PIERS IS RECOMMENDED TO BE BASED ON 25' SCOUR DEPTH

NOTE THAT THE CALCULATIONS USED WERE BASED UPON NUMEROUS MODELINGS OF THE FLOW DISTRIBUTION, BASED ON DATA AVAILABLE AT THE TIME. DUE TO DESIGN MODIFICATIONS, SOME FLUCTUATION IN ACTUAL VELOCITIES EXISTS FROM CALCULATED VS. FINAL RESULTS (TYPICALLY <0.1 FPS), HOWEVER IT IS NOT FELT THAT THIS IS SIGNIFICANT ENOUGH TO IMPACT THE FINDINGS.

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LANDSCAPE ARCHITECTURE

Project: REEMS RD. CROSSING
Project No. 1074-01
Sheet No. 1 of 18
Calculated by: RCT Date: 1-6-87
Checked by: _____ Date: _____

SCOUR SUMMARY

FEATURE	DEPTHS, FT LOCAL	GENERAL	LONGTERM
PIERS	17'	5'	5'
(SOUTH) LEFT SPUR DIKE	20'	5'	5'
(NORTH) RIGHT SPUR DIKE	27'	5'	5'

RIP-RAP BEDDING

CALCULATED AS A MIN. 50% REDUCTION IN LOCAL SCOUR DEPTH[1]

FEATURE	DEPTHS, FT LOCAL	50% RED.	DESIGN BEDDING DEPTH
PIERS	17'	8.5'	9'
(SOUTH) LEFT SPUR DIKE	20'	10'	10'
(NORTH) RIGHT SPUR DIKE	27'	14'	14'

TOTAL SCOUR

PIERS = 9' + 5' + 5' = 19 ft
LSD = 10' + 5' + 5' = 20 ft (SOUTH)
RSD = 14' + 5' + 5' = 23 ft (NORTH)

[1] US DOT, FHA, HYD. IN THE RIVER ENV-HYD & ENV. DESIGN CONSIDERATIONS, P. VI-41

NOTE: BASE DATA FOR CALCULATIONS (VELOCITIES, DEPTH & PERCENTAGES OF FLOW) BASED ON HEC-2 MODELS USING FEMA GUIDELINES.

COE & VAN LOO
PLANNING • ENGINEERING
LANDSCAPE ARCHITECTURE

Project: REEMS ROAD CROSSING
Project No. 1074-01
Sheet No. 2 of 18
Calculated by: RCT Date: 1-6-87
Checked by: _____ Date: _____

COMPUTATION OF LOCAL SCOUR:

1) FHWA METHOD [1]

FOR CIRCULAR PIERS:

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

where y_s = STABLE DEPTH OF SCOUR
y_1 = MEAN DEPTH U/S, = 19.32' (SEC 377) [2]
a = PROJECTED WIDTH, = 5'Φ + 3' DEBRIS
Fr = FROUDE NO, = $v/\sqrt{g y_1}$, v = 9.31 FPS IN CHANNEL [2]

then $y_s = (19.32)(2.0)\left(\frac{8}{19.32}\right)^{0.65}\left[\frac{9.31}{\sqrt{(32.2)(19.32)}}\right]^{0.43}$

$= 14.26'$

∴ MAXIMUM DEPTH = 14.26 + 30% [3] = **18.5'**

(ASSUME NEGLIGIBLE SKEW ∡)

2) NEIL'S METHOD:

$$d_s = 0.00073\, R^{0.619}$$

$R = \frac{vb}{\nu}$ where v = VELOCITY, 9.31 FPS IN CHANNEL [2]
b = PROJECTED WIDTH, 4'Φ + 4' = 8'
ν = KINEMATIC VISCOSITY, 1.1×10^{-5} ft²/sec

$= 0.00073 \left(\frac{(9.31)(8)}{1.1\times10^{-5}}\right)^{0.619}$

$= 12.35'$

∴ MAXIMUM DEPTH = 12.35 + 30% = **16.05'**

---

[1] HIGHWAYS IN THE RIVER ENVIRONMENT - HYDRAULIC & ENVIRONMENTAL DESIGN CONSIDERATIONS, U.S. DEPT OF TRANS, FHA, MAY 1975, PAGE VI-38
[2] FROM HEC-2 RUNS, DATA FOR SECTION 377.7
[3] FHWA, PAGE VI-40

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LOCAL SCOUR, CON'T

3) SCOUR AT TOE OF SPUR DIKE:

USING FHWA, EQ'N 6.5.6 (SCOUR @ SPILL SLOPE)

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

where $y_{1R} = 5.56'$, $y_{1L} = 8.96'$
Fr = FROUDE # $v_R = 8.9$ FPS, $v_L = 4.1$ FPS
a = PROJECTED WIDTH; 170' RIGHT
90' LEFT

LEFT DIKE: (South)

$$y_s = 1.1\,(8.96)\left(\frac{90}{8.96}\right)^{0.40}\left[\frac{4.1}{\sqrt{(32.2)(8.96)}}\right]^{0.33}$$
$$= \underline{15.45'}$$

RIGHT DIKE: (North)

$$y_s = 1.1\,(5.56)\left(\frac{170}{5.56}\right)^{0.40}\left[\frac{8.9}{\sqrt{32.2(5.56)}}\right]^{0.33}$$
$$= \underline{20.97'}$$

ADD 30%: $y_s\Big|_{\text{LEFT DIKE}} = 20'$ SOUTH

$y_s\Big|_{\text{RIGHT DIKE}} = 27'$ NORTH

PROJECTED WIDTH, ASSUMING SPUR DIKE X-AXIS PLACED PARALLEL TO FLOW;

(SOUTH) LEFT DIKE = 40 + ½(12' OFF ROAD) + 44' (2:1 SLOPE) = 90''

(NORTH) RIGHT DIKE = 120 + ½(12) + 44' = 170'

VELOCITIES, TAKEN FROM HEC-2 RUN:

Q_f SOUTH = 11,990 CFS, A = 2056.7 + 749.1 + 133.1 = 2939 SF ⇒ $v = \frac{11,990}{2939} = 4.08$ FPS
Q_f NORTH = 27,500 CFS, A = 552.4 + 2533 = 3085.4 SF ⇒ $v = 27,500/3085 = 8.91$ FPS

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COMPUTATION OF GENERAL SCOUR: [2]

DUE TO FLOWS CONFINED W/IN A CHANNEL,

$$q_2 = \frac{W_1}{W_2} q_1$$

where W_N = WIDTH FOR FLOW
q_N = UNIT FLOW RATE

& $q_N = y_N v_N$

IN NATURAL COND,

$W_1 \cong 5250'$
$v_1 \cong 8.29$ (FROM HEC-2 RUNS) [1]

$$\therefore q_1 = \frac{Q}{W_1} = \frac{250{,}000}{5250} = 47.62 \text{ CFS/ft}$$

$$\text{then } y_1 = q_1/v_1 = \frac{47.62}{8.29} = \underline{5.74 \text{ ft}}$$

IN BRIDGE COND,

$W_2 \approx 2150 - 18(8) = 2006$ ft (SUBTRACT PIERS FROM FLOW X-SECT)
$v_2 \approx 8.97$ FPS

$$\therefore q_2 = \frac{250000}{2006} = 124.63 \text{ CFS/ft}$$

$$\text{then } y_2 = 124.63/8.97 = \underline{13.89 \text{ ft}}$$

$\therefore$ GENERAL SCOUR $\approx 13.89 - 5.74 = 8$ ft

---

[1] WEIGHTED AVG. VELOCITY
[2] FROM DOT "HWYS IN RIVER ENV.," PAGE VI-29

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NOTE THAT THE EQ'N $q_2 = \frac{W_1}{W_2} q_1$ IS BASED UPON A CONSERVATION OF ENERGY WITH THE DEPTH OF FLOW AS THE ONLY VARIABLE.

THIS DOES NOT TAKE INTO ACCOUNT OTHER LOSSES, & IT IS LOGICAL TO ASSUME THAT EQUILIBRIUM IN THE RIVER CHANNEL WILL BE ACHIEVED LONG BEFORE THE GENERAL SCOUR REACHES A DEPTH OF 8'.

FURTHERMORE, DUE TO PROJECTED DEVELOPMENTS UPSTREAM OF THE SITE, IT IS LOGICAL TO ASSUME THAT THE ADDED ENCROACHMENTS WILL CAUSE A DISTRIBUTION OF THIS SCOUR THROUGHOUT THE BED. THUS, WHILE THE ENTIRE RIVER CHANNEL MAY DROP IN DEPTH, THE SCOUR IN THE LOCAL AREA OF THE CROSSING WILL DECREASE.

FINALLY, GIVEN THE RIVERS ABILITY TO CARRY THE MATERIAL OVER A LARGE DEPTH WOULD REQUIRE THE CHANNEL TO BE FORCED INTO AN ADVERSE SLOPE.

THEREFORE, A QUALITATIVE DEPTH OF 5' WILL BE USED FOR GENERAL SCOUR.

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COMPUTATION OF AGGRADATION/DEGRADATION

LONGTERM SCOUR DUE TO AGGRADATION/DEGRADATION:

A QUALITATIVE ANALYSIS WAS PERFORMED, BASED ON DATA FROM CURRENTLY FLOWN TOPOGRAPHY, 1979 FLOOD INS. STUDY,[1] & AN ESTIMATE FROM THE 1957 QUADRANGLE MAP[2]

1) FROM HEC-2, MIN ELEV @ SEC. 377.7 = 889.50 (1986)

2) FROM QUAD @ REEMS ROAD, $EL_{MIN} \approx 895$ (1957)

3) FROM HUD STUDY, REEMS RD ≈ 5000' STREAM DISTANCE FROM BULLARD AVE, MILE 95.5

$\therefore$ 95.5 - 5000/5280 = 94.55

FROM EXHIBIT 48P[1], ELEV ≈ 893.2 (1979)

NOTE THAT THE 1986 ELEVATION IS IN PART DUE TO A 100-yr EVENT OCCURRING IN 1980, AFTER THE HUD STUDY.

$\therefore$ AN ESTIMATE OF 5' OF DEGRADATION CAN BE ASSUMED, WHICH CORRESPONDS

---

[1] US DEPT OF HUD, FED INS ADMIN, FLOOD INSURANCE STUDY, EXHIBIT 48P, MAY 1979

[2] PERRYVILLE, AZ. QUADRANGLE, 1:24,000, CI = 5', 1957, PHOTO REVISED 1982

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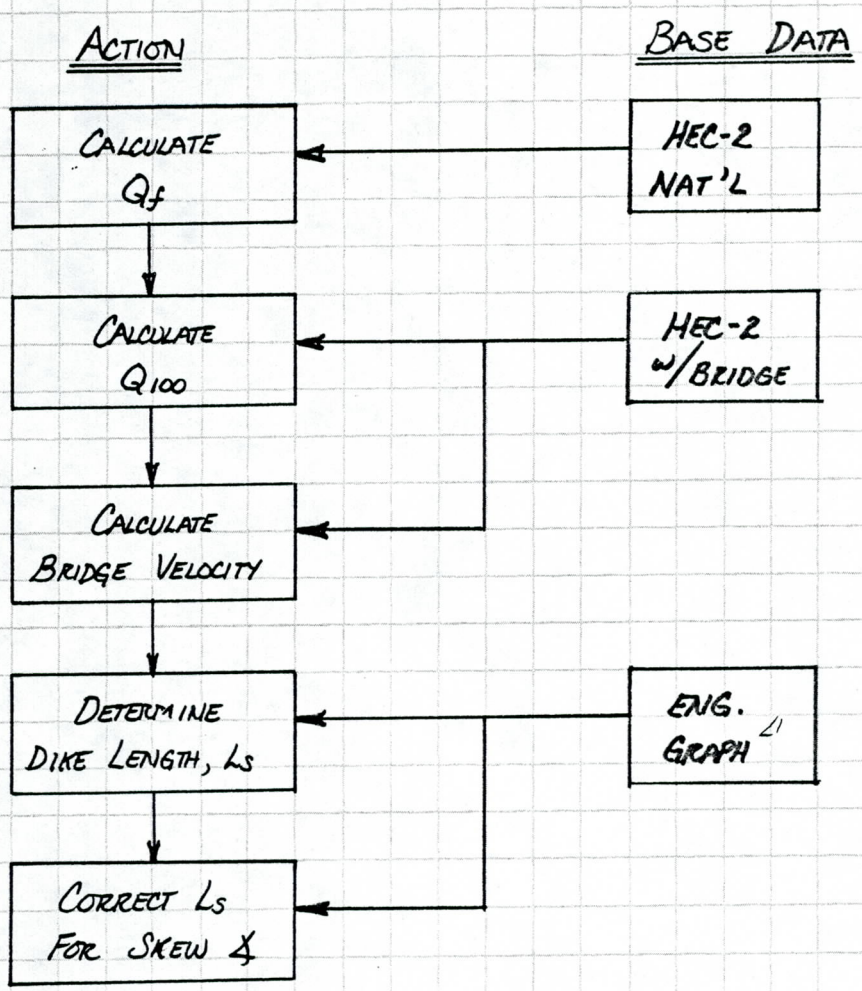
DESIGN FLOW:



[1] SOURCE: HYDRAULICS OF BRIDGE WATERWAYS, FHA, 2nd ED.

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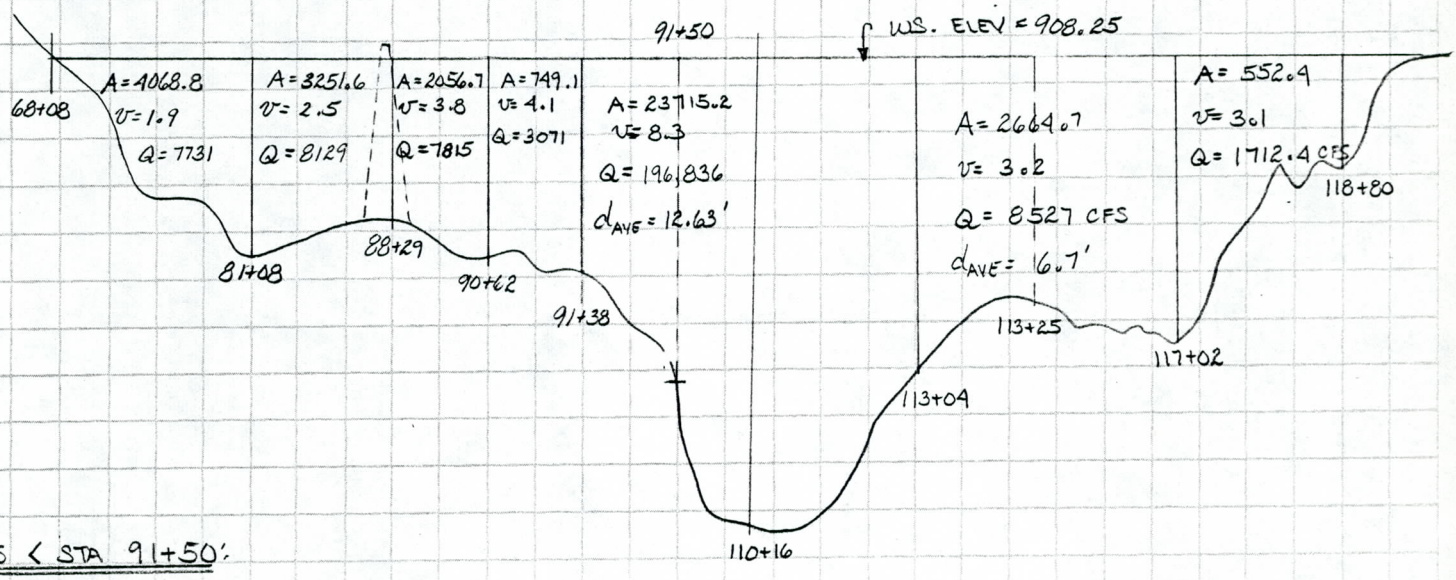
FLOW DISTRIBUTION
OF NATURAL CHANNEL
SECTION 378
NO SCALE
(TO DETERMINE Q_f)



FLOWS < STA 91+50:

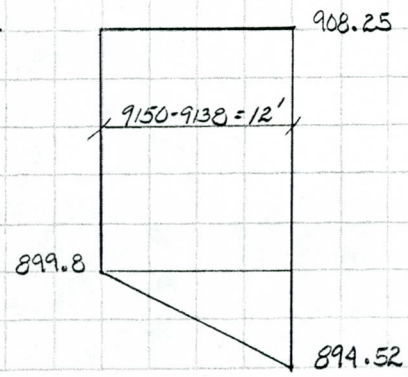
1) TOTAL FLOW FROM 68+08 TO 91+38:

$Q = 7731 + 8129 + 7815 + 3071 = \underline{26,746 \text{ CFS}}$

2) FLOW FROM 91+38 TO 91+50:

(PARTIAL ℄ FLOW FROM 91+38 TO 110+16)

a) COMPUTE AREA



$A = (8.45)12 + \frac{1}{2}(12)(5.28)$

$= \underline{133.08} \text{ SF}$

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2) FLOW FROM 91+38 TO 91+50, CONT

b) ASSUME CONSTANT VELOCITY THROUGHOUT ENTIRE SECTION, 8.3 FPS

$\therefore Q = vA = 8.3(133.08) = 1,104.6 \text{ CFS}$

3) TOTAL FLOW, Q_f, LEFT OF 91+50:

$Q_f = 1104 + 26,746 = 27,850 \text{ CFS}$

$Q_{fL} = 27,850$ CFS
SECTION 378
FLOWS < STA 91+50
NAT'L CHANNEL

FLOWS > STA 113+25:

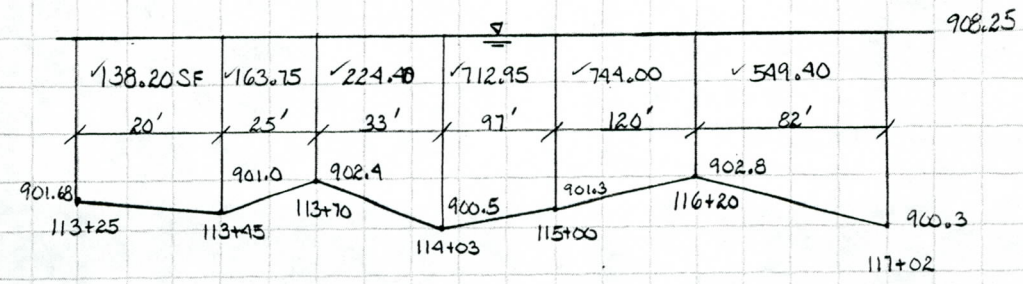
1) FLOW FROM 117+02 - 118+80:

FROM HEC-2 RUN, 1712 CFS

2) FLOW FROM 113+25 TO 117+02:

(PARTIAL OF FLOW FROM 113+04 TO 117+02)

a) COMPUTE AREA:



$A_{TOT} = 2532.70$ SF

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2) FLOW FROM 113+25 TO 117+02, CON'T

b) ASSUME EQUIVALENT VELOCITY:

FROM HEC-2 RUN, $v = 3.2$ FPS FROM 113+04 TO 117+02

$\therefore Q = vA = (3.2)(2532.7) = 8104.64$ CFS

3) TOTAL FLOW, Q_f RIGHT OF 113+25:

$Q_f = 8105 + 1712 = 9817$ CFS

$Q_{fR} = 9817$ CFS
SECTION 378
FLOWS > STA 113+25
NAT'L CHANNEL

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SECTION 378

STATION	ELEVATION
111+99	894.8
112+33	897.0
112+43	894.8
112+81	893.8
▷ 113+04	902.4
113+45	901.0
113+70	902.4
114+03	900.5
115+00	901.3
116+20	902.8
▷ 117+02	900.3

INTERPOLATED

STATION	ELEVATION	
112+25	896.48	
113+25	901.68	SPUR DIKE

STATION	ELEVATION
91+38	899.8
91+58	891.0
93+57	890.6

INTERPOLATED

STATION	ELEVATION	
91+50	894.52	SPUR DIKE
92+50	890.82	

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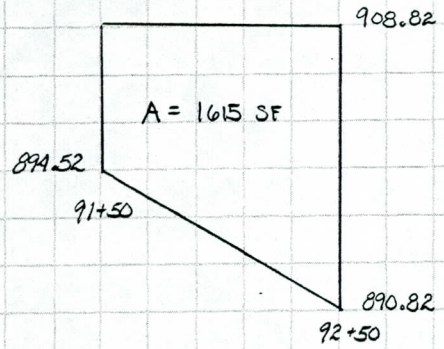
DETERMINATION OF Q_{100}
SECTION 377.7 OF BRIDGE FLOW

LEFT SIDE:

1) AREA FROM 91+50 TO 92+50:



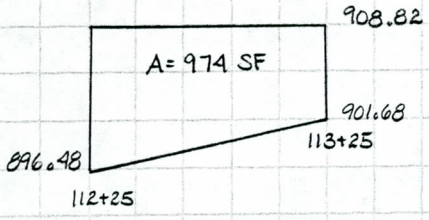
2) ASSUME SAME VELOCITY AS 91+50 TO 110+46 OF 9.3 FPS

$\therefore Q_{100} = (9.3)(1615) = 15{,}019$ CFS

$Q_{100_L} = 15{,}019$ CFS

RIGHT SIDE:

1) AREA FROM 112+25 TO 113+25:



2) WEIGHTED AVG OF

111+99	TO 112+33	(5.4 FPS)	30%
112+33	TO 112+43	(5.3 FPS)	10%
112+43	TO 112+81	(5.8 FPS)	43%
112+81	TO 113+04	(4.5 FPS)	13%
113+04	TO 113+22	(2.8 FPS)	3%

$V_{AVE} = 5.31$ FPS

$\therefore Q_{100} = (5.31)(974) = 5172$ CFS

$Q_{100R} = 5172$ CFS

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DETERMINATION OF L_S:

FROM PREVIOUS CALCULATIONS OF Q_f, Q_{100}, & FIG. 30, FHA HYDRAULICS OF BRIDGE WATERS, 2nd ED:

		Q_f, CFS	Q_{100}, CFS	SPUR [2] DISCH. RATIO	L_S, FT [1]
(SOUTH)	LEFT	27,850	15,019	1.85	162
(NORTH)	RIGHT	9,817	5,172	1.90	168

SOUTH SPUR DIKE SELECTION: ASSUME THE INCREASE IN VINEYARD ROAD ELEVATION AS A RESULT OF REEMS ROAD INCREASE WILL BLOCK OVERBANK FLOW FROM STA 88+10

$\therefore Q \approx 3071 + 7815 + 1105 = 11{,}990$ CFS

then $Q_f/Q_{100} = 11{,}990/15{,}019 \approx 0.80 \Rightarrow L_S = 82$ feet

USE MIN 100' SOUTH

NORTH SPUR DIKE SELECTION: QUALITATIVE ANALYSIS:

CONSIDERING THE EXISTING WATER COURSE FOR THE "WORST CASE" CONDITION, IT IS POSSIBLE (AS SEEN FROM TOPO) THAT A PORTION OF THE THE RIGHT OVERBANK FLOW (APPX 11% OF THE TOTAL FLOW) COULD SHIFT TO THE NORTH. THIS WOULD HAVE AN IMPACT OF RAISING Q_f TO 11% (250,000 CFS) = 27,500 CFS, RESULTING IN

$$Q_f/Q_{100} = 27{,}500/5{,}200 = 5.3 \Rightarrow L_S \approx 300 \text{ ft.}$$

FOR CONSERVATIVE PURPOSES, USE L_S = 300' NORTH

[1] WHERE $V_{N2} = Q/A_{N2} = 8.77$ FPS
$Q = 250{,}000$ CFS
$A_{N2} = 28{,}504$ SF (Σ FLOW DIST'N AREAS, SECTION 377.7)

[2] SPUR DISCHARGE RATIO = Q_f/Q_{100}

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CALCULATION OF SPUR DIKE
AXIS EQUATIONS:

FOR 2.5:1 MAJOR: MINOR AXIS;

$$1 = \frac{x^2}{L_s^2} + \frac{y^2}{(0.4L_s)^2}$$

where L_s = LENGTH OF DIKE

FOR 100' SPUR DIKE:

$$\frac{x^2}{10{,}000} + \frac{y^2}{1600} = 1$$

$$\boxed{\therefore\ y = \left[\left(1 - \frac{x^2}{10{,}000}\right)(1600)\right]^{1/2}}$$

FOR 300' SPUR DIKE:

$$\frac{x^2}{90{,}000} + \frac{y^2}{14{,}400} = 1$$

$$\boxed{\therefore\ y = \left[\left(1 - \frac{x^2}{90{,}000}\right)(14{,}400)\right]^{1/2}}$$

SPUR DIKES
RIP-RAP PLACEMENT

1) CALCULATION OF FREEBOARD:

FROM C.4.2.1,[1] USE MIN. 2.5 FEET

2) BY C-5, CHECK FOR EXISTENCE OF ROLL WAVES, & IF SO, COMPARE HEIGHT OF WAVE WITH FREEBOARD:

a) CHECK FROUDE NUMBER: $Fr = v/\sqrt{gy_1}$

$$= \frac{8.3}{\sqrt{32.2(8.45)}} = 0.50 < 2.0 \text{ FOR LEFT DIKE}$$

$$= \frac{3.2}{\sqrt{32.2(5.85)}} = 0.23 < 2.0 \text{ FOR RIGHT DIKE}$$

b) COMPARE S_o W/RATIO OF $12/Re$: where $Re = \frac{\rho v D}{\mu} = \frac{vD}{\nu}$

where $S_o = 1.303 \times 10^{-3}$

$$= \left[\frac{(8.3)(8.45)}{1.1 \times 10^{-5}}\right]^{-1}(12) = 1.88 \times 10^{-6} < S_o \text{ FOR LEFT}$$

$$= \left[\frac{(3.2)(5.85)}{1.1 \times 10^{-5}}\right]^{-1}(12) = 7.05 \times 10^{-6} < S_o \text{ FOR RIGHT}$$

SINCE $S_o > 12/Re$ & $Fr < 2.0$ FOR BOTH SIDES,
ROLL WAVES ARE NOT ANTICIPATED

3) BY SCS[2];

F_b = 20% DEPTH

LEFT: 20% (8.3) = 1.66'
RIGHT: 20% (5.85) = 1.17'
MAX: 20% (19.32) = 3.86'

USE 3.3' FREEBOARD

[1] HYDRAULIC DESIGN MANUAL, LA COUNTY FLOOD CONTROL DISTRICT

[2] SCS PLANNING & DESIGN OF OPEN CHANNELS, P 5-3

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SPUR DIKES:

DETERMINATION OF RIP-RAP SIZE:

FOR SS = 2:1 = 26.6°
ASSUME SP. GRAVITY OF 6" STONES = 2.65

FROM CALTRANS MANUAL [1]

$$W = \frac{2 \times 10^{-5} (v^6)(SG)}{(SG)^3 \sin^3(\rho - \alpha)}$$

where W = WT OF CRITICAL STONE (30%)
$\rho = 70°$, CONST. FOR BROKEN ROCK

$$= \frac{2 \times 10^{-5} v^6 (2.0)}{(2.65)^3 \sin^3(70 - 26.6)}$$

$$= 6.63 \times 10^{-6} v^6 \quad = 6.63 \times 10^{-6} (8.3 \text{ FPS})^6 = 2.17\# \text{ LEFT}$$
$$= 6.63 \times 10^{-6} (3.2 \text{ FPS})^6 = 0.01\# \text{ RIGHT}$$

FROM TABLE 2, P 113 [1], A MAXIMUM THICKNESS OF 1.8' CAN BE ASSUMED

BY DOT [2] STNDS,
FOR $v = 8.3$ FPS, SS = 2:1, $\phi \cong 0.6$ ft, $\cong 7''$
$v = 3.2$ FPS, SS = 2:1, $\phi \cong 0.25$ ft $\cong 3''$

"WORST CASE", USE $v_{CHANNEL}$ (MAX) = 9.21 FPS, SS = 2:1, $\phi = 0.75' = 9''$

CHECK BY DOT STNDS.

[1] CALTRANS "BANK & SHORE PROTECTION MANUAL" PP 110-112, NOV 1970
[2] DOT, FHA, PG 11-6

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SPUR DIKES:

DETERMINATION OF RIP-RAP SIZE:

SUMMARY

	LEFT	RIGHT
DESIGN VELOCITY, FPS	10~12	12~14
REQ'D WEIGHT, LBS. (CRITICAL)	2.2	0.01
DIAMETER, INCHES (d_{50})	18"	24"

ESTIMATES & DESIGN VELOCITIES ARE FOR CRITICAL AREAS WHERE THE GREATEST DESTRUCTIVE FORCES ARE ANTICIPATED (U/S NOSES). IN THE CHANNEL, STREAMLINED FLOW IS ANTICIPATED; ∴ A SMALLER ϕ CAN BE USED. ALONG LANDSIDE, EROSION WILL ONLY OCCUR FROM EDDIES & VORTICES. THICKNESS SHOULD BE SELECTED BASED UPON FURTHER FIELD DATA AS DESIGN IS FINALIZED. (1.5 TO 2 X d_{50}) FOR RIPRAP THICKNESS IN EXCESS OF 1.5xd_{50}, SOME DOWNWARD ADJUSTMENT COULD BE MADE TO d_{50} SIZE.

FOR NOSES, USE 22"~24". FOR OTHER (RIVERSIDE) 16" ϕ
FOR RIVERSIDE, USE 3~4"

A FILTER BED OR FILTER FABRIC MATERIAL WILL BE REQUIRED FOR THE PREVENTION OF LOSS OF FINES IN THE EMBANKMENT MATERIAL.
THE FOLLOWING OPTIONS CAN BE USED:

a) GRAVEL FILTER (OPTION)
DOT RECOMMENDS 6~9" MINIMUM

SINCE LOSS OF FINES OCCURS DUE TO TURBULENCE AROUND THE MATERIAL & THE "ROLL WAVE" EFFECT W/ IT'S SUBSEQUENT NEGATIVE PRESSURE GRADIENT, FILTERS ARE REQ'D. HOWEVER, AS NO ROLL WAVES ARE ANTICIPATED, & THE TYPICAL DURATION OF THE FLOOD EVENT IS LESS THAN 12 HOURS, A 6" FILTER IS FELT TO BE ADEQUATE.

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a) GRAVEL FILTER, CON'T

A SPECIFICATION FOR GRADATION CANNOT BE DETERMINED, DUE TO A LACK OF AVAILABLE DATA ON THE EMBANKMENT MATERIAL.

USE 6" FILTER

b) FILTER FABRIC (OPTION)

FILTER FABRIC IS USED IN LIEU OF A GRAVEL FILTER FOR PURPOSES OF REDUCING CONSTRUCTION COSTS, ESPECIALLY WHEN SPECIFYING & LOCATING "CORRECT" AGGREGATE GRADATION IS DIFFICULT.

THE FABRIC SHOULD BE POROUS TO ALLOW FOR THE STABILIZATION OF HYDROSTATIC PRESSURE, YET BE KNIT TIGHTLY TO AVOID THE MIGRATION OF PARTICLES. OTHER CONCERNS, SUCH AS TEAR STRENGTH FOR CONSTRUCTION SHOULD ALSO BE CONSIDERED.

c) GROUTED RIP-RAP (OPTION)

GROUTING THE RIP RAP MAY ALSO BE CONSIDERED AS AN OPTION TO REDUCE COSTS, BY ALLOWING FOR THE USE OF SMALLER STONES & POSSIBLY ELIMINATING THE NEED FOR BACKING MAT'L. SHOULD THIS BE USED, A MINIMUM 1/2" OF GROUT PENETRATION IS RECOMMENDED.

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LEGEND

100 YEAR FLOOD LIMITS

FLOODWAY LIMITS

CONTROL LINE

NOTE: CONTOUR INTERVAL 4 FEET.

0 400 800

PHOTO DATE 3-28-84
AERIAL MAPPING CO. #83039
COOPER AERIAL SURVEY CO #830339

GILA RIVER FLOODPLAIN DELINEATION

REVISED 6-11-87

PREPARED: 1-2-87

PLATE 9

COE & VAN LOO CONSULTING ENGINEERS INC. PHOENIX ARIZONA

FLOOD CONTROL DISTRICT
of
Maricopa County

3335 West Durango Street • Phoenix, Arizona 85009
Telephone (602) 262-1501

D. E. Sagramoso, P.E., Chief Engineer and General Manager

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JAN 20 1987

Coe and Van Loo
4550 North 12th Street
Phoenix, AZ 85014

Attention: Mr. Ashok Patel

Re: Proposed Reems Road Bridge over Gila River

Dear Mr. Patel:

After reviewing the subject report, the following suggestions are brought to your attention:

1. It may be more appropriate to model the irrigation ditch at the north side of the river, using an X3 card with the top of the canal elevation coded in the model. Although we believe this will have no impact on the floodplain width or elevation, it is a better means of providing a model that can be used for deign and FIS purposes.

2. The SB card used for the HEC-2 analysis should use bridge parameters that are closer to the proposed bridge design. Since the bridge length is used for calculating the flow over weir, using a length of 5800 ft which is about twice the length of the floodplain may generate erroneous results if the bridge is over topped during the modeling process.

Following your revisions into the final report we will be coordinating this with our study contractor for our Flood Insurance Study for this reach. At that time our contractor will make a decision as to incorporate your results into the study or revise them as appropriate.

Please do not hesitate to call me at 262-1501, if you have any questions regarding this matter.

Sincerely,

Amir Motamedi

Amir M. Motamedi
Hydrologist