FLOOD CONTROL DISTRICT

OF MARICOPA COUNTY

D.E. SAGRAMOSO, CHIEF ENGINEER AND GENERAL MANAGER

SALT RIVER FLOOD DELINEATION STUDY

COUNTRY CLUB DRIVE TO GRANITE REEF DAM
WITH PROPOSED GILBERT ROAD BRIDGE

PREPARED BY BURGESS & NIPLE INC.

OCTOBER 1988

STUDY DATE: 1988

MAPPING DATE: 1984

Burgess & Niple, Inc.
Engineers and Architects

b&n 1912

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OCTOBER 1988

PROPOSED CONDITION - GILBERT ROAD
AS NEW BRIDGE WITH ASSOCIATED CHANNEL IMPROVEMENTS

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SALT RIVER FLOOD DELINEATION STUDY
COUNTRY CLUB DRIVE TO GRANITE REEF DAM

INTRODUCTION

Purpose of Study

The purpose of this Flood Delineation Study is to investigate the existence and severity of flood hazards along the Salt River from Country Club Drive to Granite Reef Dam. The area studied includes portions of unincorporated areas of Maricopa County, Arizona; portions of the City of Mesa, Arizona, and portions of the Salt River Pima-Maricopa Indian Community.

Coordination and Acknowledgements

The Maricopa County Highway Department provided Contract Plans for the proposed Gilbert Road Bridge. The Salt River Pima-Maricopa Indian Community provided information concerning past, present, and future river bed mining and landfill operations. The Mesa City Engineer was contacted to determine potential for construction in the near future within the flood plain which might affect the study. There was none. Engineering consultants under contract with the Arizona Department of Transportation were contacted to determine potential for roadway construction in the near future within the flood plain which might affect the study. Parsons, Brinkerhoff, Quade and Douglas, Inc. provided the proposed alignment of the Red Mountain Freeway and noted that the proposed Freeway will be located outside of the 100 year flood plain as determined by this study. The Department of the Army, Corps of Engineers, Los Angeles provided 100 year flood discharges for the Salt River at Country Club Drive, Gilbert Road, and at a point just downstream of the confluence with the Verde River. The Corps of Engineers also provided values for flood elevation, and flow condition at the upstream face of the Country Club Drive bridge from their hydraulic model up to Country Club Drive, which was developed for the Federal Emergency Management Agency.

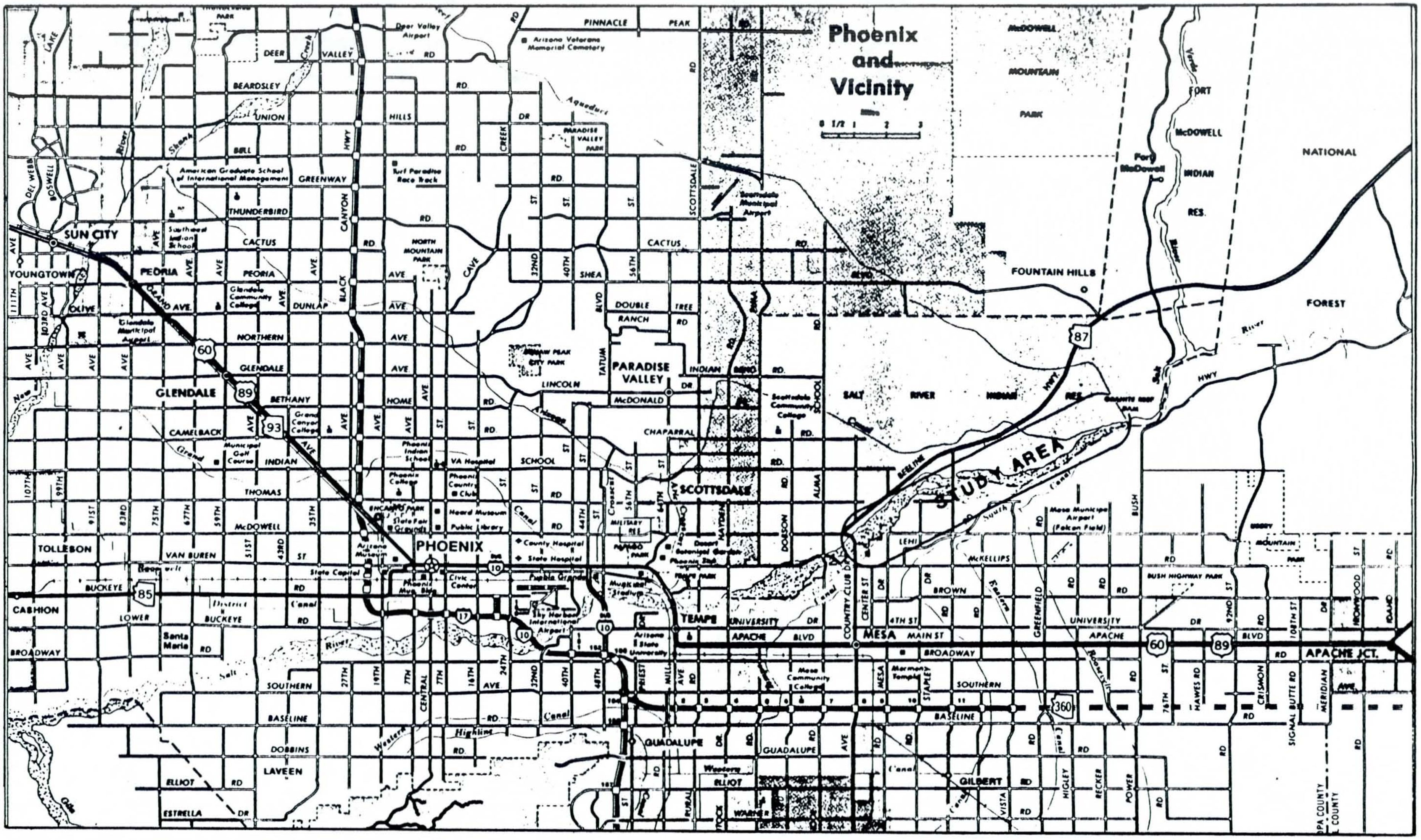

FIGURE 1

FLOOD CONTROL DISTRICT OF MARICOPA COUNTY

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APPROXIMATE SCALE

4 0 4 8 12

VICINITY MAP

AREA STUDIED

Scope of Study

This flood delineation study covers incorporated and unincorporated areas of Maricopa County along the Salt River from Country Club Drive (River Mile 28.358) to Granite Reef Dam (River mile 39.116). The study area is shown in Figure 1. The flood model includes the proposed Gilbert Road Bridge and channelization as designed by the Maricopa County Highway Department in 1981.

Community Description

Terrain varies from mountains to alluvial plains. Numerous small, intermittent streams and washes traverse the county. Major streams include the Gila, Salt, Agua Fria, New and Hassayampa Rivers.

Maricopa County has a total area of 9,238 square miles and is located in the south central region of Arizona. Total Maricopa County population in 1986 is estimated to be 1,863,900. The area is experiencing rapid population growth, having grown from 1,509,262 in 1980. The City of Mesa has grown from 152,000 in 1980 to an estimated population of 270,000 in 1986, an increase of 10 percent annually.

The area is located within the Sonoran Desert with mild, short winters and long, hot summers.

Principal Flood Problems

Moisture for storms during summer months generally originates in the Gulf of Mexico area and storms tend to be intense and of short duration. Moisture for storms at other times of the year generally originates in the Pacific Ocean and storms tend to be more gentle rains of longer duration. The watershed includes higher elevations at which snowfall accumulates and is released during periods of thaw. Flooding may occur at any time of the year.

The Salt River is controlled for water supply purposes. Water released from the various reservoirs in the watershed is diverted into irrigation canals at Granite Reef dam. Water is released into the river downstream of Granite Reef Dam if reservoirs are at capacity and flow exceeds usage of water from the canals.

The Salt River within the study area is located in a wide alluvial flood plain. Flood hazards along the river result when the river channel overflows and inundates development which has occurred along the stream.

The Salt River stream bed is composed of sand, gravel, and cobbles deposited over time from erosion of the mountains in the upper watershed. The natural equilibrium of materials moved downstream due to erosion being replaced by materials deposited by flood flows from the mountains has been disturbed by construction of the water supply reservoirs. Reservoirs impound sediments from the upper watershed. Stream bed mining for sand, gravel, and cobbles has also resulted in stream bed degradation. This degradation poses hazards to structures in and near the flood plain which may be undermined, but also tends to lower the stream bed and, therefore, flood elevations.

Flood Protection Measures

The six water supply reservoirs in the Salt River watershed are operated by the Salt River Project for water supply. The dams provide some protection from floods of low magnitude, but offer little protection from floods of large magnitude, such as the 100 year flood.

ENGINEERING METHODS

Hydrologic Analyses

Discharges for this study were provided by the Department of the Army, Corps of Engineers, and are published in Reference No. 1.

Table 1

Summary of Discharges

Flooding Source and Location	Peak 100-Year Discharge (cfs)
Salt River	
At Country Club Drive	225,000
At Gilbert Road	230,000
At Granite Reef Dam	245,000

Hydraulic Analyses

Standard hydraulic methods were used to determine 100 year recurrence interval flood hazards for this study. Analyses reported herein reflect current conditions as modified by the addition of the proposed Gilbert Road bridge and channelization project for which contract plans are complete. Construction of the project is expected in the near future.

Cross sections for the backwater analysis of the Salt River are digitized from aerial mapping at 1:48000 scale (Reference 2) with a contour interval of 4 feet. Cross sections are located at close intervals upstream and downstream of the Gilbert Road bridge to compute the backwater effect of the structure. Locations of selected cross sections used in the hydraulic analysis are shown in the Flood Profiles (Exhibit 1). Cross section locations are also shown on the Flood Boundary/Floodway Map (Exhibit 2).

Flood profiles are drawn showing computed water surface elevations to an accuracy of 0.5 feet for a flood of 100 year frequency. Water surface elevations are computed through the use of the Department of the Army, Corps of Engineers HEC-2 Water Surface Profiles computer program. The starting elevation at the upstream face of the Country Club Drive bridge was obtained from the Corps of Engineers which had recently performed a similar study for the Salt River up to Country Club Drive. All elevations used are referenced to the National Geodetic Vertical Datum of 1929. Locations of Elevation Reference Marks used in this study are shown on the maps (Exhibit 2) and described in the Elevation Reference Marks Table.

Hydraulic analyses are based upon unobstructed flow conditions. Flood elevations presented herein are considered valid only if the Country Club Drive and Gilbert Road bridges remain unobstructed, and dams in the watershed do not fail.

FLOOD PLAIN MANAGEMENT APPLICATIONS

This study has been performed to meet the standards of the National Flood Insurance Program as defined by Reference 3.

A prime purpose of the National Flood Insurance Program is to encourage state and local governments to adopt sound flood plain management programs. This study, therefore, includes a flood boundary map designed to assist communities in developing sound flood plain management measures.

Flood Boundaries

In order to provide a national standard without regional discrimination, the 100-year flood has been adopted by the Federal Emergency Management Agency (FEMA) as the base flood for purposes of flood plain management measures. The boundary of the 100-year flood has been delineated using the flood elevations determined at each cross section; between cross sections, the boundaries were interpolated using topographic maps at a scale of 1:4,800 with a contour interval of 4 feet (Reference 2).

The boundary of the 100-year flood is shown on the Flood Boundary and Floodway Map (Exhibit 2). Small areas within the flood boundaries may lie above the flood elevations, and therefore, may not be subject to flooding. Due to limitations of the map scale and lack of detailed topographic data, such areas are not shown.

Floodways

Encroachment on flood plains, such as artificial fill, reduces the flood-carrying capacity, increases flood heights of streams, and increases flood hazards in areas beyond the encroachment itself. One aspect of flood plain management involves balancing the economic gain from flood plain development

FLOODING SOURCE		FLOODWAY			WATER SURFACE ELEVATION[2]		
Cross Section	Distance[1]	Width (Feet)	Section Area (Sq. Ft.)	Mean Velocity (Feet/Sec.)	With Floodway	Without Floodway	Increase
A	28.358	1334.	23800.	9.5	1218.3	1217.3	1.0
B	28.646	1588.	18142.	12.4	1218.7	1218.0	.7
C	28.831	1700.	26347.	8.5	1221.1	1220.5	.6
D	29.017	1647.	23284.	9.7	1221.5	1221.0	.5
E	29.221	1500.	18873.	11.9	1221.9	1221.5	.4
F	29.473	2150.	26527.	8.5	1224.1	1223.1	1.0
G	29.676	2420.	28120.	8.0	1224.8	1224.3	.5
H	29.981	1420.	14497.	15.5	1225.9	1225.6	.3
I	30.194	1745.	16368.	13.7	1230.7	1230.7	.0
J	30.458	1425.	19854.	11.5	1234.1	1234.0	.1
K	30.815	1390.	18540.	12.3	1236.1	1236.1	.0
L	31.028	1431.	15439.	14.7	1238.8	1238.8	.0
M	31.301	2120.	28211.	8.1	1243.1	1242.9	.2
N	31.522	3200.	28060.	8.1	1243.7	1243.7	.0
O	31.725	3720.	26242.	8.7	1244.7	1244.6	.1
P	31.896	3700.	24272.	9.4	1246.0	1245.5	.5
Q	32.126	3100.	19808.	11.5	1247.9	1247.9	.0
R	32.296	3500.	22909.	9.9	1250.5	1250.4	.1
S	32.465	3625.	24557.	9.3	1252.3	1251.8	.5
T	32.641	3100.	23858.	9.5	1253.6	1253.1	.5
U	32.676	3100.	23980.	9.6	1254.2	1254.0	.2
V	32.862	3710.	19753.	11.6	1256.4	1256.4	.0
W	33.023	3320.	24643.	9.3	1259.0	1259.0	.0
X	33.205	3700.	27845.	8.3	1260.7	1259.9	.8
Y	33.385	3846.	30035.	7.7	1262.0	1261.2	.8

[1] Miles above confluence with Gila River
[2] Feet, NGVD 1929

TABLE 2

FLOOD CONTROL DISTRICT OF MARICOPA COUNTY

Burgess & Niple, Inc.

Engineers and Architects

FLOODWAY DATA

SALT RIVER

FLOODING SOURCE		FLOODWAY			WATER SURFACE ELEVATION[2]		
Cross Section	Distance[1]	Width (Feet)	Section Area (Sq. Ft.)	Mean Velocity (Feet/Sec.)	With Floodway	Without Floodway	Increase
Z	33.557	3870.	30115.	7.6	1262.9	1262.0	.9
AA	33.726	3651.	30328.	7.7	1263.9	1263.0	.9
BB	33.892	3270.	25420.	9.1	1264.7	1264.0	.7
CC	34.091	2770.	22962.	10.1	1266.2	1266.0	.2
DD	34.271	2157.	16379.	14.2	1267.3	1266.9	.4
EE	34.453	2261.	20222.	11.5	1270.7	1269.9	.8
FF	34.642	2110.	20141.	11.7	1272.5	1272.2	.3
GG	34.856	2080.	23752.	9.9	1274.5	1274.3	.2
HH	35.136	2310.	25208.	9.3	1276.1	1275.7	.4
II	35.297	2530.	24623.	9.5	1276.8	1276.4	.4
JJ	35.480	2495.	27209.	8.6	1278.0	1277.7	.3
KK	35.661	2593.	24926.	9.5	1278.8	1278.6	.2
LL	36.011	2095.	21218.	11.2	1280.8	1280.7	.1
MM	36.203	1965.	19112.	12.4	1282.0	1282.0	.0
NN	36.403	1950.	17103.	13.9	1283.8	1283.6	.2
OO	36.595	1611.	16229.	14.6	1286.1	1286.1	.0
PP	36.775	1380.	15503.	15.5	1288.0	1288.0	.0
QQ	36.953	1355.	21667.	11.1	1291.9	1291.8	.1
RR	37.152	1346.	20752.	11.6	1292.8	1292.8	.0
SS	37.328	1350.	20274.	11.8	1294.2	1294.1	.1
TT	37.523	1270.	20225.	11.9	1295.6	1295.2	.4
UU	37.720	910.	15128.	16.0	1296.0	1295.7	.3
VV	37.898	904.	18256.	13.3	1299.5	1299.5	.0
WW	38.074	1054.	21178.	11.5	1302.0	1301.9	.1
XX	38.261	1046.	19561.	12.4	1303.7	1303.7	.0

[1]Miles above confluence with Gila River
[2]Feet, NGVD 1929

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FLOODWAY DATA

SALT RIVER

FLOODING SOURCE		FLOODWAY			WATER SURFACE ELEVATION[2]		
Cross Section	Distance[1]	Width (Feet)	Section Area (Sq. Ft.)	Mean Velocity (Feet/Sec.)	With Floodway	Without Floodway	Increase
YY	38.439	1098.	21825.	11.1	1305.7	1305.2	.5
ZZ	38.636	1196.	22528.	10.8	1307.1	1306.2	.9
AAA	38.822	1203.	25689.	9.5	1308.4	1307.7	.7
BBB	39.009	1117.	25233.	9.7	1309.2	1308.6	.6
CCC	39.098	1179.	27239.	9.0	1309.9	1309.3	.6
DDD	39.116	1126.	20835.	11.8	1309.3	1308.7	.6

[1]Miles above confluence with Gila River
[2]Feet, NGVD 1929

TABLE 2

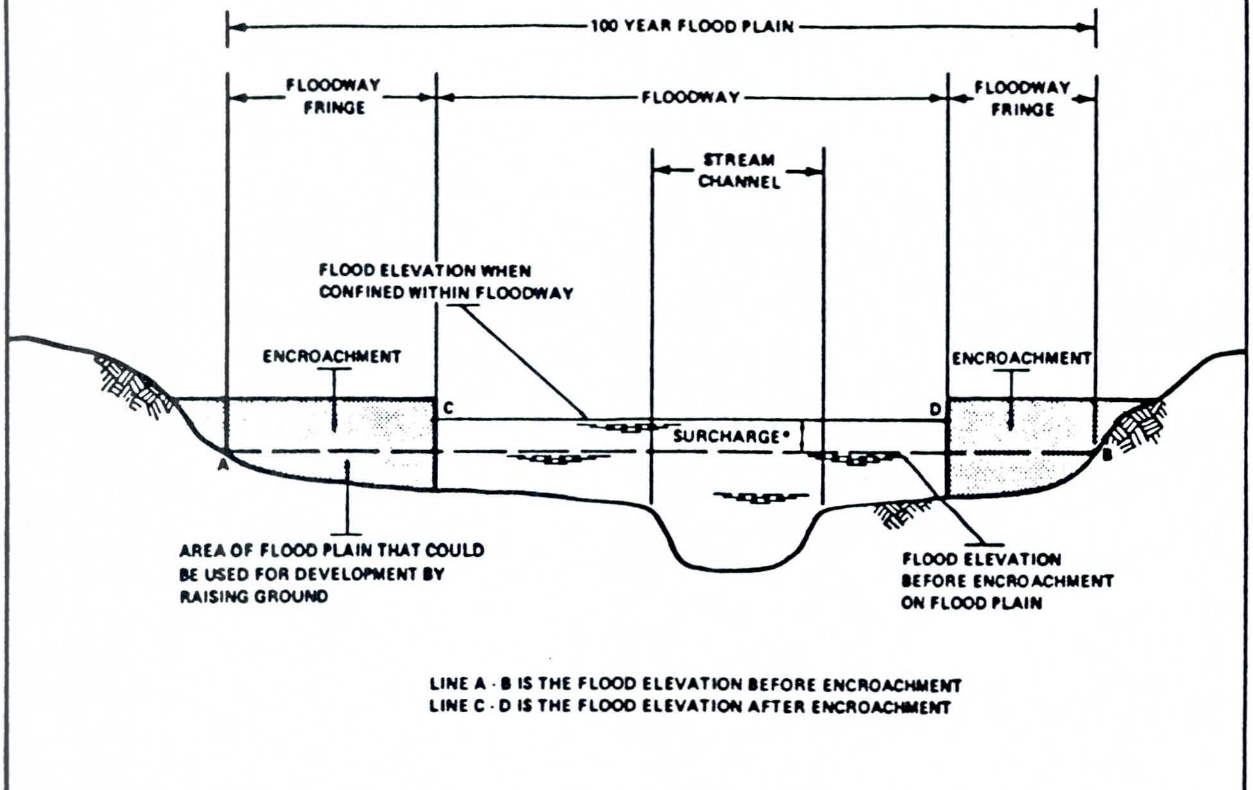
FLOOD CONTROL DISTRICT OF MARICOPA COUNTY

Burgess & Niple, Inc.

Engineers and Architects

FLOODWAY DATA

SALT RIVER



FLOODWAY SCHEMATIC - Figure 2

against the resulting increase in flood hazard. For purposes of the National Flood Insurance Program, the concept of a floodway is used as a tool to assist local communities in this aspect of flood plain management. Under this concept, the area of the 100-year flood is divided into a floodway and a floodway fringe. The floodway is the channel of a stream plus any adjacent flood plain areas that must be kept free of encroachment in order that the 100-year flood can be carried without substantial increases in flood heights. Minimum federal standards limit such increases in flood heights to 1.0 foot, provided that hazardous velocities are not produced.

The floodway presented for this study was computed on the basis of equal conveyance reduction from each side of the flood plain and adjusted for high velocities and physical discontinuities. The results of these computations are tabulated at selected cross sections for each stream segment for which a floodway is computed (Table 2).

As shown on the Flood Boundary and Floodway Map (Exhibit 2), the floodway widths were determined at cross sections; between cross sections, the boundaries were interpolated. In cases where the boundaries of the floodway and the 100-year flood are either close, together or collinear, only the floodway boundary has been shown.

The area between the floodway and the boundary of the 100-year flood is termed the floodway fringe. The floodway fringe thus encompasses the portion of the flood plain that could be completely obstructed without increasing the water-surface elevation of the 100-year flood by more than 1.0 foot at any point. Typical relationships between the floodway and the floodway fringe and their significance to flood plain development are shown in Figure 2.

INSURANCE APPLICATION

For flood insurance rating purposes, flood insurance zone designations are assigned to a community based on the results of the engineering analyses. These zones are as follows:

Zone AE: Zone AE is the flood insurance rate zone that corresponds to the 100-year flood plains that are determined in the Flood Insurance Study by detailed methods. In most instances, whole-foot base flood elevations derived from the detailed hydraulic analyses are shown at selected intervals within this zone.

Zone X: Zone X is the flood insurance rate zone that corresponds to areas outside the 500-year flood plain, areas within the 500-year flood plain, areas of 100-year flooding where average depths are less than 1 foot, areas of 100-year flooding where the contributing drainage area is less than 1 square mile, and areas protected from the 100-year flood by levees. No base flood elevations or depths are shown within this zone.

OTHER STUDIES

This study is in exact agreement with the Maricopa County Flood Insurance Study which analyzed the Salt River by detailed methods up to the Country Club Drive bridge. Elevations computed for this study are within 0.5 feet of the elevation presented in the Hydraulic Analysis for the Gilbert Road Bridge (Reference 4). Results of this study supercede flood boundaries developed by approximate methods presented on Flood Hazard Boundary Maps published by FEMA (Reference 9).

LOCATION OF DATA

Survey, hydraulic, and other pertinent data used in this study may be obtained from the Flood Control District of Maricopa County, 3335 West Durango Street, Phoenix, Arizona 85009.

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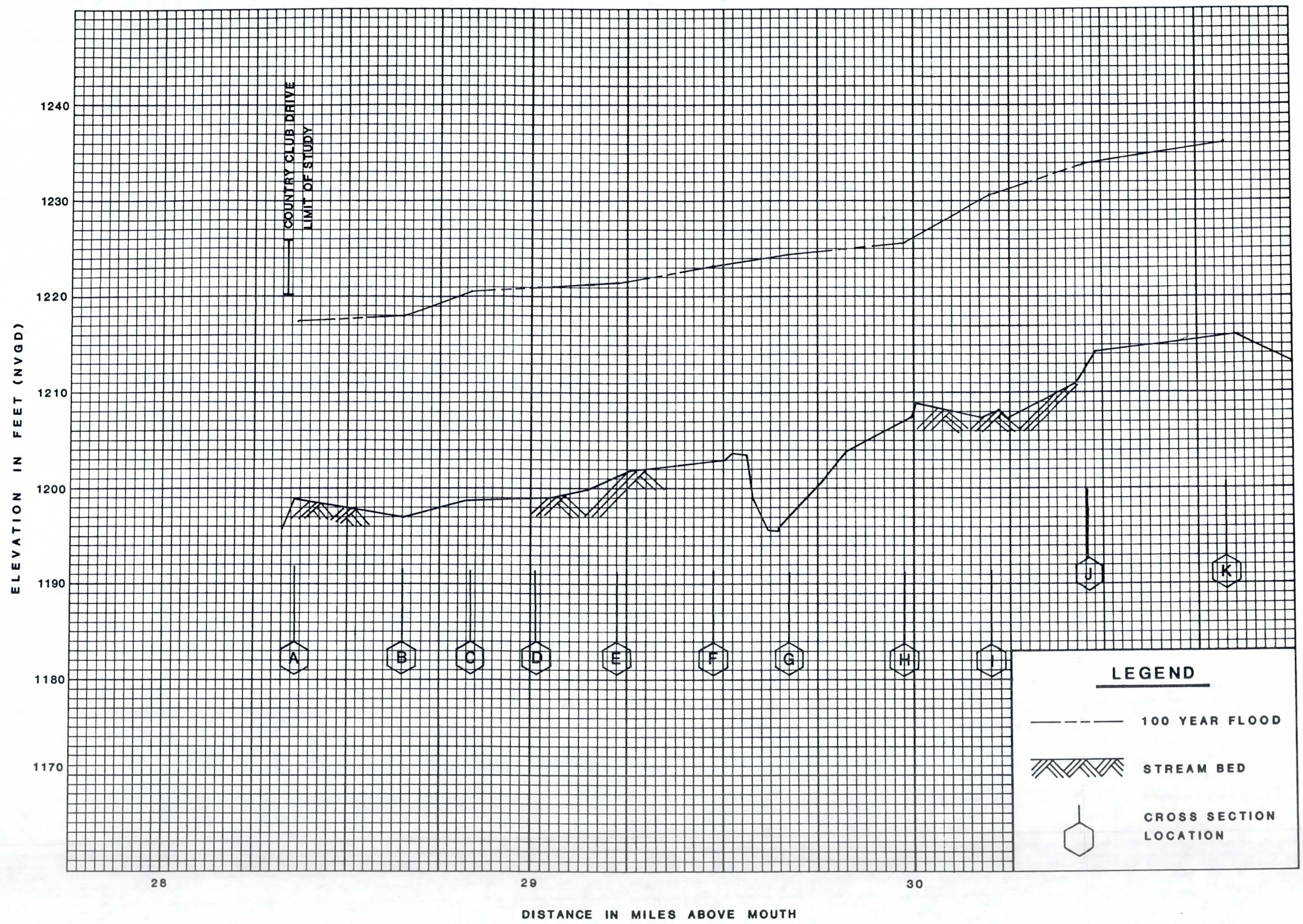
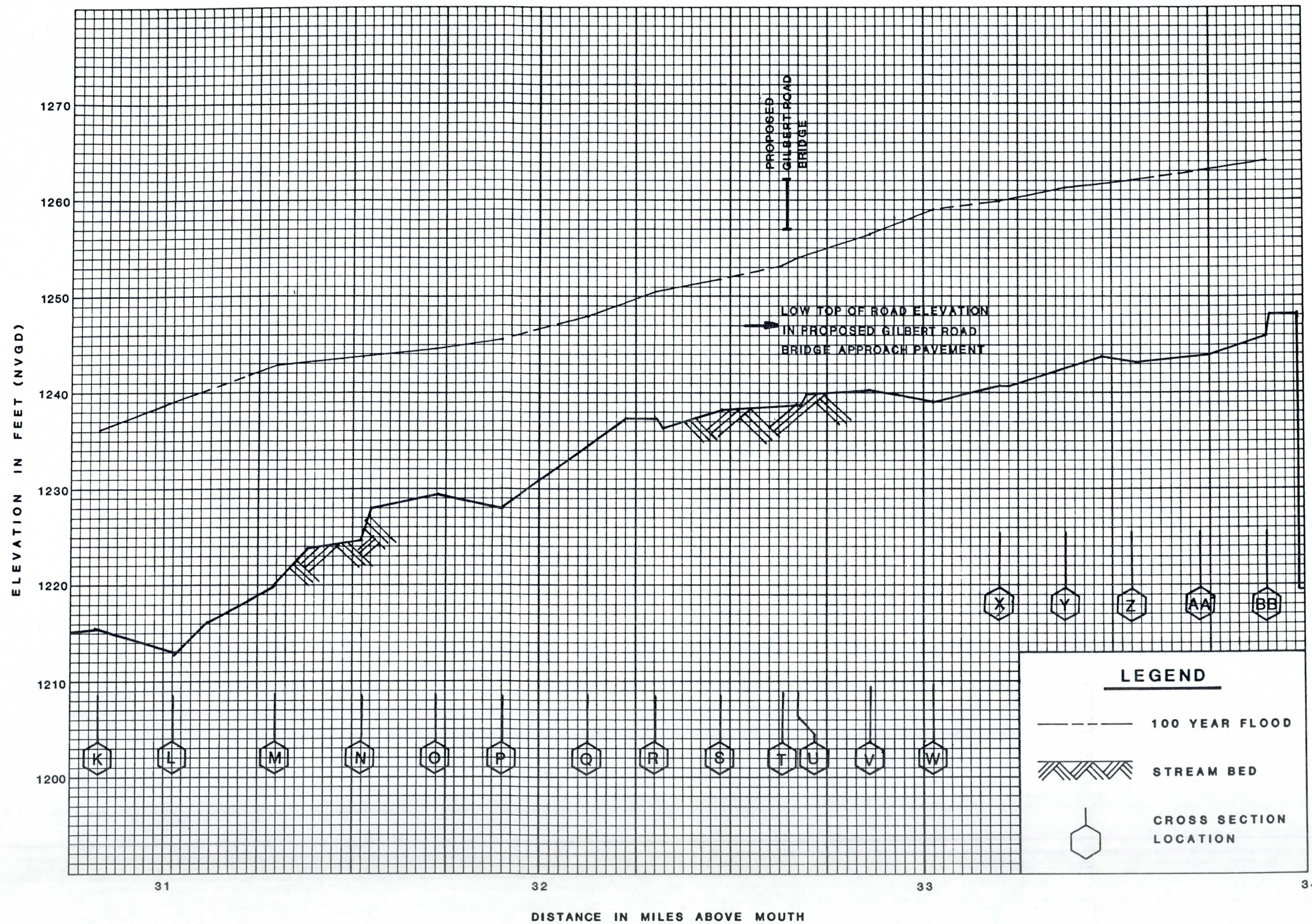


FLOOD PROFILES

SALT RIVER

FLOOD CONTROL DISTRICT OF MARICOPA COUNTY

Burgess & Niple, Inc.
Engineers and Architects



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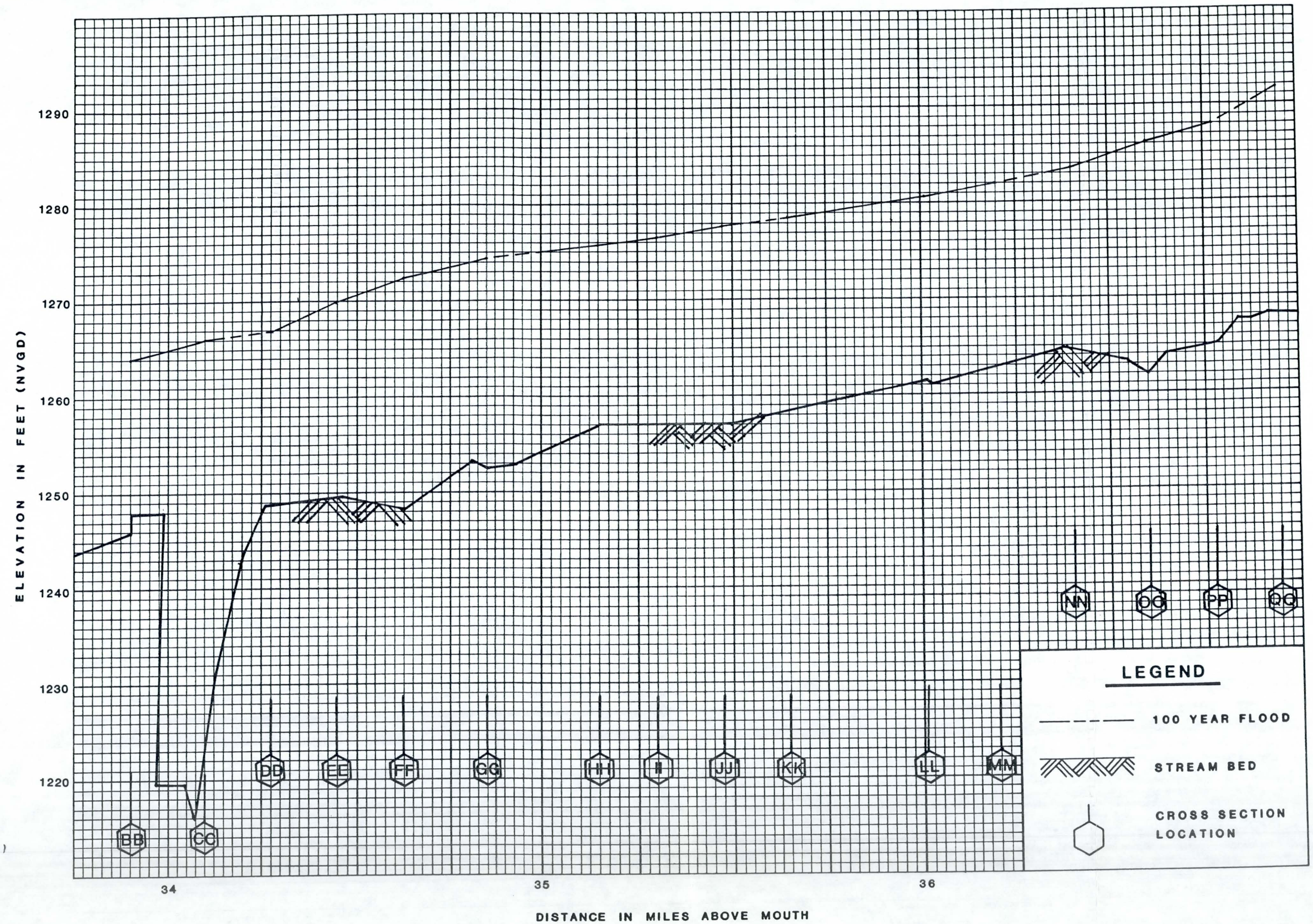

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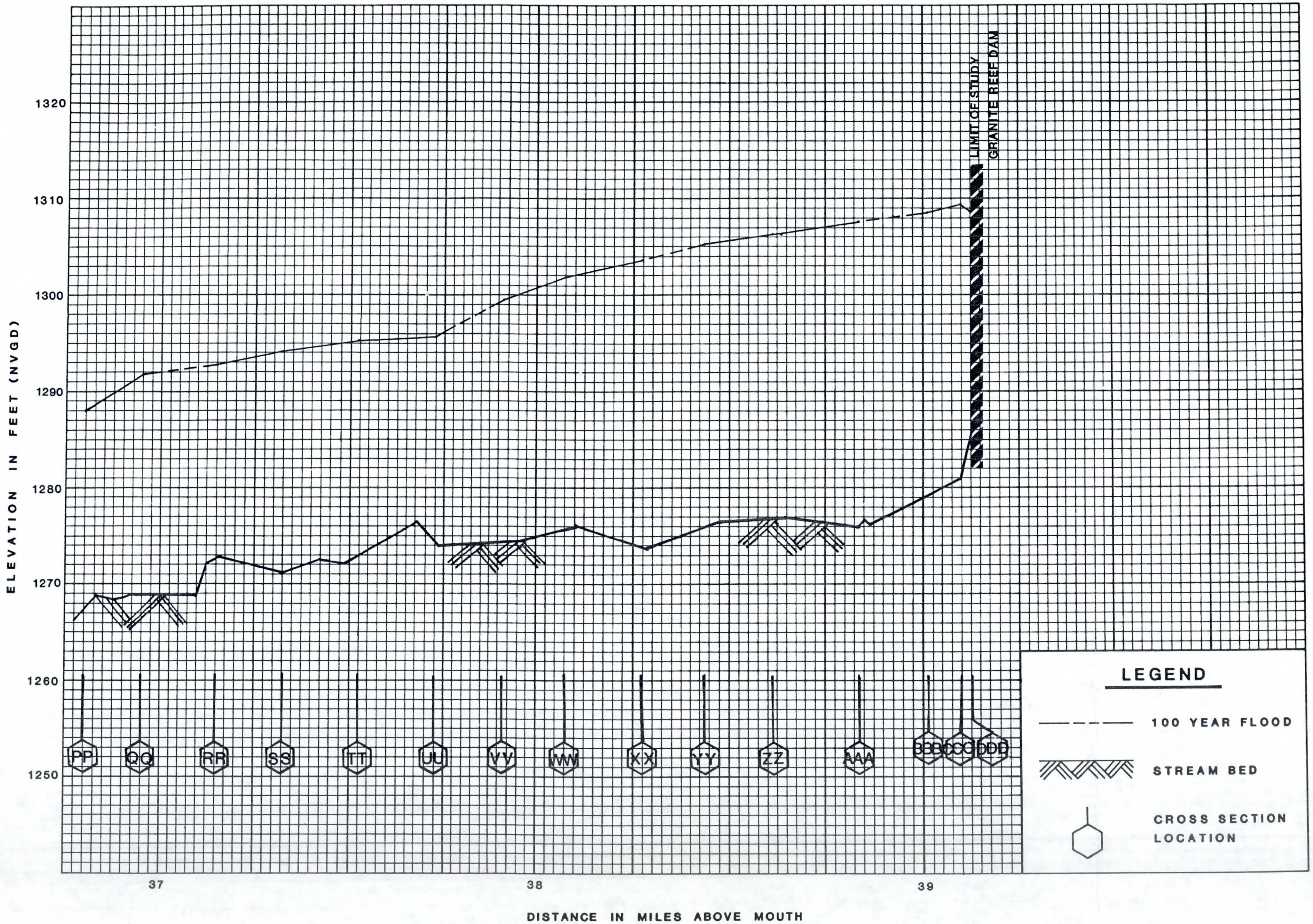

FLOOD PROFILES

SALT RIVER

FLOOD CONTROL DISTRICT OF MARICOPA COUNTY

Burgess & Niple, Inc.
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TABLE 3

Elevation Reference Marks

Reference Mark	Elevation (Feet NGVD)	Description of Location
RM1	1314.04	B.M. (1935 AZ Mk for tri-station "Granite") Bureau of Reclamation brass cap at west end of Conc. wingwall at south side of North gate house at Granite Reef Dam. Stamped 6 at top of cross 1314.04 Phoenix Datum.
RM2	1313.36	B&N No. 1 Elev. = 1313.36 Set P.K. nail in lead plug 1 foot west of east end of concrete wing wall at south east corner of bridge across the Arizona Canal.
RM3	1312.47	B&N No. 2 a No. 4 rebar w/alum. cap stamped "B.N.2 1312.47", 5-feet ± south of a 4 armed saguaro, 10-feet south of south canal road, 100-feet ± east of "Y" in canal road to dirt road west.
RM4	1313.07	V.C. 11-A a B.L.M. brass cap stamped "w 1/16 514/523, T2N R6E 1974" Elev. 1313.07.
RM5	1305.84	B&N No. 3 a No. 4 rebar w/alum. cap stamped "B.N.2 1305.84" 30-feet ± north of north edge of gravel road 100-feet ± west of 50 foot wide dirt channel.
RM6	1301.45	B&N No. 4 a No. 4 rebar w/alum. cap stamped "B.N.4 1301.45", 30-feet south of the south edge of gravel road south of canal road.
RM7	1302.58	A rebar w/alum. cap stamped "HC-11", Elev. 1302.58-feet, 20-feet north of north edge of gravel road.
RM8	1299.74	B&N No. 5 a No. 4 rebar w/alum. cap stamped "B.N.5 1299.74" 30-feet ± south of gravel road at "Y" in road.
RM9	1299.26	B&N No. 6 a No. 4 rebar w/alum. cap stamped "B.N.6 1299.26" 30 ± south of south edge gravel road at intersection of road south and southwest and bridge over Arizona Canal.
RM10	1293.62	B&N No. 7 a No. 4 rebar w/alum. cap stamped "B.N.7 1293.62" at the south right-of-way fence at S.R. 87 50-feet ± west of gravel road to east S.R. 87 M.P. 184.03.

Reference Mark	Elevation (Feet NGVD)	Description of Location
RM11	1293.88	B&N No. 8 a No. 4 rebar w/alum. cap stamped "B.N.8 1293.88" at south right-of-way fence of S.R. 87, S.R. 87 M.P. 183.50.
RM12	1281.67	B&N No. 9 a No. 4 rebar w/alum. cap stamped "B.N.9 1281.67" at south right-of-way fence of S.R. 87, S.R. 87 M.P. 183.00.
RM13	1281.25	B&N No. 10 a 1 1/4-inch alum. cap in concrete base for right-of-way fence post on south right-of-way fence of S.R. 87 stamped "183-1 65" S.R. M.P. 182.45 Elev. 1281.25.
RM14	1290.05	B&N No. 11 a No. 4 rebar w/alum. cap stamped "B.N. 11 1290.05" at south right-of-way fence of S.R. 87, S.R. 87 M.P. 182.00.
RM15	1277.39	B&N No. 12 a No. 4 rear w/alum. cap stamped "B.N.12 1277.39" on south right-of-way fence of S.R. 87, S.R. 87 M.P. 181.50.
RM16	1274.80	B&N No. 13 a No. 4 rebar w/alum. cap stamped "B.N.13 1274.80" on south right-of-way fence of S.R. 87, S.R. 87 M.P. 181.00.
RM17	1260.90	B&N No. 14 brass cap in concrete at south right-of-way fence of S.R. 87, S.R. 87 M.P. 180.52 Elev. 1260.90.
RM18	1260.31	B&N No. 15 a No. 4 rebar w/alum. cap stamped "B.N.15 1260.31" on north right-of-way fence S.R. 87, S.R. 87 M.P. 180.00.
RM19	1252.54	B&N No. 16 a No. 4 rebar w/alum. cap stamped "B.N.16 1252.54" at east right-of-way fence S.R. 87, S.R. 87 M.P. 179.41.
RM20	1221.58	B&N No. 17 a No. 4 rebar w/alum. cap stamped "B.N.17 1221.58" 65 north west of north end cross section Pt. No. 135 on cross section line extended S.R. 87 M.P. 178.02.