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MARICOPA
COUNTY
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CAVE CREEK FLOODPLAIN DELINEATION

Cave Buttes Dam to the Arizona Canal Diversion Channel

FCD 88-56

FINAL HYDRAULICS REPORT

Book 1 of 2

March, 1991

Dalgliesh & Figg, Inc.
Engineers and Architects

FLOOD CONTROL DISTRICT OF MARICOPA COUNTY

CAVE CREEK AND EAST FORK OF CAVE CREEK
FLOODPLAIN DELINEATION STUDY
ARIZONA CANAL DIVERSION CHANNEL TO CAVE BUTTE DAM

FINAL HYDRAULICS REPORT

BOOK 1 OF 2

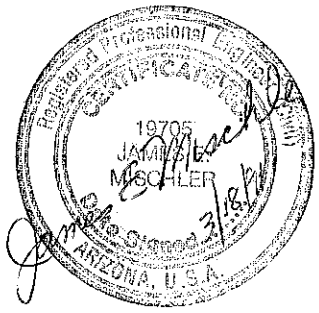
FEMA APPROVAL 1991

STUDY DATE 1990

MAPPING DATE 1989

Prepared By

BURGESS & NIPLE, INC.



MARCH 1991

CAVE CREEK WASH
FLOODPLAIN DELINEATION STUDY

Cave Butte Dam to Arizona Canal Diversion Channel

Burgess & Niple, Inc.
Engineers and Architects

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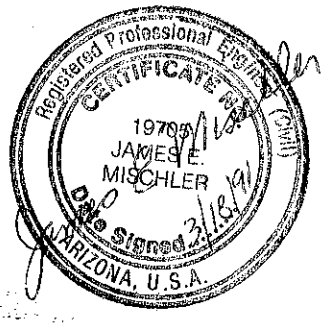
Cover Photo: Cave Creek Wash at the intersection of Grovers Street and Seventh Avenue during the minor flood of January, 1985.

* Appendices C, D, and E are bound separately.



FLOOD CONTROL DISTRICT OF MARICOPA COUNTY
CAVE CREEK WASH AND EAST FORK OF CAVE CREEK WASH
FLOODPLAIN DELINEATION STUDY
ARIZONA CANAL DIVERSION CHANNEL TO CAVE BUTTE DAM

INTRODUCTION

Purpose of Study

The purpose of this Floodplain Delineation Study is to investigate the existence and severity of flood hazards along Cave Creek Wash from the Arizona Canal Diversion Channel (ACDC) to Cave Butte Dam, and along the East Fork of Cave Creek Wash from the mouth to 1.42 miles upstream of the mouth. The area studied includes portions of unincorporated areas of Maricopa County, Arizona; and portions of the City of Phoenix, Arizona.

Coordination and Acknowledgements

References identified by number below are described in the Bibliography and References section of this report.

The Flood Control District of Maricopa County provided copies of References 1 through 5. They also provided two, six, and 24 hour rainfall distributions and miscellaneous articles on the Green and Ampt procedure.

The City of Phoenix provided copies of References 6 through 12, as well as available one-quarter section aerial photographs (1" = 100' scale), topographic maps (1" = 200' scale), and zoning maps (1" = 400' scale). Excerpts of as-built bridge plans were obtained from City files.

Soil information (Reference 13) was obtained from the Soil Conservation Service. The United States Geological Survey provided stream flow gage data for Cave Creek at Peoria Avenue for the period of record, 1957 through 1987. The Arizona State University Climatological Laboratory provided copies of precipitation records for the Deer Valley Airport Station for the period of record, 1950 to 1985.

The Arizona Projects Office of the United States Bureau of Reclamation provided design hydrology summaries, structure locations, and applicable plan sections for Reaches 10 and 11 of the Central Arizona Project Canal.

Aerial Mapping Company, Inc. provided aerial photography, dated December 1988, of the watershed area north to Cave Butte Dam (1" = 1000' scale). They also provided a computer listing of digitized cross sections for the channelized portion of Cave Creek Wash and a portion of the Arizona Canal Diversion Channel (ACDC).

Amwest Engineering Company, Inc. provided copies of their Letter of Map Revision (LOMR) request for FIRM panel 040051 0050C dated January 1988, and a request for a Conditional Letter of Map Revision (CLOMR) dated September 1989 for the area between 11th Avenue and Tierra Buena Lane.

AREA STUDIED

Scope of Study

This floodplain delineation study covers incorporated and unincorporated areas of Maricopa County along Cave Creek Wash from the ACDC (River Mile 15.263) to the toe of Cave Butte Dam (River mile 27.294). The study also includes the East Fork of Cave Creek from the mouth (River Mile 0) to a point 1.42 miles upstream. The study area is shown in Figure 1.

Community Description

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 1990 is projected to be 2,133,000. The area is experiencing rapid population growth, having grown from 1,509,262 in 1980. City of Phoenix population in 1988 was 955,695.

Terrain in Maricopa County 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.

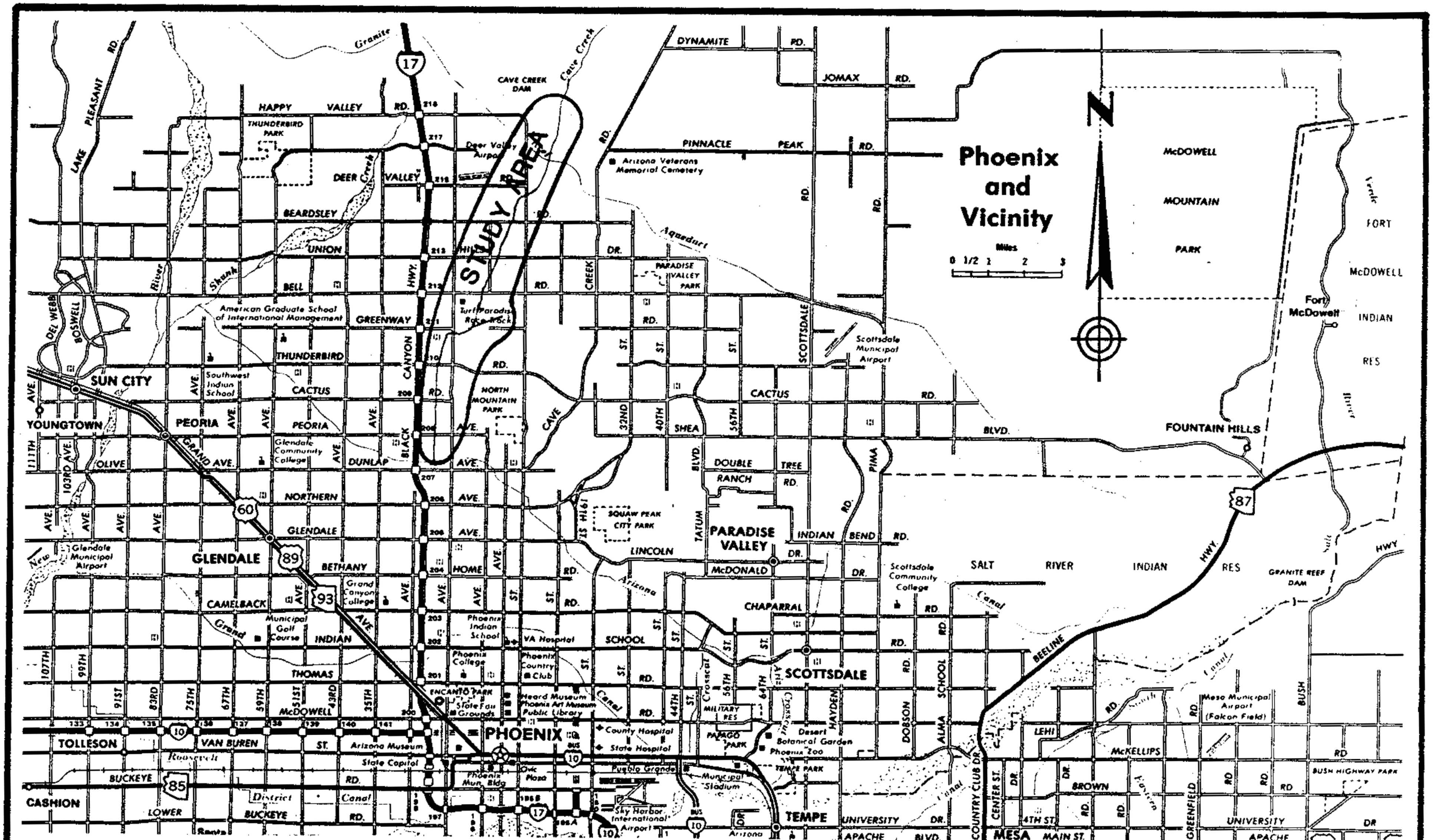


FIGURE 1

FLOOD CONTROL DISTRICT OF MARICOPA COUNTY

Burgess & Niple, Inc.

Engineers and Architects

APPROXIMATE SCALE

0 4 8 12 16

VICINITY MAP

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

Principal Flood Problems

Storms during summer months generally originate in the Gulf of Mexico area and tend to be intense and of short duration. Storms at other times of the year generally originate in the Pacific Ocean and tend to be more gentle rains of longer duration. Flooding may occur at any time of the year.

Cave Creek Wash is controlled by Cave Butte Dam for flood mitigation purposes. The dam is designed to retain a sufficient volume of the 100-year runoff to permit release of only 420 cfs downstream. An emergency spillway operates for events greater than the 100 year flood.

Cave Creek Wash and the East Fork of Cave Creek Wash within the study area are located in wide alluvial flood plains. Flood hazards along the streams result when the channels overflow and inundate development which has occurred along the streams.

Flood Protection Measures

Cave Butte Dam is operated by the Flood Control District of Maricopa County to mitigate flood hazards for events up to and including the 100-year flood. Numerous retention basins located throughout the watershed also serve to mitigate increased runoff due to urban development. Off-stream gravel mining adjacent to the channel in some areas provides unintended storage which may reduce peak flood discharges.

Construction of a concrete lined channel in the lower reach of Cave Creek Wash from the ACDC to the area of Sweetwater Road was substantially completed in 1989. The project, designed by the U.S. Army, Corps of Engineers, is intended to convey the 100-year flood within the channel. Construction includes a large sediment basin upstream of the channel and pier extensions for the Cactus Road and Peoria Avenue bridges in order to assure supercritical flow as designed.

ENGINEERING METHODS

Hydrologic Analyses

The watershed was modeled using the U.S. Army, Corps of Engineers HEC-1 computer program. The program version is dated August 2, 1988, as implemented by Dodson and Associates, Inc. in their 1989 version of ProHEC1. Modeling was accomplished using the SCS Unit Hydrograph, Initial and Uniform Losses, and routing, combining and diversion of sub-basin hydrographs. Derivation of input data, assumptions and procedures used in preparation of the computer model are discussed in Reference No. 28.

The total watershed area of 34.7 square miles is greater than the previous FEMA value of 30.4 square miles. This is primarily due to additional contributing area that has not been considered in previous studies. There are also other minor changes in basin delineation which are resultant from flow patterns changed by recent urbanization. A summary of discharges is presented in Table 1 on the following page. Refer to Exhibit 2 for a plot showing peak flood discharge vs. river mile for Cave Creek Wash.

Hydraulic Analyses

Standard hydraulic methods were used to determine 10-, 50-, and 100-year recurrence interval flood hazards for this study. Analyses reported herein reflect current conditions of the streams.

Cross sections for the backwater analysis are digitized from aerial mapping at 1:2400 scale (Reference 26) with a contour interval of 2 feet. 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 3).

Flood profiles are drawn showing computed water surface elevations to an accuracy of 0.5 feet for floods of 10-, 50-, and 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 as

Table 1

Summary of Discharges

Flooding Source and Location	D.A. (S.M.)	10-YR (cfs)	50-YR (cfs)	100-YR (cfs)
Cave Creek Wash				
Above the Central Arizona Project Canal	2.5	1,700	2,500	2,900
Below the Central Arizona Project Canal	4.0	2,700	4,000	4,600
Below Deer Valley Drive	5.0	3,000	4,500	5,200
Above the East Fork Cave Creek	8.6	3,300	4,900	5,700
East Fork of Cave Creek				
Near Paradise Lane & Central Avenue	13.4	5,300	7,900	9,100
Near Coral Gables & 7th Avenue	14.1	5,500	8,200	9,400
Mouth (Confluence with Cave Creek)	14.6	5,500	8,300	9,500
Cave Creek Wash				
Below the East Fork Cave Creek	23.5	8,400	12,700	14,600
Below 19th Avenue	25.5	8,900	13,400	15,400
Above Moon Valley Wash	26.5	8,900	13,400	15,400
Below Moon Valley Wash	33.1	10,100	15,300	17,500
At the Confluence with the Arizona Canal Diversion Channel	34.7	10,300	16,100	18,500

implemented by Dodson and Associates, Inc. in their 1989 version of ProHEC2. The starting elevation in the ACDC was obtained using normal depth. 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 3) and are described in the Elevation Reference Marks Table in Appendix A.

Hydraulic analyses are based upon unobstructed flow conditions. Flood elevations presented herein are considered valid only if the bridges and culverts 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 22.

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 flood elevations determined at each cross section; between cross sections, the boundaries were interpolated using topographic maps at a scale of 1:2400 with a contour interval of 2 feet (Reference 26.)

The boundary of the 100-year flood is shown on the Flood Boundary and Floodway Map (Exhibit 3). 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 floodplain development 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 increase in flood heights. Minimum federal standards limit such increases in flood heights to 1.0 foot, provided that hazardous velocities are not produced. Typical relationships between the floodway and the floodway fringe and their significance to flood plain development are shown in Figure 2.

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).

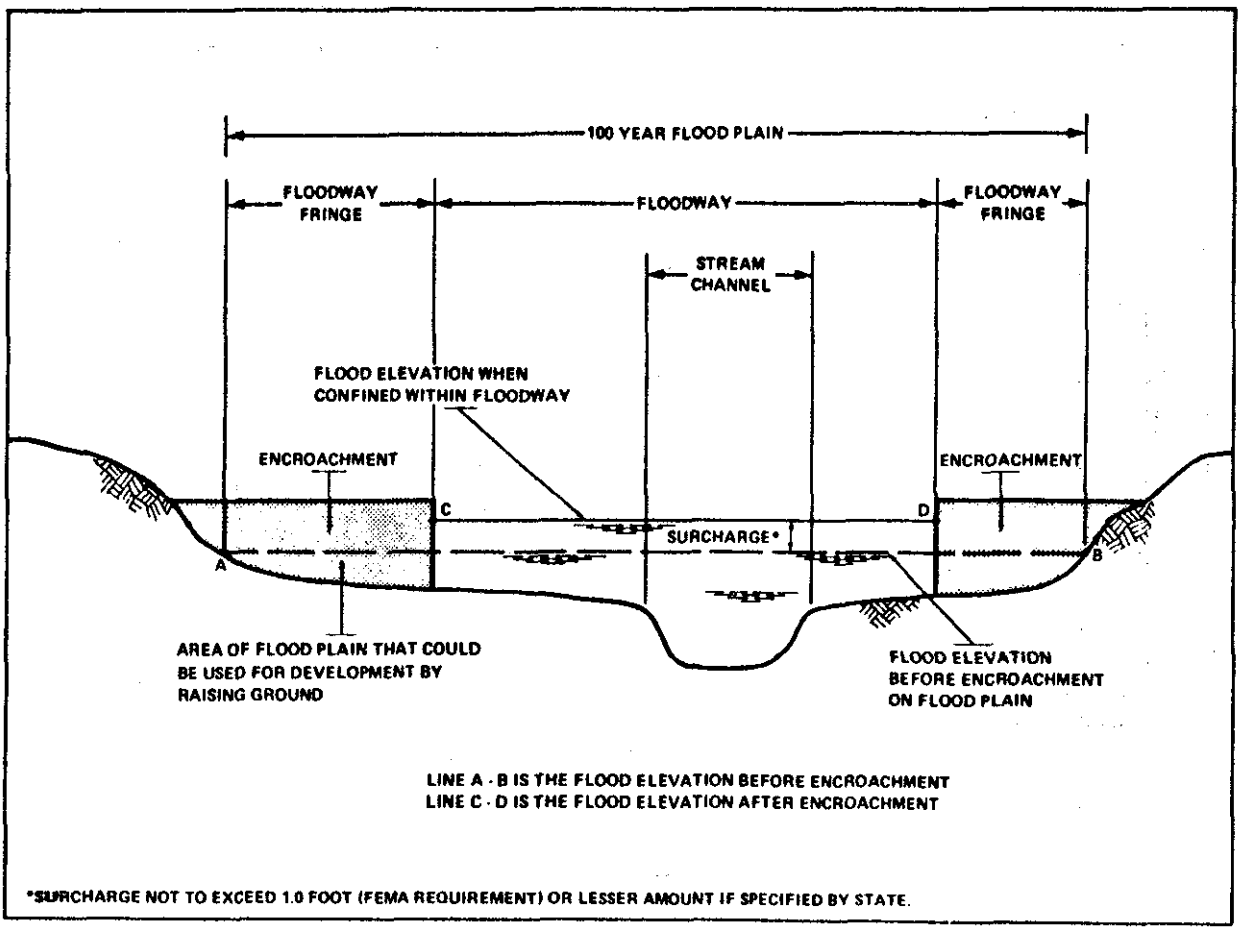


FIGURE 2

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
AT	17.588	338.	3195.	4.8	1284.7	1283.7	1.0
AU	17.662	250.	1988.	7.7	1284.8	1283.8	1.0
AV	17.783	143.	1271.	12.1	1286.4	1285.6	.8
AW	17.932	110.	1047.	14.7	1291.4	1291.0	.4
AX	18.081	185.	2411.	6.4	1299.6	1299.5	.1
AY	18.174	268.	3010.	5.1	1300.2	1300.2	.0
AZ	18.269	228.	2349.	6.6	1300.3	1300.2	.1
BA	18.362	212.	2086.	7.4	1300.6	1300.5	.1
BB	18.456	223.	1315.	11.7	1307.3	1307.3	.0
BC	18.545	288.	3071.	5.0	1308.4	1308.3	.1
BD	18.640	255.	2581.	6.0	1309.5	1309.4	.1
BE	18.734	228.	2232.	6.9	1309.7	1309.7	.0
BF	18.832	215.	2198.	7.0	1310.2	1310.2	.0
BG	18.925	200.	2086.	7.4	1310.7	1310.6	.1
BH	19.018	172.	1483.	10.4	1310.9	1310.9	.0
BI	19.117	120.	1023.	15.1	1312.7	1312.5	.2
BJ	19.210	157.	1462.	10.5	1317.2	1317.2	.0
BK	19.313	160.	1330.	11.0	1323.3	1323.3	.0
BL	19.418	163.	1343.	10.9	1325.6	1325.6	.0
BM	19.560	130.	1308.	11.2	1328.2	1328.2	.0
BN	19.742	85.	969.	5.9	1332.0	1332.0	.0
BO	19.847	86.	868.	6.6	1332.1	1332.1	.0
BP	19.960	73.	441.	12.9	1332.4	1332.4	.0
BQ	20.049	50.	366.	15.6	1338.4	1338.4	.0

[1] Miles above mouth
[2] Feet, NGVD 1929

TABLE 2

FLOOD CONTROL DISTRICT OF MARICOPA COUNTY
Burgess & Niple, Inc.
Engineers and Architects

FLOODWAY DATA

CAVE CREEK WASH

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
BR	20.144	57.	536.	10.6	1343.5	1343.5	.0
BS	20.242	71.	561.	10.2	1345.5	1345.5	.0
BT	20.335	73.	640.	8.9	1347.5	1347.4	.1
BU	20.423	114.	796.	7.2	1349.7	1349.6	.1
BV	20.529	139.	841.	6.8	1352.3	1352.3	.0
BW	20.628	130.	1059.	5.4	1353.3	1353.3	.0
BX	20.725	64.	398.	14.3	1356.0	1356.0	.0
BY	20.860	156.	852.	6.7	1366.0	1366.0	.0
BZ	20.942	250.	850.	6.7	1367.3	1367.3	.0
CA	21.127	160.	554.	10.3	1374.7	1374.7	.0
CB	21.230	225.	654.	8.7	1380.4	1380.4	.0
CC	21.363	166.	986.	5.8	1383.6	1383.4	.2
CD	21.484	225.	647.	8.8	1387.1	1386.5	.6
CE	21.576	225.	814.	7.0	1390.2	1389.2	1.0
CF	21.669	225.	686.	8.0	1393.9	1393.4	.5
CG	21.742	200.	832.	6.6	1396.2	1395.2	1.0
CH	21.840	200.	686.	8.0	1398.0	1398.0	.0
CI	21.895	245.	702.	7.8	1399.7	1399.7	.0
CJ	21.953	421.	812.	6.8	1401.2	1401.1	.1
CK	22.065	410.	1165.	4.7	1404.5	1404.1	.4
CL	22.165	400.	1253.	4.4	1406.1	1405.2	.9
CM	22.273	377.	879.	6.3	1407.6	1406.7	.9
CN	22.410	180.	560.	9.8	1414.2	1414.2	.0
CO	22.483	160.	1293.	4.3	1416.7	1416.5	.2

[1] Miles above mouth
[2] Feet, NGVD 1929

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FLOODWAY DATA

CAVE CREEK WASH

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
CP	22.578	96.	772.	7.1	1417.2	1416.5	.7
CQ	22.675	198.	1406.	3.9	1418.7	1418.0	.7
CR	22.794	183.	1174.	4.7	1419.5	1418.6	.9
CS	22.880	169.	775.	7.1	1420.5	1420.0	.5
CT	22.990	136.	643.	8.6	1424.6	1423.6	1.0
CU	23.097	132.	561.	9.8	1430.6	1429.9	.7
CV	23.168					1433.1	
CW	23.253		A FLOODWAY IS NOT DELINEATED			1434.5	
CX	23.334					1440.4	
CY	23.416		IN THIS REACH			1443.8	
CZ	23.514					1448.1	
DA	23.591					1453.1	
DB	23.691					1455.2	
DC	23.815					1459.0	
DD	23.912					1461.0	
DE	23.989	99.	835.	6.3	1462.6	1462.6	.0
DF	24.106	100.	922.	5.7	1465.2	1465.2	.0
DG	24.195	100.	1135.	4.7	1465.7	1465.7	.0
DH	24.322	140.	1776.	3.0	1466.2	1465.9	.3
DI	24.444	153.	1144.	4.6	1466.4	1466.0	.4
DJ	24.542	210.	647.	8.2	1467.3	1466.3	1.0
DK	24.635	120.	494.	10.7	1472.1	1472.0	.1
DL	24.738	264.	935.	5.6	1477.8	1476.9	.9
DM	24.838	382.	787.	6.6	1481.0	1480.3	.7

[1] Miles above mouth
[2] Feet, NGVD 1929

TABLE 2

FLOOD CONTROL DISTRICT OF MARICOPA COUNTY
Burgess & Niple, Inc.
Engineers and Architects

FLOODWAY DATA

CAVE CREEK WASH

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
DN	24.943	440.	1411.	3.7	1484.4	1483.4	1.0
DO	25.048	400.	676.	7.7	1487.6	1487.3	.3
DP	25.163	235.	927.	5.3	1493.1	1492.2	.9
DQ	25.262	273.	1082.	4.5	1495.0	1494.0	1.0
DR	25.374	98.	432.	11.3	1500.2	1499.4	.8
DS	25.434	66.	368.	13.3	1504.2	1504.0	.2
DT	25.500	80.	705.	6.9	1507.7	1507.7	.0
DU	25.561	101.	759.	3.8	1514.4	1514.4	.0
DV	25.680	100.	497.	5.4	1514.8	1514.7	.1
DW	25.786	100.	276.	9.1	1516.4	1516.3	.1
DX	25.947	100.	388.	5.9	1521.9	1521.1	.8
DY	26.058	73.	307.	7.2	1523.8	1523.5	.3
DZ	26.152	70.	353.	5.7	1525.7	1525.0	.7
EA	26.265	87.	220.	8.7	1528.1	1528.1	.0
EB	26.372	97.	372.	4.6	1531.4	1531.3	.1
EC	26.492	90.	511.	3.1	1532.2	1532.1	.1
ED	26.582	80.	544.	2.4	1532.4	1532.2	.2
EE	26.673	60.	146.	8.9	1534.9	1534.0	.9
EF	26.784	50.	123.	8.9	1546.3	1546.2	.1
EG	26.883	50.	391.	2.6	1547.9	1547.3	.6
EH	26.984	50.	273.	3.3	1548.1	1547.3	.8
EI	27.060	29.	90.	10.0	1559.5	1559.5	.0
EJ	27.166	39.	182.	3.3	1562.2	1562.2	.0
EK	27.294	50.	233.	1.7	1562.5	1562.5	.0

[1] Miles above mouth
[2] Feet, NGVD 1929

TABLE 2

FLOOD CONTROL DISTRICT OF MARICOPA COUNTY
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FLOODWAY DATA

CAVE CREEK WASH

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
BM	-19.560	130.	1308.	11.2	1328.2	1328.2	.0
A	.029	131.	683.	13.9	1329.4	1329.4	.0
B	.112	187.	1603.	5.9	1332.9	1332.9	.0
C	.198	200.	1459.	6.5	1333.3	1333.3	.0
D	.288	151.	745.	12.8	1333.3	1333.3	.0
E	.398	182.	1139.	8.3	1337.3	1337.3	.0
F	.482	191.	829.	11.5	1342.4	1342.4	.0
G	.575	210.	1294.	7.3	1344.8	1343.8	1.0
H	.697	160.	1221.	7.7	1346.0	1345.1	.9
I	.826	160.	776.	12.1	1348.3	1348.3	.0
J	.945	160.	1224.	7.7	1352.5	1352.1	.4
K	1.035	160.	1119.	8.4	1353.6	1352.9	.7
L	1.121	160.	1387.	6.8	1355.2	1354.2	1.0
M	1.204	160.	867.	10.8	1355.7	1355.4	.3
N	1.315	155.	1341.	6.8	1359.8	1359.3	.5
O	1.420	400.	1102.	7.6	1361.6	1361.0	.6

NOTE: CROSS SECTION "O" FOR THIS STUDY CORRESPONDS TO CROSS SECTION "M" IN THE PREVIOUS FLOOD INSURANCE STUDY DATED SEPTEMBER 29, 1989. RIVER MILE 1.420 FOR THIS STUDY IS EQUIVALENT TO RIVER MILE 1.445 FOR THE PREVIOUS STUDY.

[1] Miles above mouth
[2] Feet, NGVD 1929

TABLE 2

FLOOD CONTROL DISTRICT OF MARICOPA COUNTY
Burgess & Niple, Inc.
Engineers and Architects

FLOODWAY DATA

EAST FORK OF CAVE CREEK WASH

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.

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 100-year floodplains that are determined in the Flood Insurance Study by detailed methods. In most instances, whole-foot based flood elevations derived from detailed hydraulic analyses are shown at selected intervals within this zone.

Zone AO: Zone AO is the flood insurance rate zone that corresponds to areas of 100-year shallow flooding (usually sheet flow on sloping terrain) where average depths are between 1 and 3 feet. Average whole-foot depths derived from the detailed hydraulic analyses are shown within this zone.

Zone E: Zone E is the flood insurance rate zone that corresponds to erodable areas within the 100-year flood plain which are above the 100-year flood elevations. If eroded, these areas may be below the 100-year flood elevation.

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

Cave Creek was previously studied by the Federal Emergency Management Agency using detailed methodology in 1980. The most recent map revision dated September 29, 1989 is based upon the 1980 study. Numerous changes have occurred along Cave Creek Wash during the past 10 years, including:

* Construction of the ACDC
* Concrete lined channelization, ACDC to Sweetwater Road
* Sediment basin at Sweetwater Road
* Construction of the Greenway Road bridge and channelization
* Construction of channelization from Tierra Buena Lane to Bell Road, including bridges at Tierra Buena Lane, 11th Avenue, 10th Avenue, and Phelps Road
* Partial construction of channelization from Bell Road to Union Hills Drive
* Continued gravel mining and landfill operations between Beardsley Road and 7th Street
* Channelization and relocation of Cave Creek Wash midway between the CAP Canal and Cave Butte Dam

* Increased urbanization of the watershed and additional tributary area not previously considered

Due to changes in the stream and watershed as noted above, this study is not in agreement with the current Flood Insurance Study for Maricopa County, Arizona. This study reflects the most current and best data available, and should supercede the previous study.

LOCATION OF DATA

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

BIBLIOGRAPHY AND REFERENCES

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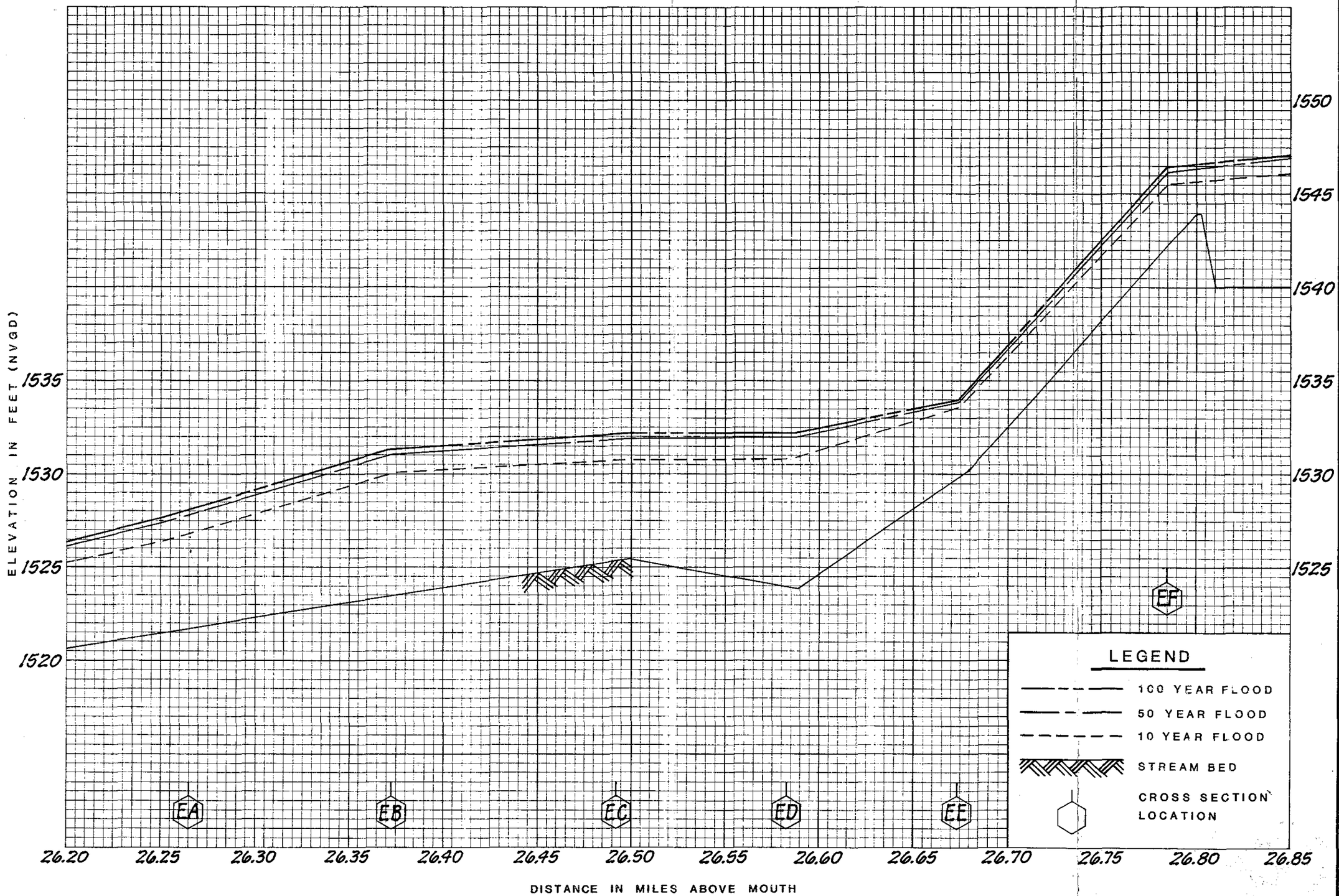


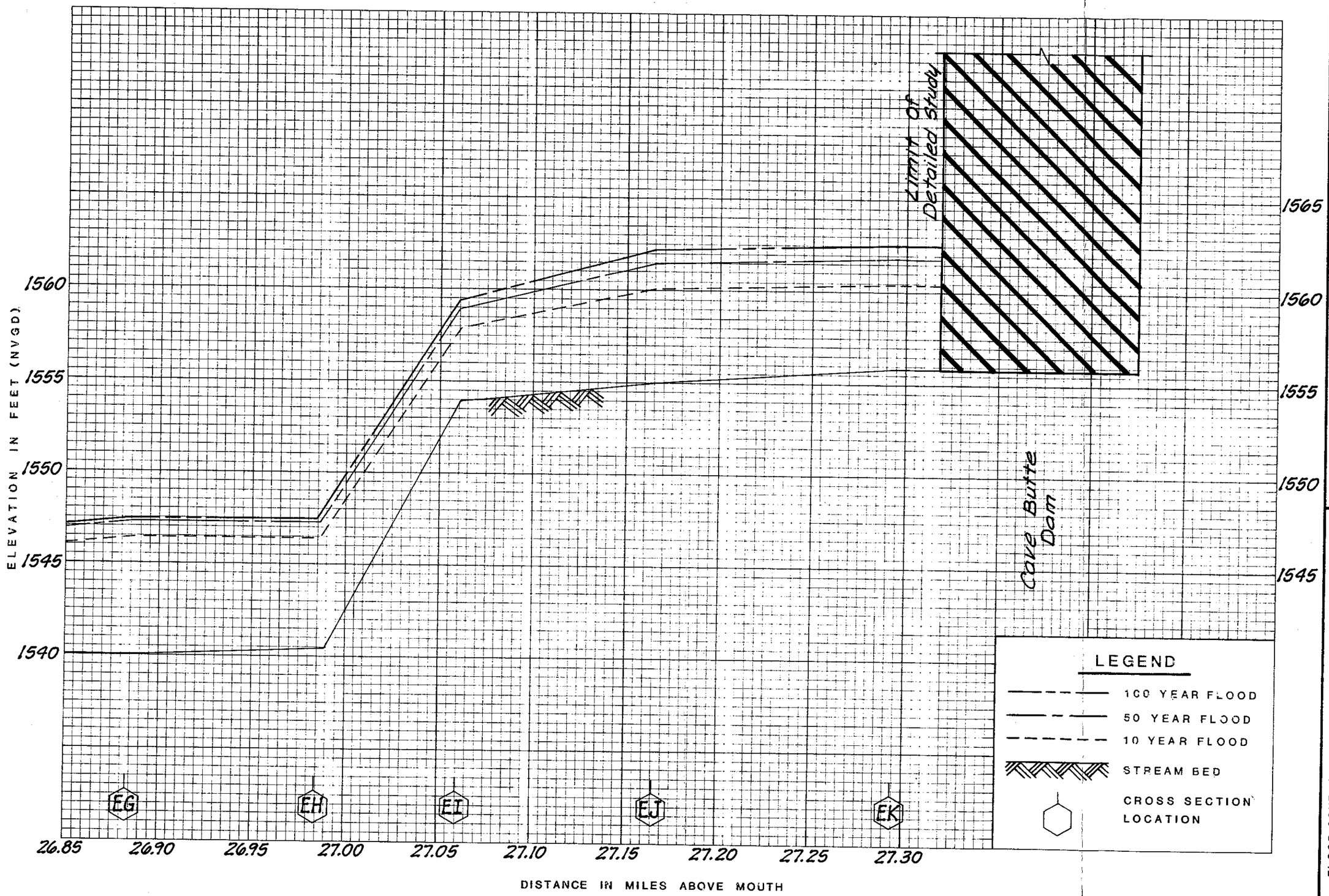
FLOOD PROFILES

CAVE CREEK

FLOOD CONTROL DISTRICT OF MARICOPA COUNTY

Burgess & Niple, Inc.

Engineers and Architects



FLOOD PROFILES

CAVE CREEK

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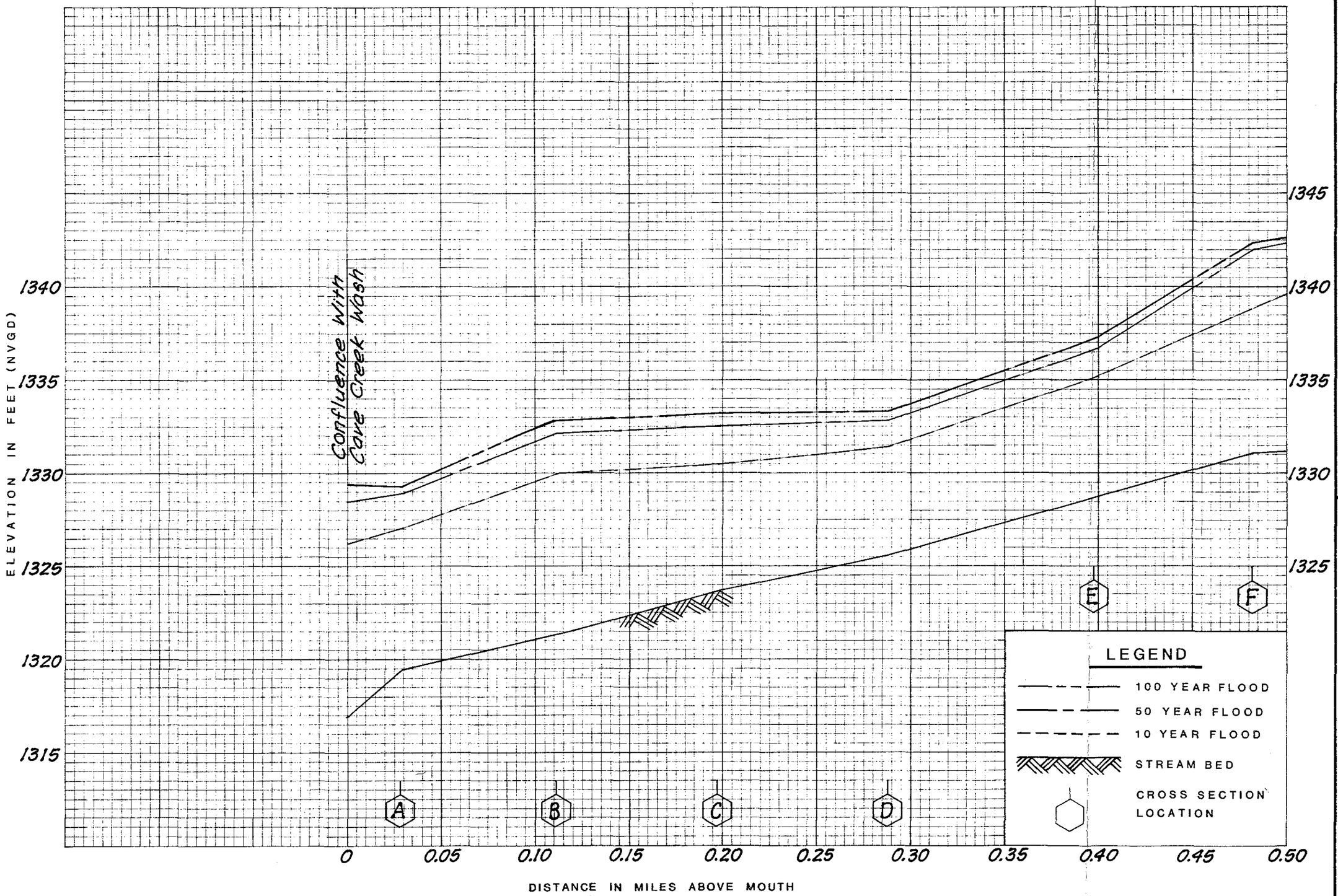

FLOOD PROFILES

EAST FORK, CAVE CREEK

FLOOD CONTROL DISTRICT OF MARICOPA COUNTY

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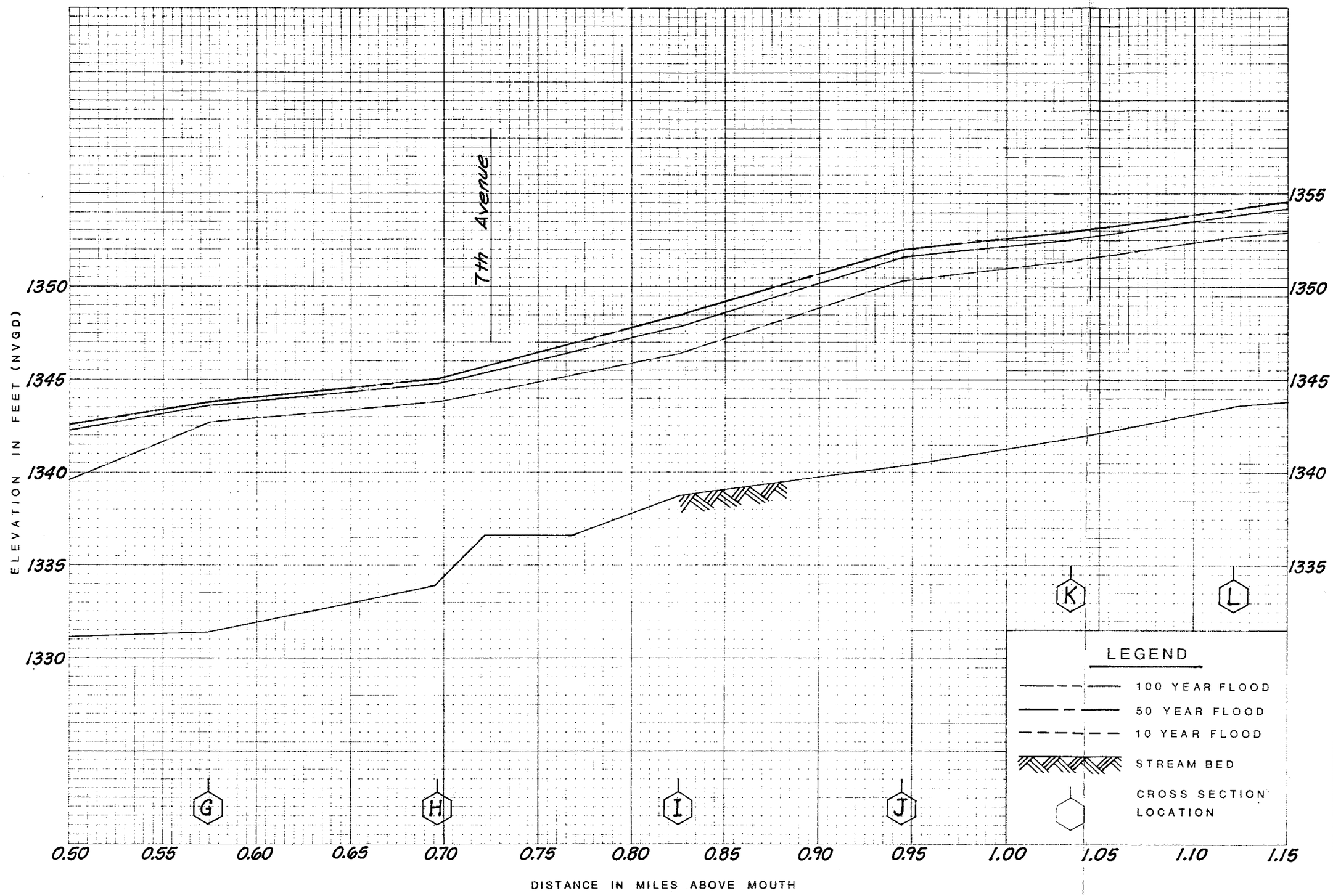

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EAST FORK, CAVE CREEK

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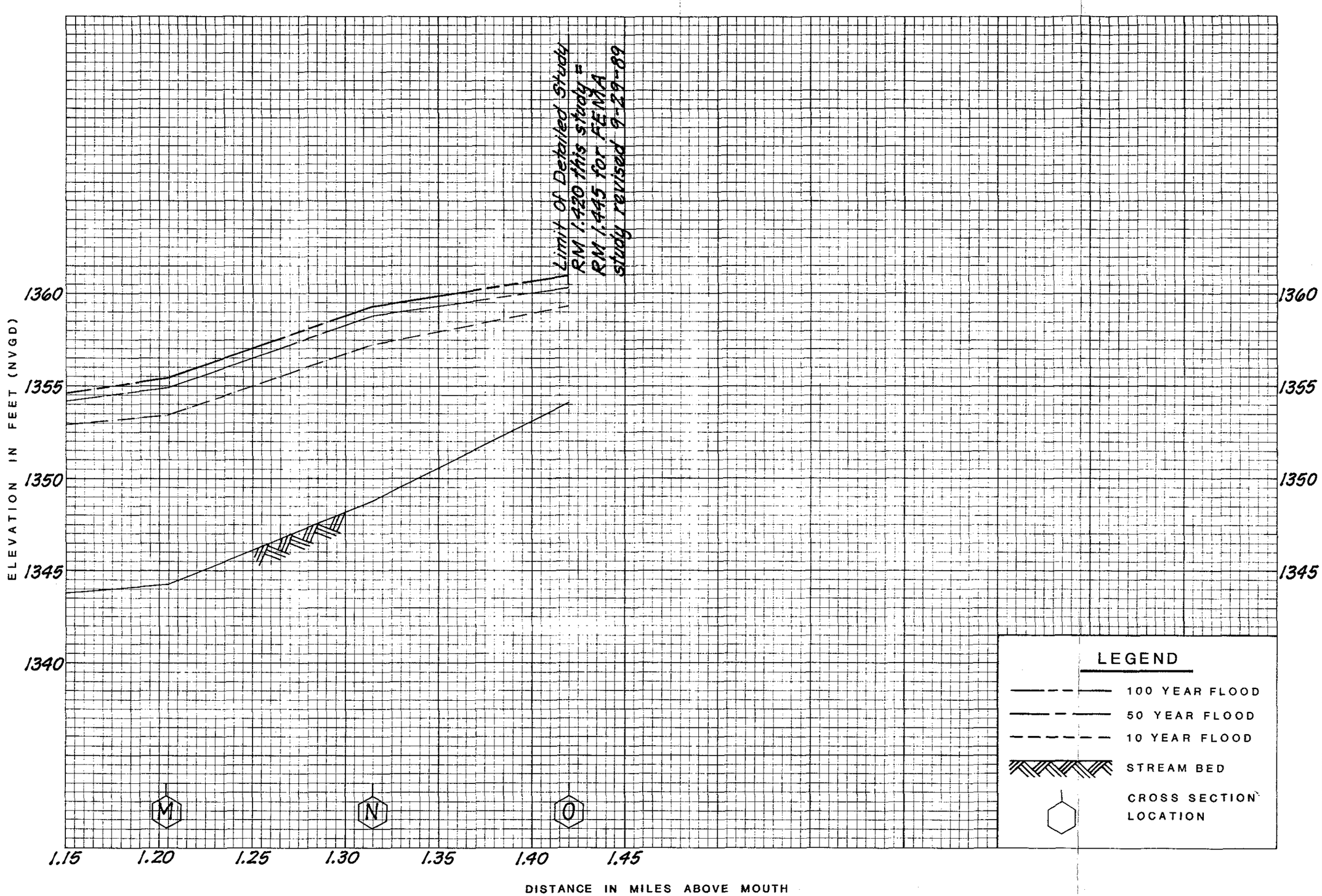

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EAST FORK, CAVE CREEK

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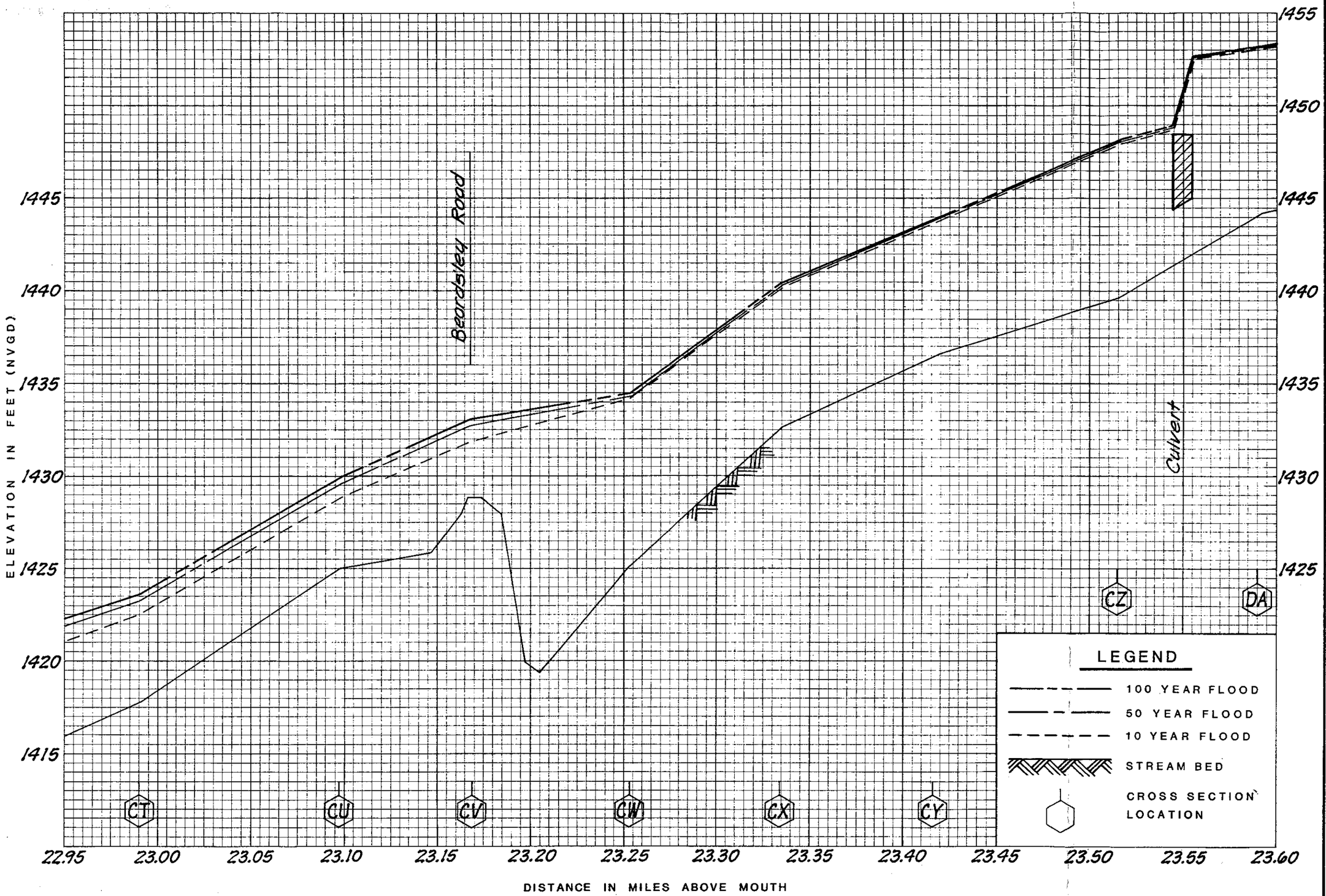

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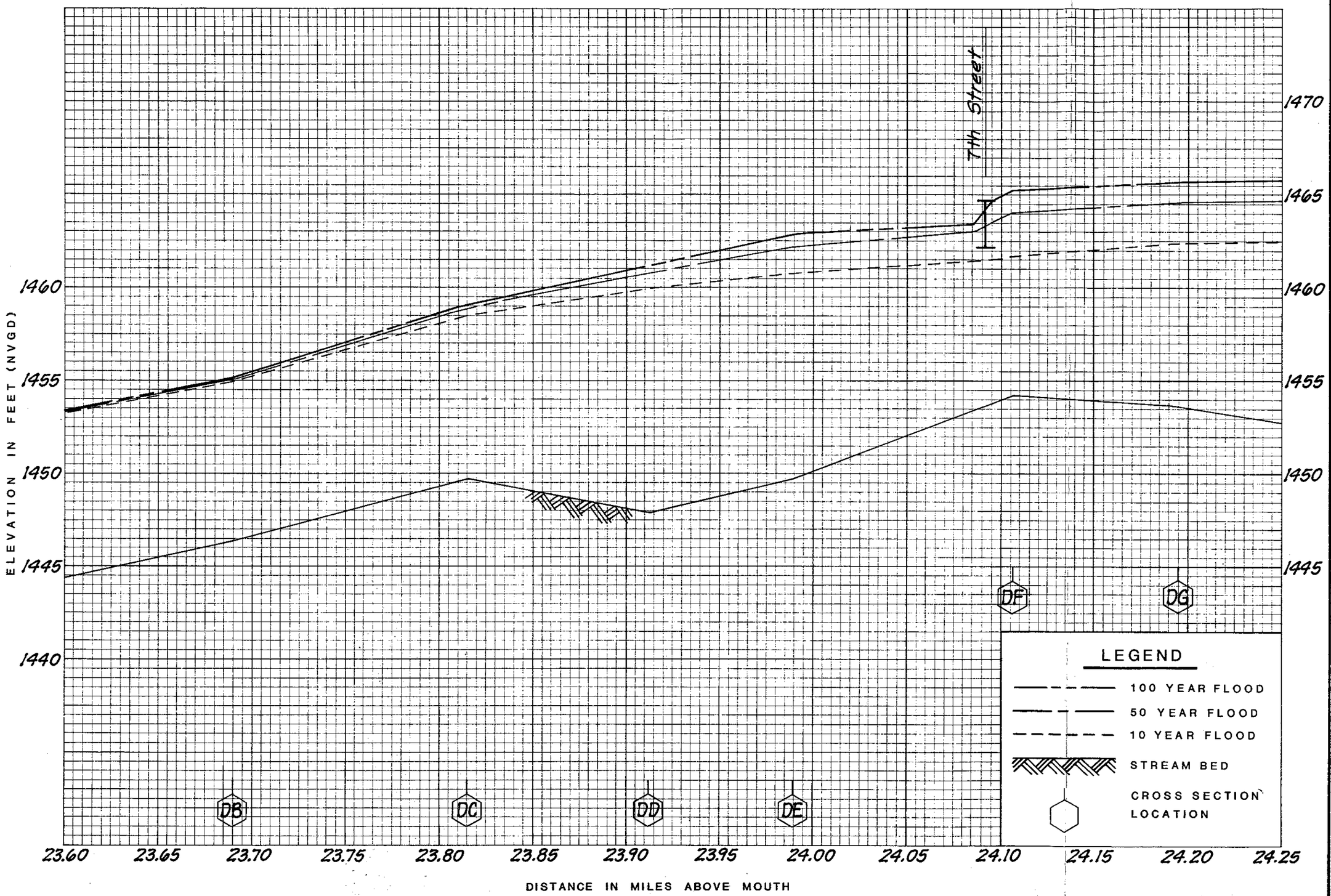

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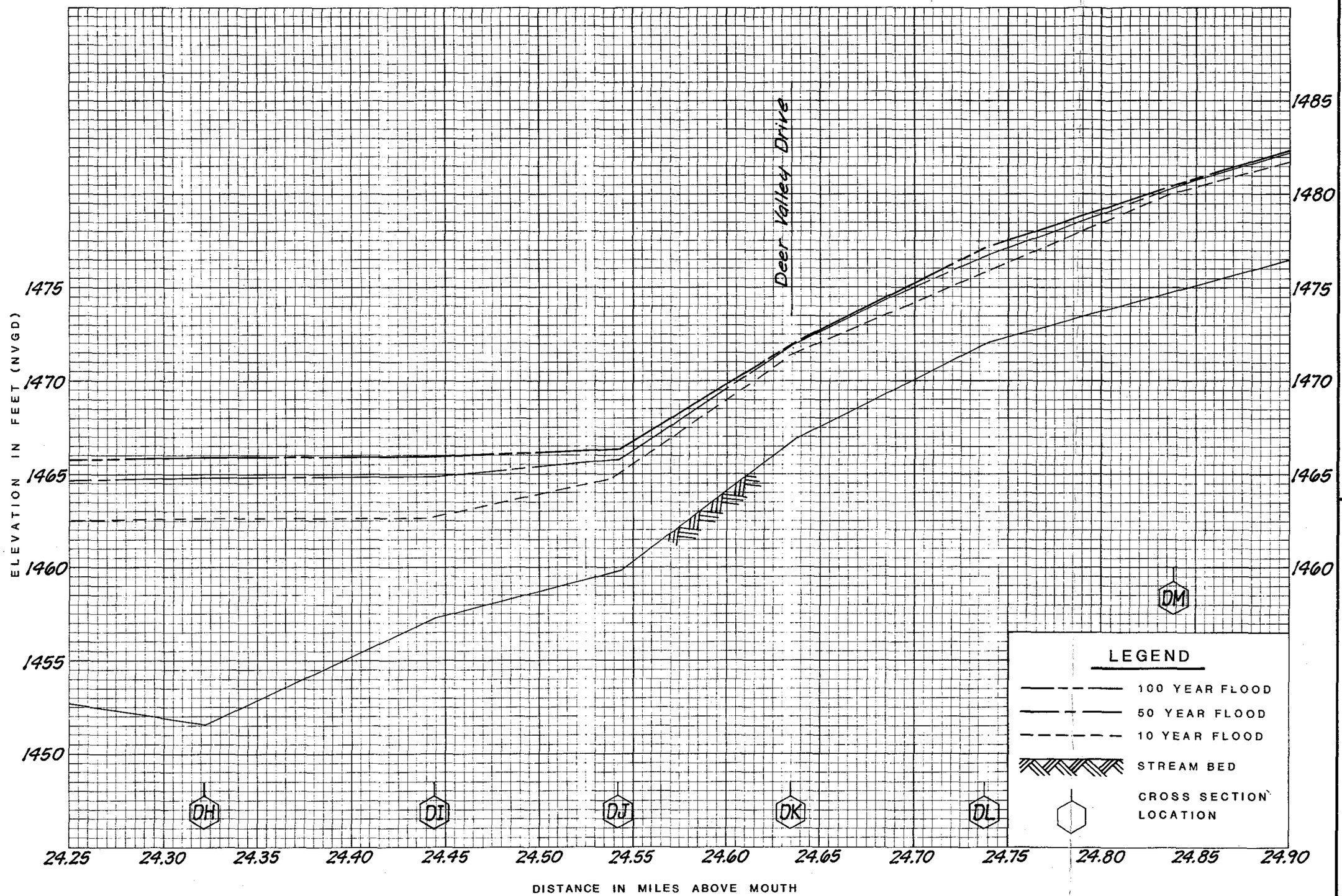

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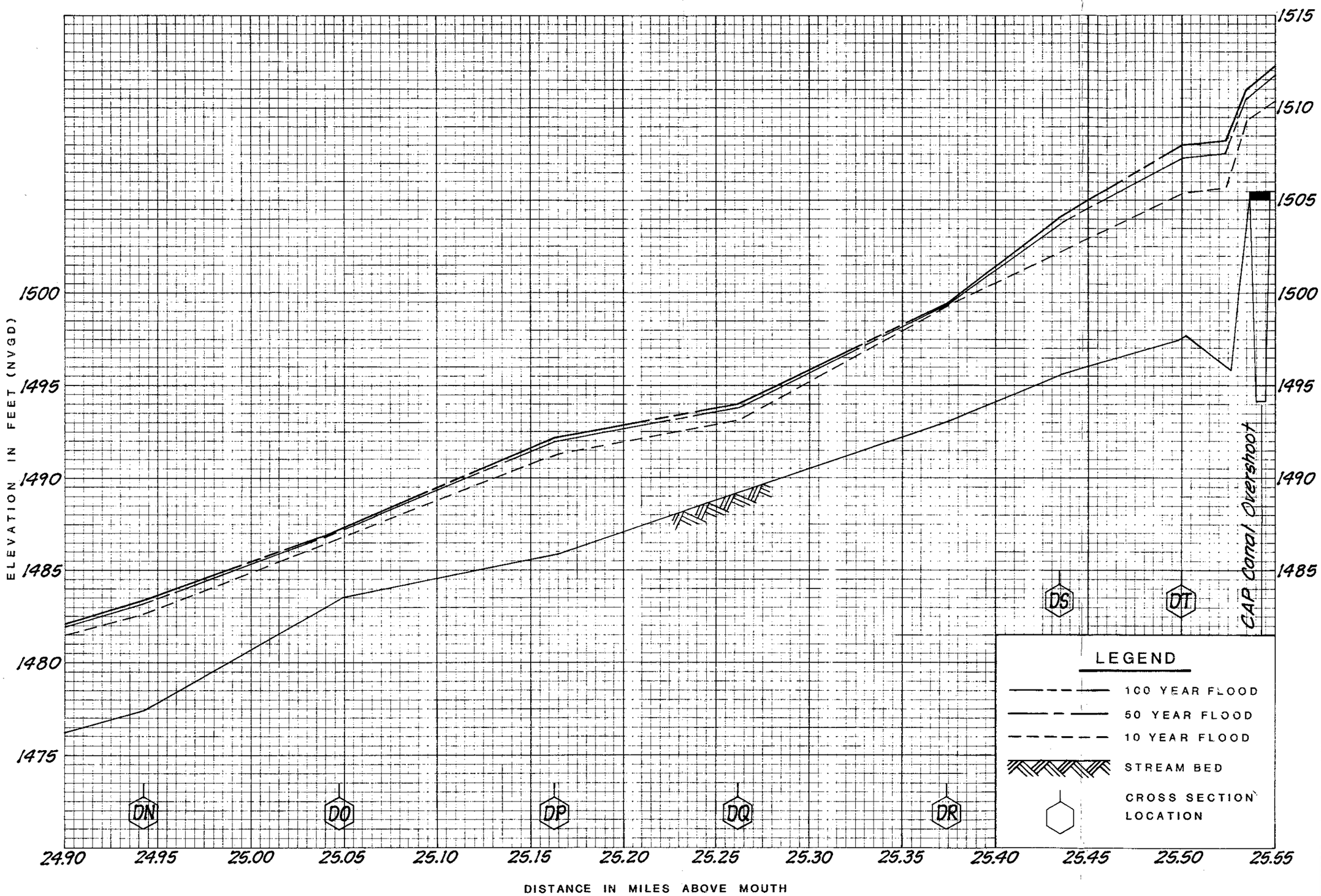

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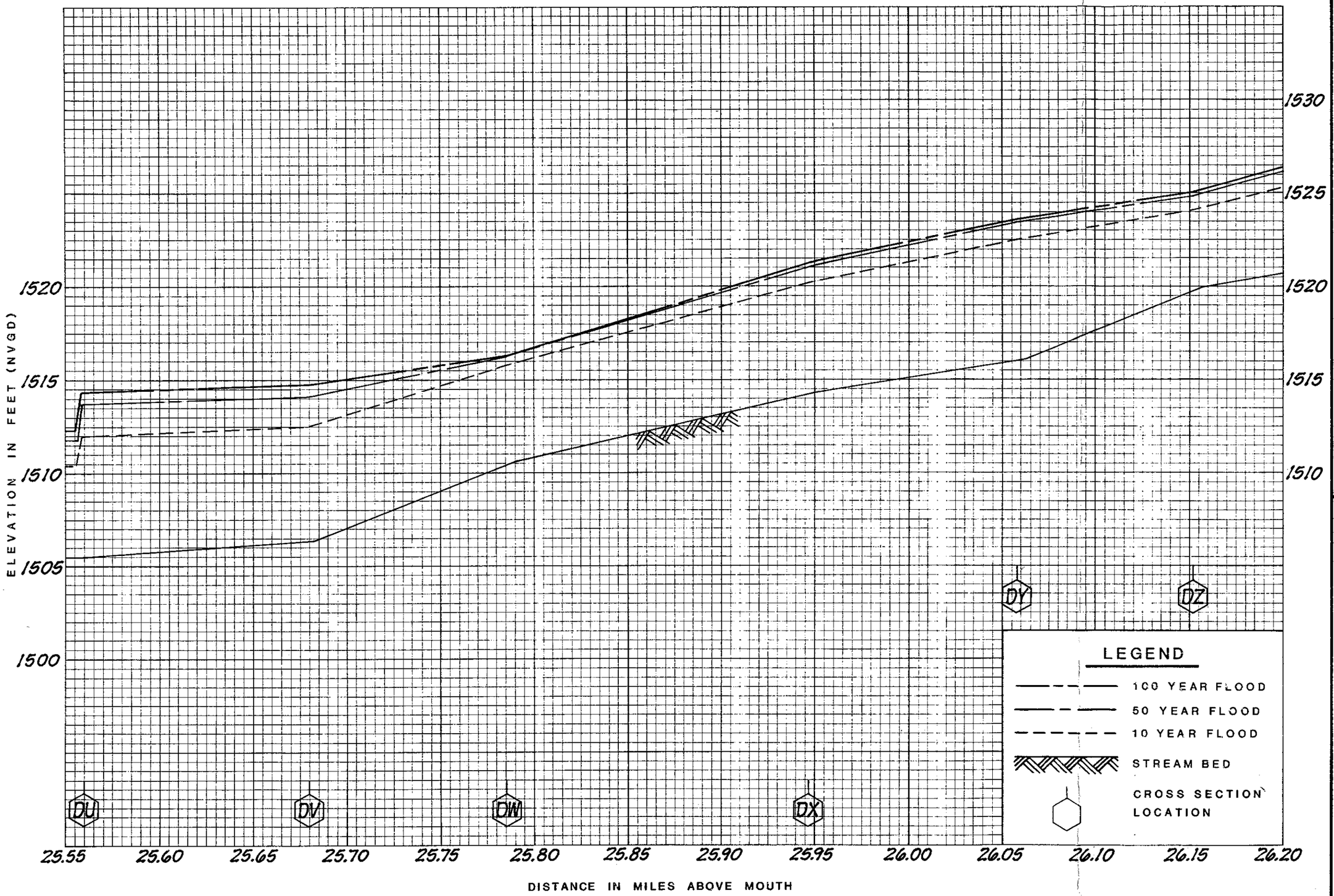

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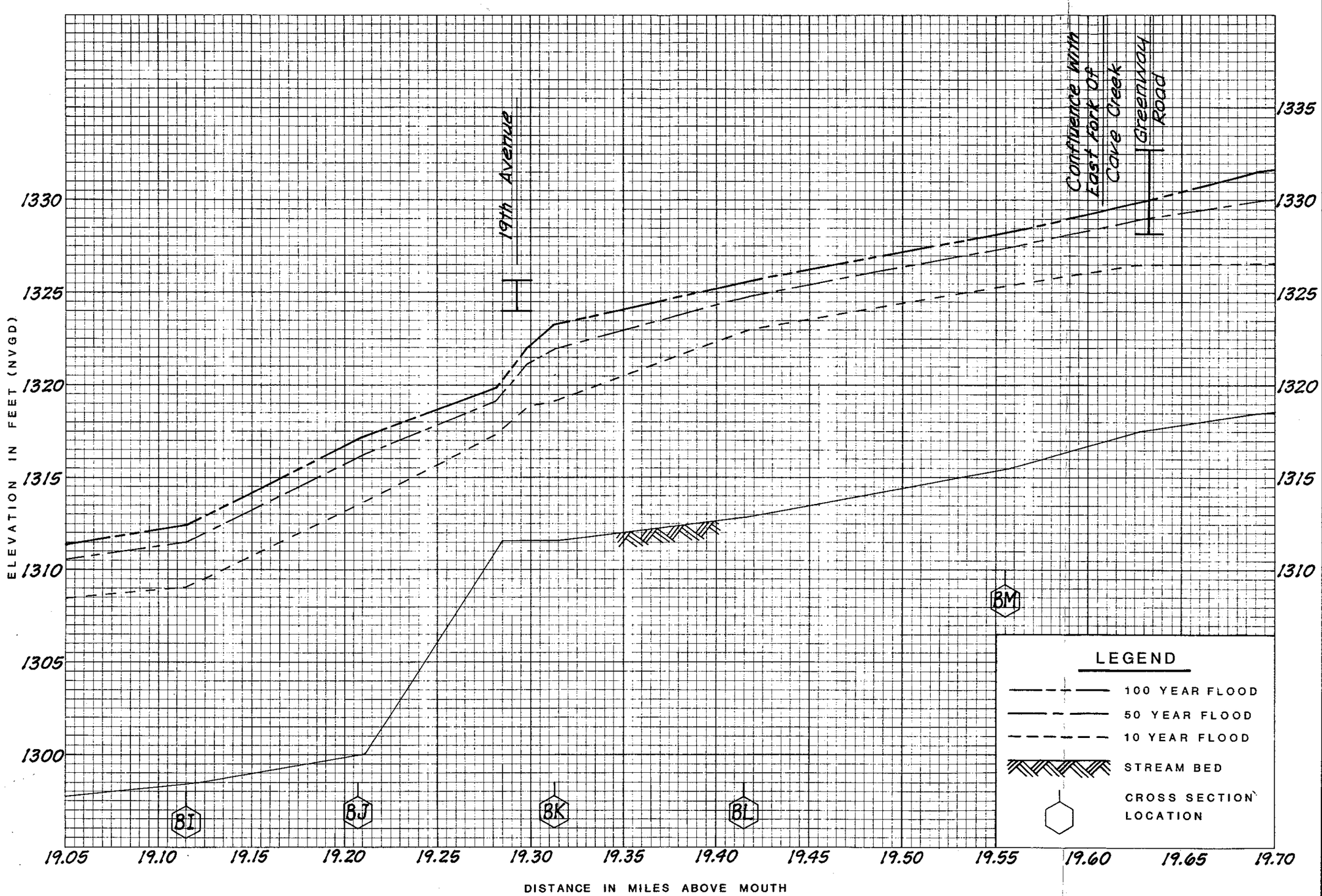

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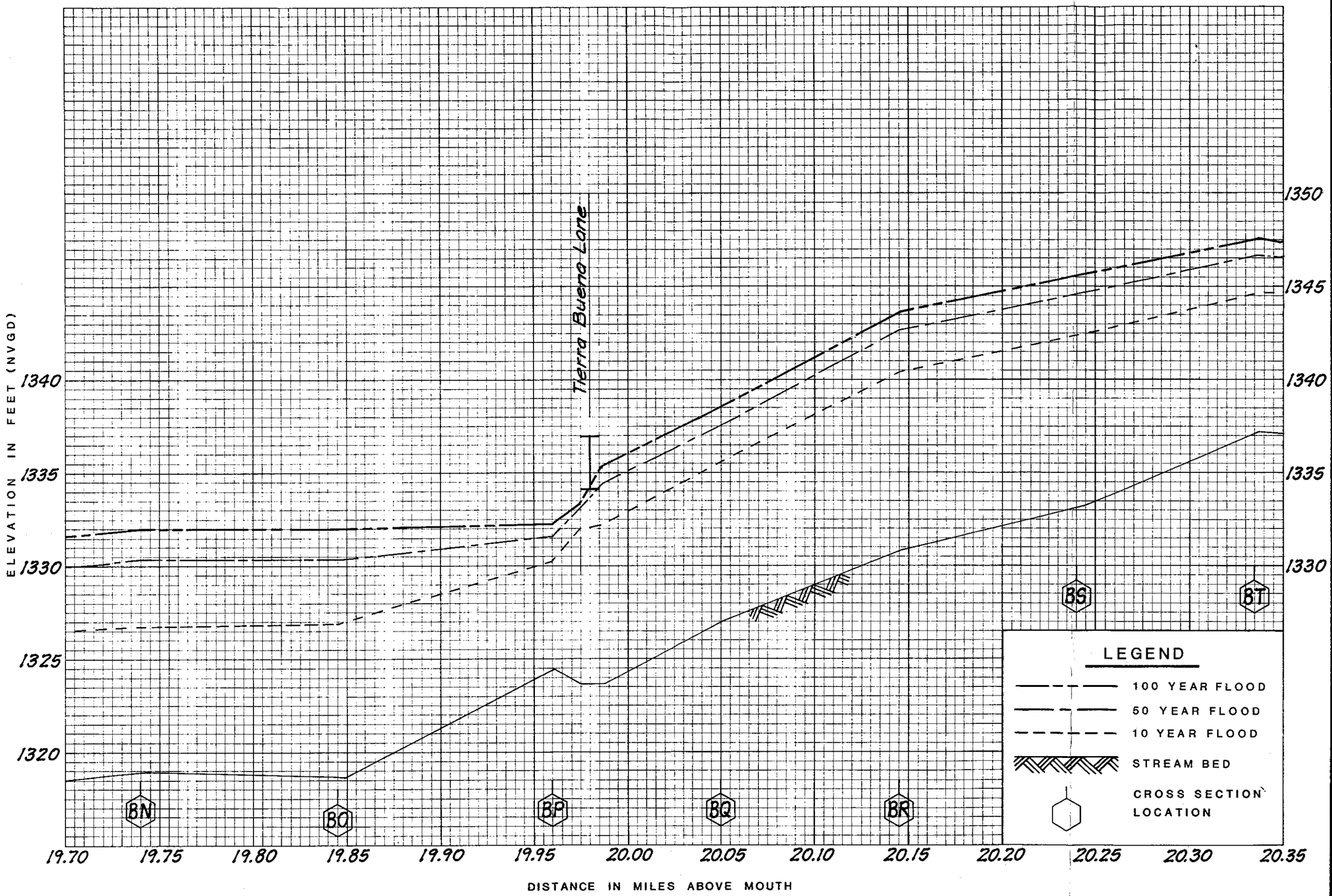

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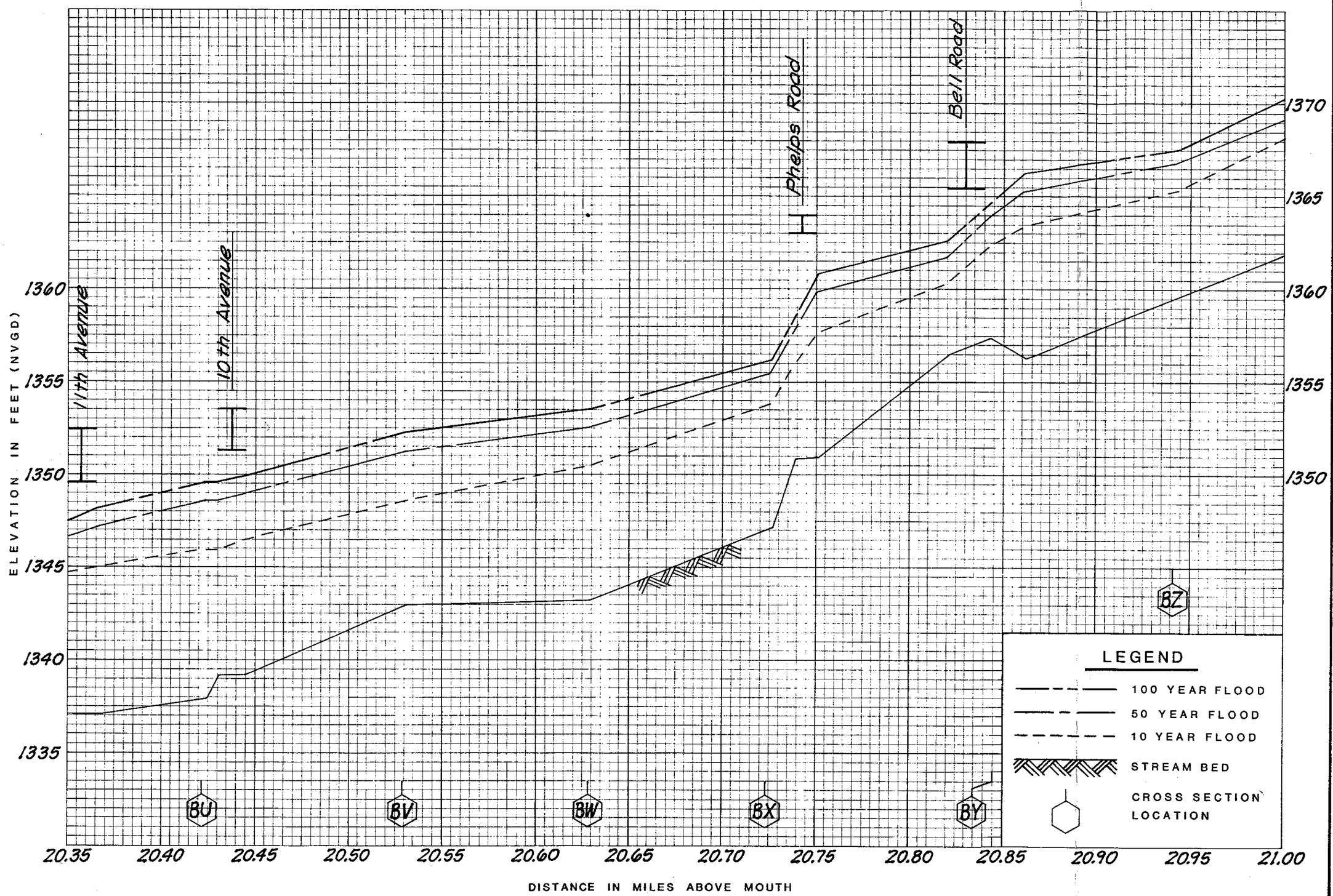

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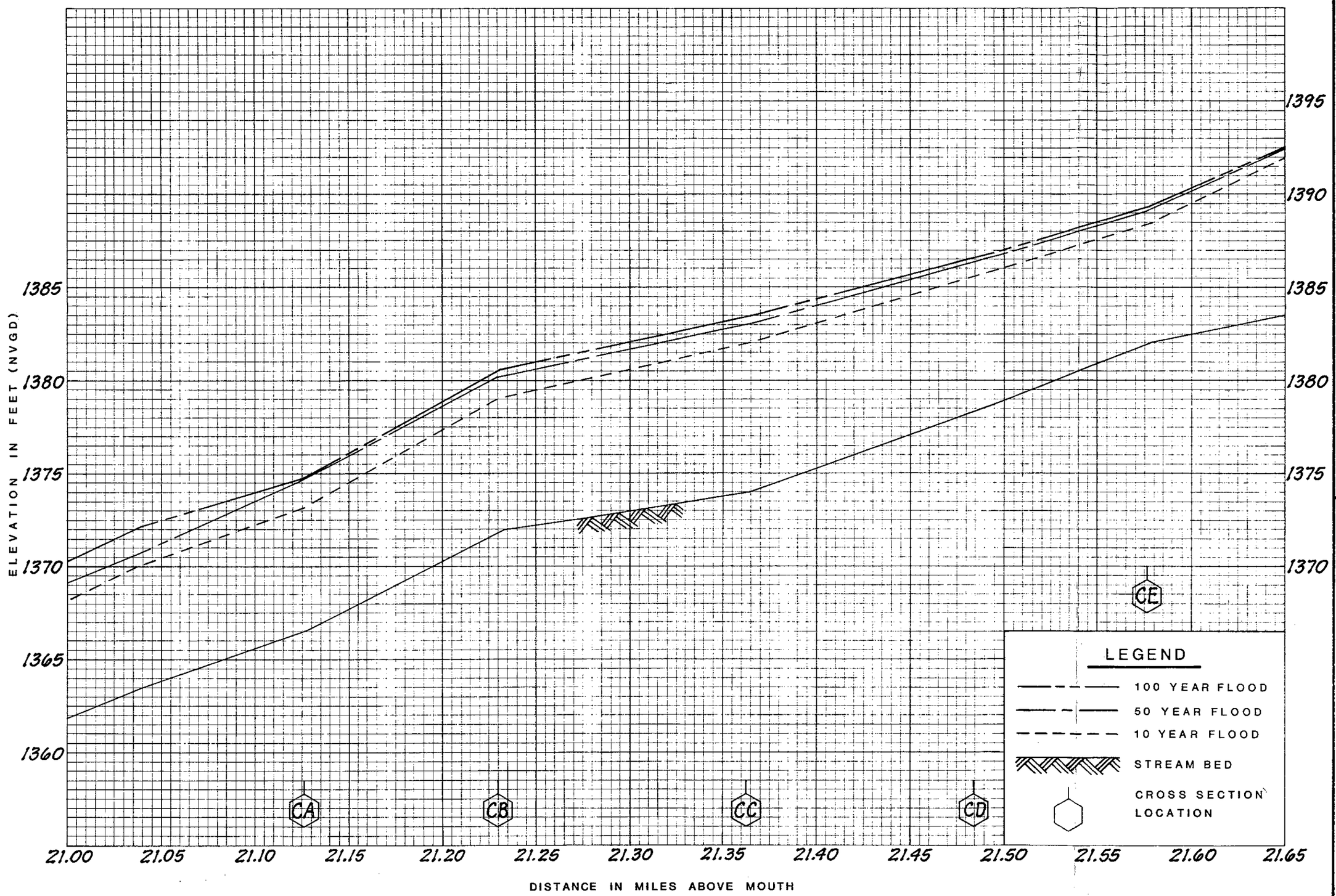

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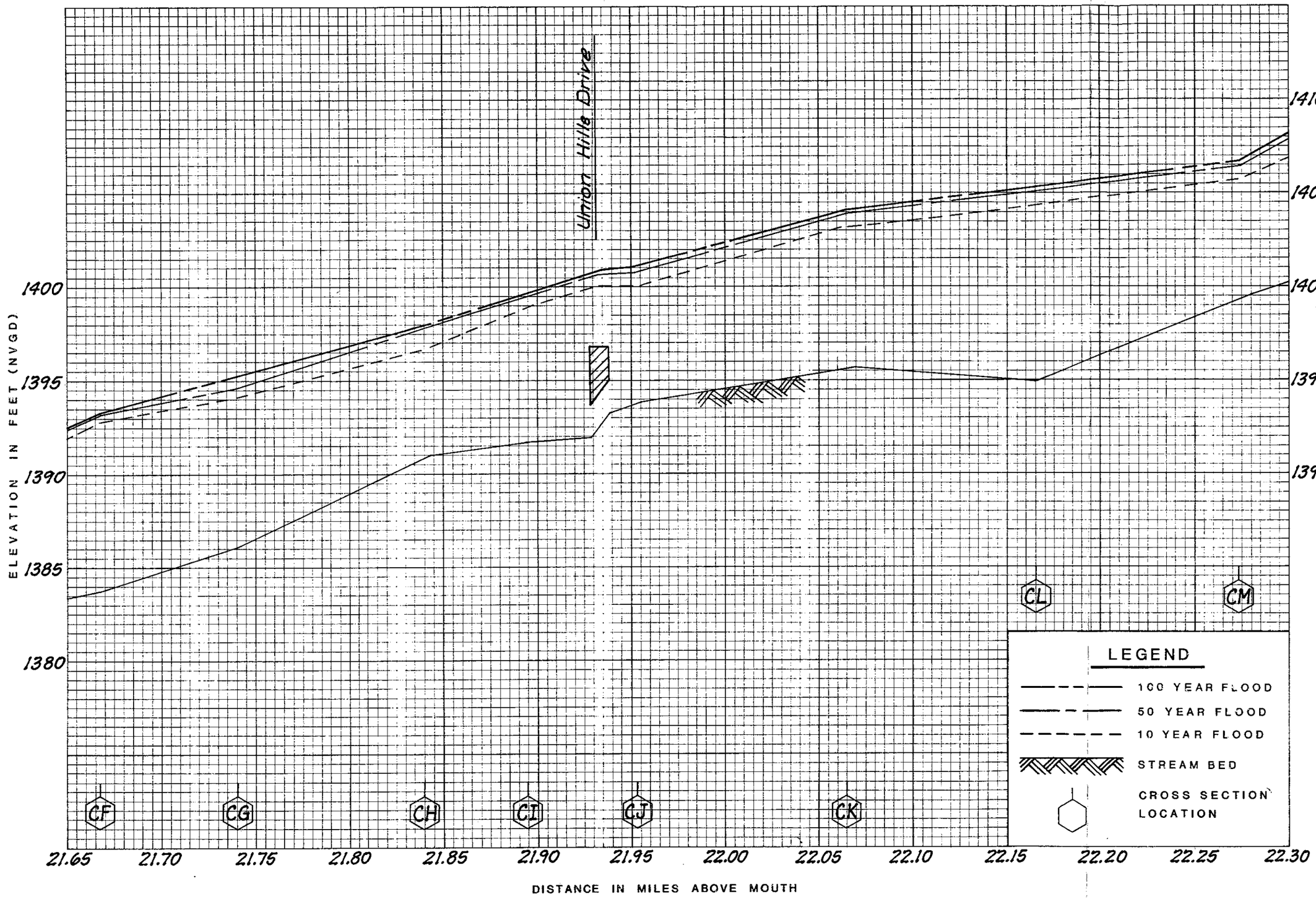

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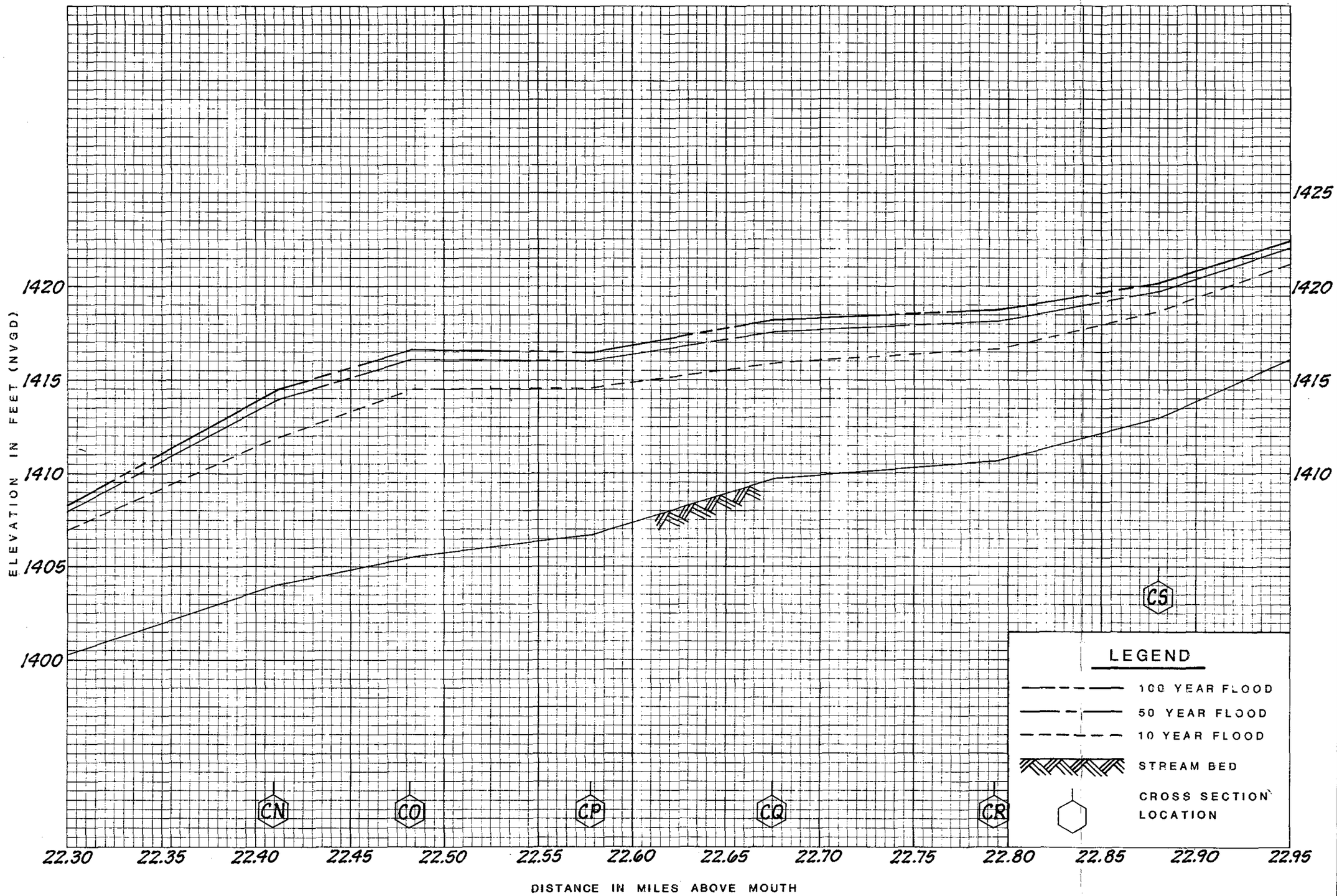

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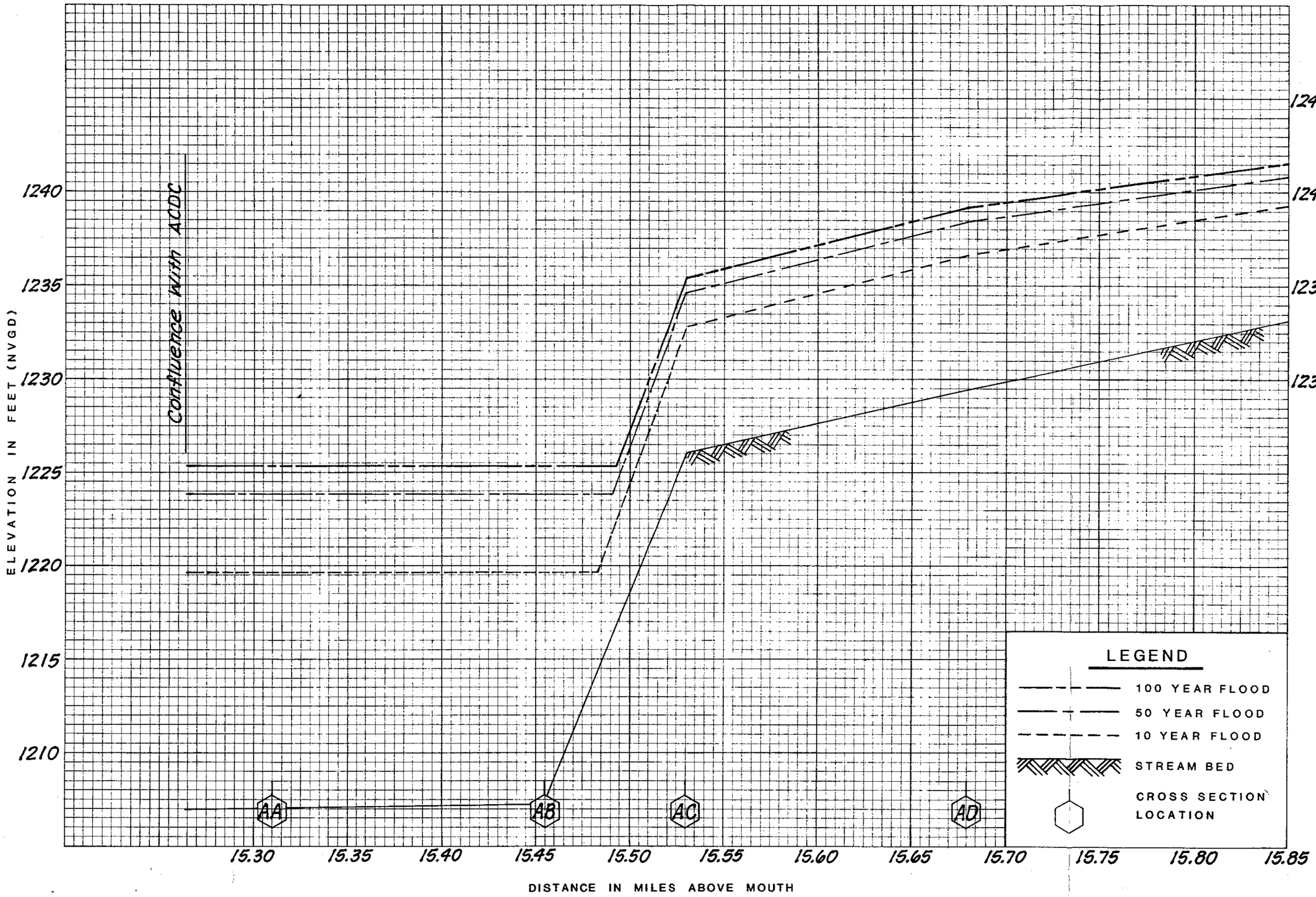

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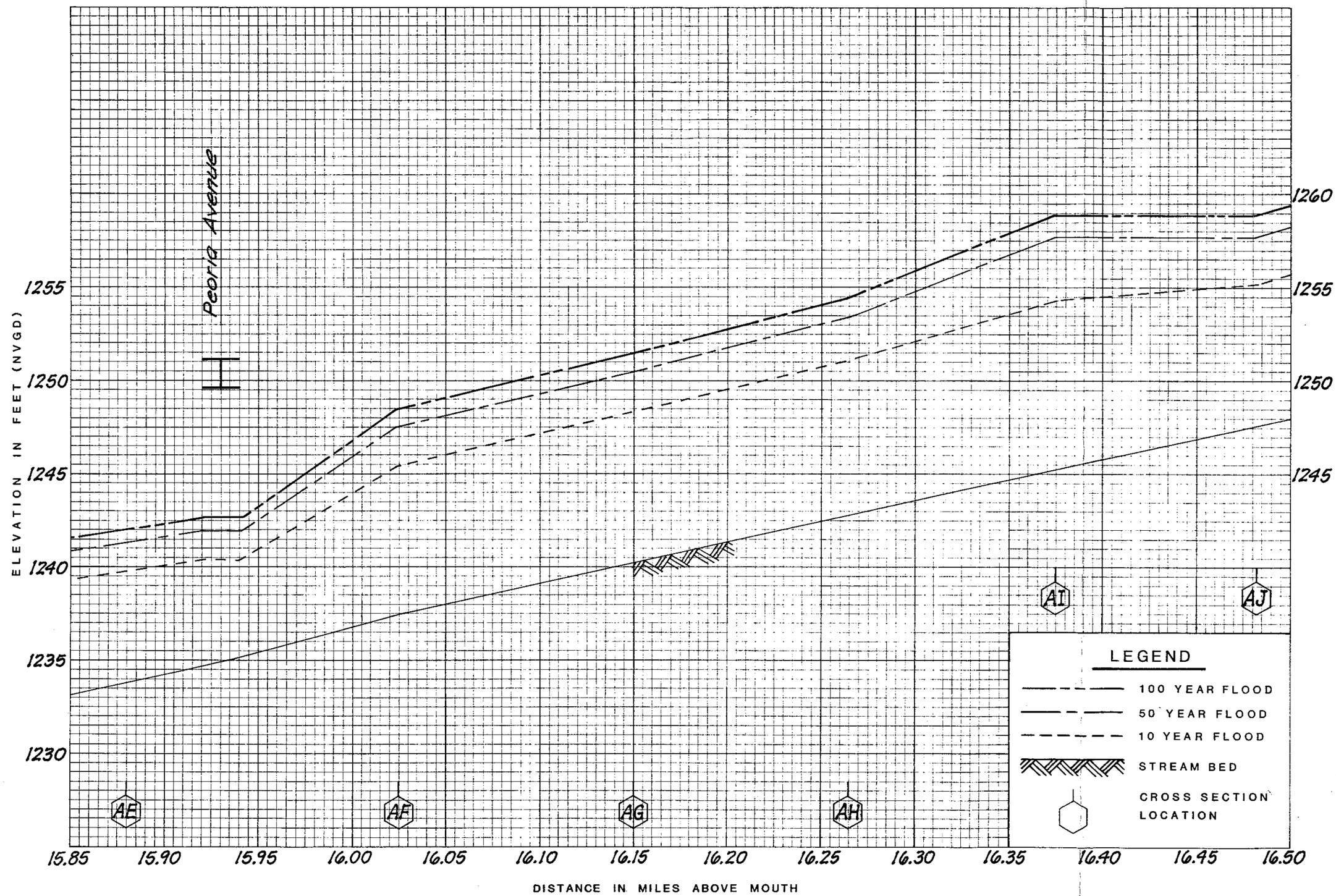

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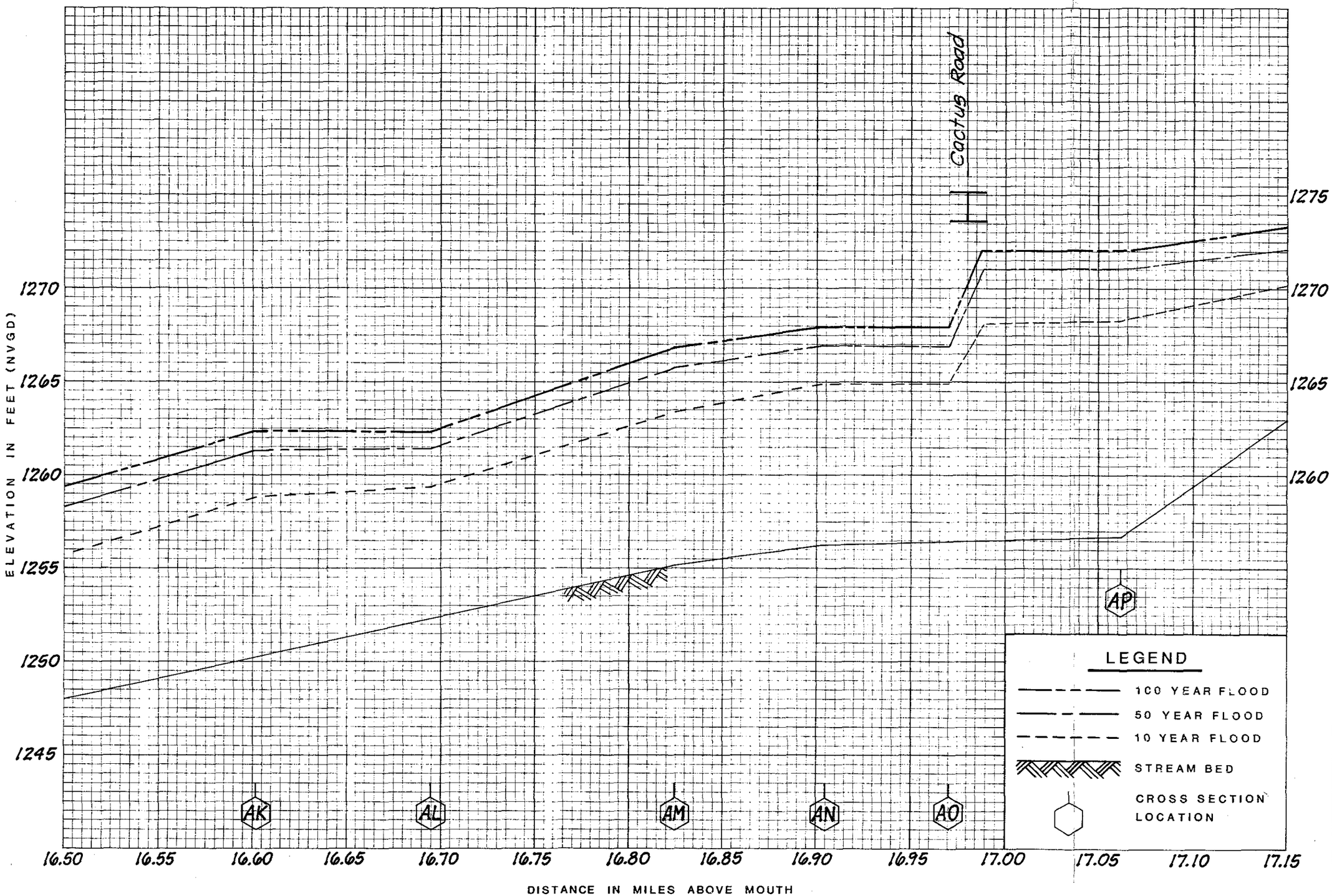

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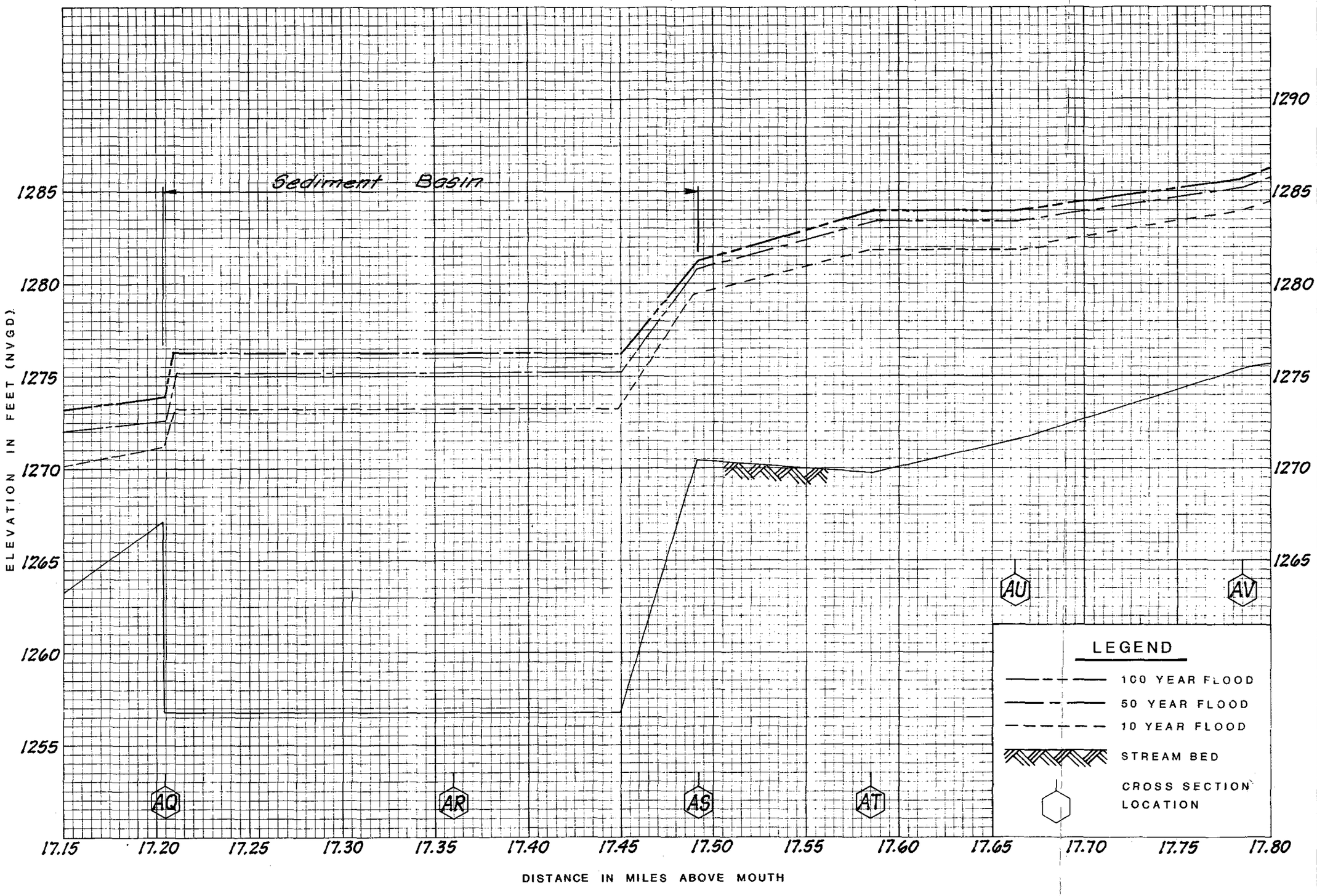

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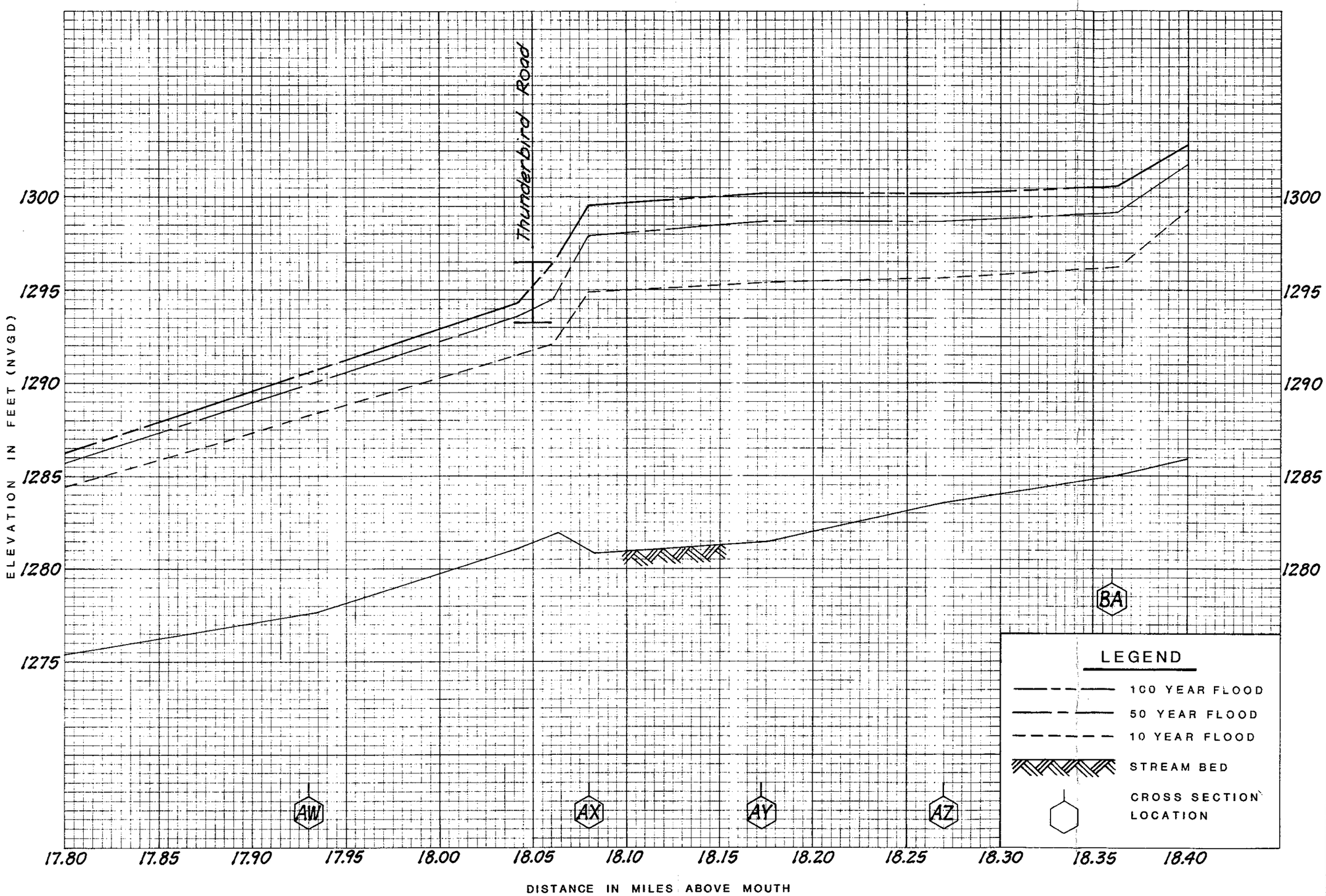

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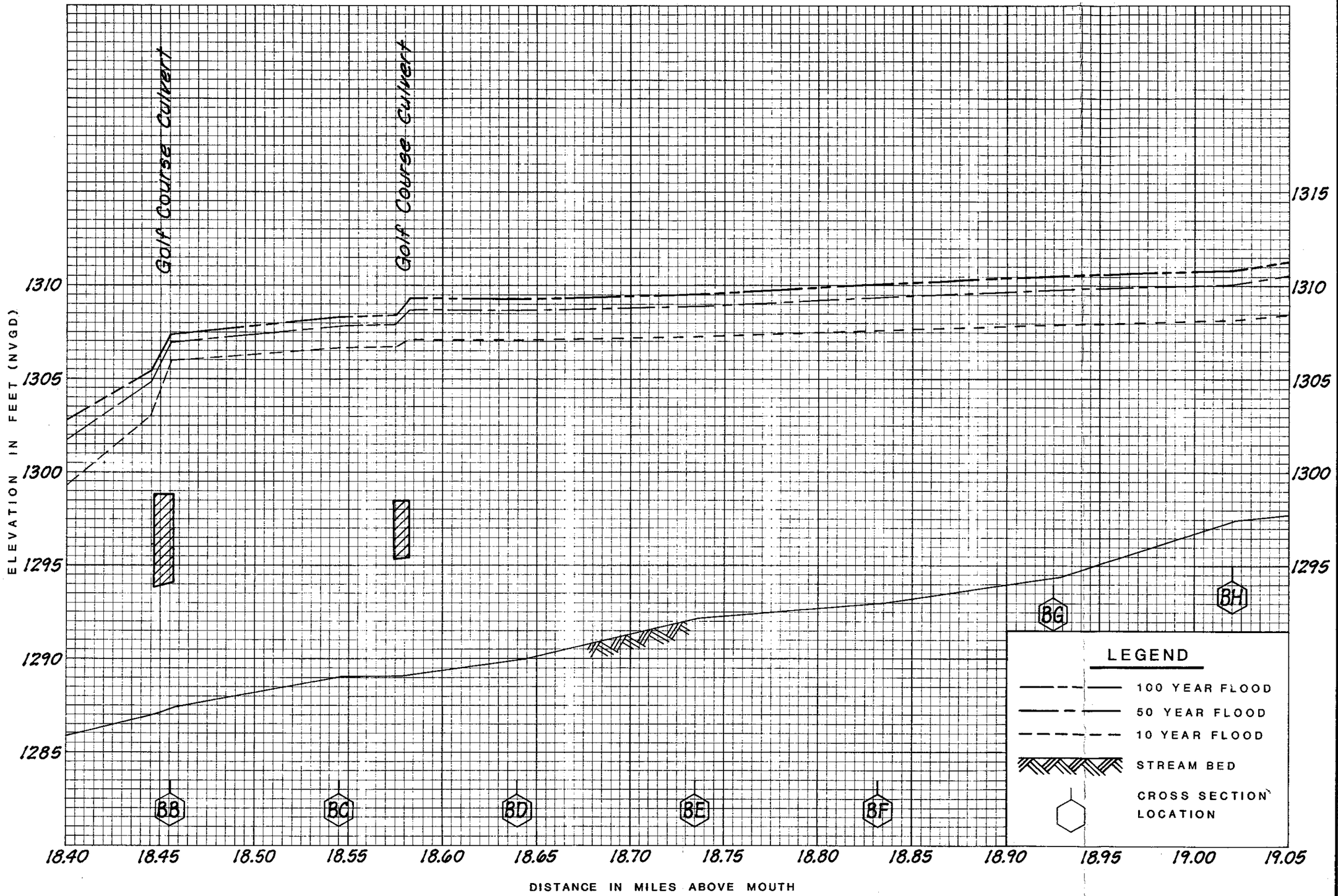

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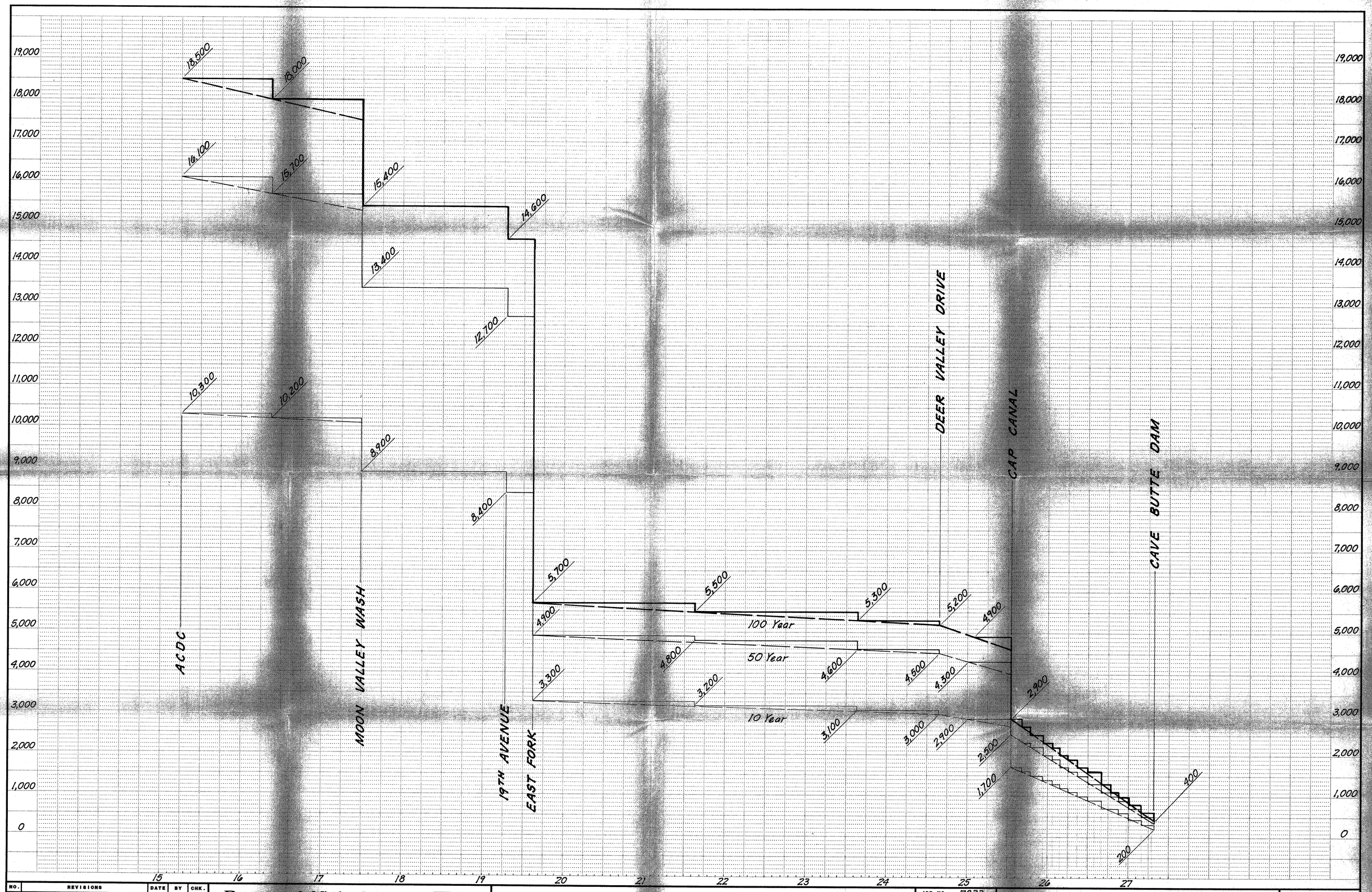


NO.	REVISIONS	DATE	BY	CHK.

Burgess & Niple, Inc.
Engineers and Architects
Akron, OH • Cincinnati, OH • Cleveland, OH • Columbus, OH • Covington, KY
Mentor, OH • Parkersburg, WV • Payson, AZ • Phoenix, AZ

bn 1912

MIDDLE CAVE CREEK FLOODPLAIN DELINEATION STUDY
FCD 88-56
FLOOD CONTROL DISTRICT OF MARICOPA COUNTY

JOB NO. 7833
DESIGNED BY: J.E.M.
DRAWN BY: L.E.U.
CHECKED BY:
APPROVED BY:
DATE:

DISCHARGE VS. RIVER MILE

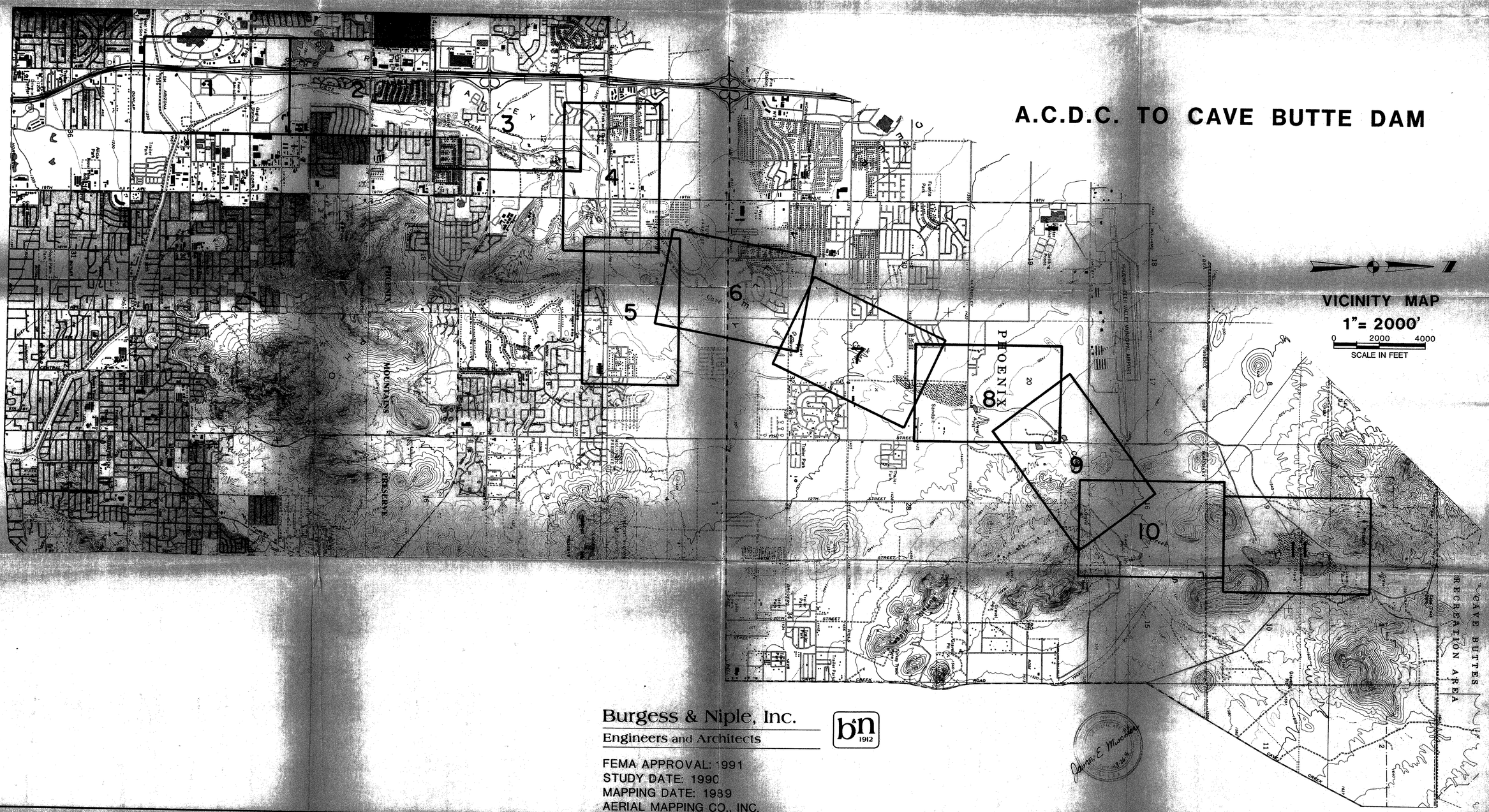
SCALE:
Horiz. 1"=0.5 miles
Vert. 1"=1,000 cfs

SHEET NO. 1 OF

FLOOD CONTROL DISTRICT OF MARICOPA COUNTY

D.E. SAGRAMOSO, CHIEF ENGINEER AND GENERAL MANAGER

CAVE CREEK & EAST FORK CAVE CREEK FLOODPLAIN DELINEATION STUDY



Burgess & Niple, Inc.
Engineers and Architects

FEMA APPROVAL: 1991
STUDY DATE: 1990
MAPPING DATE: 1989
AERIAL MAPPING CO., INC.

Summary of Discharges

Flooding Source and Location	D.A. (S.M.)	10-YR (cfs)	50-YR (cfs)	100-YR (cfs)
Cave Creek Wash				
Above the Central Arizona Project Canal	2.5	1,700	2,500	2,900
Below the Central Arizona Project Canal	4.0	2,700	4,000	4,600
Below Deer Valley Drive	5.0	3,000	4,500	5,200
Above the East Fork Cave Creek	8.6	3,300	4,900	5,700
East Fork of Cave Creek				
Near Paradise Lane & Central Avenue	13.4	5,300	7,900	9,100
Near Coral Gables & 7th Avenue	14.1	5,500	8,200	9,400
Mouth (Confluence with Cave Creek)	14.6	5,500	8,300	9,500
Cave Creek Wash				
Below the East Fork Cave Creek	23.5	8,400	12,700	14,600
Below 19th Avenue	25.5	8,900	13,400	15,400
Above Moon Valley Wash	26.5	8,900	13,400	15,400
Below Moon Valley Wash	33.1	10,100	15,300	17,500
At the Confluence with the Arizona Canal Diversion Channel	34.7	10,300	16,100	18,500

29. ERM EL. = 1234.08

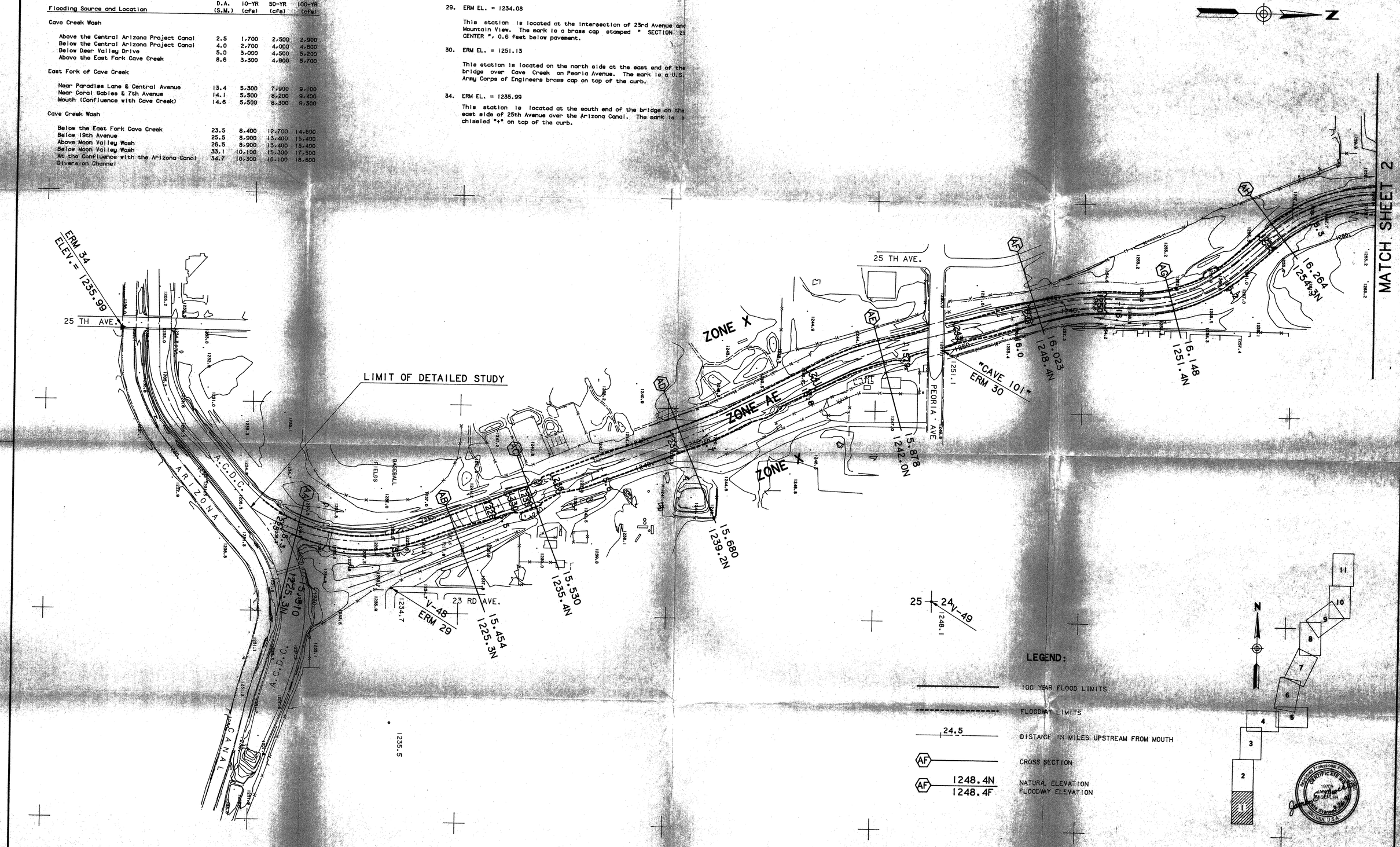
This station is located at the intersection of 23rd Avenue and Mountain View. The mark is a brass cap stamped " SECTION 23 CENTER ", 0.6 feet below pavement.

30. ERM EL. = 1251.13

This station is located on the north side at the east end of the bridge over Cave Creek on Peoria Avenue. The mark is a U.S. Army Corps of Engineers brass cap on top of the curb.

34. ERM EL. = 1235.99

This station is located at the south end of the bridge on the east side of 25th Avenue over the Arizona Canal. The mark is a chiseled "+" on top of the curb.



LEGEND:

———	100 YEAR FLOOD LIMITS
- - - - -	FLOODWAY LIMITS
24.5	DISTANCE IN MILES UPSTREAM FROM MOUTH
AF	CROSS SECTION
AF 1248.4N / 1248.4F	NATURAL ELEVATION / FLOODWAY ELEVATION

NO.	REVISIONS	DATE	BY	CHK.

Burgess & Niple, Inc.
Engineers and Architects
Akron, OH · Cincinnati, OH · Columbus, OH · Greatview Hills, KY
Painesville, OH · Parkersburg, WV · Payson, AZ · Phoenix, AZ

MIDDLE CAVE CREEK FLOODPLAIN DELINEATION STUDY
FCD 88-56
FLOOD CONTROL DISTRICT OF MARICOPA COUNTY

JOB NO. 7833
DESIGNED BY: JEM
DRAWN BY: CEU / AK
CHECKED BY: JEM
APPROVED BY:
DATE: MARCH-91

FLOOD BOUNDARY AND FLOODWAY MAP

CONTOUR INTERVAL = 2 FEET
SCALE: 0 100 200 SCALE IN FEET

SHEET NO. 1 OF 11

1. ERM EL. = 1282.83

This station is located at the intersection of Sweetwater and 25th Avenue. The mark is a City of Phoenix brass cap flush.

26. ERM EL. = 1275.52

This station is located at the north side and east end of the Cactus Road Bridge over Cave Creek. The mark is a City of Phoenix brass cap on top of the concrete curb.

31. ERM EL. = 1261.84

This station is located at the intersection of 25th Avenue and Cholla. The mark is a City of Phoenix brass cap flush.

Summary of Discharges

Flooding Source and Location	D.A. (S.M.)	10-YR (cfs)	50-YR (cfs)	100-YR (cfs)
Cave Creek Wash				
Above the Central Arizona Project Canal	2.5	1,700	2,500	2,900
Below the Central Arizona Project Canal	4.0	2,700	4,000	4,600
Below Deer Valley Drive	5.0	3,000	4,500	5,200
Above the East Fork Cave Creek	8.6	3,300	4,900	5,700
East Fork of Cave Creek				
Near Paradise Lane & Central Avenue	13.4	5,300	7,900	9,100
Near Coral Gables & 7th Avenue	14.1	5,500	8,200	9,400
Mouth (Confluence with Cave Creek)	14.6	5,500	8,300	9,500
Cave Creek Wash				
Below the East Fork Cave Creek	23.5	8,400	12,700	14,600
Below 19th Avenue	25.5	8,900	13,400	15,400
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LEGEND:

———	100 YEAR FLOOD LIMITS
- - - - -	FLOODWAY LIMITS
24.5	DISTANCE IN MILES UPSTREAM FROM MOUTH
AF	CROSS SECTION
AF 1248.4N / 1248.4F	NATURAL ELEVATION / FLOODWAY ELEVATION

CONTOUR INTERVAL = 2 FEET

NO.	REVISIONS	DATE	BY	CHK.

Burgess & Niple, Inc.
Engineers and Architects
Akron, OH · Cincinnati, OH · Columbus, OH · Greatview Hills, KY
Painesville, OH · Parkersburg, WV · Payson, AZ · Phoenix, AZ

MIDDLE CAVE CREEK FLOODPLAIN DELINEATION STUDY
FCD 88-56
FLOOD CONTROL DISTRICT OF MARICOPA COUNTY

JOB NO.	7833
DESIGNED BY:	JEM
DRAWN BY:	CEU / AK
CHECKED BY:	JEM
APPROVED BY:	
DATE:	MARCH-91

FLOOD BOUNDARY AND FLOODWAY MAP

SCALE: 0 100 200 SCALE IN FEET

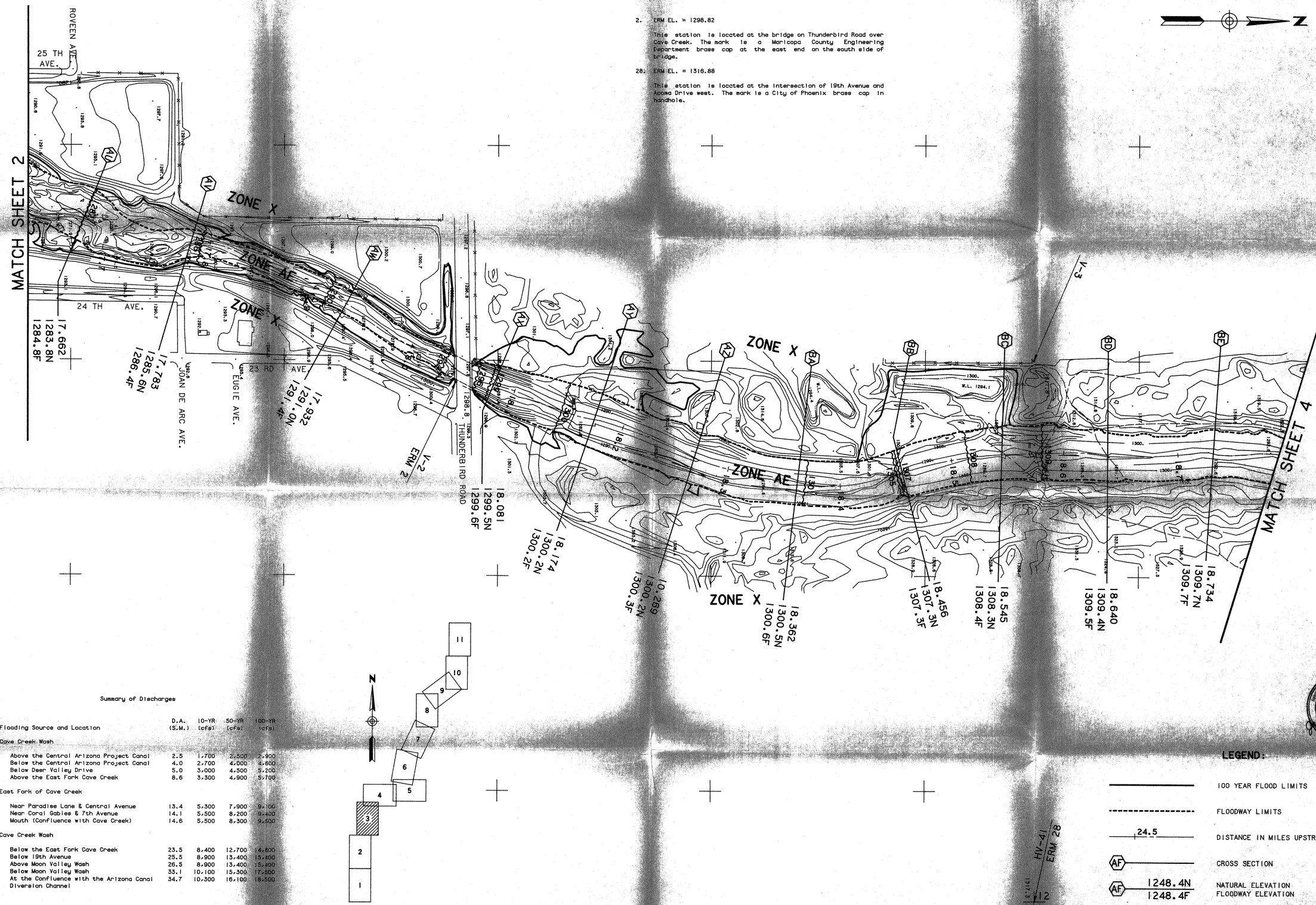
SHEET NO. 2 OF 11

2. ERM EL. = 1298.82

This station is located at the bridge on Thunderbird Road over Cave Creek. The mark is a Maricopa County Engineering Department brass cap at the east end on the south side of bridge.

28. ERM EL. = 1316.88

This station is located at the intersection of 19th Avenue and Acoma Drive west. The mark is a City of Phoenix brass cap in handhole.



Summary of Discharges

Flooding Source and Location	D.A. (S.M.)	10-YR (cfs)	50-YR (cfs)	100-YR (cfs)
Cave Creek Wash				
Above the Central Arizona Project Canal	2.5	1,700	2,500	2,900
Below the Central Arizona Project Canal	4.0	2,700	4,000	4,600
Below Deer Valley Drive	5.0	3,000	4,500	5,200
Above the East Fork Cave Creek	8.6	3,300	4,900	5,700
East Fork of Cave Creek				
Near Paradise Lane & Central Avenue	13.4	5,300	7,900	9,100
Near Coral Gables & 7th Avenue	14.1	5,500	8,200	9,400
Mouth (Confluence with Cave Creek)	14.6	5,500	8,300	9,500
Cave Creek Wash				
Below the East Fork Cave Creek	23.5	8,400	12,700	14,800
Below 19th Avenue	25.5	8,900	13,400	15,400
Above Moon Valley Wash	26.5	8,900	13,400	15,400
Below Moon Valley Wash	33.1	10,100	15,300	17,500
At the Confluence with the Arizona Canal Diversion Channel	34.7	10,300	16,100	18,500

LEGEND:

- 100 YEAR FLOOD LIMITS
- FLOODWAY LIMITS
- 24.5 — DISTANCE IN MILES UPSTREAM FROM MOUTH
- AF — CROSS SECTION
- AF 1248.4N / 1248.4F — NATURAL ELEVATION / FLOODWAY ELEVATION

CONTOUR INTERVAL = 2 FEET

NO.	REVISIONS	DATE	BY	CHK.

Burgess & Niple, Inc.
Engineers and Architects
Akron, OH • Cincinnati, OH • Columbus, OH • Crestview Hills, KY
Mentor, OH • Parkersburg, WV • Payson, AZ • Phoenix, AZ

MIDDLE CAVE CREEK FLOODPLAIN DELINEATION STUDY
FCD 88-56
FLOOD CONTROL DISTRICT OF MARICOPA COUNTY

JOB NO. 7833
DESIGNED BY: JEM
DRAWN BY: CEU / AK
CHECKED BY: JEM
APPROVED BY:
DATE: MARCH-91

FLOOD BOUNDARY AND FLOODWAY MAP

SCALE: 0 100 200 SCALE IN FEET

SHEET NO. 3 OF 11

BRUNING #307034-1

Summary of Discharges

Flooding Source and Location	D.A. (S.M.)	10-YR (cfs)	50-YR (cfs)	100-YR (cfs)
Cave Creek Wash				
Above the Central Arizona Project Canal	2.5	1,700	2,500	2,900
Below the Central Arizona Project Canal	4.0	2,700	4,000	4,600
Below Deer Valley Drive	5.0	3,000	4,500	5,200
Above the East Fork Cave Creek	8.6	3,300	4,900	5,700
East Fork of Cave Creek				
Near Paradise Lane & Central Avenue	13.4	5,300	7,900	9,100
Near Coral Gables & 7th Avenue	14.1	5,500	8,200	9,400
Mouth (Confluence with Cave Creek)	14.6	5,500	8,300	9,500
Cave Creek Wash				
Below the East Fork Cave Creek	23.5	8,400	12,700	14,600
Below 19th Avenue	25.5	8,900	13,400	15,400
Above Moon Valley Wash	26.5	8,900	13,400	15,400
Below Moon Valley Wash	33.1	10,100	15,300	17,500
At the Confluence with the Arizona Canal Diversion Channel	34.7	10,300	16,100	18,500

3. ERM EL. = 1329.81

This station is located at the bridge on 19th Avenue over Cave Creek. The mark is a City of Phoenix brass cap on top of handrail abutment on east side at north end of bridge.

4. ERM EL. = 1336.40

This station is located at what would be the intersection of 15th Avenue and Greenway Road. It is approximately the North quarter corner of section 7, T3N, R3E. The mark is a brass cap in concrete 0.3 feet below ground. Brass cap is stamped L.S.17146.

5. ERM EL. = 1339.53

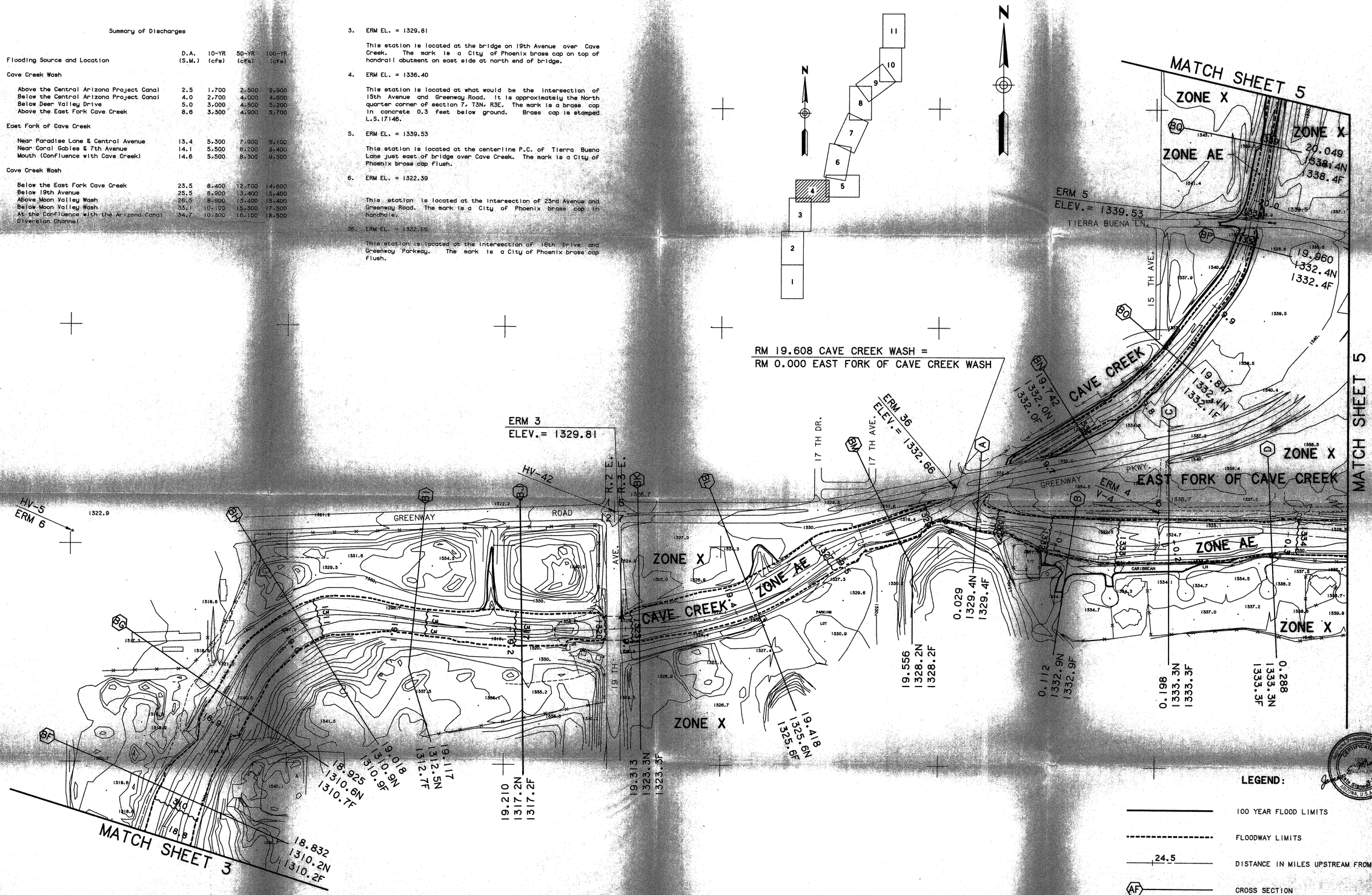
This station is located at the centerline P.C. of Tierra Buena Lane just east of bridge over Cave Creek. The mark is a City of Phoenix brass cap flush.

6. ERM EL. = 1322.39

This station is located at the intersection of 23rd Avenue and Greenway Road. The mark is a City of Phoenix brass cap in handhole.

36. ERM EL. = 1332.66

This station is located at the intersection of 16th Drive and Greenway Parkway. The mark is a City of Phoenix brass cap flush.



LEGEND:

———	100 YEAR FLOOD LIMITS
- - - - -	FLOODWAY LIMITS
24.5	DISTANCE IN MILES UPSTREAM FROM MOUTH
AF	CROSS SECTION
AF 1248.4N / 1248.4F	NATURAL ELEVATION / FLOODWAY ELEVATION

CONTOUR INTERVAL = 2 FEET

NO.	REVISIONS	DATE	BY	CHK.

Burgess & Niple, Inc.
Engineers and Architects
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Mentor, OH • Parkersburg, WV • Payson, AZ • Phoenix, AZ

MIDDLE CAVE CREEK FLOODPLAIN DELINEATION STUDY
FCD 88-56
FLOOD CONTROL DISTRICT OF MARICOPA COUNTY

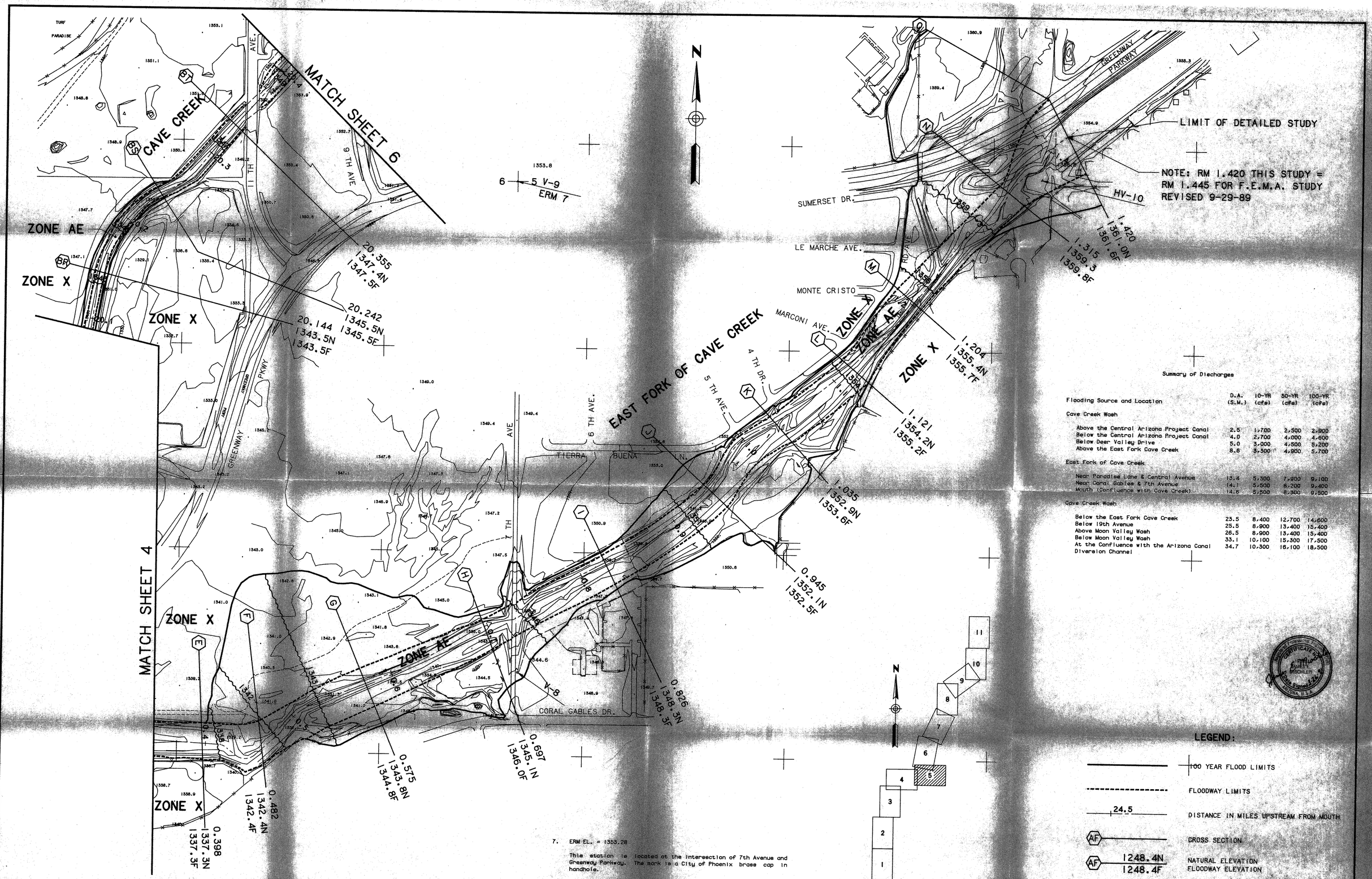
JOB NO.	7833
DESIGNED BY:	JEM
DRAWN BY:	CEU / AK
CHECKED BY:	JEM
APPROVED BY:	
DATE:	MARCH-91

FLOOD BOUNDARY AND FLOODWAY MAP

SCALE: 0 100 200 SCALE IN FEET

SHEET NO. 4 OF 11

DRAWING #307034-1



Summary of Discharges

Flooding Source and Location	D.A. (S.M.)	10-YR (cfs)	50-YR (cfs)	100-YR (cfs)
Cave Creek Wash				
Above the Central Arizona Project Canal	2.5	1,700	2,500	2,900
Below the Central Arizona Project Canal	4.0	2,700	4,000	4,600
Below Deer Valley Drive	5.0	3,000	4,500	5,200
Above the East Fork Cave Creek	8.6	3,500	4,900	5,700
East Fork of Cave Creek				
Near Paradise Lane & Central Avenue	13.4	5,300	7,900	9,100
Near Canal, Sables & 7th Avenue	14.1	5,500	8,200	9,400
Mouth (Confluence with Cave Creek)	14.6	5,500	8,300	9,500
Cave Creek Wash				
Below the East Fork Cave Creek	23.5	8,400	12,700	14,600
Below 19th Avenue	25.5	8,900	13,400	15,400
Above Moon Valley Wash	26.5	8,900	13,400	15,400
Below Moon Valley Wash	33.1	10,100	15,300	17,500
At the Confluence with the Arizona Canal Diversion Channel	34.7	10,300	16,100	18,500

7. ERM EL. = 1353.28

This station is located at the intersection of 7th Avenue and Greenway Parkway. The mark is a City of Phoenix brass cap in handhole.

LEGEND:

- 100 YEAR FLOOD LIMITS
- FLOODWAY LIMITS
- 24.5 — DISTANCE IN MILES UPSTREAM FROM MOUTH
- AF — CROSS SECTION
- AF 1248.4N / 1248.4F — NATURAL ELEVATION / FLOODWAY ELEVATION

CONTOUR INTERVAL = 2 FEET

NO.	REVISIONS	DATE	BY	CHK.

Burgess & Niple, Inc.
Engineers and Architects
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MIDDLE CAVE CREEK FLOODPLAIN DELINEATION STUDY
FCD 88-56
FLOOD CONTROL DISTRICT OF MARICOPA COUNTY

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FLOOD BOUNDARY AND FLOODWAY MAP

SCALE: 0 100 200 SCALE IN FEET

SHEET NO. 5 OF 11

BRUNING #307024-1

7. ERM EL. = 1353.28

This station is located at the intersection of 7th Avenue and Greenway Parkway. The mark is a City of Phoenix brass cap in handhole.

8. ERM EL. = 1369.11

This station is located on the west end on south side of bridge on Bell Road over Cave Creek. The mark is a Maricopa County Highway Department brass cap.

9. ERM EL. = 1367.05

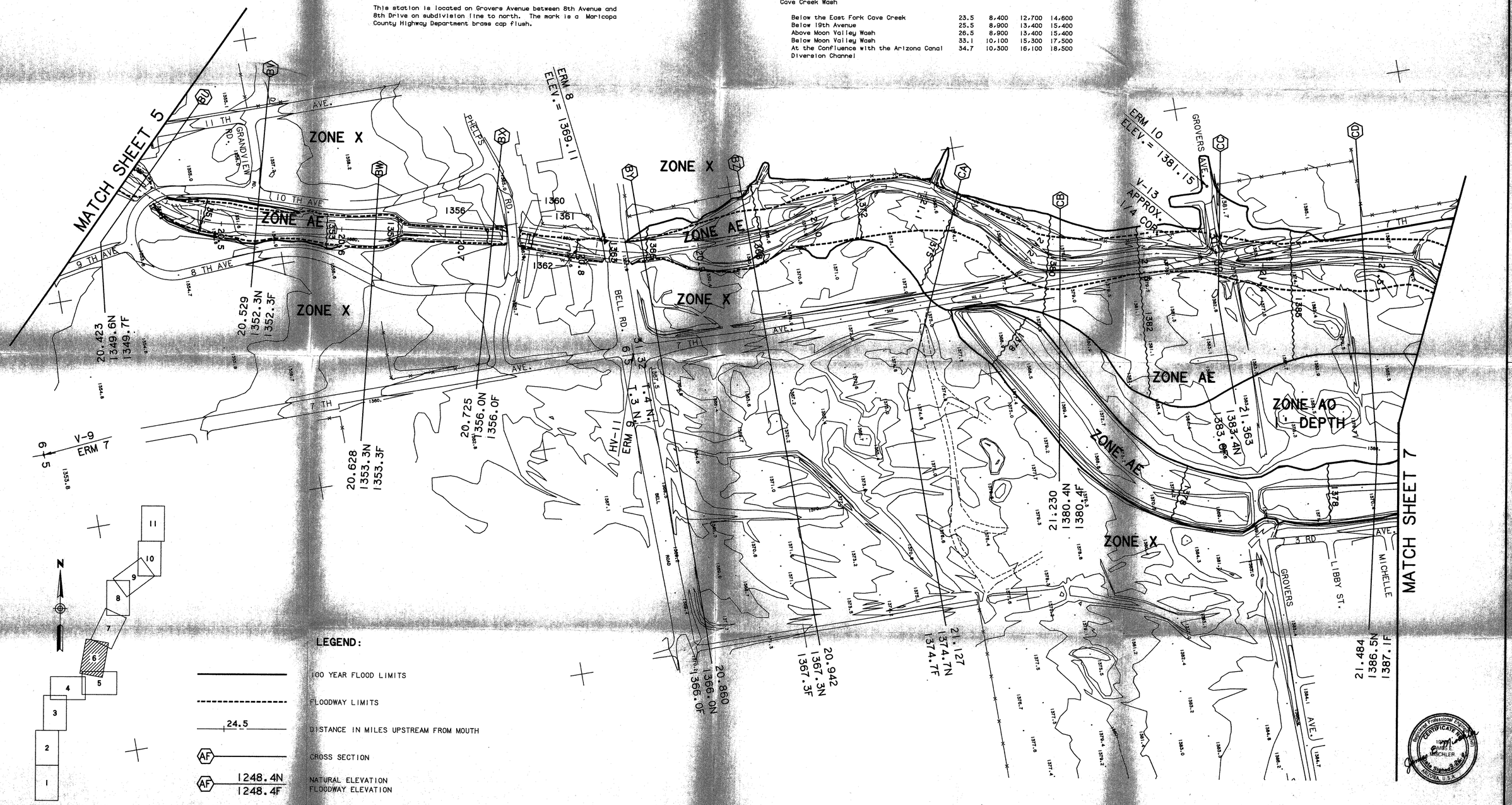
This station is located at the intersection on Bell Road and 7th Avenue. The mark is a Maricopa County Highway Department brass cap in handhole.

10. ERM EL. = 1381.15

This station is located on Grovers Avenue between 8th Avenue and 8th Drive on subdivision line to north. The mark is a Maricopa County Highway Department brass cap flush.

Summary of Discharges

Flooding Source and Location	D.A. (S.M.)	10-YR (cfs)	50-YR (cfs)	100-YR (cfs)
Cave Creek Wash				
Above the Central Arizona Project Canal	2.5	1,700	2,500	2,900
Below the Central Arizona Project Canal	4.0	2,700	4,000	4,600
Below Deer Valley Drive	5.0	3,000	4,500	5,200
Above the East Fork Cave Creek	8.6	3,300	4,900	5,700
East Fork of Cave Creek				
Near Paradise Lane & Central Avenue	13.4	5,300	7,900	9,100
Near Coral Gables & 7th Avenue	14.1	5,500	8,200	9,400
Mouth (Confluence with Cave Creek)	14.6	5,500	8,300	9,500
Cave Creek Wash				
Below the East Fork Cave Creek	23.5	8,400	12,700	14,600
Below 19th Avenue	25.5	8,900	13,400	15,400
Above Moon Valley Wash	26.5	8,900	13,400	15,400
Below Moon Valley Wash	33.1	10,100	15,300	17,500
At the Confluence with the Arizona Canal Diversion Channel	34.7	10,300	16,100	18,500



CONTOUR INTERVAL = 2 FEET

NO.	REVISIONS	DATE	BY	CHK.

DRAWING #307034-1

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MIDDLE CAVE CREEK FLOODPLAIN DELINEATION STUDY
FCD 88-56
FLOOD CONTROL DISTRICT OF MARICOPA COUNTY

JOB NO.	7833
DESIGNED BY:	JEM
DRAWN BY:	CEU / AK
CHECKED BY:	JEM
APPROVED BY:	
DATE:	MARCH-91

FLOOD BOUNDARY AND FLOODWAY MAP

SCALE: 0 100 200 SCALE IN FEET

SHEET NO. 6 OF 11

11. ERM EL. = 1416.40

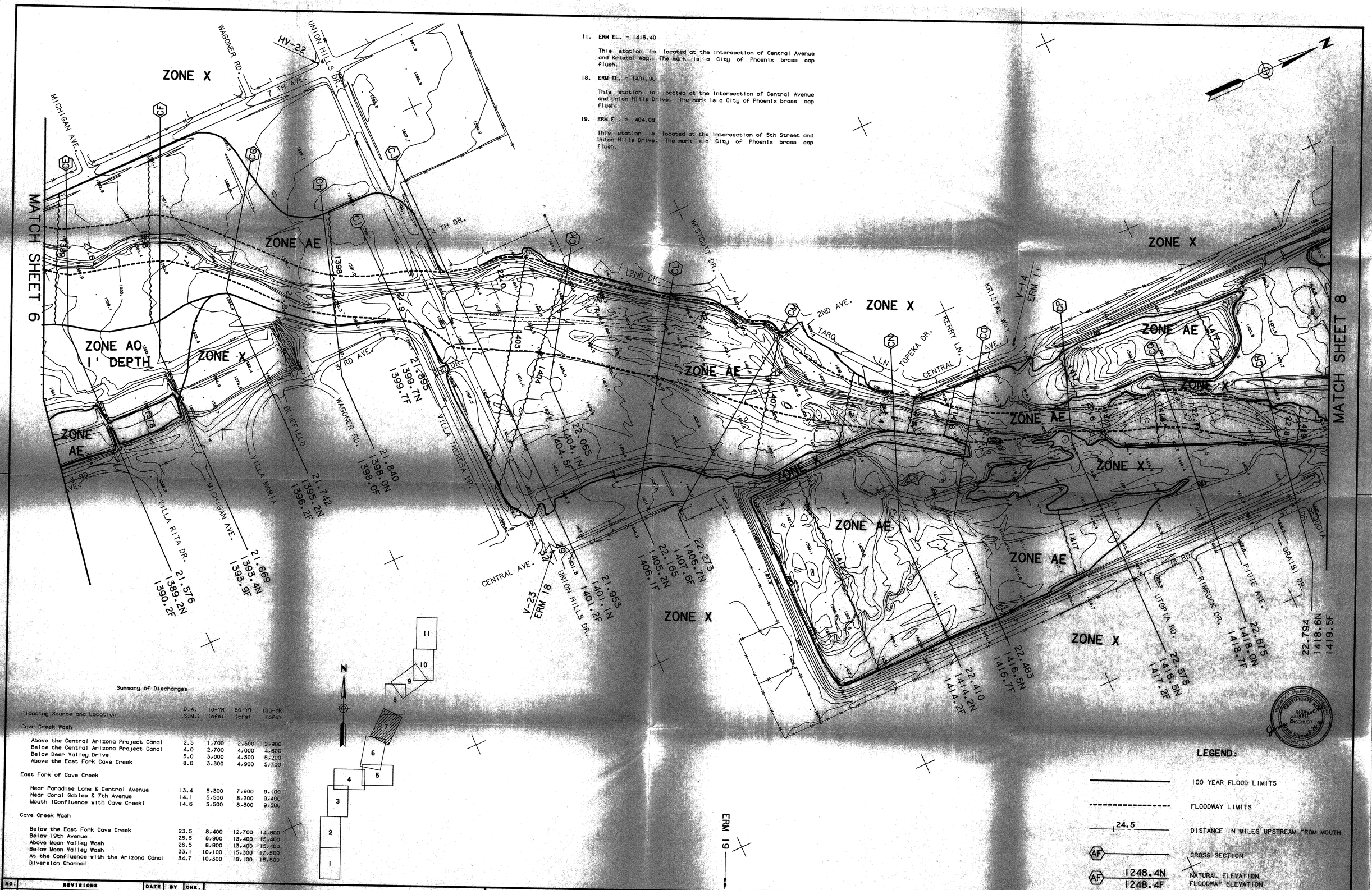
This station is located at the intersection of Central Avenue and Kristal Way. The mark is a City of Phoenix brass cap flush.

18. ERM EL. = 1401.90

This station is located at the intersection of Central Avenue and Union Hills Drive. The mark is a City of Phoenix brass cap flush.

19. ERM EL. = 1404.08

This station is located at the intersection of 5th Street and Union Hills Drive. The mark is a City of Phoenix brass cap flush.



Summary of Discharges

Flooding Source and Location	D.A. (S.M.)	10-YR (cfs)	50-YR (cfs)	100-YR (cfs)
Cave Creek Wash				
Above the Central Arizona Project Canal	2.5	1,700	2,500	2,900
Below the Central Arizona Project Canal	4.0	2,700	4,000	4,600
Below Deer Valley Drive	5.0	3,000	4,500	5,200
Above the East Fork Cave Creek	8.6	3,300	4,900	5,700
East Fork of Cave Creek				
Near Paradise Lane & Central Avenue	13.4	5,300	7,900	9,100
Near Coral Gables & 7th Avenue	14.1	5,500	8,200	9,400
Mouth (Confluence with Cave Creek)	14.6	5,500	8,300	9,500
Cave Creek Wash				
Below the East Fork Cave Creek	23.5	8,400	12,700	14,600
Below 19th Avenue	25.5	8,900	13,400	15,400
Above Moon Valley Wash	26.5	8,900	13,400	15,400
Below Moon Valley Wash	33.1	10,100	15,300	17,500
At the Confluence with the Arizona Canal	34.7	10,300	16,100	18,500
Diversion Channel				

LEGEND:

- 100 YEAR FLOOD LIMITS
- FLOODWAY LIMITS
- 24.5 — DISTANCE IN MILES UPSTREAM FROM MOUTH
- AF — CROSS SECTION
- AF 1248.4N / 1248.4F — NATURAL ELEVATION / FLOODWAY ELEVATION

CONTOUR INTERVAL = 2 FEET

NO.	REVISIONS	DATE	BY	CHK.

Burgess & Niple, Inc.
Engineers and Architects
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Mentor, OH • Parkersburg, WV • Payson, AZ • Phoenix, AZ

MIDDLE CAVE CREEK FLOODPLAIN DELINEATION STUDY
FCD 88-56
FLOOD CONTROL DISTRICT OF MARICOPA COUNTY

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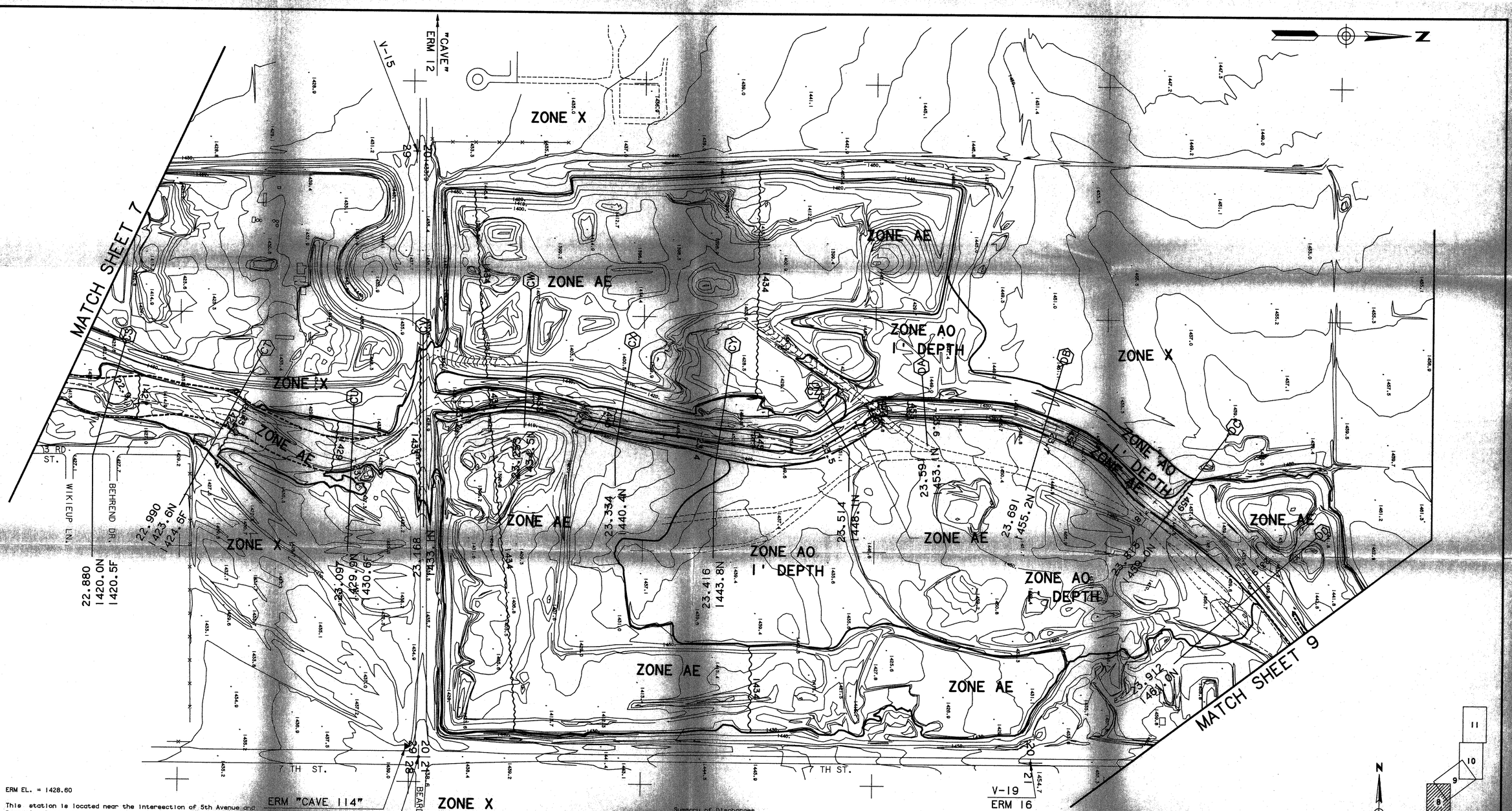
FLOOD BOUNDARY AND FLOODWAY MAP

SCALE: 0 100 200 SCALE IN FEET

SHEET NO. 7 OF 11

BRUNING #2070541



12. ERM EL. = 1428.60

This station is located near the intersection of 5th Avenue and Beardsley Road. The mark is an Arizona Department of Transportation aluminum cap stamped "CAVE 1983". It is set in the top of a 10 inch concrete monument, 500 feet east of 5th Avenue, 60 feet west of Phoenix Memorial Park cemetery, 22 feet north of the center line of Beardsley Road.

16. ERM EL. = 1454.74

This station is located on 7th Street approximately 0.5 miles north of Beardsley Road. The mark is a City of Phoenix brass cap flush. It is the East quarter corner of section 10, T4N, R3E.

17. ERM EL. = 1438.42

This station is located at the intersection of 7th Street and Beardsley Road. The mark is a Maricopa County brass cap in handhole.

37. ERM EL. = 1438.85

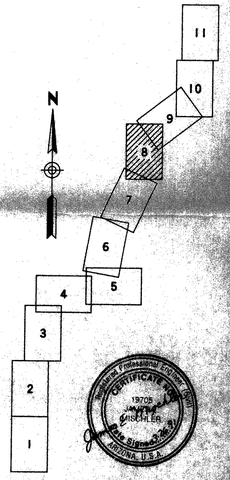
This station is located at the southwest corner of the intersection of 7th Street and Beardsley Road. The mark is a U.S. Corp of Engineers brass cap on the northeast corner of a concrete vault, marked "CAVE 114 1978".

Summary of Discharges

Flooding Source and Location	D.A. (S.M.)	10-YR (cfs)	50-YR (cfs)	100-YR (cfs)
Cave Creek Wash				
Above the Central Arizona Project Canal	2.5	1,700	2,500	2,900
Below the Central Arizona Project Canal	4.0	2,700	4,000	4,600
Below Deer Valley Drive	5.0	3,000	4,500	5,200
Above the East Fork Cave Creek	8.6	3,300	4,900	5,700
East Fork of Cave Creek				
Near Paradise Lane & Central Avenue	13.4	5,300	7,900	9,100
Near Coral Gables & 7th Avenue	14.1	5,500	8,200	9,400
Mouth (Confluence with Cave Creek)	14.6	5,500	8,300	9,500
Cave Creek Wash				
Below the East Fork Cave Creek	23.5	8,400	12,700	14,600
Below 19th Avenue	25.5	8,900	13,400	15,400
Above Moon Valley Wash	26.5	8,900	13,400	15,400
Below Moon Valley Wash	33.1	10,100	15,300	17,500
At the Confluence with the Arizona Canal Diversion Channel	34.7	10,300	16,100	18,500

LEGEND:

- 100 YEAR FLOOD LIMITS
- FLOODWAY LIMITS
- 24.5 — DISTANCE IN MILES UPSTREAM FROM MOUTH
- AF — CROSS SECTION
- AF 1248.4N / 1248.4F — NATURAL ELEVATION / FLOODWAY ELEVATION



CONTOUR INTERVAL = 2 FEET

NO.	REVISIONS	DATE	BY	CHK.

Burgess & Niple, Inc.
Engineers and Architects
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Mentor, OH • Parkersburg, WV • Payson, AZ • Phoenix, AZ

MIDDLE CAVE CREEK FLOODPLAIN DELINEATION STUDY
FCD 88-56
FLOOD CONTROL DISTRICT OF MARICOPA COUNTY

JOB NO.	7833
DESIGNED BY:	JEM
DRAWN BY:	CEU / AK
CHECKED BY:	JEM
APPROVED BY:	
DATE:	MARCH-91

FLOOD BOUNDARY AND FLOODWAY MAP

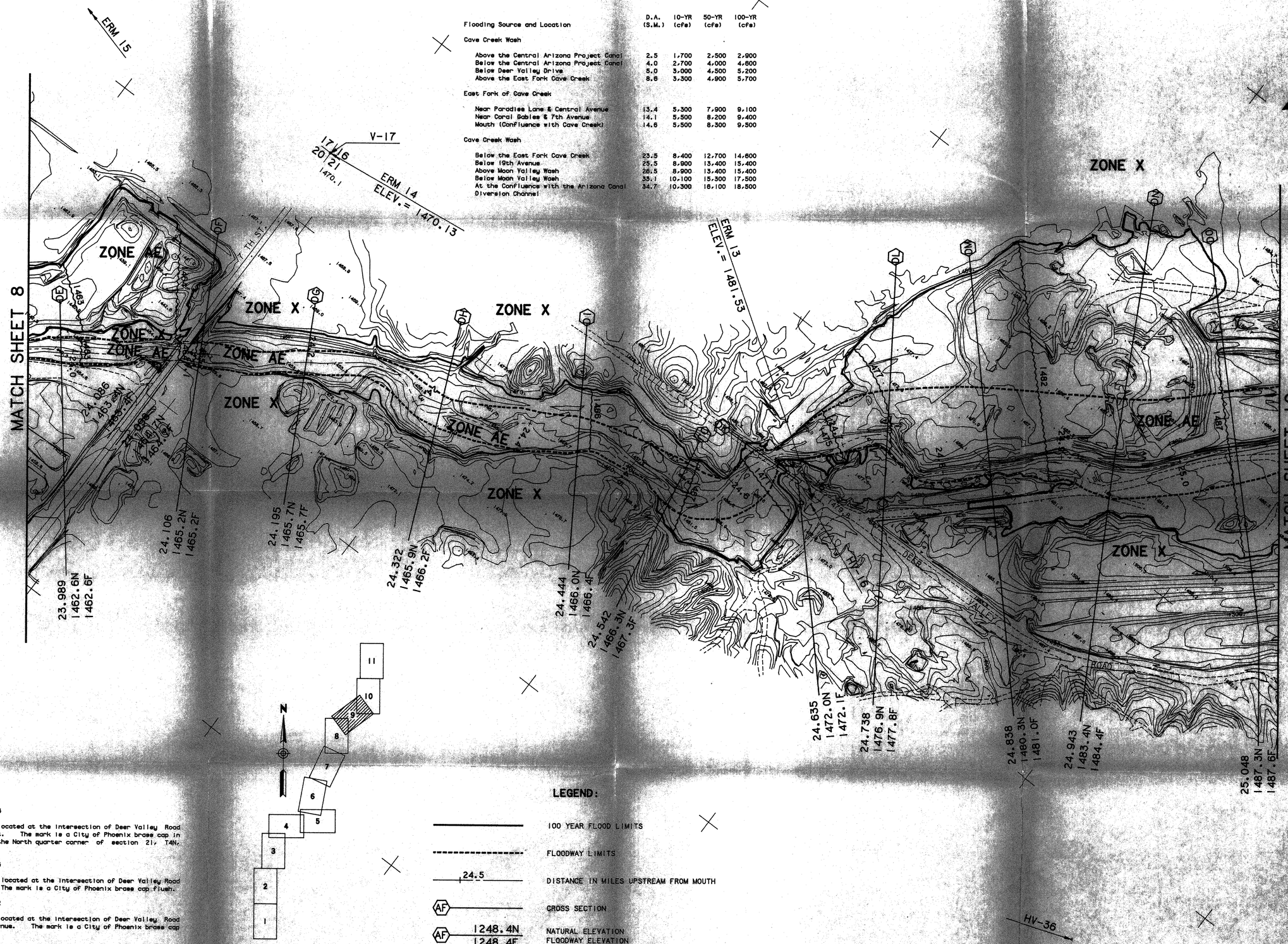
SCALE: 0 100 200 SCALE IN FEET

SHEET NO. 8 OF 11

BRUNING #307024-1

Summary of Discharges

Flooding Source and Location	D.A. (S.M.)	10-YR (cfs)	50-YR (cfs)	100-YR (cfs)
Cave Creek Wash				
Above the Central Arizona Project Canal	2.5	1,700	2,500	2,900
Below the Central Arizona Project Canal	4.0	2,700	4,000	4,600
Below Deer Valley Drive	5.0	3,000	4,500	5,200
Above the East Fork Cave Creek	8.6	3,300	4,900	5,700
East Fork of Cave Creek				
Near Paradise Lane & Central Avenue	13.4	5,300	7,900	9,100
Near Coral Gables & 7th Avenue	14.1	5,500	8,200	9,400
Mouth (Confluence with Cave Creek)	14.6	5,500	8,300	9,500
Cave Creek Wash				
Below the East Fork Cave Creek	23.5	8,400	12,700	14,600
Below 19th Avenue	25.5	8,900	13,400	15,400
Above Moon Valley Wash	26.5	8,900	13,400	15,400
Below Moon Valley Wash	33.1	10,100	15,300	17,500
At the Confluence with the Arizona Canal Diversion Channel	34.7	10,300	16,100	18,500



13. ERM EL. = 1481.53

This station is located at the intersection of Deer Valley Road and 12th Street. The mark is a City of Phoenix brass cap in handhole and is the North quarter corner of section 21, T4N, R3E.

14. ERM EL. = 1470.13

This station is located at the intersection of Deer Valley Road and 7th Street. The mark is a City of Phoenix brass cap flush.

15. ERM EL. = 1459.32

This station is located at the intersection of Deer Valley Road and Central Avenue. The mark is a City of Phoenix brass cap flush.

LEGEND:

- 100 YEAR FLOOD LIMITS
- FLOODWAY LIMITS
- 24.5 — DISTANCE IN MILES UPSTREAM FROM MOUTH
- AF — CROSS SECTION
- AF 1248.4N / 1248.4F — NATURAL ELEVATION / FLOODWAY ELEVATION

CONTOUR INTERVAL = 2 FEET

NO.	REVISIONS	DATE	BY	CHK.

Burgess & Niple, Inc.
Engineers and Architects
Akron, OH • Cincinnati, OH • Columbus, OH • Crestview Hills, KY
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MIDDLE CAVE CREEK FLOODPLAIN DELINEATION STUDY
FCD 88-56
FLOOD CONTROL DISTRICT OF MARICOPA COUNTY

JOB NO. 7833
DESIGNED BY: JEM
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APPROVED BY:
DATE: MARCH-91

FLOOD BOUNDARY AND FLOODWAY MAP

SCALE: 0 100 200 SCALE IN FEET

SHEET NO. 9 OF 11

23. ERM EL. = 1524.83

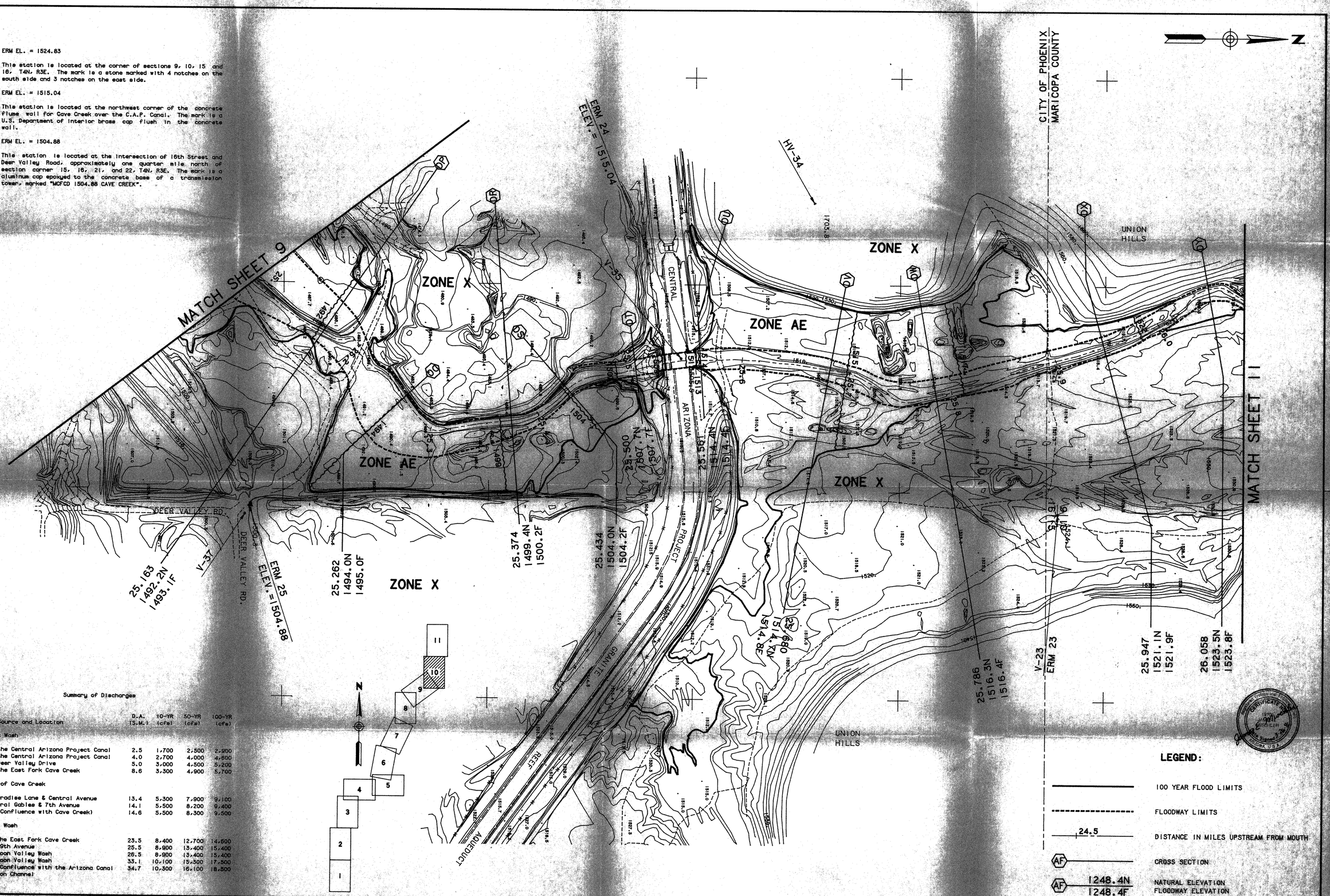
This station is located at the corner of sections 9, 10, 15 and 16, T4N, R3E. The mark is a stone marked with 4 notches on the south side and 3 notches on the east side.

24. ERM EL. = 1515.04

This station is located at the northwest corner of the concrete flume wall for Cave Creek over the C.A.P. Canal. The mark is a U.S. Department of Interior brass cap flush in the concrete wall.

25. ERM EL. = 1504.88

This station is located at the intersection of 16th Street and Deer Valley Road, approximately one quarter mile north of section corner 15, 16, 21, and 22, T4N, R3E. The mark is a aluminum cap epoxyed to the concrete base of a transmission tower, marked "MCFCD 1504.88 CAVE CREEK".



Flooding Source and Location	D.A. (S.M.)	10-YR (cfs)	50-YR (cfs)	100-YR (cfs)
Cave Creek Wash				
Above the Central Arizona Project Canal	2.5	1,700	2,500	2,900
Below the Central Arizona Project Canal	4.0	2,700	4,000	4,600
Below Deer Valley Drive	5.0	3,000	4,500	5,200
Above the East Fork Cave Creek	8.6	3,300	4,900	5,700
East Fork of Cave Creek				
Near Paradise Lane & Central Avenue	13.4	5,300	7,900	9,100
Near Coral Gables & 7th Avenue	14.1	5,500	8,200	9,400
Mouth (Confluence with Cave Creek)	14.6	5,500	8,300	9,500
Cave Creek Wash				
Below the East Fork Cave Creek	23.5	8,400	12,700	14,500
Below 19th Avenue	25.5	8,900	13,400	15,400
Above Moon Valley Wash	26.5	8,900	13,400	15,400
Below Moon Valley Wash	33.1	10,100	15,300	17,500
At the Confluence with the Arizona Canal Diversion Channel	34.7	10,300	16,100	18,500

NO.	REVISIONS	DATE	BY	CHK.

Burgess & Niple, Inc.
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MIDDLE CAVE CREEK FLOODPLAIN DELINEATION STUDY
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FLOOD BOUNDARY AND FLOODWAY MAP

SCALE: 0 100 200 SCALE IN FEET

SHEET NO. 10 OF 11

20. ERM EL. = 1679.52

This station is located on the top of Cave Butte Dam just east of a concrete structure. The mark is an aluminum cap in a concrete monument marked " CB-3 1980 ".

21. ERM EL. = 1535.25

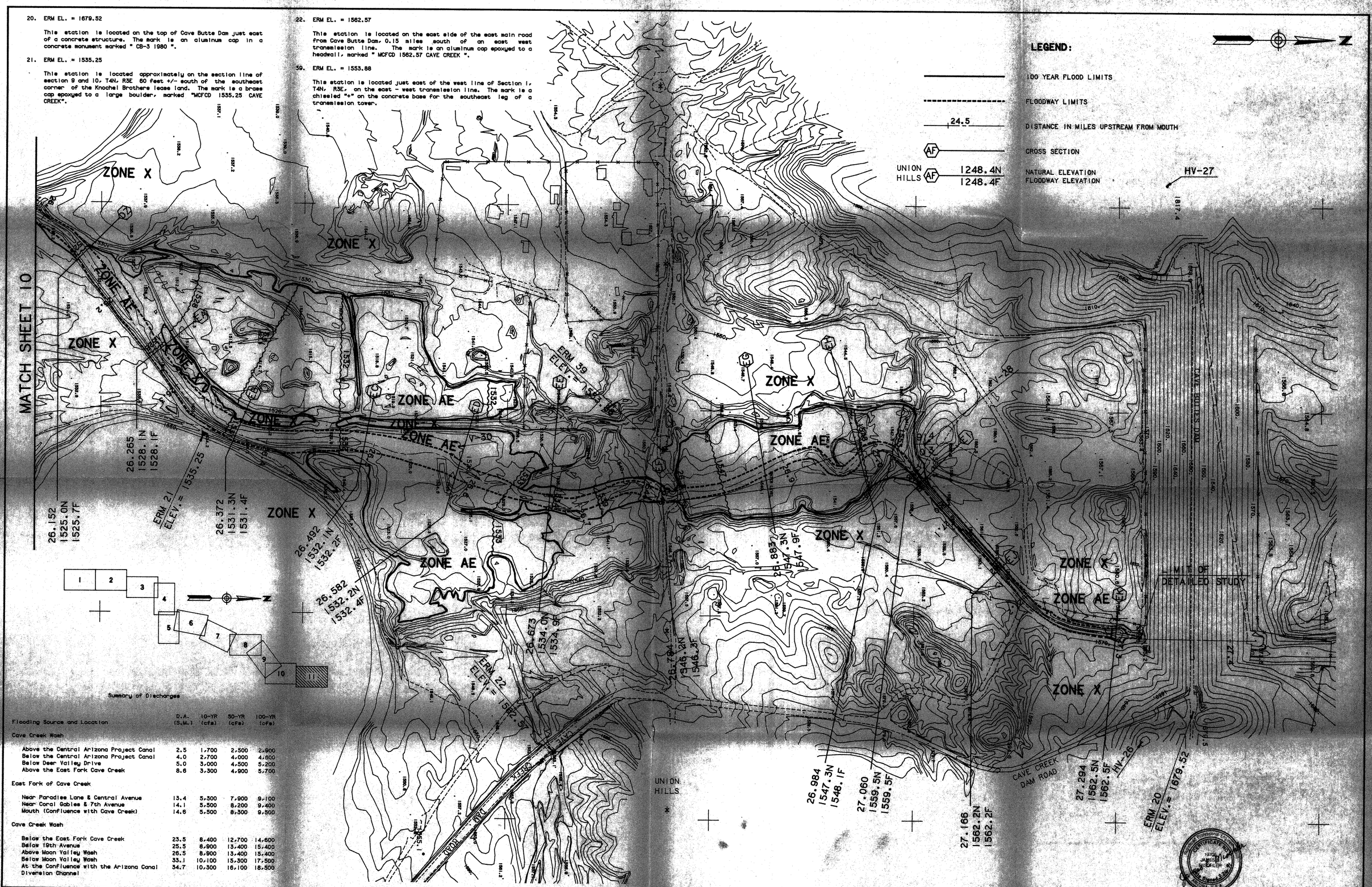
This station is located approximately on the section line of section 9 and 10, T4N, R3E 60 feet +/- south of the southeast corner of the Knochel Brothers lease land. The mark is a brass cap epoxyed to a large boulder, marked "MCFCD 1535.25 CAVE CREEK".

22. ERM EL. = 1562.57

This station is located on the east side of the east main road from Cave Butte Dam, 0.15 miles south of an east west transmission line. The mark is an aluminum cap epoxyed to a headwall, marked " MCFCD 1562.57 CAVE CREEK ".

39. ERM EL. = 1553.88

This station is located just east of the west line of Section 1, T4N, R3E, on the east - west transmission line. The mark is a chiseled "+" on the concrete base for the southeast leg of a transmission tower.



Summary of Discharges

Flooding Source and Location	D.A. (S.M.)	10-YR (cfs)	50-YR (cfs)	100-YR (cfs)
Cave Creek Wash				
Above the Central Arizona Project Canal	2.5	1,700	2,500	2,900
Below the Central Arizona Project Canal	4.0	2,700	4,000	4,800
Below Deer Valley Drive	5.0	3,000	4,500	5,200
Above the East Fork Cave Creek	8.6	3,300	4,900	5,700
East Fork of Cave Creek				
Near Paradise Lane & Central Avenue	13.4	5,300	7,900	9,100
Near Coral Gables & 7th Avenue	14.1	5,500	8,200	9,400
Mouth (Confluence with Cave Creek)	14.6	5,500	8,300	9,500
Cave Creek Wash				
Below the East Fork Cave Creek	23.5	8,400	12,700	14,600
Below 19th Avenue	25.5	8,900	13,400	15,400
Above Moon Valley Wash	26.5	8,900	13,400	15,400
Below Moon Valley Wash	33.1	10,100	15,300	17,500
At the Confluence with the Arizona Canal Diversion Channel	34.7	10,300	16,100	18,500

CONTOUR INTERVAL = 2 FEET

NO.	REVISIONS	DATE	BY	CHK.

Burgess & Niple, Inc.
Engineers and Architects
Akron, OH · Cincinnati, OH · Columbus, OH · Crestview Hills, KY
Painesville, OH · Parkersburg, WV · Payson, AZ · Phoenix, AZ

MIDDLE CAVE CREEK FLOODPLAIN DELINEATION STUDY
FCD 88-56
FLOOD CONTROL DISTRICT OF MARICOPA COUNTY

JOB NO.	7833
DESIGNED BY:	JEM
DRAWN BY:	CEU / AK
CHECKED BY:	JEM
APPROVED BY:	
DATE:	MARCH-91

FLOOD BOUNDARY AND FLOODWAY MAP

SCALE: 0 100 200 SCALE IN FEET

SHEET NO. 11 OF 11

APPENDIX "A"

ELEVATION REFERENCE MARKS

APPENDIX A
ELEVATION REFERENCE MARKS

1. ERM EL. = 1282.83

   This station is located at the intersection of Sweetwater and 25th Avenue. The mark is a City of Phoenix brass cap flush.

2. ERM EL. = 1298.82

   This station is located at the bridge on Thunderbird Road over Cave Creek. The mark is a Maricopa County Engineering Department brass cap at the east end on the south side of bridge.

3. ERM EL. = 1329.81

   This station is located at the bridge on 19th Avenue over Cave Creek. The mark is a City of Phoenix brass cap on top of handrail abutment on east side at north end of bridge.

4. ERM EL. = 1336.40

   This station is located at what would be the intersection of 15th Avenue and Greenway Road. It is approximately the North quarter corner of section 7, T3N, R3E. The mark is a brass cap in concrete 0.3 feet below ground. Brass cap is stamped L.S.17146.

5. ERM EL. = 1339.53

   This station is located at the centerline P.C. of Tierra Buena Lane just east of bridge over Cave Creek. The mark is a City of Phoenix brass cap flush.

6. ERM EL. = 1322.39

This station is located at the intersection of 23rd Avenue and Greenway Road. The mark is a City of Phoenix brass cap in handhole.

7. ERM EL. = 1353.28

This station is located at the intersection of 7th Avenue and Greenway Parkway. The mark is a City of Phoenix brass cap in handhole.

8. ERM EL. = 1369.11

This station is located on the west end on south side of bridge on Bell Road over Cave Creek. The mark is a Maricopa County Highway Department brass cap.

9. ERM EL. = 1367.05

This station is located at the intersection on Bell Road and 7th Avenue. The mark is a Maricopa County Highway Department brass cap in handhole.

10. ERM EL. = 1381.15

This station is located on Grovers Avenue between 8th Avenue and 8th Drive on subdivision line to north. The mark is a Maricopa County Highway Department brass cap flush.

11. ERM EL. = 1416.40

This station is located at the intersection of Central Avenue and Kristal Way. The mark is a City of Phoenix brass cap flush.

12. ERM EL. = 1428.60

This station is located near the intersection of 5th Avenue and Beardsley Road. The mark is an Arizona Department of Transportation aluminum cap stamped "CAVE 1983". It is set in the top of a 10 inch concrete monument, 500 feet east of 5th Avenue, 60 feet west of Phoenix Memorial Park cemetery, 22 feet north of the center line of Beardsley Road.

13. ERM EL. = 1481.53

This station is located at the intersection of Deer Valley Road and 12th Street. The mark is a City of Phoenix brass cap in handhole and is the North quarter corner of section 21, T4N, R3E.

14. ERM EL. = 1470.13

This station is located at the intersection of Deer Valley Road and 7th Street. The mark is a City of Phoenix brass cap flush.

15. ERM EL. = 1459.32

This station is located at the intersection of Deer Valley Road and Central Avenue. The mark is a City of Phoenix brass cap flush.

16. ERM EL. = 1454.74

This station is located on 7th Street approximately 0.5 miles north of Beardsley Road. The mark is a City of Phoenix brass cap flush. It is the East quarter corner of section 10, T4N, R3E.

17. ERM EL. = 1438.42

This station is located at the intersection of 7th Street and Beardsley Road. The mark is a Maricopa County brass cap in handhole.

18. ERM EL. = 1401.90

This station is located at the intersection of Central Avenue and Union Hills Drive. The mark is a City of Phoenix brass cap flush.

19. ERM EL. = 1404.08

This station is located at the intersection of 5th Street and Union Hills Drive. The mark is a City of Phoenix brass cap flush.

20. ERM EL. = 1679.52

This station is located on the top of Cave Butte Dam just east of a concrete structure. The mark is an aluminum cap in a concrete monument marked " CB-3 1980 ".

21. ERM EL. = 1535.25

This station is located approximately on the section line of section 9 and 10, T4N, R3E 60 feet +/- south of the southeast corner of the Knochel Brothers lease land. The mark is a brass cap epoxyed to a large boulder, marked "MCFCD 1535.25 CAVE CREEK".

22. ERM EL. = 1562.57

This station is located on the east side of the east main road from Cave Butte Dam, 0.15 miles south of an east west transmission line. The mark is an aluminum cap epoxyed to a headwall, marked " MCFCD 1562.57 CAVE CREEK ".

23. ERM EL. = 1524.83

This station is located at the corner of sections 9, 10, 15 and 16, T4N, R3E. The mark is a stone marked with 4 notches on the south side and 3 notches on the east side.

24. ERM EL. = 1515.04

This station is located at the northwest corner of the concrete flume wall for Cave Creek over the C.A.P. Canal. The mark is a U.S. Department of Interior brass cap flush in the concrete wall.

25. ERM EL. = 1504.88

This station is located at the intersection of 16th Street and Deer Valley Road, approximately one quarter mile north of section corner 15, 16, 21, and 22, T4N, R3E. The mark is a aluminum cap epoxyed to the concrete base of a transmission tower, marked "MCFCD 1504.88 CAVE CREEK".

26. ERM EL. = 1275.52

This station is located at the north side and east end of the Cactus Road Bridge over Cave Creek. The mark is a City of Phoenix brass cap on top of the concrete curb.

27. ERM EL. = 1293.80

This station is located at the intersection of 19th Avenue and Sweetwater Avenue. The mark is a City of Phoenix brass cap flush.

28. ERM EL. = 1316.88

This station is located at the intersection of 19th Avenue and Acoma Drive west. The mark is a City of Phoenix brass cap in handhole.

29. ERM EL. = 1234.08

This station is located at the intersection of 23rd Avenue and Mountain View. The mark is a brass cap stamped " SECTION 25 CENTER ", 0.6 feet below pavement.

30. ERM EL. = 1251.13

This station is located on the north side at the east end of the bridge over Cave Creek on Peoria Avenue. The mark is a U.S. Army Corps of Engineers brass cap on top of the curb.

31. ERM EL. = 1261.84

This station is located at the intersection of 25th Avenue and Cholla. The mark is a City of Phoenix brass cap flush.

32. ERM EL. = 1234.23

This station is located at the northwest corner of the bridge on 19th Avenue over Arizona Canal. The mark is a City of Phoenix brass cap flush in concrete approach slab.

33. ERM EL. = 1234.43

This station is located in the center of the east headwall of a concrete bridge on I-17 over the Arizona Canal. The mark is an Arizona Highway Department brass cap stamped " 1234-56 390+40.51".

34. ERM EL. = 1235.99

This station is located at the south end of the bridge on the east side of 25th Avenue over the Arizona Canal. The mark is a chiseled "+" on top of the curb.

35. ERM EL. = 1247.26

This station is located at the east right-of-way fence of I-17, 500 feet +/- south of Peoria Avenue. The mark is a brass cap in concrete stamped "PEORIA 1959 R.M.3 1970".

36. ERM EL. = 1332.66

This station is located at the intersection of 16th Drive and Greenway Parkway. The mark is a City of Phoenix brass cap flush.

37. ERM EL. = 1438.85

This station is located at the southwest corner of the intersection of 7th Street and Beardsley Road. The mark is a U.S. Corp of Engineers brass cap on the northeast corner of a concrete vault, marked "CAVE 114 1978".

38. ERM EL. = 1436.89

This station is located 0.1 mile south of milepost 218 on I-17, 97 feet west of I-17, 3.6 feet north of the witness post. The mark is a brass disc in a concrete monument marked "N343 1959".

39. ERM EL. = 1553.88

This station is located just east of the west line of Section 1, T4N, R3E, on the east - west transmission line. The mark is a chiseled "+" on the concrete base for the southeast leg of a transmission tower.

APPENDIX "B"

STUDY DOCUMENTATION

APPENDIX B

STUDY DOCUMENTATION

DESCRIPTION OF PROJECT

The purpose of this project is to develop a floodplain delineation study for middle Cave Creek from the Arizona Canal Diversion Channel to Cave Butte Dam. A portion of this reach has been previously studied by detailed methods and is presented in the 1989 FEMA report. Since the previous study, there has been significant channelization of Cave Creek Wash, especially the lower portion from the Arizona Canal Diversion Channel to Sweetwater Road where the U.S. Army, Corps of Engineers has constructed a concrete lined channel. The Flood Control District of Maricopa County retained Burgess & Niple, Inc. in 1989 to develop new hydrology as well as an HEC-2 computer model of the reach.

DATA COLLECTION AND THE REPORT

As part of this project, Burgess & Niple researched the files of the Flood Control District, the Arizona Department of Water Resources, the City of Phoenix, and other agencies to obtain mapping, previous studies, and structure plans that might be used in this study. Findings of this research are documented in a separate report for the data collection phase, and are summarized in the Coordination and Acknowledgements section of this report.

MAPPING

Mapping was originally to be developed at 1" = 400' scale, 2' contour interval. Early in the mapping phase it became apparent that 1" = 400' scale would be too small, and the scope of work was changed to 1" = 200' scale. Limits of mapping were the original 100-year flood boundary from the previous FEMA study plus approximately 400' laterally in each direction. Mapping was developed using aerial methods by Aerial Mapping Co. Inc. Control was set by Jensen Surveying Inc. Digitized contours and planimetric figures were provided to Burgess & Niple by Aerial Mapping Co. and read onto Burgess &

Niple's computer system where they were processed through CADD to generate mapping. Aerial Mapping Co. also provided reproducable ball point plots for use in comparing the original mapping with mapping generated by Burgess & Niple's CADD system, as well as for work maps during the study.

Mapping and cross sections were checked for accuracy by field survey methods. Excellent correlation was found, well within FEMA guidelines. Sections selected for field checking were at River Miles 15.310, 17.203, 19.418, 21.953, 24.106, 25.947, 27.294 on Cave Creek Wash, and 1.204 on the East Fork of Cave Creek.

HYDROLOGY

Cave Butte Dam serves to retain the majority of the 100-year flood, but would pass significant portions of the 500-year flood through the emergency spillway. Computation of 500-year hydrology would therefore include large portions of the upper watershed not necessary to be considered for events of 100 years or less. Hydrology was developed for the 10-, 50-, and 100-year recurrence intervals for Cave Creek between the Arizona Canal Diversion Channel and Cave Butte Dam. Following discussions with Burgess & Niple, the Flood Control District, and FEMA, it was determined that 500-year flood hydrology would not be computed. Hydrology is documented in detail in a separate report (Reference 28).

HYDRAULICS

Hydraulic computations were developed using the Corps of Engineers Water Surface Profiles Program; HEC-2 as implemented in the 1989 version of ProHEC-2 by Dodson and Associates, Inc. The 1989 version from Dodson Associates incorporates the late 1988 release from the Corps of Engineers.

A. Cross Sections

Cross sections shown on FEMA Flood Insurance Rate Maps revised September 29, 1989 for Maricopa County Arizona, and incorporated areas were plotted on the 1" = 200' scale mapping developed for this study. To do this, the flood insurance rate maps which were at a

scale of 1" = 1000' were enlarged and cross sections were then traced onto the new mapping. These locations were reviewed to determine if they were reasonable for use in the current study, or if revisions to the channel were sufficient to warrant alternate locations. Letters used to describe sections in the following discussion refer to the previous study.

The location of previous cross section A was used near the confluence with the ACDC. Two cross sections were added between A and B of the previous study to model the steep slope of the new Cave Creek Channel where a hydraulic jump is intended by the Corps of Engineers to dissipate energy. Cross section B from the previous study was therefore not used. Cross sections, C, D, and F from the previous study were used, but cross section E just upstream of Peoria Avenue Bridge was not used as it would be sufficient to repeat the section from cross section B.

Other previous sections, G, H, I, J, K. L, M, N, and P were used to locate new sections, although they were re-oriented to be perpendicular to the new channel. A new cross section was added between P & Q to model the spillway crest of the outflow structure from the sedimentation basin. Because the new section was very close to cross section Q, that section was deleted. Previous cross section R is within the sedimentation basin, and a new section was taken at the same location. The location of cross section S was revised to model the broad crested weir at the entrance to the sedimentation basin. Accordingly, the location of cross section T was revised to a point just upstream of where it was previously, to more appropriately model the entrance to the basin.

Previous cross sections U, V, and W were used to locate new cross sections. A new cross section was located near previous cross section X, except that it was re-oriented to be perpendicular to the stream. No cross sections were presented between Thunderbird Road and 19th Avenue in the previous FEMA study. New cross sections were

distributed through the golf course area at approximately 500' intervals. Upstream of 19th Avenue, the locations of previous sections AL and AM were used to locate new cross sections.

At the East Fork of Cave Creek, sections A, B, and C from the previous study were relocated to more appropriately model recent channelization. Cross sections D, E, F, and G were used to locate new cross sections, although the new cross sections are reoriented to be perpendicular to the stream. Two additional cross sections have been located between previous sections G and H in order to keep the distance between cross sections to about 500'. Previous locations of cross sections H, I, J, and K were reused and an additional cross section was used between previous sections I and J, again to keep the spacing to about 500'. The last cross sections in the East Fork were located to model the stream up to the downstream limit of previous channelization at River Mile 1.420.

Upstream of Greenway Road on Cave Creek Wash, new sections were taken between sections AL and AQ, three of them spaced at about 500' intervals. A section was located just downstream of Tierra Buena Lane in order to model the bridge. Several cross sections upstream of AQ were included, spaced at about 500', with sections downstream of 11th Avenue, 10th Avenue, and Phelps Road in order to model these structures.

The previous location of section BA upstream of Bell Road was used to develop a new cross section, and a new section was located between BA and BD in order to keep the spacing at about 500'. The location of BD from the previous study was again used for this study. BE was also re-used except that it was reoriented to reflect channelization that has occurred upstream of Bell Road. A new section was located between BE and BH to keep the spacing to about 500'.

Section BI which was about 100' upstream of BH was not used for this study, in that the geometry is little changed from BH. Section BH just downstream of Grovers Avenue would be sufficient for this purpose.

Sections BJ, BK, BL, BM, BN, BO, BP, and BQ were used to locate cross sections for this study, except that in the overbank areas they were relocated to more appropriately model Cave Creek channelization along the east side, constructed as part of a new housing subdivision. A new section was added upstream of BQ in order to keep the spacing within 500'. The locations of sections BR, BS, and BT were reused with this study along with modifications in the overbank areas of the locations to reflect revisions since the last study. Cross section BT is about 1/2 mile south of Beardsley Road, and is the last cross section presented by FEMA for some distance.

New cross section locations were located at approximately 500' intervals upstream of section BT in order to model the channel. One section was selected on Beardsley Road pavement to model the low crossing.

Upstream of Beardsley Road, the cross sections model the channel but not the ineffective landfill and gravel mining operation. The location of cross section BW from the previous study was reused for this study. Cross sections were located to model the fill placed in the channel for a road between the landfill and the gravel mine upstream of Beardsley Road. This fill might wash out during a flood, but for the purpose of this study, we have presumed that the fill would remain in place. The locations of cross section BZ, CB, and CE were reused for new cross sections. Additional cross sections were placed amongst these to keep the spacing within about 500'.

Upstream of Seventh Street, the only cross sections shown on the Flood Insurance Rate Maps are CG, CH, and CI, upstream of Deer Valley Road. These sections, when traced on the new mapping, do not reflect the current stream orientation. Apparently, there has been some channelization. Therefore, upstream of Seventh Street new cross sections have been located at about 500' intervals which appropriately model the stream. Sections are oriented to be perpendicular to the 100-year flood plain.

At the Central Arizona Project Canal, cross sections were located upstream and downstream, although the downstream cross section is sufficiently downstream from the canal to be out of the stilling pool.

A fairly wide space was left between cross sections at river mile 25.786 and 25.947 to avoid modeling the widening of the stream, which would in actuality, be a non-effective flow area. Moving upstream from river mile 25.947, cross sections were again located at about 500' intervals up to Cave Butte Dam. The cross sections approaching the dam were taken in the normal outflow channel for the dam, in that the peak outflow for the 100-year flood is low enough that it would be contained within this channel. We have therefore not modeled the emergency spillway which would not be in use for events up to and including the 100-year flood.

B. River Mile Stationing

The stream thalweg was sketched onto the 1" = 200' scale mapping using contours and spot elevations to define the low point of the channel. In the Corps of Engineers concrete lined channel between the ACDC and Sweetwater, the center line of the channel was used. In general, Cave Creek had a well defined channel, and the thalweg was readily apparent.

To establish stationing for the stream, a tie was made to the previous FEMA study of September 29, 1989. This study indicated the confluence of Cave Creek with the ACDC as river mile 15.263 and the centerline of Peoria Avenue as river mile 15.930. As the confluence is not well defined and the location is subjective, the center line of Peoria Avenue was used to tie this study to the original FEMA work and was established as river mile 15.930. The thalweg of the confluence was sketched such that the confluence does occur at river mile 15.263.

Because of channelization in Cave Creek Wash, river mile stationing for this study does not agree with the river mile stationing of the previous FEMA study, at points other than the center line of Peoria Avenue. For instance, at Cactus Road, this study shows the center line to be at river mile 16.980, where FEMA showed the river mile to be 16.988, a difference of about 40'. Similar differences occur throughout the study ranging from the 40' at Cactus Road to as low as 5' at 19th Avenue to 211' at Beardsley Road. Greenway Road is significantly different, apparently because of realignment of Greenway Road and construction of a new bridge.

Study limits extend from river mile 15.263 at the confluence of the ACDC to Cave Butte Dam with the centerline at river mile 27.365. Study limits on the East Fork of Cave Creek range from river mile 0 at the confluence with Cave Creek Wash, to river mile 1.420.

C. Corps of Engineers Channelization

Concurrent with this study, the Corps of Engineers substantially completed a new channel from the ACDC to about Sweetwater Road. This concrete-lined channel was designed for supercritical flow and has a large sedimentation basin at the upstream end. Mapping of this portion of the project was delayed as late as possible to incorporate as much of the construction in the aerial mapping as possible. At the time of the flight, the excavation was complete and the majority of the concrete lining was in place, but a few areas remained to be lined, and would therefore appear about 8" below final grades on the aerial mapping. Other differences include fill placed in the channel south of Peoria Road to allow construction vehicles access across the channel (to be removed) and fill placed across the sedimentation basin which served to direct storm water during construction. Design plans for the channel and digitized cross sections based upon these plans were obtained to more accurately model this reach. Digitized cross sections were used to develop cross sections for the HEC-2 model. Three of these cross sections were selected for aerial cross sectioning: one at the extreme downstream end, one at the extreme

upstream end, and one about midway. Two of those three cross sections were also checked by field methods. Field data confirmed that the Corps of Engineers plans reflect as-built conditions.

D. Mannings "n" Values

On August 14, 1989, personnel from Burgess & Niple and the Flood Control District of Maricopa County made a field reconnaissance of Cave Creek Wash using a four wheel drive vehicle. The purpose of this reconnaissance was to select Mannings "n" values for use in the study. Findings are documented in a separate report (Reference 29).

E. Structures

Bridges cross Cave Creek Wash at Peoria Avenue, Cactus Road, Thunderbird Road, 19th Avenue, Greenway Road, Tierra Buena, 11th Avenue, 10th Avenue, Phelps Road, Bell Road, and 7th Street. These structures were modeled using the special bridge routines in the HEC-2 computer program. For skewed bridges, rather than using the factor for skew, areas of the bridge opening and channel widths have been manually adjusted to reflect the area perpendicular to the stream flow. Bridge models were developed using as-built structure plans. The model for Thunderbird Road was adjusted to reflect field measurements which indicated some channel degradation since the as-built plans were prepared.

Union Hills Drive has several corrugated metal pipes beneath a low crossing and was first modeled with a bridge area and an appropriate orifice co-efficent. It was determined that the pipes were ineffective and the model was revised to treat Union Hills Drive as a normal cross section.

Several culverts constructed across Cave Creek are modeled using the special bridge routines in the HEC-2 computer program. Two culverts are located on the golf course between Thunderbird Road and 19th Avenue, and one culvert crosses Cave Creek between Beardsley Road and

7th Street. Culverts were field measured for the orifice size and type, and inverts were determined using the 1"=200', 2' contour interval mapping.

Low crossings (fords) including Union Hills Drive, Beardsley Road, and Deer Valley Road were modeled as normal cross sections.

Outflow from the sedimentation basin was modeled using elevation outflow relations obtained from the Corps of Engineers. This data was used to create an X5 card to set elevations at the appropriate cross section.

The overshoot structure that carries Cave Creek Wash across the Central Arizona Project Canal was modeled using a series of cross sections developed from plans provided by the Bureau of Reclamation and confirmed by mapping. Sections were located in the rectangular concrete channel in the low stilling pool, at the downstream end of the broad crested wier where critical depth occurs, and at the upstream end of the chute. Natural aerial sections upstream and downstream allow expansion and contraction losses to be calculated.

F. Flood Profiles

An HEC-2 computer model was established for Cave Creek Wash and the East Fork assuming subcritical flow. As expected, results indicated that flow in the concrete-lined channel from the ACDC to Cactus Road was supercritical. An HEC-2 computer model was then created for the concrete lined channel. Research indicated that the reach between the ACDC and Cactus Road was designed to yield supercritical flow (Reference 9). The sediment basin is designed to trap sediments from the design flood (future condition 100-year) to prevent an unintended increase in Mannings "n" Values as experienced on other flood control projects in the Southwest. Single piers on the Cactus Road and Peoria Avenue bridges were extended by training walls.

Hydrology computations (Reference 28) indicate that flood peaks on Cave Creek Wash and the East Fork of Cave Creek occur almost simultaneously. Flood profiles for the East Fork of Cave Creek were therefore computed as a tributary to Cave Creek Wash instead of computing the East Fork of Cave Creek as a separate model. The floodway was likewise computed as a tributary model.

Between Bell Road and Union Hills Drive, a new channel has been excavated for a future relocation and channel improvement for Cave Creek Wash. Pending construction of a bridge at 7th Avenue, the upstream inlet and downstream outlet of the new channel are blocked. Future conditions are not considered by this study, therefore, the HEC-2 computer model reflects the existing channel.

The 100-year flood profile between Bell Road and Union Hills Drive indicates that the stream overtops the "low ridge" between the existing channel and the future channel. A manual computation was performed to estimate the effect of split flow (water leaving the channel) on flood profiles. It was determined that the split flow would reduce the 100-year profile by about 0.1 - 0.2 feet, which is negligible. For purposes of the model, only the portions of cross sections in the main channel are considered effective, the future channel is considered non-effective. During a 100-year flood event, the main channel will convey the vast majority of the water, but some will flow sideways over the ridge and down into the future channel. The future channel will pond until the water reaches the elevation of the downstream outlet, where it will then rejoin Cave Creek Wash at 7th Avenue.

Between Beardsley Road and 7th Street, a similar situation occurs. A landfill is operated in a former gravel pit to the east of Cave Creek Wash and an active gravel pit is being worked on the west. Cave Creek Wash is conveyed in a channel which is perched above both the landfill and the gravel pit. The channel size is insufficient to convey the entire 50- or 100-year peak discharges, and significant amounts of water will flow over the channel banks and pond in the landfill and gravel pit. A manual computation was made to estimate

the peak discharge remaining in the channel. The remaining water flows into the landfill and gravel pit, ponding until the downstream outlet elevation at Beardsley Road is reached. Flow will then return to Cave Creek Wash.

For purposes of the HEC-2 computer model, peak discharges are reduced upstream of Beardsley Road and only the channel between levees is considered. Peak discharges are returned to full valves upstream of the split flow area where the breakout occurs. Although the landfill and gravel pit provide significant unintended storage of peak discharges which may mitigate flood hazards downstream of Beardsley Road, the storage cannot be considered by this study because the future use of the landfill and gravel pit are not controlled. It is anticipated that the landfill and gravel pit may someday be filled to an elevation above the stream, resulting in no storage of peak discharges.

Between Deer Valley Drive and the CAP Canal, a situation exists where the main channel is perched above a gravel pit to the west of the stream, but the gravel pit serves as an effective portion of the 100-year floodplain. Flow through the pit area is controlled by the downstream outlet. In order to obtain appropriate flood profile computations, the effective channel bottoms of cross sections in the gravel pit were adjusted to yield conveyance in the right overbanks which was consistent with conveyance at the downstream control section.

G. Floodway

Cave Creek Wash from the ACDC to the sediment basin is conveyed in a recently constructed concrete-lined channel and sediment basin. Encroachment of the channel or sediment would be inappropriate and render the flood control project design invalid. No floodway was therefore computed between the ACDC and sediment basin.

The floodway was computed using Method 4 equal conveyance beginning at the first natural cross section upstream of the sediment basin with a 1.0 foot surcharge. The computer generated a "sawtooth" floodway with inconsistent widths, and was not successful in achieving the goal of a maximum 1.0 foot surcharge. Floodway limits were then adjusted using Method 1 (manual) encroachment, and after several iterations, a successful floodway was computed.

As requested by the City, no encroachment was computed for the reach between Thunderbird Road and 19th Avenue which passes through a golf course owned by the City of Phoenix, except to smooth flood boundaries.

In the vicinity of the Greenway Road bridge and the confluence with the East Fork of Cave Creek, the streams are contained within a concrete-lined channel, therefore, no encroachment was computed. The East Fork of Cave Creek floodway was computed as a tributary run for Cave Creek Wash due to almost simultaneous peak flood discharges. Channelized portions of the East Fork of Cave Creek were encroached only to the limits of previously constructed channels.

Between Tierra Buena Lane and Bell Road, floodway limits were established to match floodway limits proposed in a LOMR request, for FIRM panel 040051 0050 C. (Refer to the Coordination and Acknowledgements section of this report).

Between Beardsley Road and 7th Street, a normal floodway could not be computed due to split flow discussed in the previous Flood Profiles subsection. For the assumption of conveyance through the landfill and gravel pit to remain true, corridors must be reserved in the landfill and gravel pit to convey flow. As requested by a representative of the City of Phoenix, the corridors were established to be a nominal 100' wide. Levees which separate the main channel from the landfill and gravel pit are identified as Zone E (erosion prone area).

On August 14, 1989, engineers from Burgess & Niple, Inc. and the Flood Control District of Maricopa County made a reconnaissance field trip to select Manning's "n" Values for use in backwater modeling of Cave Creek Wash, from Cave Buttes Dam to the Arizona Canal Diversion Channel. Manning's "n" values were selected for the channel and overbanks. Orientation of overbanks is left and right looking downstream.

The following report will illustrate with photos the selected Manning's "n" values.

Photo No. 1 (8909-0A)
Downstream of Cave Buttes Dam.
"n" = .03 for channel.
"n" = .04 for left and right overbanks.

Photo No. 2 (8909-1A)
Downstream of Cave Buttes Dam.
"n" = .03 for channel.
"n" = .04 for overbanks.

Photo No. 3 (8909-8A)
Knoucle Bros. Landfill looking south.
"n" = .035 for channel
The right overbank will be non-effective landfill.

Photo No. 4 (8909-11A)
Between hills in Sec. 9-10, looking south.
"n" = .035 for channel and right overbank.
"n" = .05 for left overbank.

Photo No. 5 (8909-4A)
Looking south from south side of Deer Valley Road.
"n" = .045 for channel.
"n" = .045 for left overbank.
"n" = .05 for right overbank.

Photo No. 6 (8909-3A)
Looking southwest from south side of Deer Valley Road.
"n" = .05 for right overbank.

Photo No. 7 (8909-14A)
7th Street Bridge
looking downstream.
"n" = .04 for channel
and right overbank.
"n" = .035 for left
overbank.
Right overbank is
non-effective due to
levee for landfill and
gravel pit.

Photo No. 8 (8909-16A)
Looking downstream
from gravel
pit/landfill, between
7th Street and
Beardsley Road.
"n" = .045 for channel.
Overbanks are
non-effective due to
levees.

Photo No. 9 (8909-18A)
Looking downstream
from Beardsley Road.
"n" = .045 for channel.

Photo No. 10 (8909-17A)
Looking north from
Beardsley Road.
"n" = .04 for channel.

Photo No. 11 (8909-21A)
Looking southwest from
a point 1/2 mile south
of Beardsley Road.
"n" = .045 for channel.

Photo No. 12 (8909-25A)
Looking south from
Union Hills.
"n" = .04 for channel
and overbanks.

Photo No. 13 (8909-29A)
Looking downstream
from Bell Road Bridge.
"n" = .04 for channel.

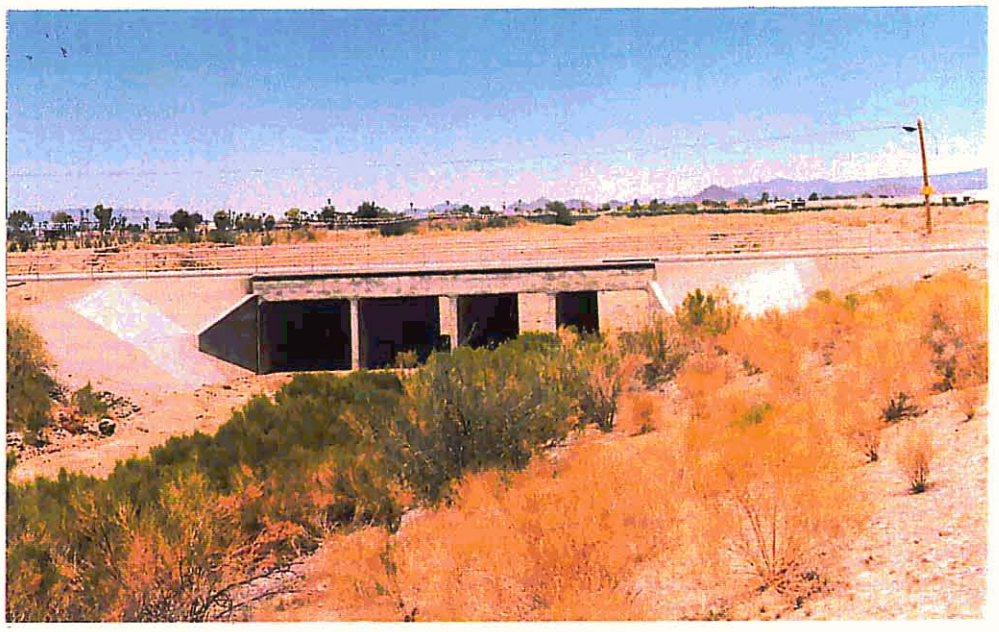


Photo No. 14 (8911-20)
Looking Upstream at
Tierra Buena Bridge.
"n" = .035 for channel.

Photo No. 15 (8909-35A)
Looking downstream from
Greenway Bridge.
"n" = .035 for natural
channel.
"n" = .015 for
concrete.

Photo No. 16 (8911-19)
Looking upstream from
19th Avenue Bridge.
"n" = .035 for channel.

Photo No. 17 (8911-03)
Looking upstream from
Thunderbird Bridge.
"n" = .035 for channel.

Photo No. 18 (8911-04)
Looking downstream from
Thunderbird Bridge.
"n" = .04 for channel.

Photo No. 19 (8910-4A)
Looking upstream from
Sweetwater Road
alignment.
"n" = .04 for channel.

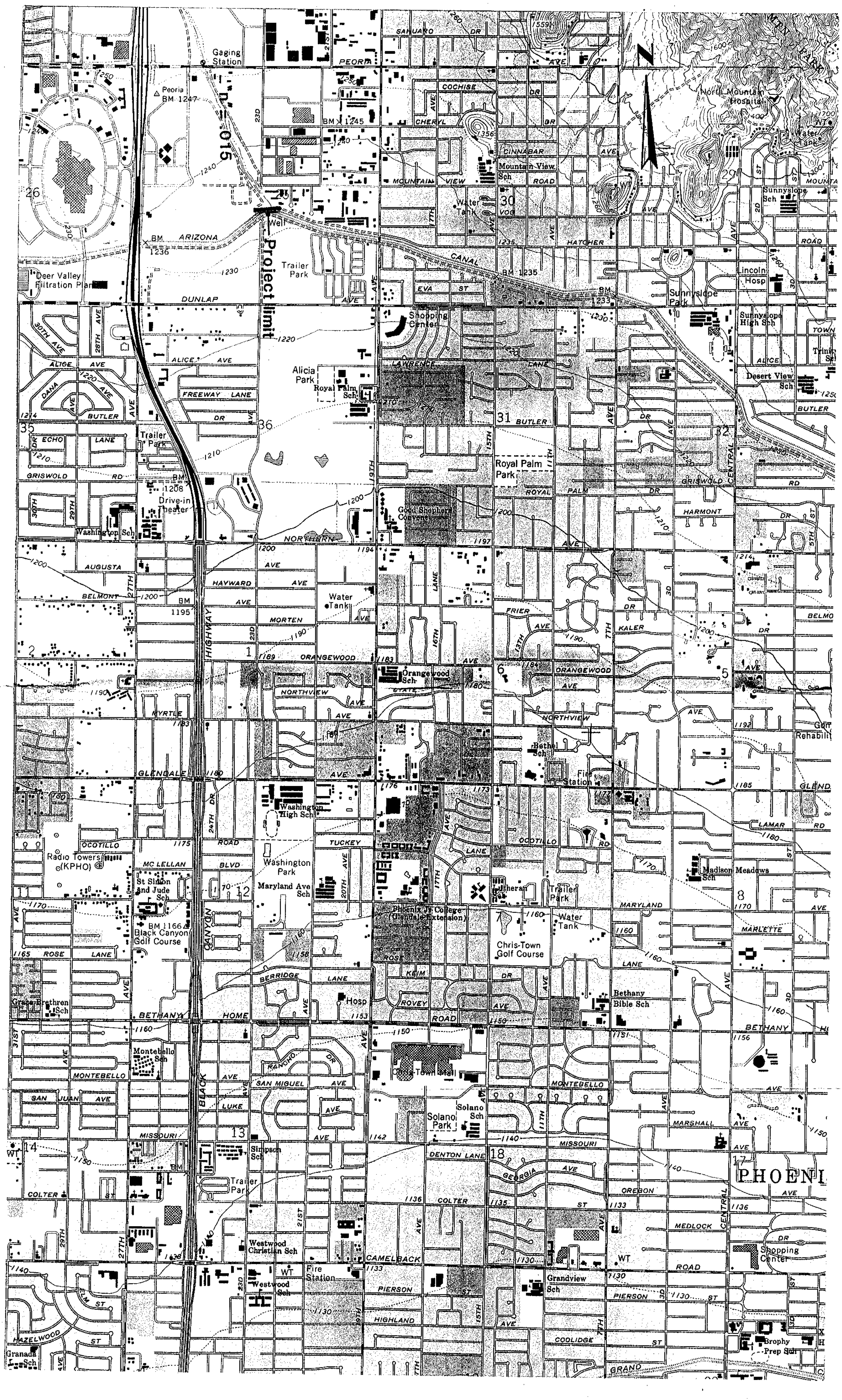
Photo No. 20 (8911-18)
Looking downstream.
Sediment basin.
"n" = .03

Photo No. 21 (8911-13)
Looking downstream.
Sediment basin.
"n" = .03

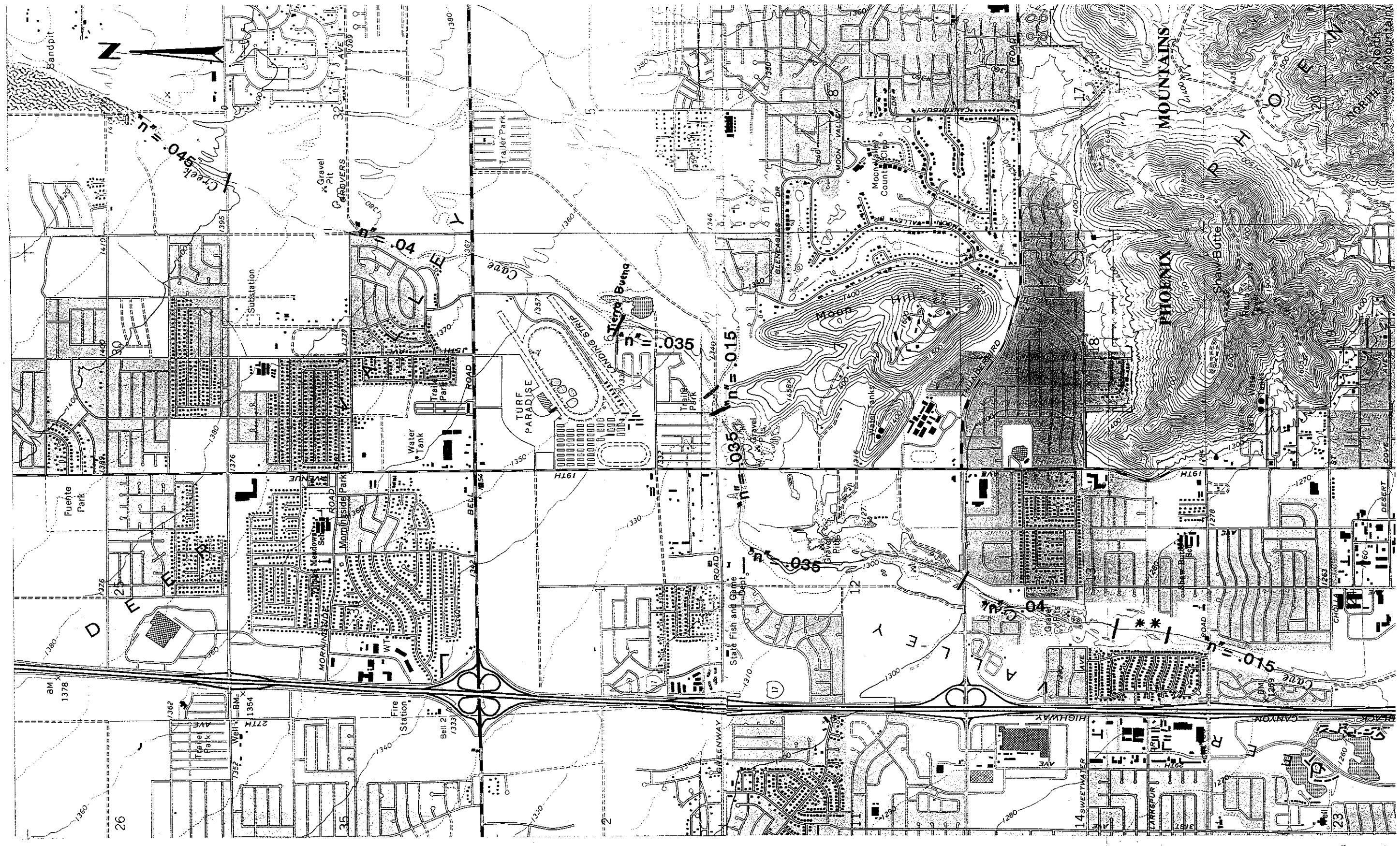
Photo No. 22 (8911-16)
Upstream influent slope at sediment basin looking west.
"n" = .035

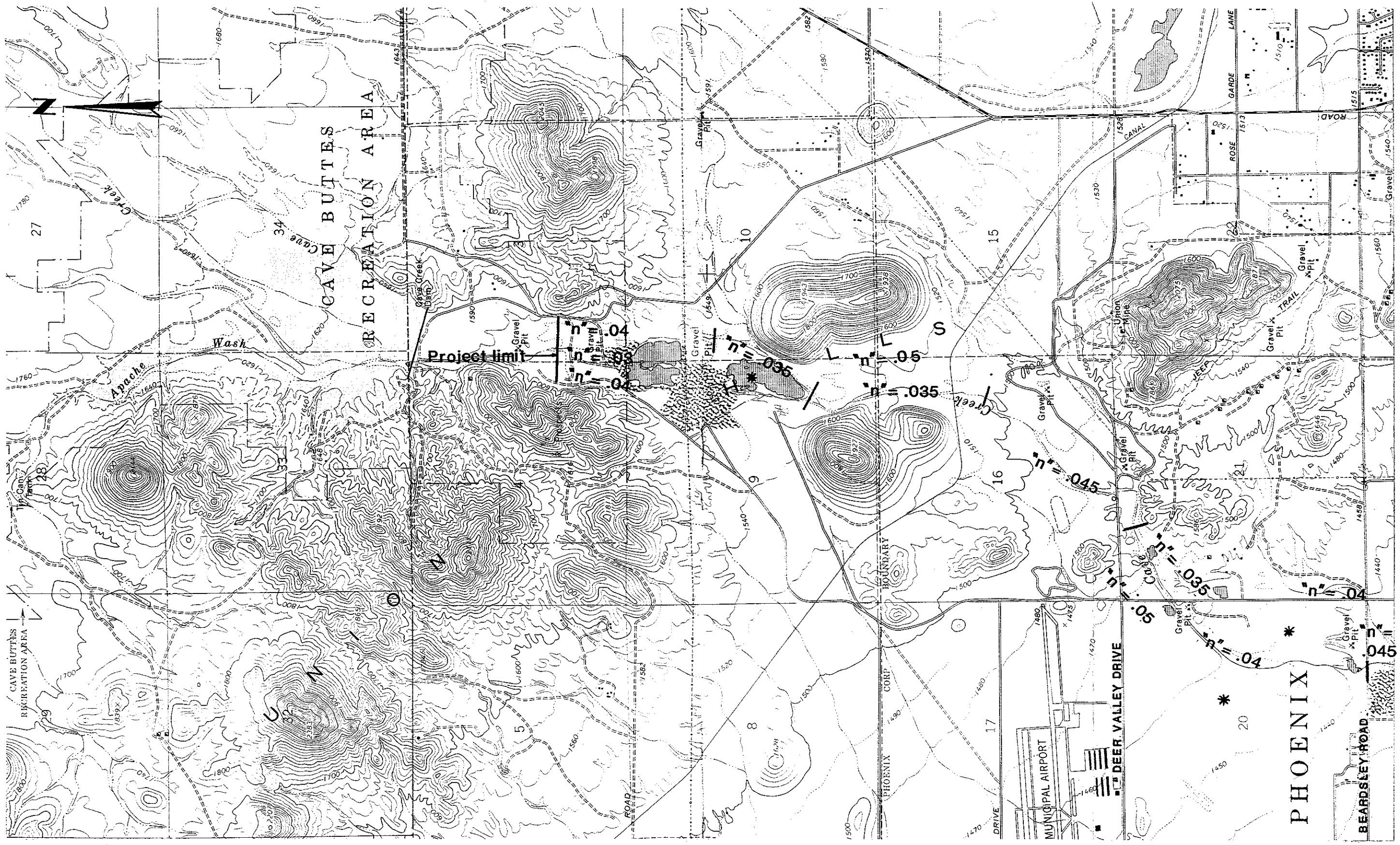
Photo No. 23 (8911-09)
Looking upstream from Cactus Bridge.
"n" = .015 for concrete.

Photo No. 24 (8911-06)
Looking downstream from Peoria Bridge.
"n" = .015 for future concrete.



Gaging Station
PEORIA
SAHUARO DR
COCHISE DR
CHERYL DR
CINNABAR AVE
Peoria BM 1247
BM 1245
015
23D
Mountain View Sch
MOUNTAIN VIEW ROAD
Water Tank
North Mountain Hospital
Sunnyslope Sch
26
30
29
Well
BM 1236
ARIZONA CANAL
HATCHER ROAD
BM 1235
BM 1233
Project limit
Trailer Park
Deer Valley Filtration Plant
DUNLAP AVE
EVA ST
Lincoln Hosp
Sunnyslope Park
Shopping Center
Sunnyslope High Sch
30TH AVE
28TH AVE
ALICE AVE
DANA AVE
BUTLER
FREEWAY LANE
LAWRENCE LANE
Alicia Park
Royal Palm Sch
Desert View Sch
35
36
31
32
ECHO LANE
GRISWOLD RD
Royal Palm Park
ROYAL PALM DR
BM 1208
Drive-in Theater
Washington Sch
Good Shepherd Convent
NORTHERN AVE
HARMONT
AUGUSTA
HAYWARD AVE
BELMONT
BM 1195
HIGHWAY
MORTEN
Water Tank
FRIER
KALER DR
ORANGEWOOD AVE
Orangewood Sch
NORTHVIEW AVE
MYRTLE
GLENDALE AVE
Bethel Sch
Fire Station
Washington High Sch
24TH DR
OCOTILLO ROAD
TUCKEY
LAMAR RD
Radio Towers (KPHO)
MC LELLAN BLVD
Washington Park
St Simon and Jude Sch
Maryland Ave Sch
Lutheran
Trailer Park
Madison Meadows Sch
Phoenix Jr College (Glendale Extension)
Water Tank
BM 1166
Black Canyon Golf Course
Chris-Town Golf Course
MARYLAND AVE
MARLETTE
ROSE LANE
KEIM DR
BERRIDGE LANE
Hosp
ROVEY AVE
Bethany Bible Sch
Grace Brethren Sch
BETHANY HOME ROAD
Montebello Sch
RANCHO DR
Chris-Town Mall
MONTEBELLO AVE
SAN MIGUEL AVE
SAN JUAN AVE
LUKE
BLACK CANYON
Solano Sch
Solano Park
MARSHALL AVE
MISSOURI AVE
Simpson Sch
DENTON LANE
GEORGIA AVE
PHOENI
OREGON AVE
COLTER ST
MEDLOCK DR
Westwood Christian Sch
CAMELBACK ROAD
Shopping Center
Fire Station
Westwood Sch
Grandview Sch
PIERSON ST
HIGHLAND AVE
ELM ST
HAZELWOOD ST
COOLIDGE ST
Granada Sch
Brophy Prep Sch
GRAND
CENTRAL


N
"n" = .045
"n" = .04
"n" = .035
"n" = .015
"n" = .035
"n" = .035
"n" = .04
"n" = .015
Creek
Cave
Gravel Pit
Substation
Trailer Park
Water Tank
TURF PARADISE
Fuente Park
Morningside Park
Meadow Sch
MORNINGSIDE
Fire Station
Well
BM 1378
BM 1354
Bell 2
State Fish and Game Depot
Moon Valley Country Club
Moon Hill
Water Tanks
Shaw Butte
Tanks
PHOENIX
MOUNTAINS
North Mountain
DESERT
CHOLLA
DOVE
BLACK CANYON HIGHWAY
SWEETWATER
LAKESPUR
GREENWAY
BELL
19TH
27TH
ROAD
AVE
DR
VALLEY
MOON
GLENEAGLES
CANTERBURY
HUMMINGBIRD
SADDLE
BROADWAY
** Sediment basin "n"= .03



* Overbank is non-effective for flow