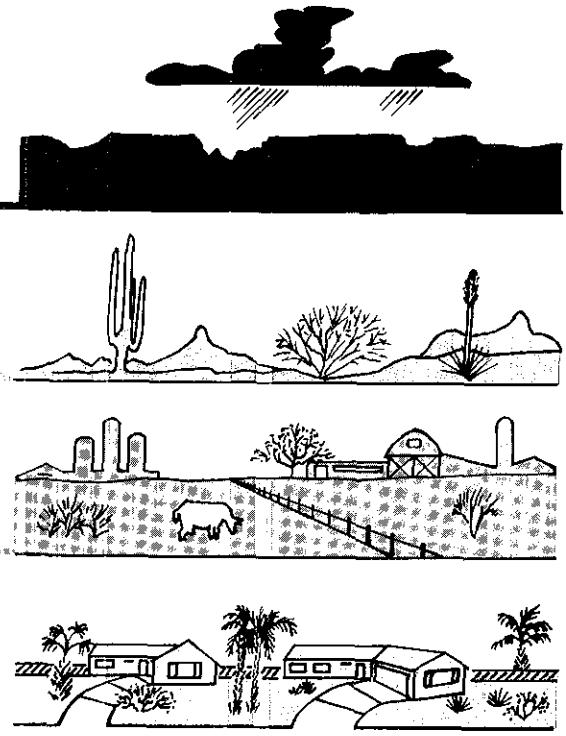

FLOOD CONTROL DISTRICT OF MARICOPA COUNTY

LITTLE SAN DOMINGO WASH
FLOOD CONTROL DISTRICT
OF
MARICOPA COUNTY

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LITTLE SAN DOMINGO WASH
FLOOD INSURANCE STUDY

Perpared by
Jan M. Farmer
Hydrologist

Flood Control District
of
Maricopa County

September 1989
Revised
January 1990

LITTLE SAN DOMINGO WASH
FLOOD CONTROL DISTRICT
OF
MARICOPA COUNTY

LITTLE SAN DOMINGO WASH

INTRODUCTION

PURPOSE OF STUDY

The purpose of this Flood Delineation Study was to investigate the existence and severity of flood hazards along the Little San Domingo Wash from the confluence with the Hassayampa River to the U.S. Highway 60, 70, & 80 crossing and to provide continuity to the existing floodplain delineation for Little San Domingo Wash upstream of U.S. Highway 60, 70, & 80.

AREA STUDIED

This flood delineation study is within the unincorporated area of Maricopa County along the Little San Domingo Wash from the confluence with the Hassayampa River to the U.S. Highway 60, 70, & 89 crossing.

COMMUNITY DESCRIPTION

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

Maricopa County has a total area of 9,238 square miles and is located in the south central region of Arizona. Total Maricopa County population in 1986 was estimated to be 1,863,900. The area is experiencing rapid population growth, having grown from 1,509,262 in 1980. In the vicinity of the study area is Morristown, a small community located along U.S. Highway 60, 70, & 89, established with scattered residences, a few cattle ranches, an industrial site, a general store, and a trailer park which is frequented by travelers during the spring.

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

PRINCIPAL FLOOD PROBLEMS

Moisture for storms during summer months generally originates in the Gulf of Mexico area and storms tend to be intense and of short duration, increasing the potential for a flash flood. Moisture for storms at other times of the year generally originates in the Pacific Ocean and storms tend to be more gentle rains of longer duration.

The watershed for the Little San Domingo Wash, is typified as arid, sub-tropical climate zone characterized by hot summers, mild winters and infrequent rainfall. Stream flow does not occur except during and immediately following rains.

The Little San Domingo Wash stream bed is composed of sand, gravel, and cobbles deposited over time from erosion of the mountains in the upper watershed, giving the wash its braided characteristics of a wide floodplain with multiple channels and multiple flow paths within these channels. The natural equilibrium of sediment movement downstream has been disturbed by construction of the U.S. Highway 60, 70, & 89. The Highway drop structure and the Santa Fe Railroad bridge which crosses the wash at the upstream portion of the study have increased degradation to the stream bed, within this portion of the study area. Additional development within the floodplain is a cattle ranch, a single engine airstrip, and two private residences within the downstream portion of the study reach.

ENGINEERING METHODS

HYDROLOGIC ANALYSES

Discharges for this study were taken from the Harris-Toups (Reference 5) study completed in 1976 for the upstream portion, of Little San Domingo Wash from U.S. Highway 60, 70, & 89 crossing at Morristown to approximately 0.7 miles upstream, (Reference 1). Peak discharge-frequency relationships were developed using the U.S. Soil Conservation Service (SCS) TR-20 program.

Summary of Discharges

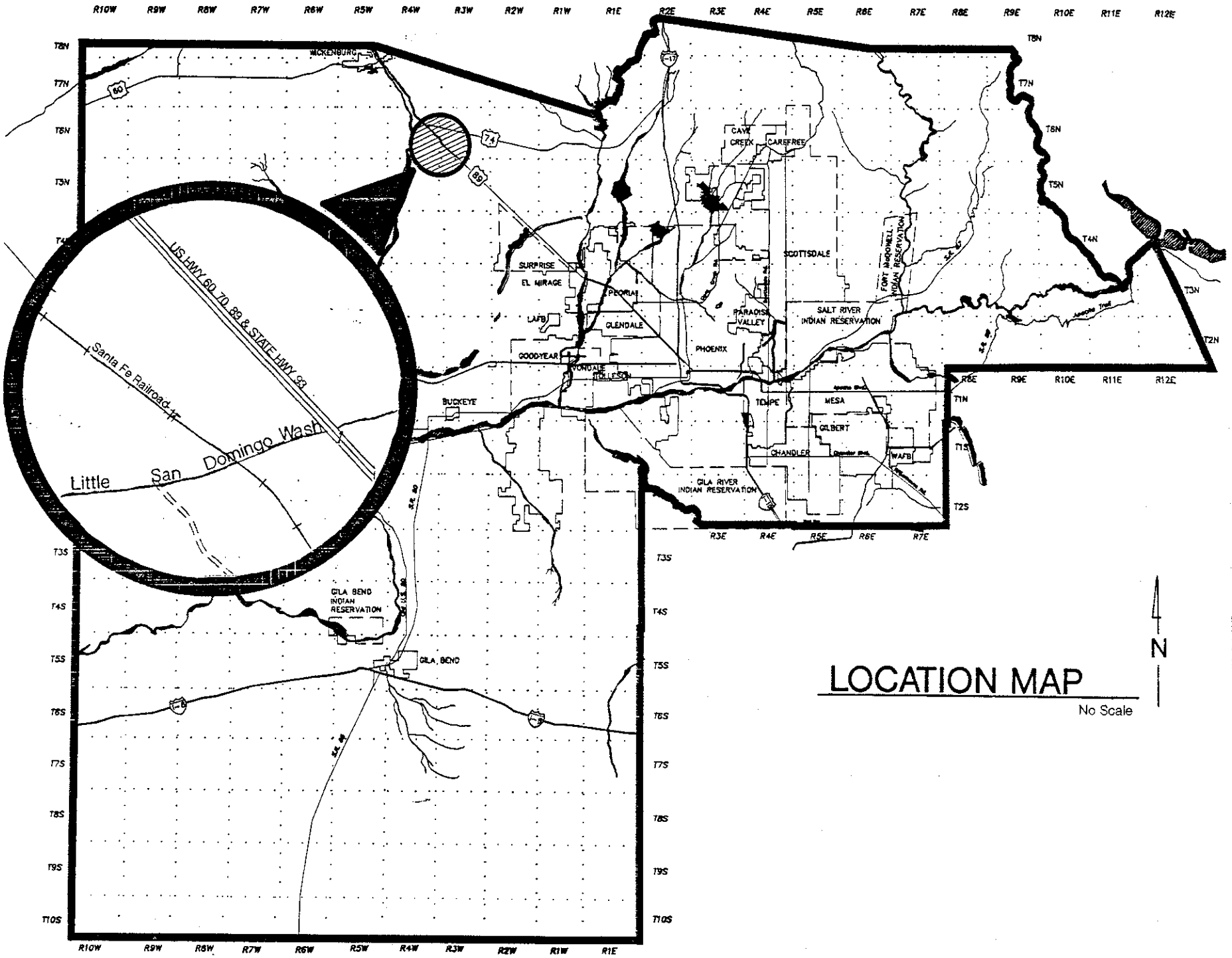
Flooding Source and Location	Peak 100-Year Discharge (cfs)
Little San Domingo At U.S. Highway 60, 70, & 80	3,090

HYDRAULIC ANALYSES

Standard hydraulic methods were used to determine 100-year recurrence interval flood hazards for this study. Analyses reported herein reflect current conditions of the Little San Domingo Wash from the confluence with the Hassayampa River to the U.S. Highway 60, 70, & 89 box culvert.

Cross sections for the backwater analysis of the Little San Domingo Wash were digitized from aerial mapping at 1:400 scale (Reference 2) with a contour interval of 2 feet. Cross section locations are shown on the Flood Boundary/Floodway Map (Exhibit 1).

Water surface elevations were computed using the Department of the Army, Corps of Engineers HEC-2 Water Surface Profiles computer program. The starting elevation at the confluence with the Hassayampa was determined by the "Area-Slope" method. Hydraulic roughness coefficients (Manning's "n") were selected on the basis of field reconnaissance, engineering judgement, and previous studies (Table 1).



LOCATION MAP

No Scale

An original hydraulic model is unavailable for the subject reach, therefore flood elevations for the 10-, 50-, and 500 year floods were not determined, as approved by the Project Officer.

All elevations used are referenced to the National Geodetic Vertical Datum of 1929. Locations of Elevation Reference Marks used in this study are shown on the maps (Exhibit 1) and described in the Elevation Reference Marks (Table 2).

FLOODPLAIN MANAGEMENT APPLICATIONS

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

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

FLOOD BOUNDARIES

In order to provide a national standard without regional discrimination, the 100-year flood has been adopted by the Federal Emergency Management Agency (FEMA) as the base flood for purposes of flood plain management measures. The boundary of the 100-year flood has been delineated using the flood elevations determined at each cross section; between cross sections, the boundaries were interpolated using topographic maps at a scale of 1:400 with a contour interval of 2 feet (Reference 2).

The boundary of the 100-year flood is shown on the Flood Boundary Map.

FLOODWAYS

Little San Domingo Wash is characterized by multiple channels and multiple flow paths within these channel, high hazardous velocities and erodible river banks. During the summer months when thunderstorms prevail over the area the Wash is also susceptible to flash flooding.

INSURANCE APPLICATION

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

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

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

LOCATION OF DATA

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

TABLE 1

Roughness Coefficient

Flooding Source	Manning's "n" overbanks	Manning's "n" channel	100-year Discharge (cfs)
Little San Domingo	0.045	0.030	3,090

TABLE 2

Elevation Reference Marks

REFERENCE MARK	ELEVATION (feet NGVD)	STATE PLANE - N -	COORDINATE - E -	DESCRIPTION OF LOCATION
RM1	1924.76	1,039,249.435	281,285.097	From the center of the RR bridge 2667 feet due east 1000 feet due south Monument Brass Cap.
RM2	1854.73	1,039,287.787	276,003.157	From the NE corner of a building with S.P.C. N=1,038,458 E=276,050; 825 feet due west Monument Brass

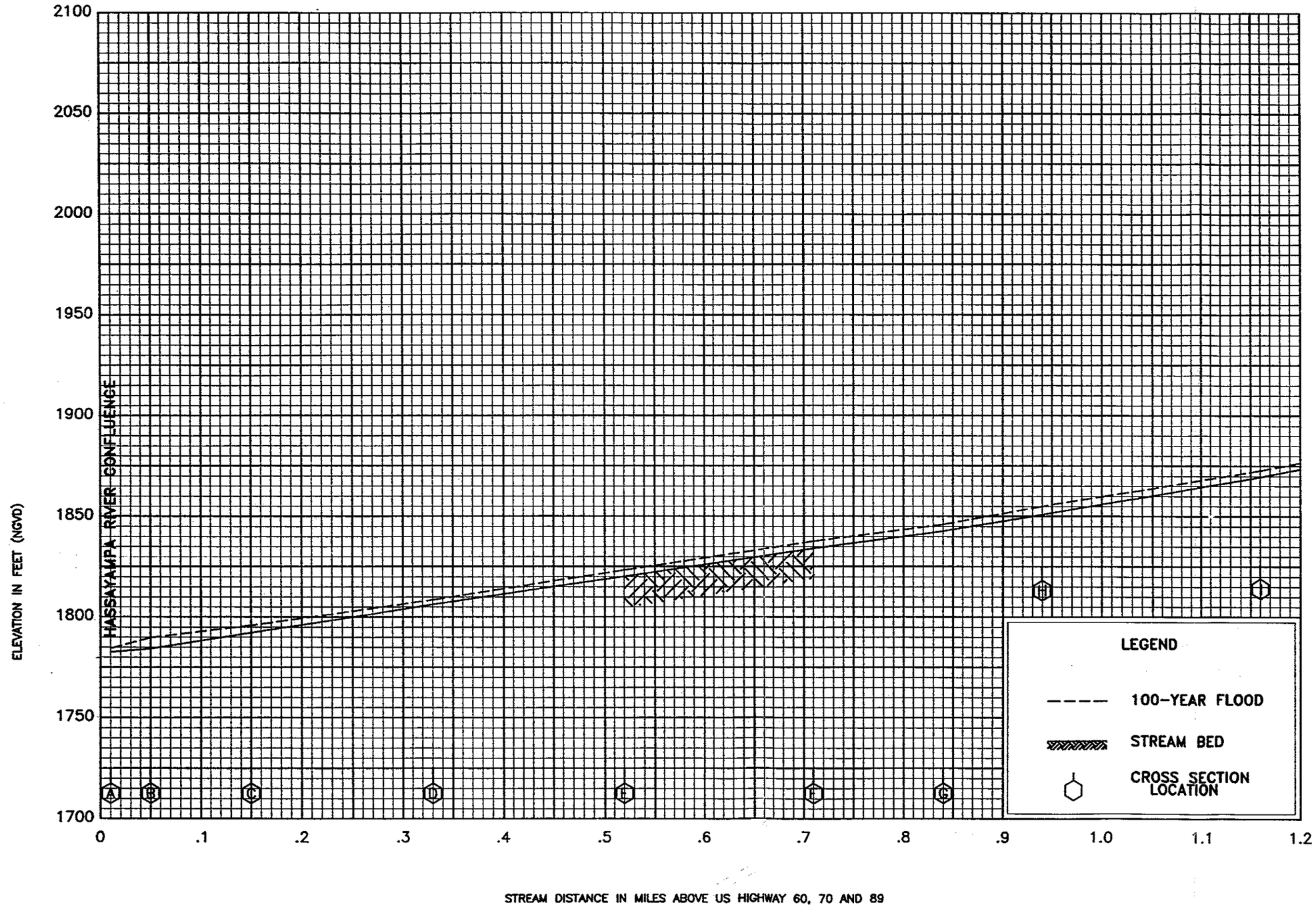
FLOODING SOURCE		FLOODWAY			BASEFLOOD			
X-SECTION	DISTANCE	WIDTH	SECTION AREA	MEAN VELOCITY	REGULATORY	WITHOUT FLOODWAY	WITH FLOODWAY	INCREASE
	MILES	FEET	SQ. FT	FT/SEC	FEET	FEET	FEET	FEET
A	0.01	331	745	4.1	1784.3	1784.3	1785.3	1.0
B	0.05	185	413	7.5	1789.7	1789.7	1789.8	0.1
C	0.15	161	401	7.7	1795.7	1795.7	1796.3	0.6
D	0.33	567	558	5.5	1808.4	1808.4	1809.4	1.0
E	0.52	244	411	7.5	1823.3	1823.3	1823.5	0.2
F	0.71	463	467	6.6	1837.5	1837.5	1838.1	0.6
G	0.84	258	415	7.5	1845.9	1845.9	1846.4	0.5
H	0.94	257	415	7.4	1854.9	1854.9	1854.9	0.0
I	1.16	219	427	7.2	1872.6	1872.6	1873.3	0.7
J	1.33	135	341	9.1	1888.9	1888.9	1889.0	0.1
K	1.42	134	341	9.1	1896.1	1896.1	1896.1	0.0
L	1.53	147	361	8.6	1906.2	1906.2	1906.8	0.6
M	1.74	286	436	7.1	1925.0	1925.0	1925.0	0.0
N	1.83	77	283	10.9	1934.7	1934.7	1934.7	0.0
O	1.85	77	283	10.9	1938.0	1938.0	1938.0	0.0
P	1.86	94	432	7.2	1939.8	1939.8	1939.8	0.0
Q	1.93	48	241	12.8	1944.8	1944.8	1944.8	0.0
R	1.97	53	321	9.6	1947.6	1947.6	1947.6	0.0

FEDERAL EMERGENCY MANAGEMENT AGENCY

MARICOPA COUNTY, AZ
AND INCORPORATED AREAS

FLOODWAY DATA

LITTLE SAN DOMINGO WASH

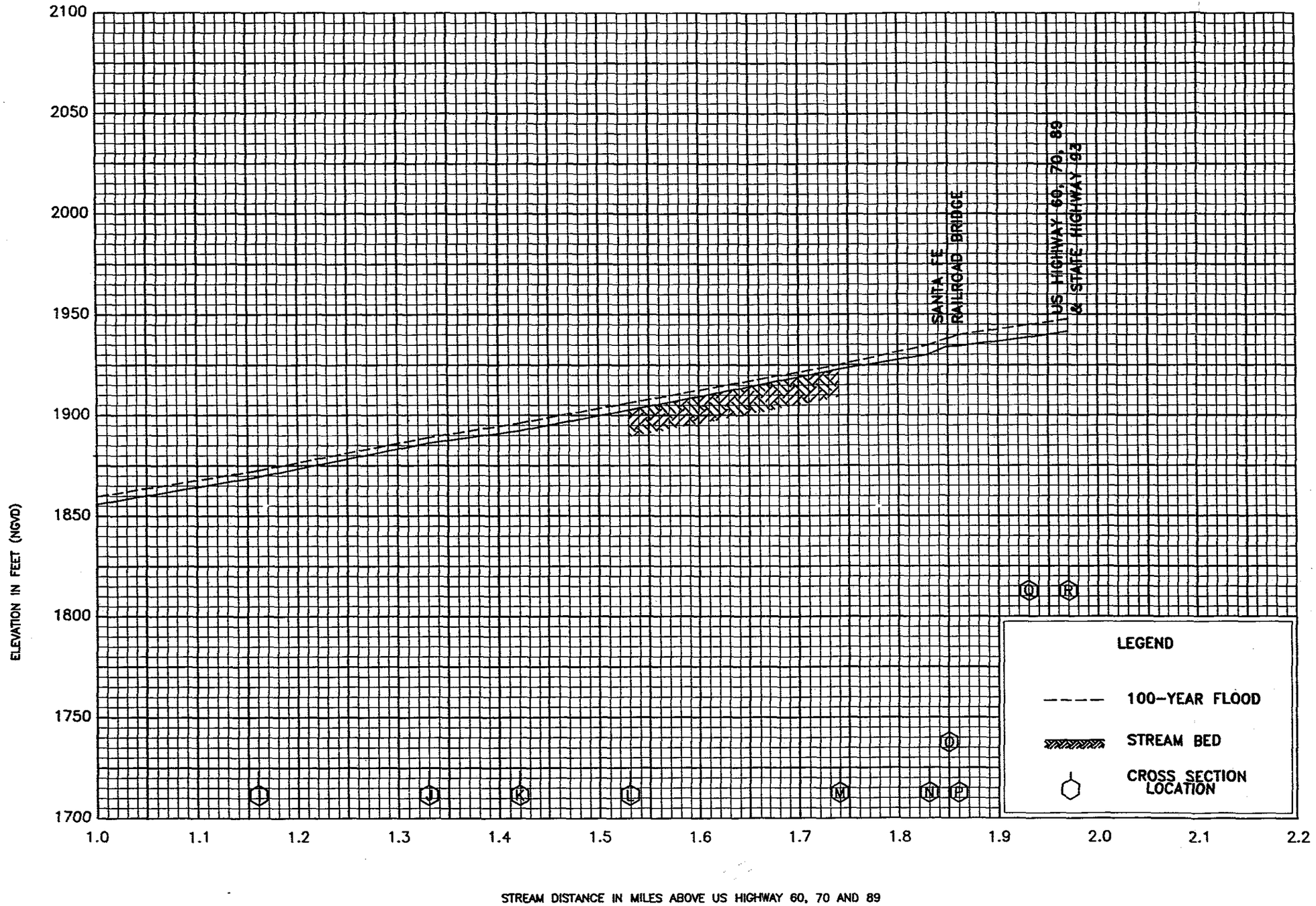


FLOOD PROFILE

LITTLE SAN DOMINGO WASH

FEDERAL EMERGENCY MANAGEMENT AGENCY

MARICOPA COUNTY, AZ
AND INCORPORATED AREAS



FLOOD PROFILE

LITTLE SAN DOMINGO WASH

FEDERAL EMERGENCY MANAGEMENT AGENCY

MARICOPA COUNTY, AZ
AND INCORPORATED AREAS

BIBLIOGRAPHY AND REFERENCES

1. Cella Barr Associates, Phoenix, Arizona, Hydrologic Analysis of the Hassayampa River in Maricopa County, Arizona, for Federal Emergency Management Agency, May 2, 1988.

2. Cooper Aerial Survey Co., Topographic Maps, Scale 1:400, Contour interval 2 feet, Little San Domingo Wash, August 1987.

3. Federal Emergency Management Agency, Federal Insurance Administration, Flood Insurance Study Guidelines and Specification for Study Contractors, September 1985.

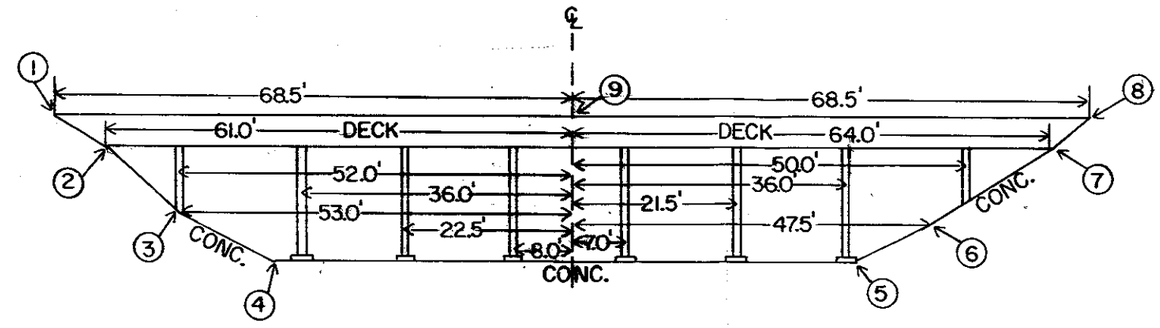
4. Federal Emergency Management Agency, Flood Insurance Study, Maricopa County, Arizona, Effective April 15, 1988.

5. Harris-Toups Associates, Little San Domingo, Flood Insurance Study, February 1977.

6. U.S. Department of the Army, Corps of Engineers, Hydrologic Engineering Center, HEC-2 Water Surface Profiles, Generalized Computer Program, Davis, California, October 1973.

7. U.S. Department of the Army, Corps of Engineers, Hydrologic Enginnering Center, Floodway Determination, Using Computer Program HEC-2, Training Document No. 5, Davis, California, January 1988.

R.R. BRIDGE 1" = 20'



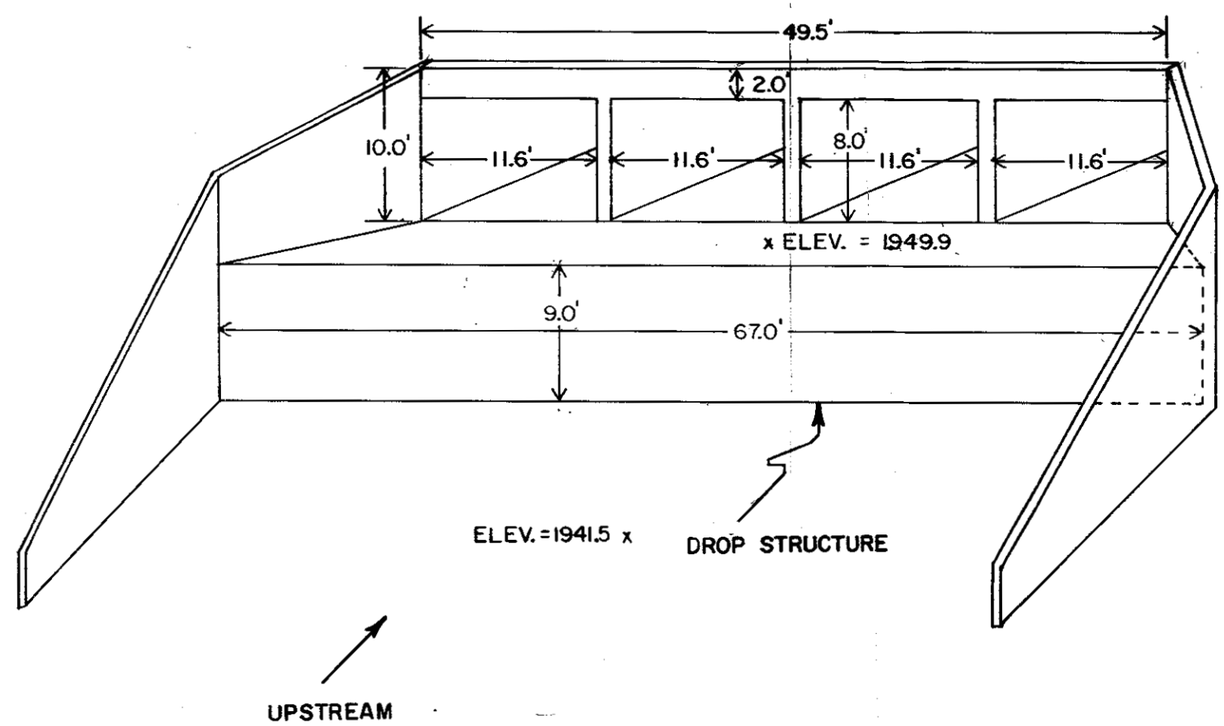
*	1	1952.8
**	2	1949.1
	3	1945.3
	4	1934.2
	5	1934.6
	6	1943.0
**	7	1949.8
*	8	1953.6
	9	1953.0

* Top of Deck

** Bottom of Deck
Low Cord

ROAD CULVERT 1" = 10'

ELEV. AT TOP OF ROAD = 1976.8



Contract No. FCD-85-9

LITTLE SAN DOMINGO WASH, T6N R4W Sec. 13, Date 6-8-87, Sheet 1 of 2

State of Arizona

DEPARTMENT OF WATER RESOURCES

15 South 15th Avenue, Phoenix, AZ 85007

, Governor
, Director

LETTER OF TRANSMITTAL

To: Jan Farmer, Hydrologist
Flood Control District of Maricopa County
3335 W. Durango St.
PHOENIX, AZ 85009

Attention:

Date: 5-11-90

File Name: mcfcd lsd.

Greetings:
We are sending you the following items by:

___ Drawings
X Copy of Letter
___ Other
___ Prints
___ Change Order
___ Plans
___ Specifications
___ Samples

Copies	Date	Description
1	5-9-90	Comment Memo - Little San Domingo

FLOOD CONTROL DISTRICT
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MAY 15 '90

	CH ENG		P & RW
	DEP		HYDRO
	ADMIN		EMGT
	FINANCE		EDP
	C & O	1	
	ENGR	2	

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These are transmitted as checked below:

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X For your use
X As requested
___ For review & comment
___ Approved as submitted
___ Approved as noted
___ Returned for corrections
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___ Resubmit ___ copies for approval
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Remarks Per our discussion of 5/8/90

Copy To: File

Signed: D. E. Creighton, Jr.
Engineering Division
Flood Management Section
(602) 542-1541

Think Conservation!

Office of Director 255-1554
Administration 255-1550, Water Resources and Flood Control Planning 255-1566, Dam Safety 255-1541,
Water Rights Administration 255-1581, Hydrology 255-1586.

DEPARTMENT OF WATER RESOURCES
ENGINEERING DIVISION
FLOODPLAIN MANAGEMENT

File: mcfcd.lsd

MEMORANDUM

TO: James R. Morris, P.E.

FROM: David E. Creighton, P.E.

DATE: May 9, 1990

SUBJECT: Review of FCEMC Little San Domingo Wash Hydraulics (HEC-2) FIS, January 1990 draft report.

Quick review of subject material has been made. The following comments are for the text, topographic map showing cross-section locations, and the HEC-2 input and summary listing for subcritical direction (J-1, IDIR = 0) runs to produce the floodplain standard summary and the floodway data summary.

An agency regulatory goal to reduce the alluvial wash "floodplain" available for possible unwise development to a minimum needs to be supported by a rational and technically supportable modelling. The integrity of the alluvial wash bottom fill, overbank limits, intermediate ridging, and overbank lows need textual support for assigning stability to ridging (possible calcareous cementing of the terrace deposits and erosional deposition) that appears to separate the main channel from the south overbank low near the east valley terrace slope (the airstrip location).

1. Community Description

The location of Morristown should be more specifically related to the approximate 2 mile length of channel between the Hassayampa River and the US 60 Highway crossing about 2,000 feet northwest of downtown Morristown. Recheck for proper US and Arizona Highway Route numbers.

2. Principal Flood Problems

Moisture source identification might be improved and clarified for this watershed to emphasize the east Pacific tropical influence ahead of the Gulf of Mexico influence. The duration of about 1 hour to 6 hours with the peak intensities during about 3 to 4 hour duration storms would be more compatible with the Hartman Wash, Ox Wash, Jackrabbit Wash, and Hassayampa River near Morristown gaging station records. The Sept 10, 1984 Hassayampa-Morristown discharge of 26,700 cfs with a mean daily flow of 1560 cfs (3094 AF) apparently is one example of a short duration, intense rainfall concentration not recorded at established stations. Aguila, Buckeye, Castle Hot Springs, Griggs, Tonopah, Walnut Grove, Wickenburg, and Youngtown all recorded less than 1" for this USGS reported date.

The re-use of the 3090 cfs value from a preceding study attributed to Harris Toups (1976) with TR-20 program suggests that the watershed CN numbers commonly used prior to the desert vegetation community values revised downward in TR-55 from the values commonly derived from the ADOT Hydrologic Design Manual (1969) Figure 2-3 probably results in an overstated Q100 value. Other more recent studies also undergird a feeling that a Q100 of 498 csm is on the high side.

3. Hydraulic Analysis

Topographic Mapping- The Little San Domingo Wash 1.975 mile length of channel is constricted at the upper end by its entrenchment through the gravelly terrace materials. Attention should be paid to the ridge lines and their extensions into the wash bottom area where they appear to create flow dividing barriers which complicate the modeling when cross-sections are too far apart and intermediate sections should be inserted. This is particularly sensitive between sections 0.94 to 1.16, and 1.16 to 1.33.

The pre-designation of cross-sections on the aerial photographs as a limiting to identify locations for digitized takeoff during the map plotting has for this channel resulted in too few cross-sections. This nees to be remedied by several intermediate sections. Interpolation by computer program is not adequate because there are longitudinal ridges in the floodplain which probably preclude overtopping and overbank flow. Thi's may create an impression of islands.

The use of the Split Flow Option and intermediate cross-sections should be made. Suggested locations are shown on Figure 2 which was marked up to longitudinal ridging. The marked up copy was taken by Ms. Farmer on May 8 following a discussion of suggested changes, option methods, topographic interpretation, flood plain management goals, and documentation. The Divided Flow in remote depressed overback areas needs to be clarified by use of Split Flow option and intermediate cross-sections.

4. HEC-2 Printout and Analysis

With 51 error warning messages (EM) total for the 18 model cross-sections, a quick analysis of the meaning and sources of the modelling error output messages shows that the channel slope, distance between cross-sections, and low overbank separated areas, and velocities have inter-related responsibilities in addition to the FEMA stance that all runs are to be based on sub-critical direction. Check the HEC-2 manual identification and diagnostic problems causing the error messages.

The following lists the EM and their frequency:

EM#	Number	EM#	Number	EM#	Number
3265	8	3280	1	3301	5
3420	1	3470	1	3495	2
3685	3	3693	3	3720	15
5227	1	7185	11		

EM 7185 - at 11 total, with 4, and 7 consecutive, states flatly that for 3 consecutive times, the model should be run supercritical rather than subcritical. IDIR has been incorrectly instructed.

EM 3420 - at 15 total, with 6, and 8 consecutive, states that critcal WSEL had to be assumed because the velocity was coming out supercritical but the instructions were subcritical.

EM 3265 - at 8 total, 6 consecutive, the Divided Flow in association with the other error messages indicates closer review and possible modification of cross-sections is desirable.

EM 3301 - at 5 total, indicates HVINS is > 0.5, meaning too much variation between cross-section areas and velocity.

EM 3685 - at 3 says that the computer gave up after 20 tries and used a default instruction.

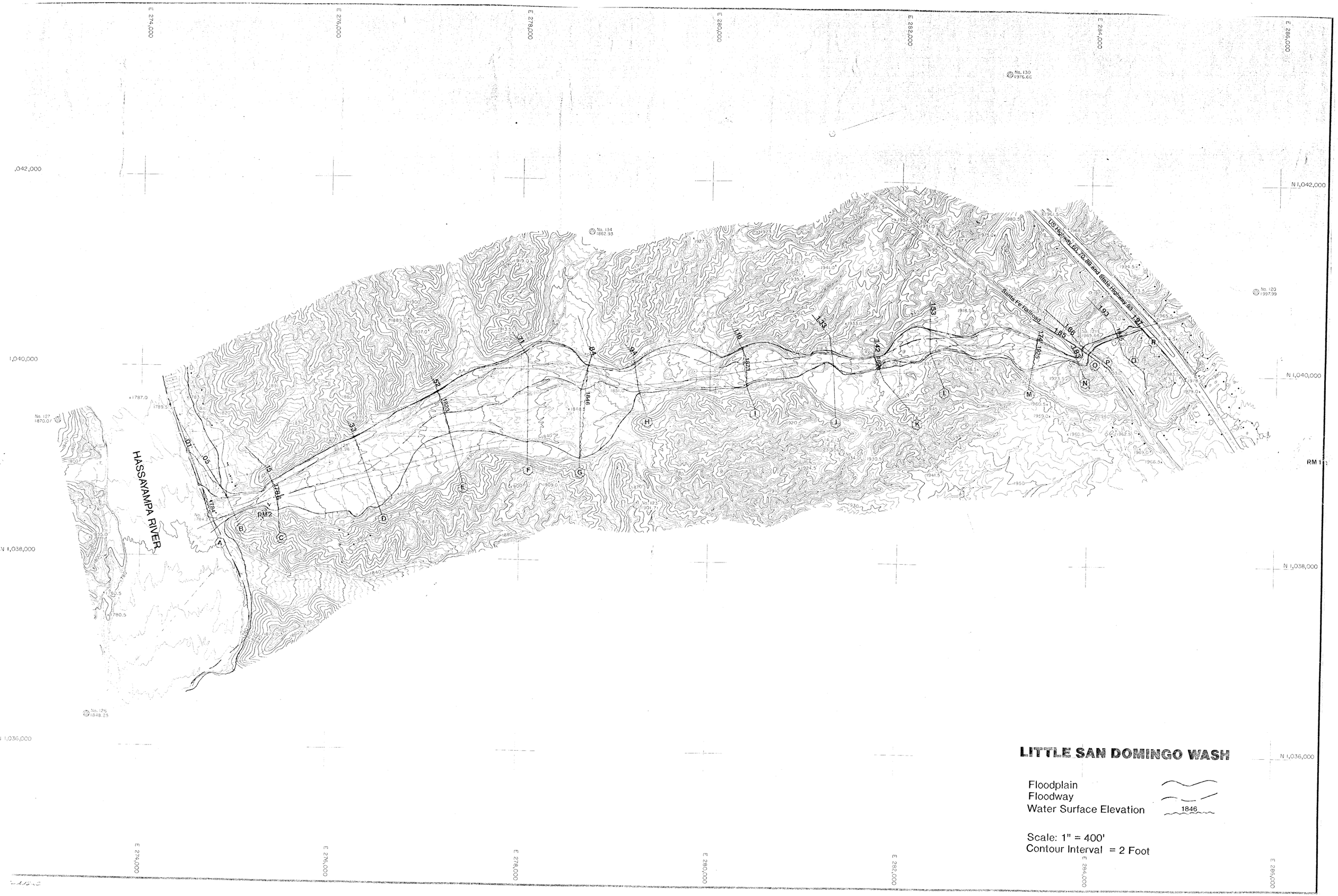
The Text and HEC-2 run IDIR - supercritical need to be clearly documented to put FEMA on notice that their subcritical direction standard is erroneous at times, which produces technically invalid or questionable results.

The cross-sections at the bridge are not located at normal HEC-2 section conventions for expansion and contraction distance ratios.

The EDIT program may assist in checking the elevation and distribution of Divided Flow between channels. Was there really communication to the channel-overbank, or was it due to the nature of the HEC-2 program to fill up the low spaces without communication of split-flow overtopping?

Little Sm Domingo

	SUP WSEL	SUB WSEL	SUP EG	SUB EG	SUP VCH	SUB VCH
1.970	1946.24	1947.8	1948.6	1949.2	12.43	9.3
1.93	1944.8	1947.1	1947.4	1948.2	12.83	8.7
1.87	1944.21	1944.2	1946.8	1946.8	12.94	13.02
1.86 Bridge	1943.78	1939.8	1944.01	1940.6	3.8	7.2
1.85	1936.25	1938.	1943.2	1939.9	21.15	10.9
1.83	1933.7	1934.7	1937.2	1936.5	15.02	10.8
1.74	1924.9	1924.9	1925.7	1925.7	7.3	6.9
1.53	1906	1906.2	1907.	1907	9.1	8.07
1.42	1895.7	1896.1	1897.5	1897.3	10.85	9.04
1.33	1888.6	1888.9	1890.1	1890.	9.8	8.9
1.17	1882.1	1882.3	1883.9	1883.9	10.9	10.1
1.16	1871.9	1872.5	1873.9	1873.2	13.5	8.1
.96	1866.7	1866.8	1867.7	1867.7	8.32	7.8
.95	1859.6	1859.6	1860.3	1860.3	6.63	7.6
.94	1854.9	1854.9	1855.6	1855.6	7.09	7.2
.85	1850.5	1850.5	1851.1	1851.1	4.47	5.1
.84	1845.5	1845.9	1846.5	1846.3	8.9	5.8
.71	1837.6	1837.5	1838.1	1838.1	5.2	5.9
.52	1823.2	1823.3	1823.9	1823.9	6.5	6.76
.33	1808.4	1808.4	1808.9	1808.9	7.6	8.09
.15	1795.6	1795.7	1796.4	1796.5	8.5	8.9
.05	1789.57	1789.7	1790.4	1790.5	8.6	8.6
.01	1783.9	1784.3	1785.2	1784.7	9.7	5.7



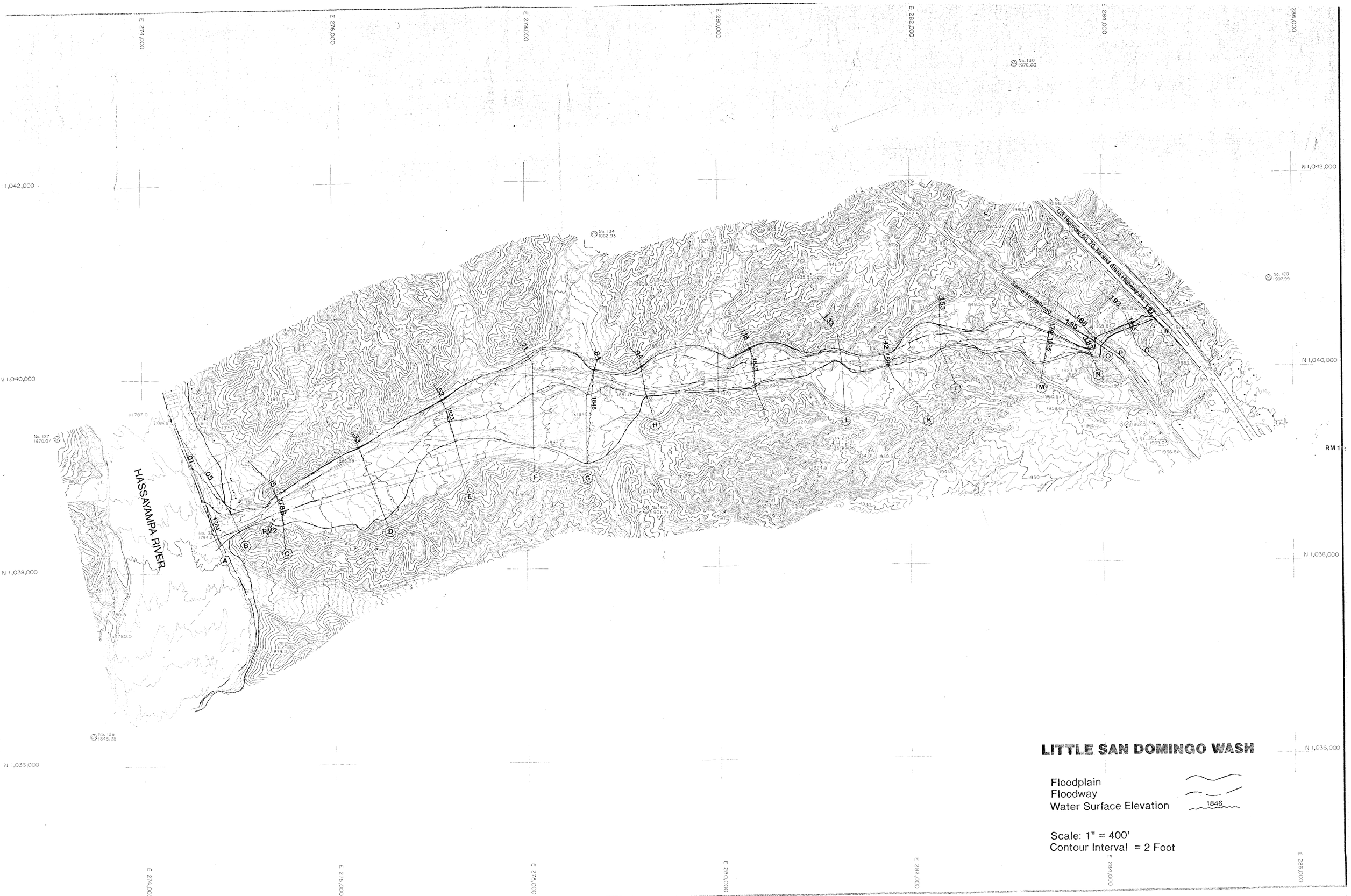
MARICOPA COUNTY FLOOD CONTROL DISTRICT, "LITTLE SAN DOMINGO WASH", Scale: 1" = 400', C.I.: 2', Photo Date: 6-10-87, Sheet 1 of 1, (C.A.S. No. 870621).

LITTLE SAN DOMINGO WASH

Floodplain
Floodway
Water Surface Elevation 1846

Scale: 1" = 400'
Contour Interval = 2 Foot

MARICOPA COUNTY FLOOD CONTROL DISTRICT, "LITTLE SAN DOMINGO WASH", Scale : 1" = 400', C.I: 2', Photo Date: 6-10-87, Sheet 1 of 1, (C.A.S. No. 870621)



MARICOPA COUNTY FLOOD CONTROL DISTRICT, "LITTLE SAN DOMINGO WASH", Scale: 1" = 400', C.I: 2', Photo Date: 6-10-87, Sheet 1 of 1, (C.A.S. No. 870621)