

**PHOENIX FLOOD DAMAGE
SURVEY**

FEBRUARY 1980

PUBLISHED BY

U. S. ARMY CORPS OF ENGINEERS

LOS ANGELES DISTRICT

APRIL 1981

FCD COPY

Property of
Flood Control District of MC Library
Please Return to
2801 W. Durango
Phoenix, AZ 85009

Phoenix Flood Damage Survey February 1980

FLOOD CONTROL DISTRICT
RECEIVED

APR 27 '81

CH ENG	HYDRO
ASST	LMgt
ADMIN	SUSP
C & O	FILE
ENGR	DESTROY
REMARKS	



US Army Corps
of Engineers
Los Angeles District

*Extra
FD-22*

U.S. ARMY CORPS OF ENGINEERS

LOS ANGELES DISTRICT

FLOOD DAMAGE SURVEY

PHOENIX, ARIZONA

FEBRUARY 1980

April 1981

TABLE OF CONTENTS (Continued)

TABLES

<u>Tables</u>		<u>Page</u>
1	Major Storms in Arizona, February 1980	6
2	Peak Discharges for February 1980	9
3	Estimate of Disaster Relief Funds Committed Statewide	16
4	American Red Cross Direct Aid to Flood Victims in Maricopa Co.	17
5	Summary of All Flood Damages	27

PLATES

Plates

1	Index Map, Phoenix Vicinity
2	Isohyetal Map, Central Arizona
3	Mass Rainfall Curves
4	Flood Hydrographs, Salt and Verde Rivers
5	Flooded Area - Granite Reef Dam to Gilbert Road
6	Flooded Area - Gilbert Road to Alma School Road
7	Flooded Area - Hayden Road to 40th Street
8	Flooded Area - 40th Street to 19th Avenue
9	Flooded Area - 19th Avenue to 67th Avenue
10	Flooded Area - 67th Avenue to 115th Avenue
11	Flooded Area - 115th Avenue to (just east of) Cotton Lane
12	Flooded Area - Cotton Lane to Airport Road
13	Flooded Area - Airport Road to Buckeye Road/(80)
14	Flooded Area - Beardsley Canal to Rose Garden Lane
15	Flooded Area - Rose Garden Lane to Peoria Avenue
16	Flooded Area - Peoria Avenue to Roosevelt Canal
17	Flooded Area - Thomas Road to Gila River

I. INTRODUCTION

A. AUTHORITY. This report is submitted under the authority of the Flood Control Act of 1938 (PL 75-761) which provided for a survey for flood control on the "Gila River and tributaries, Arizona and New Mexico."

B. SCOPE. This report is an assessment of damages in Maricopa County resulting from the flood disaster of February 13-22, 1980. The damages are restricted to those caused by inundation or erosion by flood water and by flood-transported debris within the Phoenix Metropolitan Area. Direct rain and wind damages are excluded.

C. BACKGROUND. The Phoenix Metropolitan Area is located within the valleys of four major rivers. The Salt River flows through the southern part of the urbanized area. The Agua Fria and Verde Rivers flow from the north and constitute the western and northeastern boundaries of the area. The Gila River flows through the southwestern portion of the metropolitan region and receives the flow of the Salt and Agua Fria Rivers. The Gila River then continues westward toward the Colorado River. The area drained by these rivers extends as far north as the San Francisco Peaks, east to the Continental Divide in New Mexico, and south into Mexico. Most of the rivers would flow continuously through the Phoenix Metropolitan Area were it not for major upstream dams and reservoirs. These dams are designed and operated primarily to capture surface water for water supply, and as a result, the Salt, Agua Fria and Gila River beds in the Phoenix Metropolitan Area are normally dry.

Only the major thoroughfares bridge the Salt River, and only a few of these crossings are designed to withstand major floods. Other crossings, both at the major rivers and at numerous washes throughout the valley, use dip crossings in the river beds. Numerous sand and gravel operations are located in the floodways of the Salt and Agua Fria Rivers. Outside the river beds, urban development has encroached on the flood plains over the last several decades because of both intense development pressure in the area and the low perception of flood hazards. The Gila and Agua Fria River flood plains also contain prime agricultural land, irrigated in part by flows diverted from the rivers. Few areas along the major floodways are protected by dikes, levees, or channels of any sort. Floodproofing is uncommon.

D. SUMMARY. The Salt River Project reported a peak of 170,000 cfs over the Granite Reef Dam during the February 1980 flood. On the Agua Fria River, discharges peaked at 66,000 cfs. For comparison, the flows during the March and December 1978 floods were estimated at 122,000 cfs and 140,000 cfs respectively. The most severe hydrologic event on the Salt River occurred in 1891 with an estimated flow of 300,000 cfs.

This report documents the damages caused by the flooding in the Phoenix Metropolitan Area during February 1980, as well as the events which led to the flooding. The storms and floods are detailed in terms of

precipitation and runoff. In addition, general descriptions of the disaster area and the function and response mechanism of public assistance programs are included.

Plates 5-17 outline the flood overflow boundaries on the Salt, Gila, and Agua Fria Rivers. The Corps of Engineers based these boundaries on aerial photographs taken during the floods. As with all of the information in this report, these plates represent a preliminary assessment.

1980 flood damages totaled \$63.7 million for the Phoenix Metropolitan Area.

II. GENERAL DESCRIPTION OF DISASTER AREA

A. DISASTER DECLARATION. Governor Babbitt declared a state of emergency on February 15, 1980, in Maricopa, Gila, and Yavapai Counties. On February 19, 1980, President Carter declared these counties major disaster areas.

B. LOCATION. The damages addressed in this report occurred in the greater Phoenix Metropolitan Area, located in south central Arizona. The specific areas assessed include the flood plains of the Salt, Gila and Agua Fria Rivers within the boundaries of the Phoenix Metropolitan Area (see plate 1). Damages along the Salt River are recorded from Granite Reef Dam west to its confluence with the Gila River near 115th Avenue. Damages along the Gila River are recorded from 115th Avenue west to U.S. Highway 80 near the Town of Buckeye. Damages along the Agua Fria River are recorded from Lake Pleasant south to the Gila River confluence.

C. CLIMATE. Most of the drainage area has an arid, subtropical climate, characterized by hot summers, mild winters, and infrequent rainfall. Summer thunderstorms, of high intensity but short duration, normally account for around half of the annual rainfall but are responsible for much less than half of the annual volume of runoff. In the higher elevated portions of the drainage area, the climate is somewhat cooler, with greater precipitation and considerable snow during the winter months.

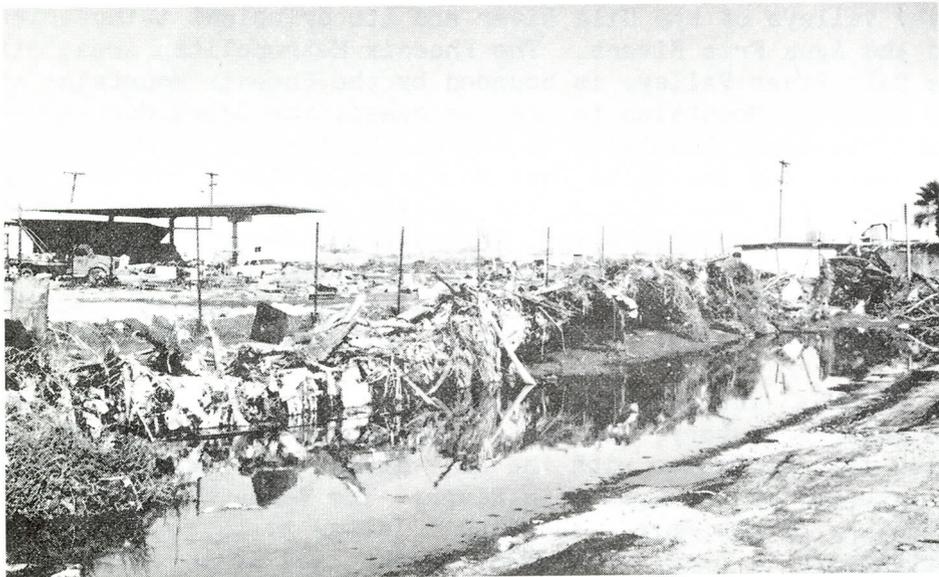
D. TOPOGRAPHY. Cities and towns in Maricopa County are located in the river valleys of the Gila River and its principal tributaries, the Salt and the Agua Fria Rivers. The Phoenix Metropolitan Area, situated in the Salt River Valley, is bounded by the Phoenix Mountains to the north, the McDowell Mountains to the northeast, the Utery Mountains to the east, the South Mountains to the south, the Sierra Estrella to the southwest, and the White Tank Mountains to the northwest. Only to the southwest and southeast do the rolling desert plains of the metropolitan area continue uninterrupted. The highest elevation in the County is Four Peaks (7,657 feet) in the Mazatzal Mountains which are divided by Maricopa and Gila Counties. The Salt River flows into the Gila River southwest of central Phoenix at an elevation of 925 feet.

E. RIVERS. The principal rivers in Maricopa County are the Gila and its major tributary, the Salt. The Agua Fria River joins the Gila River below its confluence with the Salt River. New River and Skunk Creek are tributaries of the Agua Fria River. The Verde River is the major tributary of the Salt. Additional inflow to these watercourses is contributed by numerous washes, creeks, and urban runoff.

F. CANALS. In addition to the natural watercourses, the metropolitan Phoenix area is crisscrossed by canals which deliver water from the Salt and Agua Fria Rivers to urban areas and the agricultural areas west and southwest of the central city.



The Salt River inundated the southeast end of Sky Harbor International Airport causing the closure of the south runway.



Debris along a fence on East Magnolia Street gives an indication of the level of flood waters from the Salt River.

III. STORMS OF FEBRUARY 13-22, 1980

A. METEOROLOGY.

The middle and late winter of 1979-1980 was characterized by a prominent low latitude storm track across the eastern Pacific Ocean and a series of recurrent low pressure centers just west of the southern California and Baja California coast. These factors combined to bring unusually large amounts of warm rain to most of Arizona from late December 1979 through March 1980. The pattern was especially severe during the period of February 13-22, when six major storms--one almost immediately following another--moved into the State from out of the southwest, each accompanied by a strong flow of warm, moist, tropical air from the equatorial Pacific. These conditions resulted in widespread heavy rainfall over large portions of Arizona, and the pronounced orographic uplift of the rapidly moving moist air over the mountains of central and eastern Arizona led to extremely heavy rain over certain high elevation terrain. Because of the persistence of the warm air masses, snow levels throughout the storm period remained generally around 7,000 to 8,000 feet or higher.

A detailed meteorological description of the February 1980 storm period, with an additional discussion and evaluation of National Weather Service forecasts issued and procedures enacted at the time of the events, can be found in the report entitled "The Natural Disaster Survey Report on the Disastrous Southern California and Central Arizona Floods, Flash Floods and Mudslides," prepared by the U.S. Department of Commerce, NOAA, National Weather Service, Silver Spring, Maryland (unpublished as of April 1, 1981).

Both the large scale meteorological patterns and the resultant precipitation over Arizona were very similar in many respects to those associated with the storms of February-March 1978, November 1978, December 1978, and January 1979. These patterns in turn appear to be at least partially associated with significant anomalies in the sea surface temperatures across the northeast and equatorial Pacific Ocean that persisted from late 1977 through the summer of 1980.

B. PRECIPITATION

Total precipitation during the storm period of February 13-22, 1980 ranged from less than one inch in a few portions of northeastern and far southwestern Arizona to more than 13 inches at several of the higher mountain locations in the central part of the State. Crown King (elevation 5,920 feet), in the Bradshaw Mountains northwest of Phoenix and south of Prescott, measured 16.63 inches for the 10-day period, and a large portion of central and east central Arizona received more than 7 inches. Rainfall in the Phoenix metropolitan area was generally around 1.5 to 2 inches in the southern sections and 3 to 4 inches in the northern foothills. These rainfall patterns can be seen on plate 2, which is an isohyetal analysis of the total February 13-22 precipitation in Arizona. (This plate was reproduced with permission of the National

C. RUNOFF

Runoff from the storms of February 13-22, 1980 was especially heavy in central Arizona, and the greatest discharges of modern record occurred on the Salt, Verde, Agua Fria, and Gila Rivers in the Phoenix metropolitan area, as well Oak Creek in north central Arizona. Considerable flooding occurred on portions of these rivers. Because there were no extremely high intensity, short duration bursts of rain (e.g., rates of several inches per hour for durations of two hours or less, as are observed in some of the heaviest summer thunderstorms), there was relatively little flooding on any of the smaller creeks and washes in Arizona during February 1980.

Most rivers in Arizona experienced several separate peaks in the discharge rates during the course of the February 1980 storm and flood events. These correspond for the most part to the various major storm events listed in table 1. The largest of these discharges generally occurred immediately or shortly following the pair of major storms of February 13-15 and/or the heavy storm of February 19-20. (There had also been high discharges on a number of Arizona streams at the end of January 1980 following the major storm of January 29-30.) The flow patterns on the downstream portions of several of the major watercourses, including the Salt, Verde, Agua Fria, and Gila Rivers, were complicated by regulated flood releases from upstream reservoirs.

Table 2 contains a partial list of available peak discharge data on some of the major rivers and principal tributaries in central Arizona. This list was furnished by the U.S. Geological Survey (USGS), and it represents preliminary data, subject to revision. Plate 4 contains hydrographs of discharges on the Salt and Verde Rivers during the period February 13-26, 1980. The two broken lines represent releases made by the Salt River Project from the lowest reservoir on the respective rivers, i.e., from Stewart Mountain Dam (Saguaro Lake) on the Salt River (long-dashed line) and from Bartlett Dam (Bartlett Lake) on the Verde River (short-dashed line). The solid line represents the discharge, or flow rate, past Granite Reef Dam on the Salt River located 3.4 miles below the confluence of the Salt and Verde Rivers.

In addition to the high peak discharges in Arizona during February 1980, the total volume of runoff on many rivers approached, and sometimes exceeded, the previous record for a comparable period of time. The total inflow to Roosevelt Lake on the Salt River from February 13 through 21 of 1980 was 677,000 acre-feet, while the total inflow to Horseshoe Reservoir on the Verde River for the same period of time was 515,000 acre-feet. On the Agua Fria River a total of 295,630 acre-feet flowed into Lake Pleasant during February 1980, with nearly all of this amount in the latter half of the month. Since most of these reservoirs were full or virtually full at the beginning of February 1980, almost all of the water coming into these reservoirs during the month was necessarily released downstream on the Salt, Agua Fria, and Gila Rivers. Farther downstream on the Gila River the amount of water stored behind Painted Rock Dam for flood control purposes reached an all-time

record of 1,849,509 acre-feet on March 6, 1980. The reservoir had been dry for a few days near the end of January 1980, and even as of February 15 only 51,213 acre-feet had been in storage behind Painted Rock Dam. The remaining 1,798,296 acre-feet of accumulation at Painted Rock resulted from runoff generated by the February 13-22 storms plus a relatively minor storm of March 3-4, 1980.

There were several reasons for the very high runoff (both peak discharges and volumes) in central Arizona during February 1980. First was the heavy rainfall which occurred between February 13 and 22. Secondly, the occurrence of well above normal rainfall during January 1980, including a heavy storm on January 29-30, largely saturated the ground and greatly lowered infiltration rates. The snow levels during February 1980 were generally quite high to very high. This allowed a larger proportion of the incident precipitation over the watersheds to run off instead of remaining on the ground in the form of snow. There was some melting of existing snow during February 1980, but this was relatively minor because the January 1980 storms had also been warm and had consequently not deposited a major snow cover at elevations below 7,000 feet. (This is in contrast to the flood situations of March 1978 and especially December 1978, when warm heavy rains fell upon a significant snow pack that had existed down to lower elevations, with the resulting snow melt greatly contributing to the runoff and flooding.) In addition to the watershed conditions, all of the major reservoir systems in central and eastern Arizona were nearly full at the beginning of the February 13-22, 1980, rains because of above normal storage at the end of 1979 and exceptionally heavy rainfall, runoff, and inflow that had occurred during January 1980. Thus there was little available storage in these reservoirs when the February 1980 storms hit, and nearly all of the inflow to these reservoirs had to be passed downstream. In several of these cases, however, the potential downstream flood peaks were significantly reduced and the discharges spread out over time by the operation of the upstream reservoirs, especially on the Salt and Verde Rivers.

TABLE 2

PEAK DISCHARGES FOR FEBRUARY 1980

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

Station Gate	Stream-Gaging Stations	Peak of record through 1-80		Drainage area (mi ²)	Date	Time	Gage Height (ft)	Discharge (ft ³ /s)
		Date	Discharge (ft ³ /s)					
09390500	Show Low Creek near Lakeside	12-18-78	5,550	68.6	2-15-80	2100	5.90	1,900
09424470	Kirkland Creek near Kirkland	3-1-78	7,890	109	2-19-80	2130	9.20	8,440*
09424900	Santa Maria River near Bagdad	3-1-78	24,600	1,210	2-15-80		6.84	18,500
6 09479500	Gila River near Laveen	1-2-41	11,900	20,615	2-23-80	0830	7.49	514
09489000	Santa Cruz River near Laveen	9-29-62	9,200	533	2-20-80	0430	8.36	115
09489100	Black River near Maverick	12-18-78	14,400	315	2-15-80		5.72	3,400
09489700	Big Bonito Creek near Fort Apache	12-18-78	4,510	119	2-15-80		8.19	3,360
09490500	Black River near Fort Apache (100 yr) 58,000, (50 yr) 35,000	12-18-78	40,200	1,232	2-15-80		24.00	40,000
09492400	East Fork White River nr Ft. Apache	12-18-78	751	38.8	2-15-80		2.65	280
09494000	White River near Ft. Apache	12-18-78	14,600	632	2-15-80	1900	12.24	8,400
09496500	Carrizo Creek near Show Low	12-18-78	19,400 ^a	439	2-14-80	1815	7.26	4,300
09497500	Salt River near Chrysotile	12-18-78	70,400 ^b	2,849	2-15-80	2000	16.2	60,000

TABLE 2

PEAK DISCHARGES FOR FEBRUARY 1980

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

Station Gate	Stream-Gaging Stations	Peak of record through 1-80		Drainage area (mi ²)	Date	Time	Gage Height (ft)	Discharge (ft ³ /s)
		Date	Discharge (ft ³ /s)					
09390500	Show Low Creek near Lakeside	12-18-78	5,550	68.6	2-15-80	2100	5.90	1,900
09424470	Kirkland Creek near Kirkland	3-1-78	7,890	109	2-19-80	2130	9.20	8,440*
09424900	Santa Maria River near Bagdad	3-1-78	24,600	1,210	2-15-80		6.84	18,500
6 09479500	Gila River near Laveen	1-2-41	11,900	20,615	2-23-80	0830	7.49	514
09489000	Santa Cruz River near Laveen	9-29-62	9,200	533	2-20-80	0430	8.36	115
09489100	Black River near Maverick	12-18-78	14,400	315	2-15-80		5.72	3,400
09489700	Big Bonito Creek near Fort Apache	12-18-78	4,510	119	2-15-80		8.19	3,360
09490500	Black River near Fort Apache (100 yr) 58,000, (50 yr) 35,000	12-18-78	40,200	1,232	2-15-80		24.00	40,000
09492400	East Fork White River nr Ft. Apache	12-18-78	751	38.8	2-15-80		2.65	280
09494000	White River near Ft. Apache	12-18-78	14,600	632	2-15-80	1900	12.24	8,400
09496500	Carrizo Creek near Show Low	12-18-78	19,400 ^a	439	2-14-80	1815	7.26	4,300
09497500	Salt River near Chrysotile	12-18-78	70,400 ^b	2,849	2-15-80	2000	16.2	60,000

TABLE 2

PEAK DISCHARGES FOR FEBRUARY 1980

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

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

PEAK DISCHARGES FOR FEBRUARY 1980 (Continued)

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

PEAK DISCHARGES FOR FEBRUARY 1980 (Continued)

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

PEAK DISCHARGES FOR FEBRUARY 1980 (Continued)

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

II

TABLE 2

PEAK DISCHARGES FOR FEBRUARY 1980

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

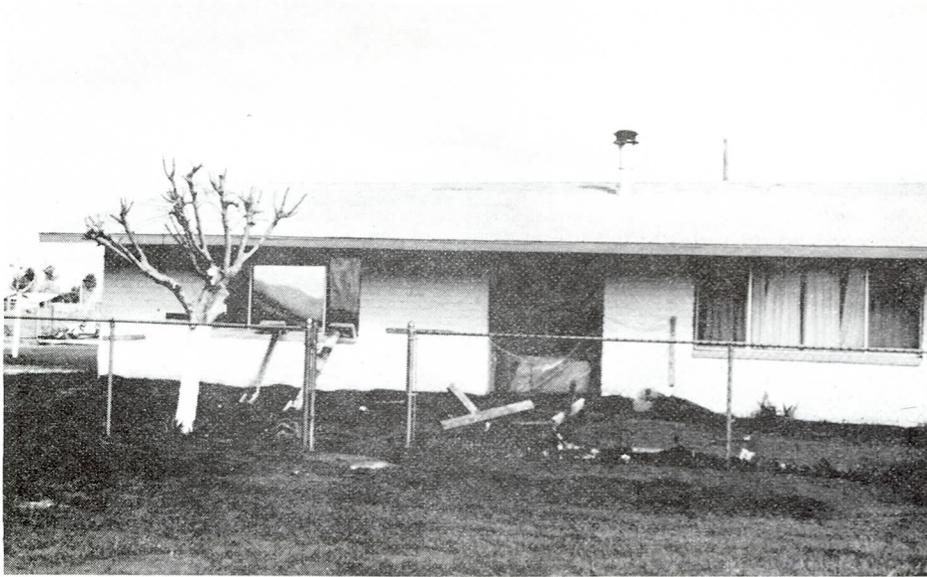
Station Gate	Stream-Gaging Stations	Peak of record through 1-80		Drainage area (mi ²)	Date	Time	Gage Height (ft)	Discharge (ft ³ /s)
		Date	Discharge (ft ³ /s)					
09390500	Show Low Creek near Lakeside	12-18-78	5,550	68.6	2-15-80	2100	5.90	1,900
09424470	Kirkland Creek near Kirkland	3-1-78	7,890	109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



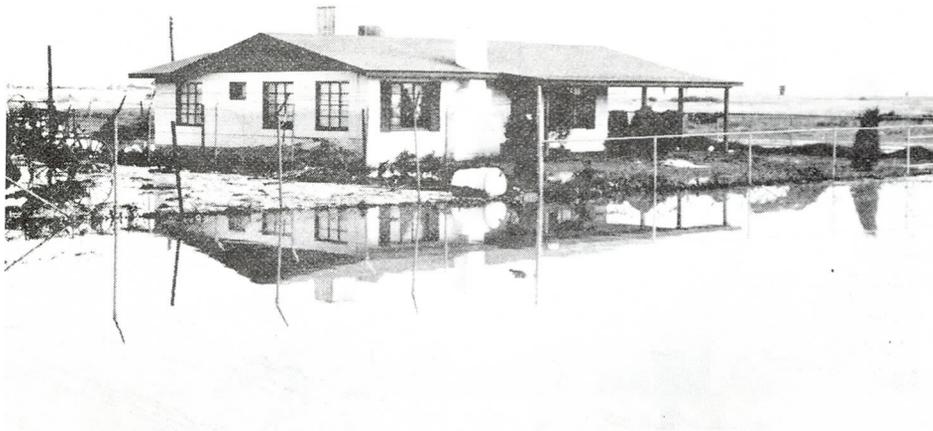
The Salt River washed out the crossing at Hayden Road.



Agua Fria floodwaters overtopping Van Buren Street.



Attempts at floodproofing with plastic and boards in Holly Acres, a neighborhood flooded by the Gila River.



A flooded home on the Agua Fria River. Note the mud and water lines along the side of the house just below the windows.

IV. PUBLIC ASSISTANCE AND EMERGENCY PROGRAMS

A. INTRODUCTION. In the weeks that followed the flood, government agencies and private charitable organizations provided assistance to the flood victims. Assistance included many forms:

- a. provision of immediate necessities to flood victims;
 - b. payments to Federal Insurance Administration policy holders;
 - c. funds to repair damaged roadways and other public facilities;
- and
- d. loans to repair or to replace eligible damaged property.

The expenditure of these funds does not relate directly to the damages reported. The types and amounts of funds committed to disaster relief provide an alternative indicator of the extent and nature of the damages sustained statewide and in the region. The committed Federal funds shown in table 3 apply to the entire state, while the American Red Cross aid shown on table 4 applies to Maricopa County only. The principal programs are discussed below along with the procedure followed in making disaster declarations.

B. DISASTER DECLARATION PROCESS. Once an area has been flooded, it may qualify for Federal assistance under Public Law 93-288. The disaster declaration process usually begins with an emergency declaration at the local level and a preliminary assessment of damages. After the Governor has declared a disaster and determined that the flood related damages are beyond the capability of State and local resources, he can request a disaster declaration by the President. When the President declares a major disaster, Federal assistance becomes available through various programs that are financed from the President's Disaster Fund and administered by the Federal Emergency Management Agency (FEMA). A Federal Coordinating Officer (FCO) is appointed to coordinate Federal relief efforts, and a State Coordinating Officer (SCO) is appointed by the Governor to cooperate with the FCO.

C. FEDERAL PROGRAMS. The principal Federal agencies offering direct post flood emergency assistance were: The Federal Emergency Management Agency (FEMA); the Small Business Administration (SBA); and the Farmers Home Administration and the Emergency Conservation Program of the Department of Agriculture. FEMA administered two programs: one under Section 404 of the Disaster Relief Act of 1974 (PL 93-288) to provide temporary housing to people who were evacuated or driven from their homes by flood waters; and another under Sections 402 and 419 of the same act to repair or restore public facilities damaged by the flood.

Individuals and businesses will be able to deduct casualty losses from their 1980 taxable income on State and Federal tax returns.

IV. PUBLIC ASSISTANCE AND EMERGENCY PROGRAMS

A. INTRODUCTION. In the weeks that followed the flood, government agencies and private charitable organizations provided assistance to the flood victims. Assistance included many forms:

- a. provision of immediate necessities to flood victims;
- b. payments to Federal Insurance Administration policy holders;
- c. funds to repair damaged roadways and other public facilities;
and
- d. loans to repair or to replace eligible damaged property.

The expenditure of these funds does not relate directly to the damages reported. The types and amounts of funds committed to disaster relief provide an alternative indicator of the extent and nature of the damages sustained statewide and in the region. The committed Federal funds shown in table 3 apply to the entire state, while the American Red Cross aid shown on table 4 applies to Maricopa County only. The principal programs are discussed below along with the procedure followed in making disaster declarations.

B. DISASTER DECLARATION PROCESS. Once an area has been flooded, it may qualify for Federal assistance under Public Law 93-288. The disaster declaration process usually begins with an emergency declaration at the local level and a preliminary assessment of damages. After the Governor has declared a disaster and determined that the flood related damages are beyond the capability of State and local resources, he can request a disaster declaration by the President. When the President declares a major disaster, Federal assistance becomes available through various programs that are financed from the President's Disaster Fund and administered by the Federal Emergency Management Agency (FEMA). A Federal Coordinating Officer (FCO) is appointed to coordinate Federal relief efforts, and a State Coordinating Officer (SCO) is appointed by the Governor to cooperate with the FCO.

C. FEDERAL PROGRAMS. The principal Federal agencies offering direct post flood emergency assistance were: The Federal Emergency Management Agency (FEMA); the Small Business Administration (SBA); and the Farmers Home Administration and the Emergency Conservation Program of the Department of Agriculture. FEMA administered two programs: one under Section 404 of the Disaster Relief Act of 1974 (PL 93-288) to provide temporary housing to people who were evacuated or driven from their homes by flood waters; and another under Sections 402 and 419 of the same act to repair or restore public facilities damaged by the flood.

Individuals and businesses will be able to deduct casualty losses from their 1980 taxable income on State and Federal tax returns.

Table 3

ESTIMATE OF DISASTER RELIEF FUNDS COMMITTED STATEWIDE^a
February 1980 Flood

AGENCY

Small Business Administration (Low interest loans for home, personal property, and business damages)	\$4,808,900
Farmers Home Administration (Agricultural losses from flooding)	1,746,820
Emergency Conservation Program	1,247,981
Disaster Unemployment Insurance	24,797
Emergency Food Stamps	43,171
Federal Insurance Administration (Payments to those insured against flooding)	1,000,000
Individual Family Grants	419,066
Federal Emergency Management Agency ^b (Roads, bridges, and other public facilities)	<u>11,769,092</u>
TOTAL FEDERAL EXPENDITURES ^c	\$21,059,827

a. As of April 3, 1981, not all approved funds had been disbursed.

b. Current estimates of eligible assistance.

c. The funds committed above represent disbursements and may not relate directly to damages.

SOURCE: The Federal Emergency Management Agency.

Table 4

AMERICAN RED CROSS DIRECT AID TO FLOOD VICTIMS IN MARICOPA COUNTY
February 1980

<u>Type of Aid</u>	<u>Amount^a</u>
Food, clothing and maintenance	\$ 64,000
Household furnishings	3,000
Medical and nursing	1,100
Occupational supplies	100
Mass care	<u>30,000</u>
Total Relief Commitments	98,200

^a Subject to revision

SOURCE: American Red Cross, Emergency Social Services

D. STATE PROGRAMS. Several of the Federal programs shown on table 3 were administered by the state. For example, the State provided individual and family grants for housing and food through the Arizona Department of Economic Security (DES). DES also processed additional unemployment insurance claims for people who became temporarily unemployed because of flooding.

E. OTHER ASSISTANCE.

The American Red Cross, the Salvation Army, and other volunteer organizations spent time with and offered direct financial aid to flood disaster victims. Some of the assistance included evacuating families, finding temporary residences, and providing food, clothing, household goods, and shelter. Emergency centers were set up in various communities along the Salt and Agua Fria Rivers.

The Salvation Army estimates spending a total of \$14,400 in the Phoenix area with \$7,300 being direct aid to flood victims. In Maricopa County the American Red Cross expended \$98,000 in direct financial aid for individual family assistance.

Table 4

AMERICAN RED CROSS DIRECT AID TO FLOOD VICTIMS IN MARICOPA COUNTY
February 1980

<u>Type of Aid</u>	<u>Amount^a</u>
Food, clothing and maintenance	\$ 64,000
Household furnishings	3,000
Medical and nursing	1,100
Occupational supplies	100
Mass care	<u>30,000</u>
Total Relief Commitments	98,200

^a Subject to revision

SOURCE: American Red Cross, Emergency Social Services

D. STATE PROGRAMS. Several of the Federal programs shown on table 3 were administered by the state. For example, the State provided individual and family grants for housing and food through the Arizona Department of Economic Security (DES). DES also processed additional unemployment insurance claims for people who became temporarily unemployed because of flooding.

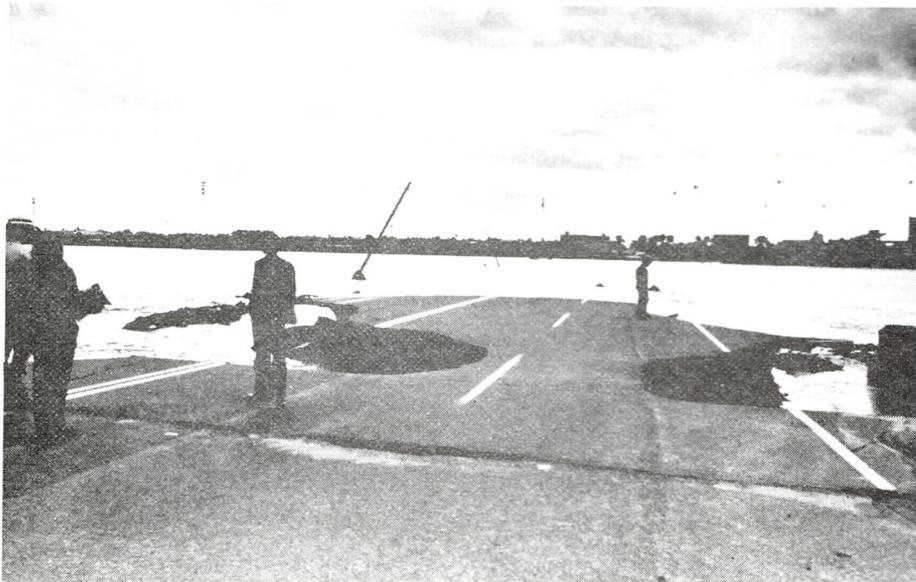
E. OTHER ASSISTANCE.

The American Red Cross, the Salvation Army, and other volunteer organizations spent time with and offered direct financial aid to flood disaster victims. Some of the assistance included evacuating families, finding temporary residences, and providing food, clothing, household goods, and shelter. Emergency centers were set up in various communities along the Salt and Agua Fria Rivers.

The Salvation Army estimates spending a total of \$14,400 in the Phoenix area with \$7,300 being direct aid to flood victims. In Maricopa County the American Red Cross expended \$98,000 in direct financial aid for individual family assistance.



Mud and debris surround a house near 67th Avenue and the Salt River.



The Salt River flooding Scottsdale Road on February 20, 1980. Arizona State University is in the background.

V. DESCRIPTION OF FLOOD DAMAGES

A. SUMMARY OF FLOOD DAMAGES. In the Phoenix Metropolitan Area, physical damages, net income losses, and emergency costs totaled \$63.7 million. Damages are categorized by types, land uses affected, and location. The Salt River suffered losses of \$49.6 million due to flood damages, the Gila River, \$6.5 million, and the Agua Fria River, \$7.6 million. The dollar amounts reported for flood damages are preliminary figures collected and updated from February 1980 through August 1980. Some estimates of damages may have changed since that time, and these changes will not be reflected in this report.

A very real loss not accounted for in damage estimates is the loss of life directly attributable to the flooding. Although there were no deaths in the Phoenix Metropolitan Area, three were reported statewide during the February 1980 flood.

In the remainder of this section, flood damages are analyzed by type, land use, and location.

B. TYPES OF FLOOD DAMAGES. Damages are classified as three principal types: physical damages, income losses, and emergency costs. Each activity affected by a flood has losses of one or more of these types.

1. Physical damages include damages to or loss of buildings; loss of contents including furnishings, equipment, materials, or finished products; cost of cleanup; and loss of roads, bridges, and utilities. Physical damages amounted to 77% of the total damages.

2. Business and income losses are lost wages or lost net profits which result from the inability to operate normally, and include plant shutdown, days out of work, decline in trade, and traffic delay. The main agricultural income loss results from disrupted normal cropping patterns. Many businesses are unwilling to release profit loss information, and therefore, statistical methods were used to estimate business and income losses each in location. These losses represent 20% of all damages reported.

3. Emergency costs are expenses associated with flood periods, such as costs of evacuation, flood fighting, disaster relief, and increased expense of normal operations during the flood, including fire, police, and other public services. Three percent of the damages were emergency costs.

For this report, cleanup costs are included with emergency costs instead of physical damages due to the method used in compiling the data.

C. TYPES OF LAND USES AFFECTED BY FLOOD DAMAGE. Flood damages for the Salt, Gila, and Agua Fria Rivers are categorized by five major land uses: residential, commercial, industrial, public, and agricultural.

V. DESCRIPTION OF FLOOD DAMAGES

A. SUMMARY OF FLOOD DAMAGES. In the Phoenix Metropolitan Area, physical damages, net income losses, and emergency costs totaled \$63.7 million. Damages are categorized by types, land uses affected, and location. The Salt River suffered losses of \$49.6 million due to flood damages, the Gila River, \$6.5 million, and the Agua Fria River, \$7.6 million. The dollar amounts reported for flood damages are preliminary figures collected and updated from February 1980 through August 1980. Some estimates of damages may have changed since that time, and these changes will not be reflected in this report.

A very real loss not accounted for in damage estimates is the loss of life directly attributable to the flooding. Although there were no deaths in the Phoenix Metropolitan Area, three were reported statewide during the February 1980 flood.

In the remainder of this section, flood damages are analyzed by type, land use, and location.

B. TYPES OF FLOOD DAMAGES. Damages are classified as three principal types: physical damages, income losses, and emergency costs. Each activity affected by a flood has losses of one or more of these types.

1. Physical damages include damages to or loss of buildings; loss of contents including furnishings, equipment, materials, or finished products; cost of cleanup; and loss of roads, bridges, and utilities. Physical damages amounted to 77% of the total damages.

2. Business and income losses are lost wages or lost net profits which result from the inability to operate normally, and include plant shutdown, days out of work, decline in trade, and traffic delay. The main agricultural income loss results from disrupted normal cropping patterns. Many businesses are unwilling to release profit loss information, and therefore, statistical methods were used to estimate business and income losses each in location. These losses represent 20% of all damages reported.

3. Emergency costs are expenses associated with flood periods, such as costs of evacuation, flood fighting, disaster relief, and increased expense of normal operations during the flood, including fire, police, and other public services. Three percent of the damages were emergency costs.

For this report, cleanup costs are included with emergency costs instead of physical damages due to the method used in compiling the data.

C. TYPES OF LAND USES AFFECTED BY FLOOD DAMAGE. Flood damages for the Salt, Gila, and Agua Fria Rivers are categorized by five major land uses: residential, commercial, industrial, public, and agricultural.

Residential damages include physical damages to residential structures, yard fixtures such as fences and driveways, and contents such as household furnishings and personal belongings; and emergency costs associated with preparations for the flood such as attempts at flood proofing, temporary housing and storage, evacuation of contents, and cleanup costs.

Residential damages occurred primarily along the Gila and Agua Fria Rivers. On the Gila River, the communities of Allenville and Holly Acres were severely flooded just as they had been in the March and December 1978 floods. On the Agua Fria River the primary residential areas affected were Hound Dog Acres, north of Sun City, and a few scattered homes in the vicinity of Van Buren Street and El Mirage Road.

Commercial losses apply to those retail and wholesale establishments who suffered physical damage to their structures, yards, and contents; business losses, measured as reductions in net profits, due to flood damaged inventories, inaccessibility due to flooding, and closures for repairs; and emergency costs incurred while evacuating equipment and flood proofing, and cleanup costs.

The greatest commercial losses occurred along the heavily urbanized sections of the Salt River between 48th Street and 35th Avenue.

Flood damages to industrial uses include physical damages to industrial plants and yards; income losses due to plant shutdowns; and emergency operations in preparation for the flood and cleanup costs.

Industrial uses are divided into two subcategories: "sand and gravel" and "other". Sand and gravel operations are the predominant industrial uses affected by the floods because they are typically located in or near riverbeds in order to be close to their source of raw materials. Many of the sand and gravel operations moved equipment to higher ground and built dikes and berms to protect their operations. Some firms experienced flooded pits or lost stockpiles to the floodwaters. The "other" category includes all non-sand and gravel industrial and manufacturing firms.

Public damages include physical damages to public property; and emergency costs associated with floodproofing, temporary repair measures, and additional manhours needed to cope with the flood emergencies, and cleanup costs.

Public uses are divided into two subcategories: "roads and bridges" and "other". Public uses other than roads and bridges include sewage treatment plants, public recreational facilities, airports, government owned properties, and major privately owned utilities.

The Phoenix Metropolitan Area sustained losses from traffic delays. These losses have been estimated for the additional time and vehicle operation costs resulting from traveling extra miles to reach an open river crossing, operating the vehicle at reduced speeds, and delays in

Residential damages include physical damages to residential structures, yard fixtures such as fences and driveways, and contents such as household furnishings and personal belongings; and emergency costs associated with preparations for the flood such as attempts at flood proofing, temporary housing and storage, evacuation of contents, and cleanup costs.

Residential damages occurred primarily along the Gila and Agua Fria Rivers. On the Gila River, the communities of Allenville and Holly Acres were severely flooded just as they had been in the March and December 1978 floods. On the Agua Fria River the primary residential areas affected were Hound Dog Acres, north of Sun City, and a few scattered homes in the vicinity of Van Buren Street and El Mirage Road.

Commercial losses apply to those retail and wholesale establishments who suffered physical damage to their structures, yards, and contents; business losses, measured as reductions in net profits, due to flood damaged inventories, inaccessibility due to flooding, and closures for repairs; and emergency costs incurred while evacuating equipment and flood proofing, and cleanup costs.

The greatest commercial losses occurred along the heavily urbanized sections of the Salt River between 48th Street and 35th Avenue.

Flood damages to industrial uses include physical damages to industrial plants and yards; income losses due to plant shutdowns; and emergency operations in preparation for the flood and cleanup costs.

Industrial uses are divided into two subcategories: "sand and gravel" and "other". Sand and gravel operations are the predominant industrial uses affected by the floods because they are typically located in or near riverbeds in order to be close to their source of raw materials. Many of the sand and gravel operations moved equipment to higher ground and built dikes and berms to protect their operations. Some firms experienced flooded pits or lost stockpiles to the floodwaters. The "other" category includes all non-sand and gravel industrial and manufacturing firms.

Public damages include physical damages to public property; and emergency costs associated with floodproofing, temporary repair measures, and additional manhours needed to cope with the flood emergencies, and cleanup costs.

Public uses are divided into two subcategories: "roads and bridges" and "other". Public uses other than roads and bridges include sewage treatment plants, public recreational facilities, airports, government owned properties, and major privately owned utilities.

The Phoenix Metropolitan Area sustained losses from traffic delays. These losses have been estimated for the additional time and vehicle operation costs resulting from traveling extra miles to reach an open river crossing, operating the vehicle at reduced speeds, and delays in

crossing the river due to increased traffic congestion. The value of additional time spent in traffic per person was taken as the current minimum wage, \$3.10 per hour. Transportation delay costs were estimated only for the Salt River crossings beginning February 16, 1980, and ending March 3, 1980, at which time the Interstate 10 bridge was re-opened thus relieving much of the traffic problem. The total cost of delays for the Salt River is estimated at a minimum of \$8.4 million: \$6.5 million in driver and occupants' additional time, \$1.6 million in additional distance travelled, and \$280,000 in additional operating costs due to reduced speeds. Though there were delays on both the Gila River and Agua Fria River, the available data is insufficient to provide good estimates of the related costs.

Agricultural damages include physical damages to crops, equipment, and structures such as irrigation ditches and fences. Damages to fields are considered separately as "soil restoration". Also included as flood damages are the income losses suffered when a farmer fails to make a profit on his crops because they were damaged by the flood.

Agricultural damages occurred primarily along the Gila River and portions of the Agua Fria River. Most of the areas had been flooded in the March and December 1978 events as well.

D. SUMMARY OF FLOOD DAMAGES BY LOCATION. Damages are presented in table 5, at the end of this section, for each of the ten locations in the flood plains assessed in this report. Damage data is further classified according to type of loss and property use. The location boundaries are:

Salt River:

- Location 1 -- 115th Avenue to 35th Avenue
- Location 2 -- 35th Avenue to 48th Street
- Location 3 -- 48th Street to Country Club Drive
- Location 4 -- Country Club Drive to Granite Reef Dam

Gila River:

- Location 5 -- U.S. Highway 80 to Watson Road
- Location 6 -- Watson Road to Perryville Road
- Location 7 -- Perryville Road to 115th Avenue

Agua Fria River:

- Location 8 -- Confluence with Gila River to Indian School Road
- Location 9 -- Indian School Road to Bell Road
- Location 10 -- Bell Road to Waddell Dam

Location 1: Salt River--115th Avenue to 35th Avenue

Damages in this location totaled over \$4,000,000. Almost \$3,000,000 are attributable to losses in the public sector.

crossing the river due to increased traffic congestion. The value of additional time spent in traffic per person was taken as the current minimum wage, \$3.10 per hour. Transportation delay costs were estimated only for the Salt River crossings beginning February 16, 1980, and ending March 3, 1980, at which time the Interstate 10 bridge was reopened thus relieving much of the traffic problem. The total cost of delays for the Salt River is estimated at a minimum of \$8.4 million: \$6.5 million in driver and occupants' additional time, \$1.6 million in additional distance travelled, and \$280,000 in additional operating costs due to reduced speeds. Though there were delays on both the Gila River and Agua Fria River, the available data is insufficient to provide good estimates of the related costs.

Agricultural damages include physical damages to crops, equipment, and structures such as irrigation ditches and fences. Damages to fields are considered separately as "soil restoration". Also included as flood damages are the income losses suffered when a farmer fails to make a profit on his crops because they were damaged by the flood.

Agricultural damages occurred primarily along the Gila River and portions of the Agua Fria River. Most of the areas had been flooded in the March and December 1978 events as well.

D. SUMMARY OF FLOOD DAMAGES BY LOCATION. Damages are presented in table 5, at the end of this section, for each of the ten locations in the flood plains assessed in this report. Damage data is further classified according to type of loss and property use. The location boundaries are:

Salt River:

Location 1 -- 115th Avenue to 35th Avenue
Location 2 -- 35th Avenue to 48th Street
Location 3 -- 48th Street to Country Club Drive
Location 4 -- Country Club Drive to Granite Reef Dam

Gila River:

Location 5 -- U.S. Highway 80 to Watson Road
Location 6 -- Watson Road to Perryville Road
Location 7 -- Perryville Road to 115th Avenue

Agua Fria River:

Location 8 -- Confluence with Gila River to Indian School Road
Location 9 -- Indian School Road to Bell Road
Location 10 -- Bell Road to Waddell Dam

Location 1: Salt River--115th Avenue to 35th Avenue

Damages in this location totaled over \$4,000,000. Almost \$3,000,000 are attributable to losses in the public sector.

Residential damages occurred between 67th and 115th Avenues. Losses totaled \$627,000. This area had been flooded in previous years but was considerably more affected by the February 1980 event.

Both the commercial and industrial sectors reported losses of approximately \$315,000 each. These sectors also reported business and income losses totaling about \$49,000.

In the public sector, \$1,478,000 in damages were to roads and bridges. Several dip crossings were washed out in this location. An additional \$1,381,000 worth of damages were suffered by the "other" category of public uses and included damages primarily to electrical facilities.

An estimated 115 acres of wheat and barley were lost in this area. This damage, along with land damages and income losses, caused the agricultural sector losses in excess of \$140,000.

Emergency costs were reported as \$6,000 by one business in this area.

Location 2: Salt River--35th Avenue to 48th Street

Location 2 is the most heavily urbanized portion of the Salt River consisting of sand and gravel operations, light industry, and commercial establishments. There are relatively few residences in this area and no agricultural land. Damages to roads and bridges accounted for one third of the total damages in this area. Business and income losses were quite heavy in this area, but this report probably does not reflect the full impact of the flood on the business community. Total damages amounted to approximately \$23,000,000.

Commercial damages of \$2,195,000 were reported in this area. Several sand and gravel operations are located in this location, and they incurred over \$1,000,000 in physical losses. Combined business losses to the commercial and industrial sectors were reported as about \$4,500,000. Emergency costs incurred by these land uses were \$460,000.

The Central Avenue Bridge, one of the two operational bridges across the Salt River during the flood, was the only crossing open in this area causing tremendous traffic problems for Central Phoenix. Damages to various roads and bridges in this location were estimated at \$7,462,000. Other public damages amounted to just over \$6,000,000 and included damages to Sky Harbor International Airport, sewer systems, gas lines, a landfill, and flood control works. Emergency costs in the public sector were \$523,000 and included emergency repair work, debris removal, traffic control and overtime wages paid to public employees involved in emergency work.

Location 3: Salt River--48th Street to Country Club Drive.

Damages along this section of the Salt River totaled \$11,237,000. Over half of these damages were to roads and bridges.

No residential or agricultural damages occurred in this location.

Only a few commercial establishments reported losses as a result of physical damages. These losses totaled \$270,000. Damages to sand and gravel operations were \$584,000 and damages to other industrial uses were \$152,000. Emergency costs were reported as \$160,000 and business losses were \$507,000 for the combined industrial and commercial sectors.

The public sector sustained the greatest amount of damage in this area. All the major crossings except the Mill Avenue Bridge were washed out and damages to roads and bridges exceeded \$7,000,000. The normal traffic flow in and out of Tempe was greatly affected because the Mill Avenue Bridge was one of the only two functional bridges crossing the Salt River, and crossing the river often took over one hour during the first couple weeks after the flood. Other public damages included phone cables, gas lines, electrical facilities, sewer systems, and flood control works. The total of these types of damages was estimated at \$2,342,000. Emergency costs for the public sector were \$68,000.

Location 4: Salt River--Country Club Drive to Granite Reef Dam

This area has less development and sustained fewer damages than other locations along the Salt River. Commercial and public land uses were the only types of land uses to incur physical damages from flooding. The residential, industrial and agricultural sectors reported no physical damages. Total damages were \$2,460,000.

Losses in the commercial sector were mostly caused by damages to contents rather than structures and were equal to approximately \$24,000. Emergency costs totaled \$68,000 which includes emergency expenses by a sand and gravel operation to protect their plant. Business and income losses were estimated at \$226,000.

In the public sector, roads and bridges accounted for \$305,000 of the damages while other public facilities sustained \$1,813,000 worth of damages. Over half of the damages to other public facilities were to Granite Reef Dam, with the remainder attributable to a four city sewer system, flood control works, and dikes, irrigation ditches, and a landfill on the Salt River-Pima-Maricopa Indian Community property. Emergency costs in the public sector totaled \$24,000.

Location 5: Gila River--U.S. 80 to Watson Road

Damages in this location totaled \$3,115,000. The primary land uses affected were agricultural and public.

In past floods, residential damages accounted for a larger percentage of the damages, but after the March and December 1978 events, the residents of Allenville were provided with temporary mobile-home housing which was not flooded by the February 1980 storm. (A project sponsored by the State of Arizona and the Corps of Engineers is currently underway to permanently relocate the entire community to a

No residential or agricultural damages occurred in this location.

Only a few commercial establishments reported losses as a result of physical damages. These losses totaled \$270,000. Damages to sand and gravel operations were \$584,000 and damages to other industrial uses were \$152,000. Emergency costs were reported as \$160,000 and business losses were \$507,000 for the combined industrial and commercial sectors.

The public sector sustained the greatest amount of damage in this area. All the major crossings except the Mill Avenue Bridge were washed out and damages to roads and bridges exceeded \$7,000,000. The normal traffic flow in and out of Tempe was greatly affected because the Mill Avenue Bridge was one of the only two functional bridges crossing the Salt River, and crossing the river often took over one hour during the first couple weeks after the flood. Other public damages included phone cables, gas lines, electrical facilities, sewer systems, and flood control works. The total of these types of damages was estimated at \$2,342,000. Emergency costs for the public sector were \$68,000.

Location 4: Salt River--Country Club Drive to Granite Reef Dam

This area has less development and sustained fewer damages than other locations along the Salt River. Commercial and public land uses were the only types of land uses to incur physical damages from flooding. The residential, industrial and agricultural sectors reported no physical damages. Total damages were \$2,460,000.

Losses in the commercial sector were mostly caused by damages to contents rather than structures and were equal to approximately \$24,000. Emergency costs totaled \$68,000 which includes emergency expenses by a sand and gravel operation to protect their plant. Business and income losses were estimated at \$226,000.

In the public sector, roads and bridges accounted for \$305,000 of the damages while other public facilities sustained \$1,813,000 worth of damages. Over half of the damages to other public facilities were to Granite Reef Dam, with the remainder attributable to a four city sewer system, flood control works, and dikes, irrigation ditches, and a landfill on the Salt River-Pima-Maricopa Indian Community property. Emergency costs in the public sector totaled \$24,000.

Location 5: Gila River--U.S. 80 to Watson Road

Damages in this location totaled \$3,115,000. The primary land uses affected were agricultural and public.

In past floods, residential damages accounted for a larger percentage of the damages, but after the March and December 1978 events, the residents of Allenville were provided with temporary mobile-home housing which was not flooded by the February 1980 storm. (A project sponsored by the State of Arizona and the Corps of Engineers is currently underway to permanently relocate the entire community to a

No residential or agricultural damages occurred in this location.

Only a few commercial establishments reported losses as a result of physical damages. These losses totaled \$270,000. Damages to sand and gravel operations were \$584,000 and damages to other industrial uses were \$152,000. Emergency costs were reported as \$160,000 and business losses were \$507,000 for the combined industrial and commercial sectors.

The public sector sustained the greatest amount of damage in this area. All the major crossings except the Mill Avenue Bridge were washed out and damages to roads and bridges exceeded \$7,000,000. The normal traffic flow in and out of Tempe was greatly affected because the Mill Avenue Bridge was one of the only two functional bridges crossing the Salt River, and crossing the river often took over one hour during the first couple weeks after the flood. Other public damages included phone cables, gas lines, electrical facilities, sewer systems, and flood control works. The total of these types of damages was estimated at \$2,342,000. Emergency costs for the public sector were \$68,000.

Location 4: Salt River--Country Club Drive to Granite Reef Dam

This area has less development and sustained fewer damages than other locations along the Salt River. Commercial and public land uses were the only types of land uses to incur physical damages from flooding. The residential, industrial and agricultural sectors reported no physical damages. Total damages were \$2,460,000.

Losses in the commercial sector were mostly caused by damages to contents rather than structures and were equal to approximately \$24,000. Emergency costs totaled \$68,000 which includes emergency expenses by a sand and gravel operation to protect their plant. Business and income losses were estimated at \$226,000.

In the public sector, roads and bridges accounted for \$305,000 of the damages while other public facilities sustained \$1,813,000 worth of damages. Over half of the damages to other public facilities were to Granite Reef Dam, with the remainder attributable to a four city sewer system, flood control works, and dikes, irrigation ditches, and a landfill on the Salt River-Pima-Maricopa Indian Community property. Emergency costs in the public sector totaled \$24,000.

Location 5: Gila River--U.S. 80 to Watson Road

Damages in this location totaled \$3,115,000. The primary land uses affected were agricultural and public.

In past floods, residential damages accounted for a larger percentage of the damages, but after the March and December 1978 events, the residents of Allenville were provided with temporary mobile-home housing which was not flooded by the February 1980 storm. (A project sponsored by the State of Arizona and the Corps of Engineers is currently underway to permanently relocate the entire community to a

flood free sight in Maricopa County.) No damages were collected for the Allenville homes which had been permanently evacuated for the mobile-homes. The remaining residential damages in this area totaled \$4,000.

There is very little commercial land use in this area and commercial damages only amounted to \$1,000. Industrial uses, sand and gravel in particular, suffered \$23,000 in physical damages and \$50,000 in emergency costs.

Public damages amounted to \$975,000. Damages to roads and bridges were more extensive through this area than the other areas along the Gila River, and they totaled \$733,000. Other public damages primarily included State Game and Fish Department facilities which are actually just downstream from the western boundary of location 5 and amounted to \$242,000.

The agricultural sector incurred most of the damages suffered in this area. Over 2,000 acres of barley, alfalfa, wheat and cotton were affected. Physical damages included soil, crop and equipment damages and totaled over \$2,000,000. Income losses due to crop damages were about \$60,000.

Location 6: Gila River--Watson Road to Perryville Road

Total damages for this location were approximately \$1,288,000.

The residential damages totaled \$187,000 and included mostly physical damages to structures. There is very little commercial land use in this area, but one establishment reported \$33,000 in damages to its inventories. There were no industrial uses damaged in this location. Business losses were reported as \$11,000.

Almost half of the damages reported in this area were public damages with \$364,000 attributable to roads and bridges and \$242,000 to electrical facilities.

The second largest amount of damages occurred in the agricultural sector. Of the \$451,000 worth of damages, \$437,000 were physical damages to crops, land and equipment and \$14,000 were income losses. Over 700 acres of barley, alfalfa, wheat, and cotton were destroyed.

There was undoubtedly some expense associated with the evacuation of equipment and household contents before the flood, but no emergency costs were reported for the purpose of this report.

Location 7: Gila River--Perryville Road to 115th Avenue

This area includes the confluence of the Salt and Gila Rivers at 115th Avenue and the confluence of the Gila and Agua Fria Rivers at Litchfield Road. Damages totaled \$2,096,000.

Residential damages exceeded \$578,000. Over half of the residential losses were in the neighborhood of Holly Acres which had been severely affected by the March and December 1978 floods. In this flood event, most residents evacuated their household contents before the flood waters inundated their homes. Some residents attempted floodproofing measures such as using sandbags and plastic to protect the bases of the houses and to keep the water from leaking inside.

The one commercial establishment in the area suffered extensive damage just as it did in the previous floods. There are no sand and gravel operations in this location.

Damages to public facilities amounted to almost \$400,000 with roads and bridges accounting for over half, \$263,000, and damages to electrical facilities making up the remainder.

Agricultural damages totaled \$848,000. Most agricultural damage resulted from land erosion, damaged irrigation structures and crop losses.

Emergency costs amounted to \$8,000 for the public sector and \$14,000 for the private sector.

Location 8: Agua Fria River--Confluence with Gila River to Indian School Road

Damages in location 8 totaled \$5,003,000.

Residential damages accounted for \$78,000, less than 2%, of the total damages. Of the homes affected by the flood, only a couple received severe structural damage.

Industrial damages included two sand and gravel operations, and damages to commercial uses included an auto wrecker and a dog racing school. The total damages to these businesses were \$120,000 including physical damages, business and income losses, and emergency costs.

In this area, the public sector received the largest amount of damage, \$3,310,000, with roads and bridges accounting for \$2,547,000, 77%, of the total public damages. The only river crossing remaining open during the flood was the Buckeye Road bridge.

Location 8 is the most sparsely populated reach of the Agua Fria River flood plain, but it is the most intensely farmed. Damages to the agricultural sector totaled \$1,534,000 including emergency costs of \$39,000. Approximately 860 acres of crops were damaged. A dairy located near the Agua Fria accounted for a large percentage of the agricultural damages.

Location 9: Agua Fria River--Indian School Road to Bell Road

This location suffered the least amount of damage of the three locations along the Agua Fria River. Damages totaled approximately \$1,071,000.

Residential damages were minimal. The town of El Mirage has been flooded in the past but was not affected by this flood (though residents were evacuated in response to flood warnings). Commercial damages amounted to \$9,000, and damages to sand and gravel operations equaled \$50,000. Business losses were estimated at \$206,000.

Public land uses accounted for the largest amount of damages in this area totaling \$621,000. \$347,000 represented damages to roads and bridges while \$274,000 were damages to private utilities, mostly gas and electric.

In the agricultural sector, land damages accounted for all of the physical losses which amounted to \$8,000. No crop losses were reported.

In addition to the physical losses, the sand and gravel operations in this location spent over \$175,000 in emergency costs to evacuate equipment and build dikes and berms. Some clean up costs are also reflected in this figure.

Location 10: Agua Fria River--Bell Road to Waddell Dam.

Total damages for this location were estimated at \$1,537,000 with most of the losses occurring in the public sector.

In the residential sector damages totaled \$170,000, the majority of which occurred in the small community of Hound Dog Acres located approximately 10 miles downstream from Lake Pleasant. This community has also been severely damaged by the previous two floods of March and December 1978. The residents of Hound Dog Acres evacuated their homes for higher ground taking as many of their personal belongings and household furnishings as possible. Rose Garden Lanes, another small neighborhood just downstream from Hound Dog Acres, was not badly flooded but incurred some land erosion and road damage.

Since there are only a few commercial establishments in this area, commercial damages were relatively small, \$2,000. There were no industrial damages reported in this area.

In this location, public land uses were the most affected by the flood primarily because of the damage to the crossing at Bell Road. Total damages to roads and bridges were approximately \$1,348,000. The remaining public damages were incurred by park facilities at Lake Pleasant and equaled about \$16,000. Total damages to public facilities were estimated at \$1,364,000.

No agricultural damages were reported in this area.

Emergency costs reported in this location were minimal.

TABLE 5
Summary of All Flood Damages (\$) February 1980

Location:	SALT RIVER				Salt Total	GILA RIVER			Gila Total	AGUA FRIA RIVER			Agua Fria Total	Total all rivers
	1	2	3	4		5	6	7		8	9	10		
Type of Damage														
Residential	627,000	246,000	0	0	873,000	4,000	187,000	578,000	769,000	78,000	*	170,000	248,000	1,890,000
Commercial	317,000	2,195,000	270,000	24,000	2,806,000	1,000	33,000	250,000	284,000	20,000	9,000	2,000	31,000	3,121,000
Industrial														
Sand and Gravel	0	1,126,000	584,000	0	1,710,000	23,000	0	0	23,000	12,000	50,000	0	62,000	1,795,000
Other	313,000	547,000	152,000	0	1,012,000	0	0	0	0	0	0	0	0	1,012,000
Public														
Roads and Bridges	1,478,000	7,462,000	7,154,000	305,000	16,399,000	733,000	364,000	263,000	1,360,000	2,547,000	347,000	1,348,000	4,242,000	22,001,000
Other	1,381,000	6,103,000	2,342,000	1,813,000	11,639,000	242,000	242,000	135,000	619,000	763,000	274,000	16,000	1,053,000	13,311,000
Agricultural														
Soil restoration	33,000	0	0	0	33,000	1,541,000	260,000	124,000	1,925,000	187,000	8,000	0	195,000	2,153,000
Income losses	*	0	0	0	*	61,000	14,000	0	75,000	195,000	0	0	195,000	270,000
Other	108,000	0	0	0	108,000	460,000	177,000	724,000	1,361,000	1,113,000	0	0	1,113,000	2,582,000
Business and Income														
Losses	49,000	4,500,000	507,000	226,000	5,282,000	*	11,000	0	11,000	33,000	206,000	*	239,000	5,532,000
Emergency costs														
Public	0	523,000	68,000	24,000	615,000	0	0	8,000	8,000	0	2,000	0	2,000	625,000
Other	6,000	460,000	160,000	68,000	694,000	50,000	0	14,000	64,000	55,000	175,000	1,000	231,000	989,000
Subtotal by Location	4,312,000	23,162,000	11,237,000	2,460,000	41,171,000	3,115,000	1,288,000	2,096,000	6,499,000	5,003,000	1,071,000	1,537,000	7,611,000	55,281,000
Transportation delays (Salt River only)														
Additional driver time					6,500,000									
Additional distance travelled					1,600,000									
Additional operating costs					280,000									
Total					8,380,000									8,380,000
TOTAL DAMAGES -- SALT RIVER ONLY					49,551,000									
TOTAL DAMAGES -- PHOENIX METROPOLITAN AREA														63,661,000
	Location 1 - 115th Avenue to 35th Avenue Location 2 - 35th Avenue to 48th Street Location 3 - 48th Street to Country Club Drive Location 4 - Country Club Drive to Granite Reef Dam					Location 5 - U.S. Highway 80 to Watson Road Location 6 - Watson Road to Perryville Road Location 7 - Perryville Road to 115th Avenue				Location 8 - Confluence with Gila River to Indian School Road Location 9 - Indian School Road to Bell Road Location 10 - Bell Road to Waddell Dam				

* Represents damages less than \$ 1,000.

TABLE 5
Summary of All Flood Damages (\$) February 1980

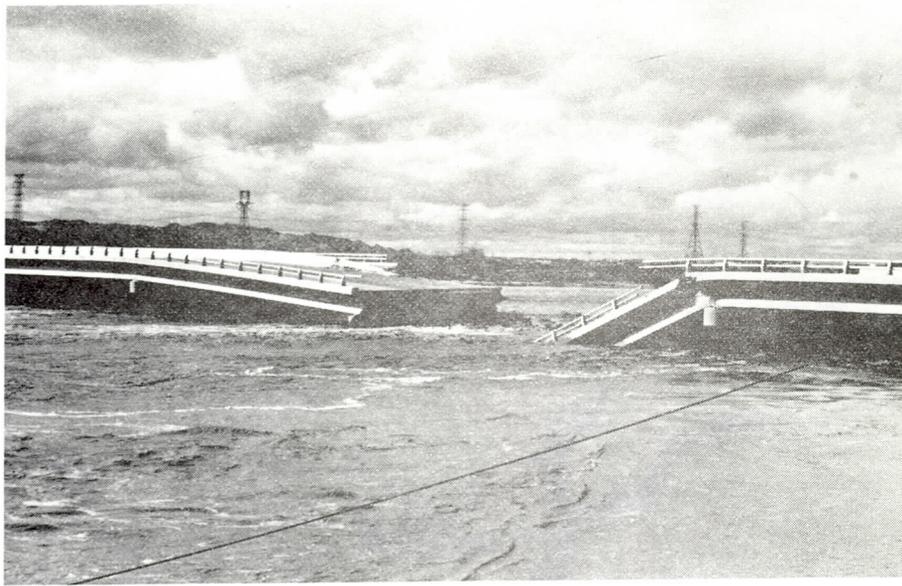
Location:	SALT RIVER				Salt Total	GILA RIVER			Gila Total	AGUA FRIA RIVER			Agua Fria Total	Total all rivers
	1	2	3	4		5	6	7		8	9	10		
Type of Damage														
Residential	627,000	246,000	0	0	873,000	4,000	187,000	578,000	769,000	78,000	*	170,000	248,000	1,890,000
Commercial	317,000	2,195,000	270,000	24,000	2,806,000	1,000	33,000	250,000	284,000	20,000	9,000	2,000	31,000	3,121,000
Industrial														
Sand and Gravel	0	1,126,000	584,000	0	1,710,000	23,000	0	0	23,000	12,000	50,000	0	62,000	1,795,000
Other	313,000	547,000	152,000	0	1,012,000	0	0	0	0	0	0	0	0	1,012,000
Public														
Roads and Bridges	1,478,000	7,462,000	7,154,000	305,000	16,399,000	733,000	364,000	263,000	1,360,000	2,547,000	347,000	1,348,000	4,242,000	22,001,000
Other	1,381,000	6,103,000	2,342,000	1,813,000	11,639,000	242,000	242,000	136,000	619,000	763,000	274,000	16,000	1,053,000	13,311,000
Agricultural														
Soil restoration	33,000	0	0	0	33,000	1,541,000	260,000	124,000	1,925,000	187,000	8,000	0	195,000	2,153,000
Income losses	*	0	0	0	*	61,000	14,000	0	75,000	195,000	0	0	195,000	270,000
Other	108,000	0	0	0	108,000	460,000	177,000	724,000	1,361,000	1,113,000	0	0	1,113,000	2,582,000
Business and Income														
Losses	49,000	4,500,000	507,000	226,000	5,282,000	*	11,000	0	11,000	33,000	206,000	*	239,000	5,532,000
Emergency costs														
Public	0	523,000	68,000	24,000	615,000	0	0	8,000	8,000	0	2,000	0	2,000	625,000
Other	6,000	460,000	160,000	68,000	694,000	50,000	0	14,000	64,000	55,000	175,000	1,000	231,000	989,000
Subtotal by Location	4,312,000	23,162,000	11,237,000	2,460,000	41,171,000	3,115,000	1,288,000	2,096,000	6,499,000	5,003,000	1,071,000	1,537,000	7,611,000	55,281,000
Transportation delays (Salt River only)														
Additional driver time					6,500,000									
Additional distance travelled					1,600,000									
Additional operating costs					280,000									
Total					8,380,000									8,380,000
TOTAL DAMAGES -- SALT RIVER ONLY					49,551,000									
TOTAL DAMAGES -- PHOENIX METROPOLITAN AREA														63,661,000
	Location 1 - 115th Avenue to 35th Avenue Location 2 - 35th Avenue to 48th Street Location 3 - 48th Street to Country Club Drive Location 4 - Country Club Drive to Granite Reef Dam					Location 5 - U.S. Highway 80 to Watson Road Location 6 - Watson Road to Perryville Road Location 7 - Perryville Road to 115th Avenue				Location 8 - Confluence with Gila River to Indian School Road Location 9 - Indian School Road to Bell Road Location 10 - Bell Road to Waddell Dam				

* Represents damages less than \$ 1,000.

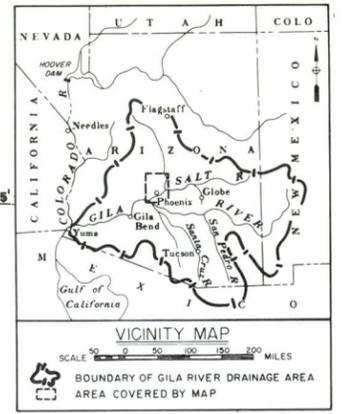
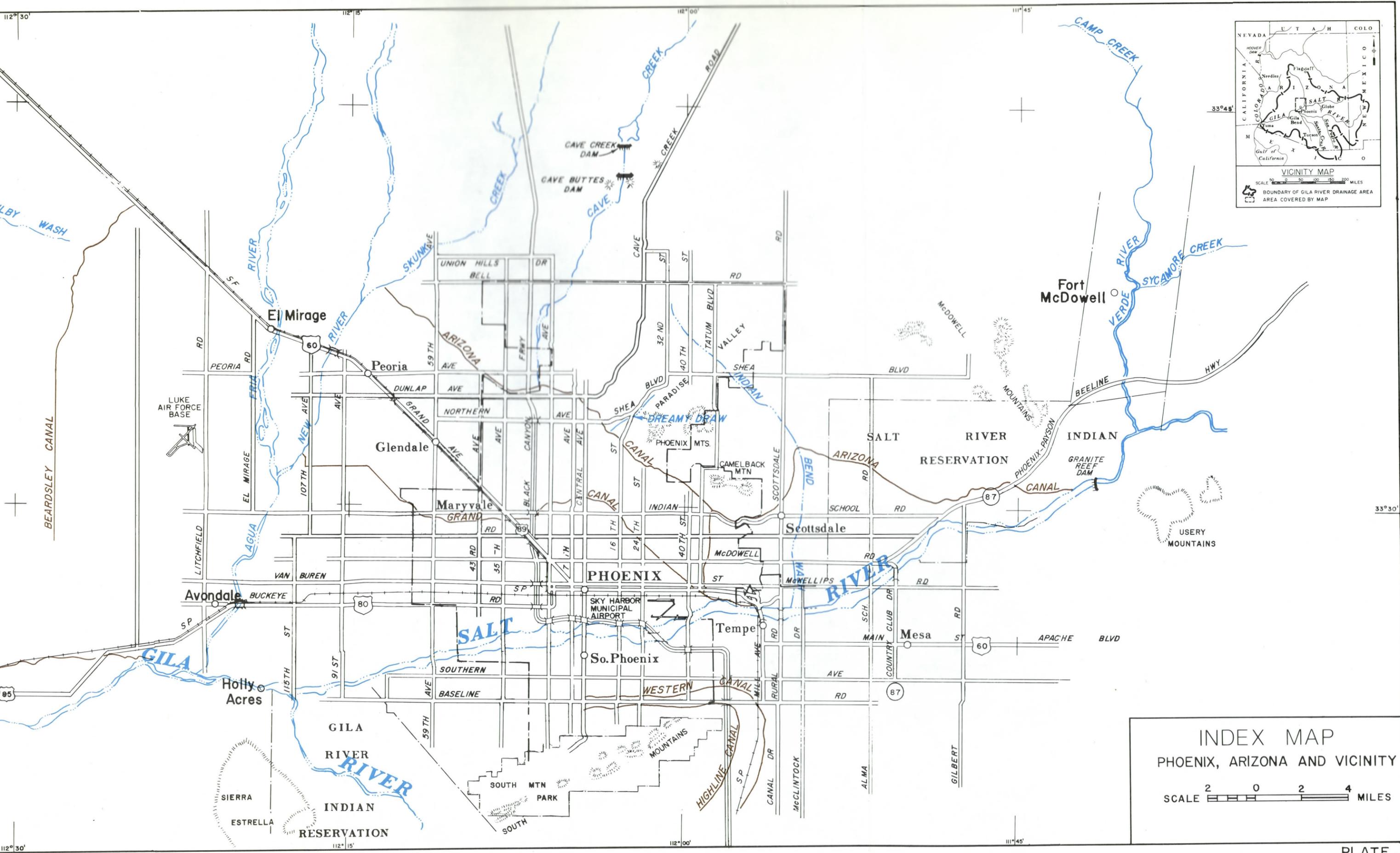
TABLE 5
Summary of All Flood Damages (\$) February 1980

Location:	SALT RIVER				Salt Total	GILA RIVER			Gila Total	AGUA FRIA RIVER			Agua Fria Total	Total all rivers
	1	2	3	4		5	6	7		8	9	10		
Type of Damage														
Residential	627,000	246,000	0	0	873,000	4,000	187,000	578,000	769,000	78,000	*	170,000	248,000	1,890,000
Commercial	317,000	2,195,000	270,000	24,000	2,806,000	1,000	33,000	250,000	284,000	20,000	9,000	2,000	31,000	3,121,000
Industrial														
Sand and Gravel	0	1,126,000	584,000	0	1,710,000	23,000	0	0	23,000	12,000	50,000	0	62,000	1,795,000
Other	313,000	547,000	152,000	0	1,012,000	0	0	0	0	0	0	0	0	1,012,000
Public														
Roads and Bridges	1,478,000	7,462,000	7,154,000	305,000	16,399,000	733,000	364,000	263,000	1,360,000	2,547,000	347,000	1,348,000	4,242,000	22,001,000
Other	1,381,000	6,103,000	2,342,000	1,813,000	11,639,000	242,000	242,000	135,000	619,000	763,000	274,000	16,000	1,053,000	13,311,000
Agricultural														
Soil restoration	33,000	0	0	0	33,000	1,541,000	260,000	124,000	1,925,000	187,000	8,000	0	195,000	2,153,000
Income losses	*	0	0	0	*	61,000	14,000	0	75,000	195,000	0	0	195,000	270,000
Other	108,000	0	0	0	108,000	460,000	177,000	724,000	1,361,000	1,113,000	0	0	1,113,000	2,582,000
Business and Income														
Losses	49,000	4,500,000	507,000	226,000	5,282,000	*	11,000	0	11,000	33,000	206,000	*	239,000	5,532,000
Emergency costs														
Public	0	523,000	68,000	24,000	615,000	0	0	8,000	8,000	0	2,000	0	2,000	625,000
Other	6,000	460,000	160,000	68,000	694,000	50,000	0	14,000	64,000	55,000	175,000	1,000	231,000	989,000
Subtotal by Location	4,312,000	23,162,000	11,237,000	2,460,000	41,171,000	3,115,000	1,288,000	2,096,000	6,499,000	5,003,000	1,071,000	1,537,000	7,611,000	55,281,000
Transportation delays (Salt River only)														
Additional driver time					6,500,000									
Additional distance travelled					1,600,000									
Additional operating costs					280,000									
Total					8,380,000									8,380,000
TOTAL DAMAGES -- SALT RIVER ONLY					49,551,000									
TOTAL DAMAGES -- PHOENIX METROPOLITAN AREA														63,661,000
	Location 1 - 115th Avenue to 35th Avenue Location 2 - 35th Avenue to 48th Street Location 3 - 48th Street to Country Club Drive Location 4 - Country Club Drive to Granite Reef Dam					Location 5 - U.S. Highway 80 to Watson Road Location 6 - Watson Road to Perryville Road Location 7 - Perryville Road to 115th Avenue				Location 8 - Confluence with Gila River to Indian School Road Location 9 - Indian School Road to Bell Road Location 10 - Bell Road to Waddell Dam				

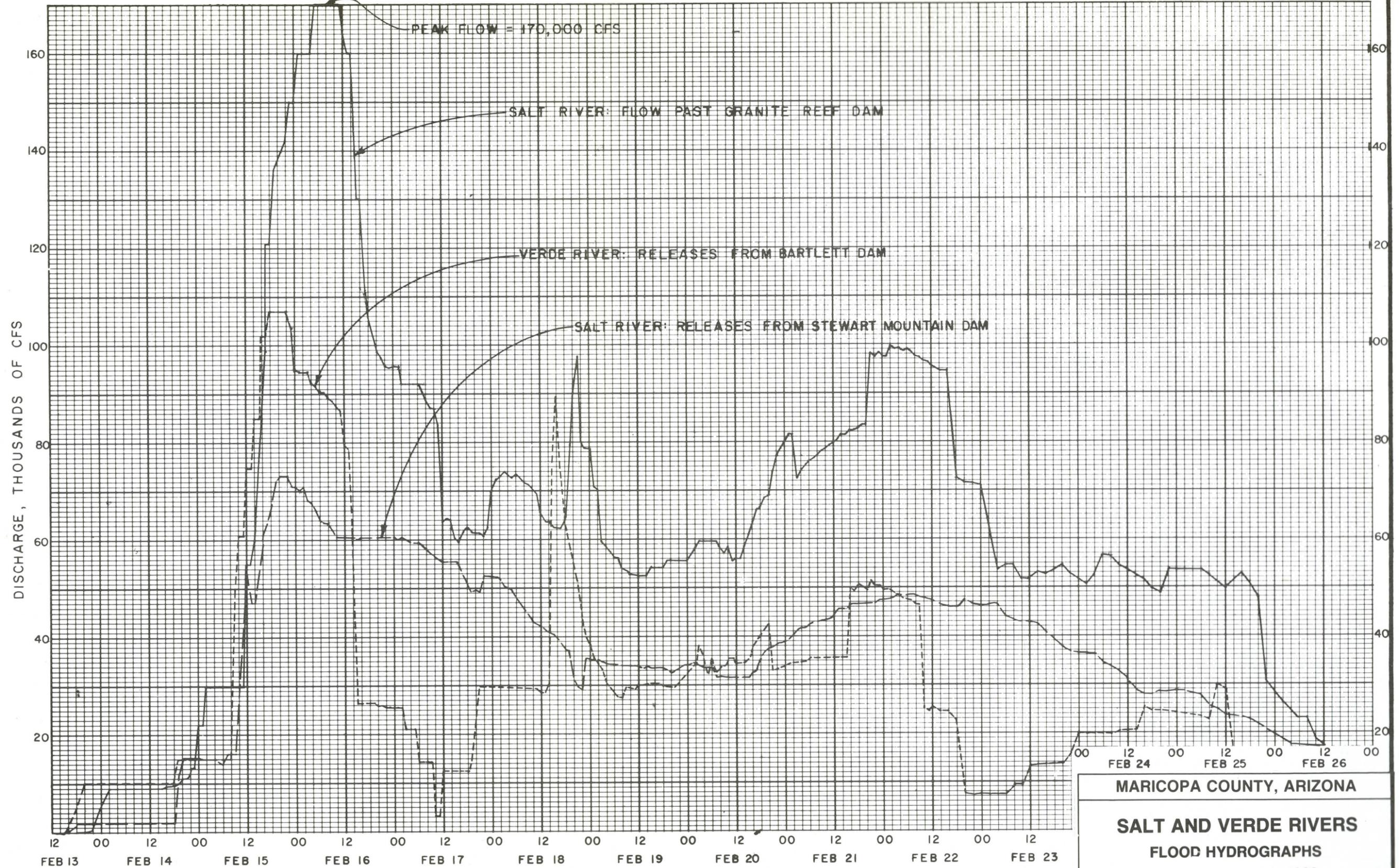
* Represents damages less than \$ 1,000.



The Indian School Road bridge collapsed on the morning of February 20, 1980, the day outflows from Lake Pleasant peaked at 66,000 cubic feet per second.



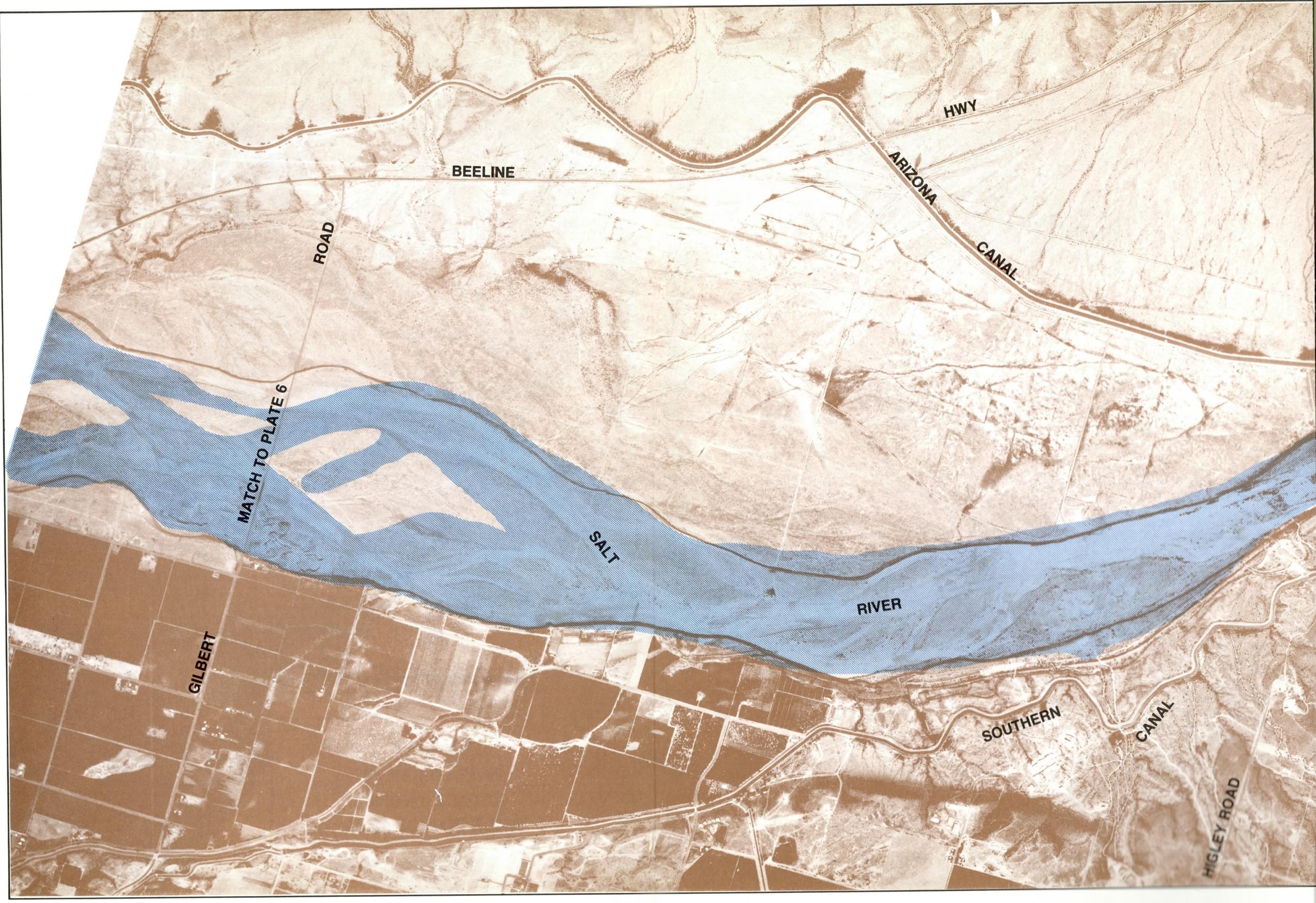
INDEX MAP
PHOENIX, ARIZONA AND VICINITY
 SCALE 2 0 2 4 MILES



MARICOPA COUNTY, ARIZONA

SALT AND VERDE RIVERS
FLOOD HYDROGRAPHS
FEBRUARY 13-26, 1980

U.S. ARMY CORPS OF ENGINEERS
LOS ANGELES DISTRICT



GILBERT

MATCH TO PLATE 6

ROAD

BEELINE

HWY

ARIZONA

CANAL

SALT

RIVER

SOUTHERN

CANAL

HIGLEY ROAD



GRANITE REEF DAM

BEELINE

HWY

ARIZONA

CANAL

SALT

RIVER

SOUTHERN

CANAL

HIGLEY ROAD

SCALE 2000 0 2000 FEET



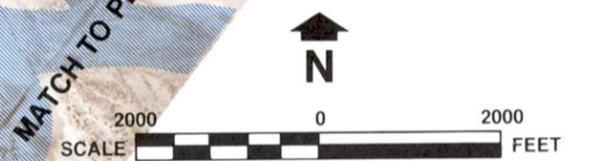
MARICOPA COUNTY, ARIZONA

SALT RIVER
FLOODED AREAS
GRANITE REEF DAM TO
GILBERT ROAD

FEBRUARY 13-22, 1980

US ARMY CORPS OF ENGINEERS
LOS ANGELES DISTRICT





MARICOPA COUNTY, ARIZONA

SALT RIVER
FLOODED AREAS
GILBERT ROAD TO
ALMA SCHOOL ROAD

US ARMY CORPS OF ENGINEERS
LOS ANGELES DISTRICT

FEBRUARY 13-22, 1980





MARICOPA COUNTY, ARIZONA

SALT RIVER
FLOODED AREAS
HAYDEN ROAD TO 40TH STREET

US ARMY CORPS OF ENGINEERS
LOS ANGELES DISTRICT

FEBRUARY 13-22, 1980



BLACK CANYON FWY

WEST BUCKEYE ROAD

EAST BUCKEYE ROAD

17

10

MATCH TO PLATE 9

AVE.

AVE.

ST.

ST.

ST.

MARICOP

SALT

RIVER

7TH

CENTRAL

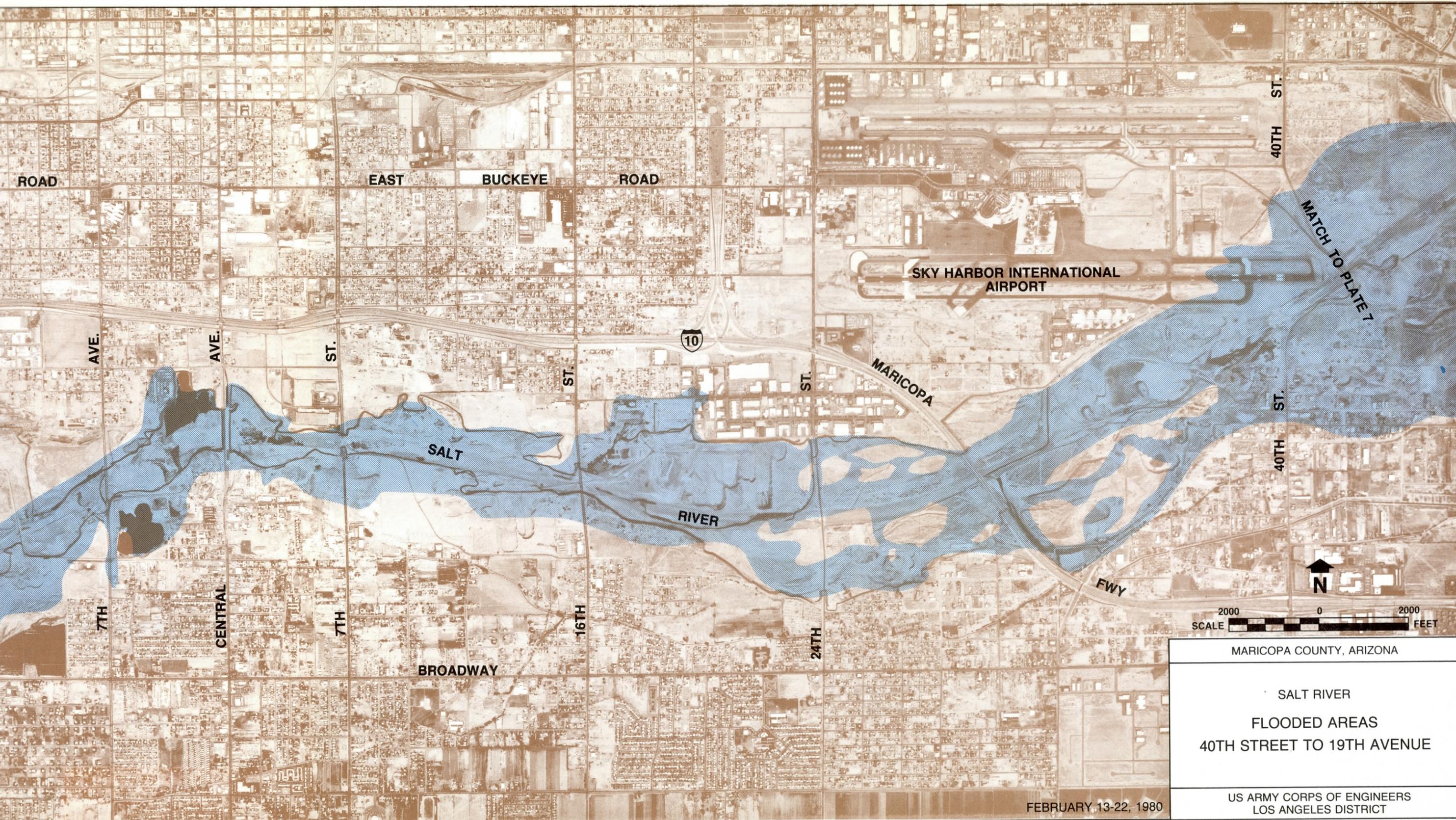
7TH

BROADWAY

16TH

24TH

19TH



MATCH TO PLATE 7



MARICOPA COUNTY, ARIZONA

SALT RIVER
FLOODED AREAS
40TH STREET TO 19TH AVENUE

US ARMY CORPS OF ENGINEERS
LOS ANGELES DISTRICT

FEBRUARY 13-22, 1980



MATCH TO PLATE 10

LOWER BUCKEYE ROAD

AVE.

67TH

51ST

SALT RIVER

SOUTHERN AVE.

35TH

BROAD

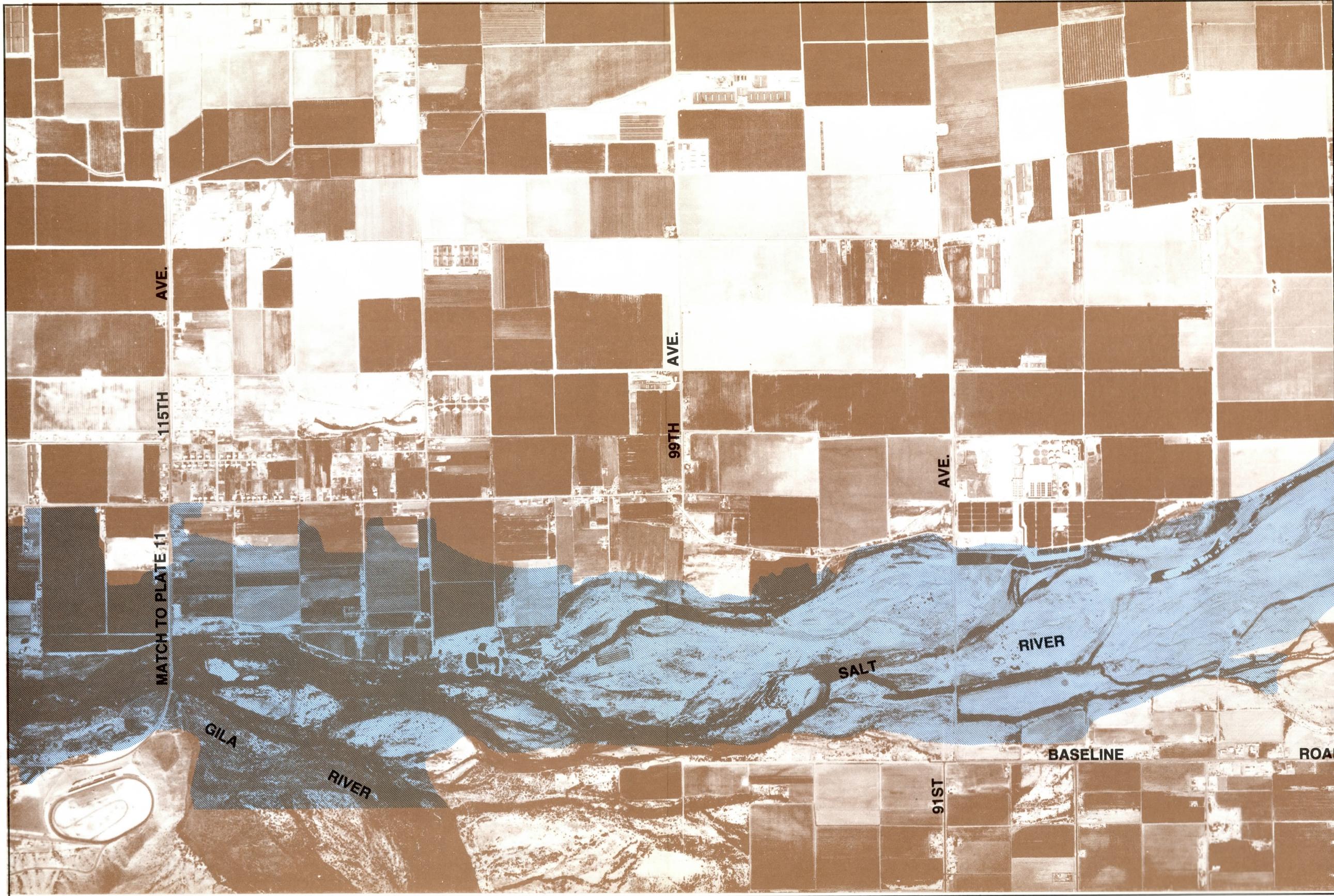


MARICOPA COUNTY, ARIZONA

SALT RIVER
FLOODED AREAS
19TH AVENUE TO 67TH AVENUE

US ARMY CORPS OF ENGINEERS
LOS ANGELES DISTRICT

FEBRUARY 13-22, 1980



115TH AVE.

115TH

MATCH TO PLATE 11

99TH AVE.

99TH

91ST AVE.

91ST

GILA

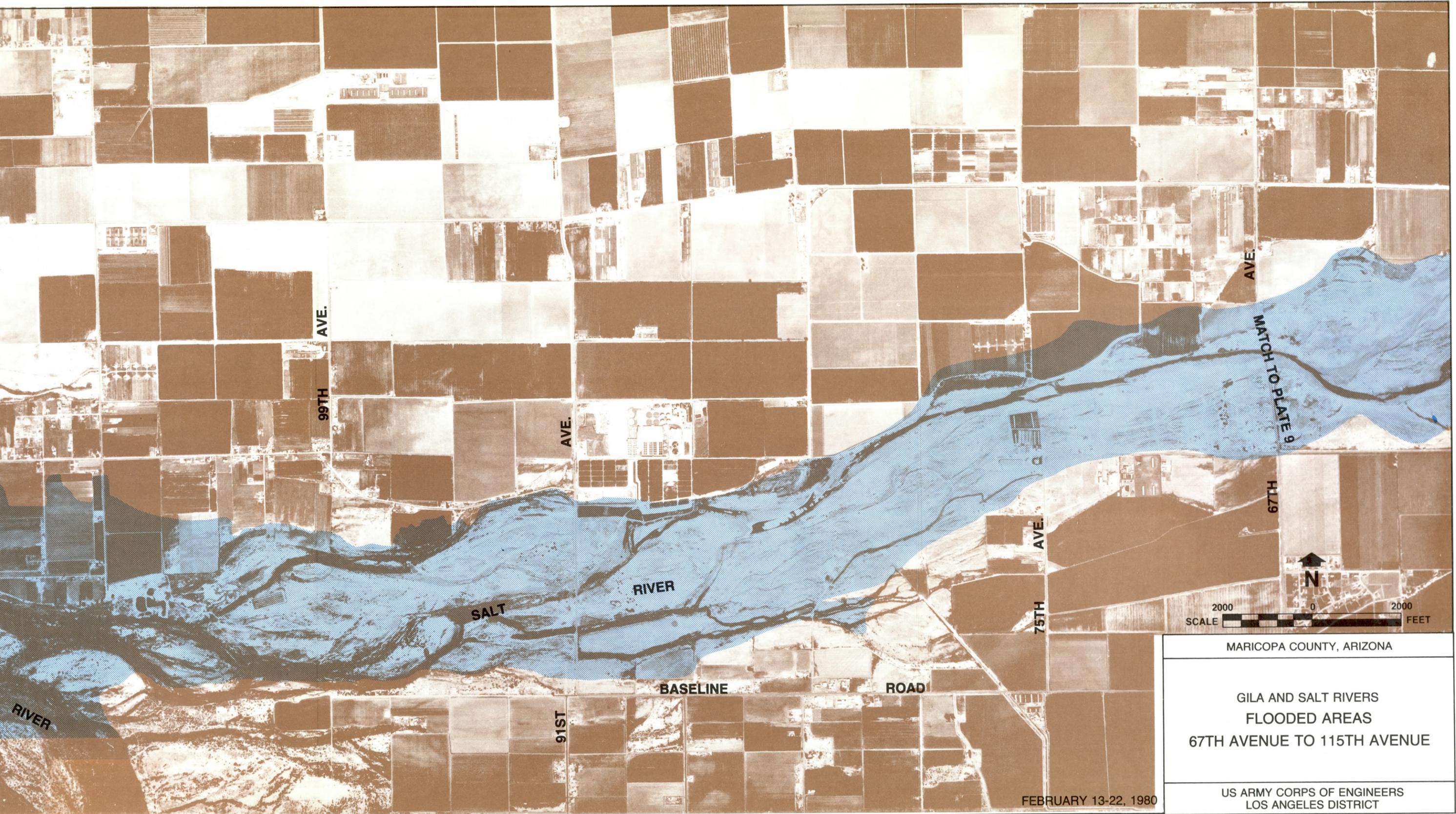
RIVER

SALT

RIVER

BASELINE

ROAD

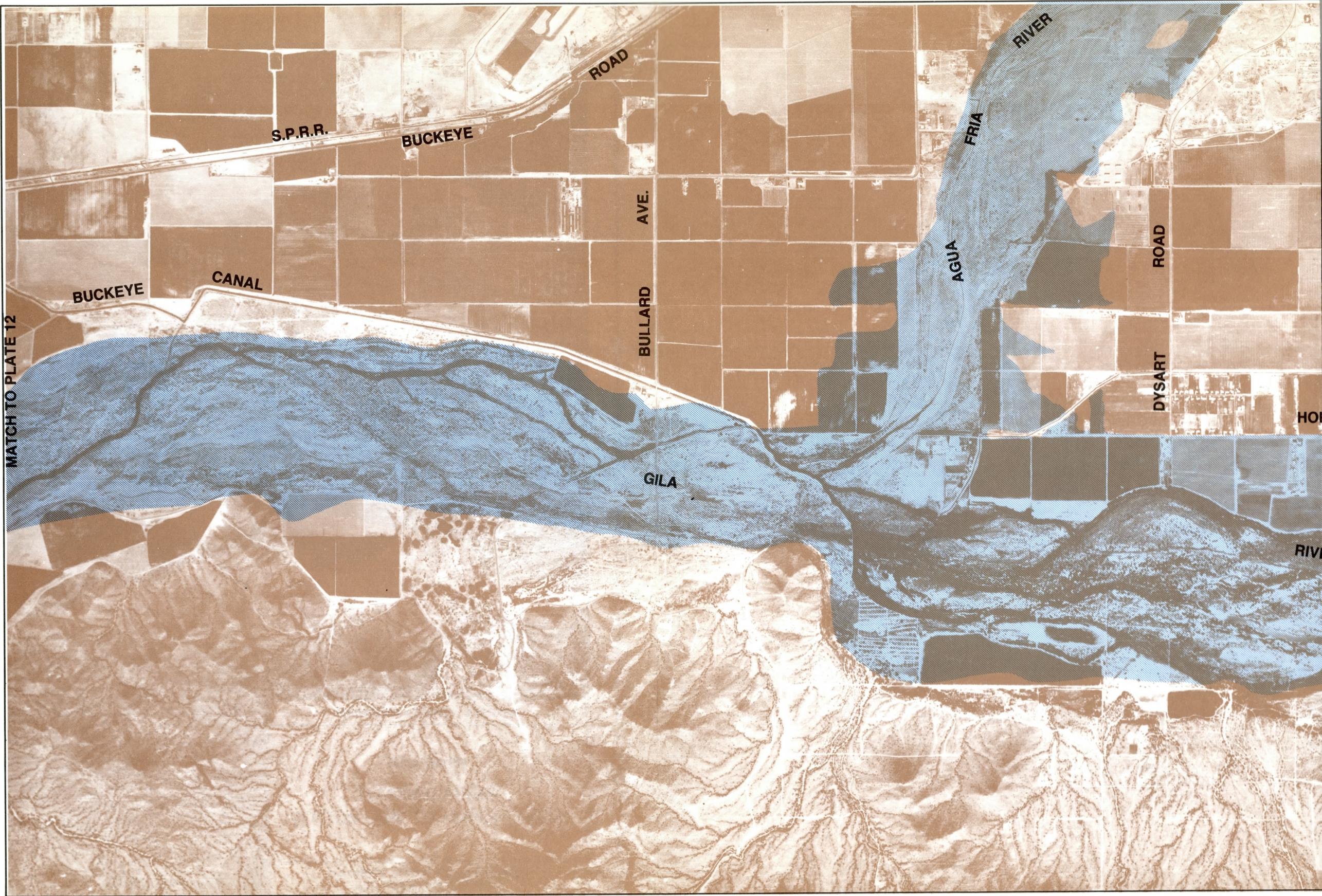


MARICOPA COUNTY, ARIZONA

GILA AND SALT RIVERS
FLOODED AREAS
67TH AVENUE TO 115TH AVENUE

US ARMY CORPS OF ENGINEERS
LOS ANGELES DISTRICT

FEBRUARY 13-22, 1980



MATCH TO PLATE 12

BUCKEYE

CANAL

S.P.R.R.

BUCKEYE

ROAD

AVE.

BULLARD

GILA

AGUA

FRIA

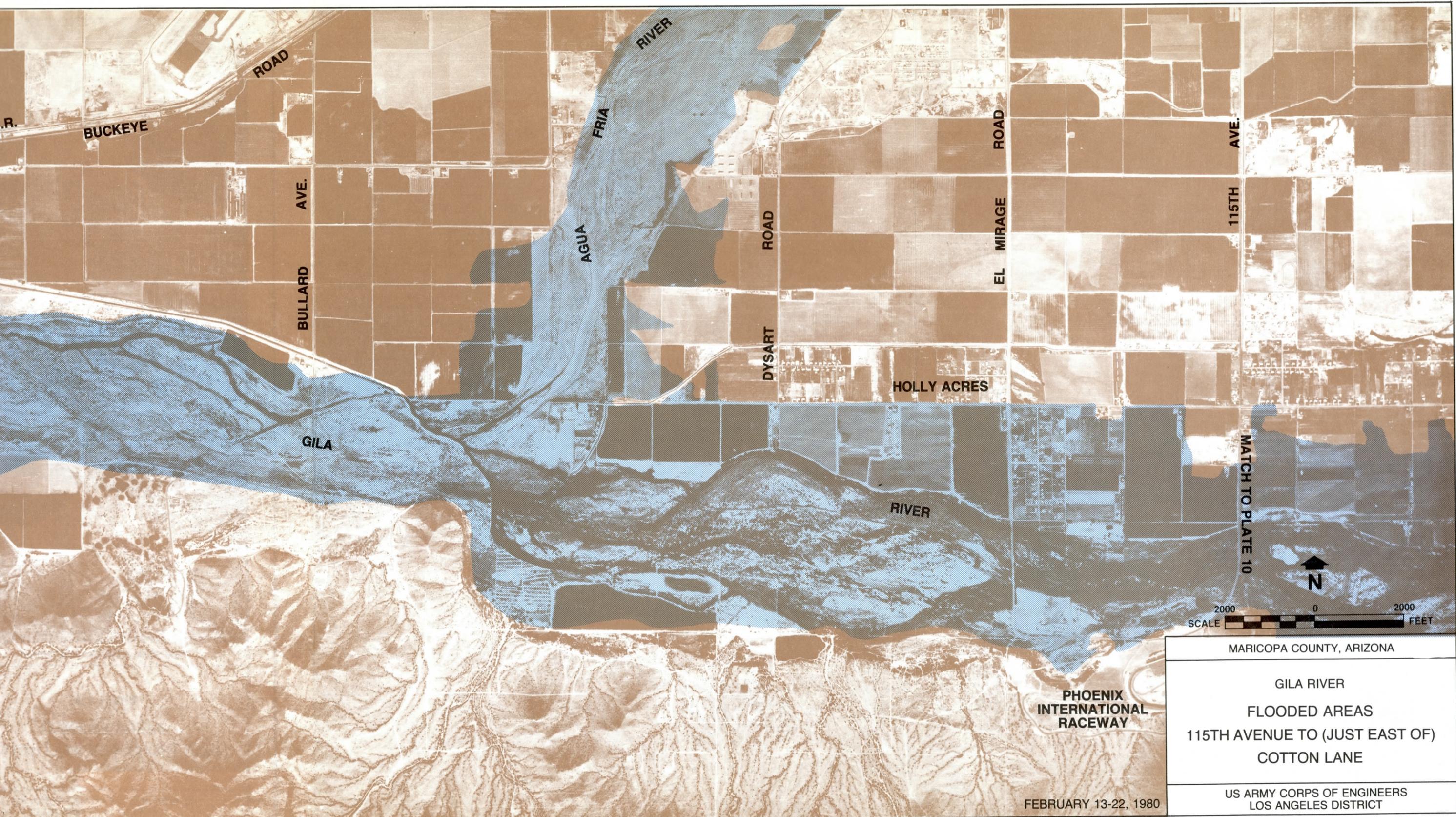
RIVER

ROAD

DYSART

HO

RIV



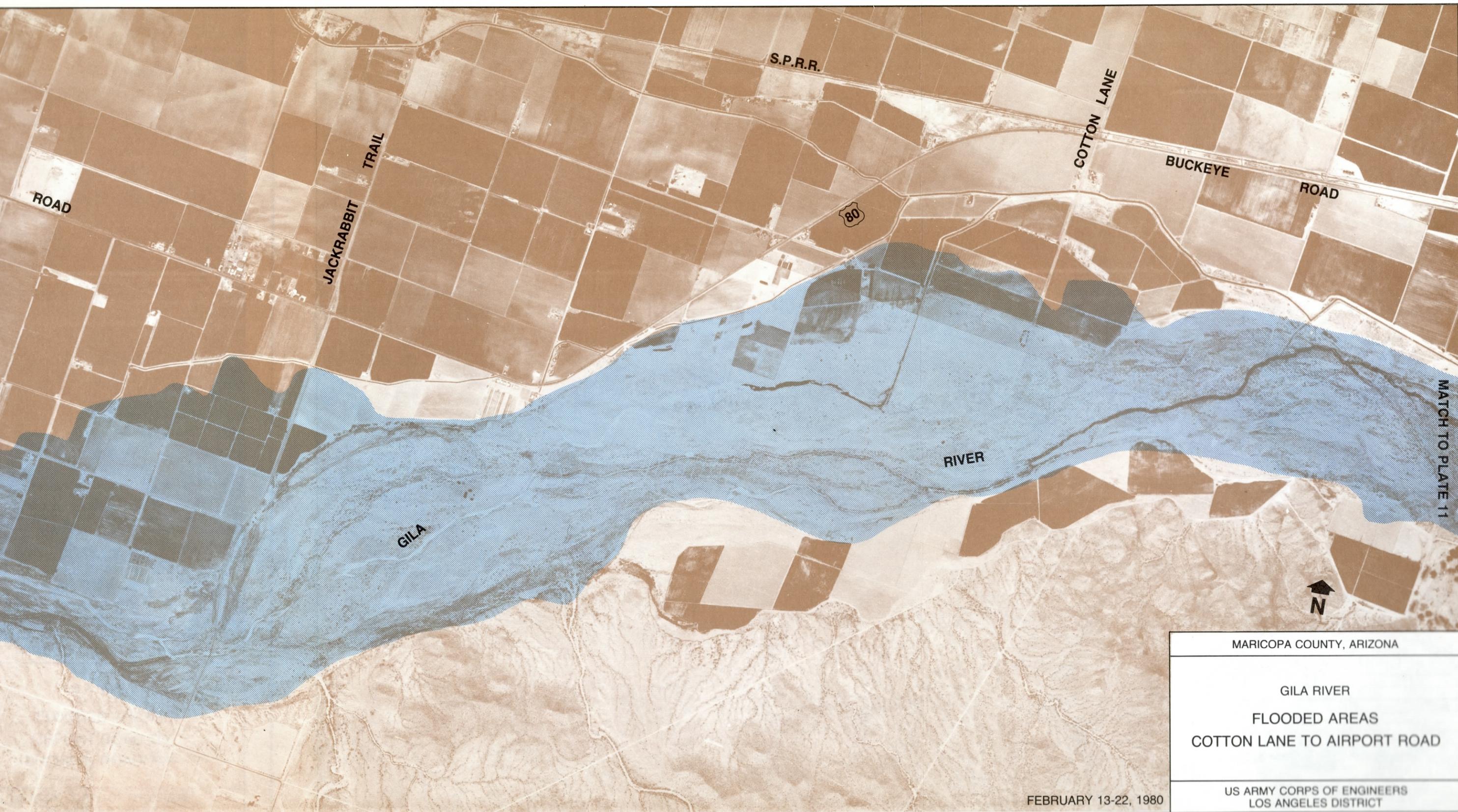
MARICOPA COUNTY, ARIZONA

GILA RIVER
FLOODED AREAS
115TH AVENUE TO (JUST EAST OF)
COTTON LANE

US ARMY CORPS OF ENGINEERS
LOS ANGELES DISTRICT

FEBRUARY 13-22, 1980

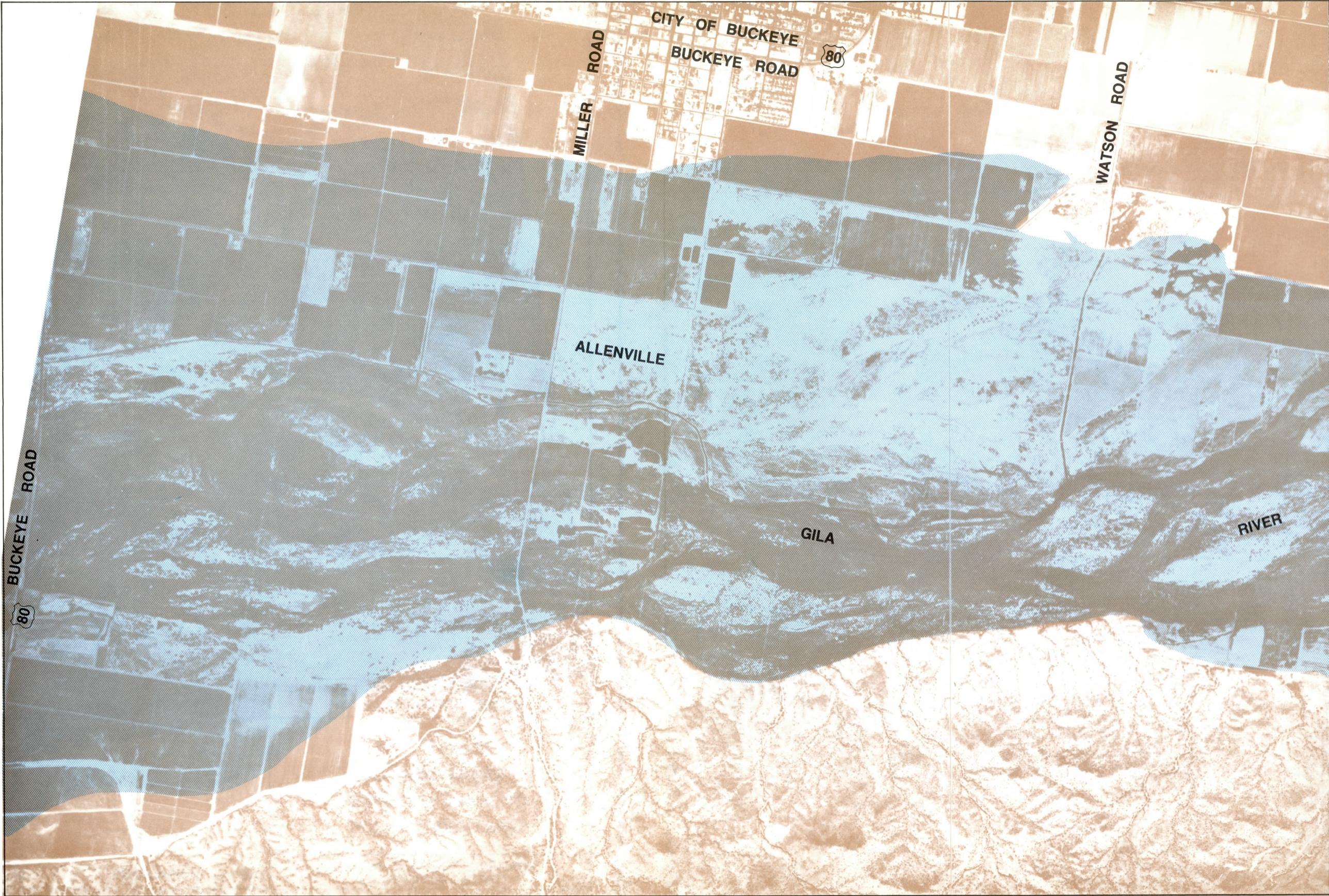




MATCH TO PLATE 11

MARICOPA COUNTY, ARIZONA
GILA RIVER FLOODED AREAS COTTON LANE TO AIRPORT ROAD
US ARMY CORPS OF ENGINEERS LOS ANGELES DISTRICT

FEBRUARY 13-22, 1980



MILLER ROAD

CITY OF BUCKEYE
BUCKEYE ROAD

80

WATSON ROAD

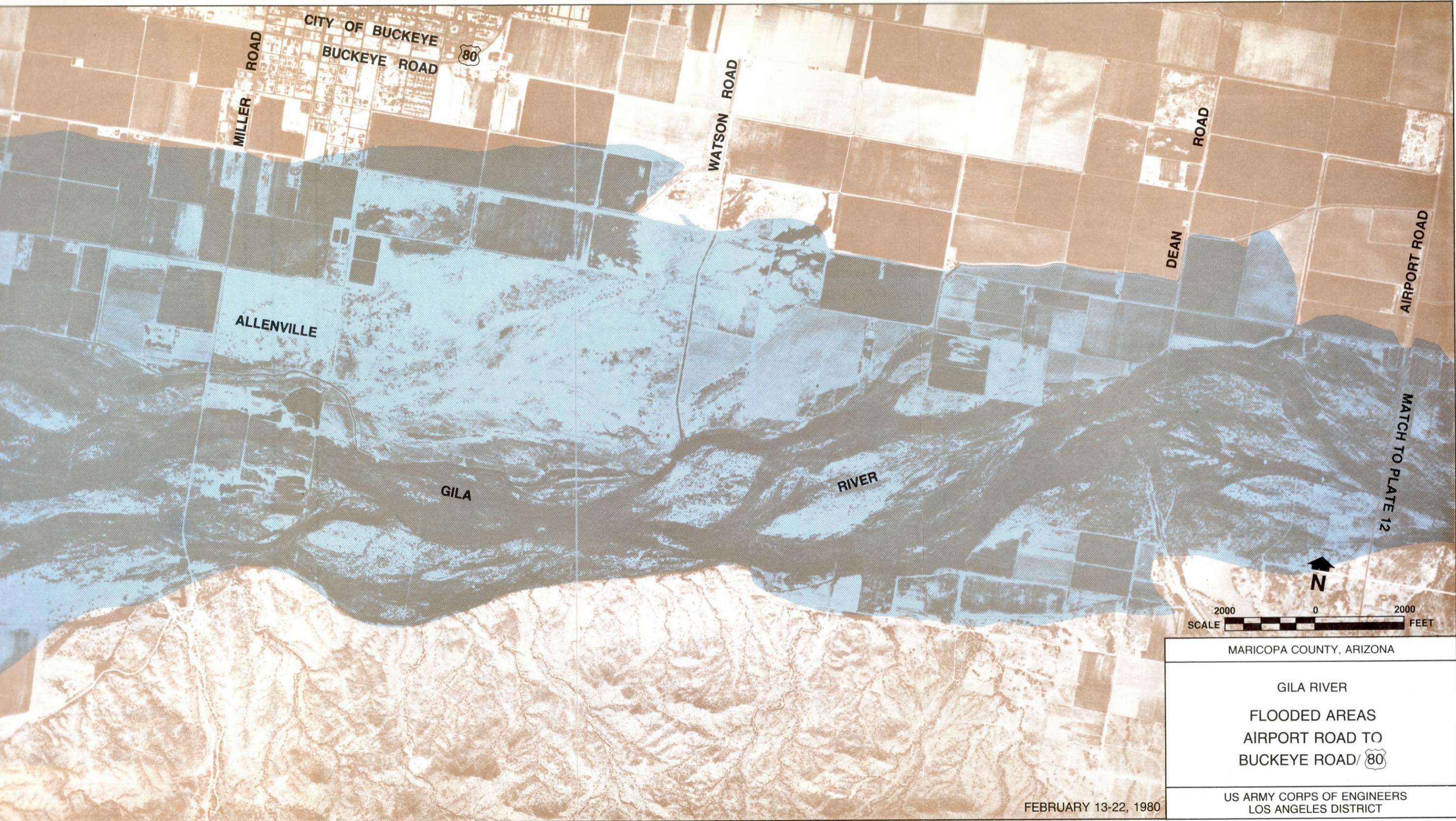
ALLENVILLE

GILA

RIVER

BUCKEYE ROAD

80



MILLER ROAD

CITY OF BUCKEYE
BUCKEYE ROAD



WATSON ROAD

DEAN ROAD

AIRPORT ROAD

ALLENVILLE

GILA

RIVER

MATCH TO PLATE 12



MARICOPA COUNTY, ARIZONA

GILA RIVER
FLOODED AREAS
AIRPORT ROAD TO
BUCKEYE ROAD/

US ARMY CORPS OF ENGINEERS
LOS ANGELES DISTRICT

FEBRUARY 13-22, 1980



MARINETTE HEADING CANAL

AGUA

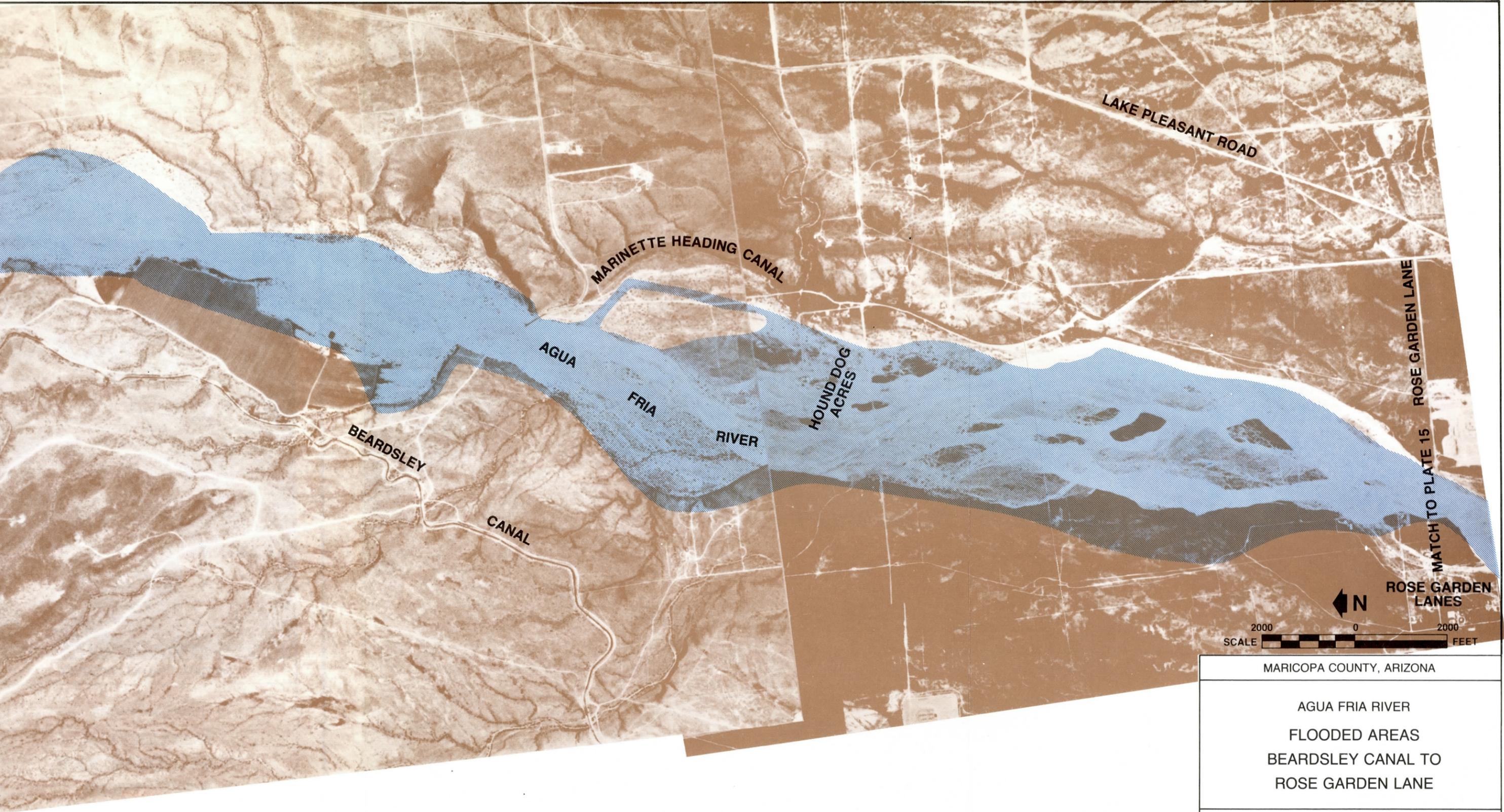
FRIA

RIVER

HOUND DOG
ACRES

BEARDSLEY

CANAL



MARICOPA COUNTY, ARIZONA

AGUA FRIA RIVER
 FLOODED AREAS
 BEARDSLEY CANAL TO
 ROSE GARDEN LANE

US ARMY CORPS OF ENGINEERS
 LOS ANGELES DISTRICT

FEBRUARY 13-22, 1980



ROSE GARDEN LANE

MATCH TO PLATE 14

WEST BEARDSLEY ROAD

UNION HILLS DRIVE

BELL ROAD

AGUA

FRIA

RIVER

ATCHISON

TOPEKA

AND

SANTA FE

GRAND

AVE.

89

60

93



UNION HILLS DRIVE

BELL ROAD

AGUA

FRIA

RIVER

SANTA FE

GRAND

AVE.

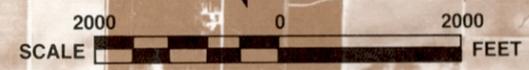
EL MIRAGE ROAD

PEORIA AVE.

MATCH TO PLATE 16

ATCHISON

TOPEKA



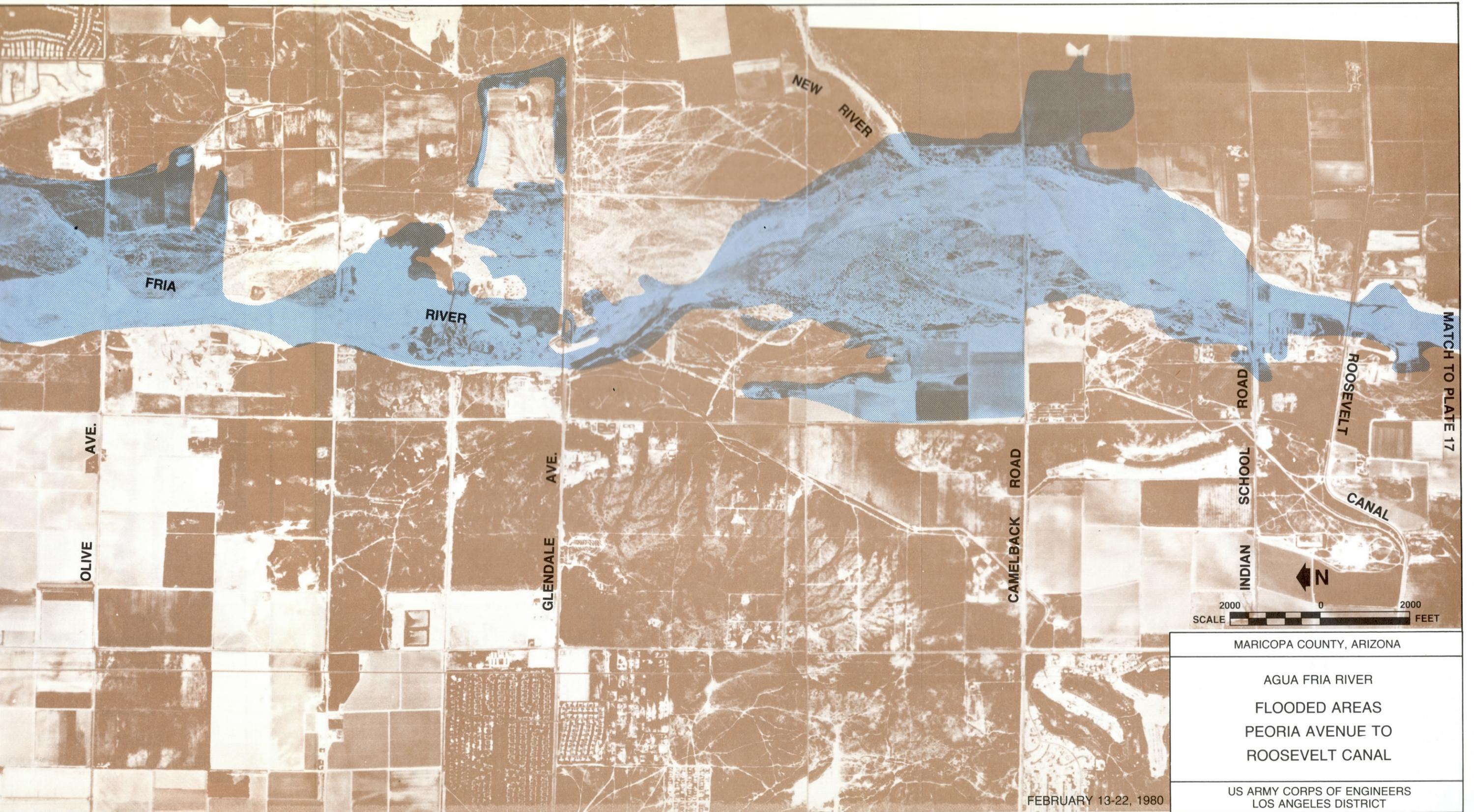
MARICOPA COUNTY, ARIZONA

AGUA FRIA RIVER
FLOODED AREAS
ROSE GARDEN LANE TO
PEORIA AVENUE

US ARMY CORPS OF ENGINEERS
LOS ANGELES DISTRICT

FEBRUARY 13-22, 1980





MATCH TO PLATE 17

MARICOPA COUNTY, ARIZONA

AGUA FRIA RIVER
FLOODED AREAS
PEORIA AVENUE TO
ROOSEVELT CANAL

US ARMY CORPS OF ENGINEERS
LOS ANGELES DISTRICT

FEBRUARY 13-22, 1980

MATCH TO PLATE 16



THOMAS ROAD

McDOWELL ROAD

VAN BUREN ST.

WESTERN AVE.

SOUTHERN ROAD

LOWER BUCKEYE ROAD

BROADWAY

AGUA

FRIA

RIVER

BUCKEYE

SOUTHERN ROAD

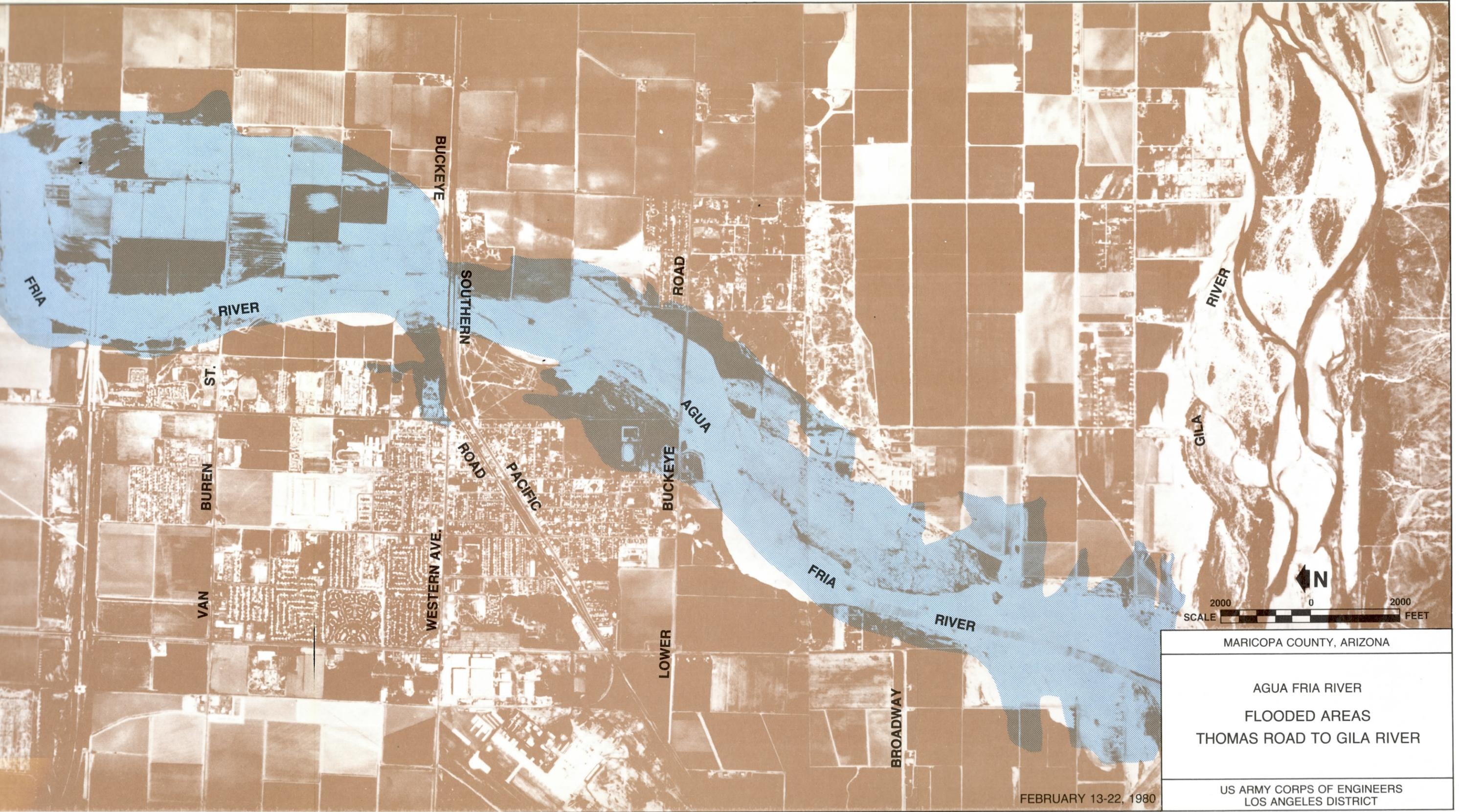
ROAD

AGUA

BUCKEYE

PACIFIC

FRIA



FRIA

RIVER

ST.

BUREN

VAN

BUCKEYE

SOUTHERN

ROAD

WESTERN AVE.

PACIFIC

ROAD

AGUA

BUCKEYE

LOWER

FRIA

RIVER

BROADWAY

RIVER

GILA

SCALE 2000 0 2000 FEET

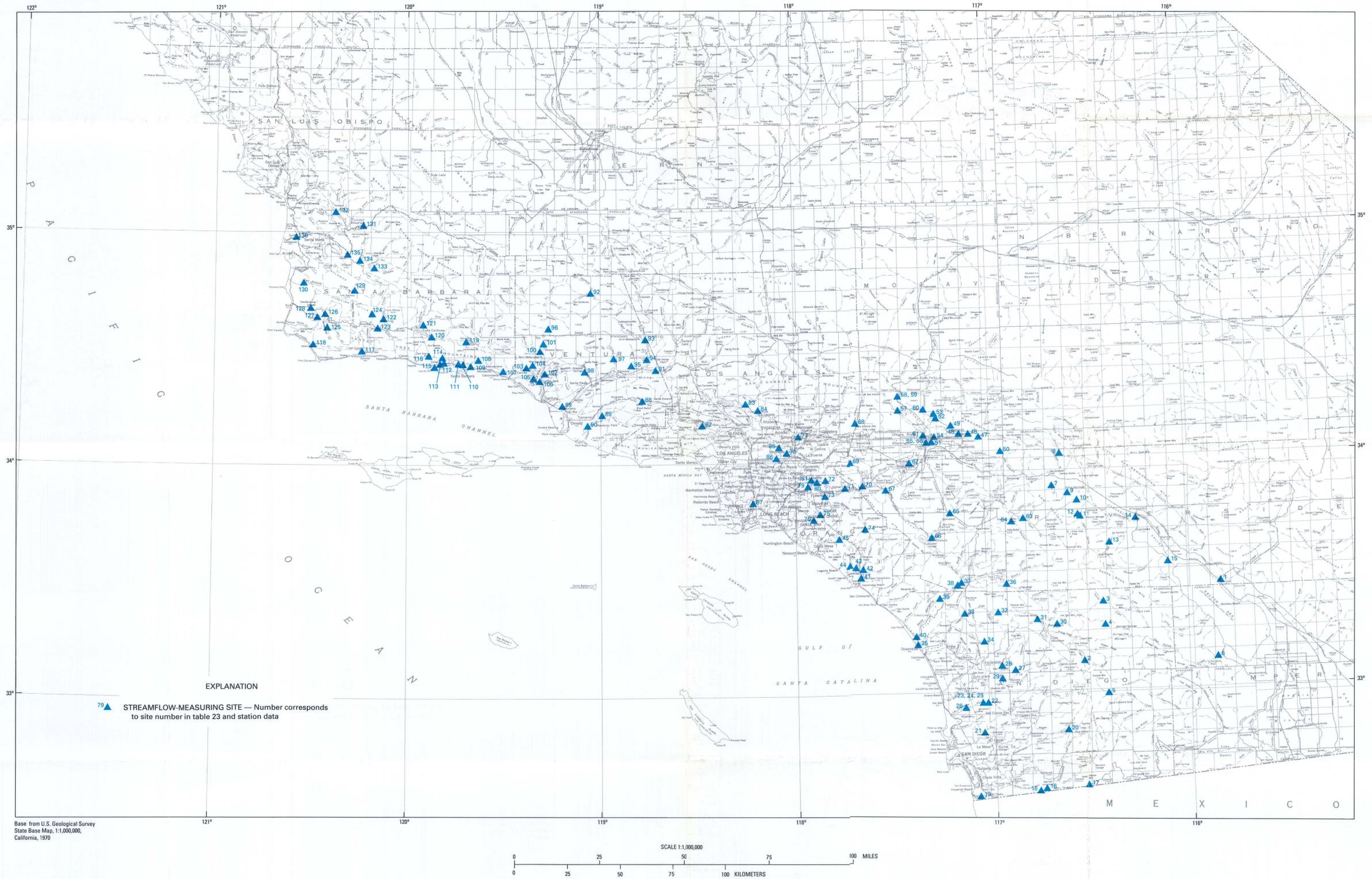
◀ N

MARICOPA COUNTY, ARIZONA

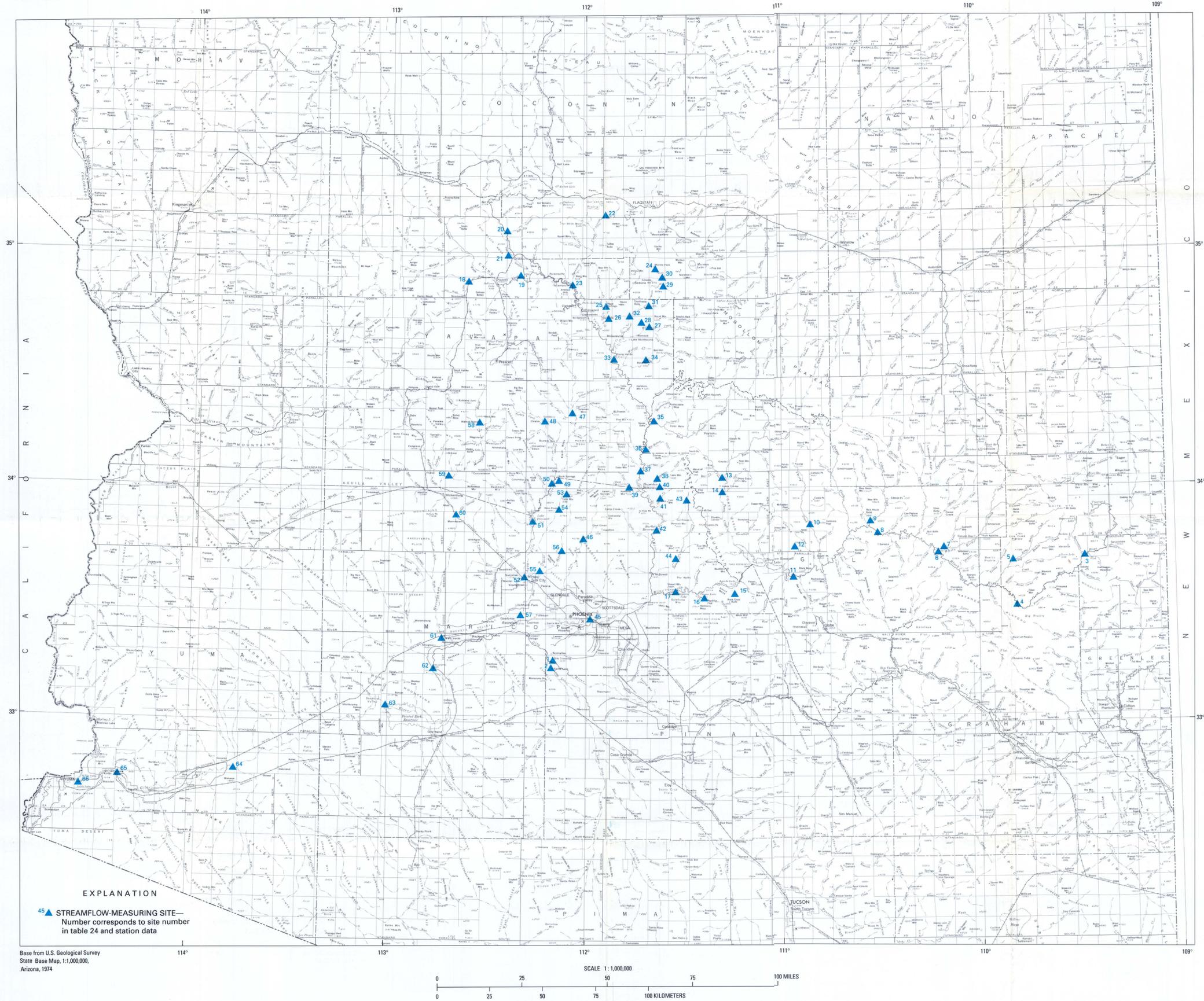
AGUA FRIA RIVER
FLOODED AREAS
THOMAS ROAD TO GILA RIVER

US ARMY CORPS OF ENGINEERS
LOS ANGELES DISTRICT

FEBRUARY 13-22, 1980



MAP SHOWING SITES IN SOUTHERN CALIFORNIA WHERE STREAMFLOW DATA WERE OBTAINED FOR FLOODS OF FEBRUARY 1980



MAP SHOWING SITES IN ARIZONA WHERE STREAMFLOW DATA WERE OBTAINED FOR FLOODS OF FEBRUARY 1980

