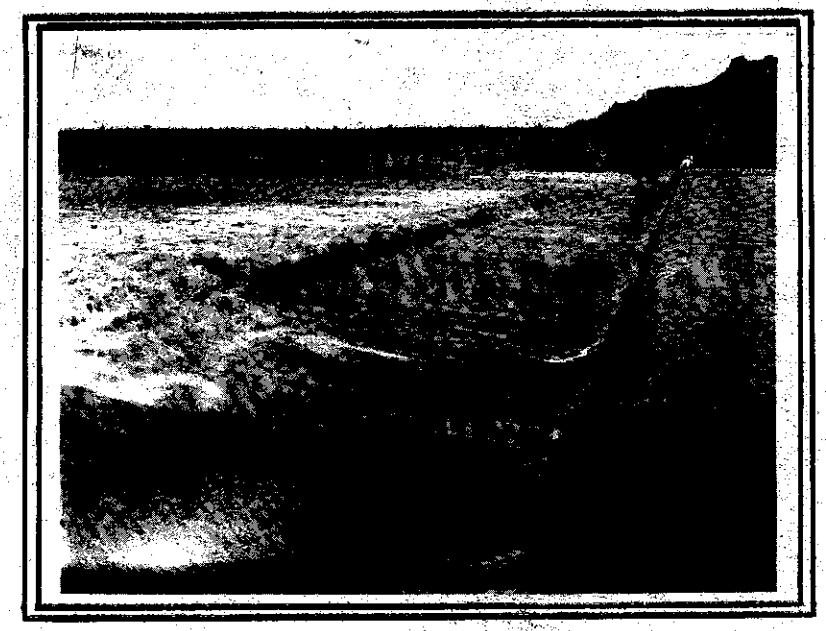
COMPREHENSIVE FLOOD CONTROL PROGRAM REPORT



PREPARED BY THE

FLOOD CONTROL DISTRICT

OF

MARICOPA COUNTY, ARIZONA

1963

Flood Control District
of
Maricopa County
4701 EAST WASHINGTON STREET
PHOENIX 34, ARIZONA

March 8, 1965

Mr. Jess Watt
Box 642
Litchfield park, Arizona

Dear Mr. Watt:

Enclosed herewith is a printed copy of the Flood Control Program for Maricopa County, approved and adopted on November 20, 1963. I know you will find it informative and hope at the same time you will find it interesting.

John C. Lowry
Chief Engineer & General Manager

JCL/db

Encl.

FLOOD CONTROL DISTRICT

OF

MARICOPA COUNTY

Comprehensive Flood Control Program Report

Board of Supervisors

of

Maricopa County

and

Board of Directors of the District

B. W. (BARNEY) BURNS
Chairman
MRS. JAMES T. O'NEIL
L. ALTON (PAT) RIGGS

County Engineer
SAMUEL F. LANFORD

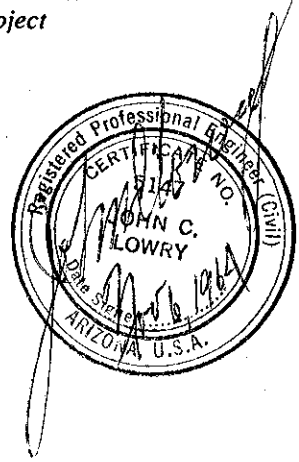
Chief Engineer and General Manager
JOHN C. LOWRY

Advisory Board

LOUIS R. JURWITZ, *Chairman*
WILBUR WEIGOLD
GEORGE CAVIN
SAM TUCKER, *ex-officio, City of Phoenix*
JOHN FISHER, *Vice-Chairman*
HUGH NICHOLS
H. S. RAYMOND
HENRY SHIPLEY, *ex-officio, Salt River Project*

Cover Picture:
Verde Flood Water at
Granite Reef Dam,
February 21, 1920

1962



ACKNOWLEDGMENTS

The Flood Control District makes a special acknowledgment to the members of the Flood Protection Improvement Committee. This committee, formed under the guidance of Jack Williams, then Mayor of Phoenix, and Fred Glendening, then County Engineer, was instrumental in the securing of passage of the Arizona State Statutes which authorized the formation of the Flood Control District. The citizens of Maricopa County are deeply indebted to this committee, whose members are here listed:

Maricopa County	**City of Phoenix**	**Salt River Project**
T. R. Neiswander	Leigh Gardner, Chairman	H. J. Roth, Secretary
H. C. Tognoni	Sam Tucker	E. L. Wilson
H. H. Williams	L. R. Jurwitz	Henry Shipley

Further acknowledgment is made to all former members of the Citizens' Advisory Board to the Flood Control District; among them, Jess Watt, first chairman; Charles Patten, former chairman; Del Fisher, Jack Williams, Othel Narramore, and Col. Robert E. Cron, Jr., former Chief Engineer-General Manager of the Flood Control District.

Thanks are due to the members of the Advisory group representing the various communities in the District, and to the newspapers of the County who made their past records available. The Flood Control District is grateful to the Maricopa County Highway Department whose facilities have been made available, and to the County Engineer, under whose direction the Flood Control District operates.

Further acknowledgments for technical assistance and cooperation:

Salt River Project
Engineering Department, City of Phoenix
Bureau of Reclamation
Soil Conservation Service
Bureau of Land Management
U. S. Army Corps of Engineers
U. S. Geological Survey
Soil Conservation Districts of the County
Roosevelt Irrigation District
Maricopa County Municipal Water Conservation District #1
Roosevelt Water Conservation District
Buckeye Irrigation & Drainage District
Maricopa County Parks & Recreation Commission
Arizona State Highway Department
Arizona State Land Department
Bureau of Indian Affairs

FLOOD CONTROL DISTRICT

of

MARICOPA COUNTY

4701 East Washington Street

Phoenix 34, Arizona

Board of Directors
Flood Control District
Phoenix, Arizona

Honorable Board:

Submitted herewith for your consideration is the Comprehensive Flood Control Program Report for Maricopa County, Arizona.

The Report consists of:

1. The basic narrative with descriptions of all drainage areas within or adjacent to the County.

2. A tabulation of drainage areas showing the major flood control problems, recommended solutions and cost estimates.

2. A summary showing the recommended projects that, based on information now available, are feasible and practical.

The conclusions and recommendations herein are based on reports by consulting engineers, various federal, state and local agencies, and on experience and studies made by the staff of the Flood Control District.

The Citizens' Advisory Board on February 6, 1963, reviewed and made suggestions regarding the contents of this report. This Board, finding the report to be satisfactory, and with the concurrence of the Chief Engineer and General Manager of the Flood Control District, and of the County Engineer, hereby recommends its adoption.

Respectfully submitted,

CITIZENS' ADVISORY BOARD

s/ Louis R. Jurwitz

Chairman

RESOLUTION

WHEREAS, the Board of Directors of the Flood Control District of Maricopa County heretofore on October 28, 1963, by a unanimous vote of the Board, tentatively adopted a comprehensive program of flood control and scheduled a public hearing on the comprehensive program and the performance of the proposed work for November 20, 1963, and

WHEREAS, after the Board of Directors of the Flood Control District tentatively adopted the comprehensive program of flood control and scheduled the notice of public hearing thereon, it thereafter gave notice of the hearing by publication in a newspaper having general circulation in the District, all of which was pursuant to the provisions of Article 5, Sections 45-2351 through 45-2370 of the Arizona Revised Statutes of 1956 as amended, and

WHEREAS, on November 20, 1963 beginning at the hour of 10 o'clock a.m. a public hearing was held on the comprehensive program of flood control and the performance of the proposed work, and all cities, persons, corporations, municipal corporations and other entities within the boundaries of the Flood Control District and other persons and entities outside the Flood Control District were given an opportunity to be heard and present their views on the comprehensive program of flood control and the performance of the proposed work, and

WHEREAS, it appearing from the comprehensive program of flood control and the supporting information, together with the statements of persons heard at the public hearing, that the comprehensive program of flood control set forth a realistic program of flood control; that the same was in the best interest of the property owners and the inhabitants of the county and that the public health, comfort, convenience, necessity and welfare would be furthered by the adoption of the comprehensive program of flood control.

NOW THEREFORE BE IT RESOLVED, by the Board of Directors of Maricopa County that the comprehensive program of flood control heretofore submitted to the Board of Directors by the Chief Engineer of the Flood Control District and the Citizens' Advisory Board and thereafter adopted by this Board of Directors, be and the same is hereby adopted and approved.

BE IT FURTHER RESOLVED, that this resolution be entered in the minutes of the Board of Directors of the Flood Control District of Maricopa County and published pursuant to the rules and regulations of this Board of Directors.

The foregoing resolution, upon a motion made by Ruth A. O'Neil, was thereafter unanimously passed and approved by the Board of Directors of the Flood Control District of Maricopa County on this 20th day of November 1963.

signed: B. W. Burns

B.W. Burns, Chairman of the
Board of Directors of the
Flood Control District of
Maricopa County

signed: Rhea Averill

Clerk of the Board

SECTION 4

REPORT OUTLINE

Chapter	
1	Cover Sheet
2	Acknowledgments
3	Transmittal Letter
4	Report Outline
5	Table of Contents
6	Appendices
7	Recommendations & Summary
8	Introduction
9	Individual Drainage Areas

SECTION 5

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SECTION 7

RECOMMENDATIONS & SUMMARY

7.1-A GENERAL

As a result of the various studies of flood control problems in Maricopa County, the Chief Engineer and staff of the Flood Control District have arrived at some definite recommendations and conclusions.

Based on this information, it is possible to classify proposed projects into two categories: Recommended and Not Recommended (or Deferred).

Projects recommended are considered justified and practical at the present time. Those not recommended are not considered justified at the present time, but could be at some future date. Ratio of benefits to cost is the main factor that has determined into which category a project is placed. In cases where the ratio will not permit recommendation, then participation by local individuals or groups may make it possible for the Flood Control District to re-classify such projects.

As directed by the flood control law (ARS, Article 5, Secs. 45-2351 to 45-2371) the District is charged with the responsibilty of operating and maintaining the projects recommended in this report. In addition to this, the District is also obligated to operate and maintain certain structures already installed, such as McMicken Dam and others. Also, the District may in the future enter into agreement with any group or agency to operate and maintain flood control structures.

Cost of this phase of the program will, of course, vary according to the type of structure. For example: a channel will ordinarily require more maintenance than a retarding dam. This responsibility and expenditure of time and money will increase with the number and age of the structures.

7.1-B RECOMMENDED PROJECTS AND PLANS (See Table 7.0-1)

7.1-B-1 Salt River Channel

a. Construct short levees along Salt River between 40th Street, Phoenix, and Tempe Butte, Tempe. Includes channel clearance along Gila and Salt River from Gillespie Dam to Granite Reef Dam.

b. As an alternate to the plan above, the Flood Control District recommends the following: channel clearing from Gillespie Dam to 107th Avenue and a lined channel from this point up the river to Country Club Drive in Mesa, then clearing on to Granite Reef Dam.

7.1-B-2 Sols Wash Channel

a. Plan calls for channel clearing and excavation beginning at U.S. Highway 89 and extending west to Flying "E" Wash; thence up Flying "E" Wash to a point above the country club.

b. Channel clearing will consist of removal of all brush, trees and debris.

c. Excavation will consist of digging a pilot channel for the total length of clearing.

d. Total planned channel work will cover approximately 2 miles.

7.1-B-3 Power House Wash

a. Construction of an earth-fill dam on the wash northeast of Wickenburg. Dam will be approximately 35 feet high and store 150 acre feet of flood water.

b. Related outlet works and emergency spillway.

7.1-B-4 Casandro Wash Dam

a. Construction of an earth-fill dam across the wash north of U.S. Highway 60-70 and just west of the city of Wickenburg. Maximum height of the dam will be 34 feet and planned flood water storage is 90 acre feet.

b. Related outlet works and emergency spillway.

7.1-B-5 Sunset & Sunny Cove Dams

a. Construction of an earth-fill dam on each of these two small washes. Height of these dams is approximately 20 ft. and total storage of both reservoirs is 137 acre feet.

b. Related outlet works and emergency spillway.

7.1-B-6 Buckeye Retarding Structure and Floodway

a. Plan calls for construction of a system of channels, retarding structures and a diversion to carry flood water to the Hassayampa River.

b. There will be two retarding structures aproximately 12 miles long. Maximum height of the dams will be 25 feet and total storage will be 5560 acre feet.

c. In conjunction with the retarding structures, two floodways and one diversion will be constructed.

7.1-B-7 Bender and Sand Tanks Improvements

a. Construction of approximately 2.5 miles of dikes along each side of each wash to guide flood water into the proposed channels.

b. Channelization of Bender & Sand Tank Washes to make their capacity adequate to carry designed flows. Total length of channel: 1.5 miles. Design capacity: 6,000 cfs.

c. Relocation of present siphon in Bender Wash. Redesign will allow irrigation water to pass under the wash.

7.1-B-8 Deer Valley Group

a. North Phoenix Mountains Diversion—Construction of a channel from 20th St. to Cave Creek, parallel to the Arizona Canal, emptying into the Arizona Canal Diversion and eventually into Skunk Creek.

Construction of a lined channel with inlet and outlet structures, from 38th St. to 48th St., parallel to Arizona Canal for disposal of flood waters to the Salt River through the old Cross-Cut Canal.

Cost planning is based on the U.S. Corps of Engineers contributing in the total cost. If they do not, then the Flood Control District will either have to support the complete project or build it jointly with the city of Phoenix.

b. **Arizona Canal Diversion**—construction of a channel parallel to Arizona Canal running from Cave Creek west to Skunk Creek. Channel will be lined with an inlet structure at Cave Creek about .5 mile west of 19th Ave.

c. **Union Hills Diversion**—construction of a lined channel beginning at 36th St. between Bell Rd. and Union Hills Dr. running generally west to empty into Skunk Creek. Channel to be concrete-lined, and have inlet structures.

d. **New River Dam**—an earth-fill dam located on New River in Sec.26, T5N, R1E, approximately 8 miles northwest of Adobe. Dam will contain 1,300,000 cu. yds. of fill and store 33,500 acre feet of water. Related outlet and emergency spillway included.

e. **Adobe Dam**—an earth-fill dam located in T5N, R2E, Secs. 27 and 34. Reservoir will store approx.13,000 ac. ft. of flood water and dam will contain 1,600,000 cu. yds. of fill. Outlet works and emergency spillway will be included.

f. **Lower Cave Creek Dam (Cave Buttes Dam)**—An earth-fill dam on Cave Creek in Sec.15, T4N, R3E, approx. 4 miles north of Bell Rd., will contain approx. 4,000,000 cu. yds. of fill and store 22,000 ac. ft. of water at spillway crest. Total surface area: approx. 700 acres. Outlet and emergency spillway will be included.

g. **Channel Clearing: Agua Fria, New River and Skunk Creek**—will consist of clearing brush and alignment of channels where needed in order to have them ready to receive flood waters introduced from Cave Creek and North Phoenix areas. All necessary structural works will be included.

7.1-B-9 West Phoenix Floodways

a. **Glendale-Peoria Drain:** Plan consists of a lined channel, trapezoidal in shape, with 2:1 side slopes, from 35th Ave. and ¼ mile south of Olive Ave. running westerly for 3¾ mi. then southerly 1 mi., then westerly about 4½ mi. to New River.

b. **Maryvale-Glendale Drain:** A lined channel running from Grand Canal ½ mi. west of 67th Ave. southerly approx. 7½ mi. to the Salt River.

c. **West Phoenix-Maryvale Drain:** Planned to run from 47th Ave. at Grand Canal south to Thomas Rd., then southerly 5.3 miles to the Salt River.

Cost planning is based on participation by the Corps of Engineers. If they do not, then the Flood Control District will have to support these projects or build them jointly with the city of Phoenix.

7.1-B-10 Old Cave Creek Dam

a. Alternate No. 1: building an earth dike 2900 ft. long across the natural spillway, and construction of a new spillway on the west side of the old dam.

b. Alternate No. 2: construction of an earth-fill dam across the natural spillway as above. An apron will be poured below the old concrete dam and flood water will flow over the dam during floods.

7.1-B-11 Cave Creek Town Dike

a. Plan consists of constructing approx. 800 ft. of earth dike with rock revetment on the wash about one-half mi. east of the town of Cave Creek.

7.1-B-12 Lower Indian Bend Channel

a. Plan is to construct a lined channel, trapezoidal in section, from Arizona Canal at Indian Bend running southerly to and entering Salt River about .5 mi. east of Scottsdale Rd.

b. Bottom width is 14 ft. and depth varies from 23 to 26 ft. with a crossing structure over Arizona Canal and an energy dissipating structure at Salt River.

7.1-B-13 Maxwell Dam

a. Construction of an earth-fill dam raising 169 ft. above the streambed with a crest length of 5200 ft. Reservoir will store approx. 1,250,000 ac. ft., with 890,000 ac. ft. assigned to flood water storage.

b. Spillway and related inlet and outlet structures are to be included.

7.1-B-14 Apache Junction-Gilbert Structures

a. Construction of one retarding basin and 14.8 miles of floodways.

b. Retarding structure will be built south of U. S. Highway 60-70-80-89 and west of Vineyard Rd. Total storage capacity: 4,135 ac. ft. with 3,960 reserved for flood storage. Dam will be 3.9 miles long, 25 ft. high.

c. Floodways will be constructed to safely carry the water to Queen Creek. Max. capacity: 2,550 cfs.

7.1-B-15 Buckhorn-Mesa Structures

a. The overall plan for flood control will include four floodway retarding structures and 8.1 miles of floodways. Total length 11.2 mi.; max. ht.: varies from 15.5 to 41. feet.

b. A debris basin and diversion box will be included to properly utilize the floodwater for irrigation purposes.

(The above plan as recommended includes Weekes Wash retarding structure and floodway. While these are considered to be necessary in the watershed plan, the Flood Control Engineer does not recommend that Maricopa County contribute the local share of funds. The greatest benefits do not accrue to developments within the County. If the rights of way and other local costs were borne by local interests, then these structures could be built.)

7.1-B-16 Mesa-Chandler-Gilbert Floodways

a. A system of channels eventually emptying into the Gila River. Channels, leading from the above cities, are designed for a 5-year frequency flood.

b. Total length: 29 miles; average bottom width: 10 ft.; average depth: 10 feet.

7.1-B-17 Williams-Chandler Structure

a. Two floodwater retarding structures, 9.2 mi. of floodway construction and one irrigation water turnout with gates.

b. Total length: 9 mi.; average height: 22 ft. dams.

c. Floodway length: 9.2 miles; capacity adequate to handle floodwaters released from the retarding structure.

7.1-B-18 Queen Creek Floodway

a. Overall plan—a channel to pick up flood water near the end of the RWCD Canal at the Maricopa-Pinal County line and take it through the Gila Indian Reservation and into the Gila River.

7.1-C PROJECTS DEFERRED OR NOT RECOMMENDED

7.1-C-1 HARQUAHALA VALLEY STRUCTURES

a: A levee approximately 10 miles long, parallel to the 1400-ft. contour line from the west side of Range 10 West approximately in the center of Township 3 North, then east to Gin Road.

b. Improvements of the channel along Gin Road to carry released flood water to Centennial Wash.

7.1-C-2 TONOPAH STRUCTURES

a. A levee approx. 12 miles long along the 1200-ft. contour beginning in Sec. 17, T2N, R7W, and extending to Sec. 16, T2N, R5W.

b. Channel improvements in Winters Wash to make it adequately to carry the designed release flow.

7.1-C-3 EAGLE TAIL MOUNTAIN STRUCTURES

a. A dike beginning in Sec. 26, T2N, R11W, and running along the 1400-ft. contour in Sec.1, T1S, R10W. Total length: 14 miles.

b. A floodway to be built, beginning in Sec. 1, T1S, R10W, and running easterly along section line intersecting Centennial Wash. Old channel to be enlarged.

7.1-C-4 MATTHIE DAM

a. An earth-fill dam located on Sols Wash approx. 8 miles west of Wickenburg. Max. dam ht.: 70 ft.; total surface area: 500 acres.

7.1-C-5 FLYING "E" WASH DAM

a. An earth-fill dam south of U.S. Highway 60-70, west of Wickenburg. Approx. ht.: 33 ft.; capacity: 335 ac. ft.

7.1-C-6 SOUTH MOUNTAIN STRUCTURES

a. An unlined channel, trapezoidal in section, parallel to Highline Canal on the south side, from 48th St. west to the Indian Reservation boundary and then to Salt River.

b. A dam west of Guadalupe and one near 43rd Ave., with related inlet and outlet control work as required.

7.1-C-7 UPPER INDIAN BEND CHANNEL

a. An unlined channel from Cholla Road and 36th St. to Arizona Canal below Indian Bend Road, joining lower Indian Bend Channel at the Canal.

b. Install box culverts to accommodate low flows and wide sections at half-mile roads.

7.1-C-8 GUADALUPE RETARDING STRUCTURE and FLOODWAYS

a. Three levees of varying lengths; average ht.: 15 ft.; total storage: 1170 ac. ft.

b. Four floodways in conjunction with retarding structures to take floodwater to Gila River. Channels to be concrete-lined and have adequate capacity to carry maximum flow from the retarding structures.

7.1-C-9 BOX CANYON DAM

a. An earth-fill dam across the Hassayampa River, approx. 246 ft. high; storage capacity: 200,000 ac. ft.

b. Related outlet works to provide for flood control and domestic water.

7.1-C-10 SANTAN STRUCTURES

a. A system of retarding structures and floodways to intercept and carry the floodwater to Queen Creek.

b. Four levees and four floodways; total length: approx. 7.3 mi. for levees with height of 18 ft. Length of floodways: 6.1 mi.; capacity: 400 cfs.

7.1-D PROGRAM SUMMARY

7.1-D-1 GENERAL

The entire program recommended by the Flood Control District will cost $115,494,000. The District will contribute $25,880,000, and receive $89,614,000 from other sources, mostly federal agencies. (These figures are approximate.)

For the purpose of this report, the complete program has been broken down into three groups or phases.

Group I includes the very minimum that could be done at the present time, and should be considered Phase I of the overall plan. Group II is an intermediate step, working toward Group III.

The flood control program as recommended requires, on most projects, federal government approval and assistance. This assistance may not always be forthcoming according to the order of projects listed in our priority grouping. For example, Soil Conservation Service funds may become available for projects in eastern Maricopa County before the U. S. Corps of Engineers funds are allocated to build structures in the Deer Valley Group. This, of course, will determine when the projects can be installed, and priorities may have to be revised.

Annual cost for the total program to the Flood Control District will depend upon the interest rate paid for bonds sold and the period of amortization. Annual funds required also include costs of maintenance and operation and are estimated as follows: (Based on an amortization of 25 years at 2-7/8% interest.)

Group I	$ 960,000	Group II	487,000	Group III	340,000

Table 7.0-1 lists the three major groups, with group III being the ultimate plan as presently recommended. County-wide coverage and degree of protection increase in each successive group.

TABLE 7.0-1 RECOMMENDED PROJECTS SUMMARY

Job Description	FCD COST	OTHER COSTS	TOTAL COST
Group I			
Gila-Salt River Channel Clearance	250,000	1,000,000	1,250,000
Lower Indian Bend Channel	1,770,000	7,250,000	9,020,000
Channel Clearing-Agua Fria, New River & Skunk Creek	250,000	1,000,000	1,250,000
Arizona Canal Diversion	944,000	7,060,000	8,004,000
Dreamy Draw Dam	150,000	300,000	450,000
N. Phx. Mtn. Channel, Phase I	1,400,000	1,926,000	3,326,000
New River Dam	2,770,000	2,002,000	4,772,000
Adobe Dam	832,000	2,301,000	3,133,000
Lower Cave Creek Dam	871,000	5,824,000	6,695,000
Union Hills Diversion	500,000	1,500,000	2,000,000
W. Phx. Floodways, Phase I			
Maryvale-Glendale Drain	320,000	1,462,000	1,782,000
Glendale-Peoria Drain	426,000	2,552,000	2,978,000
Casandro Wash Dam	60,000	-0-	60,000
Sunset & Sunny Cove Dams	79,000	-0-	79,000
Buckhorn-Mesa Structures	3,574,000	3,855,000	7,429,000
Bender & Sand Tank Structures	152,000	114,000	266,000
TOTAL — Group I	14,348,000	38,146,000	52,494,000
Group II			
Apache Jct.-Gilbert Struct.	1,209,000	3,803,000	5,012,000
Mesa-Chandler-Gilbert Floodways	3,000,000	-0-	3,000,000
Williams-Chandler Structures	837,000	3,738,000	4,575,000
Buckeye Structures	776,000	2,986,000	3,762,000
W. Phx. Floodways, Phase II			
W. Phx.-Maryvale Drain	337,000	2,205,000	2,542,000
N. Phx. Mts. Channel, Phase II	966,000	2,360,000	3,326,000
TOTAL Group II	7,125,000	15,092,000	22,217,000
Group III			
Sols Wash Channel	40,000	-0-	40,000
Powder House Wash Dam	50,000	82,000	132,000
Cave Creek Town Dike	3,000	12,000	15,000
Maxwell Dam	650,000	5,050,000	5,700,000
Salt River Channelization	2,679,000	30,261,000	32,940,000
Cave Creek Dam	65,000	91,000	156,000
Queen Creek Floodway	920,000	880,000	1,800,000
TOTAL Group III	4,407,000	36,376,000	40,783,000
GRAND TOTAL, All Groups	25,880,000	89,614,000	115,494,000

SUMMARY SHEETS OF STRUCTURES STUDIED
TABLE 7.1-1 FOR THE FLOOD CONTROL DISTRICT OF MARICOPA COUNTY

Group No. I — Projects Recommended for Immediate Construction (Continued)

Drge. Area	Location	Job Description	COSTS			Annual	Annual	Benefit-Cost	Remarks
			FCD	Other	Total	Benefits	Costs	Ratio	
1	Gillespie Dam to 107th Ave.	Channel Clearing	250,000	1,000,000	1,250,000	141,600	80,800	1.75 to 1.00	Approved by U. S. Army Corps of Engineers
27	Lower Indian Bend	Floodway Channel	1,770,000	7,250,000	9,020,000	530,000	348,000	1.52 to 1.00	Approved by U. S. Army Corps of Engineers
19-23	Agua Fria, New River, & Skunk Cr.	Channel Clearing	250,000	1,000,000	1,250,000				Deer Valley Group
22	Arizona Canal-Cave Cr. to Skunk Cr.	Divert flood water North of Canal	944,000	7,060,000	8,004,000				Deer Valley Group
25	Dreamy Draw	Earth Dam	150,000	300,000	450,000				Deer Valley Group
22	North Mt.-Arizona Canal, 20th St. to 23rd Ave.	Construct Channel	1,400,000	1,926,000	3,326,000				Deer Valley Group
22	New River NW of Glendale	Earth Dam	2,770,000	2,002,000	4,772,000				Deer Valley Group
22	NW of Adobe	Earth Dam	832,000	2,301,000	3,133,000				Deer Valley Group
22	Lower Cave Cr. Dam Site	Earth Dam	871,000	5,824,000	6,695,000				Deer Valley Group
22	Union Hills Diversion	Lined Channel	500,000	1,500,000	2,000,000				Deer Valley Group
22	64th St. to New River	**Total Deer Valley**	7,717,000	21,913,000	29,630,000	2,232,000	1,296,000	1.72 to 1.00	
22	Maryvale-Glendale Drain	Lined Channel	320,000	1,462,000	1,782,000	99,000	68,000	1.46 to 1.00	Moved to Group I (1963 Flood)
22	Glendale-Peoria Drain	Lined Channel	426,000	2,552,000	2,978,000	166,000	113,000	1.46 to 1.00	Moved to Group I

Group No. I — Projects Recommended for Immediate Construction (Continued)

Drge. Area	Location	Job Description	COSTS			Annual Benefits	Annual Costs	Benefit-Cost Ratio	Remarks
			FCD	Other	Total				
7	Casandro Wash	Earth Dam	60,000	-0-	60,000	4,500	2,500	1.80 to 1.00	FCD Project
7	Sunset & Sunny Cove Washes	Earth Dams	79,000	-0-	79,000	6,200	3,500	1.77 to 1.00	FCD Project
32	Buckhorn-Mesa	Levees & Channels	3,574,000	3,855,000	7,429,000	500,000	281,000	1.78 to 1.00	Under SCS Study
12	Bender & Sand Tanks Washes, Gila Bend	Levees	152,000	114,000	266,000	12,500	10,700	1.16 to 1.00	Under Study by Corps of Engineers
	TOTAL — GROUP I		14,348,000	38,146,000	52,494,000	3,691,800	2,203,500	1.68 to 1.00	

Recommended Projects Group II — Subject to Availability of Funds

32	Apache Junction-Gilbert	Levees & Channels	1,209,000	3,803,000	5,012,000	276,700	198,000	1.40 to 1.00	Under SCS Study
32	Mesa-Chandler-Gilbert	Channel	3,000,000	-0-	3,000,000	259,500	122,400	2.11 to 1.00	Urban Storm Drain
32	Williams-Chandler	Levees & Channels	837,000	3,738,000	4,575,000	326,000	189,000	1.73 to 1.00	Under SCS Study
9	Buckeye-Palo Verde	Levees & Channels	776,000	2,986,000	3,762,000	175,000	128,000	1.40 to 1.00	Under SCS Study
22	W. Phoenix-Maryvale	Channel	337,000	2,205,000	2,542,000	141,000	97,000	1.46 to 1.00	Moved (1963 Rain)
22	North Phx. Mt.-Old Cross-Cut Canal	Channel	966,000	2,360,000	3,326,000	232,000	136,000	1.72 to 1.00	Held Back Group II
	TOTAL — GROUP II		7,125,000	15,092,000	22,217,000	1,410,200	870,400	1.62 to 1.00	

Recommended Projects Group III — Subject to Availability of Funds

Drge. Area	Location	Job Description	COSTS			Annual Benefits	Annual Costs	Benefit-Cost Ratio	Remarks
			FCD	Other	Total				
7	Sols Wash	Channel Alignment & Protection	40,000	-0-	40,000	2,500	2,000	1.25 to 1.00	FCD Project
7	Powder House Wash	Earth Dam	50,000	82,000	132,000	10,000	5,600	1.79 to 1.00	Studied by Corps of Engineers
7	Cave Creek Town	Earth Levee	3,000	12,000	15,000	1,000	840	1.19 to 1.00	Studied by Corps of Engineers
31	Maxwell Dam (Flood Control)	Earth Dam	650,000	5,050,000	5,700,000	369,000	276,000	1.34 to 1.00	Cost of Flood Control
31	Salt River, Granite Reef to 107th Ave.	Lined Channel	2,679,000	30,261,000	32,940,000	1,800,000	1,300,000	1.38 to 1.00	Studied by Corps of Engineers
24	Cave Creek Dam (Old)	Levee	65,000	91,000	156,000	10,200	8,200	1.24 to 1.00	Studied by Corps of Engineers
33	Queen Creek	Channel	920,000	880,000	1,800,000	90,000	72,000	1.25 to 1.00	FCD Project-Aid expected from U.S. Bureau of Indian Affairs
	TOTAL — GROUP III		4,407,000	36,376,000	40,783,000	2,282,700	1,664,640	1.37 to 1.00	

Group IV — Projects Deferred as not Feasible at this time

Drge. Area	Location	Job Description	COSTS			Annual Benefits	Annual Costs	Benefit-Cost Ratio	Remarks
			FCD	Other	Total				
7	Flying "E" Wash Wickenburg	Earth Dam	-0-	183,000	183,000	4,500	7,200	0.62 to 1.00	Financing a question
26	Guadalupe Watershed	Levees & Channels	519,000	660,000	1,179,000	45,450	60,600	0.75 to 1.00	To be referred to SCS
26	South Mountain, 40th St. to 75th Ave.	Levees & Channels	2,652,000	6,251,000	8,903,000	253,000	351,000	0.72 to 1.00	To be Studied by Corps of Engineers
28	Indian Bend Wash Above Arizona Canal	Channels	1,217,000	1,701,000	2,918,000	76,000	124,400	0.61 to 1.00	To be Studied by Corps of Engineers
33	Santan Watershed	Levees & Channels	895,000	2,678,000	3,573,000	100,000	145,000	0.70 to 1.00	To be Studied by SCS
4	Harquahala Valley	Levees & Channels	400,000	3,770,000	4,170,000	70,000	171,000	0.41 to 1.00	To be Studied by SCS
4	Tonopah & Winters Valleys	Levees & Channels	120,000	1,950,000	2,070,000	50,000	85,000	0.60 to 1.00	To be Studied by SCS
4	Eagle Tail Mt.	Levees & Channels	700,000	1,849,000	2,549,000	70,000	112,000	0.63 to 1.00	To be Studied by SCS
6	Box Canyon	Earth Dam	652,000	6,948,000	7,600,000	290,000	325,000	0.90 to 1.00	To be Studied by Corps of Engineers
7	Sols Wash (Matthie Dam)	Earth Dam	500,000	556,000	1,056,000	11,000	43,000	0.26 to 1.00	Studied for Recreation
8	Upper New River	Earth Dam & Channel	50,000	450,000	500,000				Studied for Recreation

8.1-A OBJECT OF REPORT

The basic purpose of this report is to summarize and place in a usable form all pertinent information on Maricopa County flood control problems and to make recommendations for their solution.

Authority for this report is set forth in the flood control law, Article 5, Secs. 45-2351 through 45-2371, inclusive, Chapter 10, Title 45, Arizona Revised Statutes. Based on this law, the Flood Control District of Maricopa County was established by the Board of Supervisors on August 3, 1959, to include the whole County within the District.

Within this report are listed the major flood control problems, recommended solutions to prevent or minimize damage, and cost estimates on structural measures required. If, in the future, a problem should arise that has not been considered in this report, it will be studied and become a part of the comprehensive program.

Although flood control is the prime objective, consideration has been given to erosion control, recreation, irrigation, water storage, and ground water recharge.

In the past, heavy floods have occurred in certain areas but because of lack of economic development, protective measures at this time cannot be justified. Future expansion may be such that at a later date, flood control works can be recommended and installed.

8.1-B SCOPE

The area covered by this report includes all of Maricopa County, Arizona—a total of 9,226 square miles.

Topography is extremely variable, going from high mountains to flat deserts. A major portion of the County is dry, rough desert with sparse vegetation. Flash floods occur in all sections due to steep slopes, high intensity rainfall, and lack of ground cover.

General trend of drainage is to the southwest. The Gila and Salt River Basin is the main natural drain from the east side of the County until it leaves the County just south of Agua Caliente. Virtually all of the County drains into this system, with the main tributaries being Indian Bend Wash, Cave Creek, Skunk Creek, New River, Agua Fria and Hassayampa Rivers. The major flood problem areas are located near the urban population concentrations. This, of course, is due to the high damage possibilities from development, including businesses, industries and residences. Phoenix, Mesa, Apache Junction, Wickenburg, Gila Bend and the smaller towns scattered throughout the County are all greatly concerned with the problem of flood control. Extensive damage has also occurred in the developed agricultural areas throughout the County.

It should be kept in mind that according to law, the Flood Control District has the responsibility for operating and maintaining all structures which are built for flood control purposes in this County. When these projects have been authorized, a program will be set up whereby the District can begin to carry out this important phase of the flood control program.

8.1-C DIVISION OF AREAS

For the purpose of this report, Maricopa County has been divided into 35 different areas or watersheds.

Generally, the area boundaries conform to major drainage areas but this is not true in all cases. Descriptive titles have been given to make it easier to locate any particular structure within the County. Numbering of areas begins in the southwest corner and proceeds generally north and south, eventually reaching No. 35 in the northeast part of the County.

These area numbers form the basis for the divisions of the report. The report contains nine (9) chapters as shown in the report outline. Individual projects are given numbers corresponding to the drainage area in which they are located.

Example: the Harquahala detention reservoir is located in the Lower Centennial Area. Its project number is 9.4-B. The No. 9 is the chapter number; the No. 4 is the drainage area number; and the letter B indicates the order within the listing of projects.

8.1-D BASIC DATA

There have been many contributions to the study of flood control in Maricopa County. Many people have been concerned with the problem for years.

On October 31, 1957, a committee was appointed by the city of Phoenix, the Board of Supervisors of Maricopa County, and the Board of directors of the Salt River Project. This committee, called the Flood Protection Improvement Committee, was directed to prepare a general plan of flood control for greater Phoenix area and recommend methods of financing, construction and operation of major flood protection works for the benefit of all the people. This constituted one of the first organized efforts to solve the problem and provided the main impetus for formation of the present Flood Control District.

The flood Control District Engineer, in order to expedite the work, divided the County into three parts, called "study areas." Reports from consultants who studied these areas have been completed and are available in the office of the Chief Engineer.

Area 1—southeastern part of the County—studied by Benham Engineering Company.

Area 2—the western half of the County — studied by Johannessen & Girand, Consulting Engineers.

Area 3—the northeastern part of the County — studied by Yost & Gardner Engineers.

The Soil Conservation Service has prepared reports on watersheds in the eastern and southeastern parts of the County.

The U. S. Corps of Engineers, Los Angeles District, has reported on projects, including the Salt and Gila Rivers, Box Canyon Dam, Indian Bend Wash, Maxwell Dam, and others.

All of these reports are available and form the background for the preparation of this comprehensive report.

Valuable basic data has been contributed by the Salt River Project, the U. S. Bureau of Reclamation, and the city of Phoenix.

8.1-E ECONOMIC DEVELOPMENT

Arizona was among the leaders in population growth from 1950 to 1960, and was actual leader among the States during the period from 1946 to 1950.

In reviewing the population trends in Arizona in the past half century, figures indicate growth has been concentrated in the counties of Maricopa and Pima. Approximately half of Arizona's people live in Greater Phoenix and Maricopa County.

Population within the County is expected to increase 85% from the 1959 figure and by 1969 will be 1,135,000 persons. Over 185,000 new workers must come from increased vocational training as well as from newcomers to the area. Like the State of Arizona, largest numerical growth will be in manufacturing and trade. Loss in agricultural will be primarily to withdrawal of farm lands for residential and industrial use.

The County's assessed valuation has grown as follows:

Fiscal Year	Amount
1954-55	$359,352,720
1956-57	440,801,195
1958-59	538,674,654
1960-61	689,429,369
As of May, 1962	840,429,369

True value is approximately five times the above figures.

The entire County is growing rapidly, especially in urban areas. Land values are increasing very rapidly and acquisition for flood control purposes will become increasingly expensive. The table on the following page shows County population, labor force and employment as of May 1959 and projected for May 1969. This will emphasize the really tremendous growth expected for Maricopa County in the coming years.

POPULATION & EMPLOYMENT CHARACTERISTICS	1959	1969	Increase	% Increase
Total Population	614,000	1,135,000	521,000	84.9
Total Population 14 and over	420,600	756,000	335,400	79.7
Civilian Labor Force	215,500	396,000	180,500	83.8
Total Employment	208,800	378,000	169,200	81.0
Total non-agricultural Wage & Salaried	156,600	305,000	148,400	94.8
Manufacturing	29,600	72,000	42,400	143.2
Mining	500	600	100	20.0
Trade	41,200	80,500	39,300	95.4
Construction	16,100	30,200	14,100	87.6
Service	19,900	39,500	19,600	98.5
Transportation, Communications & Public Utilities	11,900	17,300	5,400	45.4
Finance, Insurance & Real Estate	9,000	16,800	7,800	86.7
Government	28,400	48,100	19,700	69.4
"All Other" Non-Agricultural*	28,600	50,000	21,400	74.8
Agricultural	24,000	23,000	1,000	4.2

*Includes self-employed, unpaid family workers and domestic household workers.
Note: Data reported to nearest 100.
Source: Arizona State Employment Service

8.1-F CLIMATOLOGY

By the standards of other regions, Arizona has very little rainfall; yet it does have relatively rainy periods in the year. These two periods are characterized by two distinctly different rainfall patterns.

Winter storms, yielding about one-half the total rainfall, occur from November through March. This precipitation usually results from general winter storms associated with extra tropical cyclones of North Pacific origin and often last for several days. These storms move south over the ocean and then inland to southern California, Arizona and New Mexico. They may cover thousands of square miles.

Summer storms, occurring during July, August & September, bring the other half of the total rainfall. During this period air currents bring warm moist air from the Gulf of Mexico. Mountain ranges and cold fronts act to produce thunderstorm conditions characterized by the cumulus clouds seen during this season. These summer storms often produce rainfall of high intensity, short duration, and limited areal extent. They may occur separately or in conjuction with general storms.

Such things as the distance from the sea by possible paths of moisture-bearing currents, depth of such currents, as affected by atmospheric depth and structure, ground elevations, temperature differentials, and other factors, influence the rain producing capacity of the atmosphere. The net effect of all these factors is to produce a variation of rainfall intensity, with geographic location. Maps have been prepared by the U. S. Department of Commerce Weather Bureau and are available for study.

Structural designs in this report are based on Technical Paper No. 40, "Rainfall Frequency Atlas of the United States" issued May 1961. For further study of rainfall patterns and intensities this report should be consulted.

The highest intensity of rainfall recorded at Phoenix Post Office Weather Bureau station occurred on July 26, 1936 when 0.43 inches of rain fell in five minutes. This is a rate of 5.16 in. per hour. The record for 10 minutes was set July 26, 1952, when 0.70 inches fell, giving a rate of 4.2 inches per hour.

The number of weather bureau precipitation stations (or cooperating stations) is increasing and valuable data is being gathered.

8.1-G RUNOFF AND STREAMFLOW DATA

Streamflow data is meager except in the case of the Salt River flows. The Flood Control District is cooperating with the U. S. Geological Survey in establishing, maintaining and operating gaging stations within the County.

Gaging stations are located on Sycamore Creek, New River, Indian Bend, Lower Hassayampa River, Centennial Wash, Rainbow Wash and at Youngtown, South Mountain and Apache Junction. These stations are now operating and will provide much needed information toward future designs. They are at critical points such as small mountainous watersheds, desert watersheds, and urban areas so they will provide valuable data. There will eventually be over 100 gaging stations in Maricopa County including approximately 34 of the recording type.

8.1-H OTHER FLOOD CONTROL PROJECTS AND STUDIES

Scattered throughout the County are various flood control projects. The White Tanks detention reservoirs, Trilby Wash-McMicken Dam, Whitlow Ranch Dam, Queen Creek Channel. Painted Rock Dam and Cave Creek Dam are examples.

The city of Phoenix has many miles of storm drains for 1 to 2-yr. frequency storms and are valuable as local street drainage. The County, State and other municipalities have smaller ditches. Some channelization and clearing has been done on the Salt and New Rivers. In some areas local owners have built dams and dikes for flood control, which are valuable for local protection.

The Salt River Project operates the Cave Creek Dam and also uses irrigation canals as well as they can to alleviate flood damage. The canals intercept runoff and where possible, the project diverts water to the Salt River and to waste ditches to minimize flood damage.

Projects are going forward for the Salt River and Lower Indian Bend through cooperation of Maricopa County and the U. S. Corps of Engineers. The Army engineers are studying projects throughout the County and the results of their findings will be of interest and importance to the community. The Corps of Engineers is also studying Upper Indian Bend, Upper Cave Creek, Skunk Creek, New River and Agua Fria and is preparing an interim report on their flood plain studies of these areas.

The Salt River Indian Reservation, through the Bureau of Indian Affairs, is studying flood control problems.

The Bureau of Reclamation continues its studies of the Central Arizona Project. The Flood Control District will coordinate efforts with the Bureau wherever possible.

Tentative alignment of the Central Arizona Project Canal is compatible with certain flood control projects in the eastern part of the County. Maxwell Dam, another Bureau of Reclamation project, will provide valuable flood water storage.

The Flood Control District is providing that center around which the entire program can be oriented. Needed flood plain zoning, checking of subdivision plats, a master plan of major works, construction of warranted projects, operation and maintenance of structures, and correlation of the plans of other agencies are part of the job of the District.

The projects recommended are based on surveys and are located where the greatest possible protection is afforded at least cost.

SECTION 9

9.0-A SALT RIVER CHANNEL

9.0-A-1 General

In order for the comprehensive plan for flood control in Maricopa County to be successful, there must be some solution presented for controlling the Salt River. Hazardous occupancy within the channel increases daily and flood plain zoning or regulation to the historical banks of the river becomes more essential.

At the present time, without construction of Maxwell Dam, the peak flow possible in the Salt River is 290,000 cfs — the Standard Project Flood. Some protection from lesser flows could be provided by building levees in key places but channelization and levee work to protect against the standard project flood is impractial. The natural banks will contain a flow of approximately 82,000 cfs, and plans recommended are based on this size of flow or less.

The plan finally adopted depends largely on the amount of water released by Maxwell Dam. The following are alternate plans based on variable flows in the River.

9.0-A-2 Plans

a. This is the plan recommended by the U. S. Army Corps of Engineers in the interim report and is based on a regulated discharge from Maxwell Dam of approximately 82,000 cfs. The County has agreed to acquire the necessary lands, easements, and rights of way.

The plan consists of short levees between 40th St., Phoenix, and Tempe Butte, Tempe, and channel improvements (primarily clearing) between Gillespie and Granite Reef Dams. Other levees for added protection to Tempe, Mesa, and other areas are presently under study and may be included in the final plan.

(For more details of this plan, see the December 1957 Interim Report on Gila and Salt Rivers by Corps of Engineers, Los Angeles District.) Maps 9.0-A through 9.0-G show planned extent and location. Table 9.0-1 shows summary of costs.

b. This alternate plan is based on an outflow of approximately 82,000 cfs from Maxwell Dam and Indian Bend Wash. Plan: Short levees between 40th St., Phoenix and Tempe Butte, Tempe, and channel clearing from Gillespie Dam to Granite Reef Dam, as shown above exclusive of the reach from 107th Ave. to Country Club Drive in Mesa. Approximate length of channel: 27 miles; unlined, bottom width 1686 ft.; average depth: 6 ft.; side slope: 2¼ : 1. Slopes will be lined with rubble masonry, bottom unlined. Total right of way cost is estimated at $13,000,000 for a width of 1900 ft. Total channel cost: $60,000,000.

c. This alternate plan is based on an outflow from Maxwell Dam of 50,000 cfs. Project consists of the following: channel clearing from Gillespie Dam to 107th Avenue and an unlined channel from that point up the river to Country Club Drive in Mesa. Bottom width: 826

ft.; average depth 6 ft.; side slopes 2¼ : 1; slopes to be lined with rubble masonry from 3 ft. above the water line to 5 ft. below the bottom of the channel. Total right of way width to be 1,000 ft.; estimated cost: $8,100,000. Total project cost: $54,100,000.

d. This alternate plan is based on an outflow from Maxwell Dam of 50,000 cfs. Project consists of: channel clearing from Gillespie Dam to 107th Ave. and a lined channel from this point up the river to Country Club Drive in Mesa. Bottom width: 35 ft.; average depth: 20 ft.; side slopes 2¼ : 1. Entire cross-section will be lined. Total right of way width: 330 ft.; estimated cost: $2,700,000. Total project cost: $32,940,000.

Based on the construction of Maxwell Dam, with an outflow of approximately 50,000 cfs, alternate (d) is the recommended plan.

9.1 AJO AREA

Ajo area is located in the extreme southwest corner of Maricopa County and has an area of 380 sq. miles. The area is bordered on the north by the Tea Kettle and Crater Mountains. General drainage is toward the west. Main drainage ways are Growler, Rio Cortez and Ten Mile Washes. They eventually drain into the Gila River.

All of this area is in the Bombing and Gunnery Range and no land development exists now and none is planned for the near future. No flood damage has been reported and none is expected.

TABLE 9.0-1 SALT RIVER CHANNEL CLEARANCE SUMMARY

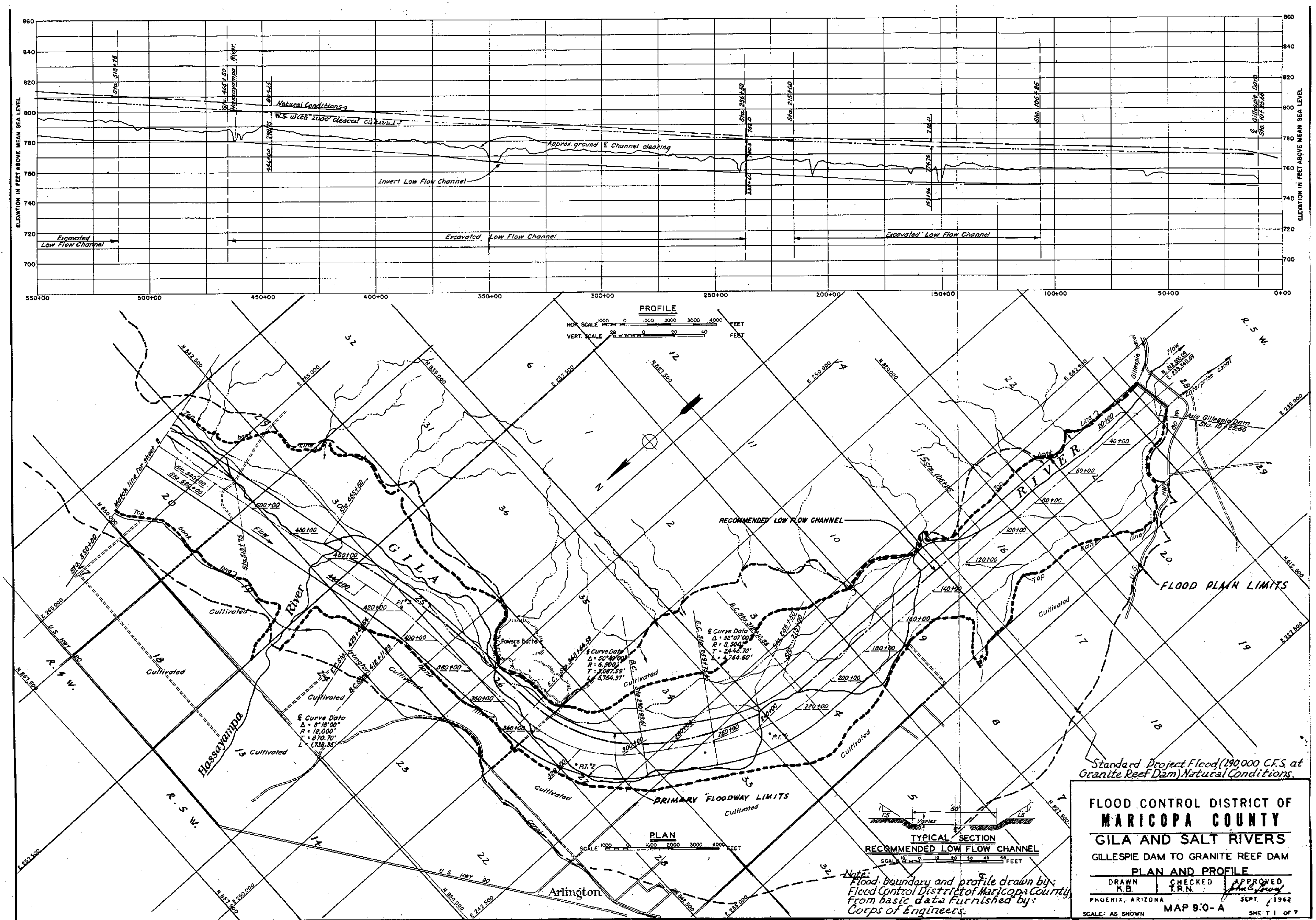
Job Description	Estimated Cost Flood Control Dist.		Corps of Engr.
Short levees between 40th Street, Phoenix and Tempe Butte, Tempe and Channel improvement from Gillespie Dam to 107th Avenue and from Country Club Drive, Mesa to Granite Reef Dam.			
TOTAL	$250,000		1,000,000
TOTAL PROJECT COST		$1,250,000	
Flood Damage without Project			173,600
Flood Damage with Project			32,000
Benefits from Reduction of Flood Damage			141,600
Irrigation Benefits			-0-
Other Benefits			-0-
Total Annual Benefits			141,600
Total Project Cost Amortized @ 2⅝ %			70,800
Annual Operation and Maintenance			10,000
Total Annual Costs			80,800
Benefit-Cost Ratio	1.75 to 1.00		

9.2 SENTINEL AREA

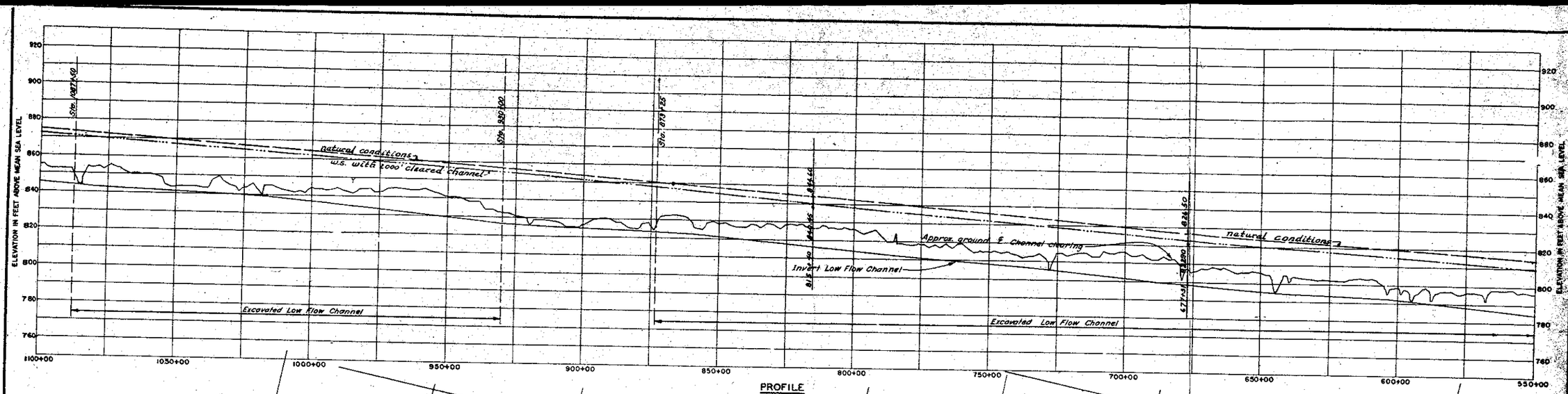
Sentinel area is located in the southwestern part of Maricopa County and has an area of 750 sq. miles. Bordered on the east by the Sauceda Mountains and on the south by the Crater Mountains, this area generally drains northwest toward the Gila River. No well-defined drainage system exists.

Most of the area is covered with lava rock. Geographically it lies within the Williams AFB Bombing and Gunnery Range. There are four auxiliary airfields located here but only minor damages have been reported.

Any possible damage in the area from floods would be to Arizona Highway 85, the Southern Pacific Railroad or U. S. Highway 80. At the present time, damages do not warrant flood control work.



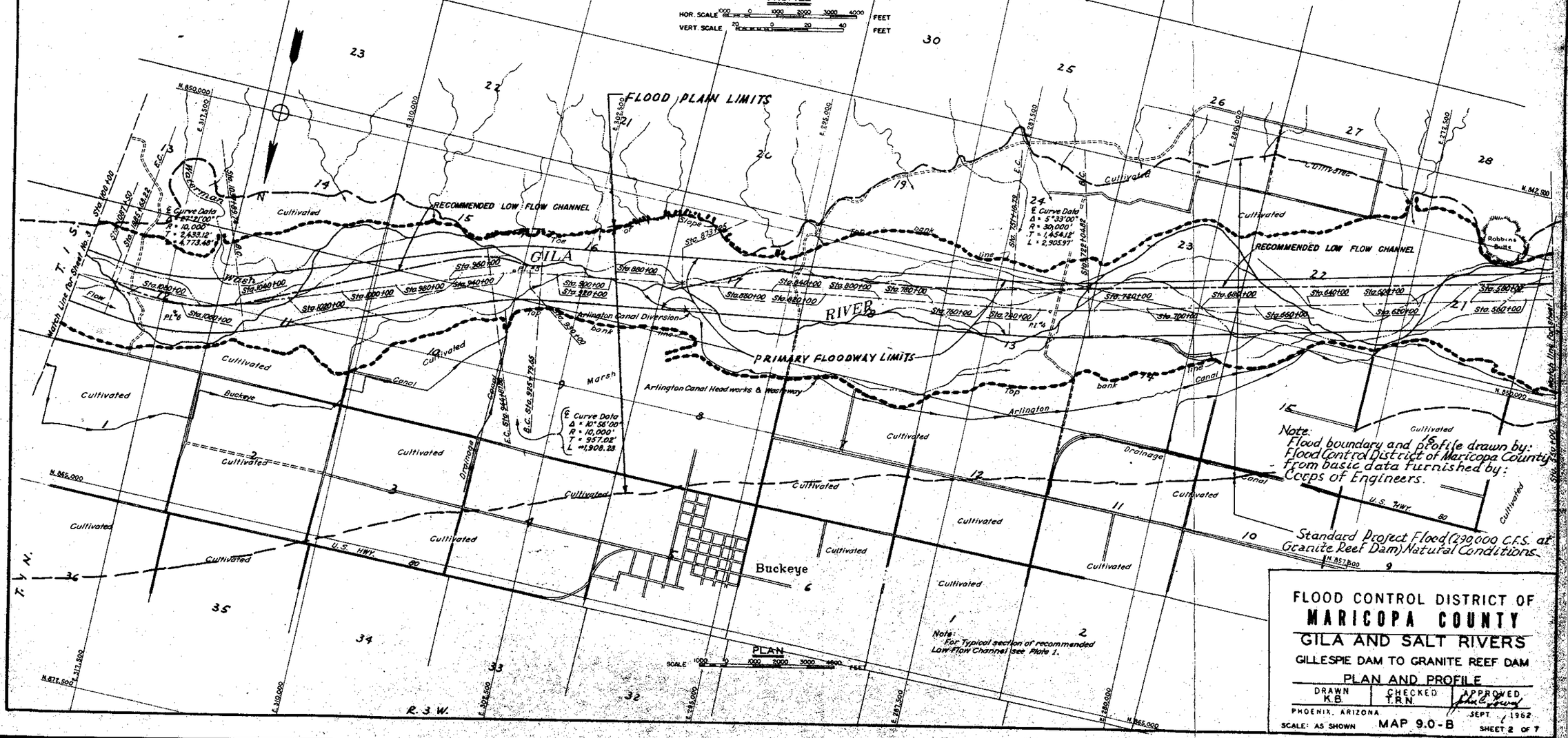
ELEVATION IN FEET ABOVE MEAN SEA LEVEL
Natural Conditions
W.S. with 2000' cleared channel
Approx. ground ℄ Channel clearing
Invert Low Flow Channel
Excavated Low Flow Channel
Sta. 465+50 Hassayampa River
Sta. 513+75
Sta. 236+50
Sta. 215+00
Sta. 106+85
℄ Gillespie Dam Sta. 10+25.66
PROFILE
HOR. SCALE
VERT. SCALE
FEET
GILA
RIVER
Hassayampa
River
RECOMMENDED LOW FLOW CHANNEL
FLOOD PLAIN LIMITS
PRIMARY FLOODWAY LIMITS
Top bank line
Cultivated
Powers Butte
Match line for sheet 2
Flow
Gillespie Canal
Enterprise Canal
Axis Gillespie Dam Sta. 10+25.66
U.S. HWY 80
R. 4 W.
R. 5 W.
Arlington
Canal
℄ Curve Data
Δ = 8°18'00"
R = 12,000'
T = 870.70'
L = 1,738.35'
℄ Curve Data
Δ = 50°49'00"
R = 6,500'
T = 3,087.59'
L = 5,764.97'
℄ Curve Data
Δ = 32°07'00"
R = 8,500'
T = 2,446.70'
L = 4,764.60'
PLAN
SCALE FEET
TYPICAL SECTION
RECOMMENDED LOW FLOW CHANNEL
Varies
Standard Project Flood (290,000 C.F.S. at Granite Reef Dam) Natural Conditions.
Note: Flood boundary and profile drawn by: Flood Control District of Maricopa County from basic data furnished by: Corps of Engineers.
FLOOD CONTROL DISTRICT OF
MARICOPA COUNTY
GILA AND SALT RIVERS
GILLESPIE DAM TO GRANITE REEF DAM
PLAN AND PROFILE
DRAWN K.B.
CHECKED T.R.N.
APPROVED
PHOENIX, ARIZONA
SEPT. 1962
SCALE: AS SHOWN
MAP 9.0-A
SHEET 1 OF 7



PROFILE

HOR. SCALE 1000 0 1000 2000 3000 4000 FEET

VERT. SCALE 20 0 20 40 FEET



Note:
Flood boundary and profile drawn by:
Flood Control District of Maricopa County
from basic data furnished by:
Corps of Engineers.

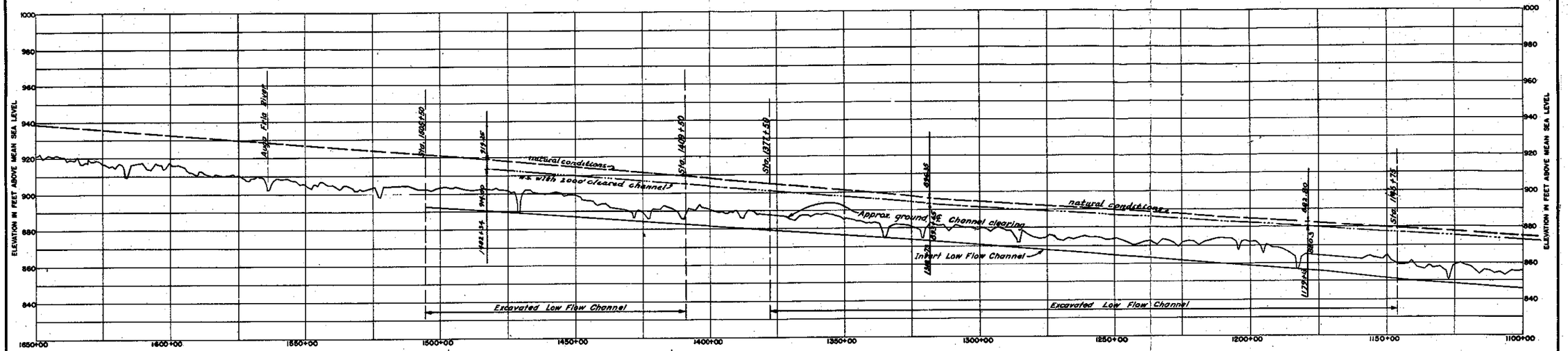
Standard Project Flood (290,000 C.F.S. at Granite Reef Dam) Natural Conditions.

FLOOD CONTROL DISTRICT OF
MARICOPA COUNTY
GILA AND SALT RIVERS
GILLESPIE DAM TO GRANITE REEF DAM
PLAN AND PROFILE

DRAWN	CHECKED	APPROVED
K.B.	T.R.N.	

PHOENIX, ARIZONA SEPT. 1962

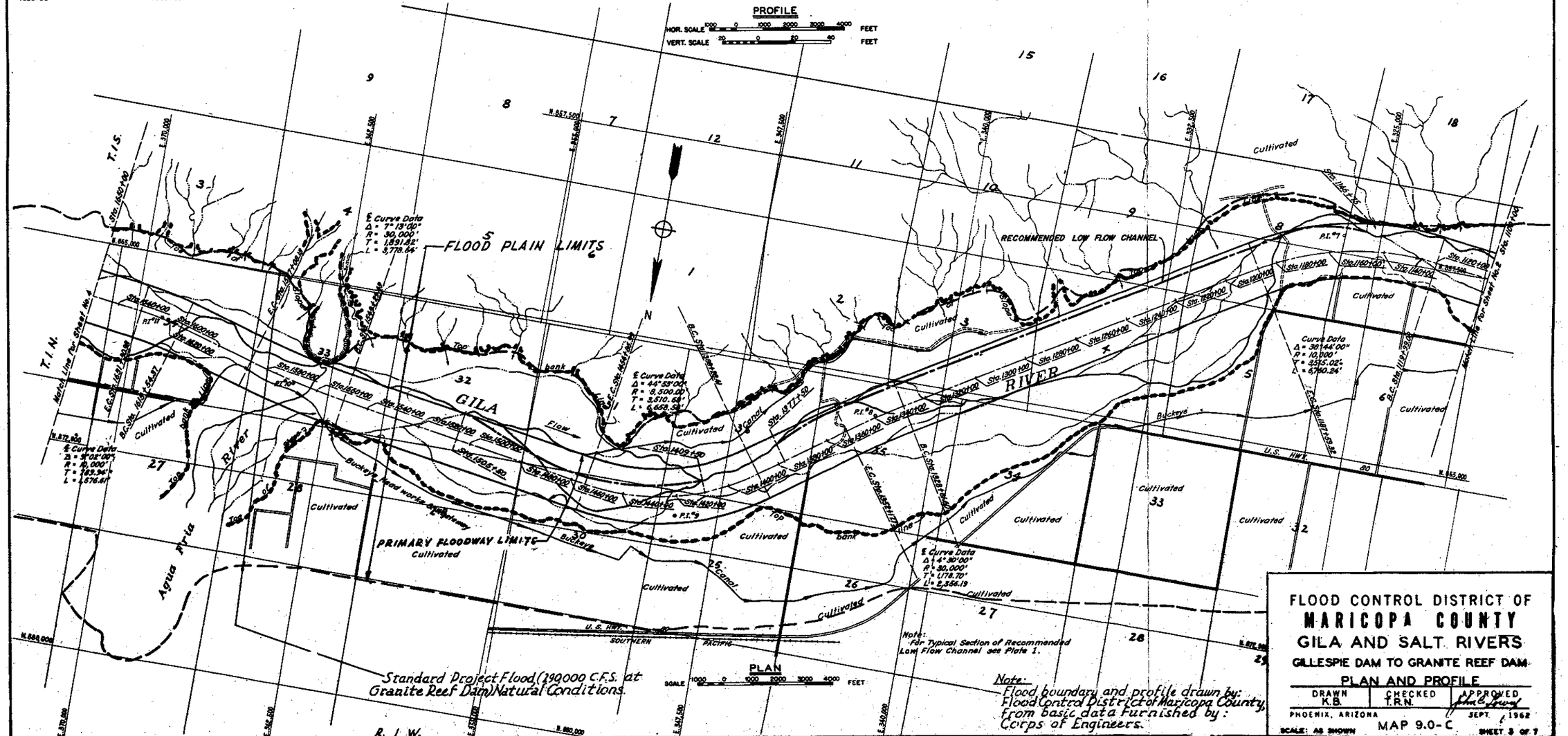
SCALE: AS SHOWN MAP 9.0-B SHEET 2 OF 7



PROFILE

HOR. SCALE 1000 0 1000 2000 3000 4000 FEET

VERT. SCALE 20 0 20 40 FEET



PLAN

SCALE 1000 0 1000 2000 3000 4000 FEET

Standard Project Flood (290000 C.F.S. at Granite Reef Dam) Natural Conditions.

Note: For Typical Section of Recommended Low Flow Channel see Plate 1.

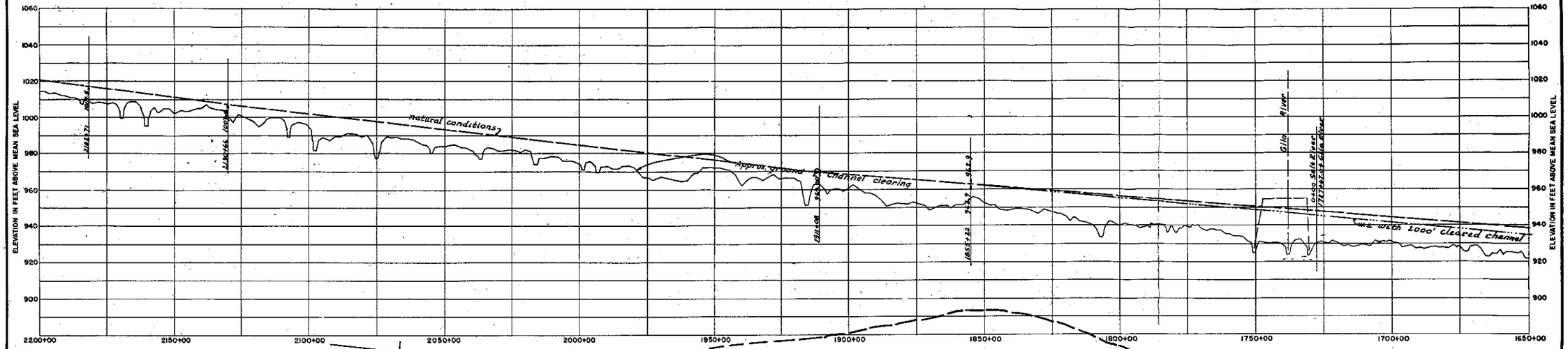
Note: Flood boundary and profile drawn by: Flood Control District of Maricopa County, from basic data furnished by: Corps of Engineers.

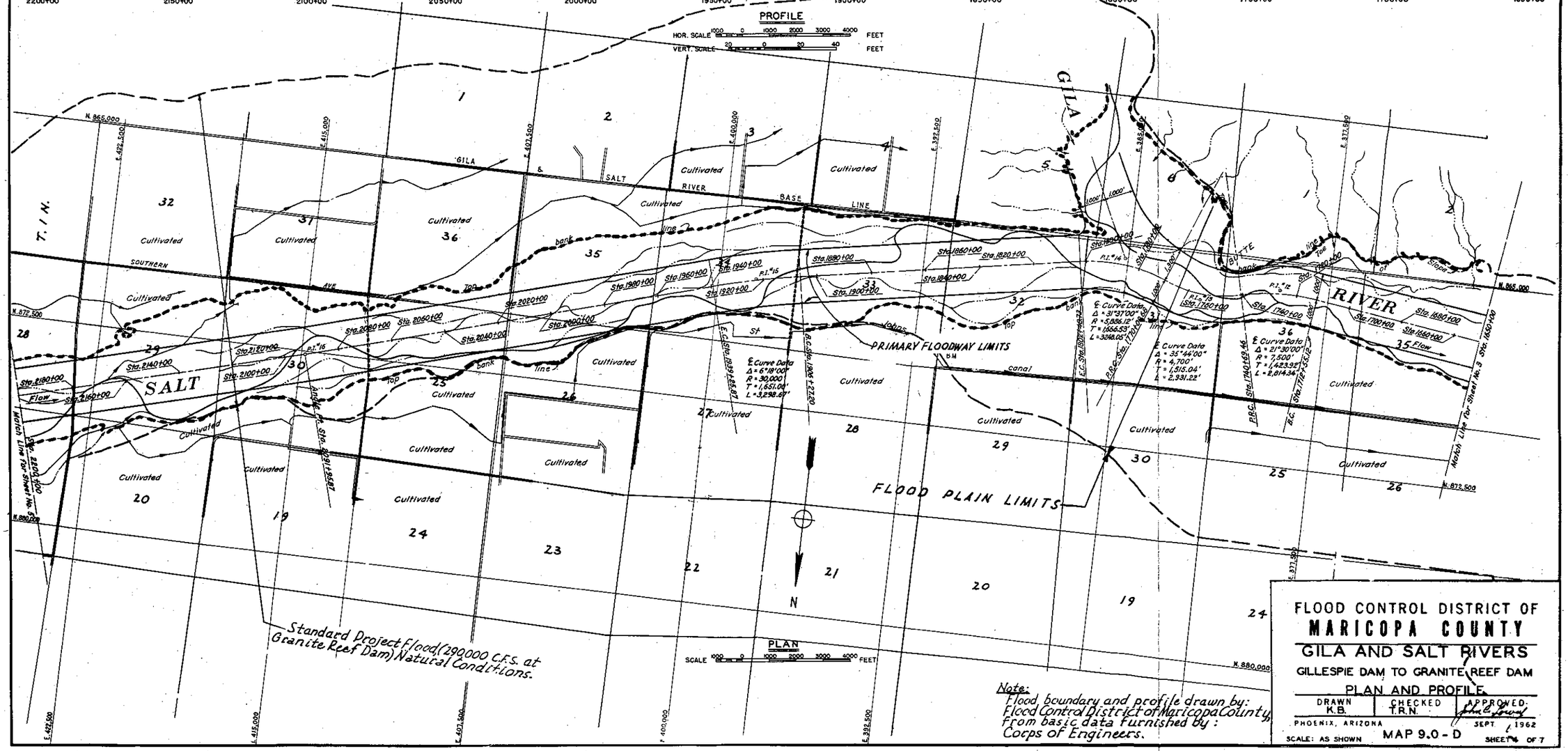
FLOOD CONTROL DISTRICT OF
MARICOPA COUNTY
GILA AND SALT RIVERS
GILLESPIE DAM TO GRANITE REEF DAM
PLAN AND PROFILE

DRAWN	CHECKED	APPROVED
K.B.	T.R.N.	

PHOENIX, ARIZONA SEPT. 1962

SCALE: AS SHOWN MAP 9.0-C SHEET 3 OF 7





FLOOD CONTROL DISTRICT OF
MARICOPA COUNTY

GILA AND SALT RIVERS

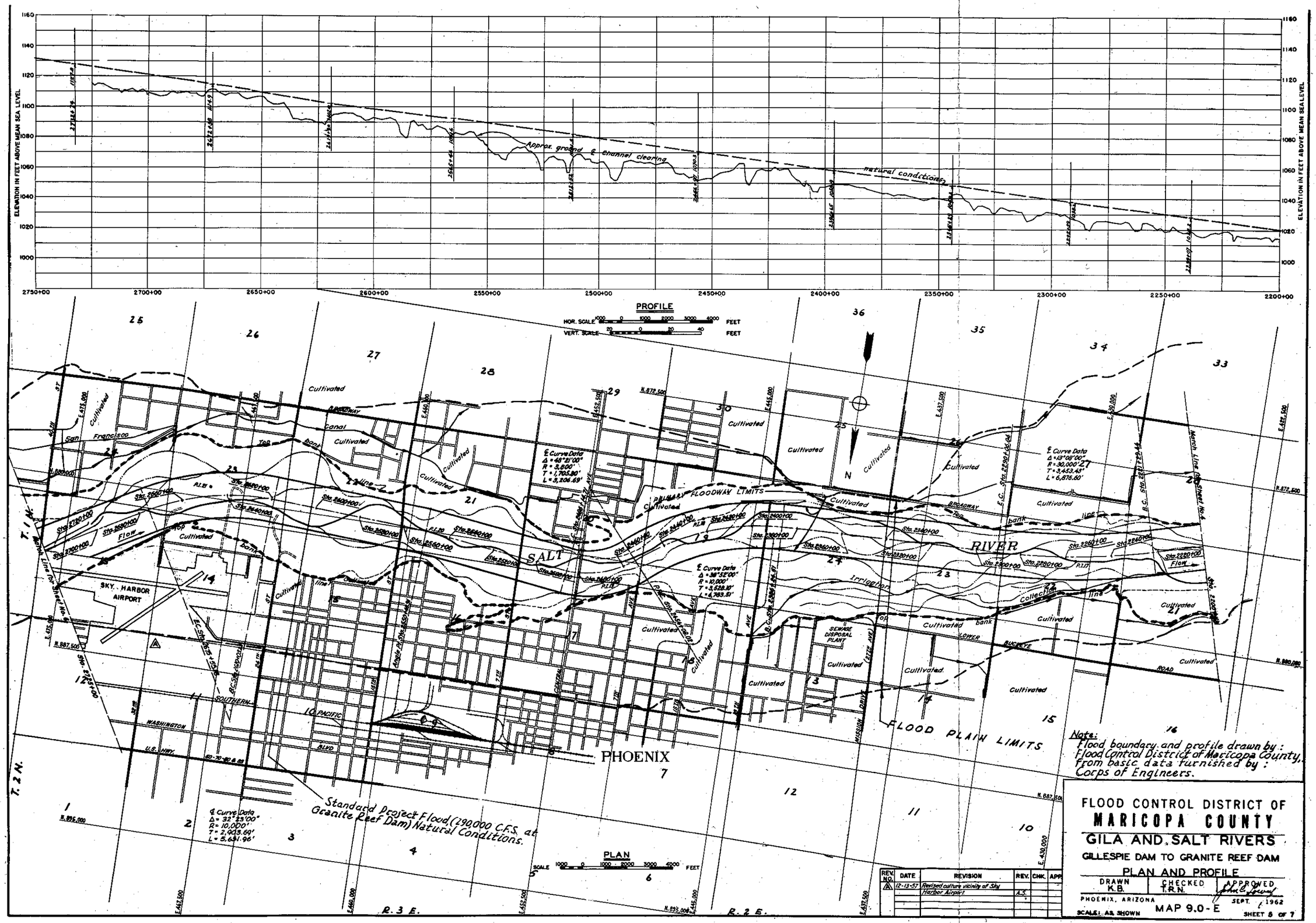
GILLESPIE DAM TO GRANITE REEF DAM

PLAN AND PROFILE

DRAWN	CHECKED	APPROVED
K.B.	T.R.N.	

PHOENIX, ARIZONA — SEPT. 1962

SCALE: AS SHOWN — MAP 9.0-D — SHEET 6 OF 7



REV. NO.	DATE	REVISION	REV.	CHK.	APP.
1	12-13-57	Revised culture vicinity of Sky Harbor Airport	A.S.		

FLOOD CONTROL DISTRICT OF
MARICOPA COUNTY
GILA AND SALT RIVERS
GILLESPIE DAM TO GRANITE REEF DAM
PLAN AND PROFILE

DRAWN	CHECKED	APPROVED
K.B.	T.R.N.	John C. Lincoln

PHOENIX, ARIZONA — SEPT. 1962
SCALE: AS SHOWN — MAP 9.0-E — SHEET 5 OF 7

Note:
Flood boundary and profile drawn by Flood Control District of Maricopa County from basic data furnished by Corps of Engineers.

REV. NO.	DATE	REVISION	REV.	CHK.	APP
A	8-22-55	Revised depth of quarry stone and gravel blankets in section			
B	12-13-57	Revised culture vicinity of Sky Harbor Airport.	A.S.		

FLOOD CONTROL DISTRICT OF MARICOPA COUNTY

GILA AND SALT RIVERS

GILLESPIE DAM TO GRANITE REEF DAM

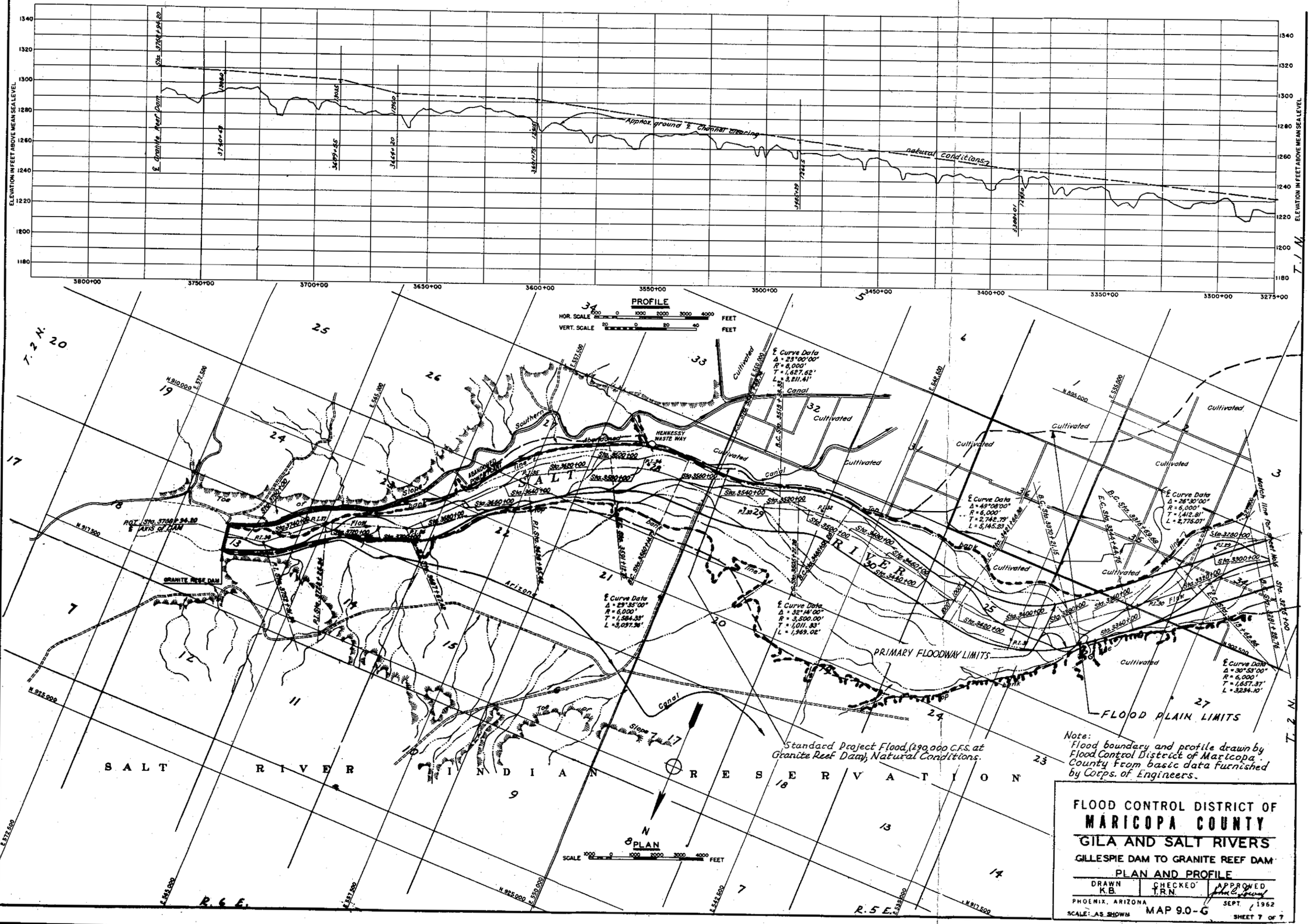
PLAN AND PROFILE

DRAWN	CHECKED	APPROVED
K.B.	T.R.N.	John C. Lowry

PHOENIX, ARIZONA — SEPT. 1962

MAP 9.0-F

SCALE: AS SHOWN — SHEET 6 OF 9



Standard Project Flood (290,000 C.F.S. at Granite Reef Dam), Natural Conditions.

Note:
Flood boundary and profile drawn by Flood Control District of Maricopa County From basic data furnished by Corps. of Engineers.

FLOOD CONTROL DISTRICT OF
MARICOPA COUNTY
GILA AND SALT RIVERS
GILLESPIE DAM TO GRANITE REEF DAM
PLAN AND PROFILE

DRAWN	CHECKED	APPROVED
K.B.	T.R.N.	John C. Lacey

PHOENIX, ARIZONA SEPT. 1962
SCALE: AS SHOWN MAP 9.0-G
SHEET 7 OF 7

9.3 PAINTED ROCK AREA

Painted Rock Area is located in the west central part of Maricopa County and has an area of 550 sq. miles. The area is bordered on the south by the Gila River and on the north by the Gila River Mountains. Principal drainage pattern is to the south, and into the Gila River.

Some flood damage could occur to the highway and railroad system but present development does not warrant protective measures.

9.4-A LOWER CENTENNIAL AREA

Lower Centennial area is located in the western part of Maricopa County and has an area of 1300 sq. miles. Drainage is southeast to the Gila River. Centennial Wash runs the full length of this area but does not show a well-defined channel.

There is some land developed along Centennial Wash from Yuma County line to the Gila River. The largest areas are near the intersection of Gin Road and Courthouse Road and near the mouth of the Wash. Approximately 70,000 acres are now under irrigation and more land is being developed.

Numerous small washes originating in the higher mountains flow into Centennial Wash. These washes cross the developed areas causing considerable damage to crops, to the land by erosion, and to established irrigation systems during heavy rains and runoff.

Potential damage from a major flood is great. Damage to pump installations, irrigation ditches and land under cultivation, and buildings would be great.

Presently there are only a few diversion dikes and levees in this area. They were built by individual property owners. These levees are inadequate to handle the heavy runoffs to which the area is subject.

To protect these agriculture areas, three projects have been proposed. They consist of dikes and floodways that will intercept the water from the mountains and direct the excess back into Centennial Wash at a place where flood damages can be held to a minimum.

9.4-B HARQUAHALA VALLEY WATERSHED

9.4-B-1 General

The flood producing area consists primarily of steep mountains between contours 1300 and 5700. The topography is characterized by the presence of many washes which emerge from the southern end of Harquahala and Bighorn Mountains onto a broad and level plain. Rainfall concentrates quickly in the washes and then flows across the plain generally in a southerly direction toward Centennial Wash.

9.4-B2- Damages

It is expected this area will be highly developed as proposed highways are completed. When this occurs, damage from flood waters will porportionately increase.

9.4-B-3 Plan

Plan for this watershed consists of a retarding structure and a floodway. The retarding basin will begin approximately on a line between Range 10 West and Range 11 West and in the center of Township 3 North, and run in an easterly direction along the 1400-ft. contour. The dike continues east until it intersects Gin Rd. Ranchers in this area have constructed a channel along the west side of the road going south toward Centennial Wash. Flow in this channel will be controlled and necessary work will be done to make its capacity adequate to carry extra water. Total length: 10 mi. dike; 7.7 miles for floodway. Original locations, sizes, and lengths: (see Johannessen & Girand Report, Western Maricopa County, Dec. 31, 1962, Appendix II-E-7-a).

After careful study, the County Flood Control Engineer has recommended some changes. The amended plan is shown in this report. A summary of costs as recommended is shown in Table 9.4-1 and Map 9.4-A shows planned extent and location. Table 9.4-A shows structural data.

9.4-C TONOPAH WATERSHED

9.4-C-1 General

The flood-producing area consists primarily of steep mountains between contours 1300 and 3000. The topography is characterized by many washes which emerge from the southern and eastern slopes of the Bighorn Mountains onto the flood plain below. Rainfall gathers rapidly into the washes and flows across the plain, south toward Centennial Wash.

Presently, the area has no extensive urban development. However, small concentrations of population are located at Tonopah. Preliminary planning for a large urban development which may extend into this watershed is in progress.

Little information is available concerning former flood damage as development of the area has only recently occurred. Potential damage from a major flood to pump installations, irrigation ditches, cultivated land and building improvements is great.

9.4-C-2 Plan

Over-all plan for flood control in this watershed consists of a retarding basin for temporary water storage and a floodway to carry the controlled flow away to an area where damage will not result.

The retarding basin begins on the northeast side of Centennial Wash in Sec. 17, T2N, R7W. The dike follows the 1200 contour in an arch to the north and ends in Sec. 16, T2N, R5W. Total length: 12 miles.

The main wash in this area is known as Winters Wash. Present plan is to empty the water into this wash in a controlled amount and to convey it to the Hassayampa River. Necessary work will be done in the wash to make its capacity adequate to carry the design flow.

Changes from the location as shown by Johannessen & Girand are recommended by the Flood Control Engineer. Benefits derived from the longer dike does not warrent its being considered at this time. (For Johannessen & Girand's recommendations, see Appendix II-E-7-b of their report of 1962.)

The revised plans are shown in this report. A summary of cost of the structure is shown in Table 9.4-2 and Map 9.4-B shows planned extent and location. Table 9.4-B shows structural data.

9.4-D EAGLE TAIL MOUNTAIN WATERSHED

9.4-D-1 General

The drainage area above the planned works is composed primarily of steep mountains and foothill slopes between contours 1300 and 2900. The topography is rough and many washes emerge from the northeastern slopes of Eagle Tail Mountains and cut through an extensive flood plain. Rainfall flows northeasterly toward Centennial Wash.

Urban development is limited to small concentrations of population at various labor camps. There are now approximately 22,000 acres of land under irrigation and more is being developed.

Since area development has only recently occurred, little information as to previous flood damage is available. Potential damage to roads, pump installations, irrigation ditches, cultivated land, and building improvements is great.

9.4-D-2 Plan

The basic plan includes a retarding basin to temporarily store water and a floodway to carry it to Centennial Wash.

The dike will begin in Sec. 26, T2N, R11W, and run southerly along the 1400-ft. contour. Structure as proposed by the Flood Control District, will end in Cec. 1, T1S, R10W. Total length: 14 miles.

Floodway to carry the controlled flow to Centennial Wash will begin in the southwest corner of Sec. 1, T1S, R10W, and run east along the section line until it empties into the main wash. At the present time, there is a channel at this location with an average depth of 6 feet and a bottom width of 50 feet. Necessary work will be done in this channel to make its capacity adequate to carry the design outflow from the retarding basin.

For recommendations of Johannessen & Girand, see Appendix II-E-7-C of their report. Revised plans as proposed by the Flood Control District are included in this report. A summary of costs is shown in Table 9.4-3 and Map 9.4-C shows extent and location. Table 9.4-C shows structural data.

9.5 UPPER CENTENNIAL AREA

9.5-A General

Upper Contennial area is located in the northwestern part of Maricopa County and includes an area of 675 sq. miles. Most of this area is outside the County but drainage pattern is such that flood water comes down Centennial Wash into Maricopa County.

Centennial Wash, the main drainage channel, runs the full length of the watershed, a wide, flat valley with gentle slopes rising to the higher rocky mountain areas along the sides. Flood waters coming down from the mountains flowing across the developed areas of the valley cause considerable damage to crops and irrigation systems.

Flood damage in upper Centennial Wash is not great. Some protection levees have been built by farmers and these provide some local protection. As development continues in this area, flood protection may become necessary, but at the present time, no flood control measures are planned.

9.6-A UPPER HASSAYAMPA AREA

This area begins above Box Canyon Damsite and north of the Maricopa County line but contributes flood water that affects land and property in this county. Total area is 417 sq. mi. Drainage area consists of steep mountains and sloping foothills ranging up to over 7,000 ft. elevation. Topography is rough and undulating. Slopes are mostly brush-covered. Rainfall is of a high intensity but usually covers small areas. Due to the steep slopes, water concentrates quickly and runs off at a high velocity. The general drainage is to the south and the Hassayampa River is the main drainage channel.

9.6-B BOX CANYON DAM

9.6-B-1 General

In the Hassayampa River basin approximately 6 miles north of Wickenburg, the hills come in close to the channel to form what is known as "The Box."

A dam has been proposed here by the U.S. Bureau of Reclamation for Whitman Project. This has been abandoned due to insufficient water for irrigation. This project is considered on the basis of flood control and domestic water supply for the town of Wickenburg.

TABLE 9.4-1 HARQUAHALA VALLEY WATERSHED SUMMARY

No.	Job Description	Estimated Cost Flood Control Dist.		SCS
1	Harquahala Retarding Basin	$300,000		$2,730,000
2	Harquahala Floodway	100,000		1,040,000
	Total:	400,000		3,770,000
	Total Project Cost:		$4,170,000	
Flood Damage Without Project				75,000
Flood Damage with Project				5,000
Benefits from Reduction of Damage				70,000
Total Annual Benefits				70,000
Total Project Cost, Amortized @ 2⅝ %				151,000
Annual Operation and Maintenance Cost				20,000
Total Annual Costs				171,000
Benefit-Cost Ratio		0.41 to 1.00		

TABLE 9.4-2 TONOPAH WATERSHED SUMMARY

No.	Job Description	Estimated Cost Flood Control Dist.		SCS
1	Tonopah Retarding Basin	$ 90,000		$1,560,000
2	Tonopah Floodway	30,000		390,000
	Total:	120,000		1,950,000
	Total Project Cost:		$2,070,000	
Flood Damage Without Project				57,500
Flood Damage With Project				7,500
Benefits from Reduction of Flood Damage				50,000
Total Annual Benefits				50,000
Total Project Cost Amortized at 2⅝ %				75,000
Annual Operation and Maintenance				10,000
Total Annual Costs				85,000
Benefit-Cost Ratio		0.60 to 1.00		

TABLE 9.4-3 EAGLE TAIL MOUNTAIN WATERSHED SUMMARY

No.	Job Description	Estimated Cost Flood Control Dist.		SCS
1	Eagle Tail Mountain Retarding Basin	$490,000		$ 969,000
2	Eagle Tail Mountain Floodway	210,000		880,000
	Total	700,000		$1,849,000
	Total Project Cost		$2,549,000	
Flood Damage Without Project				75,000
Flood Damage With Project				5,000
Benefits from Reduction of Flood Damage				70,000
Total Annual Benefits				70,000
Total Project Cost Amortized @ 2⅝ %				92,000
Annual Operation and Maintenance				20,000
Total Annual Costs				112,000
Benefit-Cost Ratio		0.63 to 1.00		

TABLE 9.4-A **STRUCTURAL DATA**
HARQUAHALA WATERSHED

Retarding Structure

No.	Item	Units	Structures
1	Drainage Area	sq. mi.	200
2	Sediment Capacity	ac. ft.	3,000
3	Flood Water Capacity	ac. ft.	17,000
4	Total Storage Capacity	ac. ft.	20,000
5	Total Surface Area	acres	2,400
6	Length	miles	100
7	Maximum Height	feet	25
8	Total Volume of fill	cu. yd.	2,000,000
9	Principal Spillway size	inches	120 x 120
10	Maximum Release Rate	cfs	1,000
	Cost Distribution		
11	Total Construction Cost	Dollars	2,730,000
12	Contract Administration	Dollars	20,000
13	Right of Way	Dollars	280,000
14	Relocations and other costs	Dollars	0
15	Flood Control Dist. Cost	Dollars	300,000
16	Total Project Cost	Dollars	3,030,000

Floodway

No.	Item	Units	Structures
1	Discharge Capacity	cfs	1,000
2	Length	feet	73,920
3	Average Bottom Width	feet	300
4	Average Depth	feet	5
5	Average Side Slope		1:1
6	Excavation	cu. yds.	490,000
7	Concrete	cu. yds.	15,000
	Cost Distribution		
8	Total Construction Cost	Dollars	1,040,000
9	Contract Administration	Dollars	20,000
10	Right of Way	Dollars	80,000
11	Flood Control Dist. Cost	Dollars	100,000
12	Total Project Cost	Dollars	1,140,000

TABLE 9.4-B **STRUCTURAL DATA**
TONOPAH WATERSHED

Retarding Structure

No.	Item	Units	Structures
1	Drainage Area	sq. mi.	145
2	Sediment Capacity	ac. ft.	600
3	Flood Water Capacity	ac. ft.	12,000
4	Total Storage Capacity	ac. ft.	12,600
5	Total Surface Area	acres	2,000
6	Length	miles	12.0
7	Maximum Height	feet	19
8	Total Volume of fill	cu. yd.	2,000,000
9	Principal Spillway size	inches	72 x 72
10	Maximum Release Rate	cfs	600
	Cost Distribution		
11	Total Construction Cost	Dollars	$1,560,000
12	Contract Administration	Dollars	10,000
13	Right of Way	Dollars	80,000
14	Relocations and other costs	Dollars	0
15	Flood Control Dist. Cost	Dollars	90,000
16	Total Project Cost	Dollars	1,650,000

Floodway

No.	Item	Units	Structures
1	Discharge Capacity	cfs	600
2	Length	feet	26,400
3	Average Bottom Width	feet	10
4	Average Depth	feet	4.2
5	Average Side Slope		1:1
6	Excavation	cu. yds.	30,000
7	Concrete	cu. yds.	6,000
	Cost Distribution		
8	Total Construction Cost	Dollars	$390,000
9	Contract Administration	Dollars	10,000
10	Right of Way	Dollars	20,000
11	Flood Control Dist. Cost	Dollars	30,000
12	Total Project Cost	Dollars	420,000

TABLE 9.4-C **STRUCTURAL DATA**
EAGLE TAIL MOUNTAIN WATERSHED

Retarding Structure

No.	Item	Units	Structures
1	Drainage Area	sq. mi.	40
2	Sediment Capacity	ac. ft.	200
3	Flood Water Capacity	ac. ft.	4,000
4	Total Storage Capacity	ac. ft.	4,200
5	Total Surface Area	acres	2,100
6	Length	miles	14
7	Maximum Height	feet	20
8	Total Volume of fill	cu. yd.	2,500,000
9	Principal Spillway size	inches	54
10	Maximum Release Rate	cfs	300
	Cost Distribution		
11	Total Construction Cost	Dollars	$ 969,000
12	Contract Administration	Dollars	10,000
13	Right of Way	Dollars	480,000
14	Relocations and other costs	Dollars	0
15	Flood Control Dist. Cost	Dollars	490,000
16	Total Project Cost	Dollars	1,459,000

Floodway

No.	Item	Units	Structures
1	Discharge Capacity	cfs	350
2	Length	feet	63,360
3	Average Bottom Width	feet	10
4	Average Depth	feet	2.8
5	Average Side Slope		1:1
6	Excavation	cu. yds.	90,000
7	Concrete	cu. yds.	variable
	Cost Distribution		
8	Total Construction Cost	Dollars	$ 880,000
9	Contract Administration	Dollars	10,000
10	Right of Way	Dollars	200,000
11	Flood Control Dist. Cost	Dollars	210,000
12	Total Project Cost	Dollars	1,090,000

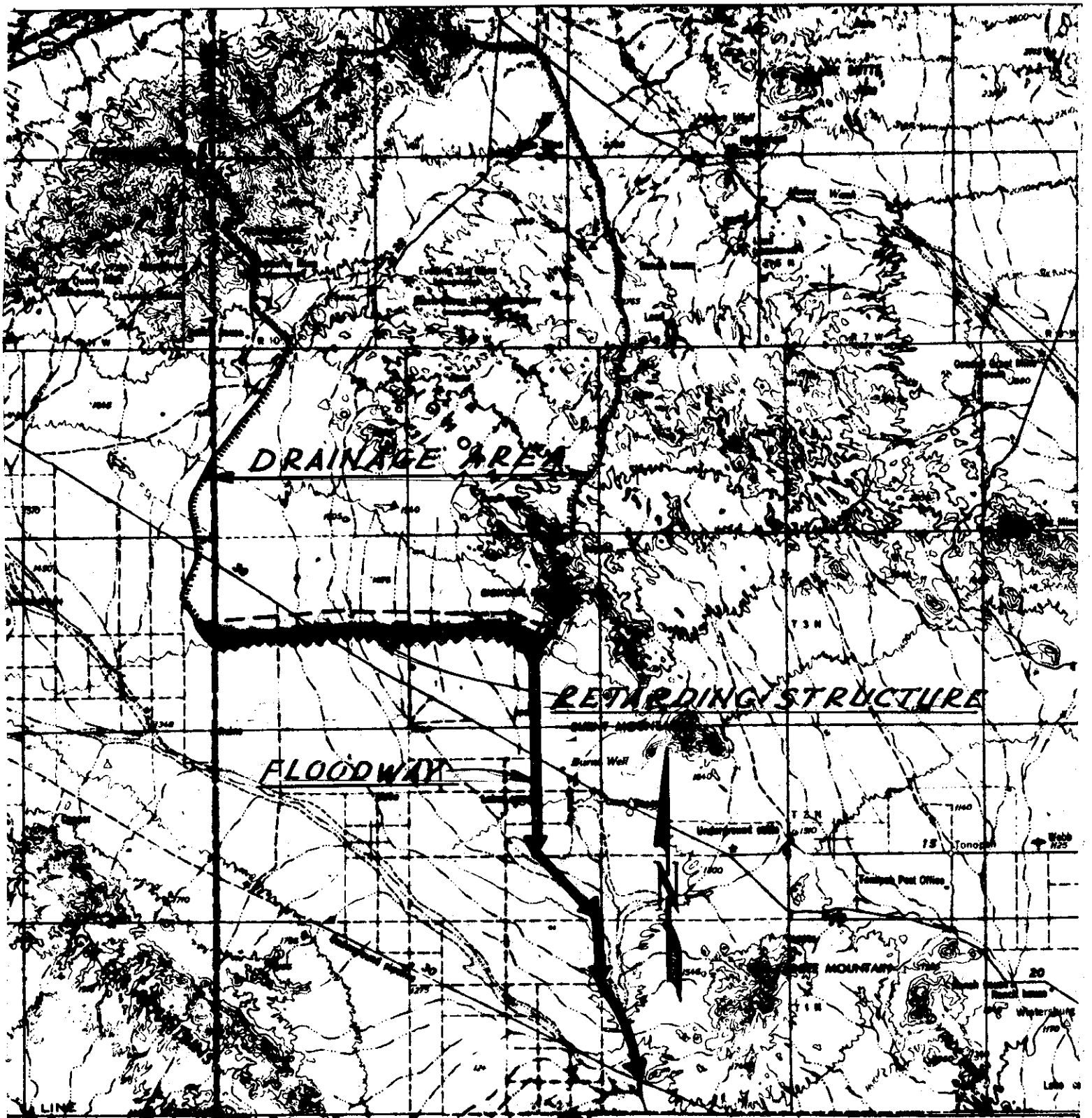
TABLE 9.6-1 BOX CANYON DAM SUMMARY

Job Description	FCD	Estimated Cost Recreation & Wildlife	Bureau of Reclamation
Box Canyon Dam	$652,000	$1,188,000	$5,760,000
TOTAL PROJECT COST		$7,600,000	
Benefits from Reduction of Flood Damage			20,000
Domestic Water Supplied			262,000
Recreation Benefits			8,000
Total Annual Benefits			290,000
Total Project Cost Amortized @ 2⅝ %			275,000
Annual Operation and Maintenance			50,000
Total Annual Costs			325,000
Benefit-Cost Ratio	0.90 to 1.00		

TABLE 9.6-A STRUCTURAL DATA

UPPER HASSAYAMPA - BOX CANYON DAM

No.	Item	Units	Quantity
1	Drainage Area	sq. mi.	422
2	Dead Storage	ac. ft.	10,000
3	Irrigation & Domestic Storage	ac. ft.	180,000
4	Flood Control Storage	ac. ft.	10,000
5	Total Storage Capacity	ac. ft.	200,000
6	Total Surface Area	acres	230
7	Length of Dam	feet	1,050
8	Maximum Height	feet	246
9	Volume of Fill	cu. yds.	3,029,000
10	Principal Spillway size, 2	inches	24
11	Maximum Release Rate	cfs	500
12	Diversion Capacity	cfs	1.500
13	Spillway Capacity	cfs	57,800
	Cost Distribution		
14	Total Construction Costs	Dollars	$5,760,000
15	Contract Administration	Dollars	40,000
16	Right of Way	Dollars	612,000
17	Relocations & other costs	Dollars	1,188,000
18	Flood Control District Cost	Dollars	652,000
19	Total Project Cost	Dollars	7,600,000



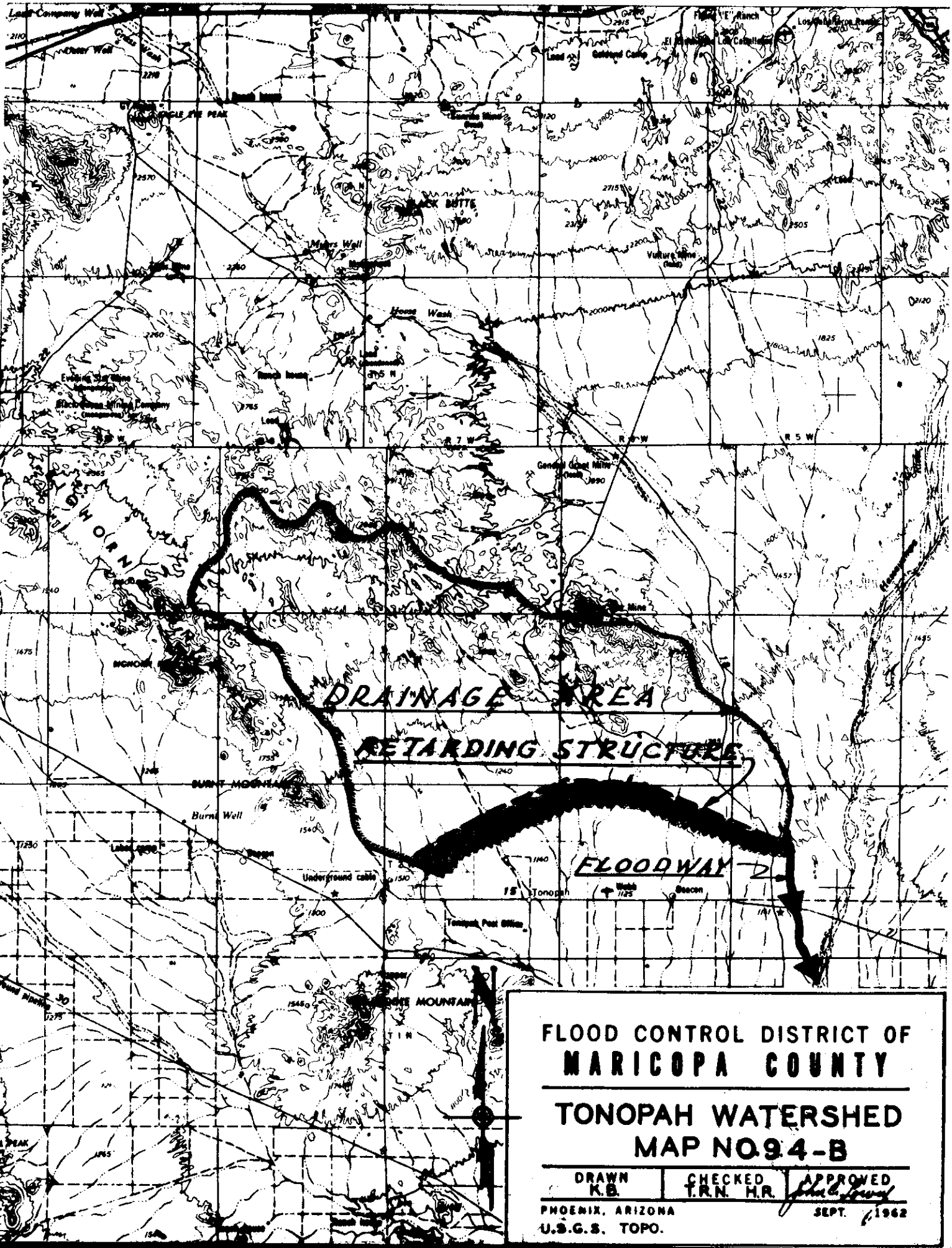
FLOOD CONTROL DISTRICT OF MARICOPA COUNTY

HARQUAHALA VALLEY WATERSHED - MAP NO. 9.4-A

DRAWN	CHECKED	APPROVED
K.B.	T.R.N. H.R.	John L. Lewis

PHOENIX, ARIZONA — SEPT. 29, 1962

U.S.G.S. TOPO.



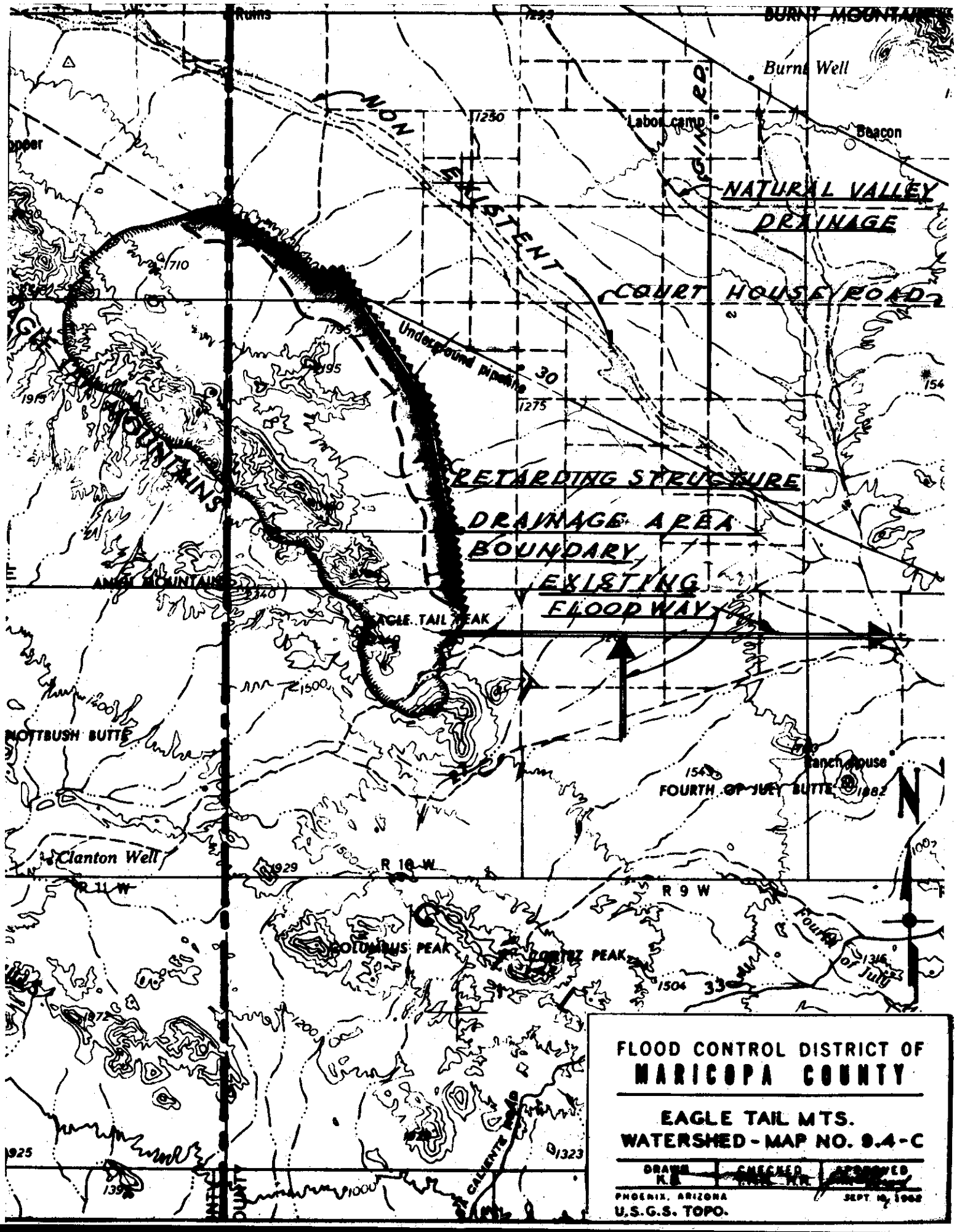
FLOOD CONTROL DISTRICT OF MARICOPA COUNTY

TONOPAH WATERSHED MAP NO. 94-B

DRAWN	CHECKED	APPROVED
K.B.	T.R.N. H.R.	John E. Lewis

PHOENIX, ARIZONA SEPT. 6, 1962

U.S.G.S. TOPO.



FLOOD CONTROL DISTRICT OF
MARICOPA COUNTY

EAGLE TAIL MTS.
WATERSHED - MAP NO. 9.4-C

DRAWN	CHECKED	APPROVED
K.B.		

PHOENIX, ARIZONA — SEPT. 19, 1962
U.S.G.S. TOPO.

It is one of the larger drainage areas in the county and contains 1,060 square miles.

The area is characterized by steep mountains blending into foothills and eventually into a broad valley. From Box Canyon at Morristown, to its junction with the Gila River, the river flows through a relatively flat sandy plain. From the point where the river leaves U.S. Highway 60 until it nears the Buckeye Valley, practically no development has occurred.

As the river enters the Valley and the topography flattens, there are scattered farms irrigated by wells. From the Roosevelt Irrigation District Canal south to the Gila River there are considerable developments.

Present plans for flood protection are all in the Wickenburg area.

9.7-B MATTHIE DAM

9.7-B-1 General

This proposed structure is located on Sols Wash approximately eight miles west of Wickenburg on the county line between Maricopa County and Yavapai County. The total area of Sols Wash above this proposed structure is 125 sq. miles. Except for very small areas, this wash drains through a broad valley with relatively flat slopes. General drainage pattern is to the east emptying into the Hassayampa River in Wickenburg.

9.7-B-2 Development and Damages

In the past, heavy rains have caused extensive damage to the Santa Fe Railroad where it crosses Sols Wash. Damage has occurred to the U.S. Highway 89 bridge in the northern section of Wickenburg. At the present time, there are no population concentrations outside Wickenburg. Property development along Sols Wash inside the city has been hindered due to constant threat of floods.

9.7-B-3 Plan

The dam proposed by Johnannessen & Girand would create a lake of approximately 500 acres in area with a maximum depth of 70 ft. The major benefit from this structure would be for recreation. There is doubt, however, that this watershed will produce the water needed to keep the reservoir full. Due to an unfavorable benefit-cost ratio and other factors, this structure is not recommended for construction by the County Flood Control Engineer at this time. Future developments may warrent a re-survey of this proposal.

For a resume of the Johannessen & Girand recommendations, see page II-6, II-7, II-8 and Appendix II-E-1, -F-1 and -G-1 of their report. Other data found in Table 9.7-1, Table 9.7-B, and Map 9.7-B.

9.7-C SOLS WASH CHANNEL

Protection from flood water is needed, especially along Flying "E" Wash and within the city limits of Wickenburg. To solve the problem, the County Flood Control Engineer recommends channel clearing in Sols Wash from the Hassayampa River to a point just above where Flying "E" Wash comes in. This will involve about 10 acres of clearing.

A pilot channel will then be excavated, beginning just below the highway bridge on Sols Wash and extended up to the junction of Flying "E" Wash; thence up this Wash for a distance of approximately 1800 ft.

For summary, see Tables 9.7-2, 9.7-A, and Map 9.7-A.

9.7-D FLYING "E" WASH DAM

9.7-D-1 General

Flood producing area consists primarily of rugged, steep mountains ranging up to approximately 3,500 ft. elevation. The topography is characterized by many washes. Drainage is generally north and eventually into Sols Wash about 2 miles above the Hassayampa River.

9.7-D-2 Development and Damages

Presently there are no centers of population within this project area. The principal damage from this wash occurs to the golf course of the Wickenburg Country Club. Damage has also been reported north of the U.S. Highway 60-70 bridge.

9.7-D-3 Plan

Johannessen & Girand reported on this project and complete information can be found in that Report. At the present time, as indicated by the benefit-cost ratio, this project is not justified on the basis of flood damage alone. Future development in this area or a sizable contribution by local interests may make this project feasible.

A summary of costs is found in Table 9.7-3 and Map No. 9.7-A shows planned location. Structural data is shown in Table 9.7-B.

9.7-E POWDER HOUSE WASH DAM

9.7-E-1 General

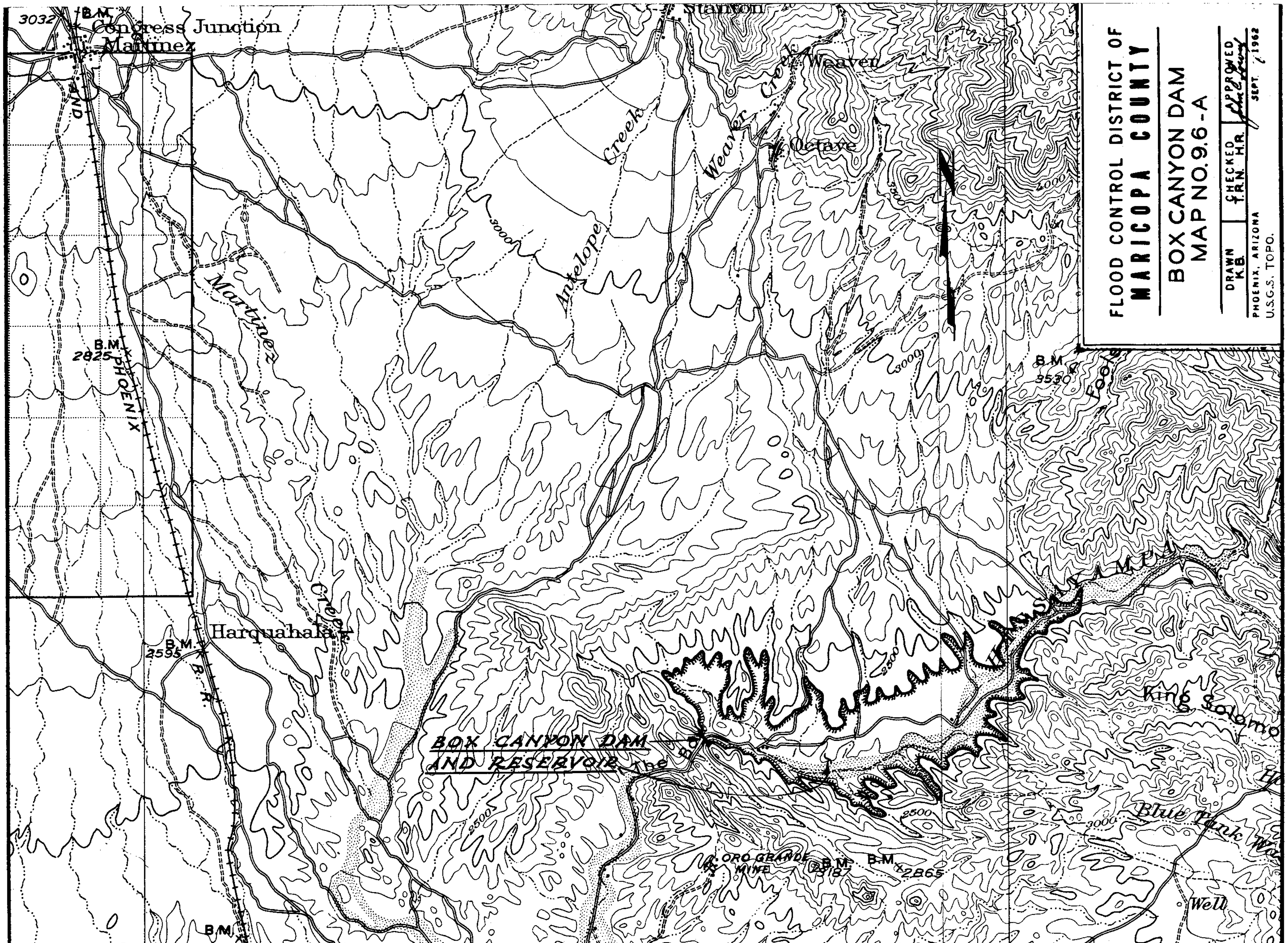
This Wash comes into the Hassayampa River on the east side within the town of Wickenburg. The wash runs through an area known locally as "East Wickenburg."

The flood producing area consists mainly of steep, brush-covered hills at an elevation of approximately 3,200 ft. Many washes cut through the lower foothills into the Hassayampa River. Grade in these washes is steep and water comes down at high velocities.

9.7-E-2 Development and Damages

Along the lower reaches of this wash is a highly developed area, including motels, service stations, private homes and other properties. Heavy runoff causes considerable damage to this developed area.

Two roads are affected by floods in this area. Both become impassible and several homes are isolated for long periods. Future developments in this area will increase possible damage.



FLOOD CONTROL DISTRICT OF
MARICOPA COUNTY

BOX CANYON DAM
MAP NO. 9.6-A

DRAWN K.B. | CHECKED T.R.N. H.R. | APPROVED | SEPT. 1962

PHOENIX, ARIZONA
U.S.G.S. TOPO.

9.7-E-3 Plan

Powder House Wash offers two damsites above the flooded area. The one recommended by the Flood Control Engineer is called the "lower alternate" site and is located approximately 1,000 feet above the point where Constellation Rd. starts to climb from the floor of the wash. The cost of the dam at the lower site is greater than that of the upper site. However, because of the greater drainage area controlled by the lower site, the additional cost appears to be justified. Table 9.7-4 shows cost summary; Map 9.7-A shows location and Table 9.7-B shows structural data.

9.7-F CASANDRO WASH (REEDS ADDITION)

9.7-F-1 General

The watershed of this wash contains approximately 1.5 sq. mi. of area and begins in the vicinity of the Vulture Mine Rd. north of Los Caballeros guest ranch, about a mile south of U.S. Highway 60-70. Terrain is rocky and grades are steep. Runoff from this area is considerably greater than the normal ratio of runoff to rainfall.

9.7-F-2 Damages

From a point near Avispa St. at the west edge of Reeds Addition to the railroad, the wash meanders through Reeds Addition in man-made channels and in the streets. Channel has been restricted by walls and other developments.

Capacity of present channel is limited and any overflow spreads into adjacent property and into homes causing extensive damage.

The constant flood threat has limited development within the Casandro tract. A major flood could cause extensive damage.

9.7-F-3 Plan

The plan for flood control will include an earth-fill dam with outlet and will be located approximately 1500 ft. downstream from where Country Club Drive crosses Casandro Wash. The dam will have an uncontrolled outlet to discharge approximately 40 cfs. The channel will handle this flow.

A summary of cost can be found in Table 9.7-5 and Map 9.7-A shows proposed location. Table 9.7-C shows structural data.

9.7-G SUNSET AND SUNNY COVE WASHES

9.7-G-1 General

These two washes are small, but runoff is high. Both washes originate in the vicinity of the Vulture Mine Road and run northeast and enter the Hassayampa River together.

Watershed is characterized by steep hills and rocky terrain. When water flows, high velocities are the result.

9.7-G-2 Development and Damages

In the path of these washes are the Sunny Cove subdivision, part of Wickenburg, Fishers Addition, and Maguire's Addition. Below the junction of these two washes, much damage has been reported during past floods and the potential damage due to the maximum flood would be very extensive. Further area development will increase the possible damage.

9.7-G-3 Plan

Plan for control of these washes consists of an earth-fill dam in each wash. Each dam will have an uncontrolled outlet. Channel below is adequate to carry the outflow. Dams will be designed to handle a 100-year frequency flood.

Cost summary is Table 9.7-6; Map 9.7-A shows proposed location and Table 9.7-C shows structural data.

9.8 ARLINGTON AREA

Arlington Area is located west of the HassayampaRiver between the river and Centennial Wash. The area is a long narrow valley extending from its junction with the Gila River north to Flat Iron Mountain. Total area: 60 sq. mi.

Flood producing area is the fairly steep country at the north end in the higher elevations. Rolling hills are traversed by distinct washes. The valley floor close to the mouth is narrow and relatively flat.

Approximately 80 acres of farm land and the Arlington Canal would be affected if flooding should occur in Arlington Wash. No definite channel exists below the canal and damage may be extensive if a flood should occur.

Under present conditions of development, and due to the small drainage area, no flood control work is planned in this area. Future conditions may warrant futher study.

9.9-A BUCKEYE VALLEY AREA

Buckeye Valley area is located in the central partof Maricopa County and includes the town of Buckeye. Total area is 120 sq. miles. Practically the whole drainage area is included in the Buckeye Watershed. Over-all drainage is to the south and into the Gila River. Possibility for development of this area in the future is considered very good.

TABLE 9.7-1 MATTHIE DAM SUMMARY

No.	Job Description	Estimated Cost Flood Control Dist.		Other
1	Earth-fill Dam and related work	$500,000		$556,000
	Total Project Cost		$1,056,000	
Benefits from Reduction of Flood Damage				4,000
Benefits from Recreation				7,000
Total Annual Benefits				11,000
Total Project Cost Amortized @ 2-5/8%				38,000
Annual Operation & Maintenance				5,000
Total Annual Costs				43,000
Benefit-Cost Ratio		0.26 to 1.00		

TABLE 9.7-2 SOLS WASH CHANNEL SUMMARY

No.	Job Description	Estimated Cost Flood Control Dist.		Other
Channel Clearing and excavation in Sols Wash & Flying "E" Wash		$ 40,000		None
	Total Project Cost		$40,000	
Flood Damage Without Project				$3,000
Flood Damage With Project				500
Benefits from Reduction of Flood Damage				2,500
Total Annual Benefits				2,500
Total Project Cost Amortized @ 2-5/8%				1,500
Annual Operation & Maintenance				500
Total Annual Costs				2,000
Benefit-Cost Ratio		1.25 to 1.00		

TABLE 9.7-3 FLYING "E" WASH DAM SUMMARY

No.	Job Description	Estimated Cost Flood Control Dist.		Other
1	Earth-fill Dam and Related Works	0		$183,000
	Total Project Cost		$183,000	
Benefits from Reduction of Flood Damage				$ 4,500
Total Annual Benefits				4,500
Total Project Cost Amortized @ 2-5/8%				6,600
Annual Operation & Maintenance				600
Total Annual Cost				7,200
Benefit-Cost Ratio		0.63 to 1.00		

TABLE 9.7-4 POWDER HOUSE WASH DAM SUMMARY

No.	Job Description	Estimated Cost Flood Control Dist.		Other Corps of Engr.
1	Earth-fill Dam & Related Works (lower site)	$50,000		$82,000
	Total Project Cost		$132,000	
Benefits from Reduction of Flood Damage				$10,000
Total Annual Benefits				10,000
Total Project Cost Amortized @ 2-5/8%				4,800
Annual Operation & Maintenance				800
Total Annual Costs				5,600
Benefit-Cost Ratio		1.79 to 1.00		

TABLE 9.7-5

CASANDRO WASH (REED'S ADDITION) DAM SUMMARY

No.	Job Description	Estimated Cost Flood Control Dist.		Other
1	Earth-fill Dam & Related Works	$60,000		0
	Total Project Cost		$60,000	
Benefits from Reduction of Flood Damage				$4,500
Total Annual Benefits				4,500
Total Project Cost Amortized @ 2-5/8%				2,200
Annual Operation & Maintenance				300
Total Annual Costs				2,500
Benefit-Cost Ratio		1.80 to 1.00		

TABLE 9.7-6

SUNSET & SUNNY COVE WASHES, DAM SUMMARY

No.	Job Description	Estimated Cost Flood Control Dist.	Other
1	Earth-fill Dam & Related Works One each on Sunset & Sunny Cove Washes	$79,000	0
	Total Project Cost	$79,000	
Flood Damage Without Project			$7,200
Flood Damage With Project			1,000
Benefit from Reduction of Flood Damage			6,200
Total Annual Benefits			6,200
Total Project Cost Amortized @ 2-5/8%			2,900
Annual Operation & Maintenance			600
Total Annual Costs			3,500
Benefit-Cost Ratio		1.77 to 1.00	

TABLE 9.7-A

STRUCTURAL DATA
SOLS WASH
CHANNEL IMPROVEMENTS

No.	Item	Units	Structure Sols Wash	Flying "E" Wash
1	Discharge Capacity	cfs	7,300	960
2	Length	ft.	8,760	1,800
3	Av. Bottom Width	ft.	60	30
4	Av. Depth	ft.	3	2
5	Av. Side Slope		3:1	3:1
6	Excavation	cu. yd.	70,000	5,400
7	Concrete	cu. yd.	--	--
	Cost Distribution			
8	Total Construction Cost		$ 35,000	$ 3,900
9	Contract Administration		1,000	100
10	Right of Way		0	0
11	Relocations & other Costs		0	0
12	Flood Control District Cost		36,000	4,000
13	Total Project Cost		36,000	4,000

TABLE 9.7-B **STRUCTURAL DATA**
LOWER HASSAYAMPA AREA
Wickenburg Flood Retarding Dams

No.	Item	Units	Structures		
			Matthie	Flying "E"	Powder House
1	Drainage Area	sq. mi.	125	9.3	1.8
2	Sediment Capacity	ac. ft.	0	0	0
3	Flood Water Capacity	ac. ft.	5,200	335	150
4	Total Storage Capacity	ac. ft.	11,500	715	200
5	Total Surface Area	acres	570	80	30
6	Length	ft.	600	1,800	450
7	Max. Height	ft.	70	33	35
8	Total Volume of Fill	cu. yd.	247,000	102,000	58,000
9	Principal Spillway Size	in.	60	48	24
10	Maximum Release Rate	cfs	260	200	40
	Cost Distribution				
11	Total Construction Cost		$1,036,000	$183,000	$ 82,000
12	Contract Administration		20,000	0	2,000
13	Right of Way		0	0	48,000
14	Relocations & other costs		0	0	0
15	Flood Control District Cost		500,000	0	50,000
16	Total Project Cost		1,056,000	183,000	132,000

TABLE 9.7-C **STRUCTURAL DATA**
LOWER HASSAYAMPA AREA
Flood Retarding Dams

No.	Item	Units	Structures		
			Casandro	Sunset	Sunny Cove
1	Drainage Area	sq. mi.	1.5	.6	1.4
2	Sediment Capacity	ac. ft.	0	27	33
3	Flood Water Capacity	ac. ft.	90	55	82
4	Total Storage Capacity	ac. ft.	90	82	115
5	Total Surface Area	acres	20	7	18
6	Length	feet	460	470	610
7	Maximum Height	feet	24	20	19
8	Total Volume of fill	cu. yd.	15,000	9,200	16,000
9	Principal Spillway Size	in.	24	24	30
10	Max. Release Rate	cfs	40	30	50
	Cost Distribution				
11	Total Construction Cost		$29,000	$32,880	$45,320
12	Contract Administration		1,000	300	500
13	Right of Way		30,000	0	0
14	Flood Control District Cost		60,000	33,180	45,820
15	Total Project Cost		60,000	33,180	45,820

9.9-B BUCKEYE WATERSHED

9.9-B-1 General

This watershed, located north of Buckeye, has an area of 104 sq. mi. above the proposed dike. Many washes emerge from the southern end of the White Tank Mountains and cut through the broad plain.

Rainfall concentrates quickly in these washes and then runs across the plain toward the Gila River.

9.9-B-2 Developments

The flood plain area is practically all under irrigation and water is delivered by canals of the Roosevelt Irrigation District, Buckeye Irrigation Company and Arlington Canal Company. U.S. Highway 80 and the main line of the Southern Pacific Railway run the length of the flood plain. Developments along the highway are extensive. Center of the urban area is the town of Buckeye with smaller concentrations at Liberty and Palo Verde.

9.9-B-3 Damages

Damage from flood water occurs almost every year. Water flows across the Roosevelt Irrigation District Canal in many places. Damage to canals and laterals as well as to irrigation land is heavy.

A major flood would cause extensive damage to farm land, urban areas and roads and highways. Damage potential increases as development increases.

9.9-B-4 Plan

The basic flood control plan for this watershed consists of a system of diversions, dikes and channels to intercept and carry the flood water to the Hassayampa River.

Beginning in Sec. 36, T2N, R3W, with a diversion, the retarding structure continues generally westward and empties into the River in Sec. 3, T1N, R5W.

Total structure length is estimated to be 14 miles.

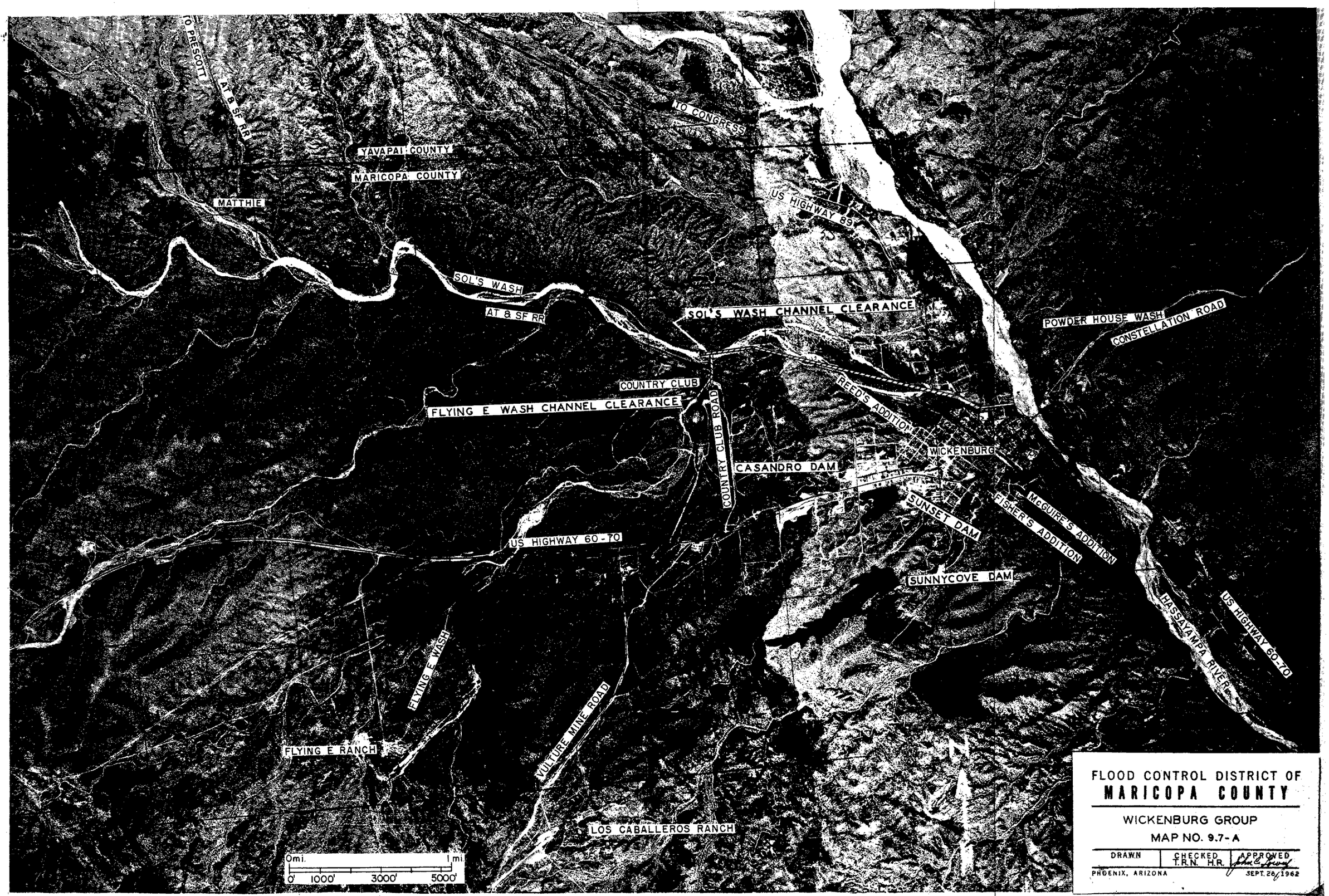
The diversion is 3 miles long, extending into Sec. 9, R3W. It picks up water that would otherwise affect Luke AFB and carries it west, emptying into "Buckeye East" retarding structure. This structure runs west into Sec. 7, where it empties into "Buckeye West" structure through the East floodway; then west to Sec. 1, T1N, R5W, where it empties into the West floodway. Water is carried from there into the Hassayampa River.

The Canal to carry the flood water to the Roosevelt Irrigation District Canal will run along the west side of Rooks Road and enter the main canal in controlled amounts. This ditch will be concrete-lined and have a capacity equal to the release rate of the principal spillway of "Buckeye West" retarding structure. Total channel length is 1.4 miles.

A summary of costs is shown in Table 9.9-1 and Map 9.9-A shows planned location. Table 9.9-A shows structural data.

9.10 GILLESPIE AREA

The Gillespie Area is located in the South portion of Maricopa County and has an area of 350 sq. mi. The topography is typical of the desert country in Central Arizona. The flood-producing areas are the Maricopa and Eagle Mountains. The Maricopa Mountains run north-south along the eastern boundary of this watershed. Many washes originate in the higher elevations and flow west and north to the Gila River. There are no major drainage channels but all are well-defined. Water collects rapidly in the washes and flows across the steep flood plain at high velocities.



FLOOD CONTROL DISTRICT OF
MARICOPA COUNTY

WICKENBURG GROUP

MAP NO. 9.7-A

DRAWN	CHECKED T.R.N. H.R.	APPROVED
PHOENIX, ARIZONA		SEPT. 26, 1962

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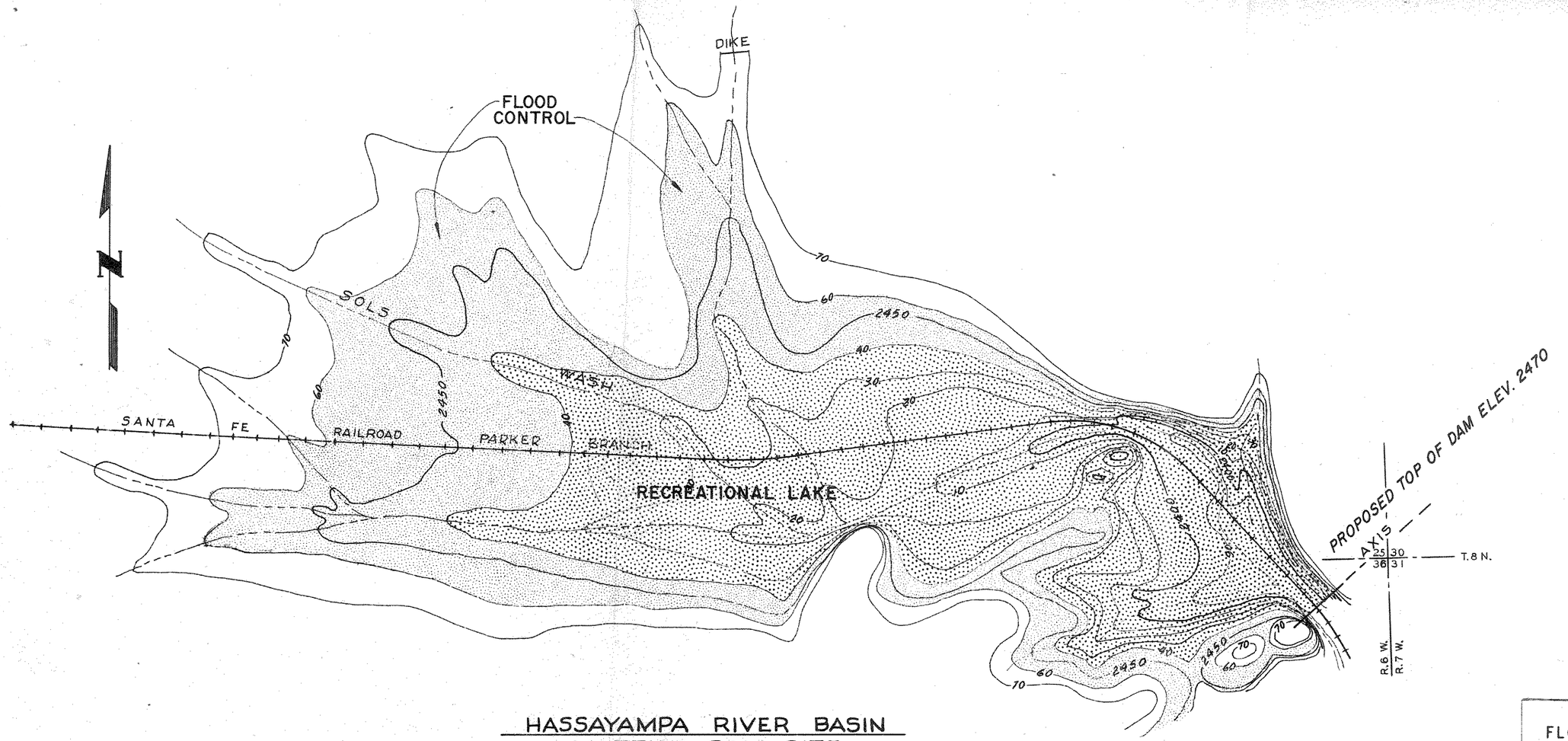


HASSAYAMPA RIVER BASIN
MATTHIE DAM SITE

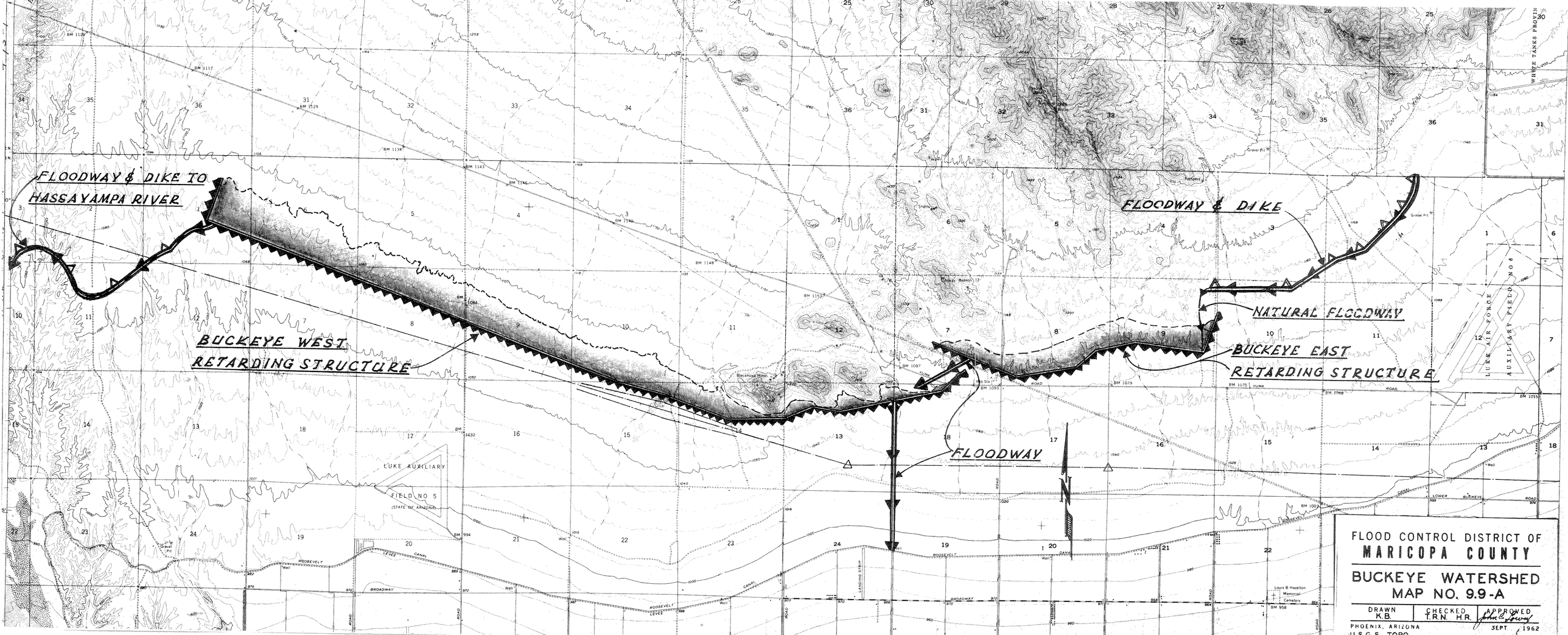
SCALE: 1" = 1000'
CONTOUR INTERVAL: 10'

FLOOD CONTROL DISTRICT OF
MARICOPA COUNTY

MATTHIE DAM SITE
MAP NO. 9.7-B

DRAWN	CHECKED	APPROVED
J.&G.	T.R.N.	John C. Lowe

PHOENIX, ARIZONA — SEPT. 1962


FLOODWAY & DIKE TO
HASSAYAMPA RIVER
BUCKEYE WEST
RETARDING STRUCTURE
FLOODWAY & DIKE
NATURAL FLOODWAY
BUCKEYE EAST
RETARDING STRUCTURE
FLOODWAY
LUKE AUXILIARY
FIELD NO 5
(STATE OF ARIZONA)
LUKE AIR FORCE AUXILIARY FIELD NO 6
WHITE TANKS PROJECTION
FLOOD CONTROL DISTRICT OF
MARICOPA COUNTY
BUCKEYE WATERSHED
MAP NO. 9.9-A
DRAWN K.B.
CHECKED T.R.N. H.R.
APPROVED
PHOENIX, ARIZONA
U.S.G.S. TOPO
SEPT. 1962

There are no extensive developments in this area. Most of it is in range land with poor vegetative cover. U.S. Highway 80 runs the entire length of the watershed and although the highway does not wash out often, flood waters do cover it during a storm and cause traffic delays and some damage.

The Gila Bend Canal is subject to washout from flood water and considerable time and money are spent during the rainy years on maintenance. At the present time, value of improvements in this area does not warrant a flood control project. Future developments may justify such protection.

TABLE 9.9-1 BUCKEYE WATERSHED SUMMARY

Job Description	Estimated Cost Flood Control Dist.		S.C.S.
Consists of two Retarding Structures, one Diversion Dike, two Floodways, and one slip-form canal for water distribution.	$776,000		$2,986,000
Total Project Cost		$3,762,000	
Flood Damage without Project			235,000
Flood Damage with Project			60,000
Benefits from Reduction of Flood Damage			175,000
Irrigation Benefits			-0-
Other Benefits			-0-
Total Annual Benefits			175,000
Total Project Cost Amortized @ 2-7/8%			114,000
Annual Operation and Maintenance			14,000
Total Annual Costs			128,000
Benefit-Cost Ratio	1.40 to 1.00		

TABLE 9.9-A STRUCTURAL DATA BUCKEYE WATERSHED

Retarding Structures

No.	Item	Unit	Structures East	Structures West
1	Drainage Area	sq. mi.	14.6	42.7
2	Sediment Capacity	ac. ft.	220	600
3	Flood Water Capacity	ac. ft.	1,240	3,500
4	Total Storage Capacity	ac. ft.	1,460	4,100
5	Total Surface Area	acre	320	990
6	Length	mile	2.8	9.0
7	Maximum Height	foot	23.5	25.0
8	Total Volume of fill	cu. yd.	535,000	1,082,000
9	Principal Spillway Size	inch	36	60
10	Maximum Release Rate	cfs	147	440

TABLE 9.9-A Continued **STRUCTURAL DATA**
BUCKEYE WATERSHED

		Cost Distribution		
11	Total Construction Cost	Dollars	691,00	1,565,000
12	Contract Administration	Dollars	5,000	12,000
13	Right of Way	Dollars	154,000	481,000
14	Relocations & Other Costs	Dollars	-0-	-0-
15	Flood Control Dist. Cost	Dollars	159,000	493.000
16	Total Project Cost	Dollars	850,000	2,058,000

Floodways

No.	Item	Units	East	West	Diversion
1	Discharge Capacity	cfs	147	685	1,910
2	Length	ft.	3,200	15,600	16,400
3	Avg. Bottom Width	ft.	12	30	90
4	Avg. Depth	ft.	30	5.0	3.1
5	Avg. Side Slope		2:1	Variable	Variable
6	Excavation & Fill	cu. yd.	17,560	172,100	140,000
7	Concrete & Rock Rip-Rap	cu. yd.	-	2,110	10,000
		Cost Distribution			
8	Total Construction Cost	Dollars	29,200	437,000	207,350
9	Contract Administration	Dollars	300	3,000	1,600
10	Right of Way	Dollars	7,000	18,000	53,000
11	Relocations & Other Costs	Dollars	-0-	-0-	-0-
12	Flood Control Dist. Cost	Dollars	7,300	21,000	54,600
13	Total Project Cost	Dollars	36,500	458,000	261,950
14	Total Cost as Shown on Table 7.0-1 includes Irrigation and Wildlife Facilities.				

9.11 THEBA AREA

Theba area is located in the southwestern part of Maricopa County and has an area of 500 sq. mi. This area is steep rocky terrain along the edges, blending into a broad valley toward the center

General drainage is toward the northwest, emptying into the Gila River. A large part of the area is included in the Williams Bombing and Gunnery Range.

Quilotosa Wash is the principal drain. It originates in the Sauceda and Sand Tank Mountains about 30 miles south and 15 miles west of Gila Bend.

Flood damage is slight in this area. Areas that have experienced some damage are Gila Bend Ranch, Gila Bend Air Force Base; Tucson, Cornelia and Gila Bend Railroad, Arizona Highway; Gillespie Canal; Southern Pacific Railroad; U.S. Highway 80; and developed areas west of Gila Bend.

At the present time, however, total damage does not warrant protective measures. Future developments may justify such protection.

9.12-A GILA BEND AREA

The Gila Bend area is located in the southwestern part of Maricopa County and has an area of 345 sq. mi. The flood-producing area is the Sand Tank Mountains which are located in the southern section. Highest point is Maricopa Peak. Many washes originate in these mountains and flow out from the southwest and northeastern slopes eventually flowing into the Gila River in the Gila Bend area.

Approximately 160 sq. miles of the total drainage area is steep, rocky terrain with shallow soils. The remaining 185 square miles is a broad, flat, flood plain with deep soils of high infiltration. Major drainages are the Bender and Sand Tank Washes.

9.12-B BENDER AND SAND TANK WASHES

9.12-B-1 General

Bender Wash heads up in the same general area on the southwestern slopes of the Maricopa Mountains about 25 miles southeast of Gila Bend, Arizona. It flows northwesterly through barren, rocky country, crossing under Highway 84, and emerging into the flat alluvial plains. It continues on northwest and passes through Gila Bend approximately 300 yards east of the main channel of the Sand Tank Wash. Before reaching the Gila Bend area, the flows of Bender and Sand Tank Washes have been joined together by means of many small cross-channels.

9.12-B-2 Development and Damages

Flood damages reported in Gila Bend area are mostly in the extreme east end of town and an area south of Gillespie Canal, east of State Highway 85. This area is known locally as "Mexican Town" and has experienced considerable flood damage in the past 5 years. In the eastern section of Gila Bend, damage occurred to motels, service stations and other business establishments, the Gillespie Canal, Southern Pacific Railroad and U. S. Highway 80. No records are available to indicate average annual cost of flood damage to the Gillespie Canal, but some damages have occurred.

9.12-B-3 Plan

A study of this area by Johannessen & Girand reveals several possible solutions. After careful consideration (and mostly due to the benefit-cost determinations) the County Flood Control Engineer has selected the following structural measures.

a. Provide adequate diking and channelization above the Gillespie Canal to guide the flood water into the channels to be constructed; channelization and dikes to be built between the canal and the railroad; between the railroad and the highway and north of the highway a sufficient distance to protect the developed property below.

b. In conjunction with this channel and dike work the present siphon located in Bender Wash under Gillespie Canal will be replaced with one of sufficient capacity to carry the canal flow under Bender Wash. This siphon would be similar to the one already existing in Sand Tank Wash.

A summary of costs is in Table 9.12-1; Map 9.12-A shows location; Table 9.12-A shows structural data.

9.13 SANTA ROSA AREA

The Santa Rosa Area is located in the southeast corner of the lower section of Maricopa County and has a total area of 60 square miles. Drainage is to the southeast and the flood waters continue in a southerly direction into Pima County. Most of the area is included in the Papago Indian Reservation.

TABLE 9.12-1 BENDER AND SAND TANK WASHES SUMMARY

Job Description	Flood Control Dist.		Estimated Cost Other
Channel Clearing and Dike Construction Includes siphon under Bender Wash	$152,000		$114,000
Total Project Cost		$266,000	
Flood Damage without Project			13,500
Flood Damage with Project			1,000
Benefits from Reduction of Flood Damage			12,500
Total Annual Benefits			12,500
Total Project Cost Amortized @ 2-5/8%			9,600
Annual Operation and Maintenance			1,100
Total Annual Costs			10,700
Benefit-Cost Ratio	1.16 to 1.00		

TABLE 9.12-A STRUCTURAL DATA
BENDER AND SAND TANK WATERSHED

Channel Clearing

No.	Item	Units	Quantity
1	Maximum Discharge	cfs	6,000
2	Total Length	ft.	7,000
3	Avg. Bottom Width	ft.	100
4	Avg. Depth	ft.	4.1
5	Avg. Side Slope		2:1
6	Total Excavation	cu. yd.	50,000

Dike Construction

No.	Item	Units	Quantity
1	Total Length	ft.	12,000
2	Maximum Height	ft.	12.0
3	Avg. Side Slope		2.5:1
4	Total Volume of Fill	cu. yd.	100,000

Cost Distribution

1	Total Construction Cost	Dollars	114,000
2	Contract Administration	Dollars	8,850
3	Right of Way	Dollars	12,000
4	Relocations & other costs	Dollars	131,150
5	Flood Control District Cost	Dollars (2, 3 & 4)	152,000
6	Total Project Cost	Dollars (1 & 5)	266,000

FLOOD CONTROL DISTRICT OF
MARICOPA COUNTY

BENDER & SAND TANK WASHES
MAP NO. 9.12-A

AERIAL PHOTO	CHECKED	APPROVED
PHOENIX, ARIZONA	T.R.N. H.R.	John C. Lowry SEPT 1962

JOHANNESSEN AND GIRAND
CONSULTING ENGINEERS, INC.

Flood damage occurring in Maricopa County is slight, mostly because this area has not been developed. Channels in the area are well-defined and there is very little chance for serious flood damage.

9.14 VEKOL AREA

The Vekol Area is located in the south central part of Maricopa County and contains an area of 285 square miles. The flood-producing area of the watershed within Maricopa County is the eastern slopes of the Sand Tank Mountains.

The topography is typical desert country of central Arizona. Many washes form in the higher elevations and cut through the moderately steep foothills, where the runoff is at high velocity. The main drainage is to the north through Vekol Wash. At the present time, there is very little development here, either urban or rural. Reports of flood damage are very few — minor damage to state and county roads and some erosion along the banks of Vekol Wash. These damages are not serious enough to warrant a flood control project.

Future developments may justify a study of flood protection.

9.15 WATERMAN AREA

The Waterman Area is located in south central Maricopa County and has an area of 520 square miles.

The main drainage channel is Waterman's Wash, originating in the eastern slopes of the Maricopa Mountains approximately 20 miles east of Gila Bend. The wash drains north through the steep foothills and then northwest into a relatively flat valley that leads into the Gila River southeast of Buckeye.

The topography is typical desert of central Arizona. The foothills and the valley are traversed by many washes. Cover is sparse and slopes are steep.

Flood damage reports from this area have been meager. There are very few developments, other than a small concentration of population at Mobile on the Southern Pacific Railroad. Range condition is poor and when rain comes it runs off rapidly.

No flood protection projects are planned at this time, but future developments may justify a re-evaluation here.

9.16-A WHITE TANKS AREA

The White Tanks area is located in the central section of Maricopa County and has an area of 200 square miles. The major flood-producing areas are the White Tank Mountains on the western border of the watershed. The White Tanks detention structures constructed several years ago have eliminated a lot of flooding problems in this area. Local flooding is still a problem in some areas. The general topography is uniform except near the montains and slope is mostly to the southeast.

9.16-B WHITE TANKS WATERSHED

9.16-B-1 Developments

Concentration of development is mostly in the valley area just north of Gila River. The area is almost completely in cultivation, with scattered population centers. Towns are Liberty, Perryville, Goodyear and Avondale. Also within this area is Luke Air Force Base, Litchfield Park and Litchfield Naval Air Station. The outlying farming areas are well populated and land values are high.

9.16-B-2 Damages

Damaging floods in this area occur frequently. Total areas affected have been reduced by construction of White Tanks projects, but many farm areas are still subject to damage. There are some residential areas and all roads and utilities are in danger from major runoff.

9.16-B-3 Plan

There are two detention structures, and McMicken Dam has its beginning here. The lower detention basin does not provide adequate storage for the flow from the drainage area above it. By constructing two small channels and dikes, about 8 sq. mi. of drainage above the upper structure can be diverted to the Trilby Wash detention basin; then, by another channel and dike, about 5 sq. mi. above the lower basin can be taken to the upper basin. This would relieve the pressure on the lower basin and extend its useful life.

To protect Luke Field, the U. S. Corps of Engineers has constructed a concrete-lined channel along Northern Ave. from the northwest corner of Luke Field to the Agua Fria River. The Maricopa County Flood Control District will be required to convey the excess water to this channel. The above projects are not included in the Summary Sheets of this report but will be done as a part of the regular program.

9.17 TRILBY WASH AREA

The Trilby Wash area is located in central part of Maricopa County northwest of Phoenix and covers an area of 320 sq. mi.

The area extends from McMicken Dam and Beardsley Canal north to approximately the Yavapai County line and from the ridge east of the Hassayampa River to the Agua Fria River. Most of the floods occurring here are produced within the watershed and above U. S. Highway 60-70.

There are many washes, essentially parallel, that run south and east. One of the main drainage ways is Trilby Wash. The Trilby Wash detention basin created by McMicken Dam, was completed in July, 1956, by the Corps of Engineers at a cost of $2,000,000. Luke AFB and the towns of Litchfield, Goodyear, Avondale and about 50,000 acres of rich farm land receive protection from this structure.

Population density is low and there is very little development. The area above U.S. 60 - 70 is desert range in fair condition. Below are irrigated farms of considerable value, mostly irrigated by wells. Highway bridges and Santa Fe Railroad are subject to flood damage. Below the highway, there would be greater damage from a major storm.

No major flood control works are planned in this area. Local problems may come up in the future, but these will be handled in the regular operation of the Flood Control District. Future developments may justify further study.

9.18 UPPER AGUA FRIA AREA

The Upper Agua Fria Area begins above Carl Pleasant Dam in northern Maricopa County and extends into Yavapai County. Total area is 1,459 square miles. This is one of the larger drainage areas that affect Maricopa County, although most of it lies outside this County.

Carl Pleasant Dam has reduced the frequency of a flood below the dam but has not reduced the probable maximum flood. The construction of New River and Adobe Dams will reduce the flood below in the Agua Fria. There are no plans for additional flood control projects within this area.

9.19 LOWER AGUA FRIA AREA

The lower Agua Fria area begins at the Lake Pleasant Dam and extends south to Salt River. Total area is 110 sq. mi. Topography consists of rough, steep hills at the upper end; smooth, flat land at the lower end near Salt River. The area is long and narrow, consisting mostly of the flood channel of the Agua Fria River and its tributaries. Cover is typically desert, with little vegetation. Velocities in the existing channels are high due to the steep slopes.

Some farming is done adjacent to the river, and there are approximately 3,000 acres excluding the river channel, which would be damaged by a major flood.

Work in the Deer Valley Group of projects will affect this area since the Agua Fria will be the outlet channel for these works. The West Phoenix floodways will also extend into this area.

9.20-A UPPER NEW RIVER AREA

The Upper New River Area begins at the proposed New River Dam in north central Maricopa County, northwest of the town of Adobe, and contains an area of 170 square miles.

The main drainage way is New River, an intermittent stream that heads up in Yavapai County about 10 miles east of Rock Springs. River channel is well-defined for most of its length.

The flood-producing area is the higher mountains at the upper end of the watershed, with elevations up to 5,000 ft. Topography is rough and many washes originate on the perimeter and flow down to the main channel. Due to the impervious nature of the ground and steep slopes, runoff is fast. Where the river crosses Black Canyon Highway, the slope of the whole watershed flattens out and the topography changes to broken, brush-covered hills.

Approximately 8 miles northwest of the town of Adobe, the hills converge to form a narrow box. At this point, the proposed New River Dam will be located.

The main urban concentration is in the town of Peoria, and development in the flood plain is limited. There is some possibility that the river may leave its present channel during a major storm and flood the town, causing extensive damage.

Some farming is done adjacent to the river and there are approximately 3,000 acres outside the river banks. The extent of damage on the Agua Fria River below New River can be reduced by construction of New River Dam.

9.20-B NEW RIVER DIVERSION

The purpose of this structure is to divert water from New River into the Agua Fria River above Carl Pleasant Dam.

The diversion is located in Sec. 11, T7N, R2E, just east of Black Canyon Highway. Required will be an earth-fill dam 50-ft. high and approximately 2 miles of diversion channel. Cost estimate: $500,000.

Most of the benefits of this construction would be for recreation and wildlife with a small amount for irrigation.

9.21 LOWER NEW RIVER AREA

The lower New River Area begins at the proposed New River Damsite and continues south to the Agua Fria River, and then to the Gila River. New River drainage area from the proposed dam to the Agua Fria covers 45 sq. mi. The watershed above the proposed New River Dam covers 170 sq. mi. Proposed reservoir capacity at spillway crest is 33,500 ac. ft. which would be released in controlled amounts to:

1. Provide water for those with water rights.
2. To recharge ground water.
3. Provide storage for additional flood waters.

From the damsite south to Deer Valley Road, the area is typical desert foothills, mostly brush-covered, with many small washes that flow to New River.

Farming areas begin at Deer Valley Road and continue to the Agua Fria River. Skunk Creek enters in Sec. 10, T3N, R1E, and would be a heavy contributor of flood water during a major storm.

Leading into New River prior to the confluence with Agua Fria is Skunk Creek (see 9.23—Skunk Creek Area). Proposed for additional protection from flood waters is a dam on Skunk Creek, referred to as Adobe Dam, which will have a reservoir capacity of 13,000 acre feet at the spillway crest. Flood water will be released in controlled amounts to prevent flood damage to areas below the dams.

Following the construction of these two dams, a channel clearance project is proposed for New River, Skunk Creek and Agua Fria River, so these channels can handle additional flood waters introduced from the Cave Creek area. Channel capacities will be such that the Cave Creek waters can be handled with no damage to the surrounding area.

In order to assure that there will be no additional threat of damage by the introduction of Cave Creek waters into the New River and Skunk Creek areas, the following sequence of construction operations will be followed:

The Adobe Dam and New River Dam will be scheduled for construction prior to the channel clearance program of the affected stream beds. The channel clearance of these stream beds will follow as the second priority in this particular program. They will not be constructed first, because the size would then have to be sufficient to handle the present possible peak floods that could come down Skunk Creek and New River. By constructing the dams first, the required channel capacity would be reduced, thus reducing the cost.

The channel clearance of these streams will take place prior to the introduction of any flood waters from Cave Creek area. The construction of the two dams on Skunk Creek and New River will so regulate the flow of floodwaters that even with the introduction of flood waters from Cave Creek, the maximum that could pass the confluence of Skunk Creek and New River would be decreased by approximately 50%.

9.22-A DEER VALLEY AREA

The Deer Valley Area west of Phoenix contains 140 sq. mi. The upper end of the watershed begins at Union Hills, one mile south of Cave Creek Dam, extends southward, widening to take in parts of Deer Valley, and includes the thickly populated areas west of Phoenix. Salt River is the southern boundary.

The major flood-producing part of this area is the upper end, east of Skunk Creek watershed. However, local flooding is produced south in the watershed as a result of flat slopes and poor outlets.

The Arizona Canal effectively divides the area into two parts, and under ordinary conditions flood waters do not cross it. However, a major flood has caused breaks in the canal, allowing water to flow through the highly developed areas below, causing major damage.

Most of the area north of the Canal is in farming but beginning at the Canal and going south toward Salt River, population density increases. Included are the towns of Glendale and Maryvale, and other suburban residential developments.

Planned projects that affect this area are North Phoenix Mountains, Arizona Canal Diversion, Union Hills Diversion, New River and Adobe Dams and the West Phoenix Floodways. They are described under Sections as follows:

9.22-B	West Phoenix Floodways	9.25-B-4	Dreamy Draw Dam
9.24-D	Lower Cave Creek Dam	9.25-B-5	Union Hills Diversion
9.25-B-2	North Phoenix Mountains	9.25-B-6	New River Dam
9.25-B-3	Arizona Canal Channel	9.25-B-7	Adobe Dam

9.22-B WEST PHOENIX FLOODWAYS

9.22-B-1 General

This area has been one of the most rapidly developing sections of Maricopa County. Settlement has been so recent that it is difficult to estimate possible damage, but it would be very serious. Hundreds of residences would be flooded by a major storm. The only possible drainage is, at the present time, the Salt River Valley Users' laterals, and it is likely they would be ineffective during a flood. In the past, no provisions have been made to carry flood water to the Agua Fria and the Salt Rivers.

9.22-B-2 Plan

a. Glendale-Peoria Drain

A lined channel, trapezoidal in section, with 2:1 side slopes from 35th Ave. and ¼ mile south of Olive Ave., running westerly for 3¾ miles, then southerly 1 mile, then westerly about 4½ miles to New River.

Much of this project is in a developing area where land acquisition costs are rising; thus total project costs will be proportionally higher. Total estimated cost: $2,978,000.

b. Maryvale-Glendale Drain

A lined channel, trapezoidal in section with 1:1 side slopes, running from Grand Canal ½ mile west of 67th Ave. southerly approximately 7½ miles to Salt River. Cost of land will continue to rise. Presently estimated total cost is $1,782,000.

c. West Phoenix-Maryvale Drain

Will run from a covered box culvert section at 47th Ave. from the Grand Canal southerly to Thomas Rd.; becoming an open-topped, lined channel, trapezoidal in section with 2:1 slopes at 47th Ave. and Thomas, then run southerly about 5.3 miles to Salt River. Present estimated cost: $2,542,000.

These 3 projects are the needed major flood channels, and it is proposed they will be done in two phases. The Maryvale-Glendale Drain and the Glendale-Peoria Drain are in Group I in Table 7.0-1. The West Phoenix-Maryvale Drain is in Group II.

Other channels and storm drains in Phoenix are needed, but plans are not now available. Study of problems in metropolitan Phoenix will be continued in cooperation with the city and other municipalities.

Table 9.22-1 shows cost summary; Map 9.22-A shows extent and location; and Table 9.22-A shows related structural data.

9.23 SKUNK CREEK AREA

The Skunk Creek area is located in central Maricopa County north of the city of Phoenix, and contains an area of 135 square miles.

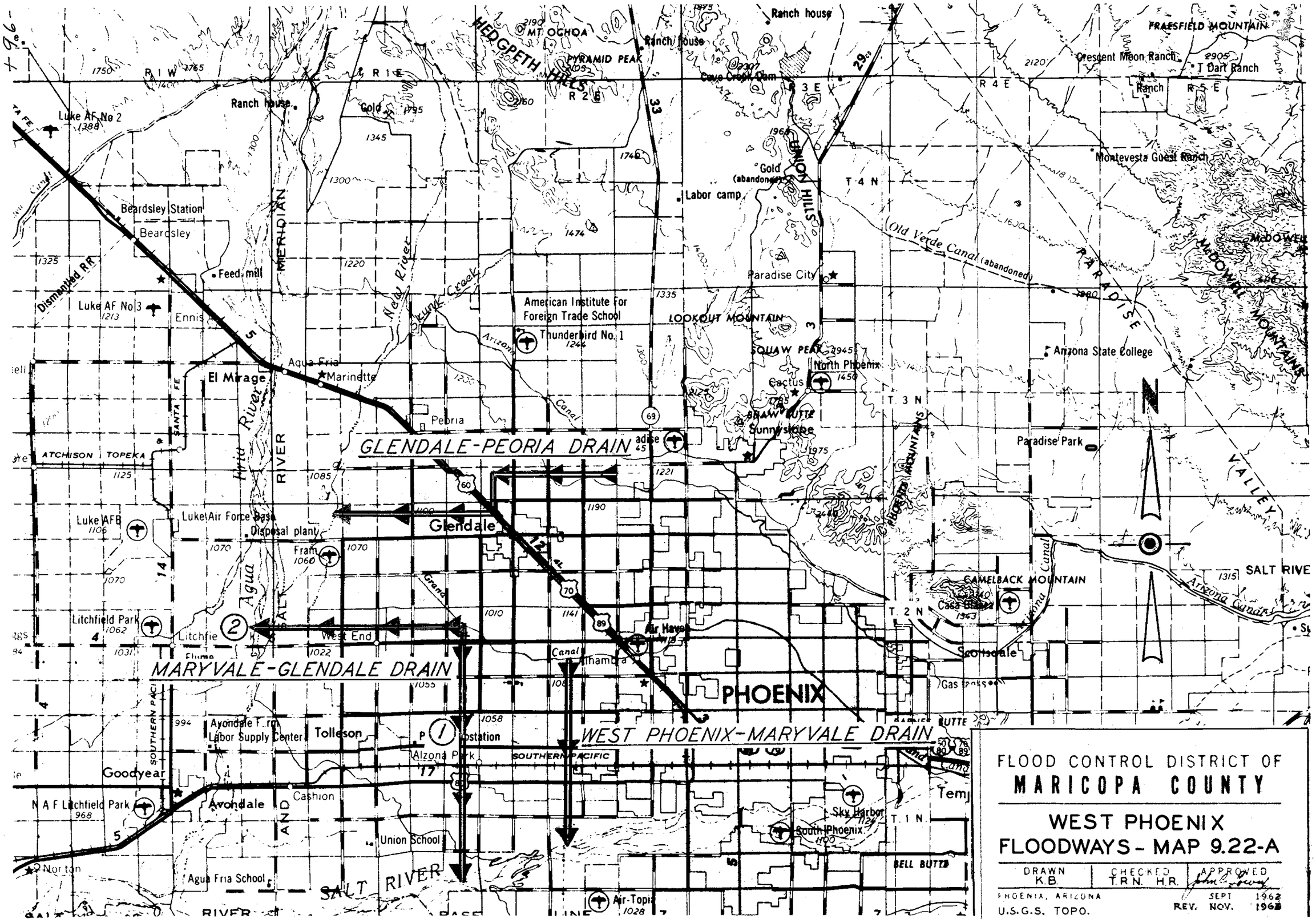
The headwaters of Skunk Creek rise on the southwestern slopes of New River Mesa and flow generally in a southwesterly direction toward New River, entering in Sec. 10, T3N, R1E.

TABLE 9.22-1 WEST PHOENIX FLOODWAYS SUMMARY

Job Description	Estimated Cost Flood Control Dist.		Corps of Engr.
Lined channels north of Glendale and west to New River near Campbell Avenue. From the Grand Canal at 71st Avenue south to the Salt River and near 47th Avenue from the Grand Canal south to the Salt River.	$1,083,000		$6,219,000
Total Project Cost		7,302,000	
Flood Damage Without Project			440,000
Flood Damage With Project			34,000
Benefits from Reduction of Flood Damage			406,000
Irrigation Benefits			-0-
Other Benefits			-0-
Total Annual Benefits			406,000
Total Project Cost Amortized @ 2-5/8%			260,000
Annual Operation and Maintenance			18,000
Total Annual Costs			278,000
Benefit-Cost Ratio	1.46 to 1.00		

TABLE 9.22-A STRUCTURAL DATA DEER VALLEY AREA West Phoenix Floodways

No.	Item	Units	Glendale-Peoria	Maryvale-Glendale	W. Phoenix-Maryvale
1	Discharge Capacity	cfs	4,100	3,180	3,600
2	Length	ft.	43,824	40,000	29,568
3	Avg. Bottom Width	ft.	13.0	10.0	9.0
4	Avg. Depth	ft.	9.0	10.0	8.0
5	Avg. Side Slope		2:1	1:1	2:1
6	Excavation	cu. yd.	368,000	333,102	266,000
7	Concrete	cu. yd.	45,810	35,000	32,000
	Cost Distribution				
8	Total Construction Cost		$2,552,000	$1,462,000	$2,205,000
9	Contract Administration		40,000	20,000	30,000
10	Right of Way		186,000	152,000	116,000
11	Relocations & Other Costs		200,000	148,000	191,000
12	Flood Control Dist. Costs		426,000	320,000	337,000
13	Total Project Cost		$2,978,000	1,782,000	2,542,000



FLOOD CONTROL DISTRICT OF
MARICOPA COUNTY

WEST PHOENIX FLOODWAYS - MAP 9.22-A

DRAWN	CHECKED	APPROVED
K.B.	T.R.N. H.R.	

PHOENIX, ARIZONA
U.S.G.S. TOPO.

SEPT 1962
REV. NOV. 1962

The topography can be divided into three distinct sections: the upper has steep mountains with brush cover; the middle is gently rolling, with low hills; and the lower is relatively flat with gentle slopes. The washes are well-defined at the upper reaches but tend to lose their identity as they flow into the flat alluvial valley.

There is very little development until Cave Creek enters the plain in upper Deer Valley. The area east of Black Canyon highway is well developed and is intensively farmed. Water is supplied by wells. Population concentrations exist at Adobe and in the rural areas west of New River.

Very little damage occurs in this area now. Potential damage, however, is high because of the rapid development. Cultivated areas along the Wash would be hardest hit by a major flood and considerable damage would result.

There are planned projects within the Deer Valley Group which affect this area. See: North Phoenix Mountains, Arizona Canal Diversion, Union Hills Diversion, Adobe and New River Dams, and West Phoenix Floodways.

9.24-A CAVE CREEK AREA

The Cave Creek Area, located in north central Maricopa County, contains 240 square miles. This area extends from Salt River to the New River Mesa in Eastern Yavapi County. It is long but not very wide.

Topography varies from high, brush-covered mountains to low desert. Direction of drainage is generally south to Cave Creek.

Other than the town of Cave Creek, there is little development in the upper Cave Creek area. Beginning at Cave Creek Dam the density of population increases, and beginning near Union Hills Drive, the whole area becomes urbanized. There are a number of subdivisions in the lower Cave Creek area and below the Arizona Canal, development is highly concentrated. Within this area, the potential damage is greater than in any other part of Maricopa County.

County roads are susceptible to washouts around Cave Creek. At times, the Creek leaves its banks and runs through the town, causing considerable damage.

As Cave Creek approaches the Arizona Canal, development increases, with a parallel increase in potential damage. In August 1943, a storm centered over the valley caused Cave Creek to overflow its banks, break the Arizona Canal and damage urban areas. A similar storm now could cause damage amounting to millions of dollars.

The recommended plan for flood control in Cave Creek area is construction of the North Phoenix Mountains Diversion, Arizona Canal Diversion, Union Hills Diversion, and Adobe and New River Dams. (See application section for descriptions of these projects.)

9.24-B OLD CAVE CREEK DAM

A major storm would fill the reservoir behind the dam and cause the present earth spillway to operate. When this happens, there is a strong possibility that the spillway will wash out and cause extensive damage below.

Studies have been made regarding a solution here, but no final decision has been reached.

9.24-B-1 Plan

Alternate No. 1: an earth dike 2,900 ft. long across the natural spillway and construction of a new spillway on the west side of the old dam. There is some doubt that a new spillway located here will stand up. Rock here is highly fractured and may fail.

Alternate No. 2: an earth-fill dam across the spillway as No. 1. However, instead of a new spillway on the west side, an apron will be poured below the old concrete dam and water will pass over the dam during a flood.

Total estimated cost will be approximately the same for either plan. Futher study will be made to determine a solution. Table 9.24-1 shows a summary of costs and Map 9.24-A shows planned location.

9.24-C CAVE CREEK TOWN DIKE

There are approximately 115 sq. mi. of drainage above the town of Cave Creek. The runoff-producing area is steep and water concentrates quickly in the washes. Flood waters run at a high velocity in the well-defined channel of Cave Creek. In the past, overflow from the Wash came over the south bank of Cave Creek and traveled in another wash through the developed portion of town.

Plan for flood control would be an 800-ft. dike, with revetment for the wash about ½ mile east of the center of the town of Cave Creek. See table 9.24-2 for cost summary.

9.24-D LOWER CAVE CREEK DAM

To help control flood waters from Cave Creek watershed, an additional structure is being studied on Cave Creek, in Sec. 9, T4N, R3E. This will become a part of the Deer Valley Group for protection of the North Phoenix Mountain Area.
(See Table 9.25-1).

This dam will materially affect the peak flow and the expected runoff from this area and will change the size and carrying capacity of the structure in Deer Valley Group (see Sec.9.25-B, of this report.)

The expected flow in the Union Hills Diversion can be reduced from 28,000 cfs to approximately 4,000 cfs. The size and cost of this structure can therefore be reduced.

This planned structure will eliminate the need for channelization and concrete-lining of outflow channels in Skunk Creek, New River and Agua Fria River. Protection will also be given the Central Arizona Project Canal (proposed) as it runs through this area.

Cost estimates indicate this structure will cost approximately $6,695,000 with $871,000 to be charged to the Flood Control District. It is expected that this total cost will be offset by savings in the Union Hills Diversion and channel clearing of Skunk Creek, New River and Agua Fria River; therefore a decrease in the total program cost can be expected.

This proposed Lower Cave Creek Dam is being studied by the Corps of Engineers. Topographic maps of this area have been made for this feasibility study. The advantages of the dam will be as follows:

1. Permit reduced and controlled flow of flood waters from the reservoir, eliminating flood damage.
2. Permit reduction in the size of the proposed Union Hills Diversion structure.
3. Eliminate the necessity for concrete lining of Skunk Creek, New River and Agua Fria.
4. Provide protection for the proposed Central Arizona Project Canal, the location of which, as presently planned, will be a short distance downstream from the dam.

From preliminary studies, it appears that the savings in reducing the size of Union Hills Drive Diversion structures and the elimination of concrete - lining the stream channels will be greater than the cost of the dam. See Map 9.24-B.

9.25-A SUNNYSLOPE AREA

The Sunnyslope area is located in central Maricopa County and includes a large section of Northeast Phoenix. Total area is 80 square miles.

The area is bounded on the south by Salt River and on the north by Phoenix Mountains. The topography consists of steep mountains and well-defined channels to the Arizona Canal, causing

rapid runoff with high velocities. These factors combined with lack of cover and urbanization of lower slopes create high peak flows.

The flood-producing area is the Phoenix Mountains. Many small washes cross the area, emptying into the Arizona Canal, causing breaks during high flows. This releases the water into highly developed urban areas below the Canal.

There has been serious encroachment on the natural channels in this area. Many subdivisions have been built without regard to floodways and channels. All of these would be seriously damaged by a major storm. Runoff comparable to that produced by the storm of August 1943 would cause millions of dollars in damage to developments here.

TABLE 9.24-1 OLD CAVE CREEK DAM SUMMARY

Job Description	Estimated Cost Flood Control Dist.	Corps of Engrs.
An earthfill dam across the original spillway, approximately 4,000 ft. long.	$65,000	$91,000
Also Location & construction of a new spillway on the west side of the Dam.		
Total Project Cost	$156,000	
Flood Damage without Project		$ 11,200
Flood Damage with Project		1,000
Benefits from Reduction of flood damage		10,200
Total Annual Benefits		10,200
Total Project Costs Amortized @ 2-5/8%		5,600
Annual Operation & Maintenance		2,600
Total Annual Cost		8,200
Benefit-Cost Ratio	1.24 to 1.00	

TABLE 9.24-2 CAVE CREEK TOWN DIKE SUMMARY

Job Description	Estimated Cost Flood Control Dist.	C. of E.
Approximately 800 ft. of dike, with revetment for the wash, about .5 mile east of the center of town	$3,000	$12,000
Total Project Cost	$15,000	
Flood Damage without Project		1,000
Flood Damage with Project		0
Benefits from Reduction of flood damage		1,000
Total Annual Benefits		1,000
Total Project Cost Amortized @ 2-5/8%		540
Annual Operation & Maintenance Cost		300
Total Annual Costs		840
Benefit-Cost Ratio	1.19 to 1.00	

TABLE 9.24-A **STRUCTURAL DATA**
LOWER CAVE CREEK DAM

No.	Item	Units	Quantity
1	Drainage Area	sq. mi.	245
2	Total Storage	ac. ft.	22,000
3	Total Surface Area	ac.	700
4	Spillway Crest Elevation	ft.	1,590
5	Top Dam Elevation	ft.	1,610
6	Length of Dam	ft.	10,220
7	Maximum Height	ft.	90
8	Total Volume of Fill	cu. yd.	4,092,000
9	Principal Spillway Size	in.	96
10	Maximum Release Rate	cfs	1,000
	Cost Distribution		
11	Total Construction Cost	Dollars	5,824,000
12	Contract Administration	Dollars	30,000
13	Right of Way	Dollars	120,000
14	Other Costs	Dollars	721,000
15	Flood Control District Cost	Dollars	871,000
16	Total Project Cost	Dollars	6,695,000

Present plan for flood control is to install the North Phoenix Mountains project described in section 9.25-B-2.

The plan is to enlarge the old Cross-Cut Canal and divert all water possible back to this channel; then construct a channel to take the remaining water west to Skunk Creek.

9.25-B DEER VALLEY GROUP

9.25-B-1 Group Definition and Extent

For the purpose of showing the complete picture and because control measures are so closely related, the following drainage areas have been combined to form a group called "Deer Valley Group." The main outlet for all works in this group is the Agua Fria River.

Sections 9.25-B through Section 9.25-B-6 show planned projects within this group.

Drainage Areas included in this group are:

19—Lower Agua Fria	—110 sq. mi.	23—Skunk Creek	—135 sq. mi.
20—Upper New River	—170 sq. mi.	24—Cave Creek	—240 sq. mi.
21—Lower New River	— 45 sq. mi	25—Sunnyslope	— 80 sq. mi.
22—Deer Valley	—140 sq. mi.		

A general description of these areas can be found in Sec. 9.19 through 9.25.

Principal streams included in this area are Agua Fria River, New River, Skunk Creek and Cave Creek; the Agua Fria being the main drainage into Salt River. Elevations in this group of individual areas vary from 800 to 5,300 feet above sea level and the topography changes from relatively flat irrigated land to steep mountains.

+102-1

200'SPILLWAY - MINIMUM CREST EL. 1639.0 (OR LOWER)

T-4-N

T-5-N

SEC. 4

SEC. 33

SEC. 28

SEC. 3

SEC. 34

SEC. 27

SEC. 2

SEC. 35

SPILLWAY EXCAV. TO BE PLACED IN ALONG DAM

EXIST. DAM CREST EL. 1642.5

APACHE CREEK

CAVE CREEK

DYKE TOP EL. 1652.0

EXPECTED MAX. WATER LEVEL 1649

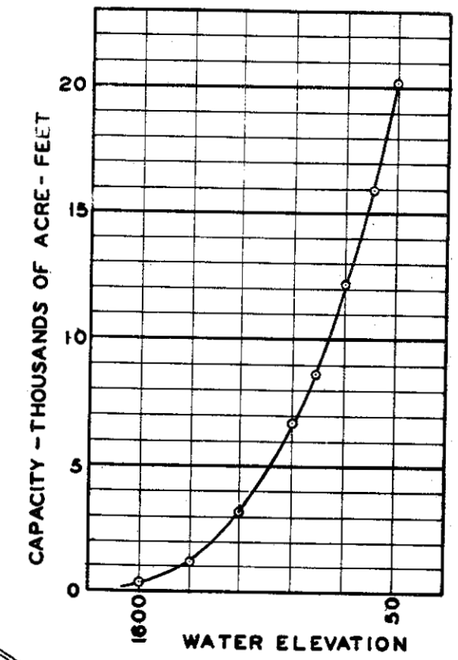
ACRES OF LAKE AT 1650 = 920

1637 1958 Survey

PRESENT NATURAL SPILLWAY

NORTH

Scale 1000 0 1000 2000



RESERVOIR CAPACITY

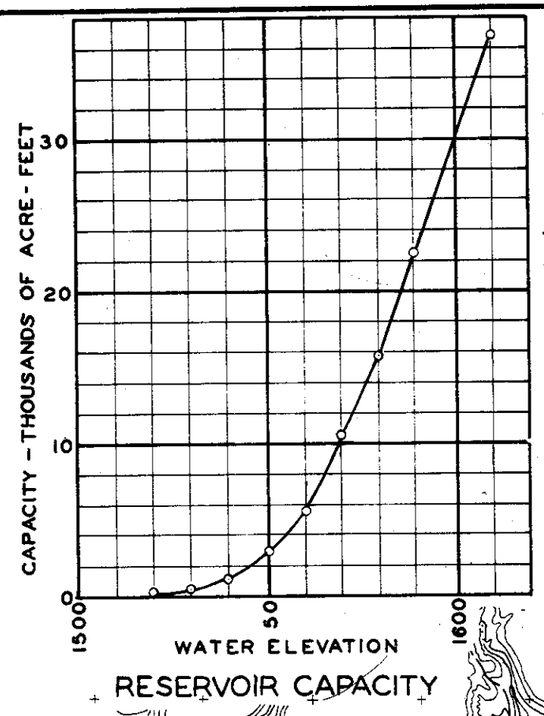
FLOOD CONTROL DISTRICT OF
MARICOPA COUNTY

OLD CAVE CREEK DAM
MAP NO. 9.24-A

F.C.D.M.C. - Y & G.	CHECKED T.R.N.-W.R.	APPROVED John C. Lowry

PHOENIX, ARIZONA SEPT. 1962

R-3-E



RESERVOIR CAPACITY

SEC 33 | SEC 34

EXIST. CAVE CREEK DAM - TOP 1642

SEC 4 | SEC 3

NORTH

1000 0 2000

T-4-N

+990,000

+985,000

+9

+3,000

+460,000

+455,000

SIDE DAM
TOP EL. 1610+

SIDE DAM
TOP EL. 1610+

500'+ SPILLWAY
CREST EL. 1595.0 (OR LOWER)

500' SPILLWAY
CREST EL. 1590.0

DAM
TOP EL. 1610+

CAVE CREEK RD.

SEC 8
SEC 17

YOST AND GARDNER ENGINEERS

FLOOD CONTROL DISTRICT OF
MARICOPA COUNTY

LOWER CAVE CREEK
DAM SITE - MAP NO. 9.24-B

DRAWN	CHECKED	APPROVED
	T.R.N. H.R.	

PHOENIX, ARIZONA

The Deer Valley Group is about 30 miles wide and 55 miles long north to south. The major flood-producing areas are the Northern Mountains.

There is a definite relation between the flood problems within this group. Ordinarily, water from an area should be taken to the major outlet in its natural channel. Due to the high cost of going through the urban areas of Phoenix and the surrounding towns, this cannot be done for the Deer Valley, Cave Creek, and Sunnyslope watersheds. Of necessity, this water must be taken to the west, and into the Agua Fria drainage. Therefore, projects planned in this area will extend from one major drainage to another.

Channel clearance along the Agua Fria, New River and Skunk Creek will consist of clearing brush, rock piles, sand bars and whatever else is necessary to make their capacity adequate to receive flood waters introduced from the Cave Creek and North Phoenix areas.

For the purpose of this report, the projects will be reported in the following order: North Phoenix Mountains, Arizona Canal Diversion, Union Hills Diversion, New River Dam and Adobe Dam. See 9.24-D for Lower Cave Creek Dam.

Map No. 9.25-A shows the whole group and the inter - relation between the planned projects.

9.25-B-2 NORTH PHOENIX MOUNTAINS DIVERSION

a. General

Solution to the North Phoenix Mountains drainage problem is difficult. A combination of a channel along the Arizona Canal plus full utilization of the Canal itself seems to be the only generally workable solution.

The difficulties of new construction through portions of the North Mountains and the consequent need to utilize Salt River project facilities, leads to the selection of the minimum design occurrence of this report. General ability of the Arizona Canal to handle water from the Arcadia District, possibility of reverse flow from 39th St. back to the Old Cross-Cut Canal, and the Canals capabilities again between 39th St. and 20th St., pointed toward an approximate 20-year flood flow design.

There are still a few (rapidly disappearing) storage sites that could be developed. If the present plan is not approved, then improvements to the Arizona Canal, utilization of the Old Cross-Cut and construction of all storages feasible becomes essential.

Without the cooperation of the Salt River Project parts of this project become prohibitive—for example, to carry about 2,000 cfs from 40th St. and the Arizona Canal (Cudia City to the Salt River) would cost approximately $5,000,000.

b. Plan

A lined channel from 20th St. to a point where Cave Creek meets the Arizona Canal, and lying immediately north of and parallel to the Arizona Canal. Deepening to produce a reverse flow of the Arizona Canal from the Echo Canyon inlet east to the Old Cross-Cut Canal at 48th St. Installation of control gates at the Echo Canyon inlet and at the old Cross-Cut Canal with adequate crossing structures at major arterials and installation of gates at the old Cross-Cut Canal crossing of the Grand Canal. The Salt River Project plans to use the Arizona Canal from east of the Cross-Cut Canal and Between 38th St. and 20th St. to handle the 20-year floods or about its present capacity. Item added for overtime and special work in Canal from Echo Canyon inlet to old Cross-Cut Canal and setting gates.

This will be done in two phases as shown in Table 7.0-1. The channel from 20th St. west and including Dreamy Draw Dam is Phase I. The remaining work will be done at a later date under Phase II.

For structural data, see map, where typical sections are given showing bottom width, side slope, capacity and other pertinent data. (See also Table 9.25-1 and Map 9.25-B)

9.25-B-3 ARIZONA CANAL DIVERSION

a. General

This project is recommended to be installed in conjunction with Union Hills Diversion and the North Phoenix Mountains channel to carry flood water to Skunk Creek.

Construction in this area is becoming increasingly difficult due to urbanization; therefore, a minimum recurrence interval has been selected for design of the project. The degree of protection will vary depending on wheather the Union Hills Diversion and the North Phoenix Mountains projects are concurrently installed.

b. Plan

A lined channel from Cave Creek to Skunk Creek lying north of and parallel to the Arizona Canal with an inlet control structure at the Cave Creek entrance about .5 miles west of 19th Ave.

Design calls for channel capacity of 10,000 cfs at Cave Creek and 12,000 cfs at Skunk Creek. Table 9.25-1 shows cost summary and Map 9.25-A shows planned location. See Table 9.25-A for structural data.

9.25-B-4 DREAMY DRAW DAM AND CHANNEL

a. General

The Dreamy Draw drainage area is located in Secs. 26, 27, 34, and 35, T3N, R3E, G&SRB&M. The wash or draw runs along and southeast of Shea Blvd. from 28th St. to 16th St. in northern areas of the city of Phoenix, and ends at the Arizona Canal west of 12th Street.

This project is recommended to be installed in conjunction with the North Phoenix Mountains channel and the Arizona Canal Diversion to carry flood waters to Skunk Creek.

Flow in the wash has caused material damage and the area has therefore been studied previously by the Flood Control District, the Salt River Valley Water Users' Association, the Soil Conservation Service and others.

The acreage contributing flow is:

1125 acres at the Arizona Canal
1090 acres at 16th St.
830 acres at possible damsite (FCD or SRVWUA)

Terrain is rocky, steep hills to alluvial outwash, with channel slopes of five feet to over 30 feet per thousand. Storage possibilites are excellent at the damsite, for any size storm, and so much area at possible spillway heights that maximum possible spills would be regulated to greatly reduced values. Most of the land involved is government-owned.

b. Plan

Dam will be an earth-fill and contain approximately 50,000 cu. yds. Reservoir storage at the spillway crest is 250 ac. ft. and total surface area is around 30 acres. Dam will have rock face, upstream 3:1 slope, downstream 2½:1 slope, with a 12 ft. top width. Local material will be used. Table 9.25-1 shows cost summary and Map 9.25-E shows planned extent and location. Table 9.25-E shows structural data.

9.25-B-5 UNION HILLS DIVERSION

a. General

This project is to be installed as part of the overall plan for flood control in the Cave Creek watershed. Other projects that are directly related to this one are North Phoenix Mountains, the Arizona Canal Diversion, Adobe Dam, Lower Cave Creek Dam and New River Dam.

One of the best jobs for controlling Cave Creek flood water has already been done in the form of the existing Cave Creek Dam. Limited capacity of the dam and residual flows originating below the Dam make further works necessary. Estimated flow below the Lower Cave Creek dam to be diverted by this structure is 4,000 cfs. This is the total flow generated above the structure and none will be by-passed.

b. Plan

A lined channel beginning approximately at 36th St. between Bell Rd. and Union Hills Drive running west to 12th St. then angles northwest to 7th Ave. and ¼ mile above Union Hills Drive then west to Skunk Creek.

The channel will have a 10-ft. bottom at the upper end with 1:1 slopes and will be 6 ft. deep. At its outlet it will have the same general shape but will be 10 ft. deep. Inlet structures will be located where needed.

Table 9.25-1 shows cost summary; Map 9.25-A shows extent and location; and Table 9.25-B shows structural data.

9.25-B-6 NEW RIVER DAM

a. General

New River Dam is planned to be built in conjunction with the Cave Creek structures and Adobe Dam. Storage in the upper reaches of New River and Skunk Creek becomes more needed depending on the amount of water diverted from Cave Creek.

If only 12,000 cfs is diverted by the Arizona Canal Diversion, the storage above is not so critical. If more water is diverted, then the channel capacity of Lower Skunk Creek and New River becomes critical and it becomes necessary to build the New River and Adobe Dams.

b. Plan

The Dam is located in Sec. 26, T5N, R1E, approximately 8 mi. northwest of Adobe. The structure will be an earth-fill and contain 1,300,000 cu. yds. of fill. The upstream face will be rip-rapped and a 72" outlet will be placed through the fill.

Reservoir storage at the spillway crest is 33,500 acre feet; total surface area is 1,550 acres. Table 9.25-1 shows cost summary; Table 9.25-C shows structural data; and Map 9.25-C shows planned extent and location.

9.25-B-7 ADOBE DAM

a. General

This structure is planned to be constructed along with the Cave Creek and New River projects. Storage above the junction of Union Hills Diversion and the Arizona Canal Diversion becomes important if large amounts of water are diverted into Skunk Creek.

This is an off-channel dam and storage area. A diversion and channel will be required to take the water to the reservoir. Land for dam and storage area is government-owned.

b. Plan

The Dam is located in T5N, R2E, and angles across the line between sections 27 and 34. Construction will consist of approximately 1,600,000 cu. yds. of earth fill. The upstream will be rock rip-rapped and a 72" free flow outlet will be placed in the fill.

Reservoir storage at the spillway crest is 13,000 ac. ft. and total surface area is 800 acres. Table 9.25-1 shows cost summary; Table 9.25-D shows structural data; and Map 9.25-D shows planned extent and location.

c. Diversion

Will consist of a channel and related dikes of adequate size to divert Skunk Creek across the Black Canyon into the Adobe Reservoir, at a point approximately 5 miles north of the town of Adobe. Construction cost is included in the Adobe Dam.

9.26-A SOUTH MOUNTAIN AREA

South Mountain Area, located just south of the Salt River across from Phoenix, contains an area of 240 sq. miles, bordered on the north by the Salt River and on the southwest by the Gila River. General drainage is in a semi-circular direction due to the fact that the center is occupied by the Salt River Mountains and water drains away in all directions.

9.26-B GUADALUPE WATERSHED

9.26-B-1 General

This watershed comprises the south and eastern slopes of the South Mountains. The flood-producing area consists mainly of steep mountains between contours 1150 and 2310. Many washes emerge from the eastern end of the South Mountains and enter the broad, level plain. Rainfall concentrates quickly in the washes and flows southeasterly to the Gila River.

9.26-B-2 Developments and Damages

The affected semi-circular flood area consists of irrigated land for about one half the area, with water supplied by southward flowing canals of the Salt River Valley Water Users. Industrial development is extensive along the east line of the drainage area.

There are some damages reported every year. Flood water runs across the developed land in many places, damaging canals, homes, business houses and the railroad and highway.

9.26-B-3 Plan

Overall plan for flood control in this area includes a system of detention levees and floodways. There will be three levees and four floodways to convey water from the base of the mountains to the River. Each detention reservoir will have a controlled outlet that will allow the channels to drain the basin in a reasonable time. A summary of costs is in Table 9.26-1; Map 9.26-A shows location, and Table 9.26-A shows related structural data.

TABLE 9.25-1 DEER VALLEY GROUP SUMMARY

No.	Job Description	Estimated Cost Flood Control Dist.	Other
1	N. Phx. Mtn. Channel	1,400,000	1,926,000
2	Arizona Canal Diversion	944,000	7,060,000
3	Union Hills Diversion	500,000	1,500,000
4	Lower Cave Creek Dam	871,000	5,824,000
5	New River Dam	2,770,000	2,002,000
6	Channel Clearing—Agua Fria, New River & Skunk Creek	250,000	1,000,000
7	Adobe Dam	832,000	2,301,000
8	Dreamy Draw Dam	150,000	300,000
	Total	7,717,000	21,913,000
	Total Project Cost	29,630,000	
Flood Damage without Project			2,648,000
Flood Damage with Project			416,000
Benefits from Reduction of Flood Damage			2,232,000
Irrigation Benefits			-0-
Other Benefits			-0-
Total Annual Benefits			2,232,000
Total Project Cost Amortized @ 2-5/8% -			1,210,000
Annual Operation and Maintenance			86,000
Total Annual Costs			1,296,000
Benefit-Cost Ratio		1.72 to 1.00	

TABLE 9.25-E **STRUCTURAL DATA**
DEER VALLEY GROUP
Dreamy Draw Dam

No.	Item	Units	Quantity
1	Drainage Area	sq. mi.	1.3
2	Total Storage	ac. ft.	250
3	Total Surface Area	acres	30
4	Spillway Crest Elevation	ft.	1401
5	Top Dam Elevation	ft.	1410
6	Length of Dam	ft.	800
7	Maximum Height	ft.	42
8	Total Volume of Fill	cu. yds.	50,000
9	Principal Spillway Size	in.	24
10	Maximum Release Rate	cfs	40
	Cost Distribution		
11	Total Construction Cost		$300,000
12	Contract Administration		5,000
13	Right of Way		100,000
14	Other Costs		45,000
15	Flood Control District Cost		150,000
16	Total Project Cost		450,000

9.26-C SOUTH MOUNTAIN WATERSHED

9.26-C-1 General

The South Mountain area has few storage sites other than the one west of Guadalupe in the city of Phoenix park and the one near 43rd Ave. Storage near South Central Avenue and 7th St. would do the next most effective job.

If a reasonable degree of protection of the South Mountain flood plain is to be achieved, a channel paralleling the foothills is required. Flood storage reservoirs require fairly rapid draining and the Highline Canal capacity is limited. If channels are built directly north from the mountains to the Salt River, there is still a need for transverse collection facilities covering principal washes between these south-north channels.

The North Phoenix Mountains afford an illustration. If work had been started on a channel paraleling the Arizona Canal when development was limited, a channel could have been provided many times less costly in right of way or construction.

9.26-C-2 Alternates

Alternate alignments and location possibilities are almost unlimited. There will be varying degrees of protection for different locations. The plan included in this report is the one proposed by the consultant. Lack of time and other factors do not allow a complete evaluation of this proposal but there are some changes that will be considered before this project is installed. Relocation of the channel beginning at approximately 24th St. to run closer to the Mountains as it goes west is one of the changes that will be studied. This will involve reversing the flow of water and bringing it back east and into the river at 32nd St. However, for the present, the plan is presented as is.

9.26-C-3 Plan

Essentially an unlined channel, trapezoidal in section, which parallels the Highline Canal on the south side; from 48th St. to 7th Ave., then westerly to the east side of the western Canal at Dobbins Road, then along the south side of Lateral 13 to 59th Ave., then northwesterly along the east boundary of the Gila River Indian Reservation to the Salt River, plus dams and detention basins in the Guadalupe Area and the vicinity of 43rd Ave. and 1.4 miles south of Dobbins Rd. There is also a collector channel from about 8th St., .5 mile south of Dobbins Rd., westerly and northwesterly converging with the aforementioned channel at 19th Ave. and Dobbins Rd. Cost summary is in Table 9.26-2 and Map 9.26-B shows location and other data.

9.27-A LOWER INDIAN BEND AREA

The Lower Indian Bend Area lies below the Arizona Canal, is located in central Maricopa County, and has an area of 65 square miles. The cities of Scottsdale, Tempe and Phoenix have urban areas here. Most of the flood water affecting this section is produced in the Pinnacle Peak-Paradise Valley-Phoenix Mountains areas. The upper boundary is the Arizona Canal and the lower boundary is the Salt River.

A major storm would cause extensive flood damage as there is serious encroachment in the present channel and floodway. A number of homes in the channel itself would be washed away.

9.27-B LOWER INDIAN BEND CHANNEL

9.27-B-1 General

The proposed improvement of Indian Bend, by providing a lined channel from the Arizona Canal to the Salt River, is recommended. Gone are the days when the natural or inexpensive waterway through this reach can be held open. Due to land acquisition costs, etc., the most practical solution is the one proposed here.

Diversion of Indian Bend easterly through Salt River Indian lands to the Salt River near the Evergreen Wasteway was an alternative studied by the US Corps of Engineers and the Flood Control District. This alternative has been abandoned and we believe the project for Lower Indian Bend as now proposed is the best since it provides a channel in the natural low spot.

TABLE 9.26-1 GUADALUPE WATERSHED SUMMARY

No.	Job Description	Estimated Cost Flood Control Dist.	SCS
1	Park Retarding Basin	$324,000	$156,000
2	Ray Road Retarding Basin	61,000	70,000
3	Proving Grounds Retarding Basin	61,000	100,000
4	Park Floodway	5,000	29,000
5	Ray Road Floodway	5,000	78,000
6	Proving Grounds Floodway	3,000	21,000
7	Reservation Floodway	60,000	206,000
	Total	519,000	660,000
	Total Project Cost	$1,179,000	
Flood Damage Without Project			45,450
Flood Damage With Project			-0-
Benefits from Reduction of Flood Damage			45,450
Irrigation Benefits			-0-
Total Project Cost Amortized @ 2⅝%			42,600
Annual Operation and Maintenance			18,000
Total Annual Cost			60,600
Benefit-Cost Ratio	0.75 to 1.00		

TABLE 9.25-A **STRUCTURAL DATA**

DEER VALLEY GROUP

Arizona Canal Diversion

No.	Item	Units	Quantity
1	Discharge Capacity	cfs	12,000
2	Length	ft.	53,850
3	Avg. Bottom Width	ft.	20
4	Avg. Depth	ft.	17.8
5	Avg. Side Slope		2:1
6	Excavation	cu. yd.	1,875,000
7	Concrete	cu. yd.	115,000
	Cost Distribution		
8	Total Construction Cost		$7,060,000
9	Contract Administration		30,000
10	Right of Way		472,000
11	Relocations & other costs		442,000
12	Flood Control District Cost		944,000
13	Total Project Cost		8,004,000

TABLE 9.25-B **STRUCTURAL DATA**

DEER VALLEY GROUP

Union Hills Diversion

No.	Item	Units	Quantity
1	Discharge Capacity	cfs	3,000
2	Length	ft.	40,000
3	Avg. Bottom Width	ft.	10
4	Avg. Depth	ft.	8.0
5	Avg. Side Slope		1:1
6	Excavation	cu. yd.	210,000
7	Concrete	cu. yd.	34,000
	Cost Distribution		
8	Total Construction Cost	Dollars	1,500,000
9	Contract Administration	Dollars	6,000
10	Right of Way	Dollars	180,000
11	Relocations & Other Costs	Dollars	314,000
12	Flood Control District Cost	Dollars	500,000
13	Total Project Cost	Dollars	2,000,000

TABLE 9.25-C

STRUCTURAL DATA
DEER VALLEY GROUP
New River Dam

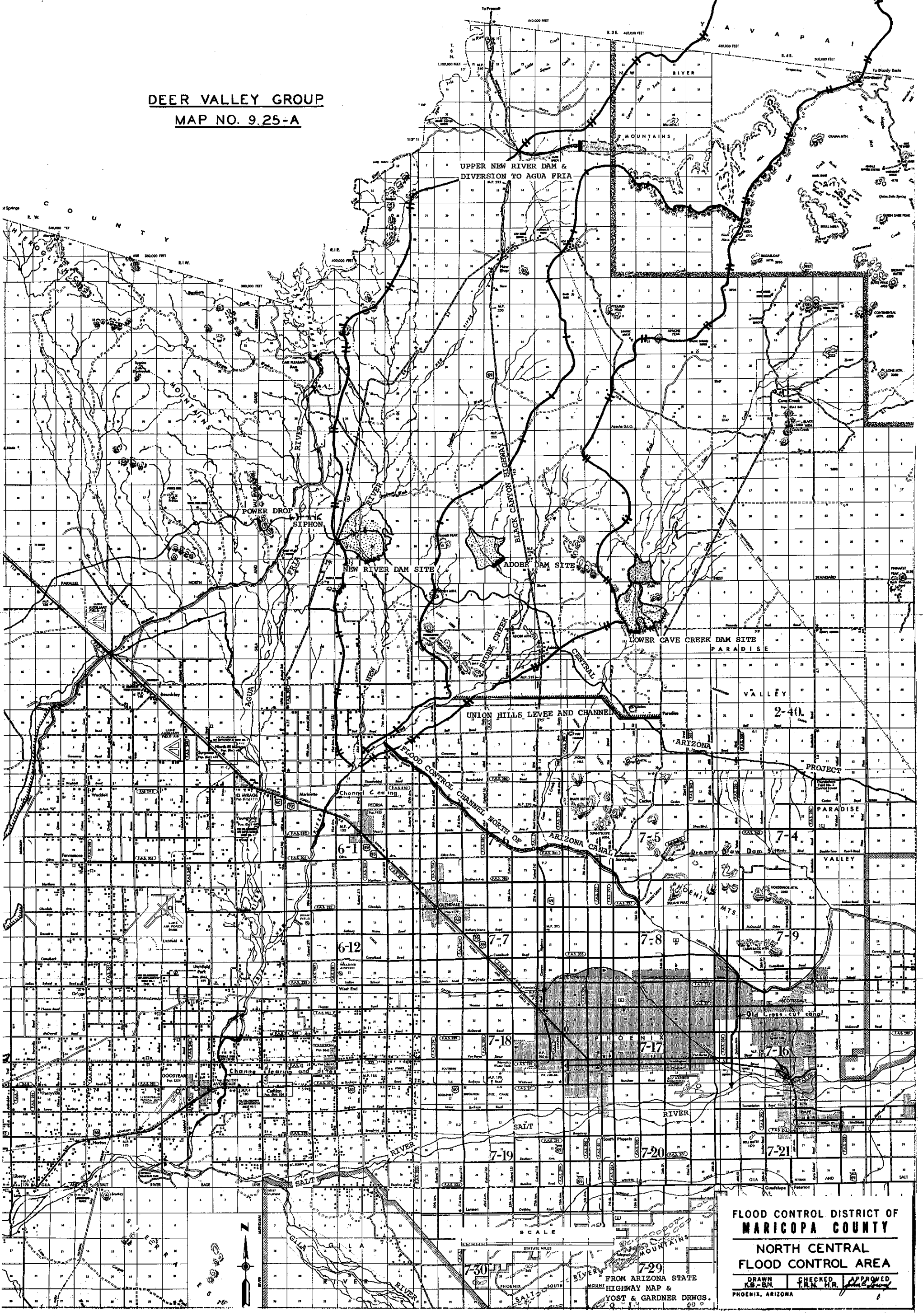
No.	Item	Units	Quantity
1	Drainage Area	sq. mi.	175
2	Total Storage	ac. ft.	33,500
3	Total Surface Area	ac.	1,550
4	Spillway Crest Elevation	ft.	1,454
5	Top Dam Elevation	ft.	1,471
6	Length of Dam	ft.	3,000
7	Maximum Height	ft.	71
8	Total Volume of fill	cu. yd.	1,333,000
9	Principal Spillway Size	in.	72
10	Maximum Release Rate	cfs	1,000
	Cost Distribution		
11	Total Construction Cost	Dollars	2,002,000
12	Contract Administration	Dollars	20,000
13	Right of Way	Dollars	2,663,000
14	Other Costs	Dollars	87,000
15	Flood Control District Cost	Dollars	2,770,000
16	Total Project Cost	Dollars	4,772,000

TABLE 9.25-D

STRUCTURAL DATA
DEER VALLEY GROUP
Adobe Dam

No.	Item	Units	Quantity
1	Drainage Area	sq. mi.	59.3
2	Total Storage	ac. ft.	13,000
3	Total Surface Area	acres	800
4	Spillway Crest Elevation	ft.	1,538
5	Top Dam Elevation	ft.	1,560
6	Length of Dam	ft.	3,800
7	Maximum Height	ft.	60
8	Total Volume of Fill	cu. yd.	1,640,000
9	Principal Spillway Size	in.	72
10	Maximum Release Rate	cfs	1,000
	Cost Distribution		
11	Total Construction Cost		$2,301,000
12	Contract Administration		30,000
13	Right of Way		66,000
14	Other Costs		736,000
15	Flood Control District Cost		832,000
16	Total Project Cost		$3,133,000

DEER VALLEY GROUP
MAP NO. 9.25-A



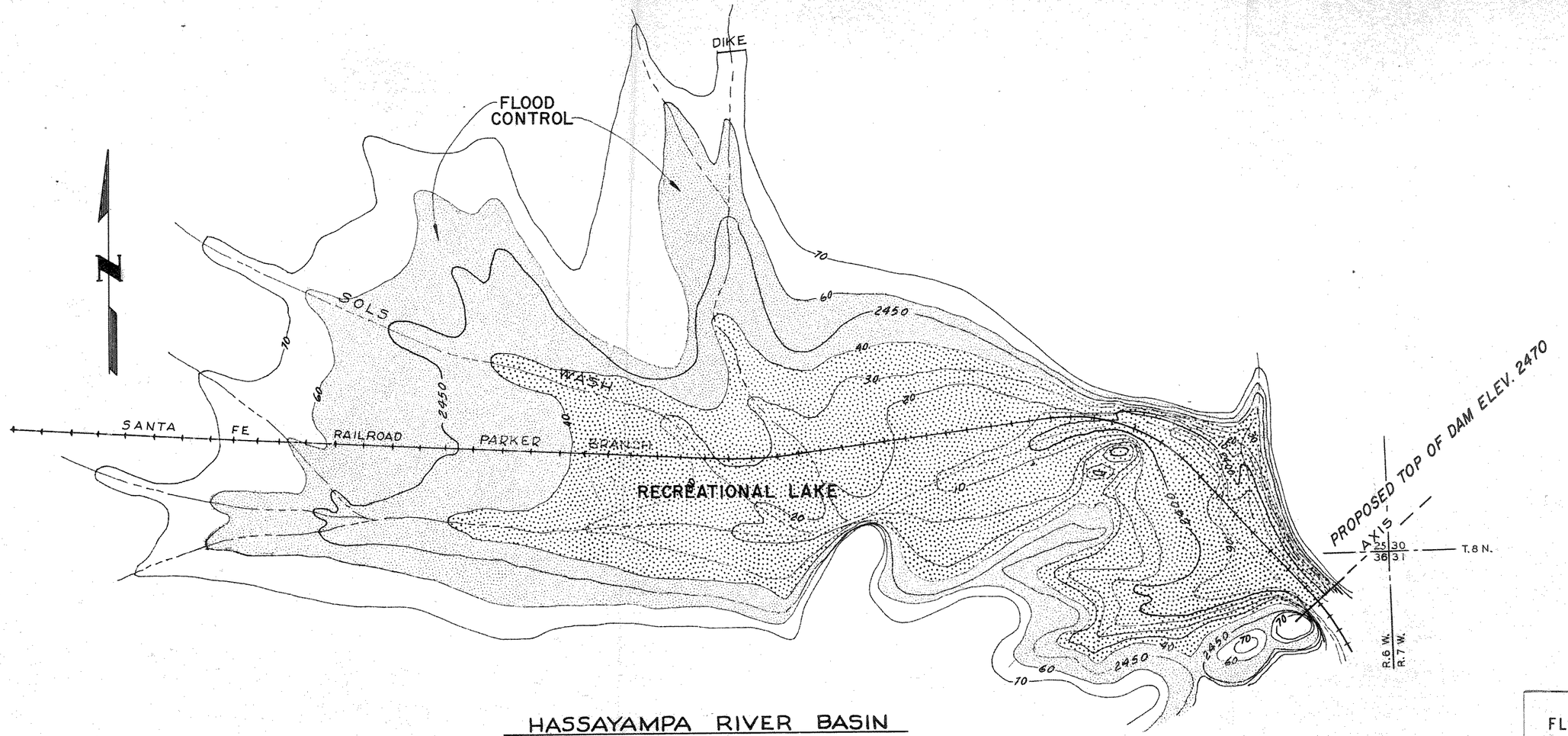
FLOOD CONTROL DISTRICT OF
MARICOPA COUNTY

NORTH CENTRAL
FLOOD CONTROL AREA

DRAWN	CHECKED	APPROVED
K.B.-B.N.	T.R.N. H.R.	

PHOENIX, ARIZONA

7.1-2



HASSAYAMPA RIVER BASIN
MATTHIE DAM SITE

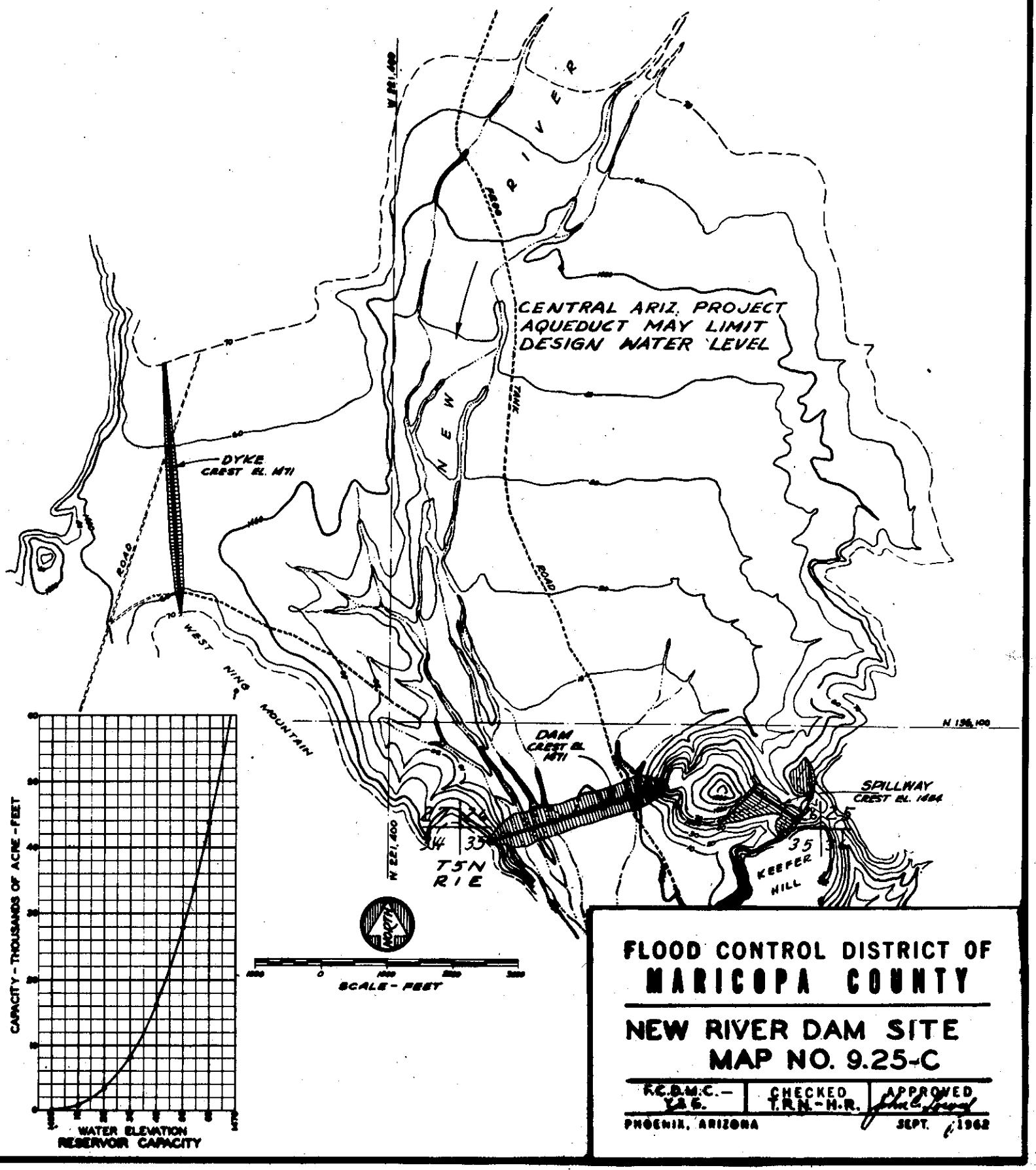
SCALE: 1" = 1000'
CONTOUR INTERVAL: 10'

FLOOD CONTROL DISTRICT OF
MARICOPA COUNTY

MATTHIE DAM SITE
MAP NO. 9.7-B

DRAWN	CHECKED	APPROVED
J.&G.	T.R.N.	John C. Lacey

PHOENIX, ARIZONA — SEPT. 1962

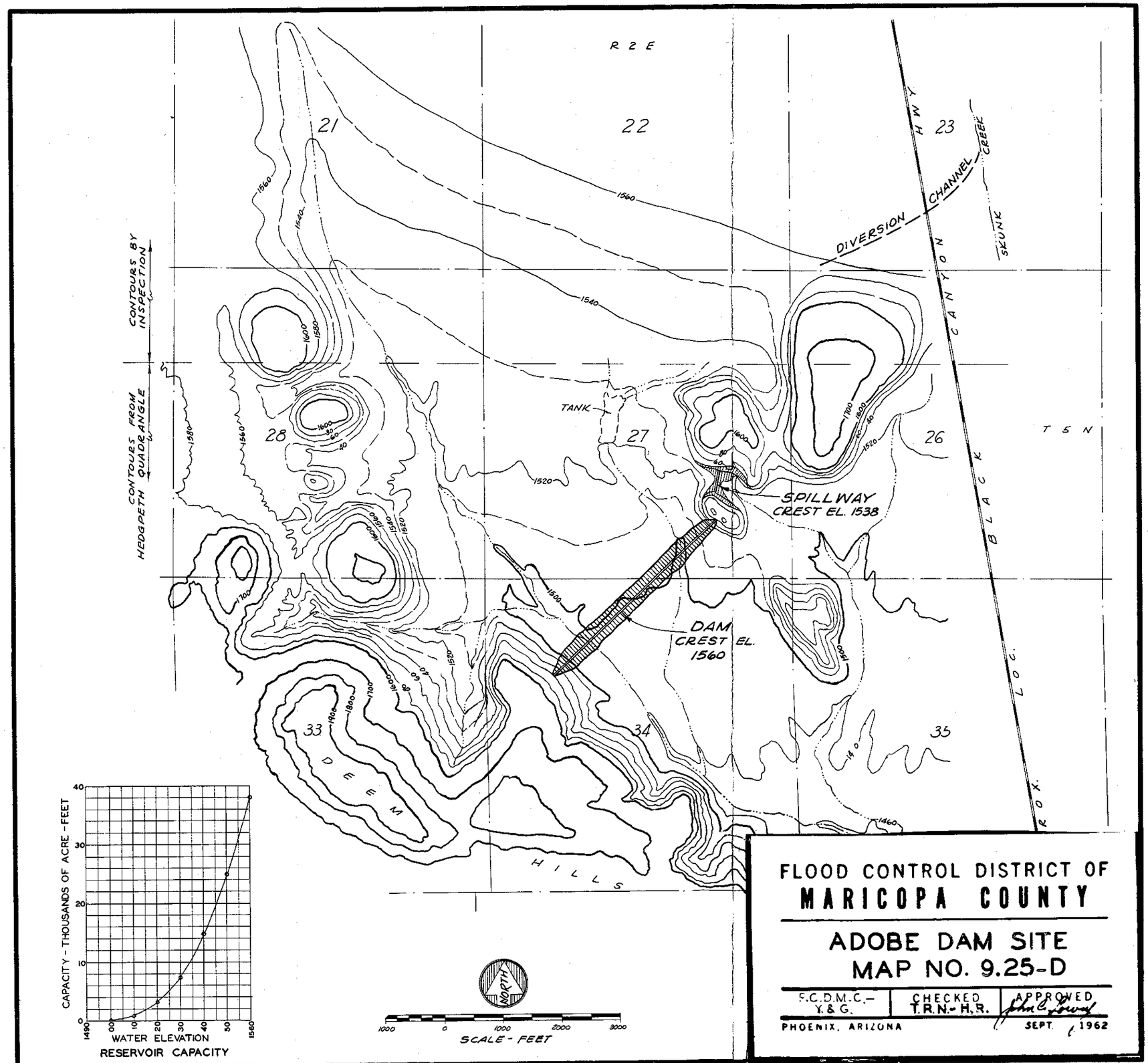


FLOOD CONTROL DISTRICT OF MARICOPA COUNTY

NEW RIVER DAM SITE
MAP NO. 9.25-C

R.C.D.M.C. — V.E.	CHECKED T.R.N. - H.R.	APPROVED

PHOENIX, ARIZONA SEPT. 6 1962

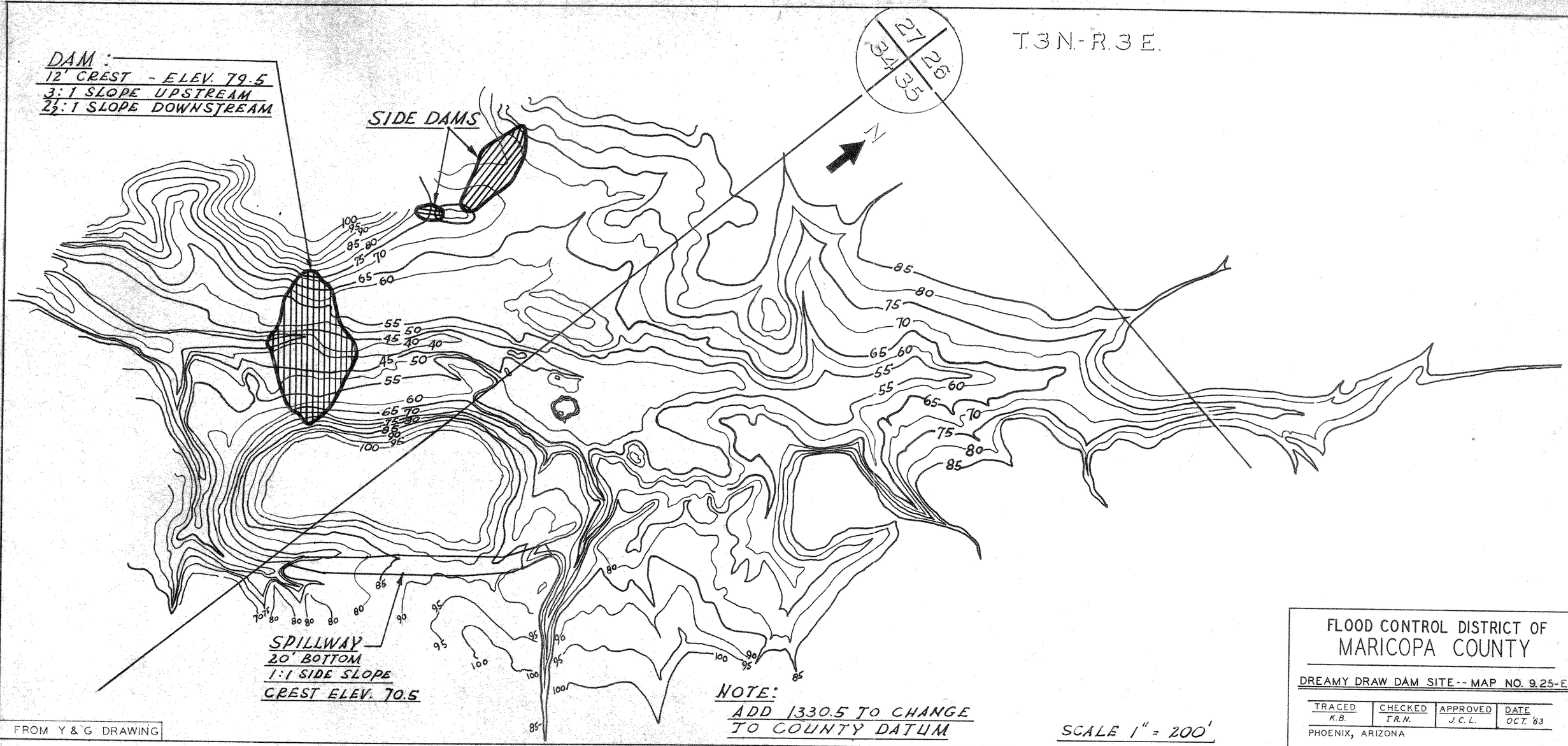


FLOOD CONTROL DISTRICT OF MARICOPA COUNTY

ADOBE DAM SITE
MAP NO. 9.25-D

F.C.D.M.C. – Y. & G.	CHECKED T.R.N. - H.R.	APPROVED John C. Lacy

PHOENIX, ARIZONA SEPT. 1962



FROM Y & G DRAWING

FLOOD CONTROL DISTRICT OF
MARICOPA COUNTY

DREAMY DRAW DAM SITE -- MAP NO. 9.25-E

TRACED	CHECKED	APPROVED	DATE
K.B.	T.R.N.	J.C.L.	OCT. '63

PHOENIX, ARIZONA

TABLE 9.26-2 SOUTH MOUNTAIN WATERSHED SUMMARY

Job Description	Estimated Cost Flood Control Dist.	Corps of Engr.
Earth Channel beginning at 48th Street running west to 59th Avenue, then northwest along Indian Reservation Boundary to Salt River. Plus Detention Dams and Retarding Basins as shown		
Total	$2,652,000	$6,251,000
Total Project Cost	$8,903,000	
Flood Damage without Project		283,000
Flood Damage with Project		30,000
Benefits from Reduction of Flood Damage		253,000
Irrigation Benefits		-0-
Other Benefits		-0-
Total Annual Benefits		253,000
Total Project Cost Amortized @ 2⅝%		322,000
Annual Operation and Maintenance		29,000
Total Annual Costs		351,000
Benefit-Cost Ratio	0.72 to 1.00	

TABLE 9.26-A STRUCTURAL DATA GUADALUPE WATERSHED

Detention Structures

No.	Item	Units	Park	Ray Road	Proving Gr.
1	Drainage Area	sq. mi.	2.5	4	3.1
2	Sediment Capacity	ac. ft.	50	50	30
3	Flood Water Capacity	ac. ft.	250	450	340
4	Total Storage Capacity	ac. ft.	300	500	370
5	Total Surface Area	acres	200	25	60
6	Length	mi.	2	.2	.5
7	Max. Height	ft.	13	15	15
8	Total Volume of fill	cu. yd.	140,000	20,000	50,000
9	Principal Spillway size	in.	36	48	36
10	Max. Release Rate	cfs	100	200	100
	Cost Distribution				
11	Total Construction Cost		$156,000	$ 70,000	$100,000
12	Contract Administration		4,000	1,000	1,000
13	Right of Way		320,000	60,000	60,000
14	Flood Control District Cost		324,000	61,000	61,000
15	Total Project Cost		$480,000	131,000	161,000

TABLE 9.26-B **STRUCTURAL DATA**
GUADALUPE WATERSHED
Floodways

No.	Item	Units	Park	Ray Rd.	Proving Gr.	Reservation
1	Discharge Capacity	cfs	100	200	100	300
2	Length	ft.	5,280	5,280	2,640	13,200
3	Av. Bottom Width	ft.	3	3	3	6
4	Av. Depth	ft.	2	3.4	2	3.4
5	Av. Side Slope		1:1	1:1	1:1	1:1
6	Excavation	cu. yd.	2,000	2,640	1,300	16,000
7	Concrete	cu. yd.	330	880	160	2,500
		Cost Distribution				
8	Total Construction Cost		$29,000	$78,000	$21,000	$206,000
9	Contract Administration		1,000	1,000	1,000	20,000
10	Right of Way		4,000	4,000	2,000	40,000
11	Flood Control District Cost		5,000	5,000	3,000	60,000
12	Total Project Cost		34,000	83,000	24,000	266,000

9.27-B-2 Plan

A lined channel, trapezoidal in section, from the Arizona Canal at Indian Bend, running southerly to and meeting the Salt River about one-half mile east of Scottsdale Road. Bottom width is 14 ft., sides slopes 2¼:1, and depth varies from 23 to 26 ft., with a crossing structure over the Arizona Canal and an energy-dissipator at Salt River. Table 9.27-1 shows cost summary and Maps 9.27-A and 9.27-B show location and other data.

9.28-A UPPER INDIAN BEND AREA

The Upper Indian Bend Area lies above Arizona Canal, northeast of the city of Phoenix, and has an area of 187 sq. mi. The runoff comes from Phoenix Mountains, Paradise Valley and Pinnacle Peak. Drainage is to the southwest, turning southward at the old Verde Canal.

Ground cover is sparse in the lower reaches and ratio of runoff to rainfall is high. Soils in the hills are shallow and relatively impervious. Water concentrates quickly in the washes and runs at high velocity to the relatively flat flood plain below.

9.28-B UPPER INDIAN BEND CHANNEL

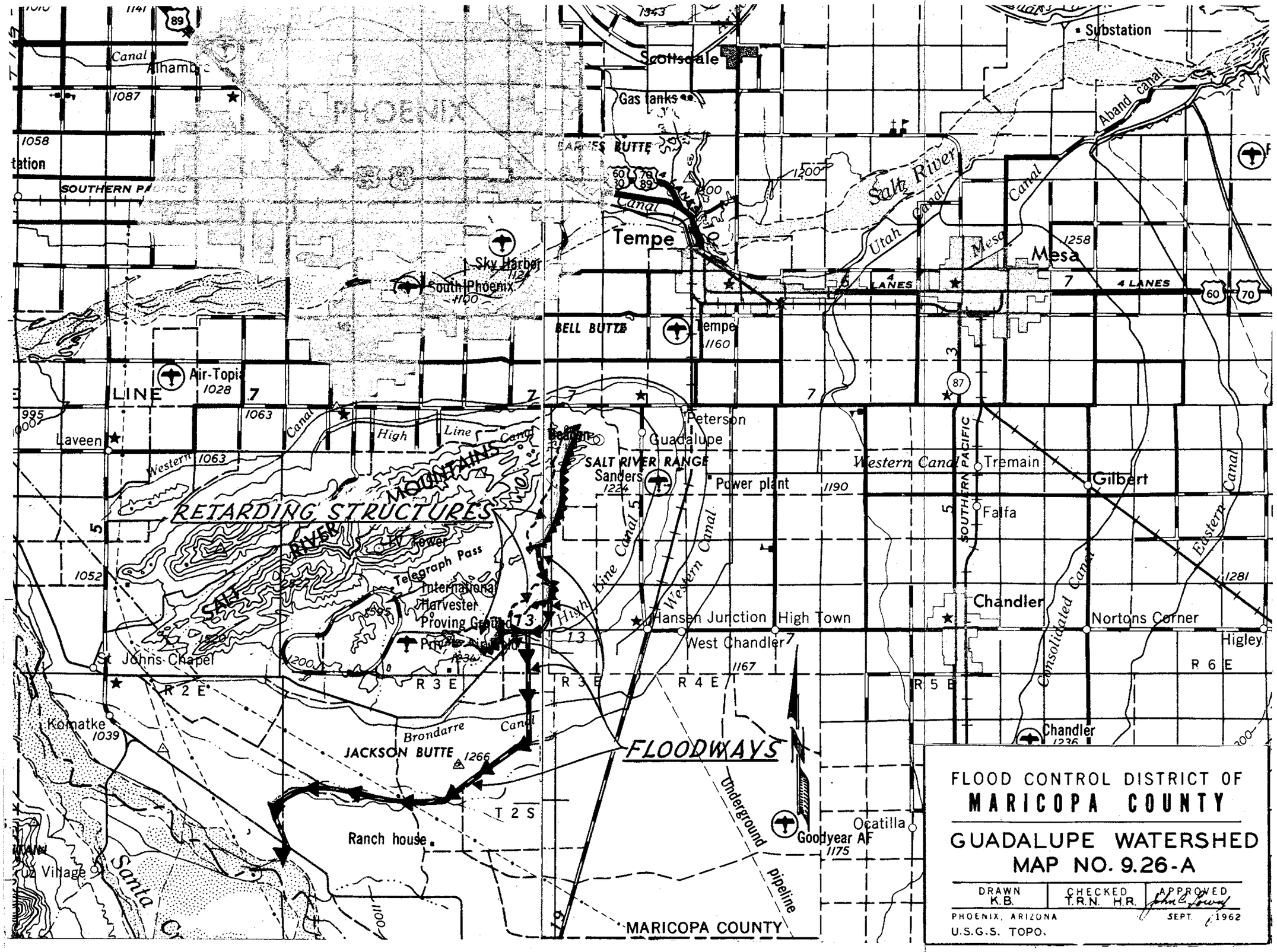
9.28-B-1 General and Damages

Damages in the past here have not been too severe, since development has only recently occurred. A major flood now would cause some damage to approximately 200 homes and businesses. Some farm land would also be damaged.

9.28-B-2 Plan

The Upper Indian Bend Area may eventually warrant expensive channel work but at the present time, by proper zoning, it can be held as a very wide flood plain with some clearing and excavation as a shallow earth channel.

The plan is for construction of an unlined earth channel from Cholla Rd. and 36th St. to Arizona Canal below Indian Bend Rd. with concrete box culverts to accommodate low flows and wide



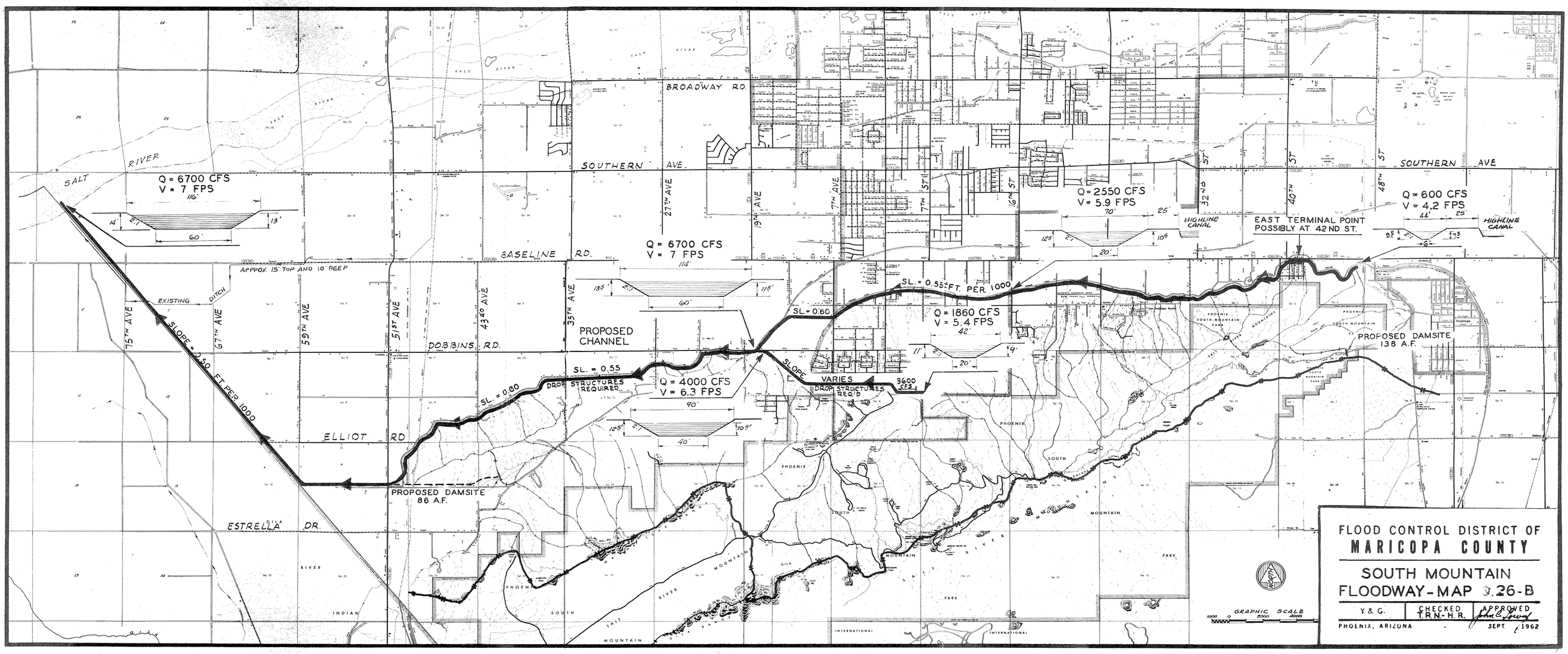
FLOOD CONTROL DISTRICT OF
MARICOPA COUNTY

GUADALUPE WATERSHED
MAP NO. 9.26-A

DRAWN	CHECKED	APPROVED
K.B.	T.R.N. H.R.	John C. Lowry

PHOENIX, ARIZONA — SEPT. 1962

U.S.G.S. TOPO.



FLOOD CONTROL DISTRICT OF
MARICOPA COUNTY

SOUTH MOUNTAIN FLOODWAY - MAP 3.26-B

Y & G.	CHECKED T.R.N.-H.R.	APPROVED

PHOENIX, ARIZONA - SEPT. 1962

sections at half-mile roads. Excavation costs reduced 50% from unit prices used elsewhere assuming excess dirt from channel can be easily disposed of. Channel to have 5:1 side slopes and approximate water depth of 5 ft., except at ½ mile road crosings, side slopes will be 15:1 with water depth of 4 ft. Water level width varies from 141 ft. at Cholla Rd. and 36th St. to 441 ft. at Indian Bend Rd., one-half mile east of Scottsdale Rd. Table 9.28-1 shows cost summary and Map 9.28-A shows location and other data.

9.29 EVERGREEN AREA

The Evergreen Area is located in the east-central part of Maricopa County and contains an area of 35 sq. miles. The runoff comes from the McDowell Mountains that form the watershed on the north. Practically all the runoff is collected by the Arizona Canal and released into the Evergreen Wasteway.

At the present time, no appreciable damages are likely here. The Salt River Indian Reservation comprises the larger part of the watershed and improvements are at a minimum. The Arizona Canal has been breached in the past, but the damage was minor.

The Flood Control District has recommended the Indians run a diversion from the northwest corner of their reservation to the southeast near Evergreen. The water can then be taken over the Canal or into Salt River in controlled quantities.

9.30 UPPER VERDE AREA

The Upper Verde Area begins above Bartlett Dam, is located in the northeast section of Maricopa County, and contains an area of 6,188 sq. miles.

The runoff-producing areas are the higher elevations of the Mogollon Rim country. The mountains are brush and tree-covered, well-rounded but relatively steep. Runoff here is controlled by the systems of dams on the Verde River, being regulated mainly by Bartlett Dam.

Flood damage is difficult to assess. A severe storm would cause some damage, but developments at present do not warrant flood control measures. Future conditions may require a study of the problems and necessary actions can be taken as developments occur.

TABLE 9.27-1 LOWER INDIAN BEND SUMMARY

Job Description	Estimated Cost Flood Control District	Corps of Engineers
A concrete-lined channel running southerly from the Arizona Canal to and meeting the Salt River at approx. 0.5 miles east of Scottsdale Road.		
Total	$1,770,000	$7,250,000
Total Project Cost	$9,020,000	
Flood Damage Without Project		555,500
Flood Damage With Project		25,500
Benefits from Reduction of Flood Damage		530,000
Irrigation Benefits		-0-
Other Benefits		-0-
Total Annual Benefits		530,000
Total Project Cost Amortized @ 2⅝ %		326,000
Annual Operation and Maintenance		22,000
Total Annual Costs		348,000
Benefit-Cost Ratio	1.52 to 1.00	

TABLE 9.28-1 UPPER INDIAN BEND SUMMARY

Job Description	Estimated Cost Flood Control District	Corps of Engineers
An unlined channel from Cholla Rd. and 36th St. to Arizona Canal below Indian Bend Rd. Includes Box Culverts for Low Flows	$1,217,000	$1,701,000
Total Project Cost:	$2,918,000	
Flood Damage Without Project	$85,000	
Flood Damage with Project	9,000	
Benefits from Reduction of Flood Damage	76,000	
Total Annual Benefits	76,000	
Total Project Cost Amortized @ 2⅝%	105,400	
Annual Operation and Maintenance	19,000	
Total Annual Costs	124,400	
Benefit-Cost Ratio	0.61 to 1.00	

9.31-A LOWER VERDE AREA

The Lower Verde River area, between Bartlett Dam and Granite Reef Dam, is in northeastern Maricopa County, and has an area of approximately 500 sq. miles.

Runoff comes from the Mazatzal Mountains on the east and McDowell Mountains on the west. Flood water from this area could cause considerable damage in Salt River Valley because there is little storage below Granite Reef Dam.

9.31-B MAXWELL DAM

9.31-B-1 General

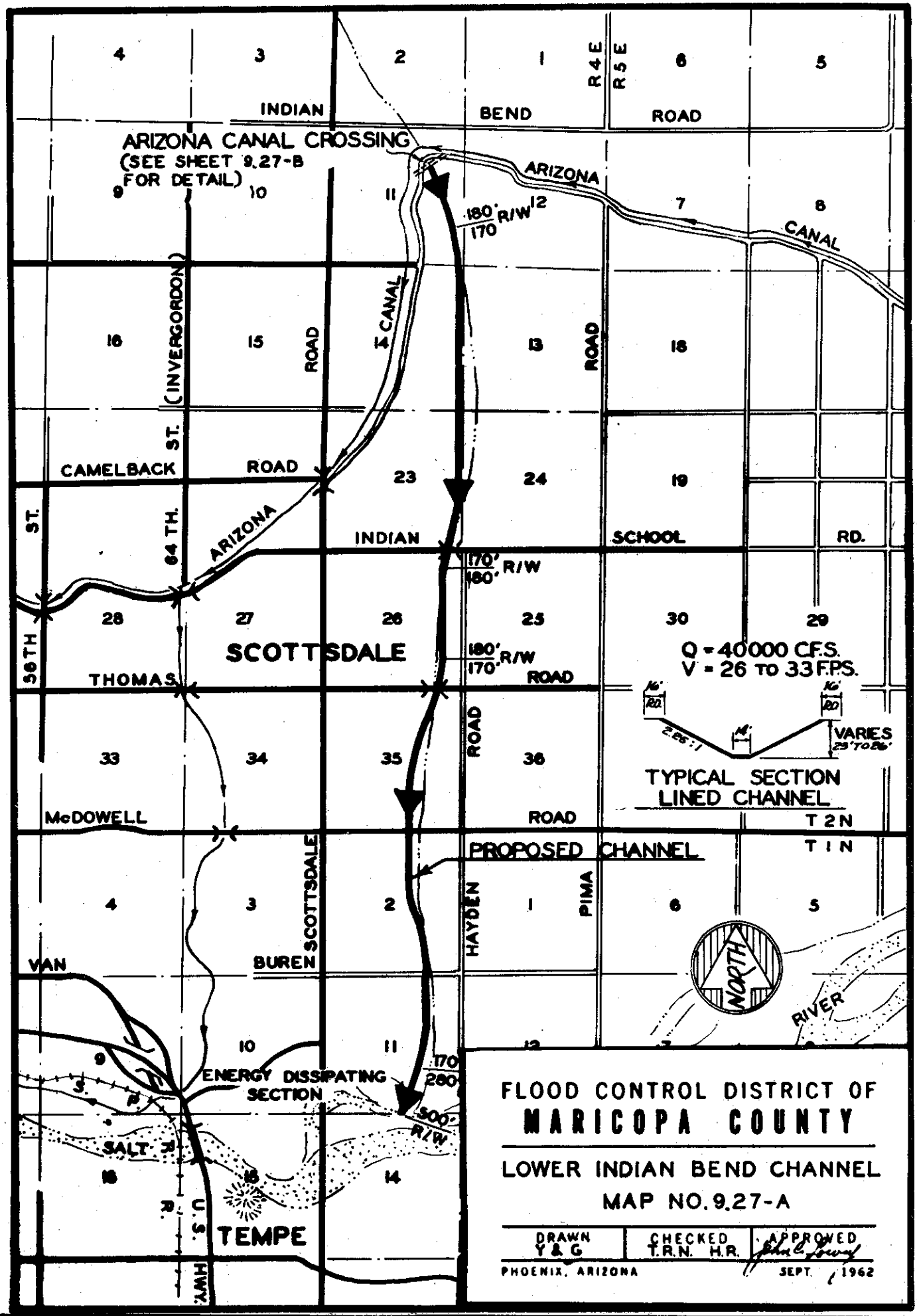
The overall plan for this Dam is to build into the planned terminal storage reservoir, 900,000 acre feet of flood control storage. Nearly all damages caused by a standard project flood along Salt River will be prevented by the construction of this dam along with the channel improvements recommended under Sec. 9.0-A. Relatively minor damages along Salt River would still occur to property located in and immediately adjacent to the river channel. Downstream from the mouth of the Salt, partial flood protection would result. Control of floods would be effected by reducing discharges from Maxwell Dam to approximately 50,000 cfs. Smaller flows than 50,000 cfs would not be affected by the operation of this reservoir.

9.31-B-2 Plan

An earth-fill dam rising 169 feet above the stream bed, with a crest length of 5,200 ft. Spillway will be in the channel section of the dam. The reservoir will extend about 10 miles north in the Verde River Valley and about 8 miles east along Salt River. Total storage is planned to be 1,250,000 acre feet with about 900,000 reserved for flood control storage. Table 9.31-1 shows cost summary and Map 9.31-A shows extent and location.

9.32-A GOLDFIELD AREA

The Goldfield Area is located in east-central Maricopa County extending into Pinal County. The eastern section contains the Superstition Mountains and is characterized by steep, rugged terrain that slopes west toward Apache Junction.



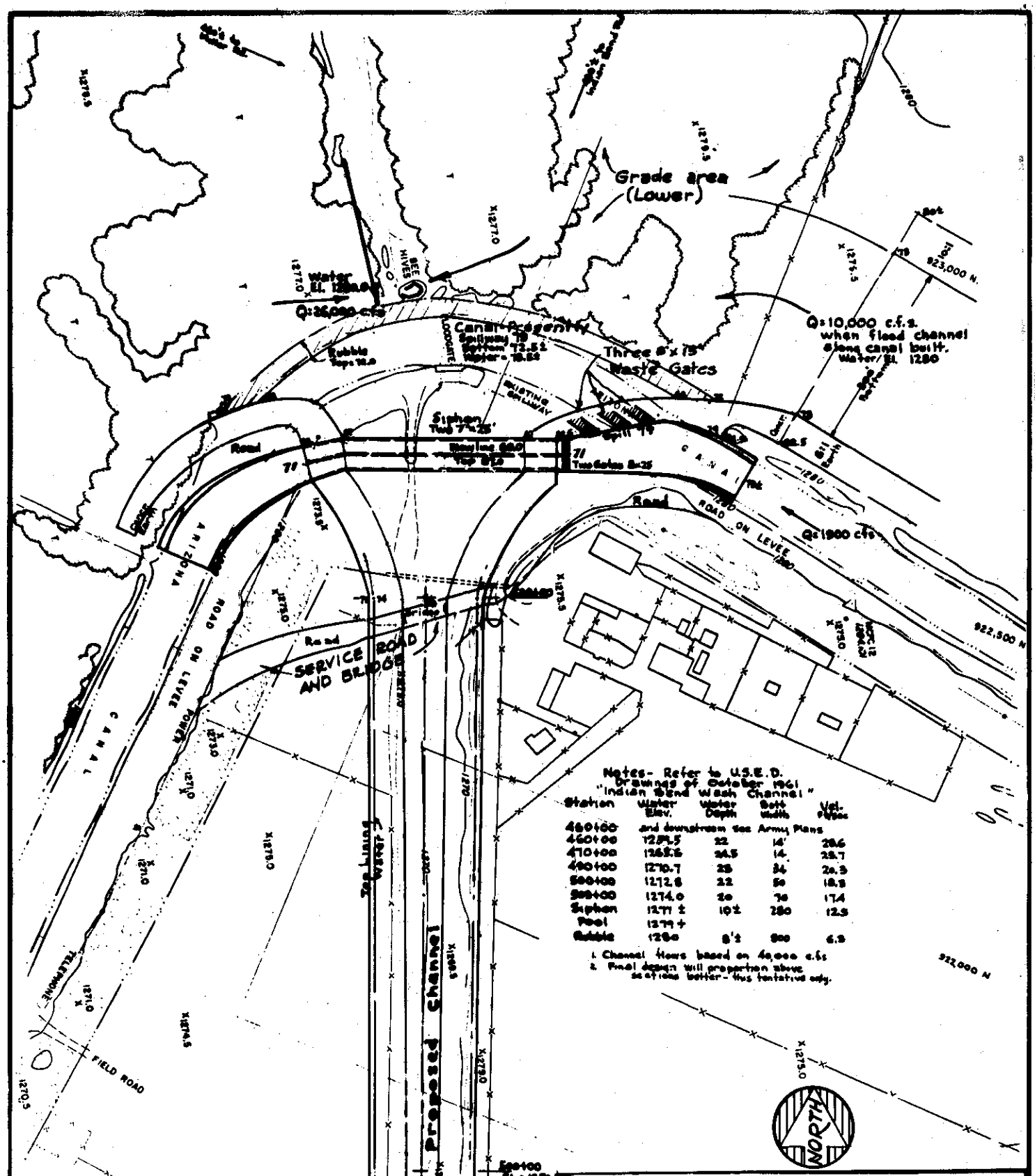
FLOOD CONTROL DISTRICT OF
MARICOPA COUNTY

LOWER INDIAN BEND CHANNEL
MAP NO. 9.27-A

DRAWN	CHECKED	APPROVED
Y & G	T.R.N. H.R.	

PHOENIX, ARIZONA SEPT. 1962

4112-2



Notes- Refer to U.S.E.D. Drawings of October 1961 "Indian Bend Wash Channel"

Station	Water Elev.	Water Depth	Bott. Width	Vel. F/sec
460+00	and downstream see Army Plans			
460+00	1285.5	22	14'	28.6
470+00	1283.5	24.5	14	29.7
480+00	1270.7	25	34	26.3
500+00	1272.6	22	50	18.3
520+00	1274.0	20	76	17.4
Siphon	1271 ±	10±	280	12.5
Pool	1279 +			
Rubble	1280	8'±	300	6.3

1. Channel flows based on 46,000 c.f.s.
2. Final design will proportion above sections better - thus tentative only.

SCALE

100 0 100 200 300

Base topographic map MARICOPA COUNTY FLOOD CONTROL DISTRICT "INDIAN BEND PARKWAY" Sheet 22

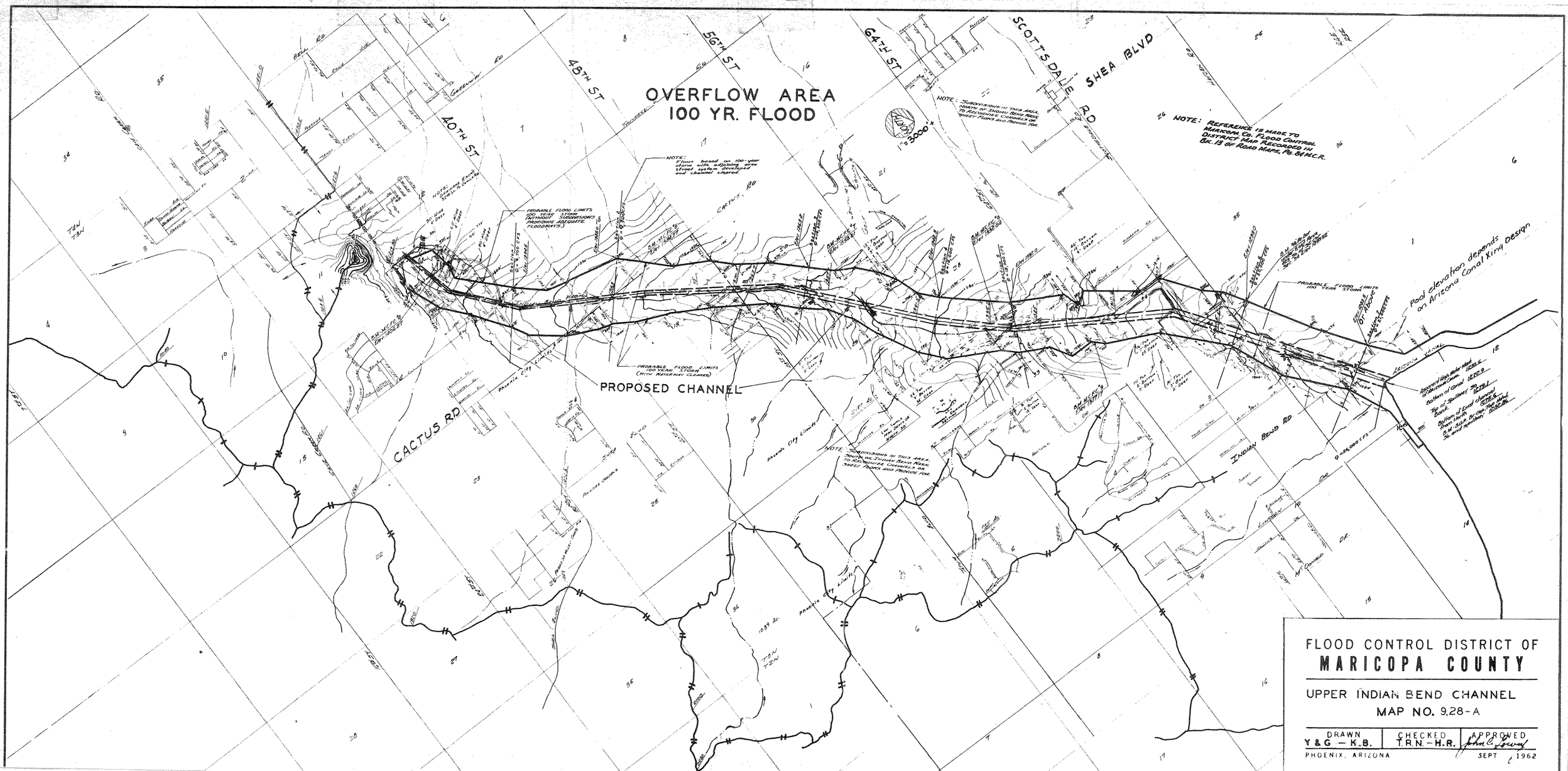
FLOOD CONTROL DISTRICT OF MARICOPA COUNTY

INDIAN BEND CHANNEL

INLET DETAILS - MAP NO. 9.27-B

DRAWN	CHECKED	APPROVED
Y & G.	T.R.N. H.R.	

PHOENIX, ARIZONA SEPT. 1962



FLOOD CONTROL DISTRICT OF
MARICOPA COUNTY

UPPER INDIAN BEND CHANNEL
MAP NO. 9.28-A

DRAWN	CHECKED	APPROVED
Y&G – K.B.	T.R.N. – H.R.	John C. Lowry

PHOENIX, ARIZONA — SEPT 1962

TABLE 9.31-1 MAXWELL DAM SUMMARY

Job Description	Estimated Cost Flood Control District	Corps of Engineers
Dam and Related Works ($5,700,000 allocated to Flood Control)	$650,000	$30,350,000
Total Project Cost		$31,000,000
Flood Damage Without Project		$280,232
Flood Damage With Project		39,232
Benefits from Reduction of Flood Damage		241,000
Irrigation and Recreation Benefits		128,000
Total Annual Benefits		369,000
Total Project Cost Amortized @ 2⅝%		235,000
Annual Operation and Maintenance		41,000
Total Annual Costs		276,000
Benefit-Cost Ratio	1.34 to 1.00	

Drainage pattern is to the southwest with numerous washes heading toward Gila River. Because of extensive development, a major storm could cause extensive damage.

Four projects are proposed: Apache Junction-Gilbert Watershed, Buckhorn-Mesa Watershed, Williams-Chandler Watershed, and Mesa-Chandler-Gilbert Floodway.

9.32-B APACHE JUNCTION-GILBERT WATERSHED

9.32-B-1 General

This watershed is located in eastern section of the Goldfield Area and will offer protection for the Gilbert-Chandler area. The flood-producing watershed is made up of steep mountains up to 5,000-ft. elevation and foothills lying between 1400 and 1700 ft. elevation. Peak flows are of short duration but high intensity. Due to steep slopes and high velocities, serious damage can result from a major storm.

9.32-B-2 Development and Damages

On both sides of U.S. Highway 60-70-80 and 89 are located many trailer parks, private homes, motels and businesses. The center of this urban area is Apache Junction. In the Apache Junction-Gilbert area, urban and commercial development has literally "exploded" during the last few years. Also included in this watershed is some of the most highly productive farm land in the State.

The heavy rains in 1954 produced damaging floods. The highway was covered from six miles west to two miles east of Apache Junction. Practically every business establishment along the road was damaged. Many homes were seriously affected by flood water.

Damage in urban areas is just a part of the total damage that may occur from a major storm. The highly productive farm land as well as irrigation systems could be severely damaged due to erosion and silt deposition.

9.32-B-3 Plan

The overall plan for flood control in this watershed includes one retarding basin and 14.8 miles of floodways. This one retarding structure will control approximately 38% of the watershed area.

The Powerline retarding structure will be built south of U. S. Highway 60-70-80-89 and west of Vineyard Rd. Structure will provide protection from the 1% storm. It will have a total storage capacity of 4,135 ac. ft., with 3,960 acre feet reserved for flood water storage and 175 acre-feet for the 50-yr. accumulated sediment storage.

The dam will be 3.9 miles long and have a maximum height of 25 ft. An earth emergency spillway 600 ft. wide with a capacity of 1,890 cfs will be located at the south end of the embankment. The maximum release from the 54" principal spillway will be 328 cubic feet per second.

The Powerline Floodway will convey floodwater from the Powerline Dam to the Roosevelt Water Conservation District floodway. This will be a combination earth and reinforced concrete channel. Water from the Vineyard Road and Rittenhouse Retarding structures in the Williams-Chandler Watershed will enter this floodway at a junction structure located at station 117+30. A stilling basin will be constructed at the lower end of the floodway.

The RWCD floodway consists of the existing floodway above the Canal. It will be enlarged to carry floodwaters originating below the floodwater retarding structure. The design capacity is variable but will be sufficient to handle water flowing in from the Buckhorn-Mesa Watershed. Water will be carried to Queen Creek or through inlet structures to the RWCD Canal for irrigation use. Table 9.32-1 shows cost summary; Table 9.32-A shows structural data; and Map 9.32-A shows planned extent and location.

9.32-C BUCKHORN-MESA WATERSHED

9.32-C-1 General

This watershed is located in eastern Maricopa and northwestern Pinal Counties. Flood-producing areas are the rugged Usery and Goldfield Mountains. Flood waters drain down onto the wide alluvial fan where slopes are flat and the channels become less-defined. Drainage pattern is to the southwest.

9.32-C-2 Development and Damages

The flood plain is representative of the County east of Phoenix and Mesa in which the population and development rates have "sky-rocketed" during the past few years. It covers the rapidly expanding urban and commercial development along the Apache Trail Highway from Mesa east to Pinal County line. The highway traverses the entire length of the watershed. Surrounding this rapidly-expanding area are highly productive farm lands. Damage from a major storm would be extensive.

Heavy rains result in destructive floods that cover the residential and commercial developments along the Apache Trail and the rich, irrigated farm lands.

From 1910 to 1960, 33 floods of varying magnitude have occurred, damaging land, residences, commercial establishments, roads and highways. Runoff during 1954 storm inundated almost 6,000 acres of highly productive irrigated land.

Total estimated damage from a flood comparable to the one in 1954, would now be $1,270,000.

9.32-C-3 Plan

Priorities and final construction plans for this project will be correlated with the plans for the location of the Central Arizona Project Canals.

The overall plan for this watershed will include 4 floodwater retarding structures and 8.1 miles of floodways. It has been determined by extensive study that these 4 structures with inter-connecting floodways with one common outlet will be the most beneficial and most economical. A debris basin and diversion box are also proposed to use the floodwater for irrigation purposes.

MAXWELL DAM SITE

STEWART MOUNTAIN DAM

TOP OF FLOOD CONTROL STORAGE

FLOOD CONTROL DISTRICT OF MARICOPA COUNTY

ORME (MAXWELL) DAM
MAP NO. 9.31-A
NAME CHANGED 1964

DRAWN	CHECKED	APPROVED
K.B.	T.R.N. H.R.	John C. Lowry

PHOENIX, ARIZONA — SEPT. 10, 1962

U.S.G.S. TOPO.

Weekes Wash Dam

The Weekes Wash retarding structure will be constructed northeast of Apache Junction on Weeks Wash, to provide protection from storms up to and including the 1% event. Total storage capacity will be 1360 acre-ft. with 1140 acre-feet of floodwater storage and 220 acre-feet for a 50-yr. accumulated sediment storage. The dam wil be 1.2 miles long and have a maximum height of 41 feet. An emergency spillway 250 ft. wide with a capacity of 6,490 cfs will discharge at the east end of the embankment. The maximum release rate from the 30-in. reinforced concrete pipe principal spillway will be 105 cu. ft. per second.

Apache Junction Dam

The Apache Junction floodwater retarding structure will be constructed north of the town of Apache Junction. It will provide floodwater protection from the 1% event. It will have a total storage capacity of 1035 ac. ft., with 930 ac. ft. for floodwater storage and 105 ac. ft. for a 50-yr. accumulated sediment storage. The dam will be 2.0 miles long and have a maximum height of 19 feet. An emergency spillway with a width of 150 ft. and a capacity of 3100 cfs will be located on the southeast end of the embankment. The maximum release from the 42-in. reinforced concrete pipe principal spillway will be 173 cfs. An earth diversion .2 miles long will be constructed above the Apache Junction Dam to divert floodwaters from a small wash into the reservoir area.

Signal Butte Dam

The Signal Butte floodwater retarding structure will be constructed above the Apache Trail near the Maricopa-Pinal County line, and will provide protection from the 1% event. Total storage capacity will be 1485 ac ft. with 1340 ac. ft. for floodwater and 145 ac. ft. for 50-yr. sediment storage. The dam will be 3.1 miles long and have a maximum height of 18 ft. An emergency spillway with a width of 200 ft. and a capacity of 4,930 cfs will be located on the east end of the embankment. The maximum release rate from the 54-in. spillway will be 294 cfs.

Spook Hill Dam

The Spook Hill floodwater retarding structure will be constructed above Apache Trail and the new Bush Highway. It will protect from the 1% event and will have total storage capacity of 1230 ac ft., with 1110 ac. ft. for floodwater storage and 120 ac. ft. for a 50-yr. accumlated sediment storage. The dam will be 4.9 miles long with a maximum height of 15.5 ft. An emergency spillway with a width of 100 ft. and a capacity of 2,680 cfs will be located on the north end of the embankment. The maximum release rate from the 5' x 5' reinforced concrete box principal spillway will be 435 cfs.

Weekes Wash Floodway

A floodway 2 miles long will convey floodwater from the 30-in. reinforced concrete pipe principal spillway in the Weekes Wash Dam to the Apache Junction Dam. This floodway will be lined with reinforced concrete with a stilling basin at the lower end and will have a capacity of 105 cfs.

Apache Junction Floodway

A floodway 1.4 miles long will convey floodwaters from the 42-in. reinforced concrete pipe spillway in the Apache Junction Dam east to the Signal Butte Dam. Floodway will be lined with reinforced concrete with a stilling basin at the lower end and will have a capacity of 173 cfs.

Signal Butte Floodway

A floodway .8 mile long will convey floodwater from the 54-in. reinforced concrete pipe spillway in the Signal Butte Dam to the Spook Hill Dam. This floodway will be lined with reinforced concrete with a stilling basin at the lower end and will have a capacity of 294 cfs.

Spook Hill Floodway

A floodway 3.9 miles long will convey floodwater from the Spook Hill Dam to the Southern Canal and the Salt River. The earth section will be 2.1 mi. long and 1.8 mi. will be lined with reinforced concrete and will have a capacity of 435 cfs. The lined section will empty into a natural wash. Floodwaters from the floodway and the wash will be conveyed into a debris basin immediately above the Southern Canal. Floodwaters may be released into the Canal through a division box with gates or through the proposed Spook Hill floodway to the Salt River.

Debris Basin

The debris basin will have a total capacity of 48 ac. ft. of which 40 ac. ft. are for floodwater and 8 ac. ft. are for sediment. The dam will be 19 ft. high and .2 mi. long. It will release 590 cfs. Its purpose is to remove sediment from water used for irrigation. There will be a division box in conjunction with the debris basin to accomplish the diversion of floodwater released from the structures into the Southern Canal. See Tables 9.32-2 and 9.32-B, and Map 9.32-B.

9.32-D WILLIAMS-CHANDLER WATERSHED

9.32-D-1 General

The watershed is composed primarily of steep mountains between contours 1700 and 5000, and foothills between contours 1400 and 1700. Flow is generally southwesterly into the broad, level plain. Velocities in the washes are high due to steep slopes and well-defined channels.

9.32-D-2 Development and Damages

Many homes, business houses, highways and roads are located in the flood plain. U. S. Highway 60-70-80-89 crosses the flood area and is subject to damage. Williams Air Force Base is considered vulnerable to heavy floods even though protective dikes and channels have been constructed there.

Chandler would suffer damage from a heavy flood. The heavy rains of 1954 caused extensive damage in the watershed. Many acres of farm land are subject to damage.

9.32-D-3 Plan

Structural measures to be installed are those needed to reduce damages caused by flooding and those needed for agricultural water management. Two floodwater retarding structures controlling 66% of the watershed area, 9.2 miles of floodway construction, and one irrigation water turnout structure with gates are included in the plan.

a. Vineyard Road Dam

Retarding structure to be constructed east of Vineyard Rd. in Pinal County, will provide floodwater protection from the 1% event, will have a total capacity of 4,310 ac. ft., with 4,110 ac. ft. allocated to floodwater storage and 200 ac. ft. allocated to 50-yr. sediment storage. The dam will be 5 miles long and have a maximum height of 21 ft. The maximum release rate from the 6' x 6' reinforced concrete culvert principal spillway will be 705 cu. ft. per second, and will drain runoff from the 1% event in about 10 days. The emergency spillway will be earth construction and will be located around the south end of the embankment.

b. Rittenhouse Dam

Retarding structure to be constructed east of the Rittenhouse Auxiliary Air Field in Pinal County, will provide floodwater protection from the 1% event; will have total storage capacity of 3,770 ac. ft. with 3,590 ac. ft. allocated to floodwater storage and 180 ac. ft. allocated to a 50-yr. sediment storage. The dam will be 4 miles long and have maximum height of 22 ft. Maximum release rate from the 54-in. reinforced concrete pipe principal spillway will be 313 cfs and will drain the runoff from the 1% event in about 10 days. The emergency spillway will be of earth construction and will be located around the south end of the embankment.

c. Rittenhouse Floodway

A floodway of 313 cfs capacity, 1.2 miles long will convey floodwater from the principal spillway in the Rittenhouse Dam to the Vineyard Rd. Dam. Floodway will be lined with reinforced concrete with a stilling basin at lower end.

d. Vineyard Road Floodway

A floodway .8 miles long will convey floodwaters from the spillway in the Vineyard Road dam to a junction structure in the Powerline floodway in the Apache Junction-Gilbert Watershed. The capacity of floodway is 705 cfs.

e. Roosevelt Water Conservation District Floodway

The existing 7.2 miles of floodway within this watershed above the RWCD Canal will be enlarged to collect and discharge floodwaters from the Vineyard Road floodway plus the flood waters from the uncontrolled area below the dams. This 7.2 miles represents a portion of the total 14.6 miles of floodway improvement proposed in the two watersheds. The remaining 7.4 miles is proposed within the Apache Junction-Gilbert Watershed. The floodway capacity varies from 4,133 cfs to 4,633 cfs, which will carry the 1% event.

f. Measures for Irrigation

A reinforced concrete structure with gates is planned in the levee between the RWCD floodway and Canal below the junction with the Powerline floodway. This structure, with a capacity of 500 cfs, will permit floodwaters to enter the canal, when desired for irrigation.

Cost summary is shown in Table 9.32-3; locations are shown on Map 9.32-C and structural works in Table 9.32-D.

9.32-E MESA-CHANDLER-GILBERT FLOODWAY

9.32-E-1 General

Affected by this floodway is one of the most highly developed areas in Maricopa County, including the population centers of Mesa, Chandler and Gilbert.

Topography of this area is characterized by relatively flat terrain with developed irrigation systems. The general drainage pattern is to the southwest into the Gila River. Presently, the urban areas have no outlet for storm runoff and this floodway will provide one.

9.32-E-2 Development and Damages

This valley area is highly developed and has expanded at a tremendous rate in the past few years. It includes Mesa, Gilbert and Chandler as the major urban areas. There are also smaller concentrations of population at West Chandler and Hightown. Numerous roads, irrigation works, and other improvements would be severely damaged by a major flood.

9.32-E-3 Plan

The overall plan for this area consists of a system of channels to serve the population centers of Mesa, Chandler, Gilbert and adjacent developments. The Mesa Channel will begin at Baseline Road one-half mile west of Country Club Drive and run south to a point at approximately the center of Section 9, T1S, R5E, where it joins a channel coming from Gilbert to form the main channel serving the whole area.

A similar channel is planned for Chandler to run along Pecos Rd. west to join the main canal where it enters the Salt River Indian Reservation. The main channel continues on to eventually drain into the Gila River. The main channel is designed to carry a 5-year flood. Total length: 22 miles; width at bottom: 10 ft.; depth: 10 ft. Chandler floodway will be 7 miles long. The Corps of Engineers will be requested to make a study of this problem.

See Table 9.32-4 and Map 9.32-D.

TABLE 9.32-1 APACHE JUNCTION-GILBERT WATERSHED SUMMARY

No.	Job Description	Estimated Cost Flood Control District	S.C.S.
1	Powerline Retarding Structure	$ 842,000	$1,170,000
2	Powerline Floodway	138,000	2,257,000
3	R.W.C.D. Floodway	229,000	376,000
	Total	$1,209,000	$3,803,000
	Total Project Cost	$5,012,000	
	Flood Damage with Project		347,000
	Flood Damage with Project		73,100
	Benefits from Reduction of Flood Damage		273,900
	Other Benefits		2,800
	Total Annual Benefits		276,700
	Total Project Cost Amortized @ 2⅝ %		181,700
	Annual Operation and Maintenance		16,300
	Total Annual Costs		198,000
	Benefit-Cost Ratio	1.40 to 1.00	

TABLE 9.32-2 BUCKHORN-MESA WATERSHED SUMMARY

No.	Job Description	Estimated Cost Flood Control District	S.C.S.
1	Apache Junction Retarding Structure	679,400	443,600
2	Signal Butte Retarding Structure	1,095,600	559,500
3	Spook Hill Retarding Structure	1,173,300	812,000
4	Weekes Wash Retarding Structure	405,500	391,000
5	Apache Junction Floodway	25,600	339,100
6	Signal Butte Floodway	14,100	229,000
7	Spook Hill Floodway	144,700	630,400
8	Weekes Wash Floodway	35,800	450,400
	Total	$3,574,000	$3,855,000
	Total Project Cost	$7,429,000	

TABLE 9.32-2 Continued

BUCKHORN-MESA WATERSHED SUMMARY

Flood Damage without Project		603,000
Flood Damage with Project		121,000
Benefits from Reduction of Flood Damage		482,000
Irrigation Benefits		17,000
Other Benefits		1,000
Total Annual Benefits		500,000
Total Project Cost Amortized @ 2⅝%		268,500
Annual Operation and Maintenance		12,500
Total Annual Costs		281,000
Benefit-Cost Ratio	1.78 to 1.00	

TABLE 9.32-3 WILLIAMS-CHANDLER WATERSHED SUMMARY

No.	Job Description	Estimated Cost Flood Control District	S.C.S.
1	Rittenhouse Retarding Structure	256,200	1,109,200
2	Vineyard Road Retarding Structure	337,600	1,336,000
3	Rittenhouse Floodway	5,000	403,500
4	Vineyard Road Floodway	10,200	291,200
5	R.W.C.D. Floodway	228,000	598,100
	Total	$837,000	$3,738,000
	Total Project Cost	$4,575,000	
Flood Damage without Project			383,100
Flood Damage with Project			103,300
Benefits from Reduction of Flood Damage			279,800
Irrigation Benefits			41,000
Other Benefits			5,200
Total Annual Benefits			326,000
Total Project Cost Amortized @ 2⅝%			163,000
Annual Operation and Maintenance			23,700
Total Annual Costs			189,000
Benefit-Cost Ratio	1.73 to 1.00		

TABLE 9.32-4 MESA, CHANDLER, GILBERT FLOODWAY SUMMARY

No.	Job Description	Estimated Cost Other	FCD
1	Mesa-Gilbert Floodway	-0-	$2,230,000
2	Chandler Floodway	-0-	140,000
3	Bridges and Other Structures	-0-	630,000
	Total	-0-	3,000,000
	Total Project Cost	$3,000,000	
Flood Damage without Project			$260,500
Flood Damage with Project			1,000
Benefits from Reduction of Flood Damage			259,500
Total Annual Benefits			2,259,500
Total Project Cost Amortized @ 2-5/8%			108,400
Annual Operation and Maintenance			14,000
Total Annual Cost			122,400
Benefit-Cost Ratio	2.11 to 1.00		

TABLE 9.32-A **STRUCTURAL DATA**

APACHE JUNCTION-GILBERT WATERSHED

Retarding Structures

No.	Item	Units	Structures Powerline
1	Drainage Area	sq. mi.	49.9
2	Sediment Capacity	ac. ft.	175
3	Flood Water Capacity	ac. ft.	3,960
4	Total Storage Capacity	ac. ft.	4,135
5	Total Surface Area	acres	690
6	Length	mi.	3.9
7	Maximum height	ft.	25
8	Total Volume of fill	cu. yd.	936,000
9	Principal Spillway size	in.	54
10	Maximum Release Rate	cfs	328
	Cost Distribution		
11	Total Construction Cost		$1,170,000
12	Contract Administration		9,000
13	Right of Way		833,000
14	Relocations & other costs		0
15	Flood Control District Cost		842,000
16	Total Project Cost		2,012,000

Floodways

No.	Item	Units	Structures Powerline	RWCD
1	Discharge Capacity	cfs	1,033	2,550
2	Length	ft.	38,890	39,100
3	Av. Bottom Width	ft.	6	80
4	Av. Depth	ft.	7	6
5	Av. Side Slope		1½:1	3:1
6	Excavation	cu. yd.	150,000	508,500
7	Concrete	cu. yd.	20,890	0
	Cost Distribution			
8	Total Construction Cost		$2,257,000	$376,000
9	Contract Administration		17,400	2,900
10	Right of Way		120,700	225,900
11	Flood Control District Cost		138,200	228,800
12	Total Project Cost		2,395,200	604,800

TABLE 9.32-B

STRUCTURAL DATA
BUCKHORN-MESA WATERSHED
Detention Structures

No.	Item	Units	Apache Junct.	Signal Butte	Structures Spook Hill	Weekes Wash	Debris Basin
1	Drainage Area	sq. mi.	8.2	14.3	11.8	10.9	1
2	Sediment Capacity	ac. ft.	105	145	120	220	8
3	Flood Water Storage	ac. ft.	930	1340	1110	1140	40
4	Total Storage Capacity	ac. ft.	1,035	1,485	1,230	1,360	48
5	Total Surface Area	acres	220	340	340	150	10
6	Length	mi.	2	3.1	4.9	1.2	.2
7	Maximum Height	ft.	19	18	15.5	41	19
8	Total Volume	cu. yd.	420,000	525,000	790,000	391,000	33,000
9	Principal Spillway Size	in.	42	54	60 x 60	30	
10	Maximum Release Rate	cfs	173	294	435	105	590
			Cost Distribution				
11	Total Construction Cost		$ 443,600	$ 559,500	$ 812,000	$391,000	
12	Contract Administration		3,400	4,300	6,200	3,000	
13	Right of Way		676,000	1,091,000	1,167,100	402,500	
14	Relocations and other costs		0	0	0	0	
15	Flood Control District Cost		679,400	1,095,600	1,173,300	405,500	
16	Total Project Cost		1,123,000	1,655,100	1,985,300	796,500	

TABLE 9.32-C **STRUCTURAL DATA**

BUCKHORN-MESA WATERSHED FLOODWAYS

No.	Item	Units	Structure Apache Junction	Signal Butte	Spook Hill	Weekes Wash
1	Discharge Capacity	cfs	173	294	435	105
2	Length	ft.	7,215	4,420	20,330	10,815
3	Av. Bottom Width	ft.	5.5	6	7	4.8
4	Av. Depth	ft.	3.3	3	3.5	3
5	Av. Side Slope		Vertical	Vertical	Vertical	Vertical
6	Excavation	cu. yd.	14,500	10,000	113,600	19,500
7	Concrete	cu. yd.	2,430	1,500	3,596	3,035
	Cost Distribution					
8	Total Construction		$339,100	$229,000	$630,400	$450,400
9	Contract Admin.		2,600	1,800	5,100	3,500
10	Right of Way		23,000	12,500	108,000	32,300
11	Relocations and other		0	0	31,600	0
12	Flood Control Dist.		25,600	14,100	144,700	35,800
13	Total Project Cost		364,700	243,100	775,100	486,200

TABLE 9.32-D **STRUCTURAL DATA**

WILLIAMS-CHANDLER WATERSHED

Retarding Structures

No.	Item	Units	Structures Rittenhouse	Vineyard Road
1	Drainage Area	sq. mi.	51.3	57.8
2	Sediment Capacity	ac. ft.	180	200
3	Flood Water Capacity	ac. ft.	3,590	4,110
4	Total Storage Capacity	ac. ft.	3,770	4,310
5	Total Surface Area	acres	680	840
6	Length	mi.	4	5
7	Maximum Height	ft.	22	21
8	Total Volume of fill	cu. yd.	883,000	1,035,000
9	Principal Spillway	in.	54	72 x 72
10	Maximum Release Rate	cfs	313	705
	Cost Distribution			
11	Total Construction		$1,109,200	$1,336,000
12	Contract Administration		8,500	10,300
13	Right of Way		247,700	327,300
14	Relocations and other costs		0	0
15	Flood Control District Cost		256,200	337,600
16	Total Project Cost		1,365,400	1,673,600

TABLE 9.32-D (cont.) **STRUCTURAL DATA**
WILLIAMS-CHANDLER WATERSHED
Floodways

No.	Item	Units	Structures Rittenhouse	Vineyard Rd.	RWCD
1	Discharge Capacity	cfs	313	705	4,633
2	Length	ft.	6,390	4,430	38,000
3	Av. Bottom Width	ft.	7.5	6	100
4	Av. Depth	ft.	5.3	5.3	7
5	Av. Side Slope		Vertical	1.5:1	3:1
6	Excavation	cu. yd.	20,000	13,000	832,000
7	Concrete	cu. yd.	2,690	2,100	0
	Cost Distribution				
8	Total Construction Cost		$403,500	$291,200	$598,100
9	Contract Administration		3,100	2,200	4,700
10	Right of Way		1,800	8,000	217,900
11	Relocations and other		0	0	5,400
12	Flood Control Dist. cost		4,900	10,200	228,100
13	Total Project Cost		408,400	301,400	826,200

9.33-A LOWER QUEEN CREEK AREA

The Lower Queen Creek area begins below Whitlow Dam and is in the extreme southeast corner of Maricopa County, and contains 530 sq. miles. This area is long east-west and Maricopa County-Pinal County line runs down the center of the watershed.

The area above the Southern Pacific Railroad to the east is rolling, moderately steep and contains many washes that cut through to Queen Creek. Below the railroad, the terrain is relatively flat.

There are extensive developments along Queen Creek, mostly within Maricopa County. A greater part of flood damage occurs within this county. Two watershed projects are planned, one of them extending into this area from area 32.

9.33-B SANTAN WATERSHED

9.33-B-1 General

Although located in Pinal County, the Santan Mountains contribute runoff affecting Maricopa County. The flood-producing area consists of steep mountains between contours 1300 and 3100. Many washes come from the north slopes of Santan Mountains into the level plain. Rainfall concentrates quickly and the washes flow to the north.

9.33-B-2 Development and Damages

The flood plain area is trapezoidal and elongated in the east-west direction. About one-fourth of the area is irrigated with well water. Principal urban area is Chandler Heights. Water flows across developed areas every year, causing damage to roads, irrigation works, and the land.

9.33-B-3 Plan

Overall plan consists of a system of detention levees and floodways to intercept and carry the water from mountain areas to Queen Creek. There will be 4 retarding structures and 4 floodways. Each levee will have uncontrolled outlets of a size suitable to discharge a predetermined amount of water into the floodways. See Tables 9.33-1 and 9.33-B, and Map 9.33-A.

9.33-C QUEEN CREEK FLOODWAY

9.33-C-1 General

Floodwaters released by the proposed projects in the southeastern part of Maricopa County are directed into the Roosevelt Water Conservation District Floodway. Water from lower Queen Creek also empties into this floodway.

All of this water is then carried on to the Gila River Indian Reservation in the NW¼, Sec. 4, T3S, R6E. Actual flood volumes, however, will be much less than in the past because water will be released in controlled amounts. This control will be effected by the retarding structures plus Whitlow Ranch Dam.

This planned floodway will carry a controlled flow of approximately 7,000 cfs to the Gila River.

9.33-C-2 Development and Damages

Located below the point of release of this water are many homes, schools and churches, as well as 3,000 acres of cultivated land and irrigation facilities. All of these would be subject to flood damage.

9.33-C-3 Plan

The plan for disposal of this floodwater consists of an earth channel beginning in the NW¼, Sec. 4, T3S, R6E, running generally southwest to a point just above the Gila Butte; then south into Gila River. Existing bridge at Highway 87 will have to be widened and a new bridge will be required on Highway 387.

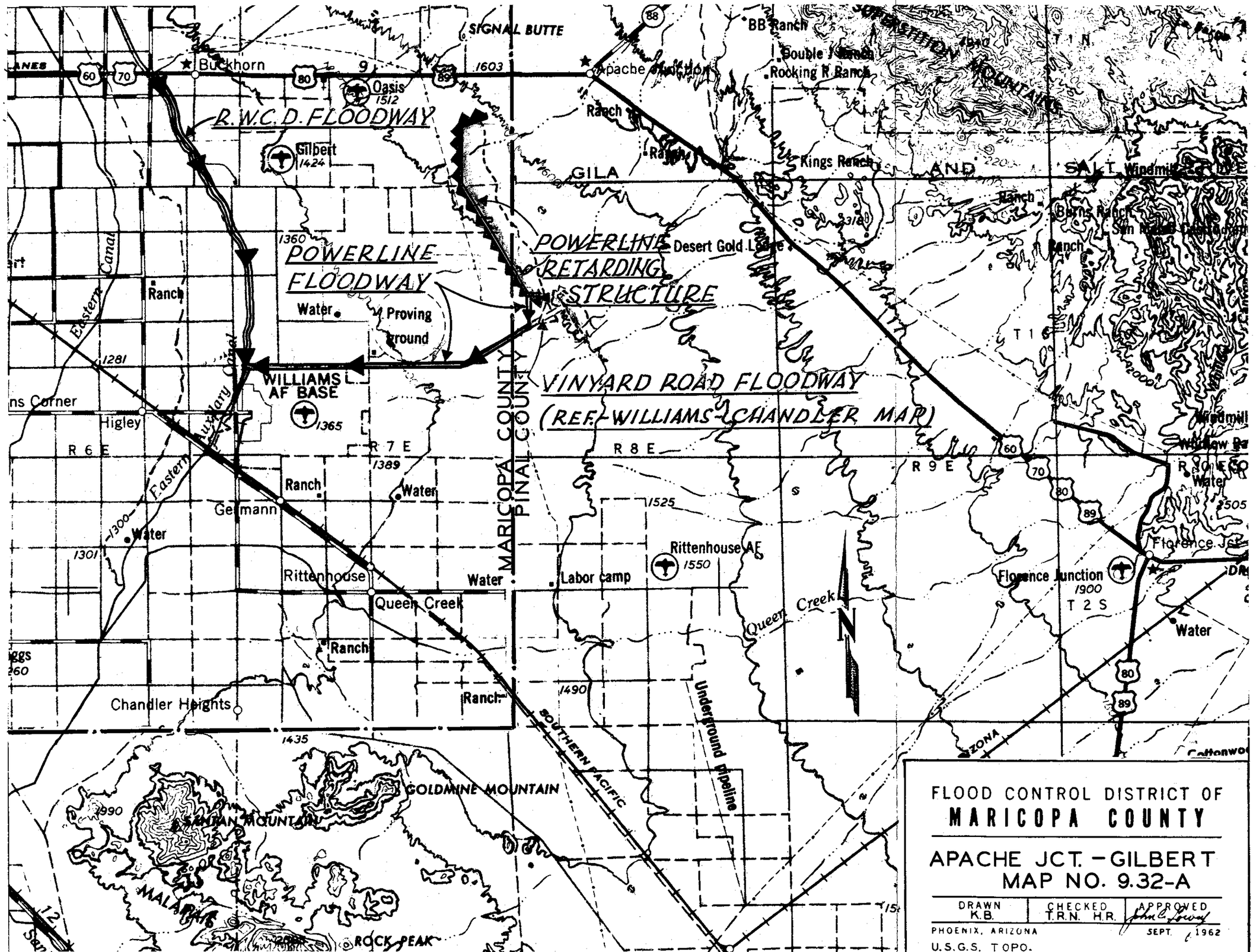
Channel will be approximately 7.6 miles long and vary from 150 to 400 ft. in width. Discharge capacity will be 7200 cfs. Excavation will be used to build a dike along each side of the channel. Table 9.33-C shows structural data; Map 9.33-B shows planned location and extent.

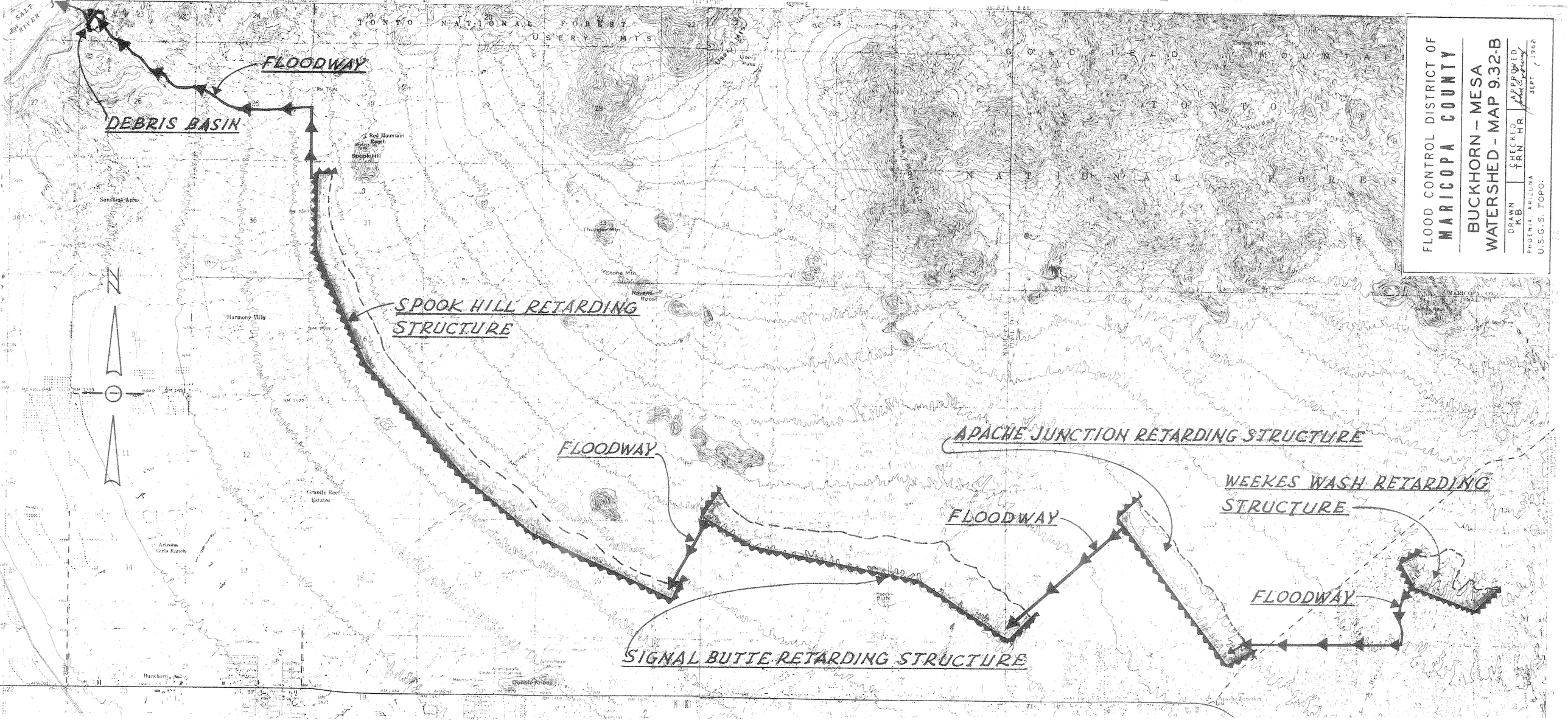
9.34 UPPER QUEEN CREEK AREA

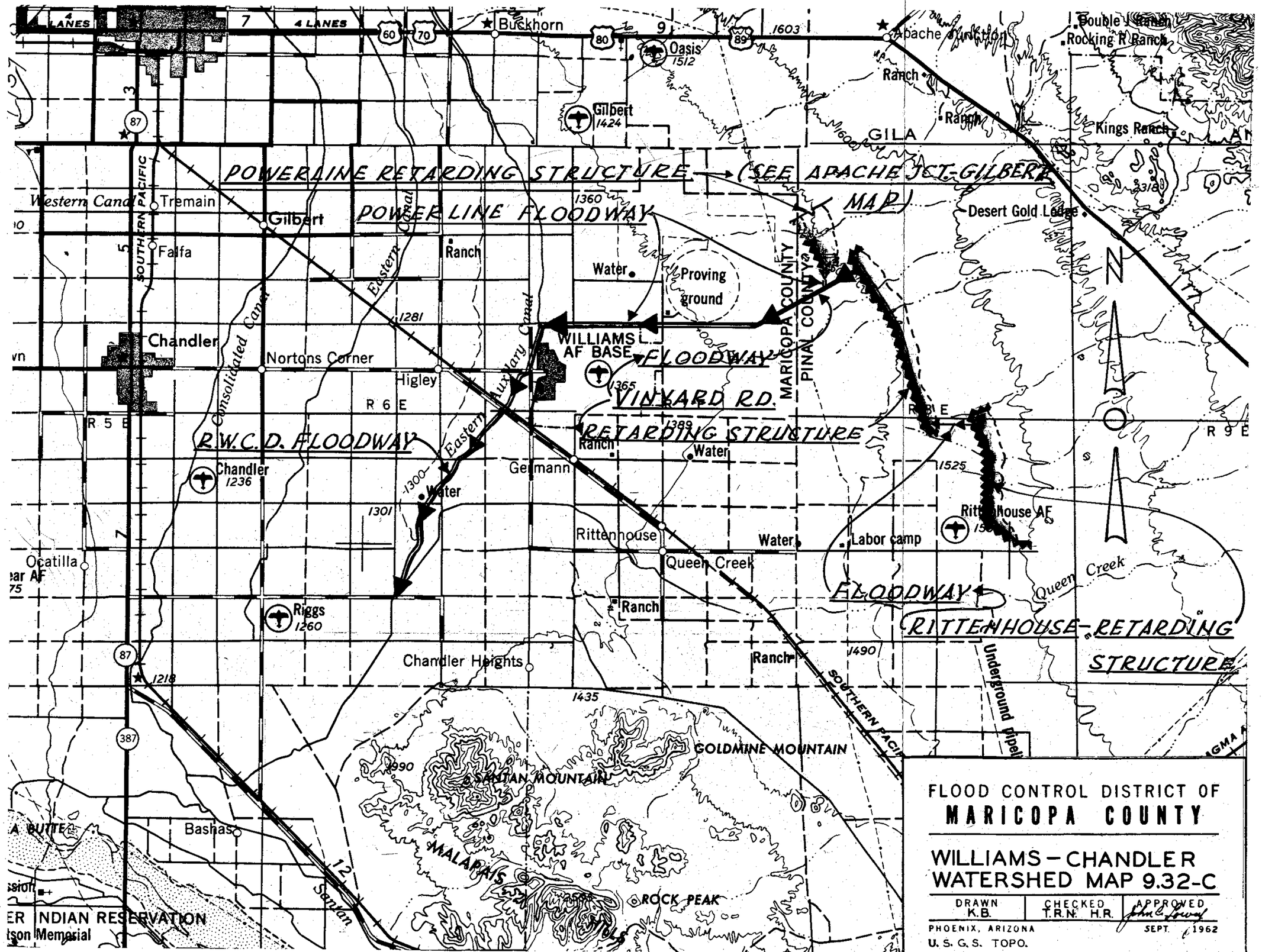
The Upper Queen Creek Area, above Whitlow Dam, is in Pinal County southeast of Apache Junction. The construction of Whitlow Ranch Dam by the Corps of Engineers has eliminated much of the previous flood conditions.

TABLE 9.33-1 SANTAN WATERSHED SUMMARY

No.	Job Description	Estimated Cost Flood Control Dist.	S.C.S.
1	Hunt Highway Retarding Basin	205,000	520,000
2	Gold Mine Retarding Basin	124,000	195,000
3	Earth Crack Retarding Basin	124,000	195,000
4	Chandler Heights Retarding Basin	204,000	650,000
5	Hunt Highway Floodway	12,000	260,000
6	Gold Mine Floodway	11,000	104,000
7	Earth Crack Floodway	11,000	104,000
8	Chandler Heights Floodway	204,000	650,000
	Total	$895,000	$2,678,000
	Total Project Cost	$3,573,000	
	Flood Damage without Project		200,000
	Flood Damage with Project		100,000
	Benefits from Reduction of Flood Damage		100,000
	Total Annual Benefits		100,000
	Total Project Cost Amortized @ 2⅝ %		129,000
	Annual Operation and Maintenance		16,000
	Total Annual Cost		145,000
	Benefit-Cost Ratio	0.70 to 1.00	


SIGNAL BUTTE
Buckhorn
Oasis
1512
1603
R.W.C.D. FLOODWAY
Gilbert
1424
POWERLINE
FLOODWAY
1360
Water
Proving
ground
Ranch
Eastern Canal
1281
WILLIAMS
AF BASE
1365
ns Corner
Higley
R 6 E
R 7 E
1389
Ranch
Water
Eastern Auxiliary Canal
Gelmann
1300
Water
1301
Rittenhouse
Water
Queen Creek
Ranch
Ranch
Chandler Heights
1435
MARICOPA COUNTY
PINAL COUNTY
1525
Rittenhouse AF
1550
Labor camp
Queen Creek
1490
SOUTHERN PACIFIC
Underground pipeline
GOLDMINE MOUNTAIN
SANTAN MOUNTAIN
1990
MALAPAI
ROCK PEAK
2088
Apache Junction
BB Ranch
Double J Ranch
Rocking R Ranch
SUPERSTITION MOUNTAINS
Ranch
Kings Ranch
GILA AND SALT
Windmill
Ranch
Burns Ranch
POWERLINE
RETARDING
STRUCTURE
Desert Gold Lodge
VINYARD ROAD FLOODWAY
(REF. WILLIAMS-CHANDLER MAP)
T 1 N
T 1 S
R 8 E
R 9 E
R 10 E
Florence Jct.
Florence Junction
1900
T 2 S
Water
2505
N
ARIZONA
Cottonwood
FLOOD CONTROL DISTRICT OF
MARICOPA COUNTY
APACHE JCT. - GILBERT
MAP NO. 9.32-A
DRAWN K.B.
CHECKED T.R.N. H.R.
APPROVED
PHOENIX, ARIZONA
SEPT. 1962
U.S.G.S. TOPO.


FLOODWAY
DEBRIS BASIN
SPOOK HILL RETARDING STRUCTURE
FLOODWAY
APACHE JUNCTION RETARDING STRUCTURE
WEEKES WASH RETARDING STRUCTURE
FLOODWAY
FLOODWAY
SIGNAL BUTTE RETARDING STRUCTURE
TONTO NATIONAL FOREST
USERY MTS
GOLDFIELD MOUNTAINS
TONTO NATIONAL FOREST
Red Mountain Ranch
Spook Hill
Sunflings Acres
Thunder Mtn.
Stone Mtn.
Ravens Roost
Harmony Hills
Granite Reef Estates
Arizona Girls Ranch
Buckhorn
Double Knolls
Apache Junction
N
FLOOD CONTROL DISTRICT OF
MARICOPA COUNTY
BUCKHORN – MESA
WATERSHED – MAP 9.32-B
DRAWN KB
CHECKED TRN HR
APPROVED
PHOENIX, ARIZONA
SEPT. , 1962
U.S.G.S. TOPO.



FLOOD CONTROL DISTRICT OF
MARICOPA COUNTY

WILLIAMS – CHANDLER WATERSHED MAP 9.32-C

DRAWN	CHECKED	APPROVED
K.B.	T.R.N. H.R.	

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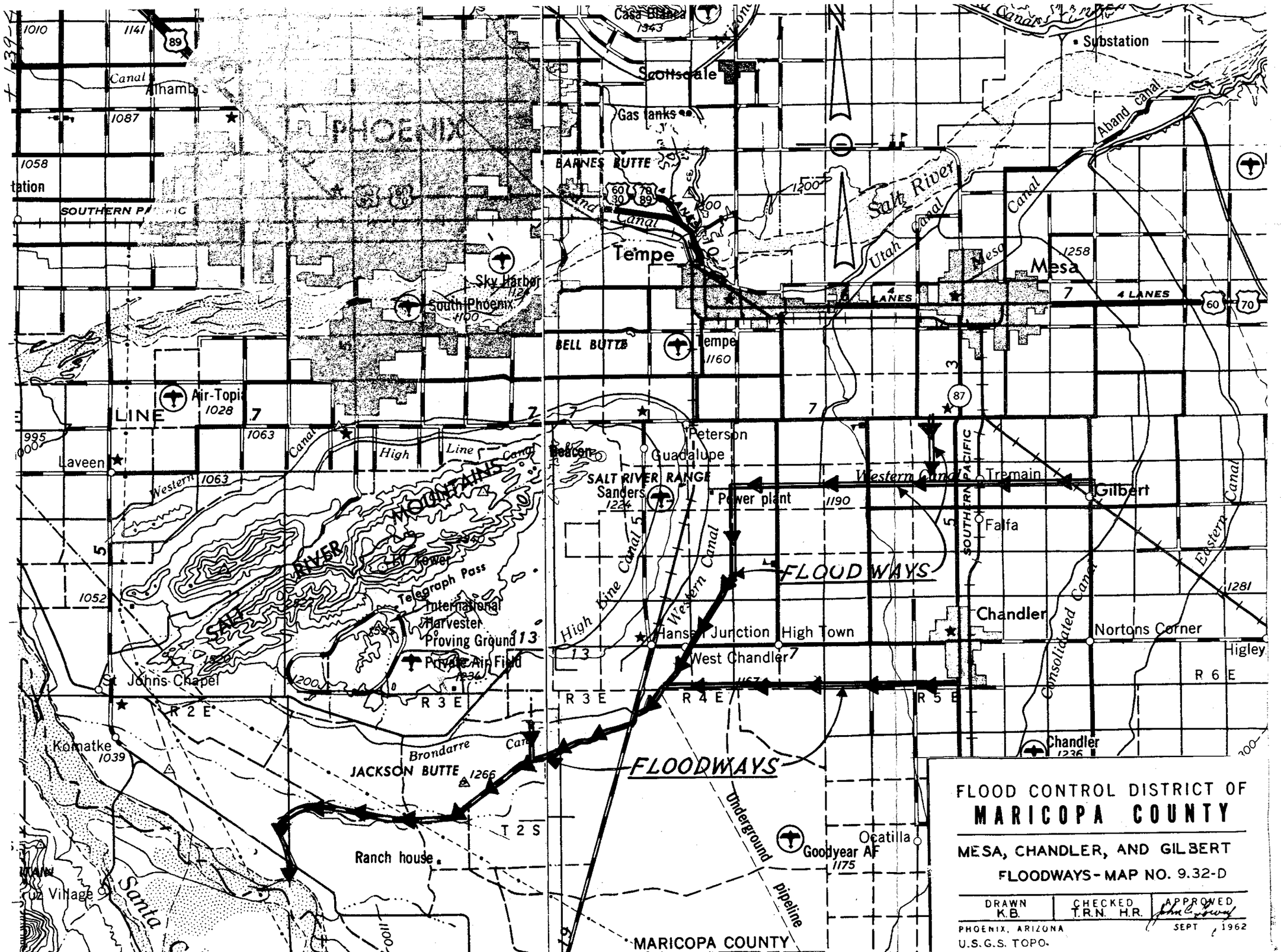

FLOOD CONTROL DISTRICT OF
MARICOPA COUNTY

MESA, CHANDLER, AND GILBERT
FLOODWAYS - MAP NO. 9.32-D

DRAWN	CHECKED	APPROVED
K.B.	T.R.N. H.R.	

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TABLE 9.33-A **STRUCTURAL DATA**

SANTAN WATERSHED

Retarding Basins

No.	Item	Units	Structures Hunt Highway	Goldmine	Earth Crack	Chandler Heights
1	Drainage Area	sq. mi.	8.8	1.3	1.2	7
2	Sediment Capacity	ac. ft.	150	10	10	50
3	Flood Water Capacity	ac. ft.	1,050	190	190	800
4	Total Storage Capacity	ac. ft.	1,200	200	200	850
5	Total Surface Area	acres	300	132	145	273
6	Length	mi.	3	1	1	2.3
7	Maximum Ht.	ft.	18	15	16	24
8	Total Volume Of Fill	cu. yd.	490,000	138,000	150,000	480,000
9	Principal Spillway Size	in.	54	54	54	54
10	Maximum Release Rate	cfs	300	350	300	350
		Cost Distribution				
11	Total Construction Cost		$520,000	$195,000	$195,000	$650,000
12	Contract Admin.		5,000	4,000	4,000	4,000
13	Right of Way		200,000	120,000	120,000	200,000
14	Relocations and other Costs		0	0	0	0
15	Flood Control Dist. Cost		205,000	124,000	124,000	204,000
16	Total Project Cost		725,000	319,000	319,000	854,000

TABLE 9.33-B **STRUCTURAL DATA**

SANTAN WATERSHED FLOODWAYS

No.	Item	Units	Structures Hunt Highway	Goldmine	Earth Crack	Chandler Heights
1	Maximum Discharge	cfs	250	300	350	400
2	Length	ft.	5,200	2,000	2,000	21,120
3	Av. Bottom Width	ft.	10	10	10	10
4	Av. Depth	ft.	4.2	4.2	4.2	4
5	Av. Side Slope		1:1	1:1	1:1	1:1
6	Excavation	cu. yd.	15,000	6,000	6,000	45,000
7	Concrete	cu. yd.	2,000	800	800	5,000
		Cost Distribution				
8	Total Construction		$260,000	$104,000	$104,000	$650,000
9	Contract Admin.		2,000	1,000	1,000	4,000
10	Right of Way		10,000	10,000	10,000	200,000
11	Relocations and other		0	0	0	0
12	Flood Control Dist.		12,000	11,000	11,000	204,000
13	Total Project Cost		272,000	115,000	115,000	854,000

TABLE 9.33-C **STRUCTURAL DATA**

QUEEN CREEK FLOODWAY

No.	Item	Units	Quantity
1	Discharge Capacity	cfs	7,200
2	Length	ft.	40,000
3	Av. Bottom Width	ft.	2,750
4	Av. Depth	ft.	5.2
5	Av. Side Slope		2:1
6	Excavation	cu. yd.	1,760,000
7	Concrete	cu. yd.	—
	Cost Distribution		
8	Total Construction Cost		$ 880,000
9	Contract Administration		20,000
10	Right of Way		50,000
11	Relocations and other costs		850,000
12	Flood Control District Cost		920,000
13	Total Project Cost		1,800,000

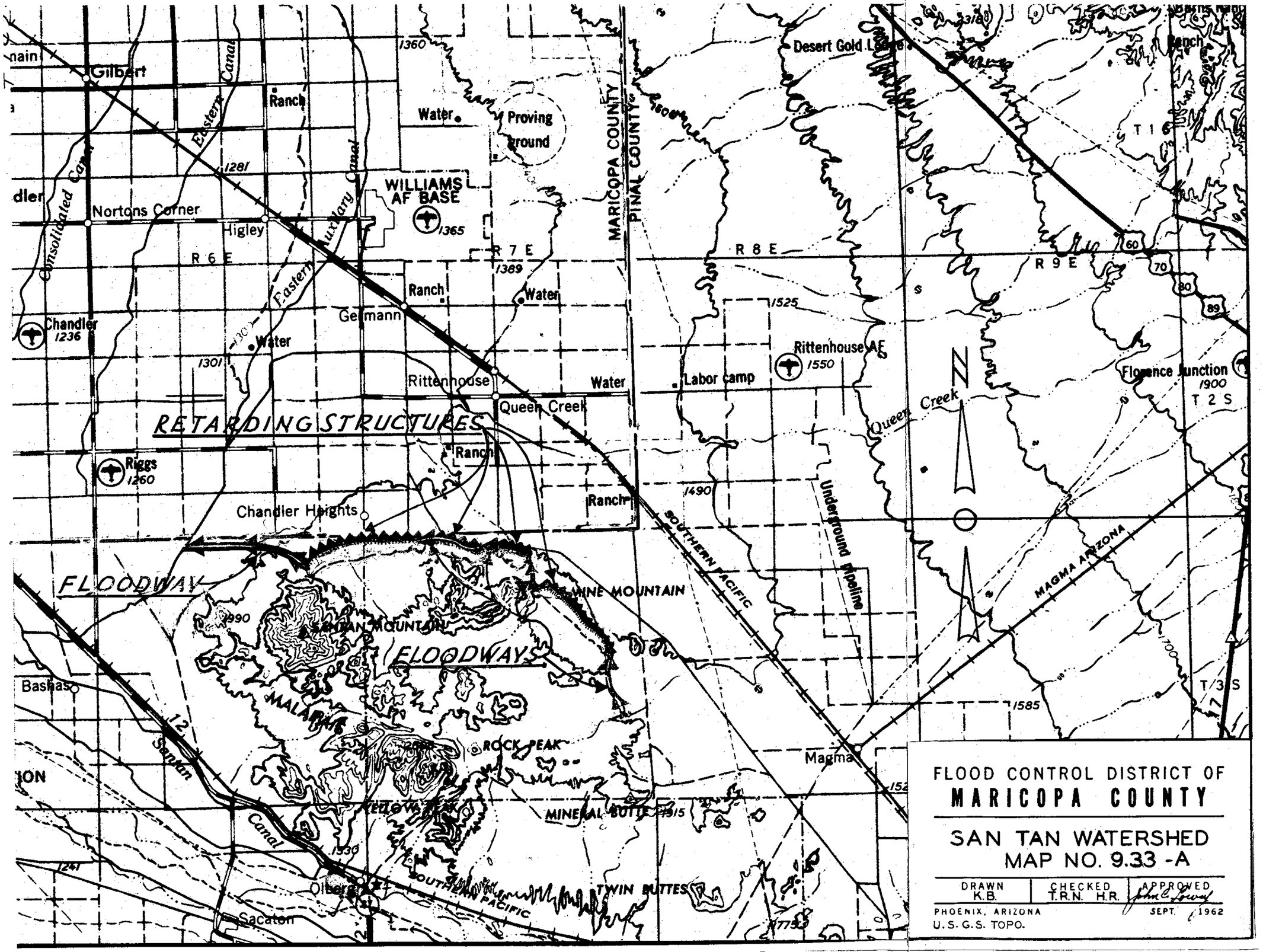
The topography is steep, rocky mountains that produce a high rate of runoff. There are many well-defined channels that carry flood water at high velocities. At present there is little development and minor damage has occurred here. No flood control measures are planned. Future economic developments may warrant further consideration of protective measures.

9.35 UPPER SALT RIVER AREA

The Upper Salt River Area is in eastern Maricopa County, mostly outside the County. Total area is 6,232 sq. miles and this is the largest single area covered in this report. The flood problem is virtually under control, mostly due to the reservoirs located on Salt River.

Topography varies from low brush-covered hills to high timber-covered mountains. Runoff is much less per unit than in the desert country at lower elevation. Snow-melt contributes to the runoff here and the proper conditions could cause a major flood.

This is virtually an undeveloped area except for recreation facilities. Because of this, there has been little damage reported and at present, no major flood control structures are planned. Future economic growth may necessitate further study of flood control problems here.



FLOOD CONTROL DISTRICT OF
MARICOPA COUNTY

SAN TAN WATERSHED
MAP NO. 9.33 -A

DRAWN	CHECKED	APPROVED
K.B.	T.R.N. H.R.	John C. Lowry

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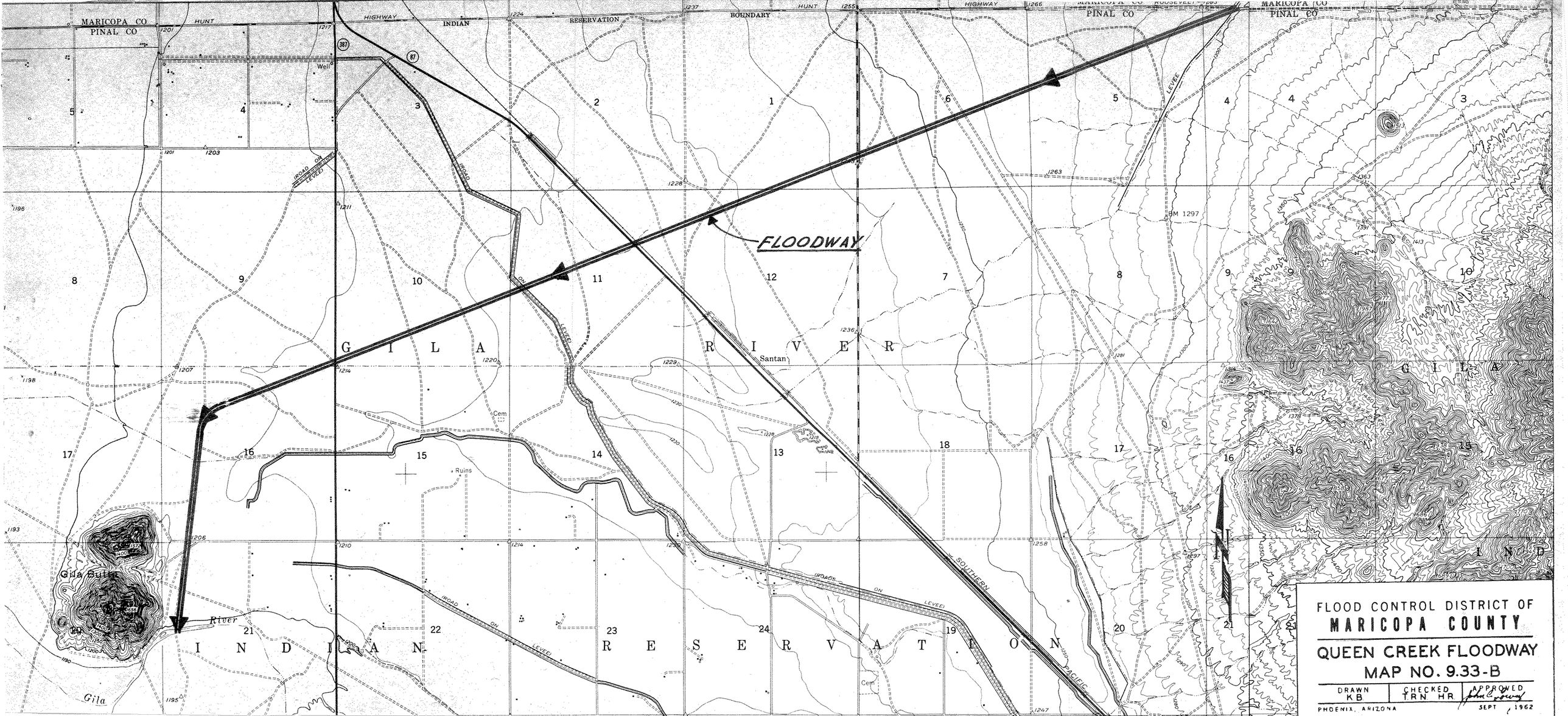

FLOOD CONTROL DISTRICT OF
MARICOPA COUNTY

QUEEN CREEK FLOODWAY
MAP NO. 9.33-B

DRAWN	CHECKED	APPROVED
KB	TRN HR	

PHOENIX, ARIZONA — SEPT 1962