

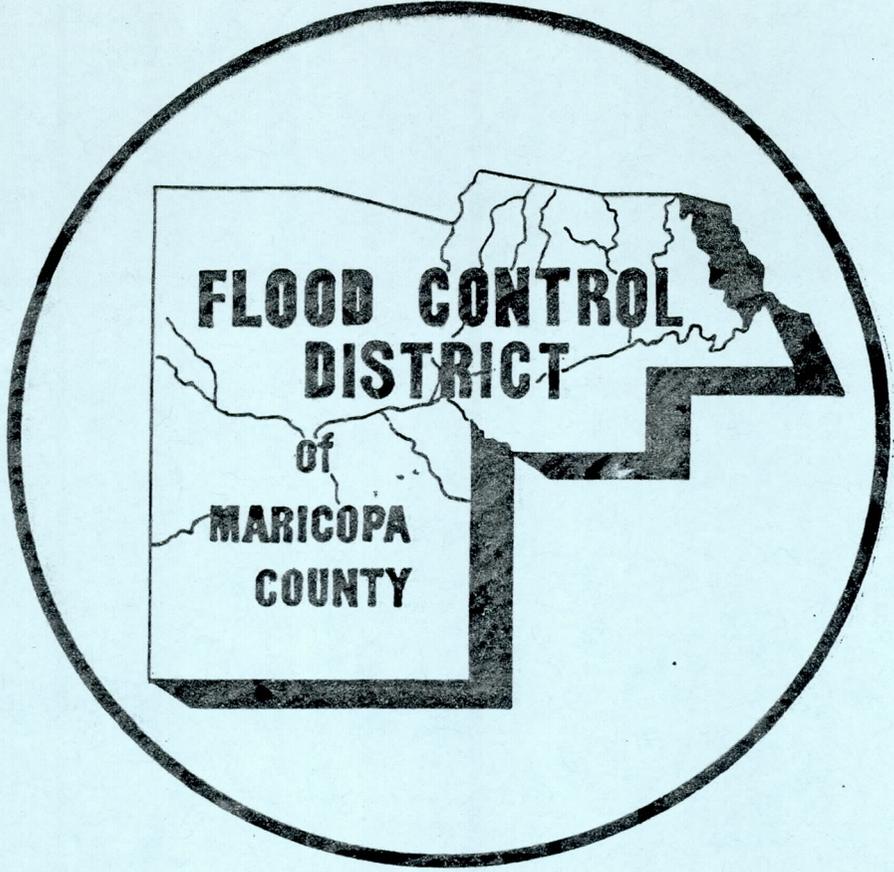


# FLOOD CONTROL DISTRICT of Maricopa County

3335 West Durango Street • Phoenix, Arizona 85009  
Telephone (602) 262-1501

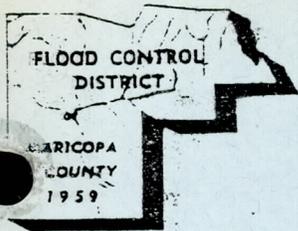
BOARD of DIRECTORS  
Tom Freestone, Chairman  
George L. Campbell  
Carole Carpenter  
Fred Koory, Jr.  
Ed Pastor

D. E. Sagramoso, P.E., Chief Engineer and General Manager



## ARIZONA CANAL DIVERSION CHANNEL REACHES 3 and 4

*TOUR of City of Phoenix A.C.D.C. Task Force  
July 27, 1985*



# FLOOD CONTROL DISTRICT

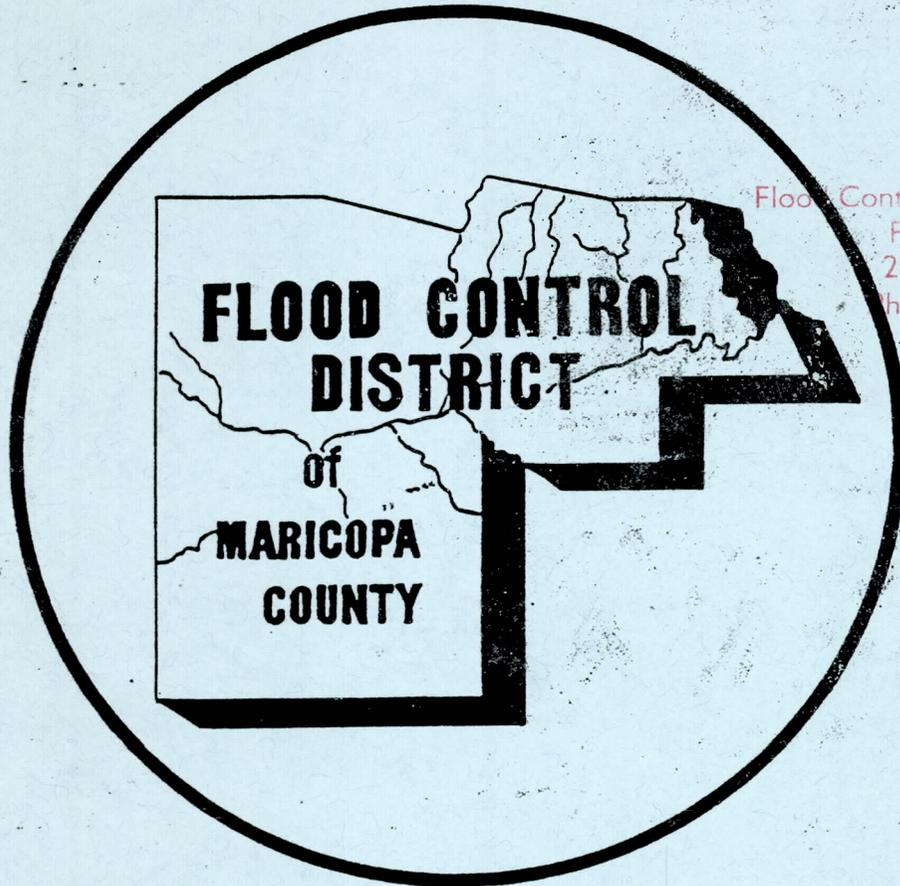
of

Maricopa County

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D. E. Sagramoso, P.E., Chief Engineer and General Manager

BOARD of DIRECTORS  
Tom Freestone, Chairman  
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Carole Carpenter  
Fred Koory, Jr.  
Ed Pastor



Property of  
Flood Control District of MC Library  
Please Return to  
2001 W. Durango  
Phoenix, AZ 85009

## ARIZONA CANAL DIVERSION CHANNEL REACHES 3 and 4

*TOUR of City of Phoenix A.C.D.C. Task Force  
July 27, 1985*

ARIZONA CANAL DIVERSION CHANNEL  
(ACDC)  
REACHES 3 & 4

TOUR of City of Phoenix ACDC Task Force  
July 27, 1985

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PHOENIX, ARIZONA AND VICINITY  
(INCLUDING NEW RIVER)

PERTINENT DATA ON  
THE ARIZONA CANAL DIVERSION CHANNEL

DESIGN FLOWS (100 year flood)	LOCATION	Q (CFS)
	Cudia City Wash	6700
	Below 16th Street	9300
	Below 10th Street	13,000
	Above Cave Creek	15,000
	Below Cave Creek	25,000
	Near 51st Avenue	26,000
	Above Skunk Creek	29,000

Design:	Configuration	Length	Dimension Range
	Concrete Retangular	11.6 miles	Base width 36' - 110' Height 20' - 25'
	Concrete Trapezoidal	1.2 miles	Base width 80' - 100' Height 20' - 21'
	Unlined	3.8 miles	Base width 220' Height 20' - 27'

Costs: (Oct 84 PB-3, ACDC only)

Flood Control	\$157,700,000
Recreation	10,650,000
Lands and Damages	94,760,000
Utilities	14,230,000
Roads and Bridges	26,310,000
	<u>303,650,000</u>

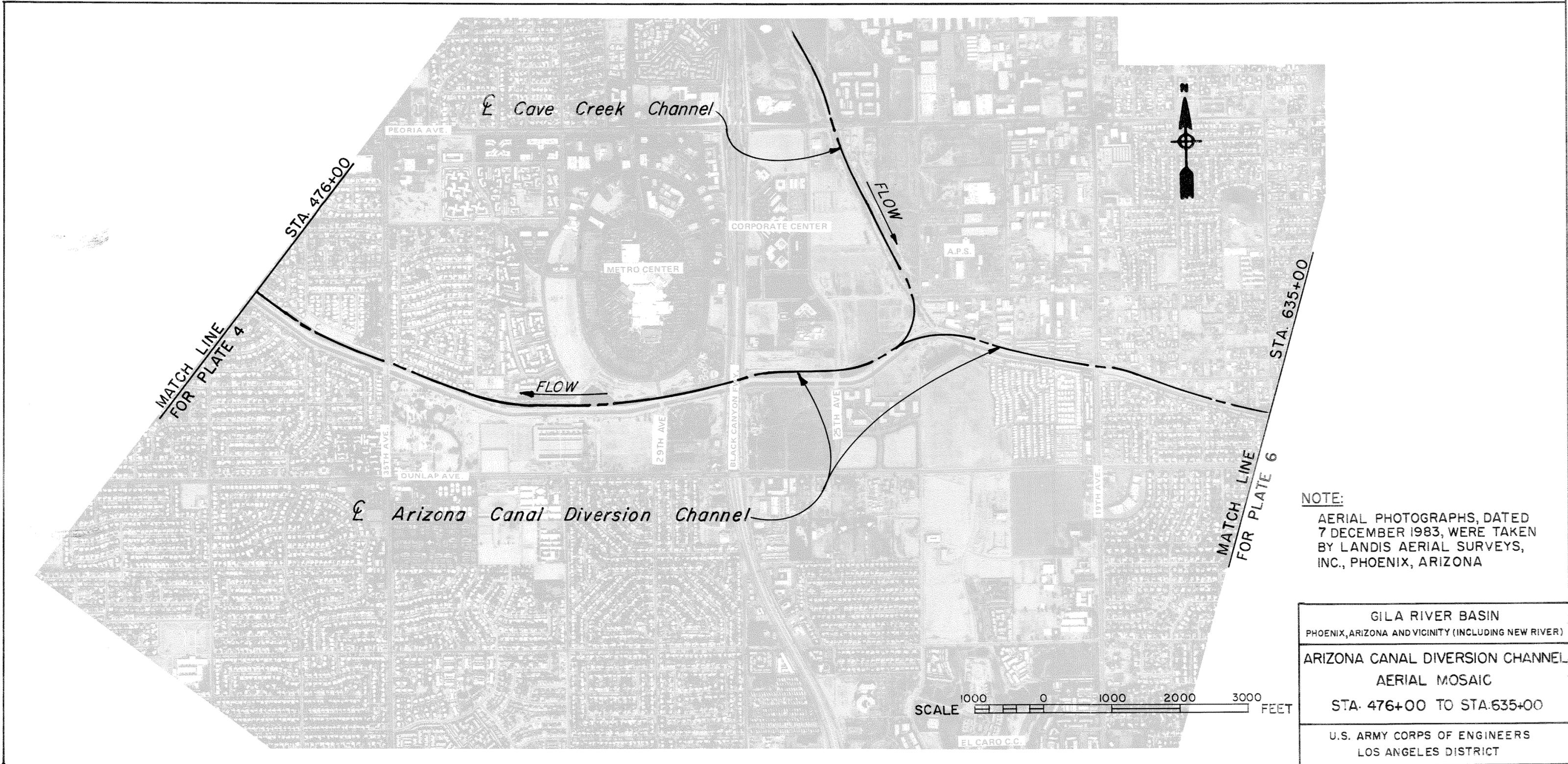
Design Schedule

Document	Draft	Final
GDM	Complete	Mar 85
FDM	Feb 85	Aug 85
P&S, Rch 1	Mar 85	Jun 85
P&S, Rch 2	Aug 86	Nov 86
P&S, Rch 3	Jan 88	May 88
P&S, Rch 4	Jul 89	Nov 89

Construction Period

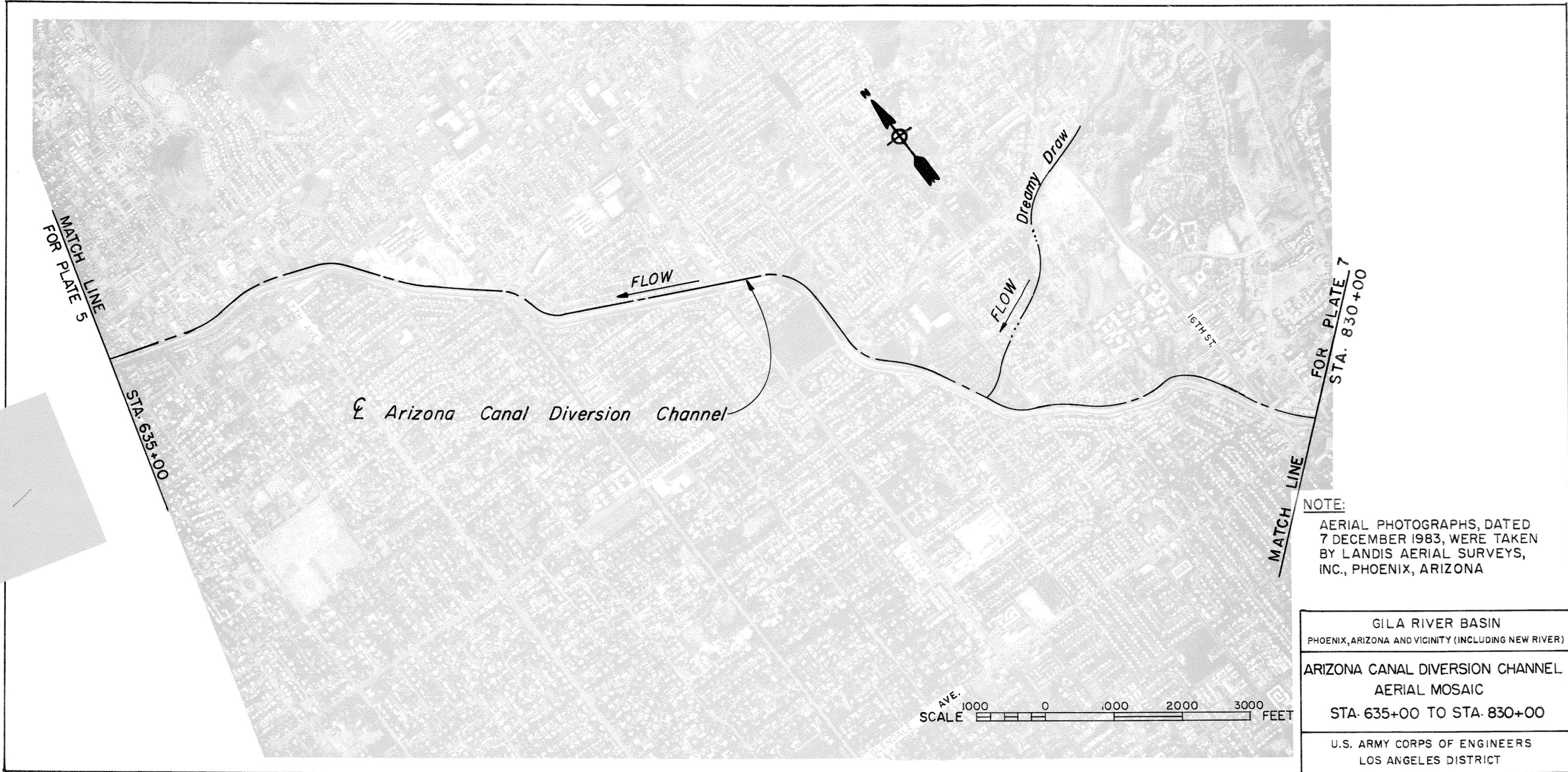
Reach 1	Aug 85 - Apr 87
Reach 2	Mar 87 - Jul 88
Reach 3	Jul 88 - Dec 89
Reach 4	Dec 89 - Jul 91





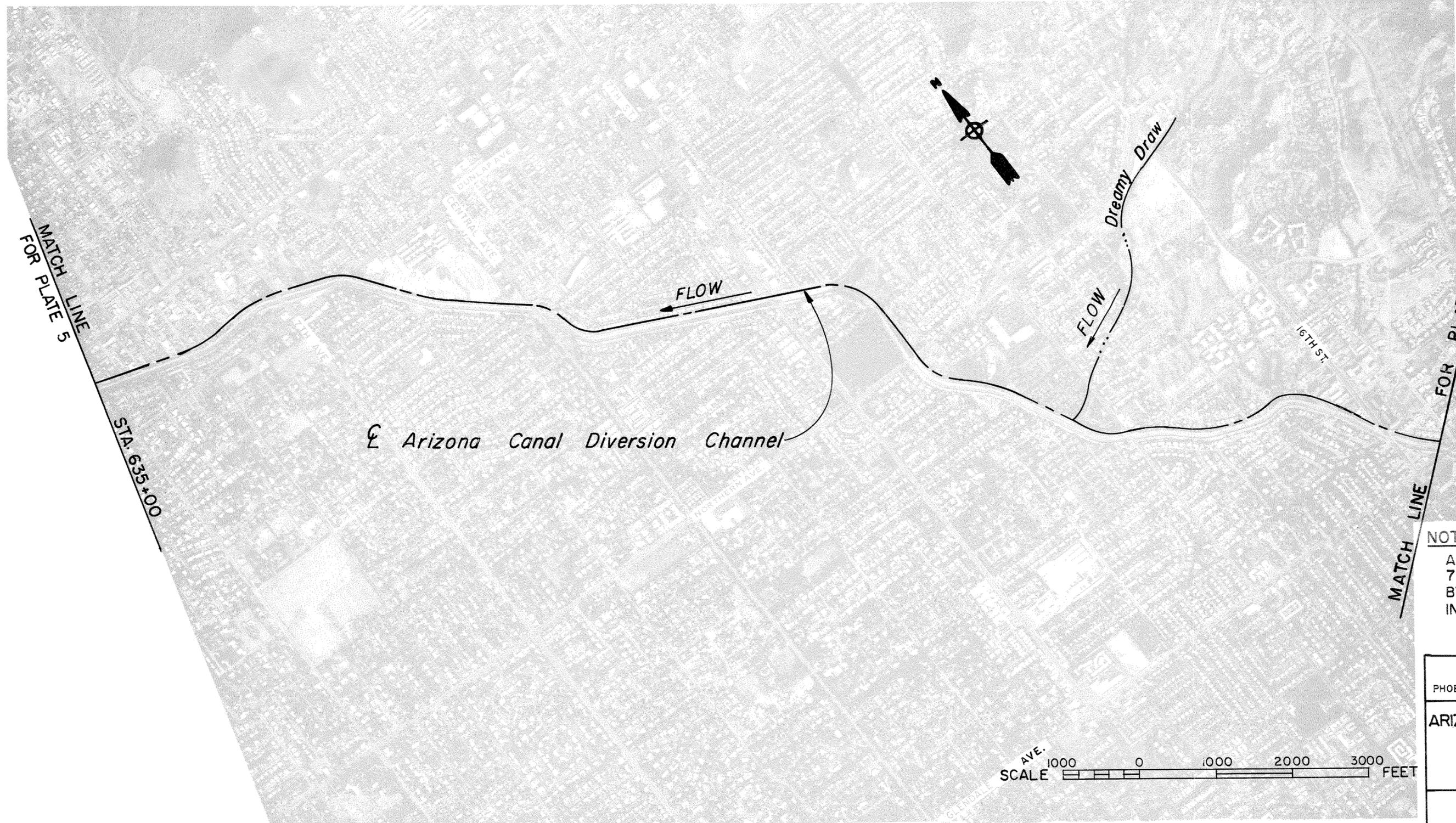
**NOTE:**  
 AERIAL PHOTOGRAPHS, DATED  
 7 DECEMBER 1983, WERE TAKEN  
 BY LANDIS AERIAL SURVEYS,  
 INC., PHOENIX, ARIZONA

GILA RIVER BASIN PHOENIX, ARIZONA AND VICINITY (INCLUDING NEW RIVER)
ARIZONA CANAL DIVERSION CHANNEL AERIAL MOSAIC STA. 476+00 TO STA. 635+00
U.S. ARMY CORPS OF ENGINEERS LOS ANGELES DISTRICT



NOTE:  
 AERIAL PHOTOGRAPHS, DATED  
 7 DECEMBER 1983, WERE TAKEN  
 BY LANDIS AERIAL SURVEYS,  
 INC., PHOENIX, ARIZONA

GILA RIVER BASIN PHOENIX, ARIZONA AND VICINITY (INCLUDING NEW RIVER)
ARIZONA CANAL DIVERSION CHANNEL AERIAL MOSAIC STA. 635+00 TO STA. 830+00
U.S. ARMY CORPS OF ENGINEERS LOS ANGELES DISTRICT



MATCH LINE  
FOR PLATE 5

STA. 635+00

Arizona Canal Diversion Channel

FLOW

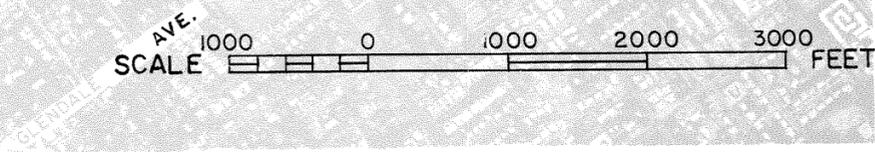
FLOW

Dreamy Draw

16TH ST.

NORTHERN AVE.

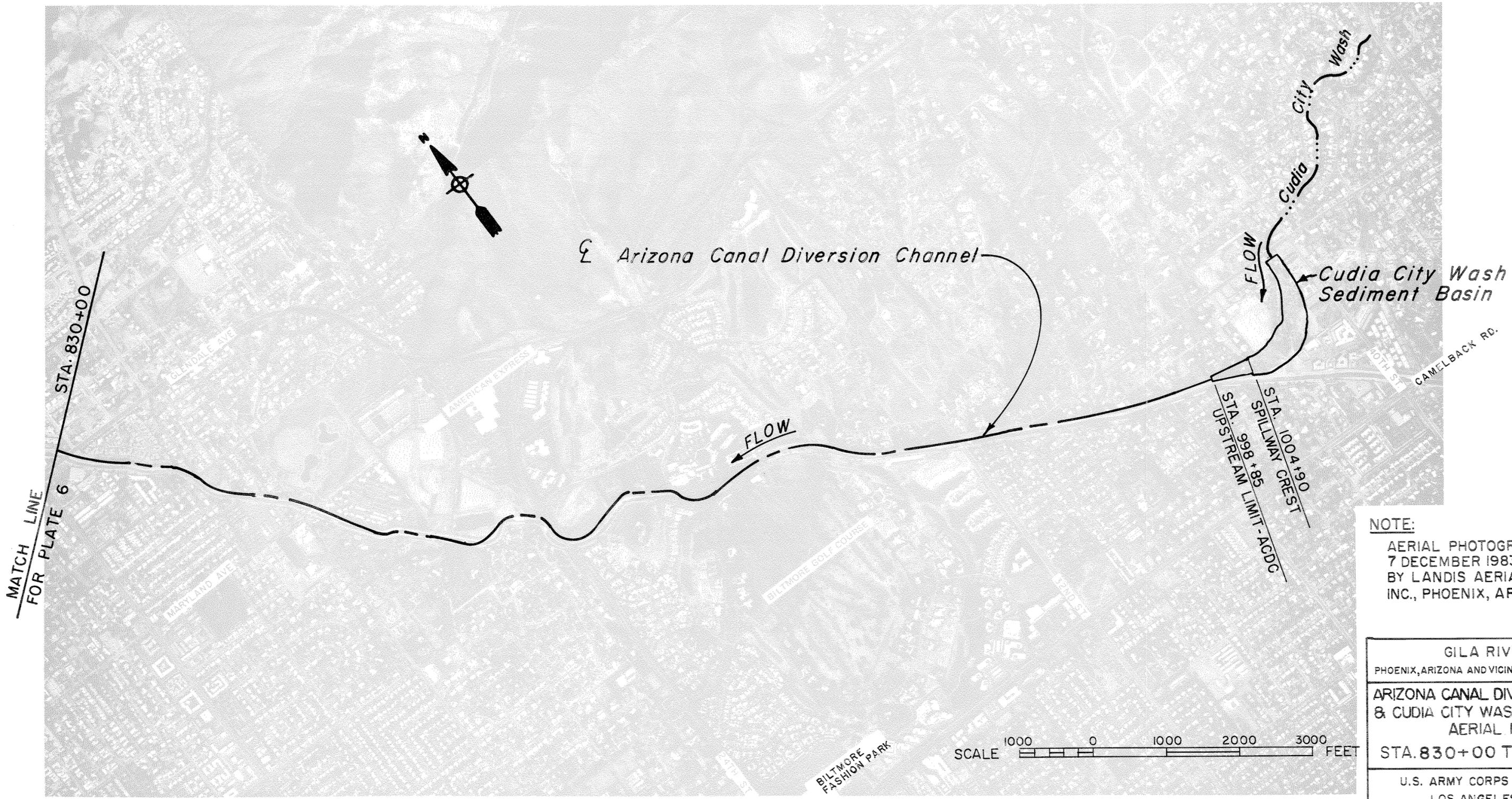
CENTRAL AVE.



MATCH LINE  
FOR PLATE 7  
STA. 830+00

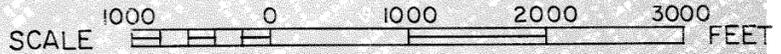
NOTE:  
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INC., PHOENIX, ARIZONA

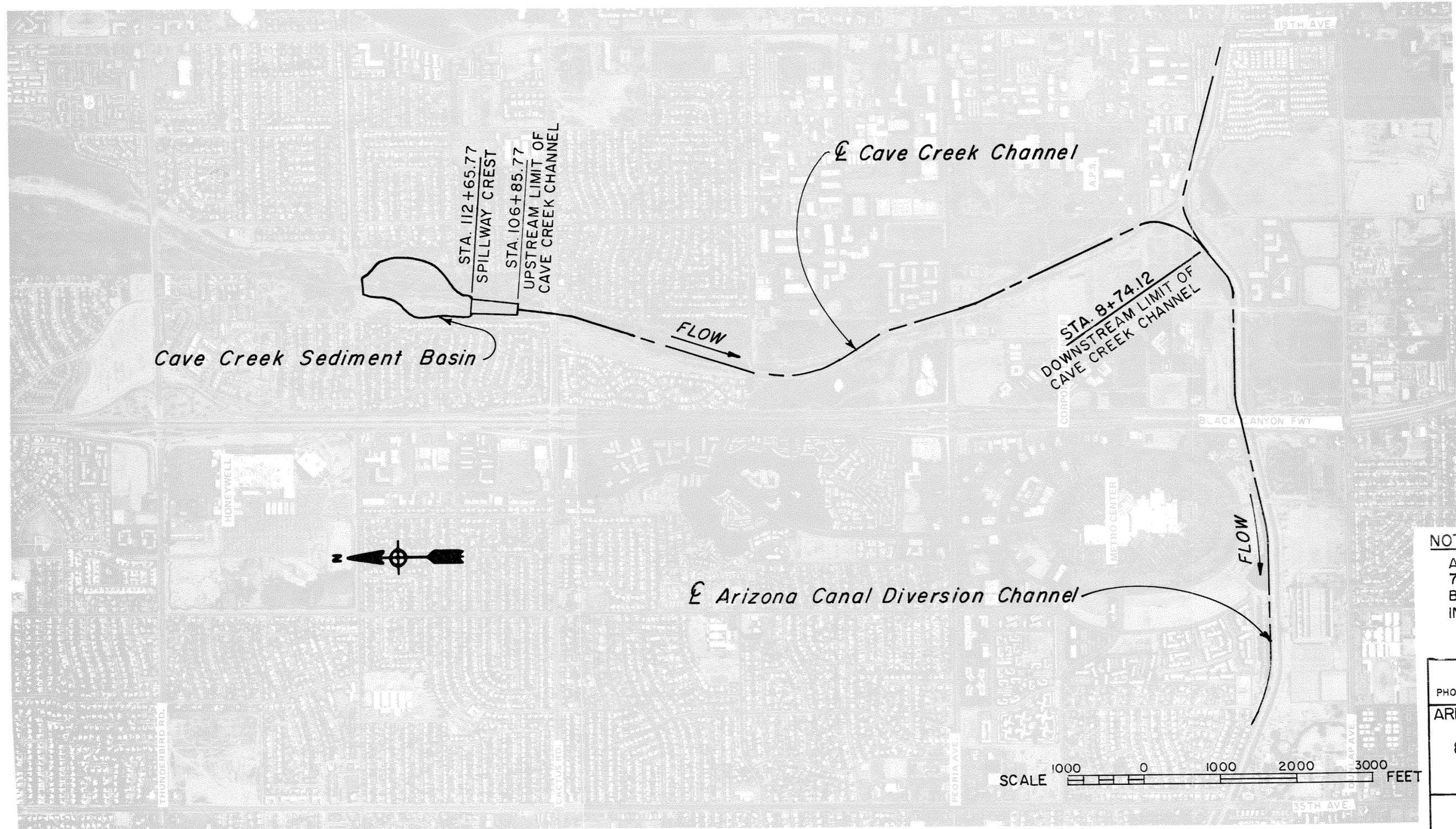
GILA RIVER BASIN PHOENIX, ARIZONA AND VICINITY (INCLUDING NEW RIVER)
ARIZONA CANAL DIVERSION CHANNEL AERIAL MOSAIC STA. 635+00 TO STA. 830+00
U.S. ARMY CORPS OF ENGINEERS LOS ANGELES DISTRICT



**NOTE:**  
 AERIAL PHOTOGRAPHS, DATED 7 DECEMBER 1983, WERE TAKEN BY LANDIS AERIAL SURVEYS, INC., PHOENIX, ARIZONA

GILA RIVER BASIN  
 PHOENIX, ARIZONA AND VICINITY (INCLUDING NEW RIVER)  
 ARIZONA CANAL DIVERSION CHANNEL & CUDIA CITY WASH SEDIMENT BASIN  
 AERIAL MOSAIC  
 STA. 830+00 TO STA. 998+85  
 U.S. ARMY CORPS OF ENGINEERS  
 LOS ANGELES DISTRICT





*Cave Creek Sediment Basin*



*FLOW*

*☒ Cave Creek Channel*

*STA. 8+74.12  
DOWNSTREAM LIMIT OF  
CAVE CREEK CHANNEL*

*FLOW*

*☒ Arizona Canal Diversion Channel*

SCALE 1000 0 1000 2000 3000 FEET

**NOTE:**

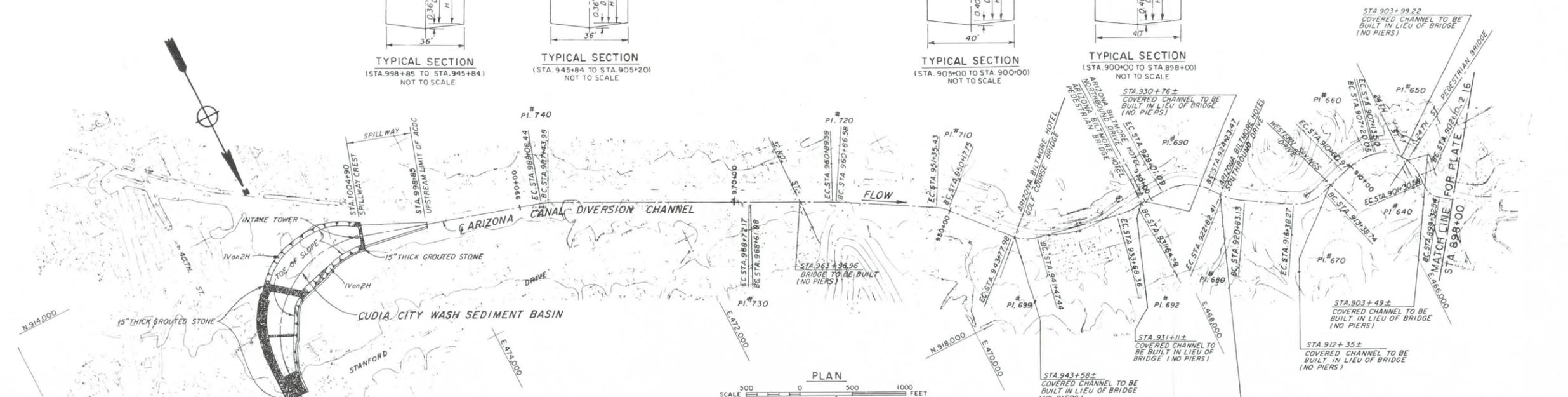
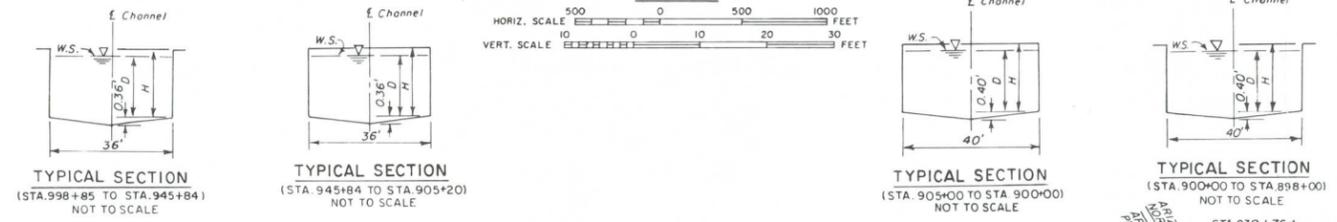
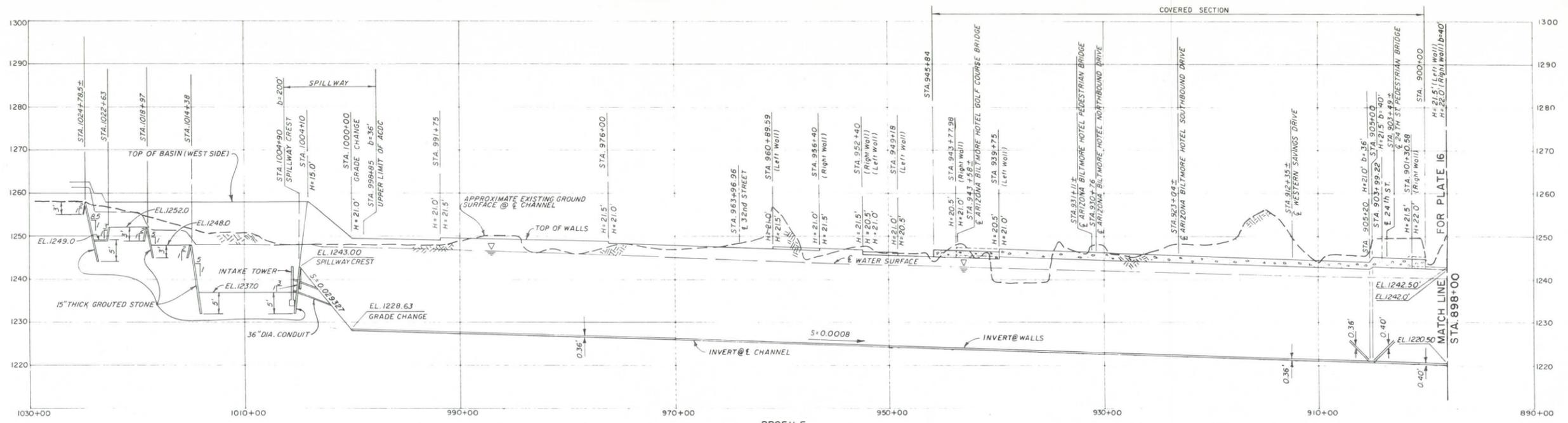
AERIAL PHOTOGRAPHS, DATED 7 DECEMBER 1983, WERE TAKEN BY LANDIS AERIAL SURVEYS, INC., PHOENIX, ARIZONA

GILA RIVER BASIN PHOENIX, ARIZONA AND VICINITY (INCLUDING NEW RIVER)
ARIZONA CANAL DIVERSION CHANNEL CAVE CREEK CHANNEL & CAVE CREEK SEDIMENT BASIN AERIAL MOSAIC STA. 8+74.12 TO STA. 101+56.33
U.S. ARMY CORPS OF ENGINEERS LOS ANGELES DISTRICT





# VALUE ENGINEERING PAYS



7900  
6200  
8000  
6300

HYDRAULIC ELEMENTS											
STATION TO STATION	SECTION	SLOPE	Q (cfs)	Dc (ft)	K=0.007 ft			K=0.002 ft			
					n	d <sub>0</sub>	Vel	n	D <sub>b</sub>	Vel	
998+85	987+00	Rect b=36'	6870	10.4	0.016	20.9	9.1	0.014	19.2	9.9	
987+00	982+00	Rect b=36'	7130	10.7	0.016	21.0	9.4	0.014	19.3	10.3	
982+00	976+00	Rect b=36'	7390	11.0	0.016	21.0	9.8	0.014	19.2	10.7	
976+00	971+00	Rect b=36'	7640	11.2	0.016	20.9	10.2	0.014	19.1	11.1	
971+00	952+84	Rect b=36'	7900	11.5	0.016	20.8	10.5	0.014	19.0	11.5	
952+84	905+20	Rect b=36'	8300	11.8	0.016	20.9	11.0	0.014	18.9	12.2	
905+20	905+00	TRANSITION	8300	11.0	0.016	21.0	10.3	0.014	19.1	11.6	
905+00	898+00	Rect b=40'	8300	11.0	0.016	21.7	9.5	0.014	20.5	10.1	

a. Used to determine wall heights  
b. Used to compute plotted water surface profile

DATUM IS NATIONAL GEODETIC VERTICAL DATUM OF 1929

GILA RIVER BASIN  
PHOENIX, ARIZONA AND VICINITY (INCLUDING NEW RIVER)

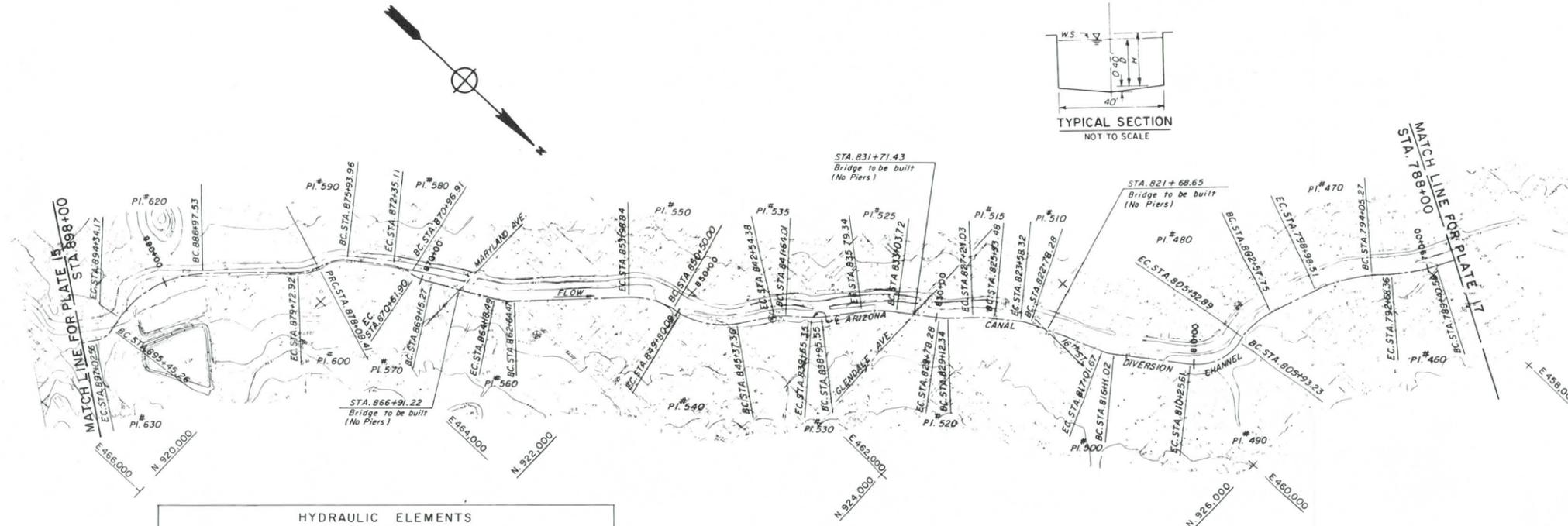
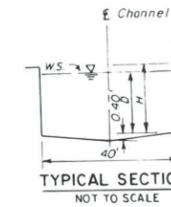
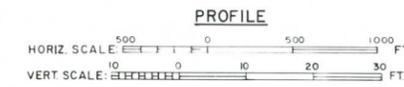
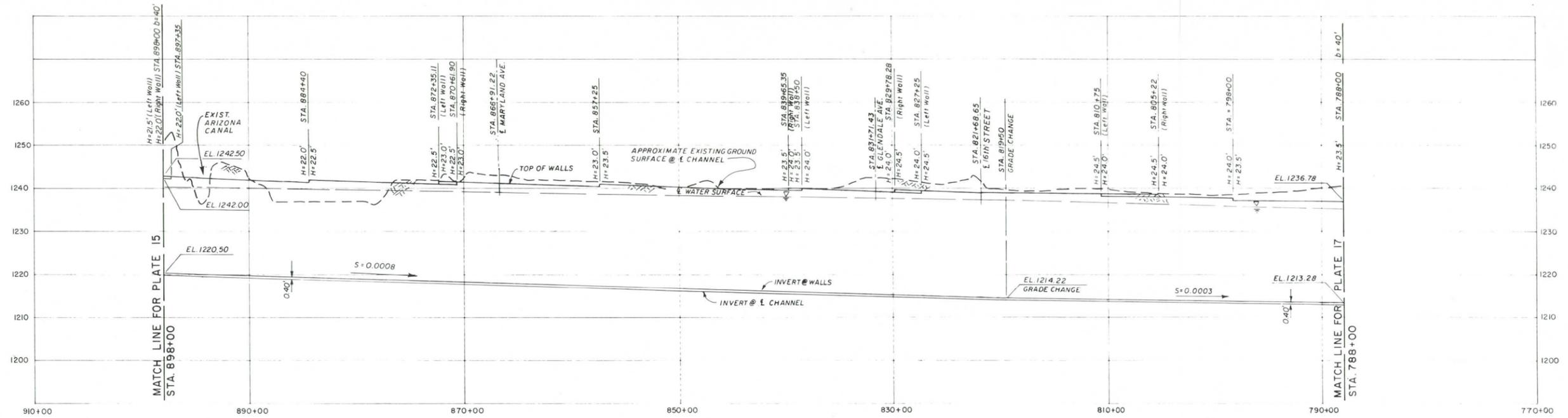
ARIZONA CANAL DIVERSION CHANNEL  
& CUDIA CITY WASH SEDIMENT BASIN

HYDRAULIC PLAN AND PROFILE  
STA. 998+85 TO STA. 898+00

U.S. ARMY CORPS OF ENGINEERS  
LOS ANGELES DISTRICT

# SAFETY PAYS

# VALUE ENGINEERING PAYS



HYDRAULIC ELEMENTS										
STATION TO STATION	SECTION	SLOPE	Q (cfs)	Dc (ft)	K = .007 ft.			K = .002 ft.		
					n	Vel	D <sub>50</sub>	n	Vel	D <sub>50</sub>
898+00 - 855+00	Rect. b=40'	0.0008	8300	11.0	0.016	21.7	9.5	0.014	20.5	10.1
855+00 - 819+50	Rect. b=40'	0.0008	8700	11.4	0.016	23.5	9.2	0.014	21.9	9.9
819+50 - 815+59	Rect. b=40'	0.0003	8700	11.4	0.016	24.3	8.9	0.014	22.6	9.6
815+59 - 812+00	Rect. b=40'	0.0003	9000	11.6	0.016	24.2	9.3	0.014	22.5	10.0
812+00 - 798+41	Rect. b=40'	0.0003	9230	11.8	0.016	23.8	9.7	0.014	22.1	10.4
798+41 - 788+00	Rect. b=40'	0.0003	9440	12.0	0.016	23.3	10.1	0.014	21.5	11.0

a. Used to determine wall heights.  
 b. Used to compute plotted water surface profile.



DATUM IS NATIONAL GEODETIC VERTICAL DATUM OF 1929

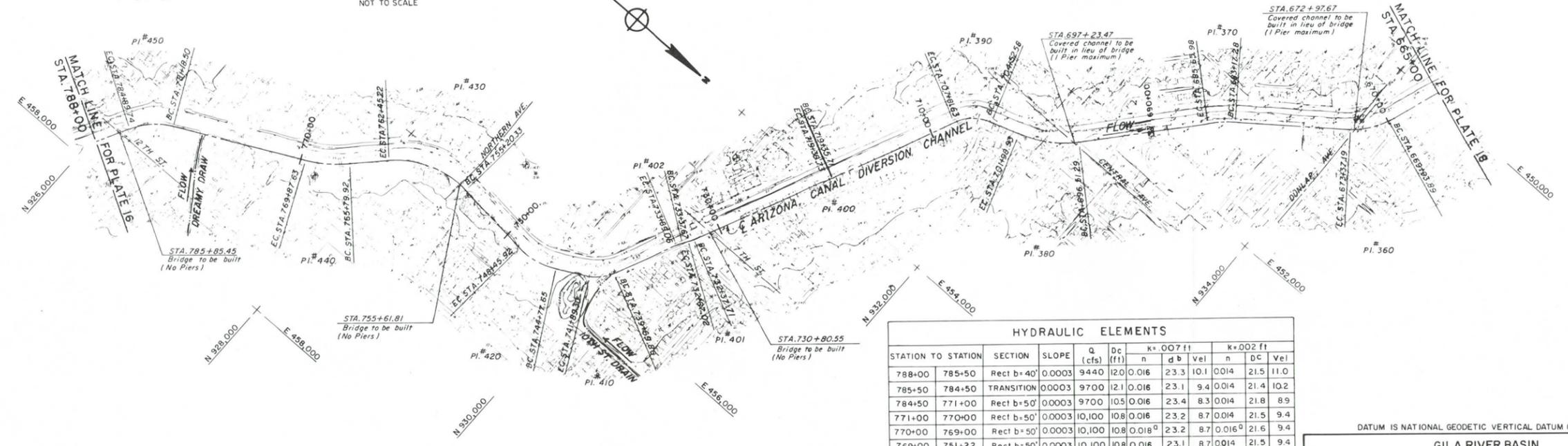
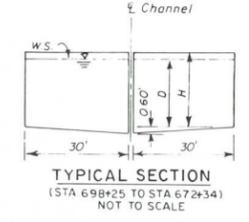
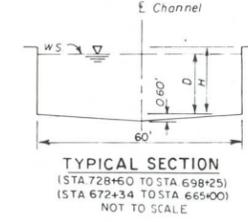
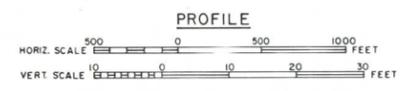
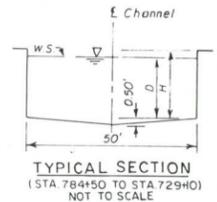
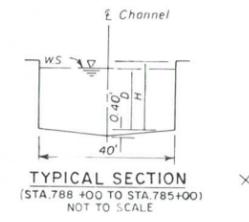
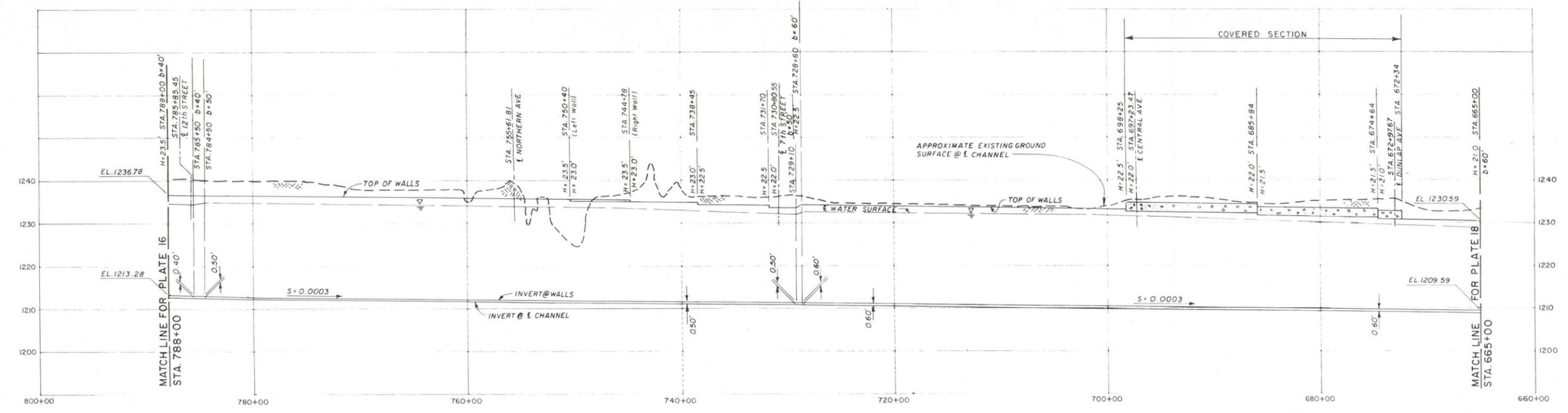
GILA RIVER BASIN  
 PHOENIX, ARIZONA AND VICINITY (INCLUDING NEW RIVER)

**ARIZONA CANAL DIVERSION CHANNEL**

HYDRAULIC PLAN AND PROFILE  
 STA. 898+00 TO STA. 788+00

U.S. ARMY CORPS OF ENGINEERS  
 LOS ANGELES DISTRICT

# VALUE ENGINEERING PAYS



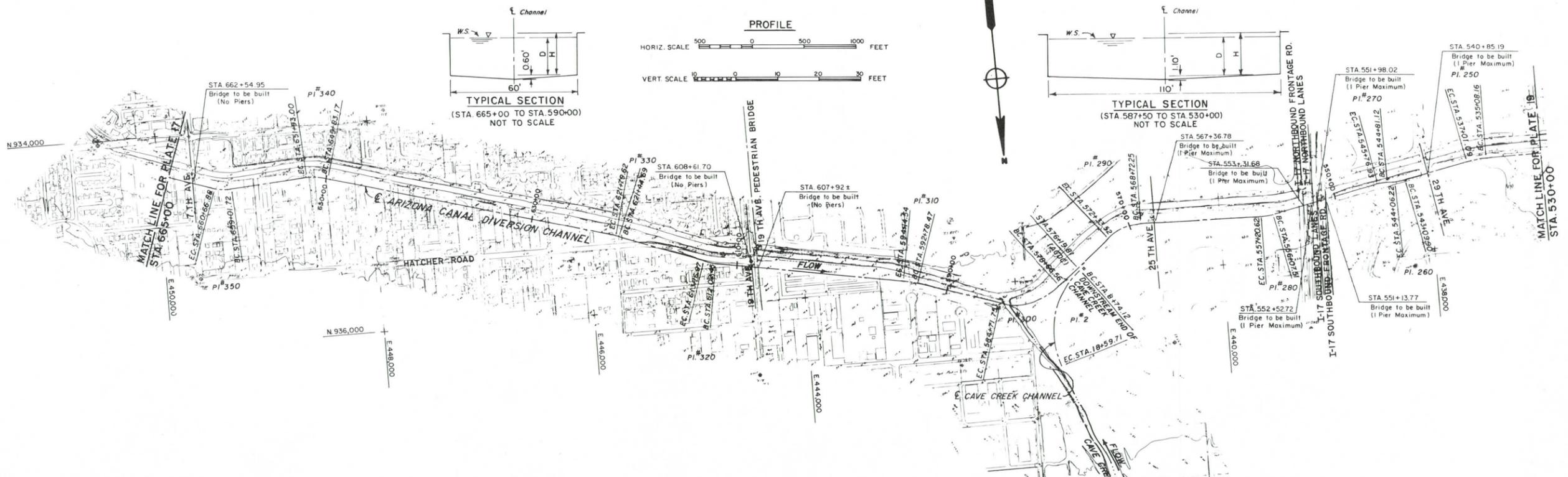
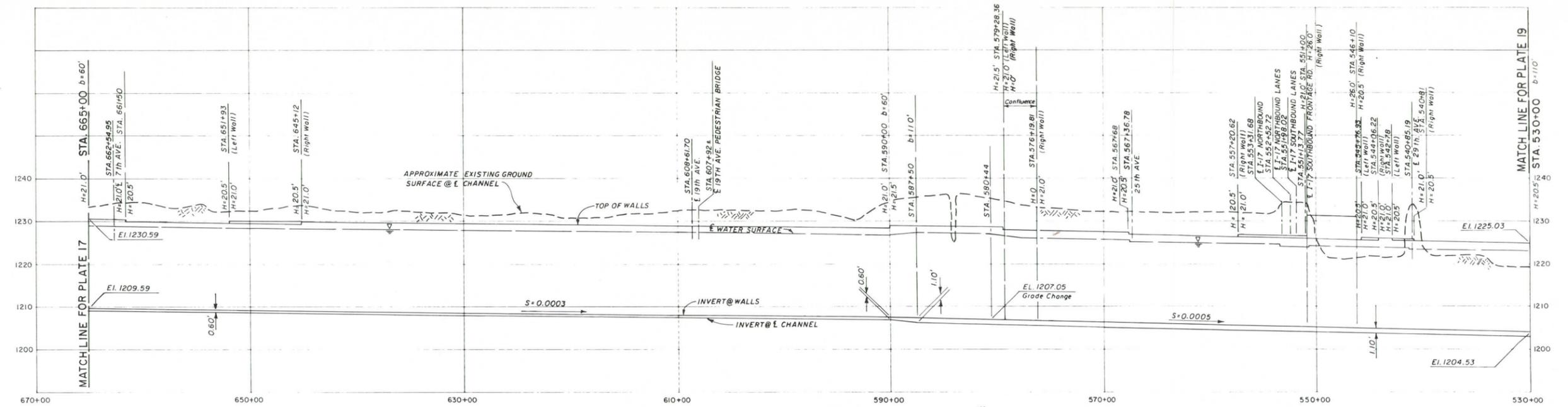
HYDRAULIC ELEMENTS										
STATION TO STATION	SECTION	SLOPE	Q (cfs)	Dc (ft)	K=0.007 ft			K=0.002 ft		
					n	d	Vel	n	Dc	Vel
788+00	785+50	Rect b=40'	9440	12.0	0.016	23.3	10.1	0.014	21.5	11.0
785+50	784+50	TRANSITION	9700	12.1	0.016	23.1	9.4	0.014	21.4	10.2
784+50	771+00	Rect b=50'	9700	10.5	0.016	23.4	8.3	0.014	21.8	8.9
771+00	770+00	Rect b=50'	10,000	10.8	0.016	23.2	8.7	0.014	21.5	9.4
770+00	769+00	Rect b=50'	10,000	10.8	0.016 <sup>a</sup>	23.2	8.7	0.016 <sup>a</sup>	21.6	9.4
769+00	751+22	Rect b=50'	10,000	10.8	0.016	23.1	8.7	0.014	21.5	9.4
751+22	746+40	Rect b=50'	10,000	10.8	0.016 <sup>a</sup>	23.0	8.8	0.016 <sup>a</sup>	21.5	9.4
746+40	731+29	Rect b=50'	Varies	12.0	0.016	22.5	10.1	0.014	20.9	11.1
731+29	729+10	Rect b=50'	12,600	12.6	0.016	21.9	11.5	0.014	20.4	12.4
729+10	728+60	TRANSITION	12,600	11.1	0.016	22.1	10.4	0.014	20.5	11.2
728+60	671+00	Rect b=60'	12,600	11.3	0.016	22.0	9.8	0.014	20.4	10.6
671+00	670+00	Rect b=60'	12,830	11.3	0.016	20.8	10.3	0.014	19.6	10.9
670+00	665+00	Rect b=60'	12,830	11.2	0.016	20.8	10.3	0.014	19.3	11.1

a. n Value increased for these reaches to account for anticipated sediment deposition  
 b. Used to determine wall heights.  
 c. Used to compute plotted water surface profile.

DATUM IS NATIONAL GEODETIC VERTICAL DATUM OF 1929  
 GILA RIVER BASIN  
 PHOENIX, ARIZONA AND VICINITY (INCLUDING NEW RIVER)  
**ARIZONA CANAL DIVERSION CHANNEL**  
 HYDRAULIC PLAN AND PROFILE  
 STA. 788+00 TO STA. 665+00

U.S. ARMY CORPS OF ENGINEERS  
 LOS ANGELES DISTRICT

# VALUE ENGINEERING PAYS

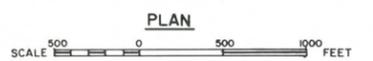
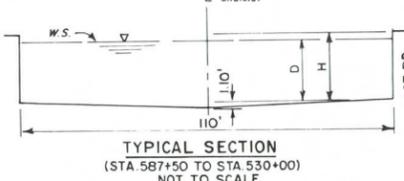
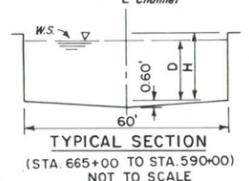
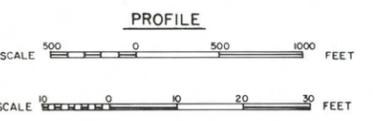


HYDRAULIC ELEMENTS											
STATION TO STATION	SECTION	SLOPE	Q (cfs)	Dc (ft)	K=0.007 ft			K=0.002 ft			
					n	db	Vel	n	Dc	Vel	
665+00	658+13	RECT. b=60'	0.0003	12,830	11.2	0.016	20.8	10.3	0.014	19.3	11.1
658+13	650+00	RECT. b=60'	0.0003	12,830	11.3	0.016	20.4	10.5	0.014	19.1	11.2
650+00	633+00	RECT. b=60'	0.0003	13,020	11.4	0.016	20.5	10.9	0.014	19.3	11.6
633+00	606+00	RECT. b=60'	0.0003	13,320	11.5	0.016	20.6	11.7	0.014	19.4	12.4
606+00	590+00	RECT. b=60'	0.0003	13,600	11.6	0.016	20.7	12.8	0.014	19.5	13.7
590+00	587+50	TRANSITION	0.0003	13,600	10.2	0.016	20.9	10.0	0.014	19.7	10.0
587+50	580+44	RECT. b=110'	0.0003	13,600	7.8	0.016	21.5	6.6	0.014	20.1	6.9
580+44	577+65	CONFLUENCE CAVE CREEK	0.0005	24,800	10.1	0.016	20.9	10.4	0.014	19.8	11.0
577+65	530+00	RECT. b=110'	0.0005	24,600	11.7	0.016	20.2	11.0	0.014	18.7	12.0

a. Values given for D are based on the contemporaneous flow when the flow downstream of Cave Creek is maximum. The higher tailwater and smaller Q above Cave Creek combine to produce greater depths than the maximum Q's upstream of Cave Creek for these reaches.

b. Used to determine wall heights.

c. Used to compute plotted water surface profile.



DATUM IS NATIONAL GEODETIC VERTICAL DATUM OF 1929

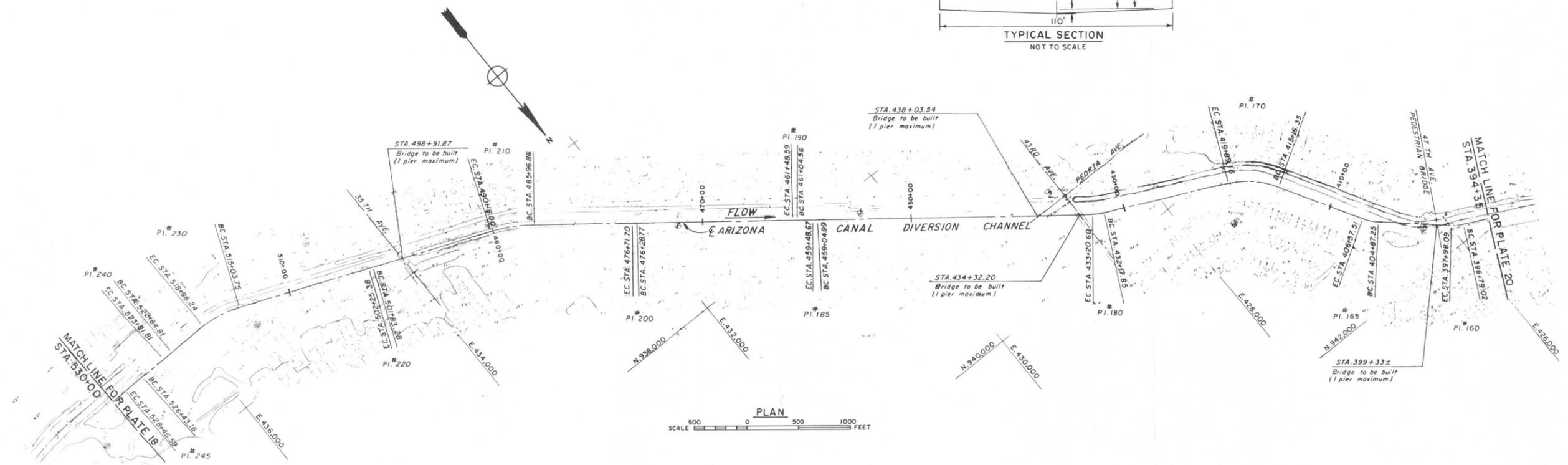
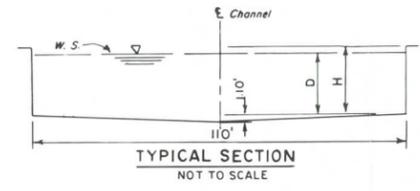
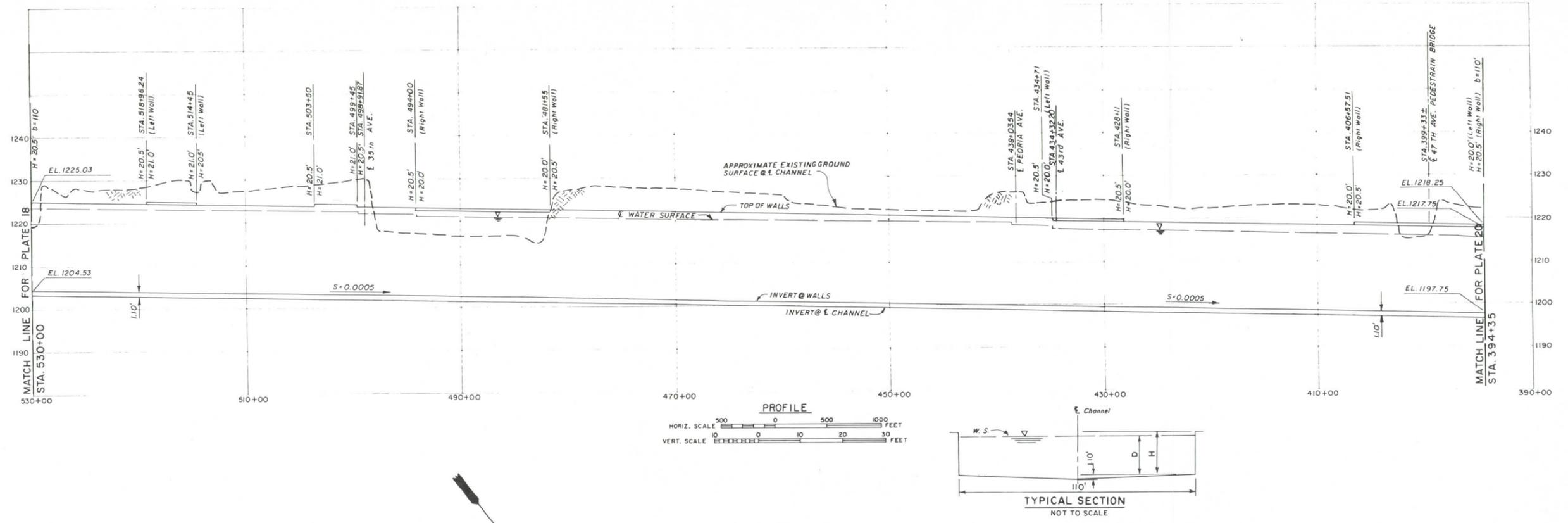
GILA RIVER BASIN  
PHOENIX, ARIZONA AND VICINITY (INCLUDING NEW RIVER)

ARIZONA CANAL DIVERSION CHANNEL

HYDRAULIC PLAN AND PROFILE  
STA. 665+00 TO STA. 530+00

U.S. ARMY CORPS OF ENGINEERS  
LOS ANGELES DISTRICT

# VALUE ENGINEERING PAYS



HYDRAULIC ELEMENTS											
STATION TO STATION	SECTION	SLOPE	Q (cfs)	Dc (ft)	K* .007 ft	K* .002 ft					
					n	d0	Vel	n	D b	Vel	
530+00	494+00	RECT b=110'	0.0005	24,600	11.6	0.016	20.2	11.1	0.014	18.8	11.9
494+00	434+71	RECT b=110'	0.0005	25,400	11.8	0.016	20.0	11.5	0.014	18.5	12.5
434+71	397+63	RECT b=110'	0.0005	26,000	12.0	0.016	19.6	12.1	0.014	18.0	13.1
397+63	395+00	RECT b=110'	0.0005	26,500	12.2	0.016	19.7	12.2	0.014	17.6	13.7
395+00	394+35	RECT b=110'	0.0005	26,700	12.2	0.016	19.6	12.5	0.014	17.5	13.9

a. Used to determine wall heights  
 b. Used to compute plotted water surface profile

DATUM IS NATIONAL GEODETIC VERTICAL DATUM OF 1929

GILA RIVER BASIN  
 PHOENIX, ARIZONA AND VICINITY (INCLUDING NEW RIVER)

**ARIZONA CANAL DIVERSION CHANNEL**

HYDRAULIC PLAN AND PROFILE  
 STA. 530+00 TO STA. 394+35

U.S. ARMY CORPS OF ENGINEERS  
 LOS ANGELES DISTRICT



# ARIZONA CANAL DIVERSION CHANNEL CONSTRUCTION SCHEDULE

<u>REACH</u>	<u>COMPLETE CONTRACT PLANS</u>	<u>BEGIN CONSTRUCTION</u>	<u>COMPLETE CONSTRUCTION</u>
1. Skunk Creek to Cactus Road	March 1985	Sept. 1985	September 1987
2. Cactus Road to Cave Creek	December 1986	March 1987	Mid 1989
3. Cave Creek to Dreamy Draw	March 1988	July 1988	Mid 1990
4. Dreamy Draw to 40th Street	October 1989	January 1990	Late 1991



ARIZONA CANAL AND ARIZONA CANAL DIVERSION CHANNEL (ACDC)  
COMPARATIVE WIDTHS AT SELECTED LOCATIONS

Reach 4

<u>Location</u>	<u>Arizona Canal (1)</u>	<u>ACDC</u>	<u>ACDC Shape</u>
(2)	(Feet)	(Feet)	
D/S Cudia City Wash (3)	68	36	Rectangular
D/S 32nd Street	75	36	Rectangular
D/S Wrigley Mansion Bridge	50	40	Rectangular
U/S Maryland Avenue	57	40	"
U/S Glendale Avenue	57	40	"

Reach 3

D/S 12th Street	58	50	"
U/S Northern Avenue	59	50	"
D/S 7th Street	65	60	"
D/S Central Avenue	67	60	"
U/S 7th Avenue	68	60	"
U/S 19th Avenue	72	60	"

Reach 2

D/S 25th Avenue	72	110	"
D/S 29th Avenue	80	110	"
D/S 35th Avenue	70	110	"
U/S 51st Avenue	59	155 (Top)	Trapezoidal

(1) Except for Cudia City Wash, measurements were taken with steel tape on a windy day and may be long by 1 to 2 feet. These measurements were taken by Stanley Lutz and an assistant (Corps of Engineers) in June 1985.

(2) D/S indicates downstream, U/S indicates upstream.

(3) This measurement was taken by James Attebery and David Harmon, (Phoenix City Engineer and Deputy) in May 1985.



PHOENIX, ARIZONA AND VICINITY  
PROJECT COSTS  
(October 1984 Price Levels)

	<u>OVERALL PROJECT COSTS, INCLUDING A.C.D.C.</u>	<u>A.C.D.C. COSTS</u>
FEDERAL	\$ 217 Million	\$ 149 Million
NON-FEDERAL	222 Million	155 Million
TOTAL	439 Million	304 Million

Table 11. Summary of First Costs for Flood Control and Recreation. (October 1984 price levels)

Description	Cudia City Wash Sediment Basin	Cave Creek Sediment Basin	Cave Creek Channel	Arizona Canal Diversion Channel				Total
				Cudia City Wash to Dreamy Draw (Reach 4)	Dreamy Draw to Cave Creek (Reach 3)	Cave Creek to Cactus Road (Reach 2)	Cactus Road to Skunk Creek (Reach 1)	
<b>FLOOD CONTROL</b>								
Construction								
Channel.....	\$2,620,000	\$5,340,000	\$6,640,000	\$28,400,000	\$29,000,000	\$36,800,000	\$22,500,000	\$131,300,000
Engineering and design..	260,000	530,000	660,000	2,900,000	2,900,000	3,700,000	2,250,000	13,200,000
Supervision and administration.....	260,000	530,000	660,000	2,900,000	2,900,000	3,700,000	2,250,000	13,200,000
Total, construction.....	3,140,000 <i>3,070,000</i>	6,400,000	7,960,000	34,200,000 <i>37,800,000</i>	34,800,000	44,200,000	27,000,000	157,700,000
Lands and relocations								
Lands and damages.....	460,000	200,000	700,000	19,300,000	21,300,000	42,000,000	10,800,000	94,760,000
Relocations								
Utilities.....	0	0	1,020,000	2,830,000	1,030,000	4,600,000	4,750,000	14,230,000
Roads and bridges.....	0	0	70,000	3,320,000	3,120,000	13,000,000	6,800,000	26,310,000
Total relocations.....	0	0	1,090,000	6,150,000	4,150,000	17,600,000	11,550,000	40,540,000
Total, lands and relocations.....	460,000 <i>800,000</i>	200,000	1,790,000	24,900,000 <i>25,450,000</i>	25,450,000	59,600,000	22,350,000	135,300,000
Total, flood control.....	3,600,000 <i>3,670,000</i>	6,600,000	9,750,000	59,650,000 <i>62,700,000</i>	60,250,000	103,800,000	49,350,000	293,000,000
<b>RECREATION</b>								
Construction								
Recreation facilities...	0	1,450,000	0	0	990,000	2,280,000	<sup>a</sup> 4,400,000	9,120,000
Engineering and design..	0	145,000	0	0	90,000	200,000	<sup>a</sup> 438,000	873,000
Supervision and administration.....	0	95,000	0	0	80,000	200,000	<sup>a</sup> 282,000	657,000
Total, construction.....	0	1,690,000	0	0	1,160,000	2,680,000	<sup>a</sup> 5,120,000	10,650,000
Lands and relocations.....	0	0	0	0	0	0	0	0
Total, recreation.....	0	1,690,000	0	290,000 <i>290,000</i>	1,160,000	2,680,000	5,120,000	10,650,000
TOTAL, FLOOD CONTROL AND RECREATION	3,600,000 <i>3,670,000</i>	8,290,000	9,750,000	62,990,000 <i>59,650,000</i>	61,410,000	106,480,000	54,470,000	303,650,000

Includes City of Glendale reach and City of Peoria reach.

Oct. 85

66,660,000

3,670,000  
62,700,000  
290,000  
66,660,000

ACDC LOCAL COSTS AS OF JULY 25, 1985

	<u>CURRENT</u>			<u>PROJECTED</u>			Total
	Lands	Roads, Bridges & Utility Relocation	Subtotal	Lands	Roads, Bridges & Utility Relocation	Subtotal	
Reach I	17,258,230	7,033,000	24,291,230	-0-	2,707,000	2,707,000	26,998,230
Reach II	10,720,034	2,500,000	13,220,034	3,714,000	9,500,000	13,214,000	26,434,034
Reach III	10,931,697	12,000	10,943,697	1,500,400	6,488,000	7,988,400	18,932,097
Reach IV	6,534,130	22,500	6,556,630	4,567,000	6,277,500	10,844,500	17,401,130
Total	45,444,091	9,567,500	55,011,591	9,781,400	24,972,500	34,753,900	89,765,491

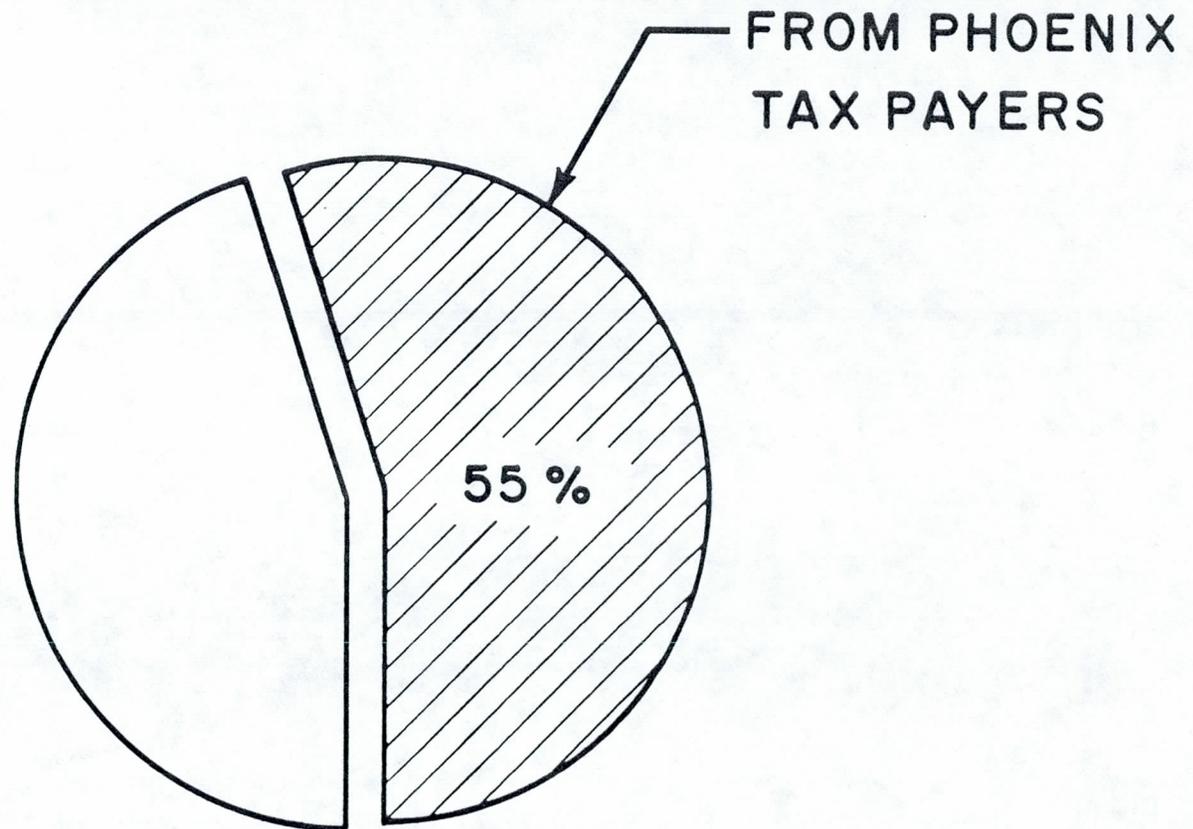


# FLOOD CONTROL TAX

@ 50¢ per \$100 of Assessed Value  
(Assessed Value is 10% of Full Cash Value)

<u>FULL CASH VALUE OF HOME</u>	<u>ANNUAL FLOOD CONTROL TAX</u>
\$100,000	\$ 50.00
75,000	37.50
50,000	25.00

# FLOOD CONTROL TAX REVENUE





LAND RIGHTS ALREADY ACQUIRED  
FOR A.C.D.C.  
(By Number of Parcels as of May 1985)

<u>REACH</u>	<u>PARCELS ACQUIRED</u>	<u>PERCENT ACQUIRED</u>
1	80	87
2	132	94
3	161	94
4	<u>61</u>	<u>62</u>
OVERALL	434	86





# FLOOD CONTROL DISTRICT of Maricopa County

3335 West Durango Street • Phoenix, Arizona 85009  
Telephone (602) 262-1501

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D. E. Sagramoso, P.E., Chief Engineer and General Manager

BOARD of DIRECTORS  
Tom Freestone, Chairman  
George L. Campbell  
Carole Carpenter  
Fred Koory, Jr.  
Ed Pastor

### Breaks In Arizona Canal (Record since 1939)

September 4, 1939.....	17 breaks
August 3, 1943.....	43 breaks
August 1, 1964.....	2 breaks
September 13, 1966.....	1 break
September 5, 1970.....	3 breaks
June 22, 1972.....	12 breaks

78

Note: Breaks do not include flows through natural spillways in Canal.  
All of these breaks resulted from thunderstorm events.

Match to Sheet 4

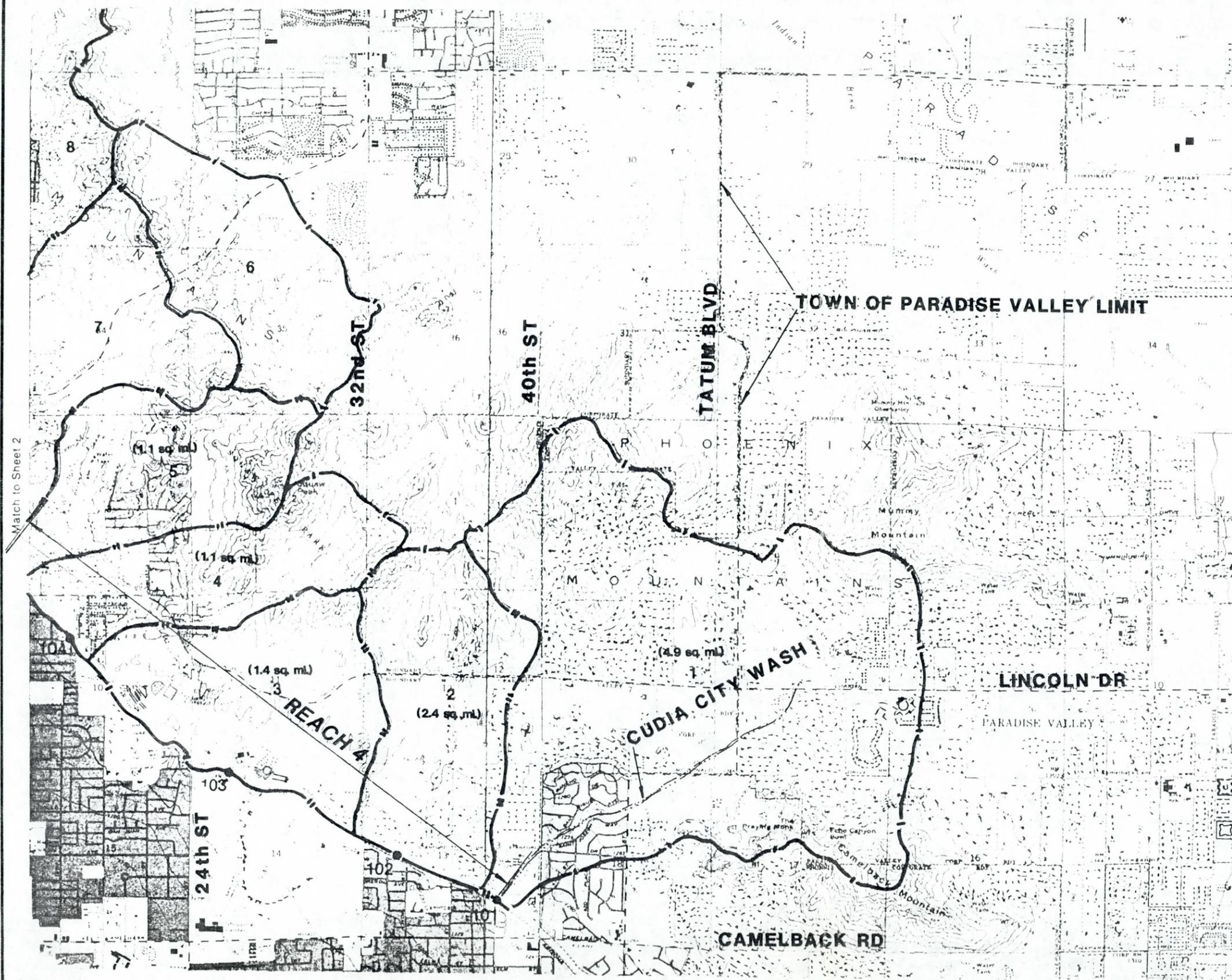


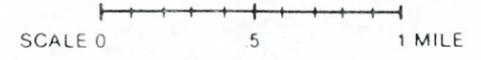
Table 4. Major Concentrated Side Inflows to ACDC.

Approximate Location <sup>a</sup>	100-Year Flood (ft <sup>3</sup> /s)
101 Cudia City Wash	6,700
2 Upstream from 32nd St.	2,400
4 Below Ocotillo Rd	1,900
5 Below 16th St.	2,300
107 Dreamy Draw	1,000
7 Northern Ave.	1,300
8 10th St.	3,900
1016 Cave Creek	16,000

Note: "Major" is defined as 1000 ft<sup>3</sup>/s or more.  
 a. See plate 10 for location.



- LEGEND**
- I — Drainage Boundary
  - II — Subarea Boundary
  - 1 Subarea Number
  - 101 Concentration Point



GILA RIVER BASIN,  
 NEW RIVER & PHOENIX CITY STREAMS, ARIZONA

**REACH 4**  
 SUBAREA BOUNDARIES  
 IN PROJECT AREA

US ARMY CORPS OF ENGINEERS  
 LOS ANGELES DISTRICT

ARIZONA CANAL DIVERSION CHANNEL

Part of the Authorized Flood Control Project  
of the U.S. Army Corps of Engineers  
for Phoenix and Vicinity

**Introduction**

The Phoenix and Vicinity Flood Control Project is a comprehensive system of flood control measures designed to provide a high degree of flood protection for the people of the metropolitan Phoenix area. The Arizona Canal Diversion Channel is an essential part of this total system. (See plate 1.)

The Phoenix area below the Arizona Canal has experienced severe local storms in March 1938, August 1943, and June 1972. Several similar storms have occurred on adjacent watersheds. During many of these events, such as the flood of June 22, 1972, runoff has ponded at the Arizona Canal and eventually overtopped it.

**Background**

Phoenix citizens and local governments became extremely concerned about the flooding threat in the late 1950's (after four floods in the previous 10 years). Faced with the prospect that the threat would become greater and greater as urbanization increased, the Corps of Engineers was requested to develop a comprehensive flood control plan for Phoenix and surrounding areas. To begin its work, the Corps held a public meeting in late 1959 to give all local interests the opportunity to describe the flooding problem and comment

on the extent of the improvements needed. At the time, the Flood Control Advisory Committee (the predecessor of the Flood Control District of Maricopa County) presented its first proposal for improvements in the area.

From 1959 to 1963, the Corps worked closely with the Flood Control District and its consultants to refine the proposal. As a result of the studies, the Corps - in cooperation with the Flood Control District of Maricopa County - developed a comprehensive five-phase flood control plan for the Phoenix metropolitan area. In 1963, the Corps presented the plan to the people of Phoenix. The plan cited the need for phased improvements in five areas:

Phase A - Indian Bend Wash from the Arizona Canal to the Salt River.

Phase B - Phoenix and Vicinity (including New River).

Phase C - Glendale-Maryvale and South Phoenix.

Phase D - Salt River downstream to the Gila River.

Phase E - Indian Bend Wash upstream from the Arizona Canal.

There was general agreement with the proposed plan, and it was formally approved by Maricopa County Flood Control District. In 1965, Congress authorized final planning of projects for the first two phases: Indian Bend Wash (completed) and Phoenix and Vicinity. Phases C through E were subsequently incorporated into the Corps' Phoenix Urban Study and the Central Arizona Water Control Study.

## **The Phoenix and Vicinity Authorized Project**

The purpose of the flood control project, authorized by Congress for Phoenix and vicinity, is to protect people from floodflows originating in the 2,695-square-mile mountain and desert drainage area north of Phoenix. Many streams including Cudia City Wash, Dreamy Draw, Cave Creek, Skunk Creek, New River, and the Agua Fria River drain flows from this mountain and desert area to the Phoenix area. Currently, a major factor in Phoenix area flooding is the interaction between the Arizona Canal (an irrigation water delivery system flowing to the west) and the many streams which intersect the canal. Urban development has obliterated the historic courses of these streams below the canal. During flooding, flows from these streams have broken through and over the canal. The problem is worsened by overland drainage from the north. The raised canal bank traps the floodwaters until they overtop the canal. This problem is becoming more severe as urban development north of the canal increases and runoff becomes greater. (See photos #1 and #2).

### **Project Alternatives Considered**

In every flood control project the Corps of Engineers must study and consider a full range of alternative solutions along a spectrum from no action to nonstructural measures to complete structural improvements. Structural improvements are those built by man to contain the flow of floodwaters. Nonstructural measures are actions taken by man to constrain future development in the floodplain (e.g., restrictive zoning), compensate people for economic loss due to flooding (e.g., acquiring flowage easements, providing flood insurance), or protect property against damage from inundation (e.g., floodproofing).

The Corps studied many alternatives. Six were considered in detail: One plan for no further action (after the construction of Dreamy Draw Dam which had been completed), three plans for complete structural improvements (dams only, channels only, and a combination of dams and channels), and two plans combining structural and nonstructural improvements. (See summary table). The main criteria for evaluating alternative plans are:

- o Plan acceptability. Is the plan acceptable to the public?
- o Plan completeness. Does the plan incorporate all necessary actions to ensure full attainment of the defined project purpose?
- o Plan effectiveness. Will the plan, when implemented, achieve its objectives?
- o Plan efficiency. Which plan will achieve national economic development, environmental quality, and other objectives in the least costly way?

Based on its evaluation, the Corps selected a modification of the originally authorized project: one of two plans combining structural and nonstructural improvements. Specifically, this plan was selected because:

- o Of the four alternatives providing the largest degree of flood protection, the costs for flood control improvements are the least.
- o It provides the second highest maximum flood control benefits (only 0.5-percent less than the alternative with the highest), but at 18-percent less cost for flood control improvements.
- o Its benefit-to-cost ratio for flood control is the highest of the four alternatives, providing the greatest degree of flood protection. The benefit-to-cost ratio expresses the extent to which economic benefits from a project compare to project costs. In this case, benefits are measured mainly in terms of flood damages prevented.
- o It has the least impact to the environment compared to the three other plans which provide comparable flood control benefits.
- o It is the plan most supported by local governments and acceptable to the general public.
- o It has the greatest recreational benefits among all the alternatives.

## **Project Support**

As stated before, the Corps planned and designed the Phoenix and Vicinity Flood Control Project in close coordination with the Flood Control District of Maricopa County and the City of Phoenix. In studying the array of alternatives, the Corps sought public input in a series of public meetings and in informal sessions with citizen environmental and planning groups. The Corps closely coordinated its planning with other Federal, state, and local government agencies. The result of this effort of coordination and cooperation, over a 20-year period of extensive planning, is a project which has been broadly supported throughout the Phoenix area.

### **Arizona Canal Diversion Channel (ACDC): Purposes**

The ACDC is intended to protect people in Phoenix, Glendale, and Peoria against 100-year floods (a flood which has a one-percent chance of occurring in any one year). If the ACDC were not built, floodflows would build up behind the Arizona Canal until they overtopped it, then breaking out in various places along the Canal. The residents of Phoenix, Glendale, and Peoria would continue to face the flood threat. (See plate 2).

### **ACDC: Features**

The ACDC will be about 17 miles long, from Cudia City Wash near 40th Street on the east to Skunk Creek on the west. It will intercept floodwaters from the Phoenix Mountains and from Cudia City Wash, Dreamy Draw, Cave Creek, and several minor tributaries, as well as from uncontrolled overland flow and storm drains. Currently, these floodwaters frequently exceed the capacity of the Arizona Canal, causing breakouts and flooding to the south. The ACDC has three types of channel configuration:

- o From 40th Street to 47th Avenue (Length, 11.4 miles). A reinforced concrete channel with vertical walls to minimize the amount of land and associated development to be purchased. Another configuration (for example, a concrete channel with sloping side walls or an unlined channel) would have required the purchase of more property at much greater cost and the relocation of many more people. The Corps selected the channel with vertical walls because it significantly reduces the cost of property acquisition and minimizes social disruption due to relocations.
- o From 47th Avenue to Cactus Road (Length, 0.75 mile). A concrete channel with sloping side walls. While more land must be acquired than for a concrete vertical wall channel, it is the least costly configuration because there was less urban development in this portion of the project area at the time the rights-of-way were acquired.
- o From Cactus Road to Skunk Creek (Length, 4.4 miles). An unlined channel. This will permit recreational uses in the channel during no-flood situations: bicycling, jogging, and equestrian trails; picnic areas; and playing fields and courts. This type of construction is possible for this stretch of the channel because there is even less urban development than from 47th Avenue to Cactus Road. This type of construction is feasible for this stretch of channel. It was preferred by the city of Glendale.

The visual impact of the channel will be minimal. Since it will be entrenched along its entire length, people will see it only from bridge crossings (and where it is covered, not at all). Experience with other Corps projects similar in design has been that concrete channels, when viewed from relatively low altitudes or acute angles at a distance, do not dominate the esthetics of an urban area. In addition, the ACDC design calls for esthetic features. In the concrete-lined portions of the channel (from 40th Street to Cactus Road), the Corps will add esthetic features such as landscaping, pigmented concrete, and channel-wall designs to further soften the impact of the ACDC on the Arizona terrain. The Corps, the Flood Control District, and affected cities have met with residents to present and discuss optional esthetic features that are the most desired.

#### **Eastern Portion of the ACDC (Reach 4):**

Originally, the Corps planned for an ACDC only 12.4 miles long: from Dreamy Draw on the east to Skunk Creek on the west. In June 1972, residents affected by Cudia City Wash in the eastern part of the area sustained several million dollars in flood damages. This flood awakened Phoenix area governments to the prospect that more severe floods might cause much more severe damage. In 1974, the Phoenix City Council requested that the Corps consider, as part of the authorized project, providing flood control improvement from Dreamy Draw to Cudia City Wash in order to protect people threatened by flooding from this drainage area. Cudia City and many minor washes flow to the Arizona Canal between Dreamy Draw and 40th Street. The Corps agreed to consider this extension, given the severity of the 1972 problem and the potential threat. After a thorough technical and economic evaluation consistent with Federal law, the Corps found that incorporating this extra area into the project would be economically justified and that it therefore should be a part of the Congressionally authorized project.

The Corps examined in detail three alternatives: (1) extending the ACDC 4.6 miles east to 40th Street; (2) building a number of small detention basins in the Cudia City Wash drainage area within the town of Paradise Valley; and (3) building a collector channel along the Arizona Canal to intercept and convey flows from 36th Street to 40th Street and then under 40th Street in a box culvert to the Salt River.

The 4.6-mile extension to the ACDC will ensure the conveyance of 100-year floodflows in the ACDC. The detention basins would reduce the peak flow in Cudia City Wash at the Arizona Canal and therefore reduce the size of the ACDC

between Cudia City Wash and Dreamy Draw. The collector channel along the Arizona Canal from 36th Street to 40th Street and the 40th Street culvert would avoid introduction of increased floodwaters into the ACDC altogether.

The Corps rejected the detention basins in Cudia City Wash drainage area. The Town of Paradise Valley strongly opposed the detention basins. Construction of the basins would undo residential development already underway or prevent development approved by Paradise Valley's Town Council. In 1974, the Town Council adopted a motion opposing both the ACDC through Paradise Valley and the detention basins.

The alternative of a collector channel along the Arizona Canal from 36th Street to 40th Street and a box culvert under 40th Street from the Arizona Canal to the Salt River was estimated to cost over \$45 million.

The cost estimate for extending the ACDC 4.6 miles east to Cudia City Wash was \$39 million. Because of the differences in costs and the fact that the ACDC extension would control floods originating in the Phoenix Mountains between the Cudia City Wash and Dreamy Draw drainage areas (while the collector channel would not), the Phoenix City Council opposed the collector channel. Given Phoenix's strong opposition, the Flood Control District of Maricopa County (the local project sponsor) gave its support to the alternative of extending the ACDC 4.6 miles to 40th Street. The Corps accepted the Flood Control District's position. The average annual cost for Reach 4 at the authorized project discount rate was \$1,081,000. The average annual benefits were determined to be \$1,403,000 for a benefit-to-cost ratio of 1.3 to 1.0. The ACDC extension was clearly the best alternative based on

flood control benefit, cost, and local acceptability criteria. Additional development south of the Arizona Canal in recent years would strengthen the benefit-to-cost ratio.

### **The Level of Flood Protection**

In trying to provide flood protection south of the Arizona Canal, the Corps analyzed three levels of flood protection: the Standard Project Flood, the 100-year flood, and the 50-year flood. Strictly from an economic standpoint, the Corps found that improvements to prevent each size flood would be economically justified. The Standard Project Flood (SPF) is the flood that would result from the most severe combination of meteorological and hydrologic conditions considered reasonably characteristic of the region. The 100-year flood is the flood that has a one percent chance of occurring in any one year. The 50-year flood is the flood that has a two percent chance of occurring in any one year. However, the Corps also found that improvements to protect against the 100-year flood were in the best overall public interest. There were two main reasons.

First, the Corps found that improvements to protect people south of the Arizona Canal against the 100-year flood would result in larger net economic benefits than improvements to protect people from a lesser (50-year) or greater (SPF) level of protection.

Second, the Corps concluded, based largely on local objections, that improvements to protect people from a Standard Project Flood would be too economically and socially disruptive to the Phoenix metropolitan area. Constructing the ACDC to provide SPF protection for residents south of the

Arizona Canal would require the Flood Control District to acquire substantially more land than for the authorized project: 62 percent more land, which would be permanently removed from the tax rolls; a 47-percent increase in home relocations; a 55-percent increase in apartment building relocations; a 63-percent increase in business relocations; and 630 additional acres of flowage easements along Skunk Creek and the New and Agua Fria Rivers to compensate for the additional waters that would be diverted. The Flood Control District has said that since it could not afford the increased costs, it could not continue to support the project if SPF design criteria were adopted for the ACDC. And, without this diversion channel, the floodflows from the Phoenix mountains would have no place to go but into the Arizona Canal or - inevitably - into the Phoenix area to the south.

Concern has been raised about whether the ACDC, designed to protect people from the 100-year flood, might cause more severe damage to them during a Standard Project Flood. It will not. In fact, the ACDC would carry away about half of the SPF, resulting in far less damage than under existing conditions. Several aspects of the ACDC support this conclusion:

East of Cave Creek. Runoff from the Phoenix Mountains will generally be concentrated, following the same course, with or without the ACDC. Diverted flows already in the ACDC will not overtop the channel banks unless additional floodwaters downstream enter the channel at the same time. But the additional floodflows would have caused flooding downstream without the ACDC. With the ACDC, however, the flooding threat is much less frequent. Only flows exceeding 100-year protection will spill over the Arizona Canal - much greater protection than is provided at present.

West of Cave Creek. Floodflows move overland, not following well-defined channels. Without the ACDC or due to channel overtopping from floods greater than the 100-year flood, downstream flooding can occur at any point because of breaks in the Arizona Canal. With the ACDC, there will be no canal breaks for any flood up to the 100-year flood. The floodflows will be totally confined within the ACDC.

Floodwaters from Cudia City Wash. If the floodflow from Cudia City Wash exceeds the 100-year flow, the ACDC will be designed to cause the excess to spill in the wash's own watershed. If necessary, structures will be built on the ACDC for this purpose.

Biltmore Estates retention basins. The Corps has considered these basins in the design of the ACDC. The watershed containing the basins contributes little to design peak discharges on the ACDC, with or without the basins. The ACDC will not affect these retention basins.

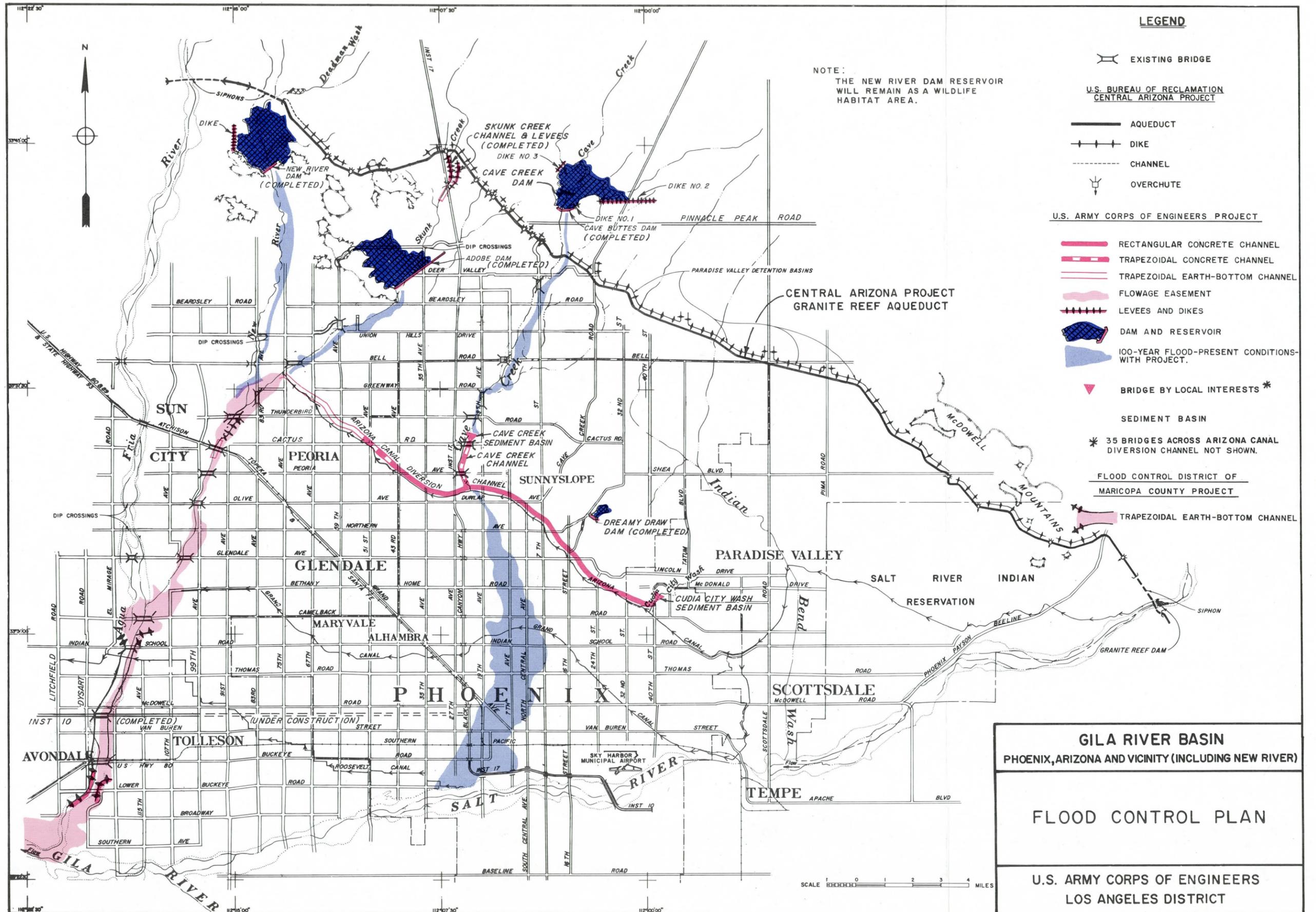
In summary, no one will be worse off all along the ACDC from any flood greater than the 100-year flood. But the ACDC will ensure that thousands of residents in Phoenix will have much greater flood protection than they now have.

#### Conclusion

The Phoenix and Vicinity flood control project is a comprehensive, integrated system of structural and nonstructural measures to provide a high degree of flood protection to the people of Metropolitan Phoenix. It is under construction. Failure to complete construction of all the elements would mean that the people of Metropolitan Phoenix would continue to be subjected to extensive flood damages.

The ACDC is an essential part of the total system. It completes the project. It provides a level of protection (100-year) which optimizes flood control benefits, it is the best economically and financially, and has had the greatest support. The ACDC will protect thousands of people not now protected - people who are increasingly vulnerable to flood damages as urban development continues. It will make flood conditions worse for no one.

The ACDC design is conservative, based on the standard Corps design criteria and the agency's long history as the main flood control builder in the country. These criteria have been reviewed and endorsed by the Corps technical review offices and the main Arizona agencies concerned with the project: the Arizona Department of Water Resources, the Flood Control District of Maricopa County, and the City of Phoenix.



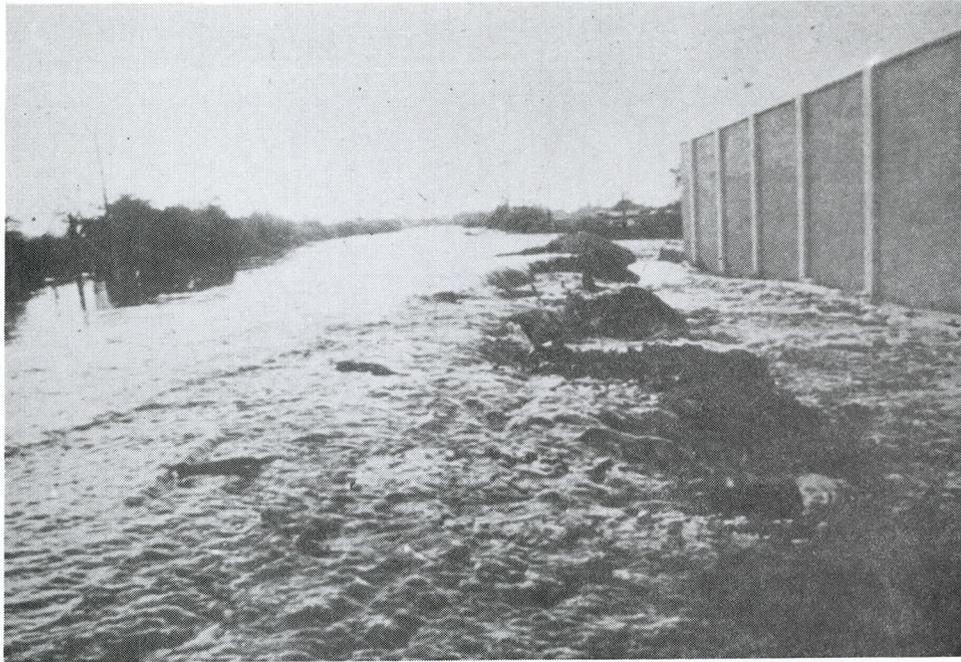


Photo #1. Floodwaters and debris flow over the top of the southern bank of the Arizona Canal east of 16th Street in Phoenix. June 22, 1972



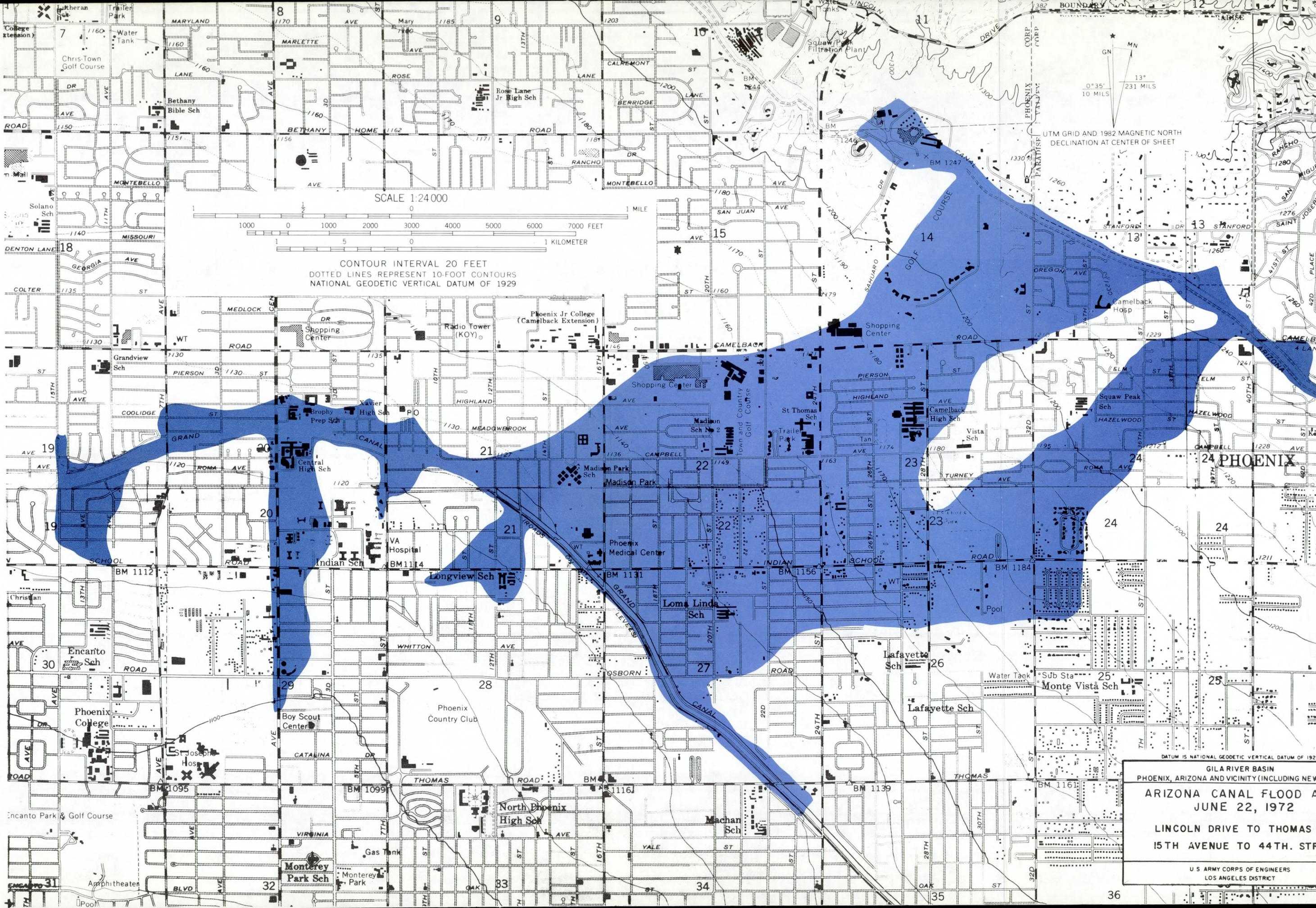
Photo #2. Homeowner on 38th Street and Camelback Road in Phoenix surveys damage from floodwaters. June 22, 1972

## PHOENIX, ARIZONA AND VICINITY (INCLUDING NEW RIVER)

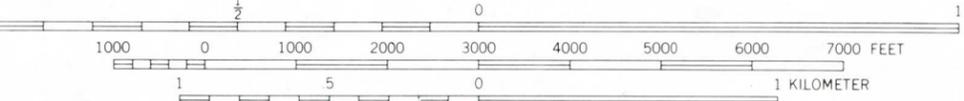
## SUMMARY OF ALTERNATIVE PLANS

ALTERNATIVE	COST (FLOOD CONTROL) (RECREATION)	PRICE LEVEL	B/C RATIO (FLOOD CONTROL) (RECREATION)	REASON FOR REJECTION	REFERENCE	REMARKS
<u>COMPREHENSIVE PLANS</u>						
1 AUTHORIZED PLAN (1964 REVIEW REPORT)	70,800,000	1963	3.0	AUTHORIZED BY CONGRESS-MODIFIED IN LATER PLANNING STAGES	1964 REVIEW REPORT	MODIFIED BECAUSE OF CHANGED PHYSICAL CONDITIONS
2 COMBINED CENTRAL ARIZONA PROJECT AND FLOOD CONTROL PROJECT	260,000,000	1972		HIGH COST WITHOUT COMPENSATING BENEFITS	1976 GENERAL DESIGN MEMORANDUM - PHASE I	PLAN STUDIED AS PROPOSED BY ARIZONA WATER COMMISSION
3 NO FURTHER ACTION	NO NEW INVESTMENT	-	APPROX 1	DOES NOT RESOLVE FLOOD PROBLEM	1976 GENERAL DESIGN MEMORANDUM - PHASE I	DREAMY DRAW DAM CONSTRUCTED PREVIOUSLY AT COST OF \$671,000
4 DAMS AND CHANNELS	257,000,000 10,030,000	1975	1.8 2.5	HIGHER COST THAN SELECTED PLAN WITHOUT COMPENSATING BENEFITS	1976 GENERAL DESIGN MEMORANDUM - PHASE I	CLOSEST OF PHASE I GDM ALTERNATIVES TO AUTHORIZED PLAN
5 DAMS ONLY	52,700,000 16,000,000	1975	2.6 1.6	WOULD PREVENT ONLY 27 PERCENT OF FLOOD DAMAGES-NOT SUFFICIENT PROTECTION.	1976 GENERAL DESIGN MEMORANDUM-PHASE I	INCLUDES ONLY DREAMY DRAW AND CAVE BUTTES DAMS
6 CHANNELS ONLY	289,000,000 5,900,000	1975	1.5 2.6	HIGHER COST THAN SELECTED PLAN WITHOUT COMPENSATING BENEFITS	1976 GENERAL DESIGN MEMORANDUM-PHASE I	DREAMY DRAW DAM INCLUDED- PREVIOUSLY CONSTRUCTED
7 STRUCTURAL AND NON- STRUCTURAL MEASURES (WITH CAVE CREEK DIVERSION CHANNEL)	218,000,000 10,300,000	1975	2.2 1.6	SLIGHTLY HIGHER COST FOR SAME BENEFITS AS SELECTED	1976 GENERAL DESIGN MEMORANDUM-PHASE I	SAME AS SELECTED PLAN EXCEPT CAVE CREEK DIVERSION CHANNEL ADDED
8 STRUCTURAL AND NON- STRUCTURAL (WITHOUT CAVE CREEK DIVERSION CHANNEL)	210,000,000 23,400,000	1975	2.2 1.6	SELECTED PLAN	1976 GENERAL DESIGN MEMORANDUM-PHASE I	SELECTED PLAN
<u>ALTERNATIVES TO ACDC</u>						
9 REPLACE ACDC WITH CULVERTS AT 7TH AVE, 16TH ST AND 40TH ST	EXCESS OF \$650 MILLION	1975	N/A	HIGH COST WITHOUT COMPENSATING BENEFITS	1976 GENERAL DESIGN MEMORANDUM-PHASE I	SOME CHANNELIZATION REQUIRED NORTH OF ACDC. EIGHT SIPHONS REQUIRED
10 CAVE CREEK CHANNEL-OPEN CHANNEL ALONG 19TH AVE	EXCESS OF \$210 MILLION	1975	N/A	HIGHER COST THAN SELECTED PLAN WITH LOWER BENEFITS	1976 GENERAL DESIGN MEMORANDUM-PHASE I	ELIMINATES ACDC FROM CAVE CREEK TO SKUNK CREEK
11 CAVE CREEK CHANNEL COVERED CONDUITS ALONG THE 7TH AVE AND 19TH AVE	EXCESS OF \$330 MILLION	1975	N/A	HIGHER COST THAN SELECTED PLAN WITH LOWER BENEFITS	1976 GENERAL DESIGN MEMORANDUM-PHASE I	ELIMINATES ACDC FROM 19TH AVE TO SKUNK CREEK
12 COMBINE ACDC AND ARIZONA CANAL	N/A	-	N/A	NO PLAN COULD BE FORMULATED THAT SATISFIED SRP NEEDS	1976 GENERAL DESIGN MEMORANDUM-PHASE I	FOUR VARIATIONS CONSIDERED: (1) COMBINED CHANNEL WITH COLLAPSIBLE DAMS (2) PIPE CONDUIT FOR SRP UNDER ACDC BERM (3) PRESSURE PIPE FOR SRP (4) COMBINED CHANNEL WITH PUMPED WATER DELIVERY FOR SRP
13 PARADISE VALLEY DETENTION BASINS	NA	-	N/A	STRENUOUS OBJECTION BY CITY COUNCIL OF PARADISE VALLEY	1976 GENERAL DESIGN MEMORANDUM-PHASE I	PLAN NOT STUDIED BEYOND CONCEPTUAL STAGE BECAUSE OF LOCAL OBJECTIONS
<u>ALTERNATIVES TO 40TH STREET TO DREAMY DRAW REACH OF ACDC</u>						
14 48TH ST DRAIN	N/A	-	N/A	NOT ECONOMICALLY JUSTIFIED	1964 REVIEW REPORT	INCLUDES COLLECTOR CHANNEL FROM 56TH ST TO 36TH STREET
15 40TH STREET DRAIN	\$45,000,000	1975	ABOUT 1.1	HIGHER COST THAN SELECTED PLAN WITHOUT COMPENSATING BENEFITS	1976 GENERAL DESIGN MEMORANDUM-PHASE I	INCLUDES SHORT COLLECTOR CHANNEL NORTH OF ACDC AND OUTLET CHANNEL AT SALT RIVER. NEW COST ESTIMATE OCT 1982 SHOWED COST \$69 MILLION

N/A - NOT AVAILABLE



SCALE 1:24 000

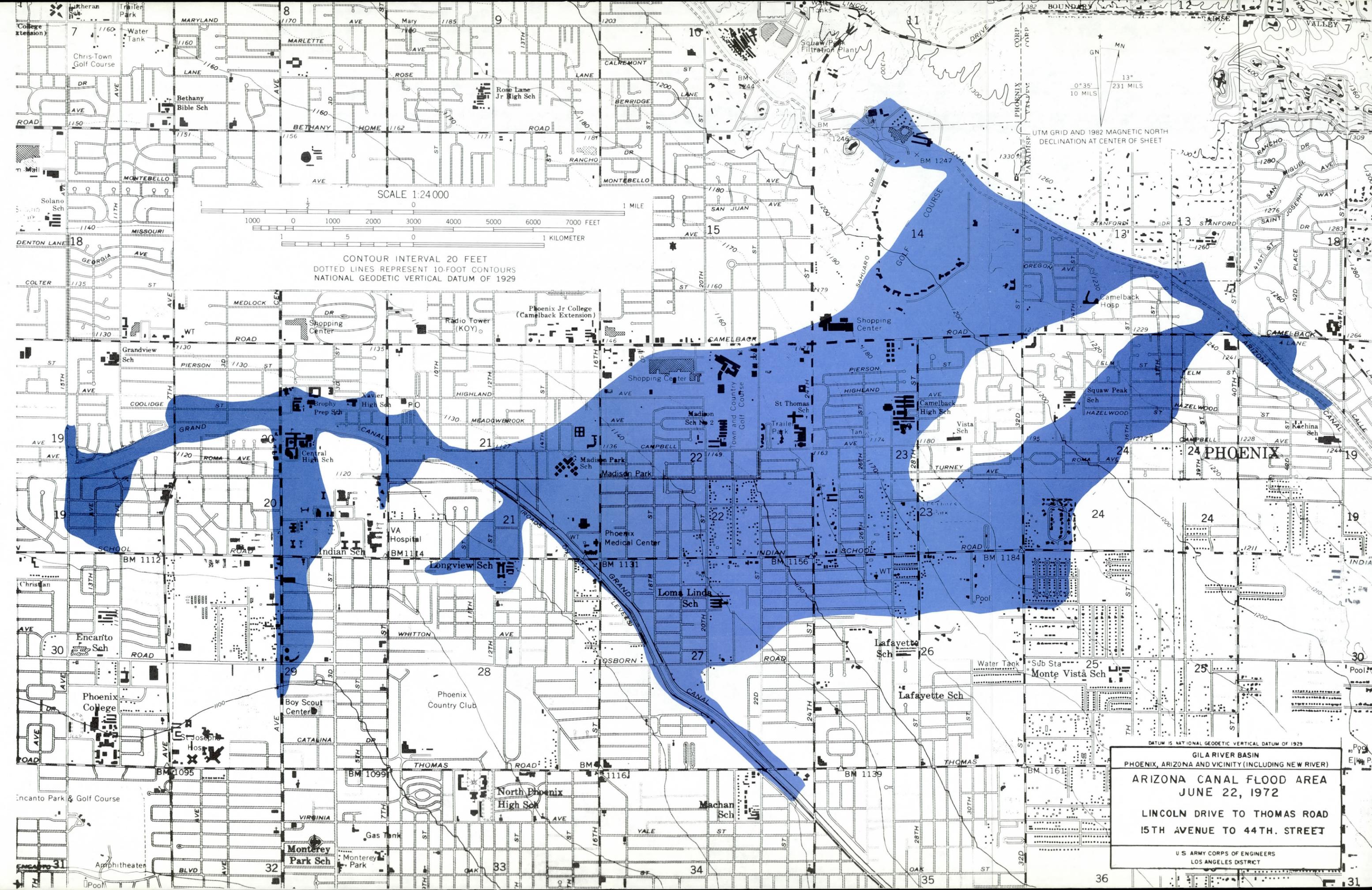


CONTOUR INTERVAL 20 FEET  
DOTTED LINES REPRESENT 10-FOOT CONTOURS  
NATIONAL GEODETIC VERTICAL DATUM OF 1929

GN MN  
0° 35' 13" 231 MILS  
UTM GRID AND 1982 MAGNETIC NORTH DECLINATION AT CENTER OF SHEET

DATUM IS NATIONAL GEODETIC VERTICAL DATUM OF 1929  
GILA RIVER BASIN  
PHOENIX, ARIZONA AND VICINITY (INCLUDING NEW)  
**ARIZONA CANAL FLOOD AREA**  
JUNE 22, 1972  
LINCOLN DRIVE TO THOMAS  
15TH AVENUE TO 44TH ST

U S ARMY CORPS OF ENGINEERS  
LOS ANGELES DISTRICT



SCALE 1:24 000  
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CONTOUR INTERVAL 20 FEET  
DOTTED LINES REPRESENT 10-FOOT CONTOURS  
NATIONAL GEODETIC VERTICAL DATUM OF 1929

UTM GRID AND 1982 MAGNETIC NORTH DECLINATION AT CENTER OF SHEET  
0°35' 13" 10 MILS 231 MILS

GILA RIVER BASIN  
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**ARIZONA CANAL FLOOD AREA**  
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LINCOLN DRIVE TO THOMAS ROAD  
15TH AVENUE TO 44TH. STREET  
U.S. ARMY CORPS OF ENGINEERS  
LOS ANGELES DISTRICT



**ACDC Contact People**

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Dan Sagramoso, Chief Engineer and General Manager, Flood Control District of Maricopa County, 3335 W. Durango St., Phoenix, AZ 85009 (602) 262-1501.

**RESPONSE SUMMARY  
WORKSHOPS FOR ESTHETIC DESIGN FOR THE  
ARIZONA CANAL DIVERSION CHANNEL  
November 27, 28, 29 and December 4, 5, 6, 11, 12, 1984**

Between November 27 and December 12, 1984, the Los Angeles District of the U.S. Army Corps of Engineers (Corps) and the Flood Control District of Maricopa County (FCDMC) hosted eight public workshops in the Phoenix area. Approximately 275 Phoenix-area residents attended these workshops which were held to discuss esthetic treatment and recreational opportunities associated with construction of the Arizona Canal Diversion Channel (ACDC).

At each workshop, Dan Sagramoso, Director of the FCDMC, presented a historical summary of the ACDC and an overview of the entire project. Mike Bornhoeft, Landscape Architect in the Environmental Resources Branch of the Corps, presented esthetic and recreation plans for the project. Other people from the Corps, and FCDMC and the City of Phoenix were also available to help provide responses.

Meeting participants were given the opportunity to ask questions and comment on what they heard. This summary includes these questions and comments and agency responses. We have divided the summary into two major sections. First, we present public questions and comments and agency responses related to overall project esthetics, recreation plans, design and operation, and rights-of-way purchase. Second, we present questions and comments that are specific to a particular meeting. In some cases, we have provided or expanded upon answers to which the agencies were unable to respond fully at the meetings.

Q = Question; A = Answer; C = Comment; R = Response

## Overall Project

### Esthetics

The esthetics discussion centered on general esthetics questions and three main issues:

- Landscaping plans and maintenance
- Fences and/or walls along the channel and maintenance road
- Channel treatment and maintenance

We present first the general esthetics questions and then questions, comments, and responses organized according to the major issues.

Q: Who will make the final decisions on esthetic issues?

A: The Corps will make the final decisions because it is responsible for detailed design of the project. All decisions will be made in close coordination with the FCDMC and the City of Phoenix. In making final decisions, the Corps will also carefully consider ideas and opinions received from the public in public workshops.

Q: What is the gross budget set up for esthetics?

A: There is no specific budget established for ACDC esthetics. When the esthetic design is complete, the Corps will prepare a cost estimate. The design and the cost estimate will be reviewed for "reasonableness" by Corps reviewing authorities (South Pacific Division Office in San Francisco). When the overall cost estimate, including channel construction and other costs is approved, the cost estimate will be reflected in Corps budget documents. The budget documents will be the basis for annual funding requests for construction of the ACDC. The overall estimate will be modified appropriately when contract plans are completed and again when the Corps receives construction bids.

Q: Will the public be given a chance to comment on the final designs?

A: The Corps' final design will not be given a broad public distribution for comment. The Corps will provide copies of the draft design report to the FCDMC, the City of Phoenix, and the Town of Paradise Valley for review and comment. We will provide copies of the final design to the FCDMC and the City for record purposes. We will provide extra copies of the draft esthetic design drawings to the FCDMC. Anyone wishing to review the draft drawings, when available, should contact the FCDMC.

Q: The channel is 17 miles long. A lot of different types of activity take place along it. Have you taken all of this into consideration in your planning? Have you considered both those who live along the channel and those who would use the recreational facilities?

A: The esthetic design will be tailed as much as possible to each individual neighborhood. We will consider both neighborhood concerns and concerns of recreational (trail) users in the design.

Q: Could the esthetic plan vary from one reach of the ACDC to another?

A: Yes.

### Landscaping

People at all meetings had questions about the landscaping planned for the ACDC. Their major concerns were that there be enough money to actually put in the plantings and to maintain them. The type of landscaping desired varied somewhat, depending on the area. However, most people stated that the plantings should be thick enough to act as a buffer between residential areas and the ACDC. A few people said that they preferred natural landscaping. Others commented that natural plantings would not be dense enough. People in one area wanted to make sure that the landscaping was compatible with the types of plantings already growing in their neighborhood. Specific questions and comments follow:

Q: What does "landscape intended" mean?

A: It means that landscaping is projected in the long-term budget. Money is budgeted for landscaping at the same time it is budgeted for construction.

Q: What happens if you run out of money before the landscaping is done?

A: That won't happen. The money for landscaping is budgeted at the same time as construction money. We will construct and landscape each channel reach before going on to the next.

Q: How long will it take to complete the landscaping?

A: The landscaping will be completed within a year of the time the channel structure is finished.

Q: What size will the plants be?

A: Each plant specie varies. The City of Phoenix has minimum standards which will be met or exceeded as determined necessary by City, County, or Corps professionals.

Q: Who will maintain the landscaping?

A: The Flood Control District will on a regularly scheduled basis.

Q: Does the County have money budgeted for landscape maintenance?

A: It is in the projected five-year budget.

Q: Are the Corps and the County in agreement as to the level of maintenance?

A: Yes. When the Corps builds a project, it must have a local sponsor. The FCDMC is the sponsor of the ACDC. In its contract with the Corps, the FCDMC agreed to maintain the area.

Q: If the maintenance doesn't meet residents' requirements, whom should they contact?

A: Dan Sagramoso at the FCDMC.

Q: Will there be a watering system for the plants?

A: Yes.

C: The water district is constantly reminding us to conserve water. The planned landscaping will require a lot of water for maintenance.

A: We will consider water conservation questions in our choices and placement of trees and plants.

C: You haven't allowed enough land for buffer zones.

R: There could be more landscaping if the FCDMC bought more land. However, that would mean more relocation of homes and businesses.

Q: If we put political pressure locally, could we get more money for landscaping?

A: No. Money for landscaping comes exclusively from the Corps. Money for landscaping is not now the major constraint on the esthetic design, land is.

Q: The sketches look great, but what guarantee do we have that the final product will really look like them? We are concerned about the resale value of our property. We want to be able to assure prospective buyers that this is what the ACDC will look like.

A: The Corps intends to make the ACDC look as good as possible, which means as good or better than the sketches. The only reason for the

channel to not look as good as the sketches would be because of insufficient rights-of-way (land) for landscaping. This situation may occur in a few areas.

C: You should involve the City Parks Department in the planning. Landscaping should be a number one priority.

R: The City Parks Department is and has been involved in the landscape planning. The Corps, the FCDMC, and the City are all placing a very high priority on landscaping.

Q: When will the plans be firm?

A: The present schedule calls for completion of the draft design by the end of September 1985.

Q: Whom should we contact if we want to see the design report?

A: Stan Lutz, Corps Project Manager, or Dan Sagramoso, Chief Engineer and General Manager of the FCDMC.

Q: Will there be a place for storm drain grills at the curb so that water can run under the landscaping and not wash it out?

A: The City will build collection channels. Their placement is a City decision.

Q: Is there a similar channel elsewhere, or is this unique?

A: There is one in Los Angeles. The concept isn't new, but it's usually not pretty.

Q: Could you use oleanders for landscaping? They would really provide a screen?

A: Oleanders can provide good screening. However, they are not one of the plants being considered because they require more water (18-36 inches per year) than desirable, should not be planted in narrow planting areas because of their growth habit, and require a high level of maintenance.

Q: Why are you landscaping south of the ACDC?

A: The area between the ACDC and Salt River Project rights-of-way is being landscaped for two reasons: (1) to soften and buffer the hannel as viewed from adjacent residences, trails, and intersections and (2) to provide erosion control for the cut slope.

C: The shrubs and trees should be low so that muggers, rapists, and thieves can't hide in that area. There should also be street lighting.

R: The current street lights will remain, but no additional lighting is planned.

Q: Can you send out a questionnaire regarding direct input of affected residents concerning their particular property and the landscaping planned across or behind it?

A: We do not at present plan to send out such a questionnaire. A property-by-property questionnaire would have limited value since the design will not be done on a property-by-property basis; we will try to achieve a series of designs over relatively long reaches that are compatible with the general landscape concept of the area.

### Fences and Walls

Participants at all workshops asked questions and expressed concern about the fences that would run along the channel. Many people objected to the fences on esthetic grounds. They offered several suggestions for replacing or camouflaging them.

- Replace the fences with block walls because block walls are more attractive and would eliminate both the residents' views of the channel and the views of people on the maintenance or recreation roads into residents' backyards. The walls in Sun City were mentioned as an example of esthetically pleasing walls.
- Plant vines on the fence.
- Put slats in the fence.

The FCDMC and Corps explained that the chain link fences are designed to protect people, especially children, from falling in. They added that maintenance personnel must be able to see into the channel so that they can remove obstructions. Thus, vines would have to be intermittent and walls would have to have openings. Another problem with vines is that they could climb over the fence and into the channel, slowing the flow of water. The Corps mentioned that one alternative would be a vinyl-clad fence, but that the color would actually make the fence more obvious. Participants agreed that safety is an extremely important consideration.

At several meetings, participants said they would like to have a chain link fence next to the channel for safety and observation, then the maintenance road, then a block wall, and, finally, a landscape zone. Most people said that a wall should be painted in earth tones so that it would blend in with the surrounding landscape.

As a result of concerns expressed at the workshops and in subsequent meetings with the City Council, the Corps is now studying the use of screening walls to block the view into the channel. It is also trying to design an alternative type of fencing that will provide both safety and channel visibility, but will be more esthetically pleasing than chain link.

Specific questions and comments follow:

Q: Will there be chain link fences on both sides of the channel?

A: Yes, there will be fencing on both sides of the channel, but the Corps is searching for a more attractive design than chain link.

Q: How will the fence go to the ground to keep people from going under it and still let debris, limbs, and water through?

A: The fence will be designed so that people cannot go under it. During large floods some debris will undoubtedly be caught by the fence. The amount of debris caught is not expected to be sufficient to seriously affect flows into the channel.

Q: Why couldn't you put a wall on the north side and visual access from the south?

A: The south side is further from the channel. Also, the north road will help prevent erosion.

C: The channel will be empty—or nearly so—most of the time. Safety is a real concern. Even a fence won't keep people out.

R: We agree that that is a concern. We may cantilever the top of the fence back out toward the road to make climbing over more difficult, at least for little children.

Q: Would it be possible to set the fence back about 6 feet from the channel so that someone climbing over would drop to the ground rather than into the channel?

A: A ledge inside the fence would be likely to encourage some youths to climb the fence.

C: You could put barbed wire on top of the fence.

R: Many people think chain link fencing along the ACDC is not esthetically acceptable. Placing barbed wire on the fence would undoubtedly make it much less acceptable.

- Q: If a child fell in, he or she couldn't get out. Will there be ladders or hand holds?
- A: The Corps is investigating the use of ladders in the channel. A final decision has not yet been made.
- C: Maybe this is an education issue. Send speakers to schools to alert children to the dangers.
- C: Cover the entire access road with fencing such as that on pedestrian over-crossings over the railroad tracks on 7th and 16th streets.
- R: They are unsightly, but effective.
- Q: Will there be a security fence on the north side of the maintenance road to keep people off private property?
- A: No. The public will need access to the trail system.
- Q: If there were a block wall, would it be as high as the fence?
- A: It would be approximately 2-1/2 to 4 feet tall. The fence would be 6 feet tall. A block wall set on a berm would bring it to the same height as the fence.
- Q: Why would the wall be so short?
- A: Where screening walls are used, they will be made high enough to block the view of the chain link fence. To make the walls higher would increase costs unnecessarily and would probably be less esthetically pleasing than a lower wall.
- Q: If we wanted gates in the wall could we have them?
- A: The walls will not be continuous; they will have breaks in them to allow water to pass through. Gates would be unnecessary.
- Q: Wouldn't a block wall inhibit the flow of water on top of the ground?
- A: A wall would have to be intermittent--probably in 30-foot sections.
- C: I am concerned that a low, staggered wall would encourage graffiti.
- Q: What is the determining factor on whether or not staggered or intermittent walls will be used?
- A: Screening walls will most likely be used where houses face the channel. Where houses back onto the channel, most of the properties have garden walls that will block the view of the channel.

## Channel Treatment and Maintenance

Three topics dominated the discussion of channel esthetics:

- Channel wall color
- Graphics
- Maintenance--especially removal of graffiti

Residents stated that they would prefer natural, sand coloring on channel walls. Many people said that they opposed graphics because

- Graphics can chip or erode and look worse than nothing.
- Murals can be ugly, and not everyone would like the same thing.
- Graphics cheapen the look of the neighborhood.
- Graphics are unnecessary because few people would see them.

Some others stated that graphics, especially in an Indian design, would be all right and might discourage graffiti. The City agreed that graphics do tend to discourage graffiti. The FCDMC added that graphics would be visible from over-crossings.

Specific questions and comments dealing with these issues and agency responses follow:

Q: How much does colored concrete cost?

A: It costs 75 cents a square yard.

Q: Could you use textured rock?

A: If the sides were textured, the channel would have to be wider. Texturing slows down the flow of water.

C: Maybe just the freeboard could be considered for texturing.

R: The freeboard must also be kept smooth to provide the same flow characteristics as the rest of the channel.

Q: Could you use camouflage coloring like the military does?

A: This is a different problem because the ACDC is larger than areas camouflaged by the military. Plus, the ACDC is linear. Even pat-

tern-break camouflage does not work well on this large an area. Adobe Dam is pattern-painted, but it still looks like a big dam.

Q: How much extra would it cost to add graphics?

A: The cost to add graphics depends on the design. The cost of graphics should not be a constraint. If graphics are desirable to the public from an esthetic point of view and improve the looks of the channel, they should be included.

Q: Who will be responsible for controlling and removing graffiti, and how are you going to do it?

A: The FCDMC will have maintenance responsibility. The District will limit access to the channel; remove graffiti immediately, which discourages vandals; and ask the police and neighbors to help prevent problems by alerting the District if there is trouble.

## **Recreation**

Discussion of recreation issues centered on six issues:

- Which agency is responsible for various parts of the recreation plans.
- Types of recreation facilities.
- Location of recreation paths.
- Access to the paths.
- Location and design of undercrossings.
- Amenities associated with recreation activities.

Questions, comments, and agency responses organized according to these issues follow:

### Agency Responsibilities

Q: Which agency will make the final decisions on recreation facilities?

A: The Corps of Engineers has the responsibility for all final design decisions. All decisions will, however, be made in close coordination with the City of Phoenix, the FCDMC, and with careful consideration of the expressed wishes of the public.

Q: Which agency pays for recreation improvements?

A: For recreation items that meet Federal criteria for cost-sharing, the Corps will pay 50 percent and the local sponsor will pay 50 percent. Within the city limits of Phoenix, the local sponsor for recreation is the City of Phoenix.

Q: Which agency builds the facilities?

A: The Corps.

Q: Which agency maintains the facilities?

A: The FCDMC will maintain all flood control facilities, including landscaping associated with flood control. The City of Phoenix will maintain all recreation facilities (within the city limits), including landscaping associated with recreation.

#### Recreation Facilities

Participants asked questions and made comments on various types of recreation planned or possible along the ACDC.

Q: What is a staging area?

A: It is a place for recreation users to assemble to begin biking, riding, jogging, etc.

C: Recreation users need assembly areas.

Q: What is a fitness station?

A: It is a wide place in the trail where there is exercise equipment such as chinning bars.

Q: How wide would the combined biking and jogging path be?

A: It would be 10 feet wide on the north road, 25 feet wide on the south.

Q: Would the bike path be interrupted between 12th and 16th streets?

A: No.

C: Please use high standards for bike paths. Use, for example, the standards of the California Department of Transportation.

R: Since the bike path will use the vehicular service road, the design standards will exceed those for bicycle paths.

- C: Equestrian trails in the area are 25 years old. Sun Circle Trail is a 100-mile loop. Phoenix Mountain Trail is lovely. Please don't disturb them.
- R: The Sun Circle Trail along the ACDC may be temporarily disrupted during channel construction. We will add five undercrossings at arterial streets; this will make the trail safer to use.
- C: There are many more joggers than equestrians using the current trail. Consideration should really be given to the needs of joggers.
- R: We are considering the needs of all potential recreation users.
- C: I am concerned about the cleanliness of the trails considered for joint use.
- R: FCDMC will be maintaining the channel and landscape area, collecting accumulated litter.
- C: We need an ATC track.
- R: There has been little support for this type of recreation. The only place space would allow this type of activity is at the Cave Creek sediment basin.

#### Location

Many people living along the proposed ACDC expressed concern about the placement of a recreation trail along the north side of the channel. They said that trails on the north side would

- Bring too many strangers to the area.
- Eliminate privacy (people using the paths would be able to look into residents' backyards).
- Cause noise.
- Create security problems (people on the trails would have access to residences backing up to the channel).
- Increase traffic and parking problems on side streets.

These people suggested putting all of the trails on the south side of the channel. They added that the south side is preferable not only because of the problems mentioned above, but also because (1) the Arizona Canal is attractive to look at

while jogging, biking, or horseback riding; and (2) joggers, bikers, and equestrians would all have easy access to undercrossings.

The agencies pointed out that the south road (the Salt River Project [SRP] access road) is unpaved and, therefore, inappropriate for bicycling. Further, SRP officials are reluctant to pave their road because they use it for dumping silt removed from the canal.

Some people stated that bikers and equestrians on the same trail could cause problems. Others said that that should not be a concern since equestrians rarely use the road. Another person noted that a paved road is not good for jogging.

One person suggested that all trails should be on the streets so that the trail areas could be used for landscaping. Another countered that using the streets would eliminate one of the main advantages of channel-side trails, namely, the safety of recreationists.

Another suggestion was that the channel be built right up against the property line and that all paths be located on the south.

#### Access

Residents asked several questions about who would have access to recreation trails and how access would be controlled.

Q: Is it policy that the roads are public rights-of-way?

A: This was written into the authorized project.

Q: Would property owners have access from the north side?

A: Yes.

Q: Would it be up to the individual property owner whether or not there was access to the recreation path from his or her property?

A: Openings through private garden walls or fences would have to be provided by the property owners. Anyone considering such access should contact the Corps so that it can design landscaping in such a way as to permit access.

Q: How can you guarantee that the recreation roads won't be used by motorcycles, three-wheelers, and all-terrain vehicles?

A: We will control the entrances by erecting barricades and posting signs.

## Underpasses

People expressed concern about existing and planned underpasses. Several people asked about the design of new underpasses, stating that the current ones are unsafe, unsanitary, and, as such, unusable. The agencies responded that they plan to correct design flaws during construction of the ACDC. Underpasses will be made as safe as possible. They will be paved, will have drains, and will be as straight as possible for visibility.

Another issue was the location of underpasses. Many people requested undercrossings at all major intersections. The agencies stated that there is not enough money to build that many. Several people said that biking and jogging trails should be on the same side of the ACDC as the underpasses.

Specific questions and comments follow:

Q: Underpasses at Indian Bend Wash are open and airy. Can those for the ACDC be like that?

A: There will not be as much space available for the undercrossings as at Indian Bend Wash. The undercrossings will be very similar to those currently existing along the Arizona Canal.

Q: Will underpasses be lighted?

A: We will consider lighting techniques.

C: Undercrossings for horses should be gravel rather than pavement.

R: We met with Sun Circle Trail people to discuss that issue. They said that pavement would be fine.

C: You must be careful if you put in drains for horses. If misplaced, they could be dangerous for bikes.

## Amenities

People had varying opinions on what amenities should be provided for trail users. Two specific issues were picnic areas and rest rooms. Several people stated that they would not like to have picnic areas built along the channel. They said that such areas would cause litter, traffic, parking, and noise problems.

Some people said that rest rooms along the ACDC would encourage vagrants and would create a policing problem. Others countered that on a 17-mile trail, rest rooms would be a necessity. They suggested building them every 5 or 6 miles.

Other comments and questions follow:

Q: Are there plans to license vendors to sell food along the bike path and trails?

A: We are not far enough along in planning to determine that. Certain parks close to the ACDC will have facilities.

C: A cafe-type facility along the bike path would be nice.

Q: Will recreation areas have lights? Will jogging paths be lighted for night joggers?

A: Current Federal policy prohibits the Corps from cost-sharing in lighted recreation facilities except for safety and security reasons. Lights will not be added to encourage night trail use.

C: Shrubbery should be low so that joggers will have a wide-open view and won't feel hemmed in.

### **Project Design and Operation**

Many people were not familiar with the ACDC project and asked many general questions about the need for the project, its design and operation, and its effects. Following are these questions and comments and agency responses to them.

C: We moved here in 1978 and didn't know about the ACDC until a year ago.

R: In 1977, we recorded a resolution with Maricopa County stating that the ACDC was going to be constructed. Title companies in the area were all notified.

Q: Did you make public announcements prior to 1978?

A: Yes, in 1974 and 1975. Recently we've been talking to citizen groups at least once a month, and there have been many newspaper articles.

Q: How did you notify people of the workshops?

A: We mailed notices to people on the north side of the canal, passed out flyers door-to-door, and sent news releases to the local newspapers.

C: You should have notified people both north and south of the canal.

R: All the workshop meetings were open to anyone who wished to attend. However, our (FCDMC and Corps) objective for the neighborhood

meetings was to target the people most directly affected by the ACDC. Since almost all, if not all, residents south of the Arizona Canal will not be able to see the ACDC when completed, the impact on residents to the south will not be nearly as great as on residents to the north. The general public meeting held after the neighborhood meetings was intended to address concerns of all people not living on the north side of the ACDC; for example, residents south of the canal, people who will travel across the ACDC, and recreation trail users.

Q: Will the project have a negative effect on property values in the area?

A: There is no reason to believe that the project will devalue anyone's property.

Q: Where will the water flowing into the ACDC come from?

A: It will come from four sources: the street, large storm drains, small neighborhood storm drains, and Cudia Wash or Cave Creek.

Q: How often will the ACDC fill up?

A: The ACDC will "fill up" on the average once in a hundred years. It will carry some water every time a rainfall occurs in Phoenix north of the Arizona Canal. The channel might carry substantial flows several times a year. In very dry years, only minor flows might occur in the ACDC.

Q: Is the ACDC the best and most economical solution?

A: We believe so. We have studied a number of alternatives.

Q: Why can't the Arizona Canal and the ACDC be combined?

A: We considered that. However, it is not possible because of the complex design and operation of the Arizona Canal.

Q: Has the Corps built anything of this scope in an urban area. If so, has it learned any do's or don't's?

A: The Corps' Los Angeles District has built a number of projects similar in some respects to the ACDC, although they have never built so large a diversion channel. These projects would probably have as many dissimilarities as similarities to the ACDC. Probably, the most important principle in planning a project is the need to determine and to address, to the fullest possible extent, the concerns of the affected public.

Q: In what direction will the ACDC flow?

A: It will flow from northeast to southwest.

Q: What are the depths and widths of the channel?

A: The channel will be 36 feet wide and 22 feet deep at the eastern end and 110 feet wide and 22 to 24 feet deep at the western end.

Q: Has the Corps restudied the ACDC since 1965?

A: We issued a report in 1976; design changes were made at that time.

Q: Is it possible for the Corps to reassess the building of the ACDC since there's been so much development in the last 20 years?

A: The development has all been taken into consideration. It would take a long time for us to reformulate this project. And, given the current competition for Federal monies, it is likely that if we did the project would never be completed.

Q: It seems as though you're building the ACDC to protect the Arizona Canal. Won't the canal become obsolete? Has the SRP contributed anything to this project?

A: The main purpose of this project is flood control, not protection of the Arizona Canal. The SRP is allowing us to use its right-of-way for south bank access.

Q: How is the project funded?

A: For flood control features, the Federal Government pays for design and construction and the local sponsor (FCDMC) pays for lands, right-of-way, and relocations of utilities, bridges, streets, and people plus a 2.3-percent contribution toward the design and construction costs. For recreation facilities, design, and construction, costs are shared on a 50-50 basis between the Federal Government and the local recreation sponsor (City of Phoenix).

Q: What is the cost per running foot for building the ACDC?

A: The estimated cost changes with inflation and as designs are refined. Based on current approved estimates, the construction cost for the ACDC through the City of Phoenix is \$195,392,000 or \$2,232 per foot.

Q: Will the south wall of the ACDC need to be reinforced more than the north wall because of its proximity to the canal?

A: The walls will be reinforced concrete--identical on both sides.

Q: If we don't like the plans, is there any way we can stop the project? Will the FCDMC buy our homes?

A: To stop the project now would require persuading the City, the FCDMC, or the Federal Government (Congress or the Administration) to withdraw its support. The FCDMC will purchase only those houses required for channel rights-of-way.

Q: Why do we have so much flooding in Phoenix compared to other cities with greater rainfall?

A: The major reason is that Phoenix does not yet have a complete storm drain system.

Q: Are we seeing final project plans, or will they change?

A: Only minor changes will occur in the channel design. We are in the process of developing the esthetic design, so some changes can be expected, particularly as a result of these meetings.

Q: In 1972-73 the channel design was extended eastward to protect the State Capitol buildings. Is that still part of the design.

A: Yes, it is still part of the project design. However, that design was not specifically related to the Capitol buildings.

Q: How many cubic feet will the channel hold?

A: It will convey 6,800 cubic feet per second (cfs) at the east end and 29,000 cfs at the west end.

C: You should dig the channel four times deeper to insure against flooding.

Q: When the ACDC is in place, will the south side of the canal never flood.

A: There may still be some times when the south side floods.

Q: What advantages will people living north of the ACDC get?

A: They are already receiving benefits from the dams. This project also gives us the opportunity to put in storm drains north of the channel.

Q: What year will the project take care of the flooding?

A: The project is scheduled for completion in 1991. As each reach is built, some improvement should occur in that reach. For example, if

there were major washes or storm drains in that reach, they would have an outlet; if ponding occurred against the Arizona Canal in the reach, it would be eliminated.

- C: The boundaries of the schedule appear loose. Construction could slip back by years.
- R: Schedules are always subject to change. However, we have no reason to expect major delays, measured in years, at this time.
- Q: Will the channel really be empty 99 percent of the time?
- A: There will often be runoff from local uses such as cars being washed.
- Q: How will you control mosquitos attracted by standing water?
- A: There shouldn't be any standing water. The concrete lining and slope should eliminate ponding.
- Q: Is that the reason the channel is concrete-lined?
- A: That is part of the reason. Another consideration is to not add sediment load below the sediment basin.
- Q: Is the north side of the ACDC higher than the south side?
- A: No. They are the same height.
- Q: What will the finished elevation be?
- A: The finished elevation of the top of the wall of the ACDC will be at existing ground level or a few feet below.
- Q: What is the design of the bottom of the channel? Is it pitched from the walls?
- A: The bottom is an exceedingly flat "v". The bottom slopes gradually from the walls. The grade is similar to that of a parking lot.
- Q: When the channel is full, how long will it take it to empty?
- A: It should empty in a couple of hours.
- Q: Where will it empty into?
- A: Skunk Creek.

- Q: Why is the portion of the ACDC near Skunk Creek not planned to be smaller and concrete? There is a lot of development taking place there.
- A: In the early stages of plan formulation, the City of Glendale expressed a strong desire to have a broad "greenbelt" channel design through their city. At that time, very little development existed along the ACDC right-of-way in the cities of Glendale and Peoria, so the broad, earth channel approach was economically feasible.
- Q: How much sediment can the ACDC handle?
- A: The ACDC will handle all the sediment that gets into it. Two sediment basins are being designed, one on Cave Creek and one on Cudia City Wash. The basins will prevent most of the potential sediment load from reaching the ACDC.
- Q: Who will clean out sediment and debris from the channel?
- A: The County Flood Control District.
- Q: Is there easy access to clean out the channel without tearing up the landscaping?
- A: There will be two access roads: one on either side of the channel. On the south side we will share the SRP's road. These roads will also be used for inspection and for access in case of flooding.
- Q: Will traffic on the maintenance roads be controlled?
- A: There will be locked gates.
- C: The locks on the Arizona Canal maintenance road are easily broken. You will need better locks than those.
- Q: What will be done to repair the streets after you complete construction?
- A: The plan is to limit construction traffic on local streets by using the channel as a haul road as much as possible. Construction contractors using local streets will be required to conform to existing codes and regulations. Under these conditions, repair of damage to local streets will be a responsibility of the agency that has normal maintenance responsibility for the streets.
- Q: Could your construction contracts specify that contractors use the channel as a haul road?
- A: No.

- Q: How will you control dust and dirt during construction?
- A: Contractor requirements will include measures such as watering down to minimize dust.
- Q: What will happen to the spoil dug to form the channel?
- A: The spoil will be taken to designated disposal sites where it will be compacted and contoured so that it can be used for development. Current planning calls for the sites to be on some undeveloped property in Peoria and Glendale and on 7th Street above Beardsley Road.
- Q: Could the slope of the channel be gentler?
- A: If the channel slopes were less steep, we would need more land, thus reducing the area available for landscaping. In some areas it might require purchasing additional right-of-way.
- Q: Will the ACDC be as high as the Arizona Canal?
- A: In some places it will be as high as the canal. In no area will it be higher.
- Q: Why are you beginning construction at the downstream end?
- A: It is customary to begin building from the downstream end. If we started upstream, the water flowing through that reach would have nothing to flow into.
- Q: Where does the channel change from concrete to grass and dirt?
- A: A short distance west of Cactus Road.
- Q: Will there be a change in the overflow map?
- A: Yes.
- Q: Will this project eliminate the need for flood insurance?
- A: In most areas it will.
- Q: Is flood insurance a Federal requirement or an insurance company requirement?
- A: If you have a Federally insured mortgage, it is a Federal requirement.

Q: How can we convince our mortgage company to drop their flood insurance requirement?

A: Show company officials the new overflow map.

Q: What is a land remnant, and how big is one?

A: When possible, the FCDMC acquires just enough property to build the ACDC; this requires splitting or buying portions of properties. When properties are split, severance damages occur. If the severance damages are sufficiently high, the damages plus the cost of the required piece of property may approach the full value of the total property. In this case, the entire property may be acquired. The portion of the property not actually required for the project is called a "remnant". Remnants may be of any size. One of three things may be done with the remnants:

- They may be incorporated into the project right-of-way and landscaped.
- They may be maintained by the FCDMC for some other purpose.
- They may be auctioned off by the FCDMC.

C: Land remnants should be used for solar energy stations.

Q: What is the City code regarding the distance of the channel from residents' property?

A: The City doesn't have such an ordinance.

Q: Is any of the channel going to be covered?

A: The ACDC will be covered in at least two locations: in the area of the Arizona Biltmore Hotel and at Sunnyslope High School. Some other locations are also being considered. The channel can be covered at Federal cost only where the total cost of covering, including rights-of-way costs, is less than the cost of an open channel and where major inflows do not have to enter the channel over the side.

Q: Is it possible that Cave Buttes Dam will flood?

A: Only in an exceedingly large flood. Cave Buttes Dam is designed to handle a standard project flood. A standard project flood is much larger than a 100-year flood.

Q: What about Dreamy Draw Dam?

A: Dreamy Draw Dam is small, serving a drainage area of only one square mile. All of the dams have spillways to protect them in the unlikely event of a flood's exceeding the dam's capacity. A Corps dam has never failed.

Q: Is the difference between the total project cost and the cost of the ACDC the cost of the dams?

A: It includes the dams, but is also for recreation development and flow-age easements.

Q: What's going to happen to wildlife during construction?

A: Any wildlife in the construction area will, of course, be disturbed. Except for some birds in a few locations, there is very little wildlife along the ACDC right-of-way. Some wildlife habitat along Cave Creek will be destroyed. Any wildlife living there (mostly small rodents and birds) would migrate. Some may be killed by construction activity.

Q: Is the EIS available?

A: Yes. You can see it at the FCDMC office (3335 W. Durango Street, Phoenix) or at the Phoenix office of the Corps (2721 N. Central Avenue).

Q: Why were big rigs drilling holes and then filling them back up?

A: They were taking soil samples.

Q: What is the Recreation Task Force?

A: The Recreation Task Force met in the mid-1970s. It consisted of representatives of agencies, community groups, and citizens from various interest groups. The Task Force's purpose was mainly to consider recreation in the dam areas because we didn't know at that time how much land would be available around the ACDC.

C: In the future, your mailings should include the names and addresses of County Flood Control District and Corps personnel whom we can contact with questions or comments.

R: The names and addresses are included with this report.

## **Rights-of-Way Purchase**

Participants stated that property that has been purchased by the FCDMC (but not removed) is not well maintained, is in some cases vacant, inviting vagrants, and generally degrades the appearance of the surrounding neighborhood. They also said that renting the houses has introduced a transient population into a settled neighborhood. Following are specific questions and comments and agency responses.

Q: When are the houses purchased by the FCDMC scheduled to be moved or demolished?

A: About six months prior to the beginning of construction in each area.

Q: How long after you remove the houses will the landscaping be completed?

A: About two years.

Q: Why did the FCDMC buy the houses so long before construction is scheduled to begin?

A: Purchases were made out of current tax revenues. By spreading out the purchases over a period of years, the tax rate could be kept lower. It was also desirable to keep the required staff needed to acquire rights-of-way to a minimal number by spreading the work load over a longer period. Additionally, with the project pending, many owners wanted to sell as soon as possible.

Q: Will people have an opportunity to buy and move the houses?

A: Yes.

Q: How much will the houses be sold for?

A: We will accept sealed bids for the houses. So, the prices will vary depending on the house.

Q: On what basis are the houses rented? What is the rental price? How much is the FCDMC making on the rentals?

A: It is more cost-effective for the County to rent these houses than to just board them up or tear them down. We rent the houses at fair market value. We have standards for tenants; for example, no one on a subsidized income is eligible, except retirees. Also, the renters must have an income no less than four times the rental price. Rental prices range from \$365 to \$1,200, depending on the area. FCDMC grosses about \$1 million and nets about \$700,000 per year.

Q: Could the original owner rent the property back?

A: Yes, but in many cases the owner wants to relocate. The owner can live there for 30 days at no cost, for 60 days at the amount of the mortgage payment, then at fair market rent after that.

Q: Who is responsible for seeing that the rented property is maintained?

A: There are people working in our rental offices who are to inspect the area and speak to tenants who don't keep up the property. If the problem is not resolved, we must follow a legal process. If you have complaints about vagrants or maintenance, call the rental office at 861-2119.

C: You should rent one house to a manager responsible for keeping up the houses.

C: I am frustrated about not being able to sell my house. I was offered \$20,000 below market value. I believe that is because the rental property is not kept up.

Q: How much money will the City lose when all this property is taken off the tax rolls?

A: To research this answer from existing records would take considerable time and effort. However, consideration should also be given to taxpayer savings afforded by the completion of the ACDC in that storm drains will not have to be sized to convey flows south to the Salt River. Additionally, those areas protected by the channel should experience increased valuations, and, in turn, increased tax revenues.

Q: Is the cost of purchasing the land included in the Corps' cost/benefit analysis?

A: Yes.

## **Individual Workshops**

On the chart on the following pages we present a summary of the workshop issues and an indication of the importance of each issue at individual workshops. The workshop held November 29 at Shaw Butte School is in one way unique from the others. It dealt in large part with the sediment basin that will be located in that reach only. Following the chart we present questions and comments and agency responses specific to each workshop.

Issue Summary	Workshop Dates & Places							
	Nov. 27 Senita	Nov. 28 Arroyo	Nov. 29 Shaw Butte	Dec. 4 Sunnyslope	Dec. 5 Crossroads	Dec. 6 Rose Lane	Dec. 11 Country Day	Dec. 12 Cortez
Approximate number of workshop participants.	50	45	20	40	16	23	60	14
<u>ACDC Project-wide Issues</u>								
Many people came for more information on the total project, asking a number of questions about project purposes, design, and how it would affect them. Several people had purchased their homes in the area in the last 7-8 years and had not been informed about the ACDC project.	M	D	M	D	M	M	M	D
Participants said that they had not had the opportunity to participate in the project planning process, giving their input. Several said that the workshops were a "sham," put on only to placate people and not giving any opportunity to contribute to project decisions.	D	0	0	0	0	0	D	I
Participants expressed concern about the effect of the ACDC on their property values, worrying that the canal would lower them.	D	0	0	I	M	D	0	0
Participants want to know what is going to be done <u>immediately</u> to control flooding. Many have been flooded, and they don't want to wait for the project.	M	D	M	I	0	0	0	I
Participants asked questions about how the project would alter the flood plain (i.e., what areas will no longer be subject to flooding?).	M	M	D	0	I	I	0	0

Importance of the Issue at the Workshop

D = A dominant issue discussed.

M = A major issue discussed.

I = An important issue discussed.

0 = Not discussed or only touched on.

Issue Summary	Workshop Dates & Places							
	Nov. 27 Senita	Nov. 28 Arroyo	Nov. 29 Shaw Butte	Dec. 4 Sunnyslope	Dec. 5 Crossroads	Dec. 6 Rose Lane	Dec. 11 Country Day	Dec. 12 Cortez
Participants said that houses and property acquired by the Flood Control District are poorly maintained, not up to the standards of the neighborhood.	D	0	0	D	M	0	0	0
Participants expressed concern for people's safety: the fear of people falling into the deep flood control channel and being injured or killed. The safety threat will be greater if more people use the proposed recreational trails.	I	I	I	0	0	M	0	M
Participants said that the channel should be covered.	0	0	0	0	0	I	D	I
Participants said that the channel should be fully maintained. They expressed concern about graffiti, trash blowing up against fences, and plants dying.	I	M	M	I	M	I	I	I
Participants said that the ACDC project should be coordinated with other projects. Specifically mentioned was the Squaw Peak Parkway/ Expressway.	0	0	0	0	D	0	0	0
<u>Esthetics</u> Participants said that landscape plantings must look natural, blending into the environment. Some said that the plantings should not conflict with the beautiful, natural plantings already in place.	M	I	I	I	I	M	M	M

Importance of the Issue at the Workshop

D = A dominant issue discussed.

M = A major issue discussed.

I = An important issue discussed.

0 = Not discussed or only touched on.

Issue Summary	Workshop Dates & Places							
	Nov. 27 Senita	Nov. 28 Arroyo	Nov. 29 Shaw Butte	Dec. 4 Sunnyslope	Dec. 5 Crossroads	Dec. 6 Rose Lane	Dec. 11 Country Day	Dec. 12 Cortez
Participants said that landscape plantings on the north side of the channel should be block walls or garden walls to screen residents' view of the channel and trail user views of residential property.	D	M	M	I	M	M	M	M
<u>Recreation</u> Recreational users argued in favor of trails along the canal rather than the channel. Most residents argued against recreational facilities and amenities (such as picnic areas and rest rooms), expressing concern about more people in the area who could bring increased crime, increase trash, and reduce residents' privacy. Some residents who did not want outside recreators were interested in trail use by neighborhood residents.	D	M	M	I	M	M	M	M
Participants argued for only one trail area: on the south side of the channel (where a currently unpaved trail already exists). Part of the current trail would have to be paved for bicyclists and joggers; the remaining portion would remain unpaved for equestrians. This would ensure underpasses for all trail users (bicyclists and joggers, if given a trail on the north side of the channel, would have to cross streets). A trail on the south side would also be more attractive for users since they could look down into the Arizona Canal (which has water).	0	M	0	0	M	0	I	D

Importance of the Issue at the Workshop

D = A dominant issue discussed.

M = A major issue discussed.

I = An important issue discussed.

0 = Not discussed or only touched on.

**November 27—Senita School**

Q: Why was the original plan for a "natural" channel in this area changed to a concrete channel?

A: Plans for this area have always specified a concrete channel. A "natural" channel must be much wider than a concrete channel because concrete moves water much more efficiently. Purchasing enough right-of-way to have a natural channel in this area was prohibitively expensive.

Q: How many homes in this area face the channel?

A: About 30 percent of them.

Q: Will the street lighting be changed?

A: If the light poles are currently in the channel right-of-way, we will have to move them.

Q: Will the high voltage towers remain where they are?

A: Yes.

Q: How far away from the existing wall at 39th Avenue is the channel going to be?

A: Twenty to twenty-five feet.

Q: How far from the Carol Avenue houses will the landscaping be?

A: From property line of residence to property line of ACDC, where landscaping begins, would be about 50 feet.

C: If you put a jogging and bike path in the landscape area, Carol Avenue will turn into a maintenance road.

R: A jogging and bicycling path will pass through the landscape area only if a maintenance road is constructed through the area as originally planned. A possible alternative is to increase land available for landscaping by using Carol Avenue for maintenance road purposes. An FCDMC maintenance vehicle might be seen on the street about once a week or, perhaps, less frequently.

Q: Who owns the property at the end of Malapai, and when are they going to clean it up?

A: The FCDMC owns the property, and, since our meeting, crews have cleaned up the area in question.

**November 28—Arroyo School**

Q: Will 7th Avenue be rechanneled?

A: No.

Q: How far west of 67th Avenue will the channel extend?

A: About one-quarter mile.

Q: Will 47th Avenue be completed as a vehicle bridge?

A: That is a City of Phoenix responsibility. At this time, the City does not have a plan to carry 47th Avenue across.

C: It seems that no one wants to take responsibility for this access problem. It should be solved now.

C: Most people north of the canal don't want 47th Avenue to go through.

Q: The school district is split by the canal. If children want to socialize with others on the opposite side of the ACDC, how can their safety be assured?

A: The canal bank currently splits the areas. The ACDC would follow the same alinement. Where there are existing canal crossings, there will be ACDC crossings.

Q: Why can't the FCDMC protect those of us living north of Bell Road?

A: The City of Phoenix is developing a storm drain system to convey runoff from areas north of the ACDC to the ACDC.

C: We are currently in a flooded area, and no one will help us.

R: The City Council has addressed this issue. City vehicles are now sent out to clean up, and the City provides sand bags. The Council has also authorized modified catch basins which should help alleviate the flooding problem.

C: When the Arizona Canal gets full, it floods at 49th Drive.

R: Runoff flowing west on Cactus Road is diverted south onto 49th Drive. To help alleviate this problem, the FCDMC is providing openings in the south curb of Cactus Road east of 51st Avenue. These openings should help by allowing Cactus Road runoff easier access to the existing detention basin located south of Cactus Road. In addition, the City of Phoenix is preparing plans for new storm drains on 43rd and 51st avenues and on Cactus Road. This should give relief to the drainage problem on Cactus Road.

Q: Why isn't water pumped out of the diversion basin?

A: It is, but there's no place to put it. The diversion basin was put there to get water off the street. When the ACDC is completed, water will flow into the channel and be gone.

Q: Why can't you put dry wells in the existing canal basin to prevent sewage problems, mosquitos, etc.

A: Dry wells are a problem because you can't drain water away fast enough to do any good.

C: The water starts to collect at the freeway and Cactus Road. The land is pitched toward Cactus, and it takes 4-1/2 days for the water to recede to 4 feet. The intersection at 51st Avenue and Cactus is lower, but our houses are even lower than that.

R: We will look at this problem and try to correct it when we put in the new channel.

Q: It seems that the Arizona Canal embankment is higher than my house. What can I do about that?

A: The Arizona Canal is the responsibility of the SRP. You will have to talk with SRP officials.

Q: There is a constant flow of water dumping into Skunk Creek from the New River Dam. Won't this project just be adding to that flood plain?

A: New River Dam does not affect Skunk Creek. New River Dam is on New River, and Adobe Dam is on Skunk Creek. Flows emanating from either of these dams are very small compared to the preproject flows on the streams. When the ACDC is completed, the frequency of a given size of flood on Skunk Creek or the New River will be almost the same as before construction of the dams and the ACDC.

Q: What will landscaping be like in the dirt-lined section?

A: There will be native plantings that we will water until they are established. We will plant trees that will not impede the flow of water.

Q: Won't the mounds in front of the parkway keep the water from flowing through?

A: The mounds are intermittent.

Q: Won't the landscaping wash away in a flood?

A: Our experience has been that it won't. We have had no problem on similar projects, such as in Indian Bend Wash.

Q: Will you buy more land for landscaping?

A: No. We will use only limited right-of-way.

Q: Have you already purchased the land?

A: In this area we have. There is a little excess land near 51st Avenue where we'll put in landscape nodes.

C: Just get rid of the water; never mind the view.

C: This area is developing too quickly commercially and can't handle the water.

**November 29—Shaw Butte School**

Q: What is a sediment basin?

A: A sediment basin is a little dam that retains water just long enough for the sediment to settle out of it.

Q: What happens to the sediment?

A: The FCDMC will regularly inspect the basin. When sediment has accumulated up to a certain point, the FCDMC will remove it.

Q: In the basin planned for the ACDC, will there be permanent retention of water for recreation use?

A: No.

Q: What will the basin be like when it's wet?

A: After a storm subsides, the water ponded in the basin will drain. The bottom of the basin will remain muddy until dried by the sun and wind.

Q: What will the basin be like when it's dry?

A: The appearance of the basin side slopes will not vary much whether wet or dry. They will be landscaped and contoured. The appearance of the bottom of the basin will vary substantially depending on condi-

tions. If the basin has not been cleaned for awhile, native vegetation will probably spring up. Small meandering flows will be seen after small rains. If the basin has been recently cleaned, the bottom will appear bare and relatively smooth.

Q: How high is an acre-foot?

A: That depends on the dimensions of the area holding the acre-foot. On an acre of land, the water would be one foot deep. In the proposed basin, an acre-foot would be about an inch deep.

Q: Where exactly is the planned basin, and what are its dimensions?

A: The basin will be between Cactus Road and Sweetwater channel. As presently designed, it will be 23 to 30 feet deep, about 1,600 feet long, and about 800 feet wide.

Q: How long will it take to get the sediment out of the basin after a flood?

A: There is no single answer to this question. For the 100-year flood, about 2-1/2 months would be required to clean the basin. The 100-year flood is a rare event that most of us will probably never see. A more likely scenario is cleaning of the basin after about 25 percent of its sediment storage capacity is filled by many smaller floods over a period of years. Cleaning under this latter condition might take about 1-1/2 months. If the basin is cleaned more frequently, the time required will be shorter.

Q: How long will it take to get the water out?

A: The design is not yet complete, but we hope to be able to drain the basin within a couple of days after the inflows have stopped.

Q: Will the basin be cement or earthen?

A: The basin will be earthen. At the inlet end, some grouted stone will be used to prevent erosion. There will be a concrete outlet channel.

Q: Won't the islands obstruct the flow of water in a critical time?

A: The purpose of the basin is to slow down, or obstruct, the flow. Islands may be incorporated into the basin if the reduction in basin volume does not reduce its ability to collect sediment.

Q: What is the spillway drop?

A: The spillway crest will be about 100 feet above the basin floor.

Q: How long is the pipe?

A: It will be about 2,500 feet long.

Q: What is the basin's slope from north to south?

A: The bottom of the basin will be sloped adequately to drain.

Q: How will the basin affect our flood insurance?

A: The basin will have no effect on flood insurance.

C: There should be a fence around the basin to protect children from falling in and to discourage misuse of the area.

R: We will consider fencing. The side slopes of the basin will be not be too steep to easily walk up. There will be little danger of anyone's falling into the basin accidentally.

C: If you don't control the area night and day, it will be used for illegal purposes such as drug transactions and ATC racing.

R: These are local police problems that will probably not be different with or without the project. The prospects of police surveillance will probably be somewhat better with a formal city park in the area than they are now with undeveloped open space.

C: When there is a flood, the basin will fill up with all kinds of debris.

R: The basin will capture debris washed down Cave Creek. The FCDMC will have responsibility for keeping the basin clean.

Q: Does the City Department of Parks have final plans for this area?

A: Final plans for the park development have not yet been completed. Recreation (park) plans are being developed concurrently with flood control plans.

C: There needs to be vegetation in the area to support the birds and animals which inhabit it.

R: Nearly all vegetation in the vicinity of the basin will be displaced by construction activities. The area will be relandscaped when construction is completed. Such vegetation will support some limited types of wildlife (birds, rodents, etc.), which will probably recolonize following construction.

- C: Don't put groundcover hanging over the sides of the basin.
- Q: Can you leave the area around the basin natural without providing recreation?
- A: The City Parks Department is committed to developing recreation in this area with or without the Corps flood control project. To leave the area around the basin natural would require a change in this long-standing commitment.
- Q: Have you planned any esthetic treatment for the tower?
- A: No, but that could be a consideration.
- Q: Is the tower higher than the surrounding terrain?
- A: The top of the tower is no higher than the top of the channel.
- Q: What will the terrain be like as Cave Creek comes into the basin?
- A: The City hasn't made definite plans yet. It may put in pocket parks. The City is still in the planning stage. It will distribute flyers inviting you to public meetings to find out how you feel about park recreational development in the area.
- Q: How long will it be between the time of the channel's going in and the parks' going in?
- A: If funds are available, recreation construction could follow immediately after construction of Cave Creek basin and channel.
- Q: Does the ridge on the west portion of the channel belong to City Parks or FCDMC?
- A: City Parks owns all that land.
- Q: Is it possible for an individual to buy land between Cactus Road and Peoria Avenue?
- A: That land belongs to the City Parks Department. You should contact the City of Phoenix.
- Q: When will construction between Cactus and Sweetwater begin and end?
- A: Based on present schedules, construction could begin about mid-1988 and be completed in about 1 to 1-1/2 years from Sweetwater to the ACDC.

C: If it rains a lot and water is released from the dams, our area will flood.

R: Outflows from the dams will all flow into the ACDC.

C: We had problems with Cave Creek Dam during the last flood.

R: Cave Creek Dam is no longer functioning. Cave Buttes Dam now takes care of that watershed.

Q: Has anyone measured the flow of water at Cactus Road Bridge?

A: Yes, there's a gage there.

Q: Can we conserve that water in some way?

A: It will eventually flow into the Gila River.

Q: Is the alley between 25th Avenue and Cave Creek Wash going to be the access road?

A: No.

#### **December 4—Sunnyslope High School**

Q: Will Las Palmaritas be narrowed for the storm drains?

A: Las Palmaritas will not change in width. Storm drains will be placed into the current street.

Q: Is Las Palmeritas being taken over by the ACDC?

A: No.

Q: Will the mortuary on Las Palmaritas be affected by the ACDC? Will FCDMC purchase some of their land?

A: The FCDMC has already purchased all the land it is going to in this area. The mortuary will not be affected.

Q: How big will the catch basins on Las Palmaritas be?

A: We are currently considering two options. One is to dig holes in the road and put in grates. The other is to regrade the street to encourage runoff toward the channel.

- Q: When 7th, 8th, and 9th avenues become cul-de-sacs, what will happen to Griswold?
- A: Those streets will not have access to Griswold.
- Q: What will happen to the alley behind 8th Place that opens onto Griswold?
- A: The alley will remain and be brought around the south side of the cul-de-sac.
- Q: Will Griswold be used as an access road?
- A: No. Griswold will be removed. A cul-de-sac will then be constructed at 8th Street and 8th Place.
- Q: How much of the channel could you see if the maintenance road were moved to the main street?
- A: The visibility would be greatly reduced.
- Q: Will there be a bridge at 7th Street?
- A: Yes.
- Q: What will happen to the water that currently backs up at Central Avenue?
- A: There will be a storm drain flowing into the ACDC. Also the landscape node at the intersection may be depressed to collect water. Storm drains, however, are designed for 2- to 5-year floods. There may be times when the drains will not handle all of the runoff, causing some water in the streets.
- Q: What landscaping will there be on 7th, 8th, and 9th streets?
- A: Seventh, Eighth, and Ninth streets will end in cul-de-sacs when Griswold Road is removed west of Tenth Street. At the end of each cul-de-sac there will be space for landscaping and mounding to help screen the ACDC. The actual landscaping will consist of native plant material such as palo verde, bird of paradise, and ocotillo.
- Q: Your designs show landscaping on the Las Palmaritas side of the channel. What happens at Griswold?
- A: Griswold will be landscaped in the same way as Palmaritas. The only difference is that no houses will face the channel.

Q: Will the large trees along East Las Palmaritas be uprooted?

A: The Corps will tag certain trees for possible retention. There are some trees along Las Palmaritas that can be saved.

Q: Will the landscaping along 7th Avenue be a parkway?

A: Where 7th Avenue crosses the channel, there is very little space for landscaping.

Q: At 7th Avenue and the Arizona Canal the FCDMC is cleaning up and installing a fence. Is that temporary?

A: Yes. It is a temporary fence to establish right-of-way. We are clearing out the undergrowth.

Q: Will this project solve the flooding problem at Central and Ruth?

A: The City is planning a storm drain in the area. The remaining water will sheet flow.

Q: Will there be room for an access road if there is also landscaping?

A: In that area there is 35 feet for the road and landscaping.

#### **December 5—Crossroads School**

Q: How are you coordinating the ACDC, its trails, and its landscaping with the expressway that the City is building?

A: The Mayor and the City Council have established a citizens committee to consider the expressway. The expressway will go over the ACDC. The ACDC plans are way ahead of the City's expressway plans. However, the FCDMC is coordinating with the City on design of the bridge that will cross the ACDC. The FCDMC will pay for the bridge, and the City will build it. Landscaping for the expressway is not part of the ACDC project. Specific questions about the expressway should be addressed to the City of Phoenix Engineering Department, Squaw Peak Parkway Coordination Office, Mr. R.B. Williams, P.E., 262-7691.

Q: How far from the wall behind Villa Valencia will the channel be located?

A: There will be approximately 25 feet. It will be composed of 10 feet of landscape space and 15 feet of maintenance road.

Q: In the Montiel area, is there room for all the things planned?

A: Yes.

Q: Will there be settling from the landfill in the Montiel area?

A: The contractor is responsible for his work. However, the landfill would need special consideration.

Q: What will happen to the drain and drainage ditch near 19th Street that presently go into the Arizona Canal?

A: They will dump directly into the ACDC.

### **December 6—Rose Lane School**

Q: What are the two big holes that are currently by North Avenue?

A: They are there to catch the current flows.

Q: What is the west boundary of the fourth reach?

A: Just west of 12th Street.

Q: How wide and deep is the channel 300 feet south of Lincoln?

A: It is 40 feet wide and 22 feet deep.

Q: What is the total right-of-way width at Torrey Blanco?

A: The right-of-way in that area is 85 feet: 50 feet for channel and 25 feet on the north side for landscaped areas, seating, shade structures, parks, etc.

Q: Where is the access road?

A: On the 35-foot strip.

Q: How much right-of-way is there at State Street north of the ACDC?

A: 100 feet.

Q: Currently Torrey Blanco has a chain link fence with mature oleander bushes. Would you replace them?

A: If we have to take them out for construction, we will replace them. If replacing them is inappropriate, we will have to devise some alternative landscape design.

- Q: Do you have budget figures on esthetics for Torrey Blanco?
- A: Estimates will be done for the project as a whole, not for specific housing areas.
- Q: Torrey Blanco residents currently have chain link fences. Will you replace them with walls?
- A: Normal policy is to replace facilities in-kind when they are removed for construction. If the property owner is paid for the item, replacement becomes his responsibility.
- Q: Could the walls be built such that only Torrey Blanco residents would have access to the paths from their neighborhood?
- A: Yes.
- Q: Torrey Blanco residents currently have lush green landscaping. Your plans show desert plants. How do you plan to integrate these two concepts?
- A: The plant species would be similar. Grass or other high-water-using plants will not be used on the ACDC.
- Q: If you built a block wall in Torrey Blanco, where would it be located?
- A: On FCDMC property between private property and the access road.
- Q: Where would such a wall be placed relative to the nineteen houses that are to be demolished?
- A: The wall would be at the beginning of the FCDMC property.
- Q: In some ways your designs are an improvement over what we currently look at. However, instead of a staggered wall, would it be possible to have a continuous wall with grates or open bricks on the bottom for the water to get through?
- A: We will investigate the concept.
- C: We would like to see a plot plan and have stakes set in the ground to help us visualize where the FCDMC property is and where the wall would be?
- R: The previous Board of Directors for the Homeowners Association at Torre Blanca was provided a plot plan and aerial photograph showing the proposed channel right-of-way and plan for realignment of the interior streets and parking areas. The FCDMC proposes to make this same information available to the new Board of Directors. The FCDMC does not propose to provide stakes on the ground, as the existing buildings will not permit clear visibility from stake to stake.

- Q: Currently there is a definite flow of water from 12th Street toward the canal. Can you assure us that the water will continue to flow in that direction and not back up.
- A: A study team is coming to study the flow in order to design for proper drainage.
- Q: Will property owners have direct access to the bike path between 12th and 16th streets?
- A: In some areas there will be access. However, the walls will be in the way in most places.
- C: The 12th Street intersection rises 12 feet at the Arizona Canal. There is a bike path there that is dangerous. Safety for bikers is a major concern, especially if the intersection will be buffered with plants.
- R: We will carefully consider the location of plant materials so that an unsafe condition is not created by obstructing views.
- C: Crosswalks on Northern are not visible. The Sun Circle Trail needs signs posted at intersections warning motorists about crossings. The crosswalks should be more clearly delineated.
- R: Textured pavement could be used at intersections. Street and traffic lights might be added.
- C: Residents would like blinking lights.
- R: The City would like to have lights-on-demand (pedestrians push a button for a walk light) at intersections. If you like that idea, contact your City Councilman.
- C: At the intersection of Glendale Avenue and 16th Street there is no way to get through on the Sun Circle Trail. It needs underpasses.
- R: Something has to be done there. Perhaps a bridge could be built if the SRP will allow it and funding can be found. This is a difficult problem to resolve.
- Q: How long will 12th Street be torn up?
- A: We don't know for sure, but it could be as long as 6 months.
- Q: Why can't we have a natural channel instead of concrete, or at least rock sides?
- A: We are constrained by the amount of right-of-way we have, and a natural or rock-sided channel would have to be wider. A concrete-lined channel passes the water much more efficiently.

**December 11—Phoenix Country Day School**

Q: Why weren't we brought into this project earlier?

A: Until 1972, this neighborhood was not a part of the project. The Corps made a presentation to the Town of Paradise Valley in 1974.

Q: Have you spoken recently with the Paradise Valley City Council.

A: Yes, on December 20, 1984.

Q: Paradise Valley is not part of Phoenix; can we stop or change the project?

A: You must let your elected officials know how you feel.

Q: Will the area between 40th Street and the Biltmore be partially underground or all underground?

A: From 24th Street eastward, 4,100 feet of the channel will be covered.

Q: What is the grade from the top of the cover to the ground?

A: At the Biltmore, it's at the surface level of the parking lot. At Western Savings, it's closer to ground level.

Q: Are you covering The Links golf course? Is it worth more than my house?

A: On the east side it will be covered to the edge of the property because we're dealing with one owner. If we didn't cover it we'd have to pay severance damages, and it's less expensive to cover it.

Q: What is the cost per square foot of covering the channel?

A: It will cost \$80 per square foot.

Q: How wide is the land from 40th Street to where you're covering it?

A: 75 feet.

Q: Wouldn't it be less expensive to cover the channel--not for traffic, just for landscaping--than to buy up homes and remove them and then put in fences and landscaping?

A: Corps policy is to cover channels only so that they will support vehicles, because assuring that no vehicles will drive on a covered channel over its projected life (at least 100 years) would be very difficult. Also, the cost of a structure to support an adequate amount of soil (sometimes wet) to support landscaping would probably not be much less than the cost of a structure that will support a vehicle.

- Q: How large is the Cudia City Wash catch basin?
- A: The spillway is 200 feet wide. It will narrow down to 36 feet when it dumps into the ACDC.
- Q: What will be done to screen this area?
- A: The same type of landscape treatment proposed for the rest of the channel is proposed at the spillway. Again, we are restricted by how much right-of-way is available.
- Q: Is a 36-foot-wide, 22-foot-deep channel required to handle flows from Cudia City Wash?
- A: Yes. Historical records of flows, statistics, and 100-year flood plans show that this size channel is needed. The Cudia City Wash slope is steep, and the Arizona Canal is very flat. Slope has a great deal to do with determining the size of the channel.
- Q: Is the channel being built here just to control the flow from Cudia City Wash?
- A: No. Cudia City Wash is the largest stream in this area, but overland sheet flow and a number of smaller washes also contribute to flooding in the area.
- Q: How are the dimensions determined?
- A: Once the design flood (in this case, the 100-year flood) is selected, standard hydraulic design techniques are used to determine the channel dimensions.
- Q: Are there storm drains going in between 24th and 40th streets?
- A: We are not aware of any storm drains presently planned for this reach. However, some may be required in the future.
- Q: What's going to keep Stanford Drive from flooding?
- A: Nothing in this project.
- Q: I own a house on Stanford Drive with the wash next to it. Are you going to cover the channel there?
- A: We don't know yet.

Q: Are you going to relocate Stanford Drive to the north?

A: If the channel is not covered in this area, we will relocate Stanford Drive. We will complete designs by October of this year.

Q: On the north side of the Arizona Canal are there any properties greater than 75 feet wide that will be condemned?

A: We would not take more than 75 feet unless we took the whole property.

Q: Is that 75 feet in addition to the 40-foot SRP easement?

A: Yes.

Q: Did you give any consideration to the one-acre minimum? What happens when 75 feet are sold off to the FCDMC, leaving you with less than the required acre?

A: This question is presently being resolved among the owner, the Town of Paradise Valley, and the FCDMC.

Q: Will there be restrictions imposed on homeowners regarding building and maintaining their own walls?

A: There won't be any restrictions on the owner's property, although he might need a building permit.

Q: There is a house next door to me on San Miguel that has been condemned. What is going to happen there?

A: The channel will go through where the house is. The rest of the property might be landscaped or sold.

C: I would prefer that it be landscaped naturally rather than developed into a picnic area or a spot for joggers.

#### **December 12—Cortez High School**

All questions and comments made at this meeting have been included in other sections of this summary.





DEPARTMENT OF THE ARMY  
LOS ANGELES DISTRICT, CORPS OF ENGINEERS  
P. O. BOX 2711  
LOS ANGELES, CALIFORNIA 90053

June 10, 1982

## ARIZONA CANAL DIVERSION CHANNEL

### Part of the Authorized Flood Control Project of the U.S. Army Corps of Engineers for Phoenix and Vicinity

This paper presents planning and technical information on the design of the Arizona Canal Diversion Channel (ACDC) as part of the comprehensive Phoenix and Vicinity Flood Control Project supported by local Phoenix area governments and authorized by Congress.

This paper is in two parts. Part One sets the context for the ACDC, presenting information on the entire Phoenix and Vicinity Flood Control Project. Part Two presents detailed information on the ACDC.

### Phoenix and Vicinity Flood Control Project

#### The Phoenix Flooding Problem

Phoenix is the last large flood prone area in the United States not protected by any type of flood control system. Severe local storms and floods in 1905, 1921, 1935, 1936, 1939, 1943, 1951, 1955, 1956, 1957, 1963, 1964, 1967, 1969, 1970, 1972, 1978, and 1980 have caused financial damage to the people of Phoenix. Large floods occurred along Cave Creek in 1905 and 1921. Because of the 1921 flood (when the State Capitol was flooded), the City of Phoenix, Maricopa County, and the State of Arizona, in cooperation with private interests, built Cave Creek Dam in 1923. Even with the dam, since 1923 there have been two large floods (1943 and 1967) and several small to medium floods on Cave Creek. Major floods have also occurred in surrounding areas.

In August 1963, a cloudburst occurred over the City of Glendale. The high-intensity rainfall caused considerable damage in Glendale and the Maryville section of Phoenix. There also was flooding above the Arizona Canal near 19th Street.

A major flood in September 1970 caused the death of 23 people (more loss of life due to a flood than any other in Arizona's recent history) and caused millions of dollars in property damage. Heavy rainfall on the

mountainous areas of Central Arizona resulted in sudden large flood flows in Tonto, Sycamore, Oak, and Beaver creeks, and in the East Verde and Hassayampa rivers. While this storm was not centered over the Phoenix area, it is meteorologically possible that a storm of equal or greater magnitude could affect Phoenix.

The storm of June 21-22, 1972, did cause extensive damages to the Phoenix Metropolitan area. President Nixon declared Maricopa County a major disaster area because of the damages. People incurred over \$4 million in flood damages from runoff between 40th Street and Dreamy Draw Dam.

More recently, Phoenix and surrounding areas were placed in danger from three storms: in February and March 1978, December 1978, and February 1980. In the March 1978 storm, the old Cave Creek Dam held 7,000 acre-feet of water and filled to within six inches of its brim. Flood water releases from Cave Creek Dam flowed down Cave Creek into the Arizona Canal, then spilled out into the urban areas of Phoenix. The Canal also spilled over at 43rd Avenue and 59th Avenue.

Phoenix citizens and local governments became extremely concerned about the flooding threat in the late 1950's (after the four floods in the previous ten years). Faced with the prospect that the threat would become greater and greater as development increased, the Corps of Engineers was requested to develop a comprehensive flood control plan for Phoenix and surrounding areas. To begin its work, the Corps held a public meeting in late 1959 to give all local interests the opportunity to describe the flooding problem and comment on the extent of the improvements needed. At that time, the Flood Control Advisory Committee (the predecessor of the Flood Control District of Maricopa County) presented its first proposal for improvements in the area.

From 1959 to 1963, the Corps worked closely with the Flood Control District and its consultants to refine the proposal. As a result of the studies, the Corps--in cooperation with the Flood Control District of Maricopa County--developed a comprehensive five-phase flood control plan for the Phoenix metropolitan area. In 1963, the Corps presented the plan to the people of Phoenix. The plan cited the need for phased improvements in five areas:

- Phase A--Indian Bend Wash from the Arizona Canal to the Salt River.
- Phase B--Phoenix and Vicinity (including New River).
- Phase C--Glendale-Maryville and South Phoenix.
- Phase D--Salt River downstream to the Gila River.

- Phase E—Indian Bend Wash upstream from the Arizona Canal.

There was general agreement with the proposed plan, and it was formally approved by Maricopa County. In 1965, Congress authorized final planning of projects for the first two phases: Indian Bend Wash (currently in the final construction stages and scheduled for completion in November 1983) and Phoenix and Vicinity (the subject of this paper). Phases C through E were subsequently incorporated into the Corps' Phoenix Urban Study and the Central Arizona Water Control Study.

### **The Phoenix and Vicinity Authorized Project**

The purpose of the flood control project authorized by Congress for Phoenix and vicinity is to protect people from flood flows originating in a 2,695-square-mile mountain and desert area which drains toward the metropolitan area. Many streams including Cudia City Wash, Dreamy Draw, Cave Creek, Skunk Creek, New River, and Agua Fria River drain flows from this mountain and desert area to the Phoenix area. Currently, a major factor in Phoenix area flooding is the interaction between the Arizona Canal (an irrigation water delivery system flowing to the west) and the many streams which intersect the canal. Urban development has obliterated the historic courses of these streams below the canal. During flooding, flows from these streams have broken through and over the canal. The problem is worsened by overland drainage from the north. The canal traps the flood waters until they overtop the canal barrier. This problem is becoming more severe as urban development north of the canal increases and runoff becomes greater.

As history has shown, floods have different intensities. The Standard Project Flood (SPF) is the flood that would result from the most severe combination of meteorologic and hydrologic conditions considered reasonably characteristic of the region. Present development within the SPF area subject to flooding consists of 50,500 acres: 17,680 acres of residences, 4,060 acres of commercial and industrial businesses, 12,530 acres of farmland, 2,800 acres of public and semipublic lands, 260 acres of parks, and 13,170 acres of undeveloped land.

A 100-year flood is the label for a flood which has a one-percent chance of occurring in any year, or a 22-percent chance of occurring in any 25-year period. A 100-year flood would inundate 31,540 acres.

The authorized Phoenix and Vicinity Flood Control Project, depending on the area, provides either SPF or 100-year flood protection. It is a comprehensive and fully integrated system of four dams in the mountains to the north, 20 miles of channelization, and 19 miles of flowage easements on open space with some floodproofing, levees, and channelization. The project also calls for recreational development, environmental and cultural resources preservation, and esthetic enhancement.

The four dams of the project are:

- Dreamy Draw Dam, on Dreamy Draw, completed in 1973.
- Cave Buttes Dam, on Cave Creek, completed in 1979.
- Adobe Dam, on Skunk Creek, completed in 1982.
- New River Dam, still to be built on the New River.

The 17-mile-long Arizona Canal Diversion Channel (ACDC), to be built north of the Arizona Canal from 40th Street on the east to Skunk Creek on the west, will intercept and convey discharges from Dreamy Draw and Cave Buttes dams as well as all other tributary flows west to Skunk Creek.

On the western end of the project, the flood waters would flow south along Skunk Creek, New River, and the Agua Fria River to its confluence with the Gila River. Channelization of these streams was not as strongly justified. Instead, flowage easements will be obtained for the 100-year flood plain.

The project will provide SPF protection from flood waters originating above the four dams and 100-year protection from flood waters originating between the dams and the ACDC.

Construction of the Phoenix and Vicinity Flood Control Project began in 1972 with the construction of Dreamy Draw Dam. Completion is scheduled for 1991.

The project will protect development worth approximately \$10.1 billion (in 1981 dollars). The total project cost estimate is \$612.3 million (including \$32.3 million for recreational development). The estimate includes:

- Actual costs for the completed portions of the project (Dreamy Draw, Cave Buttes, and Adobe dams), current studies, and construction underway.
- An allowance of approximately \$245.4 million for estimated inflation during the nine remaining years of construction.

Of the total estimate of \$580 million for the project's flood control features, \$329 million is a Federal cost, and \$251 million is a non-Federal cost. For the \$32.3 million for recreational development, \$15.3 million is a Federal cost, and \$17 million is a non-Federal cost. Inflation has been accounted for in project costs.

## Project Alternatives Considered

In every flood control project the Corps of Engineers must study and consider a full range of alternative solutions along a spectrum from no action to nonstructural measures to complete structural improvements. Structural improvements are those built by man to contain the flow of flood waters. Nonstructural measures are actions taken by man to constrain future development in the flood plain (e.g., restrictive zoning), compensate people for economic loss due to flooding (e.g., acquiring flowage easements, providing flood insurance), or protect property against damage from inundation (e.g., flood proofing).

The Corps studied many alternatives. Six were considered in detail: one plan for no further action (after the construction of Dreamy Draw Dam), three plans for complete structural improvements (dams only, channels only, and a combination of dams and channels), and two plans combining structural and nonstructural improvements. The main criteria for evaluating alternative plans encompass:

- Plan acceptability. Is the plan acceptable to the concerned governments and publics?
- Plan completeness. Does the plan incorporate all necessary actions to ensure full attainment of the defined project purpose?
- Plan effectiveness. Will the plan, when implemented, achieve its objectives?
- Plan efficiency. Which plan will achieve national economic development, environmental quality, and other objectives in the least costly way?

Based on its evaluation, the Corps selected a modification of the originally authorized project: one of two plans combining structural and nonstructural improvements. Specifically, this plan was selected because:

- Of the four alternatives providing the largest degree of flood protection, the costs for flood control improvements are the least.
- It provides the second highest maximum flood control benefits (only 0.5-percent less than the alternative with the highest), but at 18-percent less cost for flood control improvements.
- Its benefit-to-cost ratio for flood control is the highest of the four alternatives providing the greatest degree of flood protection. The benefit-to-cost ratio expresses the extent to which economic benefits from a project to the nation (measured mainly in terms of flood damages prevented) are compared to project costs.

- It has the least impact on the environment compared to the three other plans which provide comparable flood control benefits.
- It is the plan most supported by local governments and acceptable to the general public.
- It has the greatest recreational benefits among all the alternatives.

### **Project Support**

As indicated before, the Corps planned and designed the Phoenix and Vicinity Flood Control Project in close coordination with the Flood Control District of Maricopa County and the City of Phoenix. In studying the array of alternatives, the Corps sought public input in a series of public meetings and in informal sessions with citizen environmental and planning groups. The Corps closely coordinated its planning with other Federal, state, and local government agencies. The result of this effort of coordination and cooperation, over a 20-year period of extensive planning, is a project which has been broadly supported throughout the Phoenix area.

### **The Arizona Canal Diversion Channel**

This part of the paper discusses the purpose of the ACDC, its features, alternatives considered for the eastern portion of the channel, the level of flood protection provided, channel design, environmental and cultural considerations, and water quality issues.

#### **ACDC: Purposes**

The ACDC is intended to protect people in Phoenix, Glendale, and Peoria against 100-year floods and to convey flood waters draining from the dams in the mountains. If the ACDC were not built, flood flows from the dams and from severe storms between the dams and the Arizona Canal would build up behind the Canal until they overtopped it, then breaking out in various places all along the Canal. The residents of Phoenix, Glendale, and Peoria would continue to face the residual flood threat from runoff downstream of the four dams.

#### **ACDC: Features**

The ACDC will be 17 miles long, from Cudia City Wash near 40th Street on the east to Skunk Creek on the west. It will intercept flood waters from the Phoenix Mountains and from Cudia City Wash, Dreamy Draw, Cave Creek, and several minor tributaries, as well as from uncontrolled overland flow. Currently, these flood waters frequently exceed the capacity of the

Arizona Canal, causing breakouts and flooding to the south. The ACDC has three types of channel configuration:

- From 40th Street to 47th Ave. A mostly reinforced concrete channel with vertical walls to minimize the amount of land and associated development to be purchased. Another configuration (for example, a concrete trapezoidal or an unlined channel) would have required the purchase of much more property at much greater cost and the relocation of many more people. The Corps selected the channel with vertical walls because it significantly reduces the cost of property acquisition and minimizes social disruption due to relocations.
- From 47th Avenue to Cactus Road. A concrete trapezoidal channel. While more land must be acquired than for a concrete vertical wall channel, it is the least costly configuration because of less urban development in this portion of the project area.
- From Cactus Road to Skunk Creek. An unlined channel. This will permit recreational uses in the channel bottom during no-flood situations: bicycling, jogging, and equestrian trails; picnic areas; and playing fields and courts. This type of construction is possible for this stretch of the channel because there is even less urban development than from 47th Avenue to Cactus Road. This type of construction is feasible for this stretch of channel. It is preferred by the communities of Peoria and Glendale.

The visual impact of the channel will be minimal. Since it will be entrenched along its entire length, people will see it only from bridge crossings (and where it is covered, not at all). Experience with other Corps projects similar in design has been that rectangular concrete channels, when viewed from relatively low altitudes or acute angles at a distance, do not dominate the esthetics of an urban area. In addition, the ACDC design calls for esthetic features. In the concrete-lined portions of the channel (from 40th Street to Cactus Road), the Corps will add esthetic features such as landscaping and channel-wall designs to further soften the impact of the ACDC on the Arizona terrain. The Corps has begun to meet with affected residents to present and discuss optional esthetic features most desired.

#### **Alternatives: the Eastern Portion of the ACDC**

Originally, the Corps planned for an ACDC only 12.4 miles long: from Dreamy Draw on the east to Skunk Creek on the west. In June 1972, residents affected by Cudia City Wash in the eastern part of the area sustained over \$4 million in flood damages. This flood awakened Phoenix area governments to the prospect that more severe floods might cause much

more severe damage. In 1974, the Phoenix City Council requested that the Corps consider, as part of the authorized project, providing flood control improvements from Dreamy Draw to Cudia City Wash in order to protect people threatened by flooding from this drainage area. Cudia City and many minor washes flow to the Arizona Canal between 36th and 40th Streets. The Corps agreed, given the severity of the 1972 problem and the potential threat. After a thorough technical and economic evaluation consistent with Federal law, the Corps found that incorporating this extra area into the project would be economically justified and that it therefore should be a part of the Congressionally authorized project.

The Corps examined in detail three alternatives: (1) extending the ACDC 4.6 miles east to 40th Street; (2) building a number of small detention basins in the Cudia City Wash drainage area within the town of Paradise Valley; and (3) building a collector channel along the Arizona Canal to intercept and convey flows from 36th Street to 40th Street and then into a box culvert that would convey the collected flood waters and flows from Cudia City Wash south under the Arizona Canal and along 40th Street to the Salt River.

The 4.6-mile extension to the ACDC will ensure the conveyance of 100-year flood flows in the ACDC. The detention basins would reduce the peak flow in Cudia City Wash at the Arizona Canal and therefore reduce the size of the ACDC between Cudia City Wash and Dreamy Draw. The collector channel along the Arizona Canal from 36th Street to 40th Street and the 40th Street culvert would avoid introduction of increased flood waters into the ACDC altogether.

The Corps rejected the detention basins in Cudia City Wash drainage area. The Town of Paradise Valley strongly opposed the detention basins. Construction of the basins would undo residential development already underway or prevent development approved by Paradise Valley's Town Council. In 1974, the Town Council adopted a motion opposing both the ACDC through Paradise Valley and the detention basins.

The alternative of a collector channel along the Arizona Canal from 36th Street to 40th Street and a box culvert under 40th Street from the Arizona Canal to the Salt River was estimated to cost over \$45 million, as reported in the Main Report of the Phase I General Design Memorandum (March 1976). The cost estimate for extending the ACDC 4.6 miles east to Cudia City Wash was \$39 million. Because of the differences in costs and the fact that the ACDC extension would control floods originating in the Phoenix Mountains between the Cudia City Wash and Dreamy Draw drainage areas (while the collector channel would not), the Phoenix City Council opposed the collector channel. Given Phoenix's strong opposition, the Flood Control District of Maricopa County (the local project sponsor) gave its support to the alternative of extending the ACDC 4.6 miles to 40th Street. The Corps accepted the Flood Control District's position. The ACDC

extension was clearly the best alternative based on flood control benefit, cost, and local acceptability criteria.

In early 1982, the Corps consolidated its project files, discarding project data no longer considered to be necessary to continue with the design of the authorized project which was strongly supported by the City of Phoenix and the Flood Control District of Maricopa County. This consolidation was undertaken in response to a Corps record-reduction directive. In late 1981, the data on alternatives to the 4.6-mile ACDC extension which were developed in 1972-74 were no longer needed, since by then the ACDC extension was a fully integrated and accepted part of the project (and since the total costs of the alternatives, excluding utility relocations, were included in the 1976 project report). Moreover, the costs of the alternatives to the extension were no longer current. Corps policy is to update and continue only those data which are important to authorized project design.

### **The Level of Flood Protection**

In trying to provide flood protection south of the Arizona Canal, the Corps analyzed three levels of flood protection: from the Standard Project Flood, the 100-year flood, and the 50-year flood. Strictly from an economic standpoint, the Corps found that improvements to prevent each size flood would be economically justified. However, the Corps also found that improvements to protect against the 100-year flood were in the best overall public interest. There were two main reasons.

First, the Corps found that improvements to protect people south of the Arizona Canal against the 100-year flood would result in better net economic benefits than improvements to protect people from a lesser (50-year) or greater (SPF) level of protection.

Second, the Corps concluded that improvements to protect people from a Standard Project Flood would be too economically and socially disruptive to the Phoenix metropolitan area. Constructing the ACDC to provide SPF protection for residents south of the Arizona Canal would require the Flood Control District to acquire substantially more land than for the authorized project: 62 percent more land, which would be permanently removed from the tax rolls; a 47-percent increase in home relocations; a 55-percent increase in apartment building relocations; a 63-percent increase in business relocations; and 630 additional acres of flowage easements along Skunk Creek and the New and Agua Fria rivers. The Flood Control District has said that since it could not afford the increased costs, it could not continue to support the project if SPF design criteria were adopted for the ACDC. And, without this diversion channel, the flood flows from two of the completed mountain dams would have no place to go but into the Arizona Canal or--inevitably--into the Phoenix area to the south.

There is a legitimate concern about whether the ACDC, designed to protect people from the 100-year flood, might cause more severe damage to them during a Standard Project Flood. It will not. In fact, the ACDC would carry away over 50 percent of the SPF, resulting in far less damage than under existing conditions. Several aspects of the ACDC support this conclusion:

- East of Cave Creek. Runoff from the Phoenix Mountains will generally be concentrated, following the same course, with or without the ACDC. Diverted flows already in the ACDC will not overtop the channel banks unless additional flood waters downstream enter the channel at the same time. But if this happens, those flood flows would cause flooding downstream without the ACDC. With the ACDC, however, the flooding threat is much less frequent. Only flows exceeding 100-year protection will spill over the Arizona Canal—much greater protection than is provided at present.
- West of Cave Creek. Flood flows move overland, not following well-defined channels. Without the ACDC or due to channel overtopping from floods greater than the 100-year flood, downstream flooding can occur at any point because of breaks in the Arizona Canal. With the ACDC, there will be no canal breaks for any flood up to 100-year protection. The flood flows will be totally confined within the ACDC.
- Flood waters from Cudia City Wash. If the flood flow from the area served by Cudia City Wash exceeds the 100-year flow, the excess will be allowed to spill out at its source. If necessary, structures will be built on the ACDC for this purpose. Flows exceeding the 100-year flood in the drainage areas between Cudia City Wash and Dreamy Draw will not continue in the ACDC.
- Biltmore Estates retention basins. The Corps has considered these basins in the design of the ACDC. The watershed containing the basins contributes little to design peak discharges on the ACDC, with or without the basins. The final ACDC design will ensure that the ACDC does not adversely affect the capacity of these retention basins.

In summary, no one will be worse off all along the channel from any flood greater than the 100-year flood. But the ACDC will ensure that thousands of residents in Phoenix will have much greater flood protection than they now have.

## Channel Design

The Corps of Engineers designed the ACDC using standard hydraulic design criteria. Some of the elements that go into the design include the flood water discharge, channel geometry, channel slope, channel roughness, the amount of sediment in flood flows, flood flow velocities, design freeboard, and the availability of land right-of-way in which to build the channel. Using these parameters, the Corps develops a water surface profile to design a channel. The Los Angeles District has designed and built over 300 miles of concrete-lined channels based on its hydraulic design criteria.

In recent months, some critics—mainly concerned with the 4.6-mile ACDC extension from 40th Street to Dreamy Draw—have raised questions about certain aspects of the channel's design criteria: channel roughness, the design discharge, sediment in the flood flow, freeboard, and flood velocities. The Corps uses this section of the report to provide necessary data on its design criteria.

### Channel Roughness

An important factor in the hydraulic analysis is the energy lost from friction between the water and the channel surface. The loss depends on the roughness of the channel. The rougher the channel, the slower the velocity of water and, therefore, the larger the channel needed for a specified flow rate. The quality of concrete and surface finish which the Corps requires ensures that the channel surface will be relatively smooth. To allow for surface roughness, the engineer must use a coefficient factor. A commonly used coefficient to account for surface roughness is the Manning coefficient factor. A factor of 0 implies no friction between the walls and the water and therefore is unattainable. A factor of 0.012 would indicate the smoothest surface attainable under ideal conditions, while a factor of 0.016 would suggest a relatively rough concrete surface. The selection of higher roughness coefficients may be necessary under certain conditions because weather conditions might cause the surface to deteriorate with age.

The Los Angeles District has designed almost all of its concrete-lined channels using Manning's roughness coefficient factor of 0.014. This is a conservative factor consistent with the quality of the finished surface. It allows for the effects of weatherization and concrete erosion. Those effects are very small on concrete channels in Southern California and Southwestern Arizona, mainly because of the lack of freezing and thawing which cause rapid deterioration of the concrete finish.

Data collected during actual flood events on existing channels in Southern California support the Corps' use of 0.014 as the conservative coefficient factor. Tujunga Wash, the Los Angeles River Channel, and Alhambra Wash each had coefficient factors of less than 0.013. The channels ranged in age from 14 to 45 years at the time of the coefficient factor test.

The Los Angeles District consulted a Corps of Engineers Committee on channel stabilization for expert advice on the appropriateness of 0.014 as the roughness coefficient factor for the ACDC. This committee, consisting of 10 members from Corps offices and research laboratories throughout the country, confirmed the Los Angeles District's conclusion. It is also supported by expert engineers outside the Corps. L.C. Urquhart (Civil Engineering Handbook) recommends a factor of 0.014 for concrete-lined channels with good surfaces. Ven Te Chow (Open Channel Hydraulics) recommends a factor of 0.013 for concrete-lined channels with troweled surfaces.

### **Design Discharge**

The 100-year design discharge for the ACDC at Cudia City Wash is 6,800 cubic feet per second (cfs). The Part 1 Hydrology Report (1974) presented the methodology used by the Corps to generate the design discharge and other design flood values. The methodology has been published for seven years and has been coordinated with and reviewed by many local organizations including the Arizona Department of Water Resources, the Flood Control District of Maricopa County, and the City of Phoenix. The Part 2 ACDC Hydrology Report (1982) provides a comprehensive description of all data sources, assumptions, and results to produce the design discharge of 6,800 cfs.

The basic procedure was to utilize all available runoff information in order to establish discharge frequency relationships for watersheds under study in the Phoenix region. Discharge frequency relationships were established for urban watersheds in Phoenix, based on the observed runoff experience of urban watersheds in Southwestern Arizona.

Regionalization of discharge frequency relationships is a commonly used technique when streamflow information is insufficient or unavailable for the watershed being studied. While the ideal procedure for computing 100-year flood flows would be to use site-specific data, they are not available on the project drainage area.

There are, of course, other methods to establish a discharge frequency value. When different procedures are used, it is the general rule that the results will be different. Using the method of the U.S. Soil Conservation Service (SCS), one engineer established a discharge frequency value for the ACDC of 7,200 cfs. The difference between the Corps established value of 6,800 cfs and 7,200 cfs is less than six percent—so close as to suggest that good judgment was used in both methods to estimate the magnitudes of variables involved. Given the normally short periods of time that stream gages have been installed on small watersheds in Southwestern Arizona, the statistical confidence limits on 100-year flood determinations are more than plus or minus six percent for natural, undeveloped watersheds. For watersheds undergoing urbanization, such as metropolitan Phoenix, the confidence limits would be even greater. Hence, the six-percent difference

in 100-year design discharge estimates constitutes virtually complete agreement in terms of design flood magnitudes.

The SCS method (as well as the HEC-1 computer program developed by the Corps) assumes that runoff frequency is equivalent to the rainfall frequency which causes it. But this is not necessarily the case, since water will percolate into the ground. The SCS and HEC-1 methods are most valuable if they include calibrating rainfall-runoff variables to site-specific data in Cudia City Wash or calibrating the procedure to actual observed discharge frequency relationships for urban watersheds in the region. The Corps suspects that if this were done using the SCS method, the result would be a frequency discharge closer to 6,800 cfs.

### **Freeboard**

Another important part of channel design is to add "freeboard"--increasing the channel's depth beyond what is absolutely required to handle the size of flood to be controlled. Freeboard is added to ensure that the desired degree of protection will not be reduced by unaccountable factors. The freeboard for the ACDC is a minimum of two feet. This is the standard used by the Corps of Engineers for rectangular concrete channels. The Los Angeles County Flood Control District uses the same figure for channel velocities less than 35 feet per second. (The velocity in the ACDC will be 11 to 12 feet per second.) The SCS uses the larger of 10 percent of the flow depth or one foot, which for the ACDC would result in about two feet of freeboard. One engineer has argued that using criteria of the Bureau of Reclamation, the ACDC freeboard should be 5.3 feet. The Corps, in reviewing the Bureau's criteria, found that 5.3 feet of freeboard would only be required for a leveed channel (which does not apply to the ACDC). According to the Bureau's criteria, the ACDC freeboard would be 2.6 feet. However, the Bureau's criteria are for irrigation canals and not flood control channels. The ACDC, a flood control channel only, will contain no flood flow most of the time. Irrigation canals flow at or near capacity most of the time. Therefore, more freeboard for irrigation canals may be desirable to accommodate flood flows that may enter the canal.

The Corps continues to find that two feet of freeboard for the ACDC is sufficient. In any event, the Corps does not use additional freeboard to account for any insufficiency in design. That is not good engineering practice. If the Corps believed that its design parameters for the ACDC were inappropriate, the Corps would redesign the channel.

### **Flow Velocities**

Concern about velocity has been expressed because of the risk of channel failure or overtopping which might cause great damage. The ACDC has no risk of failure; and in rare instances of overtopping, no one will sustain greater damage than under current conditions. As stated above, the

ACDC will have flood velocities of 11 to 12 feet per second. The ACDC channel will be lined with 10- to 33-inch-thick reinforced concrete with double rows of rebar. It is rare to design a concrete-lined channel for such slow velocities. Normally these velocities would call for side slopes lined with rock and unlined inverts. On the ACDC, the concrete lining on a portion of the channel is only to minimize the requirements of right-of-way purchase and not to handle the flow velocities. Therefore, there is no risk of failure.

Observations of rare instances of overtopping Corps-built channels indicate that the channels sustain no damage. For example, in 1980 one channel in Los Angeles overtopped with a velocity of 30 feet per second. There was no channel damage.

In the covered portion of the ACDC, the Corps will make certain that the channel never flows full because of the increased friction created by the cover. To ensure that the box never flows full, flows in excess of the design discharge will be allowed to overflow upstream of the covered section and enter the Arizona Canal. Breakouts from the canal are what happens currently.

#### **Environmental and Cultural Considerations**

The project's impact on environmental and cultural resources is discussed fully in "Design Memorandum No. 3, General Design Memorandum, Phase I, Plan Formulation," and the "Final Environmental Impact Statement" (both published March 1976). The Corps selected the authorized plan in recognition of the documented impacts, concluding that, given the severity of the flooding problem and the effects of other alternatives providing a high degree of flood protection, the selected plan's environmental impacts are justified. These reports were widely circulated and coordinated with the public.

The Corps is sensitive to preserving cultural and archaeological sites of value. For example, the existing dam at Cave Creek (built in 1923) has been nominated to and listed on the National Register of Historic Places and preserved for its historical values. The Corps has an active archaeological program at Adobe Dam, New River Dam, and Cave Creek to preserve and understand the petroglyph sites and cultural artifacts discovered there.

The Corps acknowledges the cultural significance to Arizona of the Arizona Biltmore Hotel and the Wrigley Mansion (although they are not included in the National Register of Historic Places, nor are they designated Arizona State Landmarks). However, the ACDC, after construction, will not adversely affect these properties.

## **Water Quality**

One-hundred-eighty days prior to discharge into Skunk Creek, a permit (under the National Pollutant Discharge Elimination System) must be filed with the U.S. Environmental Protection Agency and the Arizona Department of Health. The Corps fully intends to incorporate the requirements of these agencies as they relate to water quality and construction of the project.

## **Conclusion**

The Phoenix and Vicinity Flood Control Project is a comprehensive, integrated system of structural and nonstructural measures to provide a high degree of flood protection to the people of Metropolitan Phoenix. It is under construction. Failure to complete construction of all the elements would mean that the people of Metropolitan Phoenix would continue to be subjected to extensive flood damages.

The ACDC is an essential part of the total system. It completes the project. It provides a level of protection (100-year) which optimizes flood control benefits, is the best economically and financially, and has the greatest support. The ACDC protects thousands of people not now protected—people who are increasingly vulnerable to flood damages as urban development continues. It makes conditions worse for no one. SPF protection, requiring a complete redesign of the channel, would delay completion, require relocation of significantly more people along the channel, and overtax the Flood Control District's ability to pay for it.

The ACDC design is conservative, based on the standard Corps design criteria and the agency's long history as the main flood control builder in the country. Those criteria have been reviewed and endorsed by the Corps technical review offices and the main Arizona agencies concerned with the project: the Arizona Department of Water Resources, the Flood Control District of Maricopa County, and the City of Phoenix.



# FLOOD CONTROL DISTRICT

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Maricopa County

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May 28, 1985

## FLOOD CONTROL IN THE DESERT: A PROGRESS REPORT

The Phoenix and Vicinity Flood Control Project is rapidly becoming a reality. Authorized by Congress in 1965, the project is being designed and constructed by the Army Corps of Engineers under the local sponsorship of the Flood Control District of Maricopa County. The District's job is to acquire the necessary rights-of-way, relocate affected people and facilities, and to operate and maintain the completed structures.

The project is an integrated system consisting primarily of four dams, the last of which has just been completed, about 20 miles of channelization and 19 miles of flowage easements. It is designed to protect against floodwaters originating north of the Arizona Canal, the main water supply canal north of the Salt River. Outdoor recreational developments are also included.

The backbone of the system is the Arizona Canal Diversion Channel (ACDC), a 17-mile long floodway upslope from and parallel to the Arizona Canal. The Arizona Canal does not have the capacity to handle all the storm runoff that can flow into it. Excess runoff has periodically overflowed the Canal at predetermined spillways and from random breaks in its southern bank. In 1972, for example, over 2,600 homes were damaged from breaks at 32nd and 40th Streets. The ACDC will extend from Cudia City Wash (near 40th Street in Phoenix) to Skunk Creek (about 75th Avenue in Peoria).

As in any large, multi-year endeavor, a certain amount of controversy and questioning is inevitable. The following questions are those most frequently asked by people concerned about the ACDC:

Q: How does the project work?

A: The Dreamy Draw Dam and Cave Buttes Dam (Cave Creek) will store the standard project floods (about 200 year frequency) and release the floodwater at low rates. The ACDC will accept these releases plus runoff originating below the two dams and additional runoff from washes, streets and storm drains. The ACDC will be large enough to convey flows from up to the 100-year storm harmlessly into Skunk Creek. These design flows vary from 6,800 cubic feet per second (cfs) at the eastern end to 29,000 cfs at Skunk Creek.

Adobe Dam on Skunk Creek and New River Dam are designed to store the standard project flood and to reduce the peak flows on those streams by the same amount as the diverted flows from the ACDC. Flowage easements downstream from the ACDC confluence with Skunk Creek will compensate for more frequent or longer duration lower flows.

Q: What is the current status of the project and when will it be completed?

A: Dreamy Draw, Cave Buttes, Adobe and New River Dams are already completed. Construction of the ACDC will start at the western end in the fall of 1985 and will progress in four increments with completion in 1991. About 86% of the land for the ACDC has already been acquired, and relocation of utilities, bridges and roads is in progress.

Q: How much does the project cost?

A: In 1984 dollars, total project costs are \$439 million, of which \$222 million are non-federal costs. Included are ACDC total costs of \$304 million, of which \$155 million are non-federal. To date, about \$52 million of the ACDC non-federal money has been spent or obligated.

Q: The project was authorized over 18 years ago. Is it still needed?

A: It is needed even more. Urbanization has increased storm runoff and city storm drains have been designed and built anticipating completion of the flood control project.

Q: Are there other (better) alternatives?

A: Seven system alternatives were studied, along with four alternatives to the ACDC. The authorized project was selected based on its acceptability to the public and concerned governments, and because it provided more benefits for the money.

Q: When property is acquired, are the owners treated fairly?

A: All properties are appraised by an independent fee appraiser. The District cannot, by law, offer less than the appraised value. Relocation assistance is also required by law for residential tenants, owner occupants, and small businesses. For example, relocation assistance to a homeowner includes reimbursement for moving costs, escrow fees and payment to offset higher mortgage interest rates.

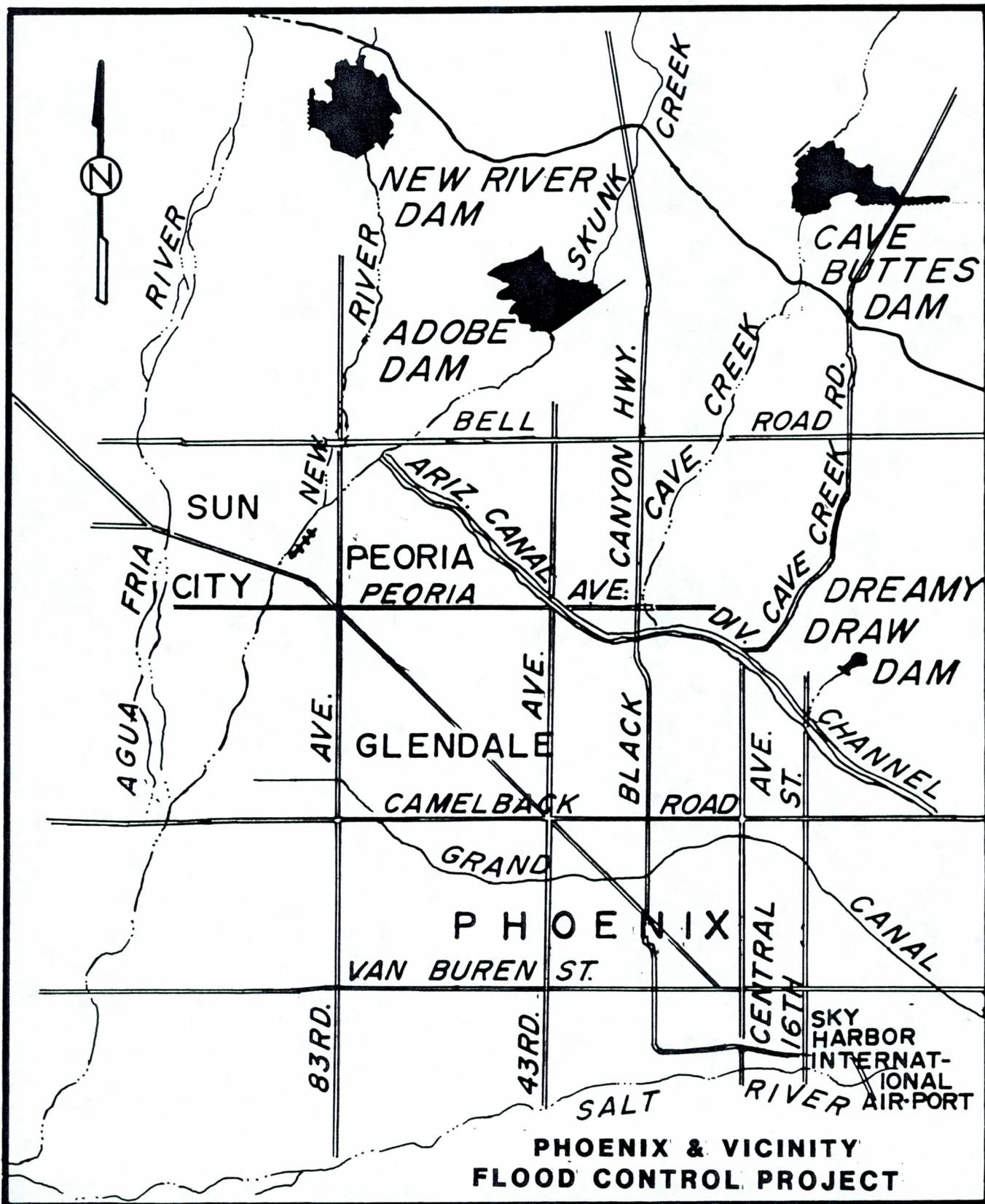
Q: Will the ACDC be ugly?

A: Since the channel will be entrenched along its entire length, the visual impact will be minimal. The ACDC will be concrete lined from 40th Street to Cactus Road (near 51st Avenue). Relatively narrow concrete lined channels do not dominate urban areas when viewed from low altitudes or acute angles at a distance. The channel will be obvious only from bridge crossings. In addition, landscaping and channel wall designs will soften the channel's impact. The channel will be covered at Sunnyslope High School and near the Biltmore Hotel in order to permit continued use of the athletic field, parking lot and other facilities. From Cactus Road to Skunk Creek the ACDC will be wider and unlined to permit recreational uses of the channel bottom.

Q: Will the diversion of flows cause increased risk of flooding to certain areas along the ACDC?

A: No. Only flows exceeding the 100-year capacity of the ACDC would overflow into the Arizona Canal and spill out from the Arizona Canal in the same way that they do now. This is much greater protection than now exists.

The Phoenix and Vicinity Flood Control Project is an integrated system of project features designed to provide a high degree of flood protection to the people of the Greater Phoenix Metropolitan Area. It is well underway. We need to maintain the level of public awareness and support for this project until it is completed.



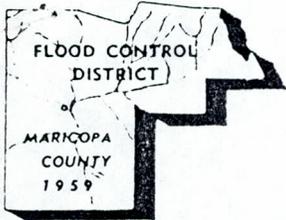
FLOODING FROM ARIZONA CANAL BREAKOUTS AT 32ND AND 40TH STREETS  
JUNE 1972 (PHOTOS FROM CORPS OF ENGINEERS FLOOD DAMAGE REPORT)



This family stands disconsolate in knee-deep floodwaters that entered their home at 38th Place and Camelback Road in Phoenix.



Young girl experiences difficulty crossing the intersection of 32nd Street and Campbell Avenue in Phoenix.



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MAY 21 1985

Mr. Richard DeUriarte  
Phoenix Gazette  
120 East Van Buren  
Phoenix, AZ 85004

Dear Mr. DeUriarte:

Here is the article regarding the Arizona Canal Diversion Channel that I promised you.

Sincerely,

D. E. Sagramoso

*Revised version  
5/21/85*

#### REACH 4, ARIZONA CANAL DIVERSION CHANNEL

The Arizona Canal Diversion Channel (ACDC) is part of an integrated system of flood control features consisting primarily of four dams and the 17 mile long ACDC. The system was approved by Congress in 1965, later modified in several ways and approved by both the City of Phoenix and the Flood Control District Board of Directors (County Board of Supervisors). The system is designed to protect against floodwaters originating north of the Arizona Canal. Outdoor recreation features are also included.

The backbone of the system is the ACDC, to be built on the north (upslope) side of the Arizona Canal and parallel to it. The Arizona Canal does not have the capacity to handle all the storm runoff that can flow into it. Excess runoff has periodically overflowed the Canal at predetermined spillways and from breaks in its southern bank. The ACDC is planned to extend from Cudia City Wash (near 40th Street and Camelback) to Skunk Creek (about 75th Avenue and Bell Road).

The channel will be built in four segments, or reaches, starting this fall at the western end. Reach 4 extends from about 12th Street to 40th Street, and is planned for construction beginning in 1989 and ending in 1991. Major flooding occurred in the Reach 4 area in 1939, 1943, and 1972. In 1972 over 2,600 homes were damaged from three breaks in the Arizona Canal just west of 40th Street.

The Flood Control District is responsible for acquiring rights-of-way and relocating affected facilities. The four dams are now complete at a local cost of \$21 million. The District has spent \$52 million on the ACDC, including almost \$7 million on Reach 4. About 86% of ACDC rights-of-way have been acquired.

Phoenix is probably the only major city in the United States without a comprehensive flood control system. The ACDC or alternatives have been under study or design by the Corps of Engineers for twenty years. At each decision point, the public heard the issues and provided input. The City of Phoenix and the Flood Control District participated in the decision process and approved the decision that was made.

Recently, critics of Reach 4 have used press releases, public meetings and paid advertisements to issue a mixture of truths, half-truths, misrepresentations and outright falsehoods. This propaganda is misleading the public with fabricated or exaggerated concerns. Let me illustrate a few of these:

° "The ACDC provides incomplete protection." This is true, of course. The ACDC provides protection against the 100-year flood, a very high level of protection. No known flood control project in the world protects against all conceivable levels of flooding.

° "Floodwaters will be diverted onto people who otherwise would not be damaged." This statement is false. Flows greater than the channel capacity will simply overflow the channel into the Arizona Canal as they would pre-project. Flows larger than the 100-year would be dramatically reduced.

° "Reach 4 is not cost effective." The authorization of a federal project is a rigorous process which includes an economic analysis . The benefits do exceed the cost or it could not have been authorized. New development which would now also be subject to damage serves to increase the benefits.

° "The ACDC will be ugly; won't be landscaped; averages 50 feet wide in Reach 4, is 65-70 feet wide near the Biltmore Hotel; is wider than the Arizona Canal in Reach 4." All of these statements have been made by critics. Actually, the ACDC will be landscaped, will be covered in some areas, is a maximum of 40 feet wide in Reach 4 and is 36 feet wide at the Biltmore, where the Arizona Canal is 68 feet wide.

While additional landscaping and aesthetic design may be desirable, I am convinced of the viability of this project, including Reach 4, from the functional, safety, economic and aesthetic points of view.

copy for  
Phx Task Force

INFORMATION SHEET  
ACDC - REACH 3

THE PURPOSE OF THE ACDC IS TO REDUCE THE OVERTOPPING OF THE ARIZONA CANAL, ITS FAILURE, AND SUBSEQUENT DOWNSTREAM FLOODING IN URBAN PHOENIX.

CONSTRUCTION OF THE PROJECT WILL ALLEVIATE THE THREAT OF FREQUENT FLOOD DAMAGES TO AREAS OF URBAN DEVELOPMENT.

FROM DREAMY DRAW (12TH STREET) TO CAVE CREEK (3.6 MILES), THE ACDC WILL BE RECTANGULAR CONCRETE CHANNEL WITH A BOTTOM WIDTH RANGING FROM 50 TO 60 FEET AND A DEPTH RANGING FROM 20.5 TO 23.5 FEET, INCLUDING A MINIMUM OF 2.0 FEET FREEBOARD. THE CHANNEL WILL BE COVERED BETWEEN CENTRAL AVE AND DUNLAP AVENUE (A DISTANCE OF 2591 FEET), THROUGH THE SUNNYSLOPE HIGH SCHOOL FACILITIES.

THE CHANNEL WILL BE ENTRENCHED FOR ITS ENTIRE LENGTH TO ALLOW SIDE INFLOW OVER THE CHANNEL WALLS. IN AREAS WHERE LOCAL PONDING WILL OCCUR AND IN COVERED REACHES, PIPE INLETS, WITH AUTOMATIC DRAINAGE GATES WILL BE PROVIDED.

MAJOR INFLOWS OCCUR AT NORTHERN AVE (DREAMY DRAW) 1,300 CFS AND AT 10TH STREET- 3,900 CFS.

7 BRIDGES WILL BE REQUIRED AT ALL STREETS THAT PRESENTLY CROSS THE ARIZONA CANAL; 12TH STR, NORTHERN AVE, 7TH STR, CENTRAL AVE, DUNLAP AVE, 7TH AVE, 19TH AVE.

DREAMY DRAW DOWNSTREAM FROM THE DAM HAS A CAPACITY FOR THE 220 CFS MAXIMUM DISCHARGE FROM THE DAM.

THE RECREATION PLAN IS BASED ON THE DEVELOPEMWT OF A SAFE, FUNCTIONAL, AND ESTHETICALLY PLEASING TRAIL SYSTEM FOR EQUESTRAINS, HIKERS, JOGGERS, AND BICYCLISTS.

LANDSCAPING IN THE CHANNEL RIGHT-OF-WAY WILL SCREEN THE CHANNEL FROM THE NORTH IN MOST AREAS.

TEMPORARY IMPACTS RESULTING FROM THE CONSTRUCTION OF THE ACDC INCLUDE INCREASED AIR POLLUTION, NOISE, AND TRAFFIC CONGESTION. CONSTRUCTION OF THE ACDC WILL RESULT IN ABOUT 11.5 MILLION CUBIC YARDS OF EXCESS SOIL. SPOIL DISPOSAL SITES HAVE BEEN ACQUIRED NEAR THE SKUNK CREEK END OF THE CHANNEL AND NORTH OF THE CHANNEL IN THE VICINITY OF 7TH STREET AND BEARDSLEY ROAD.

REACH 3 PARCELS REQ'D: 172                      PARCELS ACQ'D: 161  
PERCENT ACQ'D: 93.6                              PROPERTY COST: \$ 9.36 MILLION

46 RESIDENCE                      19 TOWNHOUSES                      40 APARTMENTS                      31 COMMERCIAL

46  
19  
40  
31  
-----  
137

? → Remainder were vacant parcels

FACT SHEET ON REACH 4ARIZONA CANAL DIVERSION CHANNEL (ACDC)

(Prepared by Staffs of City of Phoenix Engineering  
Department and Flood Control District of Maricopa County, May 1985)

This report is written to offer a brief presentation on the ACDC, Reach 4, and to provide factual data on that reach.

The sources or references for this report are shown on Appendix 1.

Arizona Canal Diversion Channel, Source A, Page 39

The ACDC will be just north and nearly parallel to the Arizona Canal. Where possible, the alignment will be such that the left wall or side slope of the channel will be near the north rights-of-way line of the canal. The ACDC will extend a distance of approximately 16.5 miles. It will provide protection to residences, businesses, and other land uses of urban Phoenix that are south of the Arizona Canal by diverting flows to Skunk Creek and the New and Agua Fria Rivers. A concrete rectangular section will extend from Cudia City Wash to 46th Drive (11.5 miles). The ACDC is designed to carry the 100-year flood. The channel will be entrenched for its entire length to allow side inflow to enter over the channel walls. Confluence structures will be required at major tributary locations and pipe inlets will be used where local ponding occurs. A total of 31 vehicular bridges will be required at all streets, driveways, and highways that presently cross the canal; 4 new pedestrian bridges will also be required.

Total First Cost (not including repair and maintenance) for Phoenix and Vicinity Project - Source A

The total first cost for construction of the Phoenix and Vicinity Project which includes the ACDC, four dams, and other measures (flood control and recreational facilities, as well as wildlife mitigation and lands and archaeological mitigation), is estimated at \$439 million (October 1984 price levels), of which \$217 million is a Federal cost and \$222 million is a non-federal cost. These estimates include \$149 million in Federal costs and \$155 in non-Federal costs for the construction of the ACDC, including recreation facilities.

Total Equivalent Annual Benefits of the Total Project - Source A, Executive Summary

The total equivalent annual benefits for the total project are estimated at \$31.6 million; and the total average annual charges are estimated at \$14.4 million, yielding an overall benefit-cost ratio of 2.2 to 1.0.

The total equivalent annual benefits for flood control are estimated at \$28.1 million; and the total average annual charges are estimated at \$12.7 million, yielding a benefit-cost ratio of 2.2 to 1.0.

The total equivalent annual benefits for recreation are estimated at \$3.52 million; and the total average annual charges are estimated at \$1.73 million, yielding a benefit-cost ratio of 2.0 to 1.0.

Annual charges and benefits are determined for a 100-year project life and an authorized 3-1/4 percent discount rate.

Reach 4 - Source A, Page A1-13

Reach 4 is that portion of the ACDC between Cudia City Wash to Dreamy Draw. The upstream reach will begin at Cudia City Wash and extend downstream to Dreamy Draw, a distance of approximately 4.2 miles. In this reach, the channel will be rectangular with base widths ranging from 36 to 40 feet and wall heights ranging from 20.5 to 24.5 feet. The channel will be open except for a covered reach from just east of the Arizona Biltmore Hotel to 24th Street.

Major Concentrated Side Inflows to Reach 4, ACDC - Source A, Page A1-27

<u>Approximate Location</u>	<u>100-Year Flood (cfs)</u>
Cudia City Wash	6,700
Upstream from 32nd Street	2,400
Below Ocotillo Road	1,900
Below 16th Street	2,300

Reach 4, ACDC Design Discharge Based on Future Conditions with Project - Source A, Page A1-24

<u>Location</u>	<u>100-Year Flood (cfs)</u>
Cudia City Wash	6,700
Above 32nd Street	7,900
Near Sahuaro Drive	8,300
Near Ocotillo Road	8,700
Downstream from 16th Street (Upstream from Dreamy Draw)	9,000

Summary of First Cost for Flood Control - Reach 4, ACDC (October 1984 Price Levels) - Source A, Page A1-69

	<u>Cudia City Wash Sediment Basin</u>	<u>Cudia City Wash- Dreamy Draw Reach 4</u>	<u>Total</u>
Construction	\$2,620,000	\$28,400,000	\$31,020,000
Engineering & Design	260,000	2,900,000	3,160,000
Supervision & Admin.	260,000	2,900,000	3,160,000
Land & Damages	460,000	19,300,000	19,760,000
Relocation of Utilities	0	2,830,000	2,830,000
Relocation Roads & Bridges	0	3,320,000	3,320,000
Totals	<u>\$3,600,000</u>	<u>\$59,650,000</u>	<u>\$63,250,000</u>

Physical Description of ACDC Reach 4 - Source A, Appendix I Plates 15, 16, & 17

<u>Location</u>	<u>Width</u>	<u>Height</u>
Cudia City Wash	36'	20.0'
32nd Street	36'	21.0'
Arizona Biltmore	36'	20.5'
East of 24th Street	36'	21.0'
Just West of the Above Location	40'	20.0'
Maryland Avenue	40'	23.0'
Glendale Avenue	40'	24.0'
East of 12th Street	40'	23.5'

June 22, 1972 Flood - Source B

Heavy thunderstorms hit Northeastern Phoenix on the evening of June 21 and the morning of June 22, 1972. The storms rainfall occurred between 6:00 a.m. and 12:00 a.m. on June 22 in the northeast part of Phoenix, with the greatest intensity recorded during a 1.5 to 2-hour period. The maximum unofficial intensity reported was 5.25 inches during an estimated two hours in the vicinity of 24th Street and Camelback Road. The heavy precipitation caused relatively high discharges on the south drainage areas on the south slopes of the Phoenix Mountains and a record discharge on Indian Bend Wash. This flood is estimated to have a frequency of occurrence of once every 70 years.

Flooding Along the Arizona Canal - Source B

The Arizona Canal from 64th Street to Cave Creek is about 12 miles long. From the 1972 rain, the flooding was mostly by the backwater from local runoff ponded along and above the canal bank. The flooded area along this reach amounted to 500 acres. Flood damage in this part of the city totaled about \$608,000 (\$1,508,000)\* Water inundated the basement and the ground floor of the Arizona Biltmore Hotel north of the Biltmore Golf Course, damaging much of the operating equipment. In general, flood damages to commercial establishments were minimal because few commercial establishments existed above the canal.

Breaks in the Arizona Canal - Source B

From the runoff caused by the June 1972 storm, there were numerous breaks in the Arizona Canal causing flooding to the south. Breaks occurred at 23rd Avenue, Central Avenue, 7th Street, 12th Street, 16th Street, 18th Place, 20th Street, 32nd Street and 40th Street. The grand total of the damage caused by these breaks was \$4,255,000 (\$10,552,000)\*.

Breaks in the Grand Canal - Source B

The June 1972 flood caused water to flow out of the Arizona Canal through the overflow structures and breaks in the canal's south bank. These waters, plus other rainfall, inundated areas above and below the Grand Canal in the City of Phoenix. The summary of flood damages along the Grand Canal and resulting from breaks in the Grand Canal totaled \$2,568,000 (\$6,292,000)\*.

Summary of Damages from June 22, 1972 Flood in the Phoenix Metropolitan Area - Source B, Page 55

The summary of flood damages from the June 1972 flood gave a total physical damage of \$7,975,000 (\$19,778,000).\* Damages to business loss and emergency cost were \$2,583,000 (\$6,406,000).\* Total damage \$10,558,000 (\$26,184,000).\*

\*The first figure is in 1972 dollars. The figure in parentheses is the 1972 figure inflated by the Consumer Price Index to 1984.

Land Development North and South of the Arizona Canal - Source B

A review of aerial maps as well as the general review of the conditions that existed in 1972 reveals that there has been a great amount of new development both north and south of the Arizona Canal, especially between 24th and 40th Streets. For instance, in 1972 very little development existed north of the Arizona Canal other than the Arizona Biltmore Hotel and a few homes. Much of the land fronting on Camelback Road was either undeveloped or was residential in nature. The area north of Camelback Road and west of 32nd Street was essentially fenced desert area with a few homes in the Arizona Biltmore Estates. This area was heavily flooded in 1972, but fortunately the area was primarily vacant. The same flood now would cause extensive damage and would greatly escalate the flood damage figures over just inflation factoring.

Summary of First Cost for Arizona Canal Diversion Channel (October 1984 Price Levels) - Source A, Page A1-69

The cost for the construction of the flood control features of the ACDC include the cost of constructing the channel, engineering and design costs, supervision and administration of the construction contract, land acquisition and severance damages, and relocation of utilities, roads and bridges. The summary of the costs are:

<u>Location</u>	<u>Description</u>	<u>Cost</u>
Cactus Road - Skunk Creek	Reach 1	\$ 49,350,000
Cave Creek - Cactus Road	Reach 2	103,800,000
Dreamy Draw - Cave Creek	Reach 3	60,250,000
Cudia City Wash - Dreamy Draw	Reach 4	59,650,000
Cave Creek Channel		9,750,000
Cave Creek Sediment Basin	Part Reach 2	6,600,000
Cudia City Wash Sediment Basin	Part Reach 4	<u>3,600,000</u>
Total		<u>\$293,000,000</u>

Comments Against Reach 4 - Source C

Propaganda and flyers published in opposition to Reach 4 address a number of issues. Stated below are some of the issues and response:

"Reach 4 - an empty ditch, 50' wide and 24' deep with a chain link fence on both sides." Another statement was that the "the drainage ditch was three times as big as the Arizona Canal." From Cudia City Wash to 24th Street, the channel is 36' wide. From 24th Street to 12th Street, it is 40' feet wide. The width of the Arizona Canal at 38th Street measures 68' wide. Alternates to a chain link fence and other aesthetic treatments are under study.

"Plan 6 - true flood control." "Reach 4 ... questionable benefits." Plan 6 would provide flood protection along the Salt and Verde Rivers. It is unrelated to the protection area provided by the ACDC. Federal funds for Plan 6 are entirely separate from authorized funding of the ACDC.

"Reach 4 is poor flood protection." The ACDC will be designed for a 100-year event, a very high level of protection. This, of course, is not "total flood protection." On the other hand, there is a factor of safety built into channel design. No known flood control project in the world protects against all conceivable levels of flooding.

"Reach 4 costs outweigh benefits." Phase B is a total control "package" made up of flowage easements, channel and dams. The project was justified on the basis of the entire system being in place. It was authorized on the basis of favorable benefit/cost ratio.

"Reach 4 is an add-on component." Several modifications of the original project have occurred, including deleting channelization of the Agua Fria and using flowage easements instead, dropping a Union Hills diversion channel and extending the Arizona Canal Diversion Channel from Dreamy Draw easterly to intercept Cudia City Wash. The entire flood control program was restudied and reformulated.

"Flood waters will be diverted onto people who otherwise would not be damaged." This statement is false. Flows greater than the channel capacity will simply overflow the channel into the Arizona Canal as they would pre-project flows larger than the 100-year would be dramatically reduced.

#### CONCLUSION:

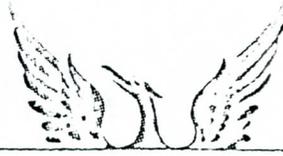
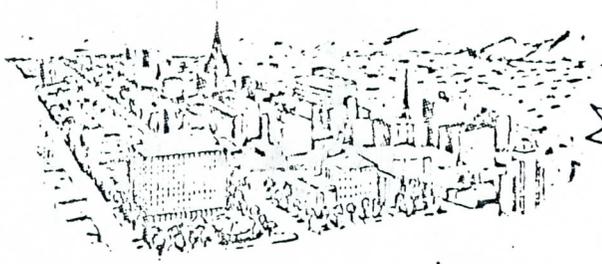
The Phoenix and Vicinity Flood Control Project is an integrated system of project features designed to provide a high degree of flood protection to the people of the Greater Phoenix Metropolitan Area. It is well underway. We need to maintain the level of public awareness and support for this project until it is completed.

SOURCE A - U. S. Army Corps of Engineers  
Arizona Channel Diversion Channel (including Cave Creek and  
sedimentation basins on Cave Creek and Cudia City Wash)  
Final Report - March 1985. This report includes  
Design Memorandum No. 3,  
General Design Memorandum - Phase II, and  
Project Design, Part 5 (including  
Feature Design for Cactus Road to Skunk Creek)

SOURCE B - U. S. Army Corps of Engineers  
"Report on Flood of 22 June 1972, Phoenix  
Metropolitan Area, Arizona, October 1972"

SOURCE C - Arizona Canal Diversion Channel, Reach Four Fact Sheet  
"Prepared by Citizens Against Reach Four, April 30, 1985"  
and The Arizona Republic, May 14, 1985,  
Paid Political Advertisement by "Citizens Against Reach Four"





CITY OF PHOENIX

ARIZONA

ENGINEERING DEPARTMENT • 700 MUNICIPAL BUILDING • 251 WEST WASHINGTON • PHOENIX, ARIZONA 85003

January 12, 1973

Col. John C. Lowry, Chief Engineer  
and General Manager  
Maricopa County Flood Control District  
3325 West Durango Street  
Phoenix, Arizona 85009



Dear Col. Lowry:

Flood Control Program - Arizona Canal Channel.

We respectfully ask that an official request be made to the Corps of Engineers' office for a study to extend the Arizona Canal channel eastward. It is thought it would be desirable to extend the channel to the Cudia City wash in the vicinity of 40th Street.

A couple of years ago we requested that the channel be extended from 12th Street easterly to 16th Street or slightly beyond. It was my understanding that the Corps would consider this request.

In April of 1972, at a public hearing on Phase "B," we asked that the Corps consider extending the Arizona Canal channel easterly to 24th Street or beyond. Apparently this letter from the City Engineer was never considered an official request.

This study for extension is of major importance to us and to the Program since major washes flow southerly into Phoenix and into the Arizona Canal between 12th and 40th Streets. The Cudia City wash alone has a drainage area of 4 square miles. Records show that during the June, 1972, storm it carried in excess of 4,000 cfs, an amount in excess of what we expect to handle in our underground storm drainage system. The need for study is timely since it is my understanding that the Corps is presently evaluating the Arizona Canal right of way for its adequacy to contain the flood control channel. Since the area east of 12th Street will contribute substantially to the runoff, this input should be considered by the Corps of Engineers as soon as possible.

Your prompt attention in transmitting this request is hereby solicited.

Very truly yours,

*J. E. Attebery*  
J. E. Attebery, P.E.  
City Engineer

JEA:fns

c: Mr. Glendening

Mr. Teeples



Flood Control District  
of  
Maricopa County

3325 WEST DURANGO STREET  
PHOENIX, ARIZONA 85009

February 5, 1973

District Engineer  
U.S. Army Corps of Engineers  
Los Angeles District  
P.O. Box 2711  
Los Angeles, California 90053

Gentlemen:

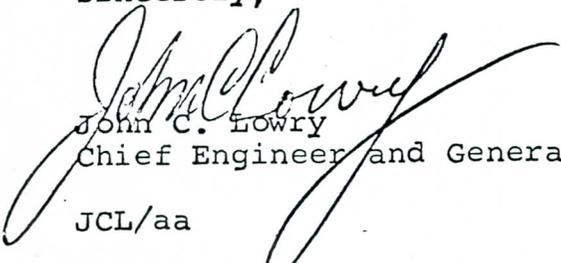
RE: ARIZONA CANAL FLOOD CHANNEL

Sometime ago this office received a letter from the City Engineer, City of Phoenix on the above subject. A copy of that letter is attached and is self-explanatory.

This channel, as you know, is a part of Phase B. The Interim Report of Phase B indicates the Arizona Canal Channel will start about 12th Street. After receipt of this report, a few years ago it was recommended that your office when you start the construction planning consider extending this channel to about 20th Street. The City of Phoenix now requests the study, when made, consider the extension of this channel further to the east to 40th Street. The letter from the City of Phoenix explains why.

It is requested that you do make this study and consider the feasibility of extending the channel further east to 40th Street. Your comments on this request are desired.

Sincerely,

  
John C. Lowry  
Chief Engineer and General Manager

JCL/aa

Attachment

cc: Maj. Worthington, Corps of Engineers  
Mr. Attebery, City of Phoenix

SP123-DC

8 March 1973

Mr. John Lewry  
Chief Engineer & General Manager  
Flood Control District of  
Maricopa County  
2325 W. Pecos Street  
Phoenix, Arizona 85009

Dear Mr. Lewry:

As requested in your letter of 5 February 1973, we will consider the  
feasibility of extending the Arizona Canal Diversion Channel, a part  
of the New River and Phoenix Stream Project, east to 40th Street.

Sincerely yours,

GARTH A. FUQUAY  
Chief, Engineering Division

FUQUAY

GILDEA

POTTER

MISHINARA

BERGSCHWIDER

Cy Furn:  
Major Worthington  
Phoenix Office

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(5d)

# Salt River Project

WATER POWER

BOX 52025 PHOENIX, AZ 85072-2025

May 13, 1985

TELEPHONE 236-5900

Honorable Mayor and City Council:

I am unaware of any organization in the Salt River Valley with longer direct involvement in local storm runoff than the Salt River Project (SRP). In early stages of valley urbanization, SRP canals and distribution laterals were the only means available for handling storm water. As cities grew, the connection of catch basins into the SRP system helped stretch the limited funds cities had available for storm systems. The Salt River Project joined with Maricopa County and the City of Phoenix in strongly supporting formation of the Flood Control District of Maricopa County. In accordance with state statutes, one member of the Citizens Advisory Board of the Flood Control District is from SRP.

It is the policy of the Salt River Project that during times of local storms, reasonable precautions and actions will be taken to minimize the effect of such storms on SRP facilities and on the property of others. These precautions and actions include:

Observation patrols within and peripheral to SRP area to collect weather data, location and quantities of runoff;

Shutting off pumps and reducing water levels if storm is imminent;

Monitoring scope and intensity of storms;

Releasing water through drain gates into recognized drainage channels;

Maintaining records of storm activity and releases.

I personally observed the extensive damage caused by the June 22, 1972 storm. The canal breaks just west of 40th Street were the result of heavy inflows into the Arizona Canal from Cudia City Wash, the starting point of Reach 4 of the Arizona Canal Diversion Channel.

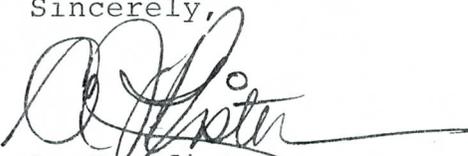
May 13, 1985  
Page 2

I know there were other severe storms prior to 1972 and am sure there will be future storms of equal or greater intensity than those of which we have records. The diversion channel will intercept heavy flows and carry them safely west and north to Skunk Creek and the New River. Without this channel, the heavy flows from intense storms once again will flow over spillways and/or through ruptured canal banks, leaving trails of heartbreak as they try to follow natural channels to the Salt River, channels filled and leveled for the building growth of Phoenix.

The Flood Control District of Maricopa County and the U. S. Corps of Engineers, working with local agencies, have constructed several flood control facilities during recent years. These include Dreamy Draw Dam, Cave Buttes Dam, Adobe Dam and New River Dam. Each facility provides additional protection to this community. However, each is one portion of a comprehensive flood control plan for the valley. None provides the protection from heavy runoff north of the Arizona Canal which Reach 4 of the Arizona Canal Diversion Channel is designed to handle.

The Salt River Project has approved joint use of canal right-of-way for maintenance equipment to reduce both cost and impact of the channel. We know the flood potential is real. We strongly support Reach 4 and the balance of the Arizona Canal Diversion Channel.

Sincerely,



A. J. Pfister  
General Manager

mja

xc: J. Lassen  
S. Hancock  
M. Rappoport  
R. Teeples

HONORABLE MAYOR AND CITY COUNCIL:

I AM UNAWARE OF ANY ORGANIZATION IN THE SALT RIVER VALLEY WITH LONGER DIRECT INVOLVEMENT IN LOCAL STORM RUNOFF THAN THE SALT RIVER PROJECT (SRP). IN EARLY STAGES OF VALLEY URBANIZATION, SRP CANALS AND DISTRIBUTION LATERALS WERE THE ONLY MEANS AVAILABLE FOR HANDLING STORM WATER. AS CITIES GREW, THE CONNECTION OF CATCH BASINS INTO THE SRP SYSTEM HELPED STRETCH THE LIMITED FUNDS CITIES HAD AVAILABLE FOR STORM SYSTEMS. THE SALT RIVER PROJECT JOINED WITH MARICOPA COUNTY AND THE CITY OF PHOENIX IN STRONGLY SUPPORTING FORMATION OF THE FLOOD CONTROL DISTRICT OF MARICOPA COUNTY. IN ACCORDANCE WITH STATE STATUTES, ONE MEMBER OF THE CITIZENS ADVISORY BOARD OF THE FLOOD CONTROL DISTRICT IS FROM SRP.

IT IS THE POLICY OF THE SALT RIVER PROJECT THAT DURING TIMES OF LOCAL STORMS, REASONABLE PRECAUTIONS AND ACTIONS WILL BE TAKEN TO MINIMIZE THE EFFECT OF SUCH STORMS ON SRP FACILITIES AND ON THE PROPERTY OF OTHERS. THESE PRECAUTIONS AND ACTIONS INCLUDE:

- o OBSERVATION PATROLS WITHIN AND PERIPHERAL TO SRP AREA TO COLLECT WEATHER DATA, LOCATION, AND QUANTITIES OF RUNOFF
- o SHUTTING OFF PUMPS AND REDUCING WATER LEVELS IF STORM IS EMINENT
- o MONITORING SCOPE AND INTENSITY OF STORMS
- o RELEASING WATER THROUGH DRAIN GATES INTO RECOGNIZED DRAINAGE CHANNELS

- o MAINTAINING RECORDS OF STORM ACTIVITY AND RELEASES.

I, PERSONALLY, OBSERVED THE EXTENSIVE DAMAGE CAUSED BY THE JUNE 22, 1972 STORM. THE RESULTS OF INFLOWS BETWEEN 32ND AND 40TH STREETS ARE DESCRIBED IN THE U.S. ARMY CORPS OF ENGINEERS "REPORT ON FLOOD OF 22 JUNE 1972, PHOENIX METROPOLITAN AREA ARIZONA," AND I QUOTE: "THE FLOODING IN THIS AREA, AMOUNTING TO 2,800 ACRES, RESULTED FROM LOCAL RUNOFF CAUSED BY THE THUNDERSTORMS CENTERED AT 24TH STREET AND CAMELBACK ROAD AND FROM FLOODWATERS GUSHING FROM SPILLWAYS AND A BREAK IN THE CANAL." FLOODWATERS CAUSED A BREAK IN THE SOUTH BANK OF THE CANAL AT 40TH STREET AND CAUSED THE SPILLWAY AT 30TH STREET, 32ND STREET, AND 40TH STREET TO RUN AT MAXIMUM CAPACITY."

QUOTING AGAIN FROM THE CORPS REPORT, "THE FLOODWATERS COMBINED NEAR 28TH STREET AND INDIAN SCHOOL ROAD, THEN SPREAD OUT UNTIL THE WATERS PONDED ALONG THE GRAND CANAL. THE OVERFLOW AREA OF ABOUT 5 SQUARE MILES, EXTENDED FROM THE ARIZONA CANAL ON THE NORTH TO THE GRAND CANAL ON THE SOUTH, AND FROM 40TH STREET ON THE EAST TO 12TH STREET ON THE WEST. CAMELBACK ROAD FROM 40TH STREET TO 16TH STREET RESEMBLED A RIVER. OUTSIDE WATER DEPTHS RANGED FROM 4 FEET NEAR THE BREAKS TO 1-1/2 TO 2 FEET NEAR THE GRAND CANAL. THE FLOODWATERS WIPED OUT BLOCK-WALL FENCES AND CAUSED SERIOUS STRUCTURAL DAMAGES. TOTAL DAMAGES IN THIS AREA WERE ESTIMATED AT \$3,768,000, 85 PERCENT OF WHICH ACCRUED TO RESIDENTIAL PROPERTY."

HISTORICAL RECORDS ON CANAL BREAKS AND SPILLWAY OVERFLOWS ARE INCOMPLETE. HOWEVER, WE DO KNOW THAT THE JUNE 22, 1972 STORM CAUSED 3 BREAKS IN THE ARIZONA CANAL JUST WEST OF 40TH STREET, EACH 25 FEET WIDE AND 4 AND 5 FEET DEEP.

WE DO KNOW THAT THE SAME STORM CAUSED 7 BREAKS IN THE GRAND CANAL BETWEEN CENTRAL AVENUE AND 12TH STREET, BREAKS TOTALLING 200 FEET IN LENGTH, FROM 3 TO 5 FEET DEEP.

WE DO KNOW THAT A STORM ON AUGUST 2-3, 1943 CAUSED 20 BREAKS IN THE ARIZONA CANAL WEST OF 40TH STREET.

WE DO KNOW THAT A STORM OF SEPTEMBER 4, 1939 CAUSED 5 BREAKS IN THE ARIZONA CANAL BETWEEN 12TH AND 40TH STREETS, AND THAT THE 2 BREAKS JUST WEST OF 40TH STREET TOTALLED 72 FEET IN LENGTH AND AVERAGED 7 FEET IN DEPTH.

I AM SURE THERE WILL BE FUTURE STORMS OF EQUAL OR GREATER INTENSITY THAN THOSE OF WHICH WE HAVE RECORDS. THE DIVERSION CHANNEL WILL INTERCEPT HEAVY FLOWS AND CARRY THEM SAFELY WEST AND NORTH TO SKUNK CREEK AND THE NEW RIVER. REACH 4 BEGINS WHERE CUDIA CITY WASH INTERSECTS THE ARIZONA CANAL. WITHOUT THIS CHANNEL, THE HEAVY FLOWS FROM INTENSE STORMS ONCE AGAIN WILL FLOW OVER SPILLWAYS AND/OR THROUGH RUPTURED CANAL BANKS, LEAVING TRAILS OF HEARTBREAK AS THEY TRY TO FOLLOW NATURAL CHANNELS TO THE SALT RIVER, CHANNELS FILLED AND LEVELED FOR THE BUILDING GROWTH OF PHOENIX.

THE FLOOD CONTROL DISTRICT OF MARICOPA COUNTY AND THE U.S. CORPS OF ENGINEERS, WORKING WITH LOCAL AGENCIES, HAVE CONSTRUCTED SEVERAL FLOOD CONTROL FACILITIES DURING RECENT YEARS. THESE INCLUDE DREAMY DRAW DAM, CAVE BUTTES DAM, ADOBE DAM, AND THE NEW RIVER DAM. EACH FACILITY PROVIDES

ADDITIONAL PROTECTION TO THIS COMMUNITY. HOWEVER, EACH IS ONE PORTION OF A COMPREHENSIVE FLOOD CONTROL PLAN FOR THE VALLEY. NONE PROVIDES THE PROTECTION FROM HEAVY RUNOFF NORTH OF THE ARIZONA CANAL WHICH REACH 4 OF THE ARIZONA CANAL DIVERSION CHANNEL IS DESIGNED TO HANDLE.

IN JUNE, 1972, IT WAS ESTIMATED THAT WATER ENTERING THE ARIZONA CANAL BETWEEN 32ND AND 40TH STREETS FLOODED ABOUT 2600 HOMES AND 15 APARTMENT COMPLEXES. WATER IN HOMES AND APARTMENTS WAS UP TO 4 FEET DEEP. MORE WATER THAN THE ARIZONA CANAL IS DESIGNED TO CARRY FLOWED THROUGH THE BILTMORE SHOPPING CENTER AT 24TH AND CAMELBACK.

SINCE 1972, PROPERTY VALUES HAVE INCREASED DRAMATICALLY! VACANT LAND, UNDAMAGED IN 1972, NOW CONTAINS BEAUTIFUL, VALUABLE HOMES AND COMMERCIAL BUILDINGS. THERE IS LESS ROOM FOR FLOOD WATERS TO FLOW AND MORE PEOPLE IMPACTED.

IN MY OPINION, UNLESS REACH 4 IS BUILT, A STORM SIMILAR TO JUNE, 1972, WOULD DO GREATER DAMAGE TO MORE PEOPLE.

DON'T BE MISLEAD BY COMPARISONS OF 1985 CONSTRUCTION COSTS AND 1972 DAMAGES. AESTHETICS ARE VERY IMPORTANT, BUT GREEN BELTS ARE NOT FEASIBLE WHERE RIGHTS-OF-WAY ARE AT A PREMIUM. WE MUST NOT MISS THIS ONE-TIME OPPORTUNITY FOR PROTECTION FROM CUDIA CITY WASH.

THE SALT RIVER PROJECT HAS APPROVED JOINT USE OF CANAL RIGHT-OF-WAY FOR MAINTENANCE EQUIPMENT TO REDUCE LAND REQUIREMENTS FOR THE CHANNEL. CANAL RELOCATIONS WILL REDUCE BOTH COST AND IMPACT OF THE CHANNEL. WE KNOW THE FLOOD POTENTIAL IS REAL. WE STRONGLY SUPPORT REACH 4 AND THE BALANCE OF THE ARIZONA CANAL DIVERSION CHANNEL.



CITY OF PHOENIX DEPARTMENT  
CITY CLERK'S OFFICE  
251 WEST WASHINGTON  
PHOENIX, ARIZONA 85003

DEED 123866 518

DEED 20633 S 10037  
At Canal E/24th St N/Camelback

CORRECTIVE  
GRANT OF EASEMENT

EASEMENT (ES)

241467

This Grant of Easement executed this 17th day of May, 1977, by Arizona Biltmore Estates, Inc., a Delaware corporation (hereinafter referred to as "ABE"), in favor of the City of Phoenix, a municipal corporation (hereinafter referred to as "City").

WHEREAS, the City, in connection with the rezoning of certain property owned by ABE, required that ABE grant to it a certain 65 foot easement for flood control purposes, the fee to which easement is to be conveyed to the Flood Control District of Maricopa County (hereinafter referred to as the "Flood Control District") at the time flood control facilities (hereinafter referred to as the "Flood Control Facilities") are authorized to be constructed on, across and under the real property included within said easement area.

NOW, THEREFORE, for the consideration stated above, ABE hereby grants to the City an easement for the construction and operation of Flood Control Facilities on, across and under the real property described as Parcels A, B and C on Exhibit A attached hereto and made a part hereof (said property hereinafter referred to as the "Easement Area"), subject to the following terms and conditions:

1. ABE reserves unto itself, its successors and assigns, the right to the continued use of the Easement Area for parking, landscaping, driveways and such other uses as it deems appropriate so long as ABE constructs no permanent structures thereon, and provided that such uses do not interfere with the normal operation and maintenance of the Flood Control Facilities. All rights granted or reserved under this paragraph shall terminate upon the delivery of the Warranty Deed contemplated in paragraph 3 below.
2. Any portion of the Easement Area not used for Flood Control Facilities by the Flood Control District or for relocation of the Arizona Canal by the Salt River Project within 15 years from the date hereof shall, upon sixty (60) days written notice to the Flood Control District and the City, and without any other action on the part of ABE, the Flood Control District or the City, revert to ABE and this agreement shall be of no further force and effect with respect thereto.
3. If, within the 15-year period referred to in Paragraph 2 above, the Flood Control District has authorized the Flood Control Facilities to be constructed upon the Easement Area, ABE or the then current owner of the fee to the Easement Area shall execute and deliver to the City for recording a Deed to the Easement Area wherein fee title to the Easement Area is conveyed to the Flood Control District. Said Deed shall be subject to the following covenants, conditions and restrictions:

- (a) The owner of record of the Easement Area shall ~~be liable for damages for (i) the loss of facilities within the Easement Area, such as but not limited to, structures, parking facilities, landscaping, utilities and so forth, and (ii) loss in value, if any, to ABE's property resulting from severance of the Easement Area.~~ Loss of value, if any, referred to above shall be determined as of the date the Flood Control Facilities are authorized and the Easement area is conveyed in fee to the Flood Control District. In addition, such loss in value shall not relate to improvements constructed on property adjacent to the Easement Area subsequent to the date this Grant of Easement is recorded. Further, such loss in value



DEED 123806 519

shall not relate to the approval of site plans or zoning changes for which this Grant of Easement is a prerequisite.

- (b) To minimize the damage to be incurred by ABE resulting from the construction of the Flood Control Facilities within the Easement Area, (i) ABE reserves and retains the right to landscape and park upon any portion of the Easement Area conveyed hereby but not actually used for Flood Control Facilities or transferred to the United States for Arizona Canal right-of-way, (ii) ABE shall have architectural review of the bridges to be constructed over the Arizona Canal and the Flood Control Facilities and such bridges shall have the same general appearance as the existing bridges, but the additional cost of identical reproduction of the existing bridges shall be borne by ABE, (iii) to the extent feasible from an economic and engineering point of view, all or a portion of the Flood Control Facilities will be placed underground rather than on the surface; and in this connection, if the Flood Control Facility can be placed underground at a cost not exceeding one hundred twenty-five percent (125%) of the cost of placing the same on the surface, it shall be placed underground; and further, if the cost of placing the Flood Control Facility underground exceeds 125% of the cost of placing the Flood Control Facility on the surface, ABE shall have the option of requiring the Flood Control Facilities to be placed underground by agreeing to pay the cost thereof which exceeds 125% of the surface construction costs; and (iv) if the Flood Control Facilities are placed underground, no fences shall be constructed on the Easement Area adjacent to the underground facilities; and to the extent feasible, ABE shall have the right to landscape and park cars on the Easement Area, subject to permit or other requirements and restrictions pertaining to the Arizona Canal right-of-way.
- (c) In the event that all or part of the Flood Control Facilities are placed underground as provided in Paragraph 3(b) above, ABE agrees to waive, with respect to that portion of the Flood Control Facilities placed underground, its rights to damages resulting from the severance of the Easement Area from the property adjacent to the Easement Area and the loss in value to ABE's property resulting from the construction and maintenance of the Flood Control Facilities to which it would otherwise be entitled subject to Paragraph 3(a)(ii).
- (d) ~~The Flood Control District shall save and hold ABE harmless~~ from any loss, cost, damage or expense, including attorneys' fees,

suffered or incurred by ABE as a result of the construction, location, operation and maintenance of the Flood Control Facilities.

This agreement and the terms and conditions thereof shall run with the land and shall be binding on and shall inure to the benefit of the City, the Flood Control District, and ABE and their respective assigns, successors and representatives.

IN WITNESS WHEREOF, ABE has executed this Grant of Easement as of the day and year first above written.

ARIZONA BILTMORE ESTATES, INC.

By: [Signature]  
Its: Vice President & General Counsel

STATE OF ARIZONA )  
County of Maricopa ) ss:

On this 17<sup>th</sup> day of May, 1977, before me, the undersigned notary public, personally appeared BRIAN L. ZEMP, who acknowledged himself to be the Vice President and General Counsel of ARIZONA BILTMORE ESTATES, INC., and that he, being authorized so to do, executed the foregoing instrument for the purposes therein contained, by signing the name of the corporation by himself as such officer.

IN WITNESS WHEREOF, I have hereunder set my hand and official seal.

[Signature]  
Notary Public

My commission expires:  
December 31, 1978

This instrument is being executed by the Grantor herein for the purpose of correcting the easements granted by that certain instrument of record in the office of the County Recorder of Maricopa County, Arizona in Docket 12106 at page 571, in which said descriptions were set forth upon a map and labeled Exhibit "A", said Exhibit "A" being filed in the office of said County Recorder.

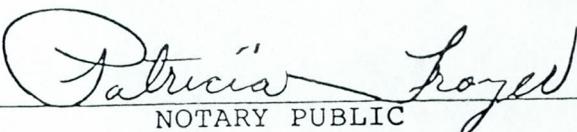
ARIZONA BILTMORE ESTATES, INC.

By: [Signature]  
VICE PRESIDENT & GEN. COUNSEL

STATE OF ARIZONA        )  ss:  
COUNTRY OF MARICOPA  )

On this, the 7<sup>th</sup> day of March, 1976, before me, the undersigned Notary Public, personally appeared BRIAN L. ZEMP, who acknowledged himself to be the Vice President and General Counsel of ARIZONA BILTMORE ESTATES, INC., and that he, being authorized so to do, executed the foregoing instrument for the purposes therein contained, by signing the name of the corporation by himself as such officer.

IN WITNESS WHEREOF, I have hereunto set my hand and official seal.

  
\_\_\_\_\_  
NOTARY PUBLIC

My commission expires:

Dec. 31, 1978

GRANT OF EASEMENT

This Grant of Easement executed this 7th day of March, 1977, by Arizona Biltmore Estates, Inc., a Delaware corporation (hereinafter referred to as "ABE"), in favor of the City of Phoenix, a Municipal corporation (hereinafter referred to as "City").

WHEREAS the City, in connection with the rezoning of certain property owned by ABE, required that ABE grant to it a certain 65' easement for flood control purposes, the fee to which easement is to be conveyed to the Maricopa County Flood Control District (hereinafter referred to as the "Flood Control District") at the time flood control facilities (hereinafter referred to as the "Flood Control Facilities") are authorized to be constructed on, across or under the real property included within said easement area.

NOW, THEREFORE, for the consideration stated above, ABE hereby grants to the City as easement for the construction and operation of Flood Control Facilities on, across and under the real property described as Parcels A, B, and C on Exhibit A attached hereto and made a part hereof (said property hereinafter referred to as the "Easement Area"), subject to the following terms and conditions:

1. ABE reserves unto itself, its successors and assigns, the right to the continued use of the Easement Area for parking, landscaping, driveways and such other uses as it deems appropriate so long as ABE constructs no permanent structures thereon.
2. Any portion of the Easement Area not used for Flood Control Facilities by the Flood Control District or for relocation of the Arizona Canal by the Salt River Project within 15 years from the date hereof shall, without any action on the part of ABE or the City, revert to ABE and this Agreement shall be of no further force and effect with respect thereto.
3. If, within the 15-year period referred to in Paragraph 2 above, the Flood Control District has authorized flood control facilities to be constructed upon the Easement Area, ABE shall execute and deliver to the City for recording a Deed to the Easement Area wherein fee title to the Easement Area is conveyed to the Flood Control District. Said Deed shall be subject to the following covenants, conditions and restrictions:
  - (a) The Owner of record of the Easement Area shall be paid damages for injuries suffered as a result of (i) the severance of the Easement Area from the adjacent property, (ii) the loss of facilities within the Easement Area, such as but not limited to structures, parking facilities,

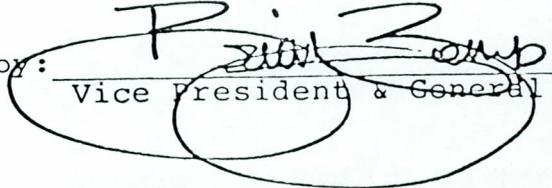
landscaping, utilities and so forth, and (iii) loss in value to ABE's property resulting from construction and maintenance of the Flood Control Facilities within the Easement Area.

- (b) To minimize the damage to be incurred by ABE resulting from the construction of the Flood Control Facilities within the Easement Area, (i) ABE reserves and retains the right to landscape and park upon any portion of the Easement Area conveyed hereby but not actually used for Flood Control Facilities, (ii) ABE shall have architectural approval of the bridges to be constructed over the Arizona Canal and the Flood Control Facilities, (iii) to the extent feasible from an economic and engineering point of view, the Flood Control Facilities will be placed underground rather than on the surface and in this connection if the Flood Control Facility can be placed underground at a cost not exceeding One Hundred Twenty-Five Percent (125%) of the cost of placing the same on the surface, it shall be placed underground, and further, if the cost of placing the Flood Control Facility underground exceeds 125% of the cost of placing the Flood Control Facility on the surface, ABE shall have the option of requiring the Flood Control Facility to be placed underground by agreeing to pay the cost thereof which exceeds 125% of the surface construction cost and (iv) if the Flood Control Facility is placed underground no fences shall be constructed on the Easement Area and to the extent feasible ABE shall have the right to landscape and park cars on the Easement Area.
- (c) In the event that the Flood Control Facility is placed underground as provided in Paragraph 3 (b) above, ABE agrees to waive its rights to damages resulting from the severance of the Easement Area from the property adjacent to the Easement Area and the loss in value to ABE's property resulting from the construction and maintenance of the Flood Control Facility to which it would otherwise be entitled subject to Paragraph 3 (a) (1) and (iii).
- (d) The Flood Control District shall save and hold ABE harmless from any loss, cost damage or expense, including attorney fees, suffered or incurred by ABE as a result of their leaving the Flood Control Facility and damaging property of ABE, successors or assigns.

This agreement and the terms and conditions thereof shall run with the land and shall be binding on and shall inure to the benefit of the City and ABE and their respective assigns, successors and representatives.

IN WITNESS WHEREOF, ABE has executed this Grant of Easement as of the day and year first above written.

ARIZONA BILTMORE ESTATES, INC.

by:   
Vice President & General Counsel

FLOOD CONTROL DISTRICT  
RECEIVED

MEMORANDUM

JUN 27 1985

To: LJR  
From: JML  
Subject: Biltmore / Reach IV  
Date: June 25, 1985

7	HYDRO	3
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4	ENGR	DIS. INCY
	FINANCE	5 JER

LAWS - ASS. G. FILE #

This memo will be a follow-up to the memo attached dated June 7, 1985. After I obtained the easement map from SRP, I inquired as to whether SRP had given the Biltmore a license to use the area on either side of the canal for parking or other uses. Leroy Nunn at SRP's property department returned my call last week, and called again this morning. They have found some permits to the Biltmore which specifically refer to bridges, pipe crossings, and other utility uses.

The first license was granted in 1928 and gives the Biltmore a license for the erection and maintenance of bridge structures. There is also a license dated 1967 to use the project right-of-way for utility and pipe crossings. SRP and the Salt River Valley Water Users Association gives literally "thousands" of licenses to various entities to use the canal right-of-way and they are rarely revoked. However, according to Nunn, under the Salt River Agreement with the Federal Government there must be a one year revocation of notice, so all licenses, easements, etc. contain a maximum of one year notice of revocation, to track the old federal language. Therefore, any license the Biltmore does have would have a revocation clause which gives at the most one year notice. According to Nunn, many have a ten (10) day revocation period.

The SRP licenses are not recorded, and if there is any more formal agreement with the Biltmore that the SRP was unable or unwilling to provide, it should show up in the title search that Ed Opstein has requested. This title search should also verify whether the warranty deed from the city to the Flood Control District is valid, with a previous deed from Arizona Biltmore Estates to the city.

01270 F 523

This should answer your two questions regarding Reach IV. First question: Does SRP own the land subject to an easement to the Arizona Biltmore Hotel where the parking lot is located? If so, get a copy. Copy of their official easement map is attached. Question two: Is there an expiration date on the original FCD easement for Reach IV through the Biltmore? Answer: If the easement is not used, it expires in fifteen (15) years from the signing, or on May 17th, 1992.

JML

:krf

cc: Dan E. Sagramoso

M E M O R A N D U M

To: LJR / Biltmore - Reach IV File  
From: JML  
Date: June 7, 1985

This morning I visited the SRP offices and talked with a Mr. Staley in the Land Management Division. He stated that all SRP canal easements are at a minimum of 50 feet on either side of the canal from the water line or the toe of the slope of the canal wall, whichever is greater. So all right-of-ways are at least 100 feet plus the width of the canal and/or water. I also talked with a Mr. Leroy Nunn in their Lease Department, who stated that he would need some time to investigate whether there was an official Biltmore lease of the right-of-way on the north side of the canal through the Biltmore. He will get back to me next week.

Attached is a copy of SRP's official Right-of-Way Map for the area from 24th Street to 32nd Street. As you can see, the width varies from 196.38 feet at 24th Street to 193.50 feet at 32nd Street. This corresponds with the information on the City of Phoenix engineering maps which we used.

JML

:krf

cc: Dan E. Sagramoso

KNOW ALL MEN BY THESE PRESENTS

That the Salt River Valley Water Users' Association, an Arizona Corporation, hereby publishes this plat showing the right of way necessary for the construction and maintenance of the proposed

ARIZONA CANAL  
 SEC. 11 & 14 T2N R3E  
 GUSARROW

Said plat does not show and it is not the intention to show or refer to all rights of way and rights possessed by the United States of America and neither the association or incorporation of said plat shall result in or constitute any donation or other disposal in whole or in part, of any rights of way or rights which the United States of America is entitled to utilize or enforce.

IN WITNESS WHEREOF, The Salt River Valley Water Users' Association has hereunto caused its corporate name to be signed and its corporate seal to be affixed by the undersigned officers lawfully duly authorized this 22<sup>nd</sup> day of April, 1974.

SALT RIVER VALLEY WATER USERS ASSOCIATION  
 Attest: Ken Smith President  
Henry Public Secretary

STATE OF ARIZONA } S 5  
 COUNTY OF MARICOPA }

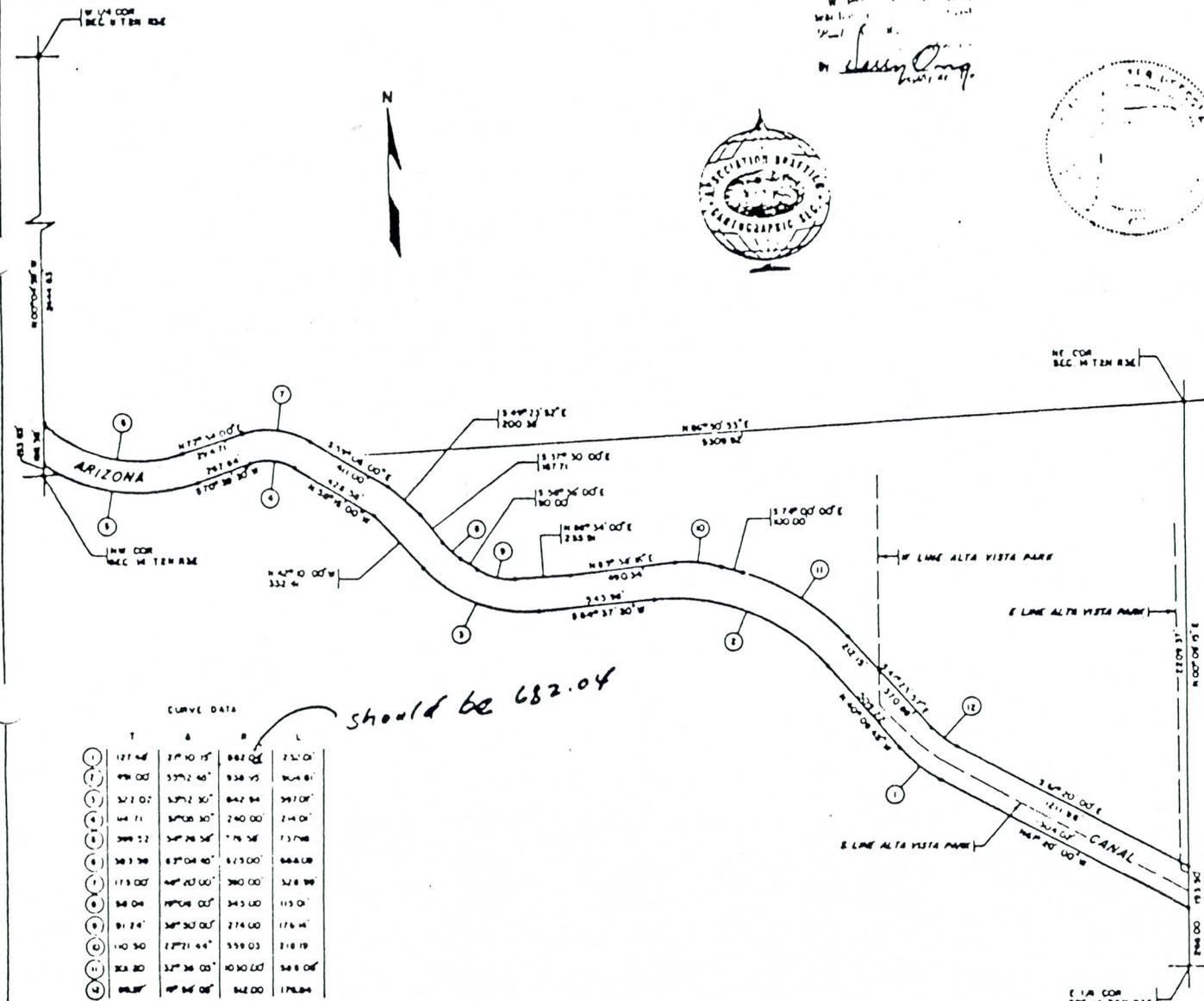
On this, the 25<sup>th</sup> day of April, 1974 before me the undersigned official, personally appeared Ken E. Abel and T.E. Smith who acknowledged themselves to be President and Secretary, respectively, of the Salt River Valley Water Users' Association and that they, as such officers, respectively, being duly authorized so to do, executed the foregoing instrument for the purposes therein contained by signing the name of the corporation by themselves as such officers respectively.

IN WITNESS WHEREOF, I have set my hand and seal this 25<sup>th</sup> day of April, 1974.  
Ken E. Abel  
 Notary Public  
 My Commission Expires May 3, 1975

This is to certify that the survey described and plotted herein was made under my direction during the month of Feb., 1974.  
Paul W. Harmon  
 Registered Civil Engineer

I hereby certify that the map or instrument was filed and recorded at request of

Book-172  
 31  
Henry Public



CURVE DATA

T	A	B	C
1	127.46	27°10'15"	882.00
2	49.00	33°52'46"	938.95
3	32.00	33°52'30"	842.84
4	44.71	37°03'30"	740.00
5	389.22	34°28'36"	776.36
6	363.36	63°04'46"	673.00
7	173.00	64°23'00"	380.00
8	64.04	77°04'00"	343.00
9	91.24	34°30'00"	274.00
10	140.50	27°21'44"	359.00
11	38.20	32°36'00"	1030.00
12	88.87	47°34'00"	642.00

*should be 682.04*

NOTE  
 • INDICATES RIGHT OF WAY MONUMENTS SET

4-22-74	S LINE ALTA VISTA PARK
REVISION	REVISION
SALT RIVER VALLEY WATER USERS' ASSOCIATION PARENTS ARIZONA	
RIGHT OF WAY ARIZONA CANAL SEC. 11 & 14 T2N R3E	
Checked Date	By Date
APRIL 8, 1974	APR 11, 1974

that Zoning Application No. 119-74, as filed on April 12, 1974, and amended October 2, 1974 and December 10, 1974, and as reflected on the sketch dated December 24, 1974, and identified by the signature of Mayor Timothy A. Barrow be approved subject to the following stipulations:

1. Zoning shall vest concurrently with final site plan approval as individual final site plans are approved and site plans in accordance with Section 511 are required for all zoning districts. Site plans shall be reviewed by the Planning Commission within fifty (50) days after filing with the Planning Department as required by Section 511.
2. Applicant will grant sufficient right of way for a 65 foot easement for flood control purposes on the north side of the Arizona Canal across applicant's property from 32nd Street on the east to 24th Street on the west.

Conditional upon:

- a. Use of said easement for parking, landscaping or any other necessary use provided that no permanent structure will be placed thereon. Said use will be permitted until such time easement is used for flood control purposes.
- b. Settlement with owners of record by negotiation or condemnation with the Maricopa County Flood Control District at the time flood control facilities are authorized pursuant to paragraph C hereof for damages said facilities may create.

It is stipulated that damages contemplated herein relate to loss of existing facilities within the easement, such as but not limited to parking, utilities, etc., plus severance damages to adjacent properties. No damages are contemplated for the real property described in the easement or for structures, including parking areas, utilities, etc., constructed in said easement after the recording of said easement.

- c. Easement to become a fee title right of way for the benefit of the Maricopa County Flood Control District at such time as said flood control district authorizes construction of a flood control project between 24th and 32nd Street.

*TAB*  
12-24-74

d. Any portion of said easement not used for flood control purposes within 15 years from date of recording shall automatically revert to owners of record.

*Trails*

3. Right of way shall be provided for a trail system known as Grand Paseo acceptable to the City of Phoenix and shall be developed to link the Sun Circle Trail at the Arizona Canal to an underpass at Lincoln Drive.
4. There shall be no waiver of the Hillside Ordinance except as approved by City Council for height waivers.
5. Expansion of Biltmore Fashion Park should be done in such a manner that the resultant center offers an atmosphere conducive to pedestrian traffic.
6. Lincoln Drive shall be fully improved for the full extent of the property abutting Lincoln Drive in accordance with typical 24th Street parkway section north of Arizona Canal as shown on City Engineer's plan for P-64341.00 (GT) with variable median as approved by City of Phoenix.
7. Rights of way for Lincoln Drive, Camelback Road and 24th Street abutting the property shall be dedicated as required by the City of Phoenix.
8. The applicant shall pay all costs of improvements to Lincoln Drive, Camelback Road and 24th Street abutting the property.
9. After the initial vesting of zoning, the Arizona Biltmore Estates will dedicate from its property sufficient land to provide 65 feet of right of way for 32nd Street from the section line west to establish a right of way for a four-lane roadway between Camelback Road and the Arizona Canal, and that the applicant may utilize existing roadway and right of way not required for City minimum standard frontage road. Further, the Arizona Biltmore Estates shall dedicate 80 feet of right of way, plus necessary slope rights from Bethany Home Road extended (the north boundary of Alta Vista Park Subdivision) to Lincoln Drive along a mutually agreeable line just westerly of the city limits. This stipulation may be modified if existing dedicated right of way or newly acquired right of way east of city limits is available for use.

In order to complete the aforementioned road, the City of Phoenix agrees to acquire the necessary right of way and slope rights from the Arizona Canal to Bethany Home Road extended.

Within four years after initial vesting of zoning, the Arizona Biltmore Estates agrees to construct 32nd Street to four-lane rural major street standards at its expense from Camelback Road to the Arizona Canal and from Bethany Home Road extended north to Lincoln Drive, and further to reconstruct or widen, as necessary, upon mutual agreement between Arizona Biltmore Estates and the City of Phoenix, the existing bridge

*JTB*  
*11-24-74*

across the Arizona Canal at 32nd Street to sixty-four (64) feet. Furthermore, if mutual agreement is not forthcoming, the decision should be presented to the Phoenix City Council who shall be final authority in the matter.

Within four years after initial vesting of zoning and upon acquisition of the necessary right of way between the Arizona Canal and Bethany Home Road extended, by the City of Phoenix, the developer shall construct this portion of 32nd Street to four-lane rural major street standards.

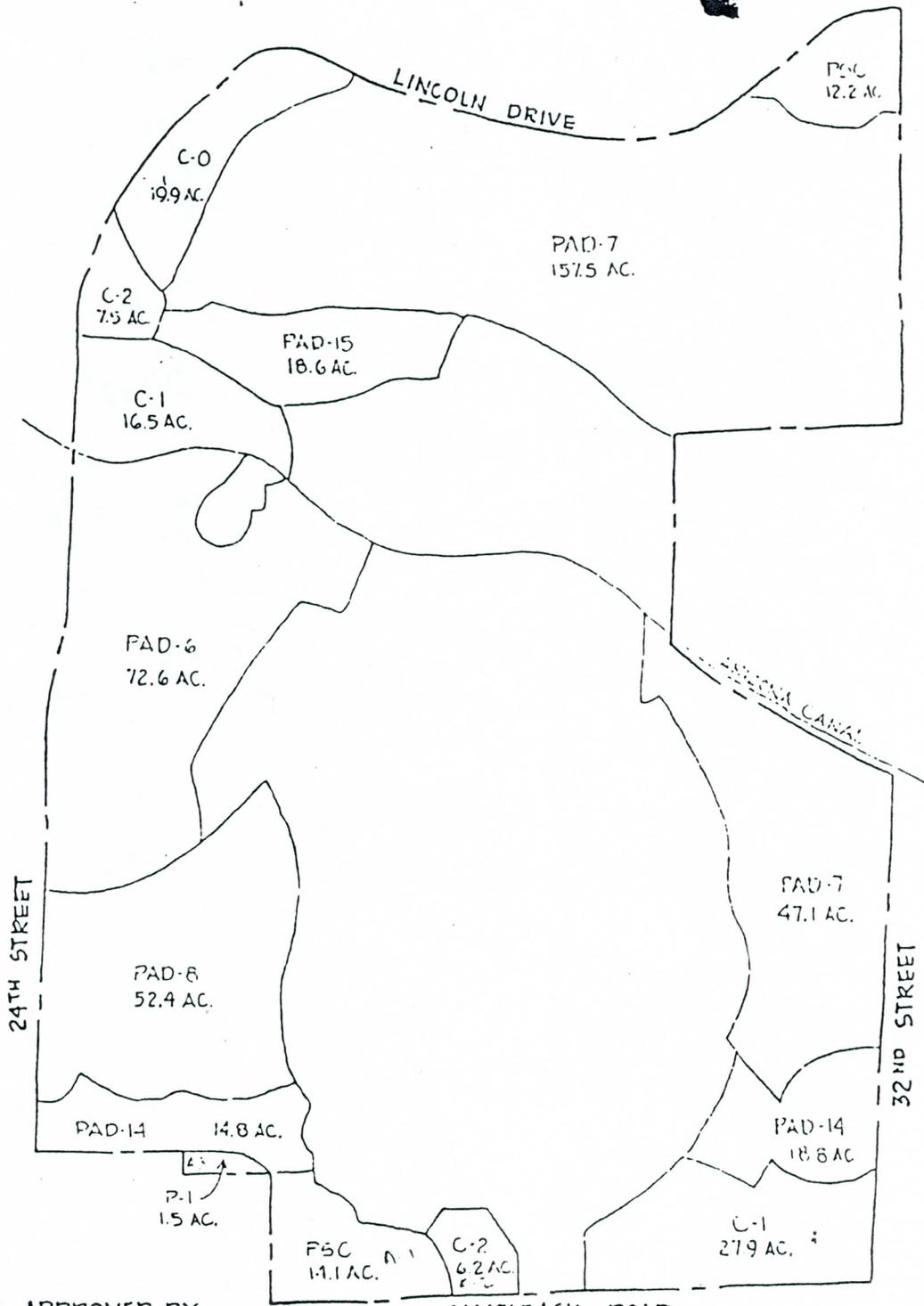
All plans and specifications shall be subject to the approval of the City Engineer and the City Traffic Engineer of the City of Phoenix, and the construction shall be consistent with the standard specifications for four-lane rural major street standard of the City of Phoenix Engineering Department.

Biltmore to prepare construction drawings for one mutually agreeable alignment and in accordance with City standards.

For purposes of this stipulation, a four-lane rural major street standard shall include the following: 48 foot paved roadway with 10 foot graded shoulders within 80 feet of right of way and with slope rights where necessary except south of the canal there shall be one 10 foot gravelled shoulder on the west side.

10 That the applicant submit legal descriptions necessary to establish the zoning districts as approved.

*J. B.*  
12-24-74



ING PLAN AS APPROVED BY  
CITY COUNCIL ON DECEMBER 24, 1974.

*Anthony G. ...*  
CITY OF PHOENIX

ARIZONA BILTMORE ESTATES, INC.

RESOLUTION (NO. FCD 84-3)

ENDORSEMENT OF THE DESIGN ALTERNATIVE (A-4)  
FOR THE ARIZONA CANAL DIVERSION CHANNEL.

The Board of Directors of the Flood Control District of Maricopa County convened in the Supervisors' Auditorium at 205 West Jefferson Street, Phoenix, Arizona, on MAR 5 1984, 1984, with a quorum present, and in accordance with the recommendation of the Chief Engineer and General Manager, adopted the following Resolution on motion made by Mr. \_\_\_\_\_.

WHEREAS the Board of Directors of the Flood Control District of Maricopa County by adoption of a Resolution on July 29, 1974 and an amending Resolution on February 28, 1977 directed and authorized the Chief Engineer and General Manager to acquire necessary land rights for a comprehensive flood control project for Phoenix, Arizona and Vicinity (including New River), developed by the Corps of Engineers, and

WHEREAS the Corps of Engineers published General Design Memorandum No. 3, Phase I for the Phoenix, Arizona and Vicinity (including New River) project in March 1976, and

WHEREAS, the Corps of Engineers is now proceeding to initiate formulation of the Design Memorandum for the Arizona Canal Diversion Channel (ACDC) element of the Phoenix, Arizona and Vicinity (including New River) project, and

WHEREAS, in the design of the ACDC, the Corps of Engineers has developed and evaluated four alternatives for handling the sediment load: (A-4) sediment basins on Cudia City Wash, Dreamy Draw, Little Dreamy Draw, and Cave Creek, or provide sediment space in the channel itself by (B) widening, (C) deepening, or (D) a combination of widening and deepening the channel, and

WHEREAS, the Corps also evaluated alternative (T-2) which, in addition to sediment basins as in alternative (A-4), would require the construction of two detention basins in the Town of Paradise Valley, and relocation of the Phoenix Country Day School or the relocation of at least 16 additional homes, and

WHEREAS, the Town of Paradise Valley continues to object to the construction of detention basins within the Town limits and the Phoenix Country Day School opposes relocation, and

WHEREAS, the estimated costs for each alternative prepared by the Corps of Engineers indicate that alternative (T-2) requiring relocation of the Phoenix Country Day School and/or the destruction of additional homes has the least total cost, although most disruptive and least politically acceptable of the alternatives, and

WHEREAS, alternative (A-4) requiring the construction of the four sediment basins is in accordance with the project features and description as published in the Phase I GDM, is the next least costly alternative and is a lesser burden on local taxpayers than alternative (T-2).

NOW, THEREFORE, BE IT RESOLVED, that the Board of Directors of the Flood Control District of Maricopa County endorses the Corps of Engineers' design alternative (A-4) for the ACDC that requires the construction of sediment basins on Cudia City Wash, Little Dreamy Draw, Dreamy Draw, and Cave Creek and authorizes and directs the Chief Engineer & General Manager to make this endorsement known to the Corps of Engineers, and to cooperate and participate in the implementation of this preferred design alternative.

Dated this 5th day of March 1984.

Fred Kooy, Jr.  
Chairman, Board of Directors

ATTEST:

Cherie Pennington  
Clerk of the Board



W. S. GOOKIN & ASSOCIATES  
ENGINEERS • HYDROLOGISTS • PLANNERS • SURVEYORS  
4203 NORTH BROWN AVENUE  
SCOTTSDALE, ARIZONA 85251  
(602) 947-3741



W. S. GOOKIN, P.E., PRESIDENT  
W. SCUDDER GOOKIN, P.E., VICE PRESIDENT  
FRANK S. TUREK, M.S., R.G., VICE PRESIDENT  
T. ALLEN J. GOOKIN, P.E., TREASURER

OUR FILE NO. \_\_\_\_\_

FLOOD CONTROL DISTRICT  
RECEIVED

May 21, 1982

JAN 13 '88

U. S. Army Corps of Engineers, Los Angeles District  
Engineering Division  
300 N. Los Angeles Street  
P. O. Box 2711  
Los Angeles, CA 90053

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	FINANCE	8	TER
REMARKS		3 EAR	

Att: Mr. Norm Arno, Chief of the Engineering Division

Dear Mr. Arno:

Enclosed is a copy of our final report entitled "Arizona Biltmore Estates and the Arizona Canal Diversion Channel cudia city wash to 16th street."

If you have any questions concerning this report, please do not hesitate to contact me.

Sincerely,

W. S. GOOKIN & ASSOCIATES

W. Scudder Gookin, P.E.

WSG:jz

Enclosure

cc: Vern Schweigert

**W. S. GOOKIN & ASSOCIATES**  
ENGINEERS • HYDROLOGISTS • PLANNERS • SURVEYORS  
4203 NORTH BROWN AVENUE  
SCOTTSDALE, ARIZONA 85251  
(602) 947-3741



W. S. GOOKIN, P.E., PRESIDENT  
W. SCUDDER GOOKIN, P.E., VICE PRESIDENT  
FRANK S. TUREK, M.S., R.G., VICE PRESIDENT  
T. ALLEN J. GOOKIN, P.E., TREASURER

OUR FILE NO. \_\_\_\_\_

**FLOOD CONTROL DISTRICT  
RECEIVED**

JAN 13 '83

May 21, 1982

U. S. Army Corps of Engineers, Los Angeles District  
Engineering Division  
300 N. Los Angeles Street  
P. O. Box 2711  
Los Angeles, CA 90053

CH ENG	HYDRO
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REMARKS	3 EAR

Att: Mr. Norm Arno, Chief of the Engineering Division

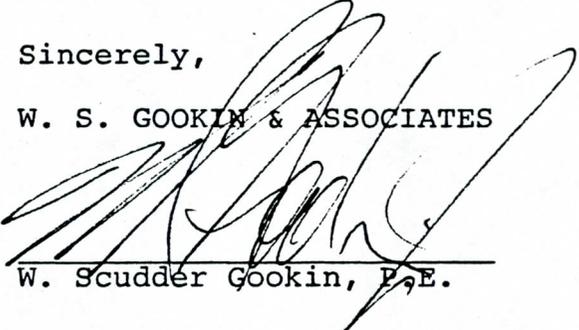
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Sincerely,

W. S. GOOKIN & ASSOCIATES

  
W. Scudder Gookin, P.E.

WSG:jz

Enclosure

cc: Vern Schweigert

ARIZONA BILTMORE ESTATES  
AND THE  
ARIZONA CANAL DIVERSION CHANNEL  
CUDIA CITY WASH TO 16TH STREET

Prepared by

W. S. GOOKIN & ASSOCIATES  
4203 N. Brown Avenue  
Scottsdale, Arizona 85251

947-3741



An examination of the ACDC project from its inception near the Cudia City Wash to 16th Street.

#### INTRODUCTION:

The Firm of W. S. Gookin & Associates was retained by Rostland management to review the situation of the ACDC project in relation to the Biltmore properties. Mr. Vern Schweigert has explained some of the concerns of the Biltmore area property owners with respect to the ACDC project. Some of the concerns related to the esthetics, safety, and disruption of the project.

#### RECENT HISTORY:

In discussion with Mr. Schweigert, and from a review of the correspondence, it is clear that the easement for the construction of the ACDC project was granted by the prior owners of the Biltmore properties, Talley Industries. Talley owned a parcel of land that encompassed much more than the Biltmore Hotel itself.

The Talley ownership also encompassed a great deal of property lying on the north side of Lincoln Drive into the foothills north of the Biltmore and the Wrigley Mansion. In prior years, the northern portions of the property had been maintained by the Biltmore as a scenic walkway that contained winding red sidewalks to prevent guests from becoming lost in the desert as well as numerous verandas along the red sidewalk for people to rest in the shade and enjoy the views overlooking Phoenix. Longtime Phoenix residents know this area as the "Red Sidewalk".

When Talley owned the property, negotiations were begun to allow zoning for the construction of a housing development in the "Red Sidewalk" area. At the time of the negotiations, the City of Phoenix was in the process of trying to firm up a Mountain Preserve. Proposals to put a housing development in the "Red Sidewalk" area were met with strong public resistance for a variety of reasons.

While the negotiations for the required zoning changes were being held, they were also in process negotiations to acquire Rights-of-Way for the ACDC project. Talley got the zoning for the "Red Sidewalk" housing project and the City of Phoenix and Maricopa County Flood Control District got the easement for the ACDC Right-of-Way through the Biltmore properties. Since no appreciable payment was received for the Right-of-Way, it has been assumed the rezoning of the "Red Sidewalk" for a housing development was the payment for the Right of Way.

Shortly after all of this took place, the current owners of the Biltmore bought the property. Rostland has no interest in the development of the "Red Sidewalk" area.

#### NATURE OF THE AREA:

Visits to the site have been made and it is obvious that construction of the proposed ACDC project will result in considerable disruption to the surrounding area both during and after construction. The existing retention basins on the golf courses obviously represent a very substantial expense on the part of the owner. This is evident from the extent, depth and careful attention to contouring and landscaping.

The Arizona Biltmore is a beautiful resort by any standard. It is listed in most tour guides as among the finest in the world. Having been built in the 1920's following a Frank Lloyd Wright design adjacent to the world famous Wrigley Mansion, it has been a prominent Phoenix landmark since it was built. It has always been known for its manicured lawns and gardens as well as its immaculate upkeep. Because of this longstanding appearance, the surrounding residential developments are also some of the most expensive in Arizona because of the desirable location.

The existing Arizona Canal in the vicinity of the Biltmore is lined with large trees and gives the appearance of slow moving stream that is full of water most of the year. Since the canal was in place when the Resort and the Mansion were built, it is an addition to the overall effect. The canal is presently lined, but due to being full most of the time does not

give the appearance of a cold concrete channel.

The disruption that will be occurring if the ACDC is built will include a total interruption of traffic across the canal at various points during the construction. There will also be the loss of parking in the front of the Hotel until construction is complete. The construction adjacent to the front door of the Hotel will undoubtedly have an adverse effect on business, assuming that the patrons of the Biltmore are particularly sensitive to noise, dust, and inconvenience.

#### INVESTIGATIONS:

The Firm of W.S. Gookin & Associates reviewed photographs and numerous documents furnished by Mr. Schweigert. We also reviewed the documents in our library with particular attention to flood flow analyses of the Cudia City Wash and adjacent areas. We made one on site examination of the grounds of the Arizona Biltmore Estates and traversed the highways surrounding the estates on several occasions.

#### Maricopa County Flood Control District:

The Firm of W. S. Gookin & Associates contacted the Maricopa County Flood Control District and made an appointment with Mr. John Rodriguez of that office. Mr. Rodriguez represented that he was the most familiar with the ACDC project of those persons currently at the Flood Control District.

A meeting was held with Mr. Rodriguez at the Flood Control Office in Phoenix. At the meeting, Mr. Rodriguez was asked about the inception of the project and to see what plans and designs he had for the ACDC project. Mr Rodriguez was most cooperative during the contacts with him.

Mr. Rodriguez showed a series of aerial photographs that had graphic depictions of the proposed project displayed on them. These photos were in color and were display size and mounted on boards, having obviously been prepared for public presentations of the various features of the project. He also showed various architectural depictions of the

possible typical appearance of the project. He stated the purpose of the fence was to keep people from falling into the canal as well as throwing in trash.

The meeting at the Flood Control Office also yielded the names of the reports done in 1976. They had a copy of "Gila River Basin New River and Phoenix Streams Design Memorandum No. 3, General Design Memorandum-Phase I Plan Formulation--Main Report, March 1976" and "Gila River Basin New River and Phoenix Streams Design Memorandum No. 3, General Design Memorandum-Phase I Plan Formulation, Appendices, March 1976". Those were briefly examined at the time, and an inquiry was made as to the whereabouts of the environmental documents, if any. Mr. Rodriguez searched his office and determined that the document was in the possession of "some attorneys" who were using it in relation to another matter. The Flood Control District did not have copies of any of the materials examined that could be borrowed, but they did make copies of a few pages that were of specific interest.

Mr. Rodriguez did provide the name and telephone number for the Army Corps of Engineers in Los Angeles. The name he gave was Mr. Nick Romanzov (213) 688-2754. This was important because discussions with Mr. Rodriguez made it clear the Flood Control District was not involved in the design of the project and knew very little about current events in that regard.

#### U. S. Army Corps of Engineers:

This office made telephone inquiries of Mr. Nick Romanzov and learned that the desired reports were out of print but that the reports should be available for inspection from the Phoenix office of the Corps. Upon contacting the Phoenix office of the Corps, we were allowed to borrow the two documents previously listed as well as the "Final Environmental Impact Statement, New River & Phoenix City Streams, Maricopa County, Arizona, March 1976". While the documents were borrowed, they were reproduced in their entirety with the exception of the colored plates that were copied in black and white. Additionally, the large maps were reduced due to the copying facilities available at the time.

The three documents total over a thousand pages and concerned more than just the ACDC project. The ACDC project is a part of the "New River and Phoenix City Streams" project of the U. S. Army Corps of Engineers. The various aspects of this overall project are:

- Arizona Canal Diversion Channel (ACDC)
- Cave Buttes Dam
- Adobe Dam
- New River Dam
- Skunk Creek, New and Agua Fria Rivers

Reading the portions of the reports that relate to the ACDC project raised many more questions than it answered. In an attempt to get these questions answered, Mr. Romanzov was again called in Los Angeles. At that time, he was asked about the supporting data for some of the assertions and statements made in the reports and appendices.

Mr. Romanzov said that the supporting data for the entire project was in the files of the Corps in Los Angeles and that we were welcome to come look at the data. When asked if the data could be sent to the Arizona Office of the Corps, he said this could not be done, and if we wanted to see the data we would have to come to Los Angeles to see it. Mr. Romanzov asked us to identify with greater specificity the subject areas for which we wanted to see supporting materials. He stated that if we wanted to come look at the materials we would need to make an appointment to be sure that the people who had worked on the project were going to be available.

During this conversation he was told that we were particularly interested in seeing the studies of the alternate routes mentioned in the various reports and the supporting data for their rejection. He was also advised that we were interested in the historic and aesthetics sections of the Environmental Impact Statement. It was made clear during the conversation that the focus of interest was in the ACDC project from its inception near the Cudia City wash to 16th Street.

It was decided to travel to Los Angeles to view the documents in the files of the Corps. Mr. Romanzov was called to set up an appointment. During that

conversation he said that the meeting could tentatively be set up for Monday, April 19, but that he would not be able to confirm that date until Friday April 16. On Thursday, April 15, he called back to change the date to Wednesday, April 21. Mr. Romanzov also stated that he would need a letter at that time stating what questions we had so that they could specifically be answered.

A letter of questions was prepared, a copy of which is attached, and hand delivered by Mr. Scudder Gookin, P.E. on April 21.

Upon his arrival at the Corps of Engineers office in Los Angeles at approximately 9 a.m., Mr. Romanzov met Mr. Scudder Gookin, P.E. and indicated that the meeting would have to be over by 11:30 as he and his staff had another scheduled at another location at 11:30 the same morning. He said that any unanswered questions would be answered by mail.

The meeting that followed was a procession of various people who were currently in charge of the various aspects of the project. It was clear from remarks made that few of the people at the meeting were actually involved in the preparation of the 1976 reports. Many of those in attendance were not in the Los Angeles office at the time of preparation of the report.

The first people that were met were Mr. Romanzov, Mr. Cliff Ford, P.E. and Mr. Vance Carson. These gentlemen were involved in the design of the project. Unfortunately the availability of the people was not in the order of the questions set forth in the letter, and a considerable amount of hopping around was done during the meeting. In addition to the persons mentioned above, there were various other persons in and out of the meeting who were introduced as being interested in aspects including hydrology, archeology, environmental, and landscape design. At the meeting, the only documentation offered in response for Mr. Gookin's questions was a copy of a document titled "Gila River Basin New River and Phoenix City Streams Arizona, Design Memorandum No. 2, Hydrology, Part 2, 1982". Mr. Gookin was given copy of document number 17 of that report and a further discussion of this will

follow later in this report.

At the end of the meeting at 11:30 a.m., Mr. Gookin was told that his questions would be responded to in writing "soon". Mr. Romanzov also said that he "owed" Rostland management a meeting and that it would be held in early May of this year jointly with the Flood Control District and Mr. Dave Burris of the City of Phoenix.

A written response to the questions posed has been received by this office by express mail on the afternoon of May 11, 1982. A copy of that letter is also attached. In addition to the questions raised in the letter there were others raised. The following is a listing of the questions discussed, the answers received at the time and comments thereon:

QUESTION:

Where are the engineering data, criteria and computations for the standard project flood and the 100 year flood for the tributaries from 16th Street to and including the Cudia City Wash.

RESPONSE:

A copy of the most recent hydrology report was provided with the understanding that it is not yet public and is subject to review. When told that some of our Firm's studies showed the 100 year flood on Cudia City Wash to be about 7200 cfs instead of 6800 cfs the response was that the difference was small due to a possible difference in method. Mr. Gookin was also told that Mr. John R. Erickson had computed a 100 year flow higher than 6800 cfs.

DISCUSSION:

During discussions, the Hydrologist commented that the differences between the 6800 cfs and the 7200 cfs were "minor". Mr. Gookin suggested that 400 cfs (approximately 179,520 gallons per minute) is not minor if it is going through your property.

An examination of the Hydrology report Mr. Gookin was given does not yield the type of information that was requested. The computations are not shown and the

methodology discussed is suspect, to say the least. The figures generated are based on a generalized percentage breakdown of the differences between a 100 year, Standard Project Flow, etc. for the Tucson gage and the Youngtown Gage. There is no analysis of the appropriateness of this approach. Given the lack of provided documentation underlying the report we would not recommend relying on it for specific property protection. The normal procedure for computation of 100 year floods is to utilize data that is site specific. Percentage extrapolations is not an accepted methology for analyzing the flood flows. Two common techniques are available for this.

The first is known as the SCS method (SCS stands for Soil Conservation Service) which is the procedure utilized by this office where appropriate and is the accepted standard by the State of Arizona for flood design. The second technique that would be acceptable is the HEC-1 computer program designed by the Army Corps of Engineers.

The utilization of a percentage extrapolation to compute the design flood bases upon the relation for the Tucson gage and the Youngtown gage is unusual and questionable. This is particularly true in light of the comment that the Corps is presently still running the sedimentation analysis to determine the effects of sediment on the flows to be expected. The Corps assured Mr. Gookin that the design freeboard in the channel would take care of this problem. Based upon our computations, the increase in depth as a result of the increased flows that a proper analysis shows is 0.5 feet.

QUESTION:

What are the design criteria and hydraulics coefficients considered in the design of the channel, particularly in the vicinity of the Biltmore properties.

RESPONSE:

Mr. Gookin was told that the entire channel was designed using a complex backwater analysis. The Manning's N factor considered in this analysis was 0.014. Mr. Gookin was also told that the Corps is in

the process of recalculating all of the hydrology to account for sedimentation and that the final designs would encompass all changes resulting from the newest calculations.

#### DISCUSSION:

A backwater analysis is a computation of the upstream water surface profiles based on estimates of the physical parameters of a channel. The Corps people at the meeting said that a complete backwater analysis of the entire channel of the ACDC was being performed to include all proposed structures, stilling basins, piers, sedimentation, etc. This is an undertaking that is so mathematically large that only the largest computers available have sufficient capacity and speed to complete.

When Mr. Gookin questioned the wisdom of using a roughness factor of 0.014 to allow for possible future degradation of the channel he was told that many Corps channels have been measured with an N factor of 0.011 (smoother than 0.014), and that the use of 0.014 was quite conservative. This firm believes that the recommendations given in the "Civil Engineering Handbook" by L. C. Urquhart and published by Mc Graw Hill would be more realistic for a project that will be in use as long as this one will, particularly because there will inevitably be some deterioration in the smoothness of the channel from the anticipated high velocity flows. Urquhart recommends on page 323 that the values for good concrete lined channels should be 0.014 and that fair channel should be 0.016.

A second authority as to value of Mannings Roughness Factor is "Open Channel Hydraulics by Ven Te Chow, Phd. dated 1959". In these tables, it is indicated that for a float finish concrete channel, a value of .016 would be reasonable as the ditch ages.

Our experience in Central Arizona has been that concrete surfaces deteriorate with age and that it is prudent to design to the rougher 0.016 resulting in a larger channel to account for future surface deterioration. The Corps assured Mr. Gookin that the planned freeboard in the channel will handle this. However, the significance of the variation is considerable. Based on our computations, from .014 to

.016, this would increase the depth approximately 1.9 feet. When this variance is taken into account and the earlier variance for the flows is added, it becomes apparent that the freeboard in the channel is inadequate.

This is not surprising since the freeboard is inadequate for a channel of this magnitude, even if the other factors had been properly evaluated. The Bureau of Reclamation in "General Requirements and Design Computations by A. J. Aisenbray, Jr." indicates that for an irrigation structure of this size, the freeboard for the hard surface lining should be 2.6 feet instead of the 2 feet recommended by the Corps. Since these Bureau of Reclamation freeboards are for trapezoidal ditches and the envisioned ditch is rectangular, that figure should be increased even further. In addition, based on the Bureau of Reclamation Criteria, the total freeboard lined and unlined for a trapezoidal channel should be 5.3 feet. The plans and profiles contained in Design Memorandum No. 3 show a total design freeboard of approximately 2 feet. The freeboard recommended by Bureau of Reclamation is a minimum when applied to a flood channel. Unlike the irrigation system where the flows can be controlled and shut off if necessary to allow modification or cleaning of the ditches when the freeboard proves inadequate, a flood cannot be turned off to allow necessary repairs and then turned back on again for the duration of the flood.

The inadequate freeboard is acerbated by the current intention of covering the ditch, this could lead to a catastrophic failure of the carrying capacity of the system. Many people who do not work in hydrology do not realize that a covered conduit flowing partially full can convey significantly more water than a covered conduit flowing full. The reason for this is that once the water reaches the top of the conduit, the wetted perimeter of the conduit is suddenly increased by the amount of the covering. This causes a sudden and substantial increase in the friction which causes a sudden and substantial decrease in the carrying capacity of the conduit. Thus, once the conduit fills, the carrying capacity is significantly reduced. This will cause a portion of the normal flows to leave the diversion channel and flow through the Biltmore in addition to those flows

?  
but not  
reduced  
below the  
design capacity if  
there is sufficient  
freeboard to  
begin with

that were not designed for.

QUESTION:

What is the justification for the protection against a 100 year event instead of a Standard Project Flood.

RESPONSE:

The first response given to this question was that the decision was made solely on the basis of economics. Almost immediately the response was changed to say that it was based on a variety of factors including cost and the size of the right of way required.

DISCUSSION:

Normal procedure in a flood study requires that a careful and detailed economic analysis be made to determine the optimal design flood and the economic desirability for the project. It was apparent in the meeting that either this had not been done or that the Corps did not wish to release it.

QUESTION:

What assurance can the Corps give that no water will enter the Biltmore property on the north side of the ACDC project that would not presently occur.

RESPONSE:

This matter had not been examined, but the Corps said it would, in its letter, respond. Mr. Gookin was assured that this matter would be handled in final design. The response letter does not address this issue.

DISCUSSION:

Under present conditions, the Cudia City Wash has no recorded history of reaching the Arizona Biltmore. If the design flow capacity of the ACDC is exceeded, we know of no proposed measure to prevent flooding outside the ACDC right of way.

*can be explained*

While we are not attorneys and a legal opinion should probably be sought to confirm this, it has been our experience that under Arizona laws, any man-made change in the natural flow patterns must not leave any owner of land who is not involved in that action, liable to flooding worse than that which would have occurred in the prior state.

OK

The Corps of Engineers is admitting in this project, that it is importing flood waters for floods in excess of a 100 year frequency that cannot be handled by its system and will, therefore, flood this area. Acquisition of flood easement only grants the Corps the right to handle water within that easement.

or over into the Az canal and beyond

Further discussions with the Corps people relating to the recent installation of retention basins on the golf course showed that they have not been taken into account in any of the designs to date. Discussions were also held regarding the adequacy and the purpose of the retention basins on the golf course. It was pointed out by Mr. Gookin that there may be confusion as to the retention basin function, and specifically, whether or not the basins were intended to take care of inflow from the Cudia City wash instead of local drainage. The Corps expressed doubt that the facilities would handle more than a 10 year storm, although the drainage area controlled by these basins was apparently unclean. Clearly, the drainage retention effect of the golf course was not intended to handle Cudia City Wash floods. Therefore, the Corps probably erred in the evaluation of the effectiveness of the golf course retention.

Mr. Gookin also pointed out that depending on the final design of the ACDC, overflow from the ACDC could impinge on the capacity of the Biltmore's retention basins. He also pointed out that there was a certification by an Arizona Professional Engineer concerning the capacity and that the Biltmore was entitled to rely on that until someone shows to the contrary. Mr. Gookin was assured that this matter would be taken care of in the final design.

they would surely be filled if there was no ACDC

QUESTION:

What measures are being taken to handle the proposed 11 to 12 feet per second proposed flood

velocities.

RESPONSE

Mr. Gookin was assured this problem would be handled in the final design of the project. He was told that the Corps presently has numerous projects in California that exceed 40 feet per second (approx 30 mph) in various portions. The Corps presently envisions linings 10 to 12 inches thick reinforced with double rows of re-bar.

DISCUSSION:

It is most important when velocities of this type are to be encountered, that failures or overtopping MUST be prevented or tremendous damage will result. This concept was discussed at great lengths with the Corps by Mr. Gookin

QUESTION:

The 1976 reports mention alternates to the Eastern extension of the ACDC canal having been considered and rejected on the basis of costs. Recognizing that the Corps doesn't know the final cost of the ACDC, please show the documentation and work to support the discarding of the other routes.

RESPONSE:

"It's too bad you weren't here a couple of months ago. At that time our files relating to that matter were discarded to the dump." This response was essentially confirmed in the letter received May 11.

DISCUSSION:

Further questioning concerning this disposal yielded the information that the materials had been loaded into a dumpster and sent wherever the rest of the refuse from the building goes. Mr. Gookin specifically asked if any of the material had been sent to the Federal Records Center as many other, if not all, Government offices do, and he was told that they were not. We believe this destruction of Federal Records probably violates Federal rules and/or statutes, but an attorney would have to be consulted

in this matter. The Corps now claims to have nothing to support the present route in its files.

Since the time the Corps of Engineers performed the economic studies, they have incorporated significant variations to correct certain objectionable aspects of the initial design. These changes, however, will be expensive and in fact, the final cost of the system is apparently not known. To select one of several alternatives on the basis of a cost comparison, discard all known data except for the selected alternatives, and then proceed to make significant and expensive modifications in the selected alternatives without giving reconsideration to the discarded alternatives is irrational.

*No  
during early  
planning  
and design  
there are  
always some  
changes*

**QUESTION:**

Please show what documentation there is to support the contention concerning minimal aesthetic impact in the Environmental Impact Statement.

**RESPONSE:**

Mr. Gookin was assured that these matters will be handled in the final design. Attractive "typical" architectural renderings of landscape were presented.

Mr. Romanzov said the Corps has determined that on the basis of severance damage, the decision had been made to cover the channel in front of the hotel without cost to the Biltmore. This cover will be sufficient to handle the vehicular loadings of the parking lot that will remain on top of it. All fences on the open portions will be 5 or 6 feet tall and will be recessed 2 or 3 feet from the natural ground surface since they will be mounted to the top of the channel wall. The corps is looking to the Biltmore for input on the matter of landscaping.

**DISCUSSION:**

The Corps seems genuinely eager to work with the property owners in the matter of aesthetics. The original question of the minimal impact still does not seem to be answered.

QUESTION:

What consideration was given to the Arizona Biltmore and the Wrigley Mansion as Arizona Landmarks.

RESPONSE:

Neither of those facilities is in the National Register of Historical Places and as such no consideration was given in the original design. The Corps is aware of the local significance and wants to work with the property owners and neighbors to solve this problem in the final design. Mr. Gookin was assured that the original bridges belonging to the Biltmore across the Arizona Canal would be untouched.

DISCUSSION:

The Corps appeared to have a genuine concern for the historic landmarks involved whether or not they are listed in the historic register. This concern was moderated by a negative response in their letter received May 11.

QUESTION:

Has the Corps or the Flood Control District been issued an NPDES discharge permit for this project.

RESPONSE:

No one at the meeting specifically knew if such a permit had been acquired but the Corps said they would respond. The letter received May 11 confirmed need for such a permit.

The nature of an NPDES permit is such that considerable work must be done to get one, and the granting of such a permit is not guaranteed.

DISCUSSION:

Inquiry with the Arizona Department of Health Services indicates that no such permit has been applied for or issued. Under current rules such a permit is probably required, but no one has raised the issue concerning the ACDC yet.

REMARKS:

In light of the fact that the ACDC has already had an environment impact study, there are too many items that are not available for review. The standard answer of "that is being taken care of in final design" has been overworked in this case.

The U. S. Army Corps of Engineers has destroyed much of the underlying supporting data and computations. With the information that the Corps has released it is impossible to do a reasonable analysis of what they have done, or what they propose to do. The Flood Control District is looking to the Corps for all of the technical information so they obviously have the same problem.

It is obvious from the fact with two paralleling canals, i.e. Arizona and ACDC with the ACDC having a bottom or invert at least 10 feet lower than the bottom of the Arizona Canal, a failure in the Arizona Canal would be very apt to discharge the Arizona Canal into the ACDC, thereby immeasurably increasing the damage to the Biltmore.

Discussions held on May 12, 1982 make the lack of documentation more obvious. All that has been available so far has been general discussion followed by answers. The supporting computations relating to costs, floods, and cost/benefits have not been risk potential.

There are some underlying flaws in the project that appear to be insolvable without damage to the surrounding area. These flaws are:

1). The ACDC is apparently under designed for a 100 year flood even when freeboard is taken into account.

2). The design freeboard is inadequate for the size flows envisioned.

3). The ACDC should be designed for a Standard Project Flood and not a 100 year flood.

4). The existing Right of Way is not large enough to accomodate a channel for a Standard Project

*Political  
& community  
decision*

Flood. .

5). Flood water that never before came into the Biltmore area will be introduced by this project probably in violation of Arizona Law. ?

6). The effects of this project on surface water quality are unknown. ?

7). No consideration has been given to the consequences of a channel failure, which could result in the collapse of the Arizona Canal. below ground no failure

8). Failure of the ACDC channel would undoubtedly result in considerable damage outside of the right-of-way.

9). Inadequate economic analysis of the design flood and of alternative routes makes the particular choice appear arbitrary.

W. S. GOOKIN & ASSOCIATES  
ENGINEERS • HYDROLOGISTS • PLANNERS • SURVEYORS  
4203 NORTH BROWN AVENUE  
SCOTTSDALE, ARIZONA 85251  
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W. S. GOOKIN, P.E., PRESIDENT  
W. SCUDDER GOOKIN, P.E., VICE PRESIDENT  
FRANK S. TUREK, M.S., R.G., VICE PRESIDENT  
T. ALLEN J. GOOKIN, P.E., TREASURER

OUR FILE NO. \_\_\_\_\_

April 20, 1982

U. S. Army Corps of Engineers, Los Angeles District  
Engineering Division  
300 N. Los Angeles Street  
P. O. Box 2711  
Los Angeles, CA 90053

Att: Mr. Norm Arno, Chief of the Engineering Division

Dear Mr. Arno:

This is to confirm some discussions I have had with Mr. Nick Romanzov concerning some information I would like to see. I have had the opportunity to briefly review the following documents:

- 1) Final Environmental Impact Statement New River and Phoenix City Streams Maricopa County, Arizona.
- 2) Gila River Basin New River and Phoenix City Streams Design Memorandum No. 3 General Design Memorandum Phase I Plan Formulation Main Report.
- 3) Gila River Basin New River and Phoenix City Streams Design Memorandum No. 3 General Design Memorandum Phase I Plan Formulation Appendices.

I am particularly interested in the ACDC project. Some information I would like to see that does not appear to be specifically covered in the documents I saw include the following:

- A) The engineering data, criteria and computations for the standard project flood and the 100 year flood for tributaries from 16th Street to and including the Cudia City Wash.

*Report Available*

Mr. Norm Arno  
April 20, 1982  
Page 2

*11-11-82*

B) The design criteria and hydraulics coefficients considered in the design of the channel, particularly in the vicinity of the Biltmore Properties.

*11-11-82*

C) What measures are proposed to handle 11 to 12 feet per second flow velocities. *Should not be any problem*

D) In the reports, mention is made of alternative routes considered and rejected because of cost. I would like to see information as to the relative costs considered at the time of selection. *Cost*

E) I would like to see the documentation regarding the aesthetic statement in the Environmental Statement. *Handled in design*

F) I would like some explanation as to why protection for a 100 year flow was considered as opposed to any other frequency. *Cost*

G) I would like to see the extent of the materials collected on archeological and historical sites involved in the project.

Any help you can give me in my overall understanding of this project will be greatly appreciated. I am gathering this information on behalf of my client Rostland Arizona, Inc. I look forward to meeting with you on April 21, 1982.

Sincerely,

W. S. COOKIN & ASSOCIATES

*[Signature]*  
-----  
W. Scudder Cookin, P.E.

jz

RECEIVED MAY 11 1982



DEPARTMENT OF THE ARMY  
LOS ANGELES DISTRICT, CORPS OF ENGINEERS  
P. O. BOX 2711  
LOS ANGELES, CALIFORNIA 90053

SPLED-DM

10 MAY 1982

Mr. W. Scudder Gookin, P.E.  
W. S. Gookin & Associates  
4203 North Brown Avenue  
Scottsdale, AZ 85251

Dear Mr. Gookin:

You, in your letter (20 April 1982) and at a subsequent meeting (21 April 1982) with members of my staff, requested our assistance in providing answers to several items requested on behalf of your client, Rostland Arizona, Inc., relative to the Arizona Canal Diversion Channel (ACDC). As requested and as discussed at the referenced meeting, the following information pertaining to your items A through G are provided:

a. Item A: At the referenced meeting, you were provided with a draft copy of the report, "Gila River Basin, Phoenix, Arizona & Vicinity (including New River), Design Memorandum No. 2, Hydrology, Part 2", April 1982. This report presents the development of design discharges for the ACDC and selected tributaries, including Cudia City Wash.

b. Item B: The ACDC is being designed in its entirety, as well as in the vicinity of the Arizona Biltmore Hotel, using standard design procedures. The wall heights of the channel were determined by first computing the depth of flow assuming gradually varied flow and using the standard step method with a Mannings coefficient of 0.014. A freeboard of two feet was added to the computed water surface.

c. Item C: A concrete channel lining reinforced with steel bars will be used from Cudia City Wash to Cactus Road, a distance of about 14 miles of the 17 mile length of the project. The reinforced concrete lining will be more than adequate to handle flow velocities of 11 to 12 feet per second.

d. Item D: Information as to the relative costs of alternative routes considered were developed prior to 1975 and have since been discarded, in 1981, as part of our files and records reduction campaign.

e. Item E: This request was satisfied during the meeting held on 21 April 1982. Representatives from Environmental Resources Branch presented alternative esthetic plans for various reaches of the ACDC. Similar esthetic treatment alternatives are presently being developed for the reach fronting the Arizona Biltmore Hotel. The alternatives will be presented to Rostland Arizona, Inc. in May 1982.

SPLED-DM

Mr. W. Scudder Gookin, P.E.

f. Item F: Optimization data were developed for the ACDC and downstream flowage easements, as discussed in our report, "Gila River Basin, New River and Phoenix City Streams, Arizona, Design Memorandum No. 3, General Design Memorandum Phase I, Plan Formulation", dated March 1976. The ACDC and flowage easements along Skunk Creek, New River and Agua Fria River were subjected to analyses for a range of flood frequencies to determine the economic optimum plan, which is the plan that the average annual benefits exceed the average annual costs by the widest margin. The maximum net benefits were found to occur at about the 100-year frequency, which is the level of protection recommended in the interim survey report for Phoenix, Arizona and Vicinity (including New River) dated January 1964.

g. Item G: A survey of cultural resources was conducted by Arizona State University (ASU), Department of Anthropology, under contract to the Corps of Engineers. The findings of this survey are available in the report entitled, "An Archaeological Survey in the Gila River Basin, New River and Phoenix City Streams, Arizona, Project Area". Copies of the report are available at the ASU, Department of Anthropology and at our Phoenix Area Office.

In addition to the above, you requested at the referenced meeting information on: (a) Public Law 92-500, Section 402-National Pollutant Discharge Elimination System (NPDES) Permit; (b) additional risk exposure of floods exceeding 100 year event and; (c) whether or not the Arizona Biltmore Hotel and the Wrigley Mansion are historic landmarks. Our response follows:

a. NPDES Permit: Discharge of water from the ACDC into Skunk Creek requires a NPDES permit. Permit application must be filed with the Environmental Protection Agency and the Arizona Department of Health Services 180 days prior to discharge into Skunk creek.

b. Additional Risk Exposure of Floods Exceeding 100-year Event: The existing Arizona Canal normally intercepts flood water from drainage areas adjoining its north bank until the volume of water exceeds the capacity of the canal. The remaining water then flows over spillways on the south bank and, if these are inadequate, overflows or cuts through the south bank at random locations. The ACDC to be constructed along the north side of the Arizona Canal will intercept all flows up to the 100-year frequency flood, thus providing a much higher degree of protection than the canal which is not a flood control structure. If the flood water exceeds the capacity of the ACDC, it will overflow into the Arizona Canal until the canal capacity is exceeded. The remaining water will flow over spillways on the south bank and, as under existing conditions, overflow or cut through the south bank at random locations when the canal capacity is exceeded. If we find that construction of the ACDC could increase the risk exposure over what currently exists when floods of greater magnitude than the 100-year frequency flood occur, we will study the feasibility of providing spillways on the ACDC near the existing Arizona Canal spillways.

SPLED-DM

Mr. W. Scudder Gookin, P.E.

c. Are Arizona Biltmore Hotel and the Wrigley Mansion historical landmarks? Based on a conversation with the Arizona State Historic Preservation Officer, neither of these properties are included in the National Register of Historic Places, nor are they designated Arizona State Landmarks.

If you have any additional questions, please contact Mr. Nick M. Romanzov, the Project Manager, at (213) 688-2754.

Sincerely,



NORMAN ARNO  
Chief, Engineering Division

CONCEPTUAL STUDY  
AN ALTERNATIVE TO ACDC

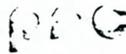
March 29, 1983

Prepared For:

ARIZONA BILTMORE ESTATES VILLAGE ASSOCIATION  
2423 EAST MARSHALL AVENUE  
PHOENIX, ARIZONA 85016

Prepared by:

PRC TOUPS,  
A DIVISION OF PRC ENGINEERING, INC.  
4131 NORTH 24th STREET  
SUITE 110  
PHOENIX, ARIZONA 85016  
(602) 954-9191



Planning Research Corporation

PRC TOUPS  
Division of PRC Engineering  
4131 North 24th Street  
Phoenix, AZ 85016  
602-954-9191

FLOOD CONTROL DISTRICT  
RECEIVED

APR 07 '83

William R. Mills, Jr., P.E., President; David M. Wood, Executive Vice President;  
Cooper Roberts, P.E., Vice President; John W. Stansel, A.I.A., Associate Vice President;  
Ashok C. Patel, P.E., Associate Vice President; Edward A. Adair, Associate Vice President

6 April 1983

Flood Control District of Maricopa County  
3335 West Durango Street  
Phoenix, Arizona  
Attn: Mr. D. Sagromoso, Manager

4	CH ENG		HYDRO
3	ASST		LMgt
	ADMIN		SUSP
	C & O		FILE
1	ENGR		DESTROY
	FINANCE	2	JER
REMARKS			

Re: Alternative Flood Control in Reach 4 of the  
Arizona Canal Diversion Channel

Dear Mr. Sagromoso:

At the request of our client, Arizona Biltmore Estates Village Association we have undertaken a conceptual study for determining the most cost effective alternative to provide flood protection at the east end of the reach. The attached report sets out an alternative which, at a conceptual stage, has a potential for providing protection from the 100-year return frequency flood event. In addition, the alternative would substantially reduce capital costs to the Arizona Canal Diversion Channel; materially enhance the esthetics of the area through the elimination of an open channel; and reduce the taxpayer's future debt financing obligation.

Before we proceed any further with our study we, on behalf of our client, wish to have the District's concurrence in the technical and economic feasibility of the proposed alternative. We are aware that work towards making the ACDC a reality is currently underway and that, therefore, time to affect modifications in concept and design is critical. We are most willing to accomodate your needs in facilitating a conceptual review in whatever way may best assist the review process.

In order to keep our client informed regarding the project's status may we expect to receive your review comments by April 29th? If that date is impossible to meet please tell us when we may expect to hear from you.

Sincerely,

PRC TOUPS, A Division of  
PRC Engineering, Inc.

Edward A. Adair, P.E.  
Vice President

EAD/sk  
enclosure

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Cost Summary

    Cudia City Wash Basin including Outlet Drain

    35th Street Wash Basin including Outlet Drain

    Biltmore Storm Drain

ACDC Western Reach, Cost Reduction Estimates

PLATE 1 Location and Drainage Area Map

PLATE 2 ACDC Alternative, Eastern Reach

## SCOPE OF STUDY

The purpose of this report is to investigate an alternative solution for flood protection in the eastern study reach of the Arizona Canal Diversion Channel (ACDC) from 24th Street to 40th Street. The scope of this report is to evaluate the alternative on a conceptual basis.

## GENERAL BACKGROUND

The U.S. Army Corps of Engineers has considered providing a concrete lined rectangular channel to intercept and convey flood flows from the drainage area of about 7.7 square miles in the two mile long study reach of ACDC (See Plat 1). The concrete lined channel is designed to carry the 100-year frequency flood flows ranging from 6900 cfs at its upstream end near the Cudia City Wash to about 8400 cfs at 24th Street.

An alternative method of protection has been studied from a conceptual level of effort which can reduce the capital cost as well as the aesthetic impact while providing a flood protection from the 100-year frequency storm.

## ALTERNATIVE EVALUATION

### General

In the alternative evaluation, two detention basins are considered (Plate 2). These basins will collect and detain flood flows from the 100-year frequency storm. A large size storm drain is provided at the discharges of each basin so that the basin size can be minimized. The storm drain will extend along the north side of existing Arizona Canal to discharge into the proposed ACDC

immediately west of 24th Street. The storm drain is sized so that it can be placed within the Salt River Project (SRP) right-of-way. The attenuation of the flood peak achieved as a result of detention will reduce the design peaks in the ACDC throughout its remaining eight mile reach west of 24th Street. Consequently, downsizing of ACDC will be possible for the eight mile reach, resulting in capital cost reduction. Comparison of capital costs between an open channel design and the alternative appear to show a significant reduction of 5.7 million dollars with the alternative. The attenuation of the flood peak through the basin alternative also has the potential effect of reducing capital costs an additional 17.5 million between 24th Street and Skunk Creek.

Cudia City Wash Basin

The first basin comprised of about 39 acres is located on the southwest side of the intersection of 40th Street and Stanford Drive and would be located on the parcel which is presently being used by the North Phoenix Country Day School. This basin would have an average depth of 27 feet and would collect and detain flood flows from the Cudia City Wash. A large ungated outlet in the form of a 72 inch reinforced concrete pipe would be provided to continuously drain the basin during and after the storm event. The outflow from the 72 inch pipe would then be discharged into a ten-foot by eight-foot concrete box conduit which will run along the north side of the Arizona Canal 3430 lineal feet westerly to 33rd Street.

Cudia City Wash Basin - Summary:

Drainage Area	5.23 Square Miles
100-Year 24-Hour Precipitation	4 Inches
Runoff Curve Number	91
Runoff	3.0025"
Runoff Volume	840 AcFt
Estimated Outflow from 10' x 8' box	500 cfs
Required Detention Volume	500 AcFt
Freeboard	1.5 Feet
Basin depths (varies)	17.5 to 40 feet
Basin drain time	1 Day (Maximum)
Basin Size	39 Acres

### 35th Street Wash Basin

The second basin comprised of about eleven acres would be located on the west side of 35th Street and about 1200 feet north of Stanford Drive. This basin would collect flood flows from three unnamed tributaries draining about 1.5 square miles of watershed. Three inlets would be provided to intercept flood flows from these tributaries. The basin having an average depth of 22 feet would detain about 130 acre feet of runoff during the 100-year storm event. An ungated 60 inch reinforced concrete pipe would be provided to continuously drain the basin. The pipe would connect to the ten-foot by eight-foot concrete box conduit which comes from the Cudia City Wash Basin at 33rd Street and the Arizona Canal. From the junction at 33rd Street and the Arizona Canal, the box would be enlarged to a ten-foot by ten-foot size and extended westerly 6780 lineal feet adjacent to and parallel with the Arizona Canal to the ACDC now having its eastern terminus located west of 24th Street.

#### 35th Street Wash Basin - Summary:

Drainage Area	1.5 Square Miles
100-Year 24-Hour Precipitation	4 Inches
Runoff Curve Number (Wtd.)	88.3
Runoff	2.98"
Runoff Volume	234 AcFt
Estimated outflow from 60" RCP	250 cfs
Required detention volume	130 AcFt
Freeboard	1.5 feet
Basin depths (varies)	15 to 32 feet
Basin drain time	1 Day (Maximum)
Basin Size	11 Acres

### Biltmore Storm Drain

In the watershed of about one square mile which directly affects the Arizona Biltmore Estates, there are a series of existing flood retarding elements including detention basins, lakes and drainage channels which compose the Biltmore flood protection system. This flood protection system was sized to reduce flood flows which occur from a ten-year two-hour storm event and are therefore, presently undersized to effectively contain the 100-year 24-hour storm event. Our preliminary examination of these elements lead us to the conclusion that enlarging these facilities would not be cost-effective. In this alternative, precast concrete boxes were considered to convey the 100-year flood flows from the Biltmore property discharging into the ACDC west of 24th Street.

Presently, storm flow from about .36 square miles concentrates in the retention basin located immediately north of the Arizona Canal and east of Biltmore Hotel tennis courts. In the alternative, an inlet structure would be provided to intercept the 100-year flood outflow from the exiting retention basin. The intercepted flow would then be carried by a second ten-foot by ten-foot concrete box conduit laid parallel to the box conduit coming from the 35th Street and Cudia City detention basins as discussed earlier in this report. The second box conduit will also terminate at the ACDC west of 24th Street.

A major portion of the Biltmore watershed drains through a tributary wash which terminates immediately west of the Biltmore Hotel and north of the Arizona Canal. A third box conduit (ten-foot by ten-foot) would intercept flows from this tributary through an inlet structure. The box would be extended about 1750 lineal feet to the ACDC west of 24th Street.

Biltmore Storm Drain - Summary:

Drainage Area (Varies)	0.4 to 1.0 Square Mile
100-Year 24-Hour Precipitation	4 Inches
Runoff Curve Number	91
Runoff Peaks (Varies)	800 to 1400 cfs
Storm Drain Size	1. 10 x 10 Pre-cast box 2. 10 x 10 Pre-cast box

## CONCLUSIONS AND RECOMMENDATIONS

An alternative solution of flood protection for the eastern reach of Arizona Canal Diversion Channel (ACDC) was investigated in this conceptual study. Based upon this study, the following conclusions are drawn:

1. The alternative to ACDC is feasible in the study reach. This alternative consists of a combination of detention basins and a two-mile long storm drain system as shown on Plate 2. It will require an estimated 50 acres of land which includes two existing residential homes and the North Phoenix Country Day School property. The cost of this alternative is estimated to be 25.2 million dollars based upon 1982 land values and construction prices as compared to Corp's present estimate of 31 million dollars for the same reach. For more detailed cost estimates, reference should be made to the Appendix.
2. A reduction in the flood peak will result for the entire reach of ACDC, thus making possible the structural downsizing of the entire ACDC.
3. Improvement costs are estimated to be reduced by 17.4 million dollars (1982 pricing) for the reach west of 24th Street and extending to Skunk Creek.

4. The estimated savings using the alternative is summarized below:

REACH	ACDC	ALTERNATE	COST DIFFERENCE
Eastern Reach ACDC East of 24th Street	31,000,000	25,223,000	5,777,000
Western Reach ACDC West of 24th Street	<u>130,837,000<sup>a</sup></u>	<u>113,343,000<sup>a</sup></u>	<u>17,494,000<sup>a</sup></u>
TOTAL	161,837,000	138,566,000	\$23,211,000

a. Does not include reduced cost of right-of-way, utilities, bridges, etc.

## AVAILABLE DATA AND REFERENCES

For the purpose of this conceptual study, the following references were cited:

1. U.S. Army Corps of Engineers, "Gila River Basin, New River and Phoenix City Streams, Arizona, Design Memorandum No. 3, General Design Memorandum - Phase 1, Plan Formulation." March 1976.
2. U.S. Department of Agriculture, Soil Conservation Service, "Arizona General Soil Map", Portland, Oregon, December 1975.
3. U.S. Department of Agriculture, Soil Conservation Service, "Urban Hydrology for Small Watersheds", Technical Release No. 55, January 1975.
4. U.S. Department of Commerce, National Weather Service, "Precipitation Frequency Atlas of the Western United States", Volume VII - Arizona 1973.
5. City of Phoenix, "Storm Drain Design Manual, Subdivision Drainage Design." October 1972.
6. Arizona Department of Transportation, "Hydrologic Design for Highway Drainage in Arizona", Phoenix, Arizona, December 1968.
7. City of Phoenix, "Quarter Section Maps."

## APPENDIX

Cost Analysis

Cost Summary

Cudia City Wash Basin including Outlet Drain

35th Street Wash Basin including Outlet Drain

Biltmore Storm Drain

ACDC Cost Reduction West of 24th Street

PLATE 1 Location and Drainage Area Map

PLATE 2 ACDC Alternative, Eastern Reach

COST ANALYSIS

A conceptual cost analysis is prepared for the alternative studied so that a cost comparison can be made with the planned Arizona Canal Diversion Channel for the study reach. The analysis is based on the 1982 price index and only includes major elements of the flood control improvements. It is also assumed that the storm drain facility which runs parallel to Arizona Canal will be contained within the Arizona Canal right-of-way limits. Consequently, no right of way acquisition cost is considered for placing the drain facility along the Arizona Canal.

Cost Summary (1982 Price)

	<u>ACDC Present Estimates By Corps</u>	<u>Alternative To ACDC</u>	<u>Cost Reduction</u>
Eastern Reach ACDC East of 24th Street:			
Cudia City Wash Basin		15,877,200	
35th St. Wash Basin		4,879,000	
Biltmore Storm Drain		4,467,000	
	<u>\$ 31,000,000<sup>a</sup></u>	<u>\$ 25,223,200</u>	<u>\$ 5,776,800</u>
Western Reach ACDC West of 24th Street:			
	<u>\$ 130,837,000<sup>b</sup></u>	<u>\$ 113,343,000<sup>b</sup></u>	<u>\$17,494,000<sup>b</sup></u>
			<u>\$23,270,800</u>

a. Prorated based on Corps 1982 Estimate of 53.4 million dollars for the ACDC - Cudia City Wash to Dreamy Draw.

b. Does not include reduced costs of right-of-way, utilities, bridges, etc.

The cost estimate for various elements of the alternative is summarized below:

1. Cudia City Wash Basin including outlet drain:

Construction costs:

Excavation	1,459,000	C.Y.	\$ 5.00	\$ 7,295,000
Drop Structure	1	L.S.		100,000
Fencing & Gates	52.00	L.F.	7.00	36,400
Landscaping	78,000	S.F.	.60	46,800
72" RCP Outlet Drain	250	L.F.	125.00	31,250
1-10'x 8' Pre-Cast Concrete Box	3,430	L.F.	325.00	<u>1,114,750</u>

Subtotal \$ 8,624,200

Right of Way costs:

Land	39	Ac.	50,000	\$ 1,950,000
Buildings	83,000	S.F.	41.00	<u>3,403,000</u>

Subtotal \$ 5,353,000

TOTAL CONSTRUCTION AND RIGHT OF WAY \$ 13,977,200

CONTINGENCIES 10% 1,400,000

ENGINEERING & ADMINISTRATIVE 5% OF CONSTRUCTION COST 500,000

TOTAL \$ 15,877,200

2. 35th Street Wash Basin including Outlet Drain

Construction costs:

Excavation	341,000	C.Y.	\$ 4	\$ 1,364,000
Drop Structures	1	JOB L.S.		100,000
Fencing and Gates	3,600	L.F.	8.33	30,000
Landscaping	21,600	S.F.	.60	13,000
60" RCP Outlet Drain	600	L.F.	100.00	60,000
1-10'x 10' Pre-Cast Concrete Box	2,830	L.F.	400.00	<u>1,132,000</u>

Subtotal \$ 2,699,000

Right of Way costs:

Land	11	Ac.	100,000	1,110,000
Single Family Homes (Building Only)	2	EA.	300,000	<u>600,000</u>

Subtotal \$ 1,710,000

TOTAL CONSTRUCTION AND RIGHT OF WAY \$ 4,409,000

CONTINGENCIES 5% 220,000

ENGINEERING & ADMINISTRATIVE  
9% OF CONSTRUCTION COST 250,000

**TOTAL** \$ 4,879,000

3. Biltmore Storm Drain

Construction costs:

2 - 10' x 10' Pre-cast Concrete Boxes	2,200	L.F.	760	\$ 1,672,000
3 - 10' x 10' Pre-cast Concrete Boxes	1,750	L.F.	1,140	<u>1,995,000</u>
Subtotal				3,667,000
CONTINGENCIES 15%				\$ 500,000
ENGINEERING AND ADMINISTRATIVE 7% OF CONSTRUCTION COST				<u>250,000</u>
TOTAL				<u>\$ 4,467,000</u>

## ACDC COST REDUCTION - WESTERN REACH

The ACDC is presently designed to carry 8400 cfs Peak downstream from its location near 24th Street. With the proposed alternative in-place this value of peak discharge (8400 cfs) will be reduced to approximately 2200 cfs. As discussed earlier in this report, the reduction in peak will be achieved by detaining major flood flows in to the Cudia City Wash Basin and 35th Street Wash Basin. With the reduced flow, the present size of ACDC can therefore be downsized. The following tabulation indicates modified channel cost for the western reach of ACDC:

ACDC Reach	ACDC Present Estimates by Corps (1976 Price)	Alternate ACDC reduced cross-section (1976 Price)	Reduced Cost (1976 Price)
24th Street to Dreamy Draw	7,030,000 <sup>a</sup>	6,154,100	875,900
Dreamy Draw to Cave Creek Wash	19,470,000	15,398,900	4,071,100
Cave Creek Wash to Cactus Road	17,500,000	15,912,800	1,587,200
Cactus Road to Skunk Creek	<u>14,600,000</u>	<u>13,299,000</u>	<u>1,301,000</u>
	\$ 58,600,000	\$50,764,800	\$7,835,200
Reduced cost (1982 Price index) = \$ 7,835,200 x 1.8606			
= \$ 14,478,000			
Reduced cost engineering, design, Supervision & Administration = \$ <u>2,916,000</u>			
Total	\$ 17,494,000		

a. Cost prorated from ACDC - 40th Street to Dreamy Draw based on length in feet.



# PRC Troups

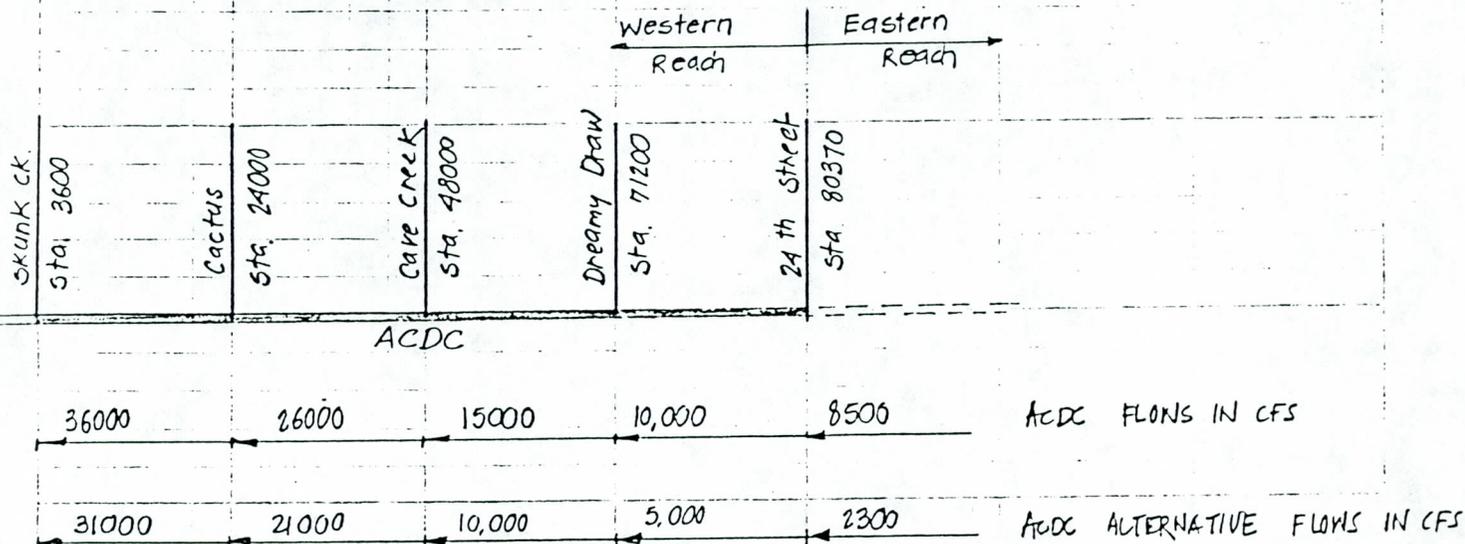
CONSULTING ENGINEERS AND PLANNERS

BY TRP DATE 3/21/83 CLIENT AEVA SHEET NO. 1 OF 7

CHECKED \_\_\_\_\_ DATE \_\_\_\_\_ JOB ACDC Alternative JOB NO. 603.900-3

## COST REDUCTION - ACDC WESTERN REACH

### DESIGN FLOWS ACDC



### channel Construction SUMMARY OF A COSTS

Reach	ACDC Present Estimates by CORPS (1976 Price)	Alternative to ACDC (1976 Price)	Cost Reduction (1976 Price)
24 st. to Dreamy Draw	7,030,000*	6,154,100	\$ 875,900
Dreamy Draw to Cave Creek	19,470,000	15,398,900	4,071,100
Cave Creek to Cactus	17,500,000	15,912,800	1,587,200
Cactus to skunk Creek	14,600,000	13,299,000	1,301,000
	\$ 58,600,000	\$ 50,764,800	\$ 7,835,200
			Cost Reduction (1982 Price Index) = 7,835,200 X 1.8606 = \$14,478,000

\* Pro-rated based on length in ft.



# PRC Toups

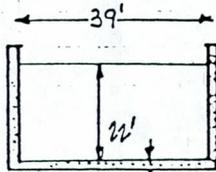
CONSULTING ENGINEERS AND PLANNERS

BY \_\_\_\_\_ DATE \_\_\_\_\_ CLIENT \_\_\_\_\_ SHEET NO. 2 OF 7

CHECKED \_\_\_\_\_ DATE \_\_\_\_\_ JOB \_\_\_\_\_ JOB NO. \_\_\_\_\_

ACDC REACH FROM 24<sup>th</sup> ST TO DREAMY DRAW  
STA 80,370 STA 71,200

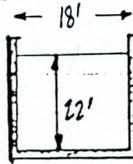
(i) ACDC - AVE. FLOW = 9250 cfs  
V = 10.8 fps



Assume 12" thick

(ii) ACDC - ALTERNATIVE :

AVE FLOW = 9250-5000  
= 4250 cfs  
V = 10.8 fps



Reduction in concrete requirement for bottom slab :

$$= (39' - 18') \times 1' \text{ thick} \times (80,370 - 71,200) \text{ L.F.} \times \frac{1}{27} \frac{\text{c.f.}}{\text{c.f.}}$$
$$= 7132 \text{ c.f.}$$

Cost Reduction:

Ref. Table 9, A 8-22 (Ref. No. 1)

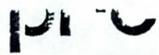
Estimate cost of Rein. Concrete :

Vol: Concrete (invert) + concrete (walls) = 66,700 c.f. + 60,000 = 126,700 c.f.

Cost: Concrete (invert) + concrete (walls) + Port. cement + steel \$  
= 1,867,600 + 2,764,000 + 1,430,000 + 3,800,000  
= \$9,857,600

∴ Unit cost = \$9,857,600 / 126,700 c.f. = \$77.80 / c.f.

Reduction in concrete cost = 7132 c.f. @ \$77.80 / c.f. = \$554,900



# PRC Toups

CONSULTING ENGINEERS AND PLANNERS

BY \_\_\_\_\_ DATE \_\_\_\_\_ CLIENT \_\_\_\_\_ SHEET NO. 3 OF 7

CHECKED \_\_\_\_\_ DATE \_\_\_\_\_ JOB \_\_\_\_\_ JOB NO. \_\_\_\_\_

## Earthwork Reduction:

$$\text{Volume of Earthwork} = 21' \text{ width} \times 25' \text{ depth} \times 9170' \text{ length} \times \frac{1}{27} = 178,306 \text{ c.y.}$$

$$\begin{aligned} \text{Unit cost of earthwork} &= \text{Excavation cost} + \text{Excess excavated material} \\ &= \$ 1.60 + \$ .20 \\ &= \$ 1.80 \end{aligned} \quad \text{compaction}$$

$$\begin{aligned} \therefore \text{Reduction in earthwork cost} &= 178,306 \text{ c.y.} \times \$ 1.80/\text{c.y.} \\ &= \$ 320,950 \end{aligned}$$

$$\begin{aligned} \text{Net reduction in cost} &= \$ 554,900 + 320,950 \\ &= \$ 875,850 \end{aligned}$$



# PRC Toups

CONSULTING ENGINEERS AND PLANNERS

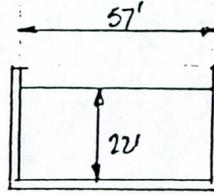
BY \_\_\_\_\_ DATE \_\_\_\_\_ CLIENT \_\_\_\_\_ SHEET NO. 4 OF 7

CHECKED \_\_\_\_\_ DATE \_\_\_\_\_ JOB \_\_\_\_\_ JOB NO. \_\_\_\_\_

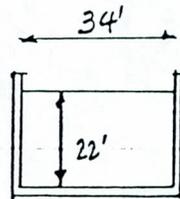
## ACDC REACH

Dreamy Draw (sta. 71200) to Care Creek (sta. 48000)

(i) ACDC arc. design Flow = 12,500 cfs  
V = 10 Fps ±



(ii) ACDC Alternative Flow = 7,500 cfs  
V = 10 Fps ±



Reduction in concrete requirements (Top & bottom slabs):

$$= \frac{57' - 34'}{57} = 0.4035 \%$$

Cost Reduction:

Conc. Bottom slab:  $77,800 \text{ c.y.} \times 0.4035 \times 28 \text{ \$/c.y.} = \$ 879,000$

Conc. Top slab  $12,300 \text{ c.y.} \times 0.4035 \times 112 \text{ \$/c.y.} = 555,900$

$$\text{Portland cement \& steel} = \frac{\$ 1,624,000 + 5,300,000}{77,800 \text{ c.y.} + 54,000 \text{ c.y.} + 12,300 \text{ c.y.}} = \$ 48^{05} / \text{c.y. Conc}$$

(Cement + steel) bottom slab =  $77,800 \times 0.4035 \times 48^{15} \text{ \$/c.y.} = \$ 1,508,400$

top slab =  $12,300 \times 0.4035 \times 49^{05} \text{ \$/c.y.} = 238,470$

Total Reduction in Conc. Cost =  $879,000 + 555,900 + 1,508,400 + 238,470$

$$= \$ 3,181,800$$



# PRC Toups

CONSULTING ENGINEERS AND PLANNERS

BY \_\_\_\_\_ DATE \_\_\_\_\_ CLIENT \_\_\_\_\_ SHEET NO. 5 OF 7

CHECKED \_\_\_\_\_ DATE \_\_\_\_\_ JOB \_\_\_\_\_ JOB NO. \_\_\_\_\_

## Earth Work Reduction:

$$\begin{aligned} \text{Volume of Earthwork} &= 23' \text{ width} \times 25' \text{ depth} \times 23,200 \text{ LF} \times \frac{1}{27} \frac{\text{CY}}{\text{CF}} \\ &= 494,074 \text{ c.y.} \end{aligned}$$

$$\text{Unit cost of Earthwork} = \$180 / \text{c.y.}$$

$$\therefore \text{Reduction in earthwork cost} = 494,074 \text{ c.y.} \times \$180 / \text{c.y.} = \$889,300$$

$$\begin{aligned} \text{Net cost reduction} &= \$3,181,800 + 889,300 \\ &= \$4,071,100 \end{aligned}$$



# PRC Toups

CONSULTING ENGINEERS AND PLANNERS

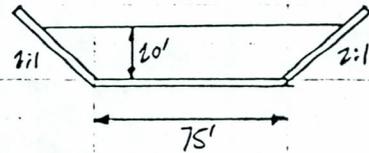
BY \_\_\_\_\_ DATE \_\_\_\_\_ CLIENT \_\_\_\_\_ SHEET NO. 6 OF 7

CHECKED \_\_\_\_\_ DATE \_\_\_\_\_ JOB \_\_\_\_\_ JOB NO. \_\_\_\_\_

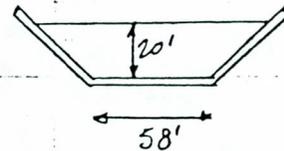
## ACDC REACH

Care Creek (Sta. 48000) toactus (Sta. 24000)

(i) ACDC. are. design Flow = 28,500 cfs



(ii) ACDC Alternative Flow = 23,500 cfs



$$\text{Reduction in concrete requirements} = \frac{75' - 58'}{58'} = 0.2267\%$$

Cost Reduction:

$$\text{Conc. bottom slab} = 68,600 \text{ c.y.} \times 0.2267 \times 28 \frac{\$}{\text{c.y.}} = \$ 435,400$$

$$\text{Port. cement \& steel} = \frac{1,492,000 + 2,525,000}{68,600 \text{ c.y.} + 63,800} = \$ 30^{34} / \text{c.y.}$$

$$\text{(Cement + steel) bottom slab} = 68,600 \times 0.2267 \times 30^{34} \frac{\$}{\text{c.y.}} = \$ 471,800$$

$$\text{Total reduction in conc. cost} = \$ 907,200$$

Earth Work Reduction:

$$\text{Vol. of Earth work} = 17' \text{ width} \times 25' \text{ depth} \times 24000 \text{ L.F.} \times \frac{1}{27} \frac{\text{c.y.}}{\text{c.F.}} = 377,800 \text{ c.y.}$$

$$\therefore \text{Reduction in Earth work cost} = 377,800 \text{ c.y.} \times 1^{80} / \text{c.y.} = \$ 680,040$$

$$\text{Net cost reduction} = \$ 1,587,200$$



# PRC Troups

CONSULTING ENGINEERS AND PLANNERS

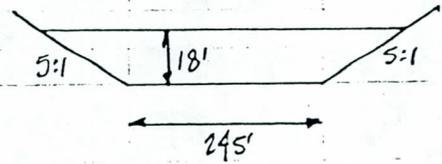
BY \_\_\_\_\_ DATE \_\_\_\_\_ CLIENT \_\_\_\_\_ SHEET NO. 1 OF 7

CHECKED \_\_\_\_\_ DATE \_\_\_\_\_ JOB \_\_\_\_\_ JOB NO. \_\_\_\_\_

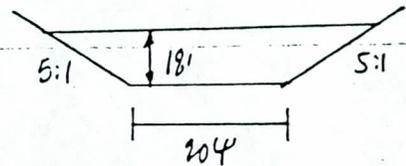
## ArDC Reach

Cactus (Sta. 24000) to Skunk Creek (Sta. 3600)

(i) ArDC arr. design Flow = 34,000 cfs



(ii) ArDC Alt. Flow = 29,000 cfs



Earthwork Reduction:

$$\begin{aligned} \text{Volume of Earthwork} &= (245 - 204) \times 21' \text{ depth} \times 20,400 \text{ L.F.} \times \frac{1 \text{ C.Y.}}{27 \text{ C.F.}} \\ &= 650,530 \text{ C.Y.} \end{aligned}$$

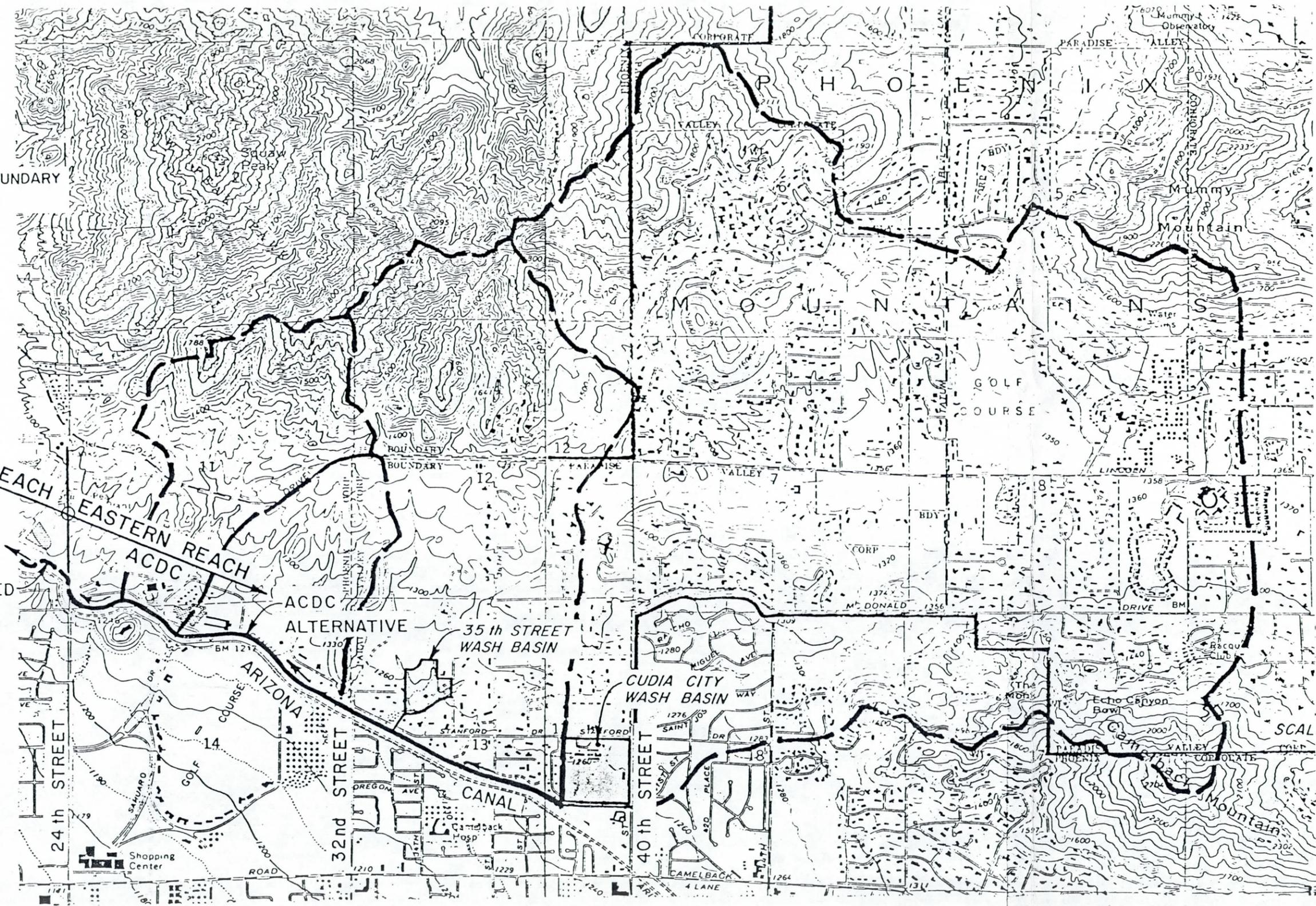
$$\therefore \text{Reduction in Earthwork Cost} = 650,530 \text{ C.Y.} \times 2 \$/\text{C.Y.} = \$1,301,000$$

**LEGEND**

-  DRAINAGE AREA BOUNDARY
-  DIRECTION OF FLOW

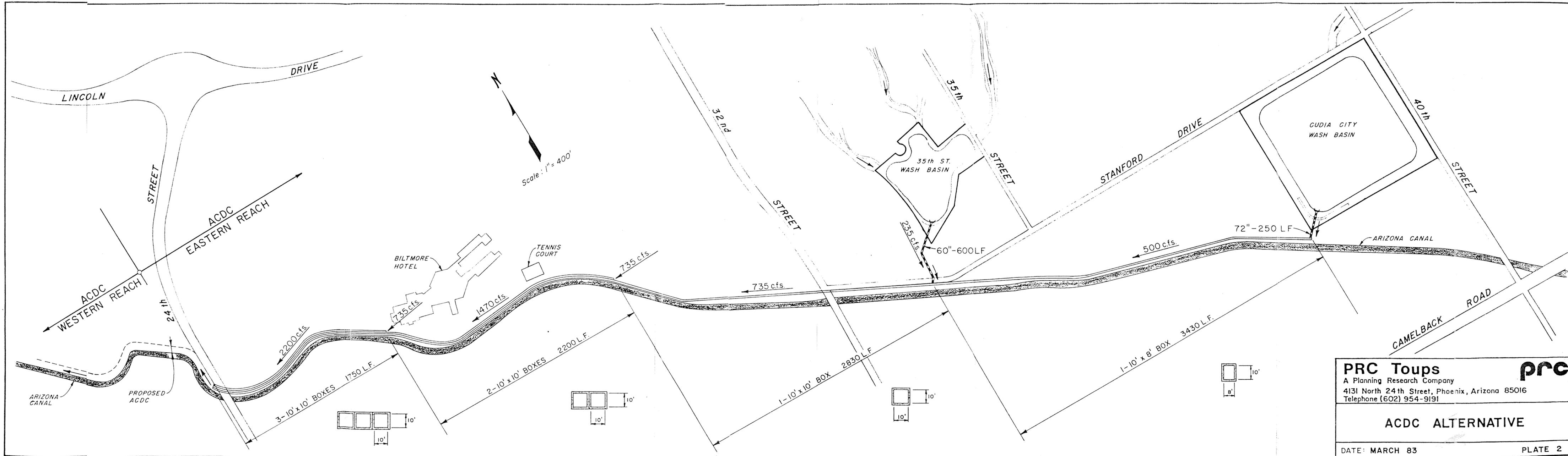
WESTERN REACH  
ACDC

PROPOSED  
ACDC



SCALE: 1" = 2000'

**LOCATION AND DRAINAGE AREA MAP**



**PRC Toups**  
 A Planning Research Company  
 4131 North 24th Street, Phoenix, Arizona 85016  
 Telephone (602) 954-9191



**ACDC ALTERNATIVE**



TOWN OF  
PARADISE VALLEY

OFFICE OF TOWN MANAGER

6401 EAST LINCOLN DRIVE  
TOWN OF PARADISE VALLEY, ARIZONA 85533

PHONE: 948-7412

FLOOD CONTROL DISTRICT  
RECEIVED

DEC 30 '83 December 29, 1983

2	ADAIR	HYDRO
	ASST	LMgt
	ADMIN	SUP
	C & O	FIN
	FINANCE	DESIGN
		JER
		SRLB

Mr. D. E. Sagramoso, P.E.  
Flood Control District of Maricopa County  
3335 West Durango  
Phoenix, Arizona 85009

Dear Dan:

Thank you for sending me a copy of your 15 December 1983 letter to Mr. Adair. The Town is certainly supportive of your position that the alternative proposed by Mr. Adair's group should not be recommended to the Corps of Engineers. As you know, the Town feels very strongly that the alternative approved several years by all municipalities involved, as well as the Corps of Engineers and the Flood Control District, is the plan that should be pursued and constructed. The detention alternative proposed by Mr. Adair is not acceptable to the Town of Paradise Valley and would be fought by the Town should an attempt be made to implement this plan.

I hope that this issue is now finally put to rest and that we will proceed posthaste to contract the diversionary channel which will provide flood relief for all parties concerned.

Again, thanks very much. I wish you a very Happy New Year.

Sincerely,

Oscar A. Butt

OAB/emb

PROJECT ARIZONA CANAL DIVERSION CHANNEL  
 DETAIL Flood Control Alternatives A-4 and T-2  
Summary of Apportioned F.C. Prelim First Costs

(in thousand dollars)

Item	Alt A-4	Alt T-2
	Cave Creek Sed basin below Peoria Ave	Toups plan detention basin Smaller ACDC
<b>FEDERAL</b>		
Constr	134,990	117,570
Cash Contrib	-3,100	-2,700
Total	<u>131,890</u>	<u>114,870</u>
<b>Non-FEDERAL</b>		
Land & damages	116,660	127,780 - 136,730
Bridges	30,150	28,950
Cash Contrib	3,100	2,700
Total	<u>149,910</u>	<u>159,430 - 168,380</u>
<b>Grand Total</b>	<u><u>281,800</u></u>	<u><u>274,300 - 283,250</u></u>

Estimate excludes esthetic treatment and side drain structures, and utility relocations

FLOOD CONTROL DISTRICT OF Maricopa County

PROJECT ARIZONA CANAL DIVERSION CHANNEL  
 DETAIL AIT A-4 Flood Control Prelim First Costs

COMPUTATION  
AND DATA SHEET

FILE No. \_\_\_\_\_

COMPUTED \_\_\_\_\_ DATE \_\_\_\_\_ CHECKED BY \_\_\_\_\_ DATE \_\_\_\_\_ PAGE 2 OF 3

(in thousand dollars)

<u>DESCRIP</u>	<u>Constr</u>	<u>Lands &amp; Damages</u>	<u>Bridges</u>	<u>Total</u>
Cudia City Wash Sed Basin	2,570	1,080		3,650
Dreamy Draw Sed Basin	560	70		630
Little Dreamy D. Sed. Basin	230	180		410
Cave Creek Sed. Basin	7,280	5,500		12,780
Cave Creek Channel	1,600	1,030	1,600	4,230
<u>ACDC Channel</u>				
Cudia City - Dreamy Draw	32,770	24,800	4,330	61,900
Dreamy Draw - Cave Creek	32,880	27,400	4,370	64,650
Cave Creek - Cactus Rd	38,400	43,900	12,100	94,400
Cactus Rd - Skunk Cr	18,700	12,700	7,750	39,150
	<u>134,990</u>	<u>116,660</u>	<u>30,150</u>	<u>281,800</u>

FLOOD CONTROL DISTRICT OF MARICOPA COUNTY

PROJECT

ARIZONA CANAL DIVERSION CHANNEL

COMPUTATION AND DATA SHEET

DETAIL

Alt T-2 Flood Control Prelim First Costs

FILE NO.

COMPUTED

DATE

CHECKED BY

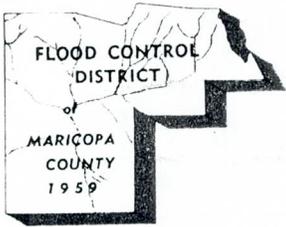
DATE

PAGE

3 OF 3

(in thousand dollars)

Descrip	Constr	Land & Damage	Bridges	Total
Cudia City Wash Det Basin	8,000	16,850 - 25,800		24,850 - 33,800
35 <sup>th</sup> Ave Basin	3,450	2,350		5,800
Dreamy Draw Basin	560	70		630
Little Dreamy Draw Basin	230	180		410
Cave Creek Basin	7,280	5,500		12,780
Cave Creek Channel	1,600	1,030	1,600	4,230
ACDC Channel				
Cudia City - Dreamy D	19,100	17,800	3,800	40,700
Dreamy Dr - Cave Creek	26,450	27,400	4,050	57,900
Cave Creec - Cactus Rd	33,400	43,900	11,500	88,800
Cactus Rd - Skunk Cr.	17,500	12,700	8,000	38,200
Total	117,570	127,780 to 136,730	28,950	274,300 to 283,250



# FLOOD CONTROL DISTRICT

of

Maricopa County

3335 West Durango Street • Phoenix, Arizona 85009  
Telephone (602) 262-1501

BOARD of DIRECTORS

Hawley Atkinson, Chairman  
George L. Campbell  
Tom Freestone  
Fred Koory, Jr.  
Ed Pastor

D. E. Sagramoso, P.E., Chief Engineer and General Manager

DEC 15 1983

Mr. Edward A. Adair, P. E.  
PRC Engineering  
4131 North 24th Street  
Phoenix, Arizona 85016

Dear Mr. Adair:

As you know, the Flood Control District submitted your conceptual study of an alternative to the ACDC to the Corps of Engineers for review of its technical and economic feasibility. We have now received the Corps' conclusions concerning your proposal and other alternatives developed by the Corps.

At the time your study was submitted, the Corps of Engineers was preparing to develop design alternatives to account for the impact of sediment that will be carried into the diversion channel during periods of flooding. Sediment transport had not been considered during the initial plan formulation and is not reflected in the Phase I General Design Memorandum plans or costs.

Because the Corps needed to develop data in more detail than was included in your study, the alternative you proposed was refined in their new analysis. The results of this analysis show that there is no significant difference between the costs of the detention basin alternative and the planned alternative, especially considering the vagaries of determining the costs of relocating the Phoenix Country Day School.

In other words, the estimated cost differences in the two alternatives vary from zero to about 2.7%, depending on the specific site to which the Phoenix Country Day School might be relocated, and preparation of a more detailed estimate of the site development and other relocation costs. Even assuming some overall cost savings in the detention basin alternative, the overall savings would reduce the federal cost and increase the local cost by the saved amount, thus increasing the local tax burden or reducing funds available for other needed flood control projects.

We have reviewed the cost estimates used in the Corps' comparison of the alternatives and find them reasonable. We have also applied the more detailed engineering analysis developed by the Corps to the estimate included in your March 1983 presentation and find that the adjusted cost estimates and the Corps' estimate are within acceptable variances.

Mr. Edward A. Adair  
Page 2

Aside from cost there are a number of factors to consider:

1. Since Salt River Project's long standing policy will not permit construction of the underground conduits within the Arizona Canal right-of-way, the detention basin alternative offers no less inconvenience to your client during the construction period than does the planned alternative. The width of the excavation would be about the same in either case, e.g., a 36 foot wide covered channel versus three 10 foot wide box culverts.
2. There is more positive control of side drainage under the planned alternative.
3. The detention basin alternative is more disruptive in that not only must the school be relocated, but homes or other facilities may well have to be relocated to make room for the school at a new site.
4. The detention basin alternative has been and is now vigorously opposed by the Town of Paradise Valley because the basins are located within the Town limits although the Town is not benefited by the project.
5. The Phoenix Country Day School opposes relocation.

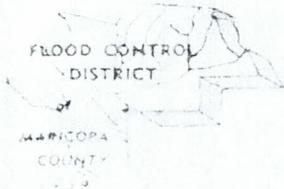
In consideration of the above, I am prepared to recommend that the Corps of Engineers continue to pursue the project as described in the Phase I GDM, with inclusion of appropriate sediment control facilities. It has been a pleasure working with you and we greatly appreciate your demonstrated professionalism in developing the alternative and interacting with us to further explore the matter.

Sincerely,



D. E. Sagramoso, P. E.

Copies to: Mr. Oscar Butt, Paradise Valley Town Manager  
Mr. James E. Attebery, Phoenix City Engineer  
Mr. W. D. Mathews, Dooley-Jones & Associates  
Mr. Norman Arno, Los Angeles District, Corps of Engineers



# FLOOD CONTROL DISTRICT

of

Maricopa County

SEP 28 1982

Mr. Vernon S. Schweigert  
Executive Vice-President  
Rostland Arizona, Inc.  
2701 East Arizona Biltmore Circle  
Phoenix, Arizona 85016

Re: Arizona Canal Diversion Channel

Dear Mr. Schweigert:

As a result of our discussions this past spring with you and other interested property owners at the Biltmore Estates concerning the design concept for the Diversion Channel through the Biltmore area, I asked the Corps of Engineers to study the economics of a covered versus an open channel.

The Corps has now informed us that the study has been completed with the conclusion that the covered channel alternative is more advantageous and will be incorporated into the final design for the reach extending from the east boundary of Arizona Biltmore Estates to 24th Street.

We will continue to keep you informed as the project develops.

Sincerely,

D. E. Sagramoso, P. E.

Copies to: Mr. Gary Driggs, Western Savings and Loan Association  
Colonel Paul W. Taylor, District Engineer, Corps of Engineers  
LTC. William Green, Deputy District Engineer, Corps of Engineers  
Mr. James E. Attebery, City Engineer, City of Phoenix

Mrs. Karl William Almquist  
2423 East Marshall Avenue  
Phoenix, Arizona 85016

January 11, 1984

Mr. D. E. Sagramoso, Chief Engineer and General Manager  
Maricopa County Flood Control District  
3335 West Durango Street  
Phoenix, Arizona 85009

Dear Mr. Sagramosa:

Thank you for your prompt reply of December 28 to our ACDC committee's request of written confirmation that the ARIZONA CANAL DIVERSION CHANNEL Reach 4 between 24th street and the eastern boundary of the Arizona Biltmore Estates (the eastern edge of the Biltmore Hotel tennis court area) will be covered.

The purpose of this letter is to reply to your communication of December 15, 1983 to Ed Adair, PRC Engineering, Inc., in which you gave your assessment of the Corps of Engineers analysis of our alternate retention basin plan, designated Alt. T-2 in the Corps report. The Corps of Engineers report indicates a possible savings of 7.5 million over their current plan. Our committee feels this justifies further pursuance of a second alternate proposal to be prepared by PRC Engineering, Inc. We are therefore requesting you to allow four to six weeks for preparation of a plan that encompasses an altered retention basin configuration that we feel would be acceptable to all parties concerned.

We appreciate your courtesy in extending this time to us and also your efforts to stay in touch with our Board on matters pertaining to Reach 4.

Sincerely,

*Marianne Almquist*

Marianne Almquist  
Chairman, ACDC Committee

**FLOOD CONTROL DISTRICT  
RECEIVED**

JAN 12 '84

2	<del>CHIEF</del>		HYDRO
7	ASST	3	LMgt
	ADMIN		SU:SP
	C & O	7	FILE
4	<del>FINANCE</del>		DESTROY
	FINANCE	5	RLB
REMARKS	G JER		

FILE C.I. 1.1



PHOENIX, ARIZONA AND VICINITY (INCLUDING NEW RIVER)

SUMMARY OF ALTERNATIVE PLANS

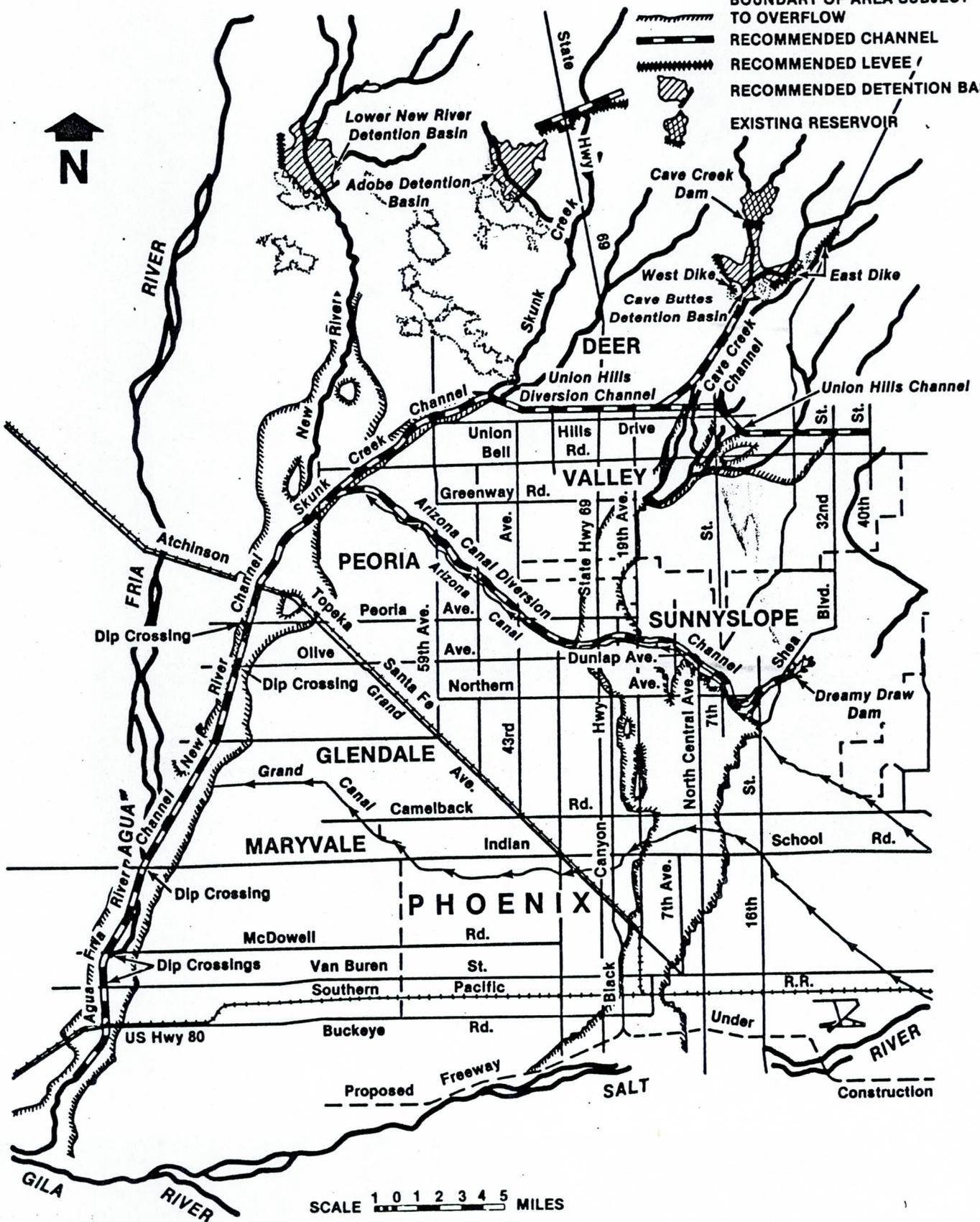
ALTERNATIVE	COST (FLOOD CONTROL) (RECREATION)	PRICE LEVEL	B/C RATIO (FLOOD CONTROL) (RECREATION)	REASON FOR REJECTION	REFERENCE	REMARKS
<u>COMPREHENSIVE PLANS</u>						
1 AUTHORIZED PLAN (1964 REVIEW REPORT)	70,800,000	1963	3.0	AUTHORIZED BY CONGRESS-MODIFIED IN LATER PLANNING STAGES	1964 REVIEW REPORT	MODIFIED BECAUSE OF CHANGED PHYSICAL CONDITIONS
2 COMBINED CENTRAL ARIZONA PROJECT AND FLOOD CONTROL PROJECT	260,000,000	1972		HIGH COST WITHOUT COMPENSATING BENEFITS	1976 GENERAL DESIGN MEMORANDUM - PHASE I	PLAN STUDIED AS PROPOSED BY ARIZONA WATER COMMISSION
3 NO FURTHER ACTION	NO NEW INVESTMENT	-	APPROX 1	DOES NOT RESOLVE FLOOD PROBLEM	1976 GENERAL DESIGN MEMORANDUM - PHASE I	DREAMY DRAW DAM CONSTRUCTED PREVIOUSLY AT COST OF \$671,000
4 DAMS AND CHANNELS	257,000,000 10,030,000	1975	1.8 2.5	HIGHER COST THAN SELECTED PLAN WITHOUT COMPENSATING BENEFITS	1976 GENERAL DESIGN MEMORANDUM - PHASE I	CLOSEST OF PHASE I GDM ALTERNATIVES TO AUTHORIZED PLAN
5 DAMS ONLY	52,700,000 16,000,000	1975	2.6 1.6	WOULD PREVENT ONLY 27 PERCENT OF FLOOD DAMAGES-NOT SUFFICIENT PROTECTION.	1976 GENERAL DESIGN MEMORANDUM-PHASE I	INCLUDES ONLY DREAMY DRAW AND CAVE BUTTES DAMS
6 CHANNELS ONLY	289,000,000 5,900,000	1975	1.5 2.6	HIGHER COST THAN SELECTED PLAN WITHOUT COMPENSATING BENEFITS	1976 GENERAL DESIGN MEMORANDUM-PHASE I	DREAMY DRAW DAM INCLUDED- PREVIOUSLY CONSTRUCTED
7 STRUCTURAL AND NON- STRUCTURAL MEASURES (WITH CAVE CREEK DIVERSION CHANNEL)	218,000,000 10,300,000	1975	2.2 1.6	SLIGHTLY HIGHER COST FOR SAME BENEFITS AS SELECTED	1976 GENERAL DESIGN MEMORANDUM-PHASE I	SAME AS SELECTED PLAN EXCEPT CAVE CREEK DIVERSION CHANNEL ADDED
8 STRUCTURAL AND NON- STRUCTURAL (WITHOUT CAVE CREEK DIVERSION CHANNEL)	210,000,000 23,400,000	1975	2.2 1.6	SELECTED PLAN	1976 GENERAL DESIGN MEMORANDUM-PHASE I	SELECTED PLAN
<u>ALTERNATIVES TO ACDC</u>						
9 REPLACE ACDC WITH CULVERTS AT 7TH AVE, 16TH ST AND 40TH ST	EXCESS OF \$650 MILLION	1975	N/A	HIGH COST WITHOUT COMPENSATING BENEFITS	1976 GENERAL DESIGN MEMORANDUM-PHASE I	SOME CHANNELIZATION REQUIRED NORTH OF ACDC. EIGHT SIPHONS REQUIRED
10 CAVE CREEK CHANNEL-OPEN CHANNEL ALONG 19TH AVE	EXCESS OF \$210 MILLION	1975	N/A	HIGHER COST THAN SELECTED PLAN WITH LOWER BENEFITS	1976 GENERAL DESIGN MEMORANDUM-PHASE I	ELIMINATES ACDC FROM CAVE CREEK TO SKUNK CREEK
11 CAVE CREEK CHANNEL COVERED CONDUITS ALONG THE 7TH AVE AND 19TH AVE	EXCESS OF \$330 MILLION	1975	N/A	HIGHER COST THAN SELECTED PLAN WITH LOWER BENEFITS	1976 GENERAL DESIGN MEMORANDUM-PHASE I	ELIMINATES ACDC FROM 19TH AVE TO SKUNK CREEK
12 COMBINE ACDC AND ARIZONA CANAL	N/A	-	N/A	NO PLAN COULD BE FORMULATED THAT SATISFIED SRP NEEDS	1976 GENERAL DESIGN MEMORANDUM-PHASE I	FOUR VARIATIONS CONSIDERED: (1) COMBINED CHANNEL WITH COLLAPSIBLE DAMS (2) PIPE CONDUIT FOR SRP UNDER ACDC BERM (3) PRESSURE PIPE FOR SRP (4) COMBINED CHANNEL WITH PUMPED WATER DELIVERY FOR SRP
13 PARADISE VALLEY DETENTION BASINS	NA	-	N/A	STRENUOUS OBJECTION BY CITY COUNCIL OF PARADISE VALLEY	1976 GENERAL DESIGN MEMORANDUM-PHASE I	PLAN NOT STUDIED BEYOND CONCEPTUAL STAGE BECAUSE OF LOCAL OBJECTIONS
<u>ALTERNATIVES TO 40TH STREET TO DREAMY DRAW REACH OF ACDC</u>						
14 48TH ST DRAIN	N/A	-	N/A	NOT ECONOMICALLY JUSTIFIED	1964 REVEIW REPORT	INCLUDES COLLECTOR CHANNEL FROM 56TH ST TO 36TH STREET
15 40TH STREET DRAIN	\$45,000,000	1975	ABOUT 1.1	HIGHER COST THAN SELECTED PLAN WITHOUT COMPENSATING BENEFITS	1976 GENERAL DESIGN MEMORANDUM-PHASE I	INCLUDES SHORT COLLECTOR CHANNEL NORTH OF ACDC AND OUTLET CHANNEL AT SALT RIVER. NEW COST ESTIMATE OCT 1982 SHOWED COST \$69 MILLION

N/A - NOT AVAILABLE

# AUTHORIZED PLAN (1964 REVIEW REPORT)

**LEGEND**

- BOUNDARY OF AREA SUBJECT TO OVERFLOW
- RECOMMENDED CHANNEL
- RECOMMENDED LEVEL
- RECOMMENDED DETENTION BASIN
- EXISTING RESERVOIR



SCALE 1 0 1 2 3 4 5 MILES

**PHOENIX, ARIZONA AND VICINITY  
ALTERNATIVE—AUTHORIZED PLAN  
(1964 REVIEW REPORT)**

**COST:**

Flood control	\$70,800,000 (1963 Prices)
Recreation	Not Included

**BENEFIT TO COST RATIO:** (3 Percent, 100 Year Life)  
Flood control 3.0

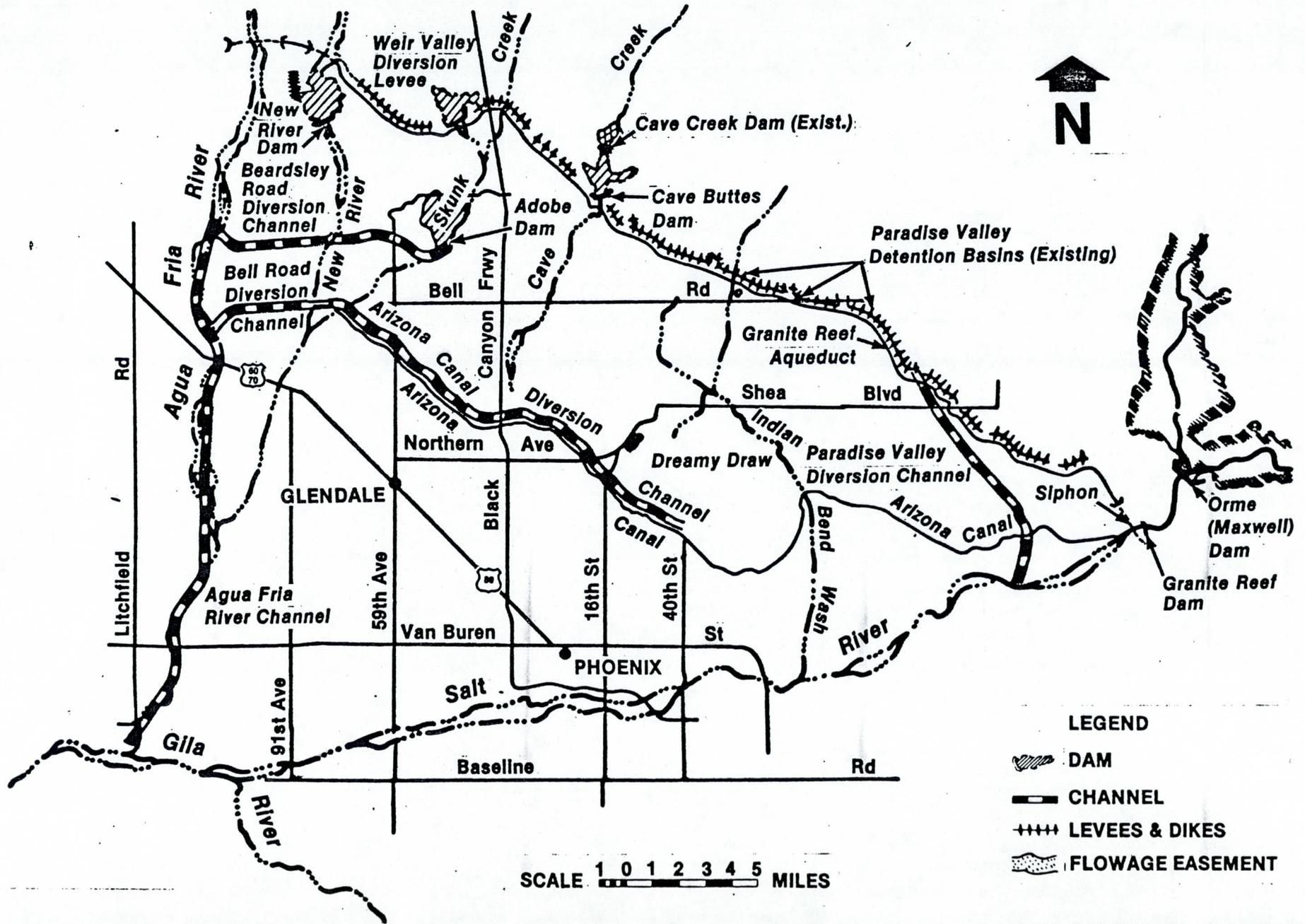
**REASON FOR REJECTION:**

Plan recommended to and authorized by Congress but modified in later planning stages because of changed physical and economic conditions.

**REFERENCE SOURCE:**

1964 Review Report and 1976 General Design Memorandum—  
Phase I.

# COMBINED CENTRAL ARIZONA PROJECT/ FLOOD CONTROL PROJECT



**PHOENIX AND VICINITY  
ALTERNATIVE—COMBINED CENTRAL ARIZONA  
PROJECT AND FLOOD CONTROL PROJECT**

**COST:**

**Approximately \$260,000,000 (1972 prices)  
260,000,000 (1975 price level by index)**

**BENEFIT TO COST RATIO:**

**Not determined. Analysis showed no significant increase in flood control or water conservation benefits over selected plan.**

**REASON FOR REJECTION:**

**Higher cost than selected plan without compensating benefits.  
Much of higher cost would have to be borne by local interests.  
Would require difficult gated operation of Paradise Valley  
Detention Basins.**

# **PHOENIX AND VICINITY ALTERNATIVE—COMBINED CENTRAL ARIZONA PROJECT AND FLOOD CONTROL PROJECT (CONT)**

## **REMARKS:**

**Plan was analyzed as proposed by Arizona Water Commission. Provides water conservation outlets from Adobe and Cave Buttes Dams into Granite Reef Aqueduct. Excess flood waters from Cave Buttes Dam would be diverted into the Paradise Valley Detention Dike System to a 10 mile diversion channel to the Salt River. Excess flood waters from Adobe Dam would be diverted through a wasteway to New River Dam. The plan adds a diversion channel north of Union Hills Drive from Skunk Creek and New River to Agua Fria River and extends the Arizona Canal Diversion Channel from Skunk Creek to New River and Agua Fria River.**

## **REFERENCE SOURCE:**

**1976 General Design Memorandum— Phase I.**

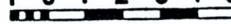
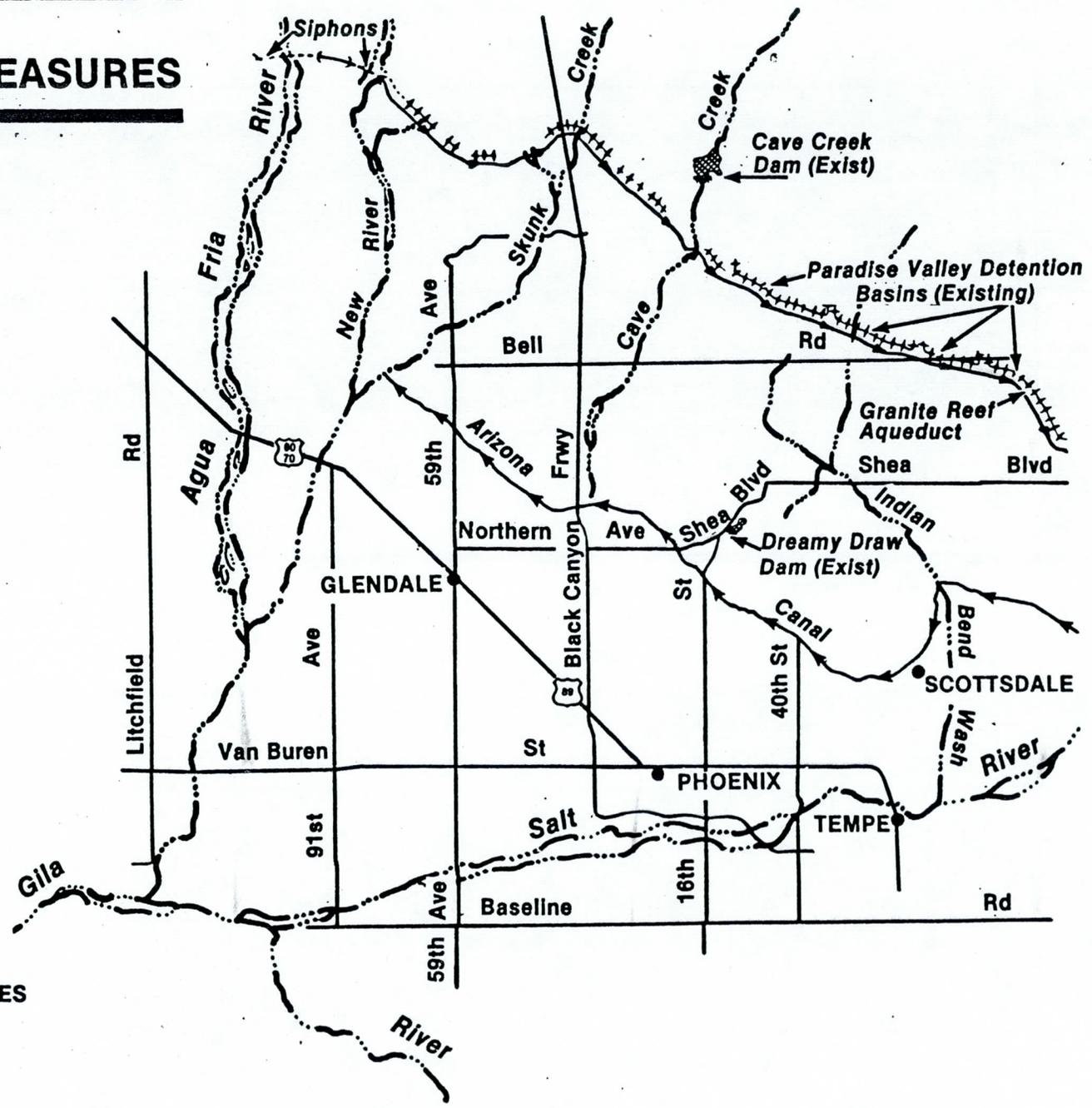
# NO FURTHER STRUCTURAL MEASURES



## LEGEND

-  DAM
-  CHANNEL
-  LEVEES & DIKES
-  FLOWAGE EASEMENT

SCALE 1 0 1 2 3 4 5 MILES

# **PHOENIX, ARIZONA AND VICINITY ALTERNATIVE—NO FURTHER STRUCTURAL MEASURES**

## **COST:**

**No additional costs for structural measures after construction of Dreamy Draw Dam. Costs would be incurred by the acceptance of flood damages and administrative costs of local and federal assistance for flood fighting and flood damage recovery.**

## **BENEFIT TO COST RATIO:**

**Over long period of time B/C ratio would approach unity (1:1) because costs would be limited to flood damage repair and replacement costs except for administrative costs for flood fighting and flood damage recovery. Intangible costs for flood caused deaths, injury and disruption of normal activities would remain unabated.**

## **REASON FOR REJECTION:**

**Does not provide acceptable degree of flood protection.**

## **REFERENCE SOURCE:**

**1976 General Design Memorandum—Phase I.**

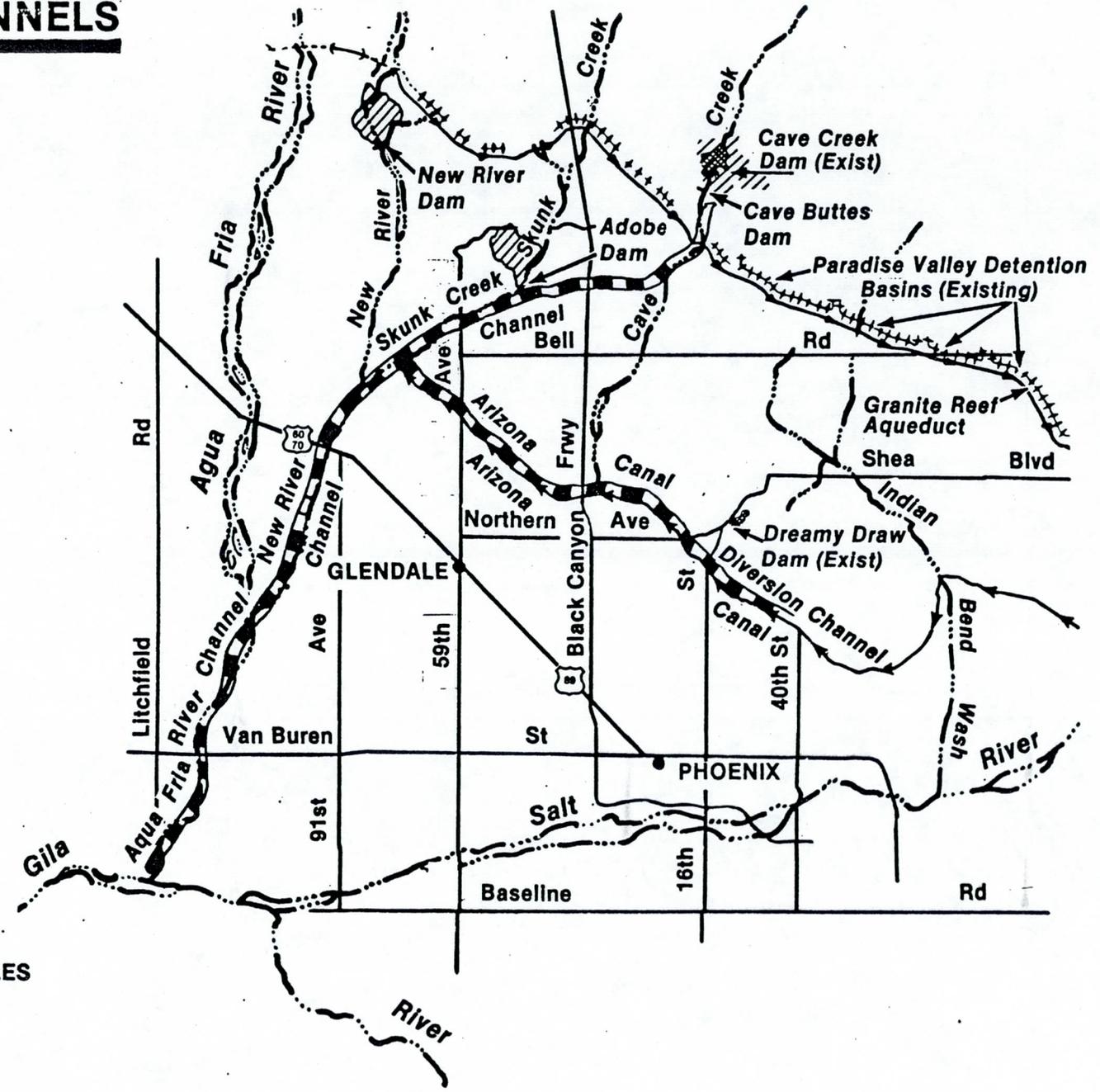
# DAMS AND CHANNELS



## LEGEND

-  DAM
-  CHANNEL
-  LEVEES & DIKES
-  FLOWAGE EASEMENT

SCALE  0 1 2 3 4 5 MILES



# PHOENIX AND VICINITY ALTERNATIVE—DAMS AND CHANNELS

## **COST:**

Flood Control	\$257,000,000 (1975 prices)
Recreation	10,030,000 (1975 prices)

**BENEFIT TO COST RATIO:** (3¼ percent, 100 year life)

Flood Control	1.8
Recreation	2.5

## **REASON FOR REJECTION:**

Higher cost and lower benefits than selected plan.

## **REMARKS:**

Differs from selected plan by—selected plan eliminated Cave Creek Diversion Channel, Skunk Creek Channel, New River Channel, and Agua Fria River Channel and added flowage easements and flood plain management on these streams along with some local protection works on the Agua Fria River.

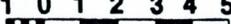
## **REFERENCE SOURCE:**

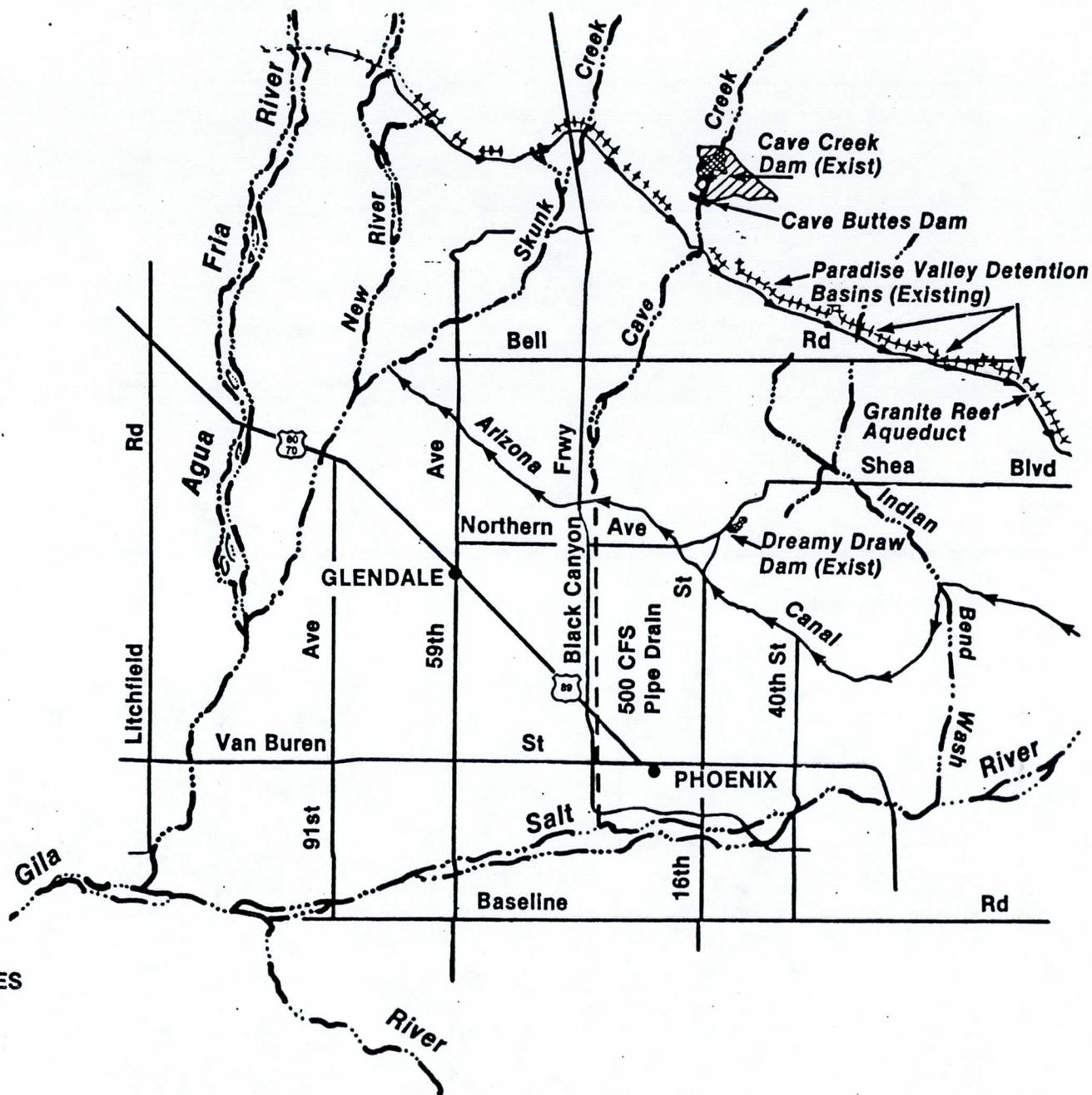
1976 General Design Memorandum—Phase I.

# DAMS ONLY



- LEGEND**
-  DAM
  -  CHANNEL
  -  LEVEES & DIKES
  -  FLOWAGE EASEMENT
  -  PIPE DRAIN

SCALE  MILES



**PHOENIX AND VICINITY  
ALTERNATIVE—DAMS ONLY  
(DREAMY DRAW AND CAVE BUTTES)**

**COST:**

Flood control	\$52,700,000 (1975 prices)
Recreation	16,000,000 (1975 prices)

**BENEFIT TO COST RATIO:** (3¼ percent, 100 year life)

Flood control	2.6
Recreation	1.6

**REASON FOR REJECTION:**

Reduces pre-project flood damages by only 27 percent. Additional investments could be made that would provide flood protection benefits greater than their costs.

**REMARKS:**

Differs from selected plan by—does not include Adobe Dam; New River Dam; the Arizona Canal Diversion Channel; flowage easements on Skunk Creek, New River and Agua Fria River; or local protection structures on Agua Fria River.

**REFERENCE SOURCE:**

1976 General Design Memorandum— Phase I.

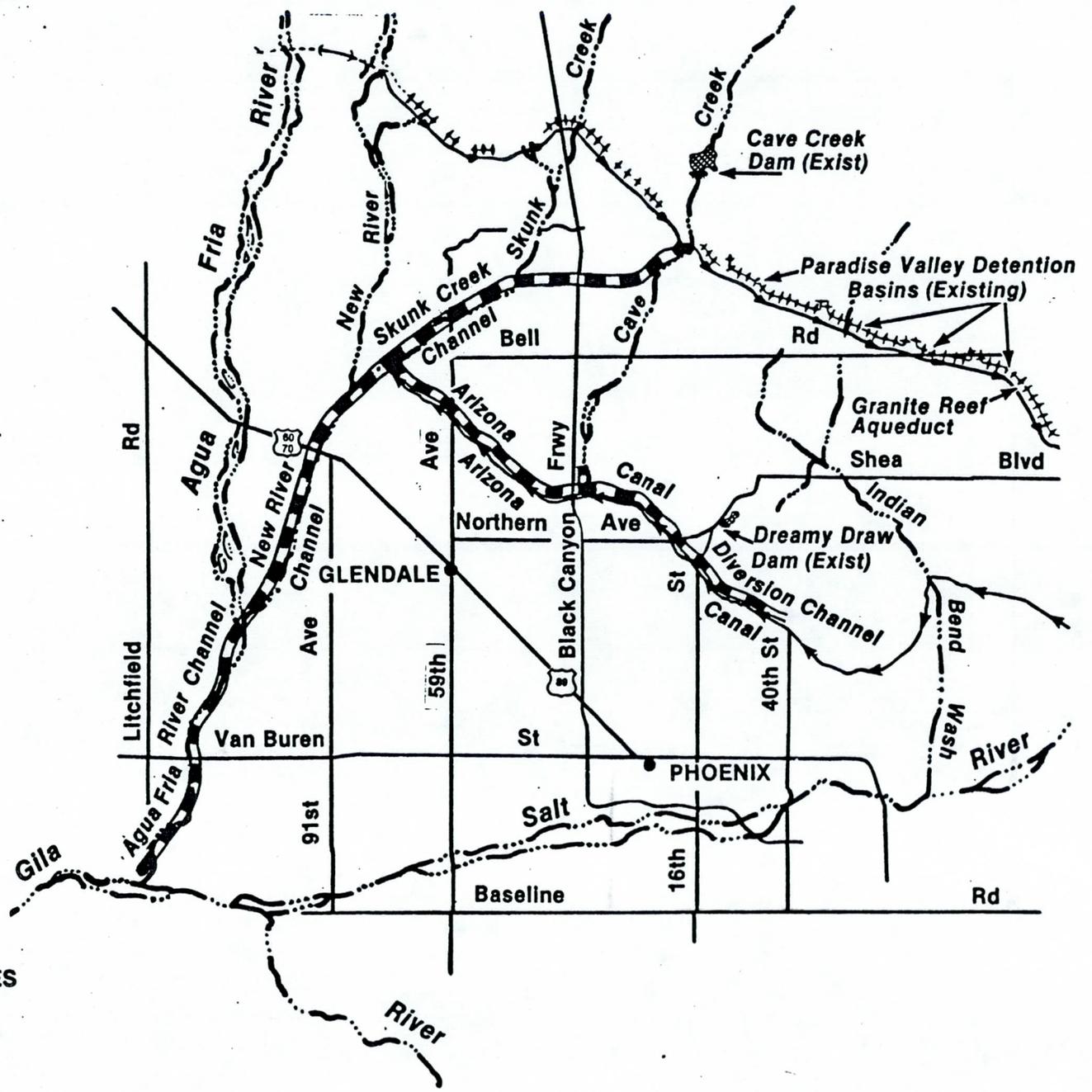
# CHANNELS ONLY



## LEGEND

-  DAM
-  CHANNEL
-  LEVEES & DIKES
-  FLOWAGE EASEMENT

SCALE 1 0 1 2 3 4 5 MILES



# PHOENIX AND VICINITY ALTERNATIVE—CHANNELS ONLY

## **COST:**

Flood control	\$289,000,000 (1975 prices)
Recreation	5,900,000 (1975 prices)

## **BENEFIT TO COST RATIO: (3¼ percent, 100 year life)**

Flood control	1.5
Recreation	2.6

## **REASON FOR REJECTION:**

Higher cost and lower benefits than selected plan.

## **REMARKS:**

Differs from selected plan by—eliminates Cave Buttes, Adobe and New River Dams; includes channelization on Skunk Creek, New River and Agua Fria River.

## **REFERENCE SOURCE:**

1976 General Design Memorandum—Phase I.

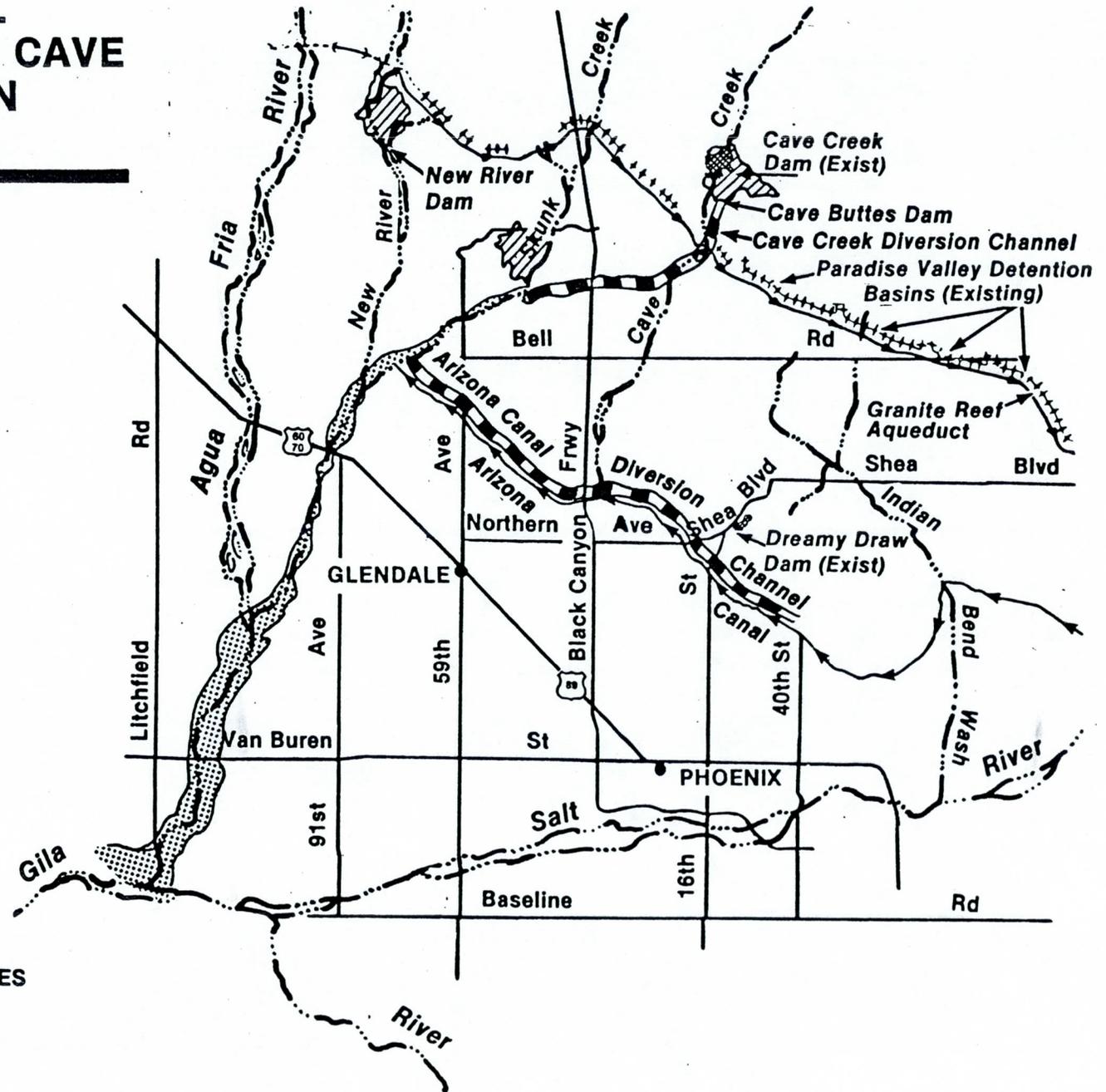
5

# STRUCTURAL & NONSTRUCTURAL MEASURES (WITH CAVE CREEK DIVERSION CHANNEL)



- LEGEND**
-  DAM
  -  CHANNEL
  -  LEVEES & DIKES
  -  FLOWAGE EASEMENT

SCALE 1 0 1 2 3 4 5 MILES



**PHOENIX AND VICINITY  
ALTERNATIVE—STRUCTURAL AND  
NONSTRUCTURAL MEASURES (WITH CAVE CREEK  
DIVERSION CHANNEL)**

**COST:**

Flood Control	\$218,000,000 (1975 prices)
Recreation	10,300,000 (1975 prices)

**BENEFIT TO COST RATIO:** (3¼ percent, 100 year life)

Flood Control	2.1
Recreation	2.8

**REASON FOR REJECTION:**

Higher cost than selected plan, benefits the same.

**REMARKS:**

Differs from selected plan by—adds Cave Creek Diversion Channel.

**REFERENCE SOURCE:**

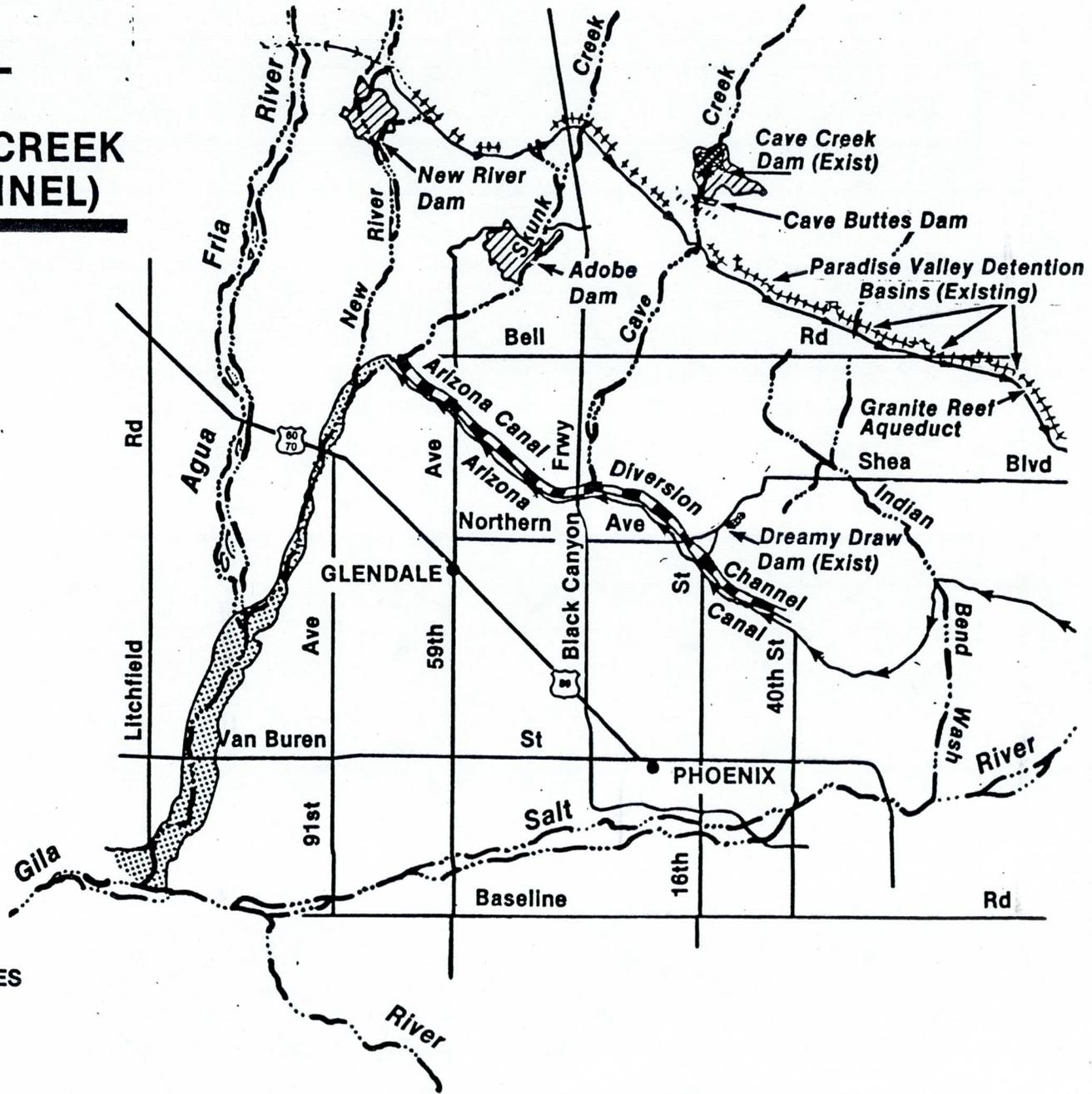
1976 General Design Memorandum—Phase I.

# STRUCTURAL & NONSTRUCTURAL MEASURES (WITHOUT CAVE CREEK DIVERSION CHANNEL)



- LEGEND**
-  DAM
  -  CHANNEL
  -  LEVEES & DIKES
  -  FLOWAGE EASEMENT

SCALE 1 0 1 2 3 4 5 MILES



# PHOENIX AND VICINITY ALTERNATIVE—STRUCTURAL AND NONSTRUCTURAL MEASURES (WITHOUT CAVE CREEK DIVERSION CHANNEL)

## COST:

Flood control	\$210,000,000 (1975 prices)
Recreation	23,400,000 (1975 prices)

**BENEFIT TO COST RATIO:** (3¼ percent, 100 year life)

Flood control	2.2
Recreation	1.6

## REASON FOR REJECTION:

Selected plan—not rejected.

## REMARKS:

This plan selected for implementation in 1976 General Design Memorandum—Phase I.

## REFERENCE SOURCE:

1976 General Design Memorandum—Phase I.

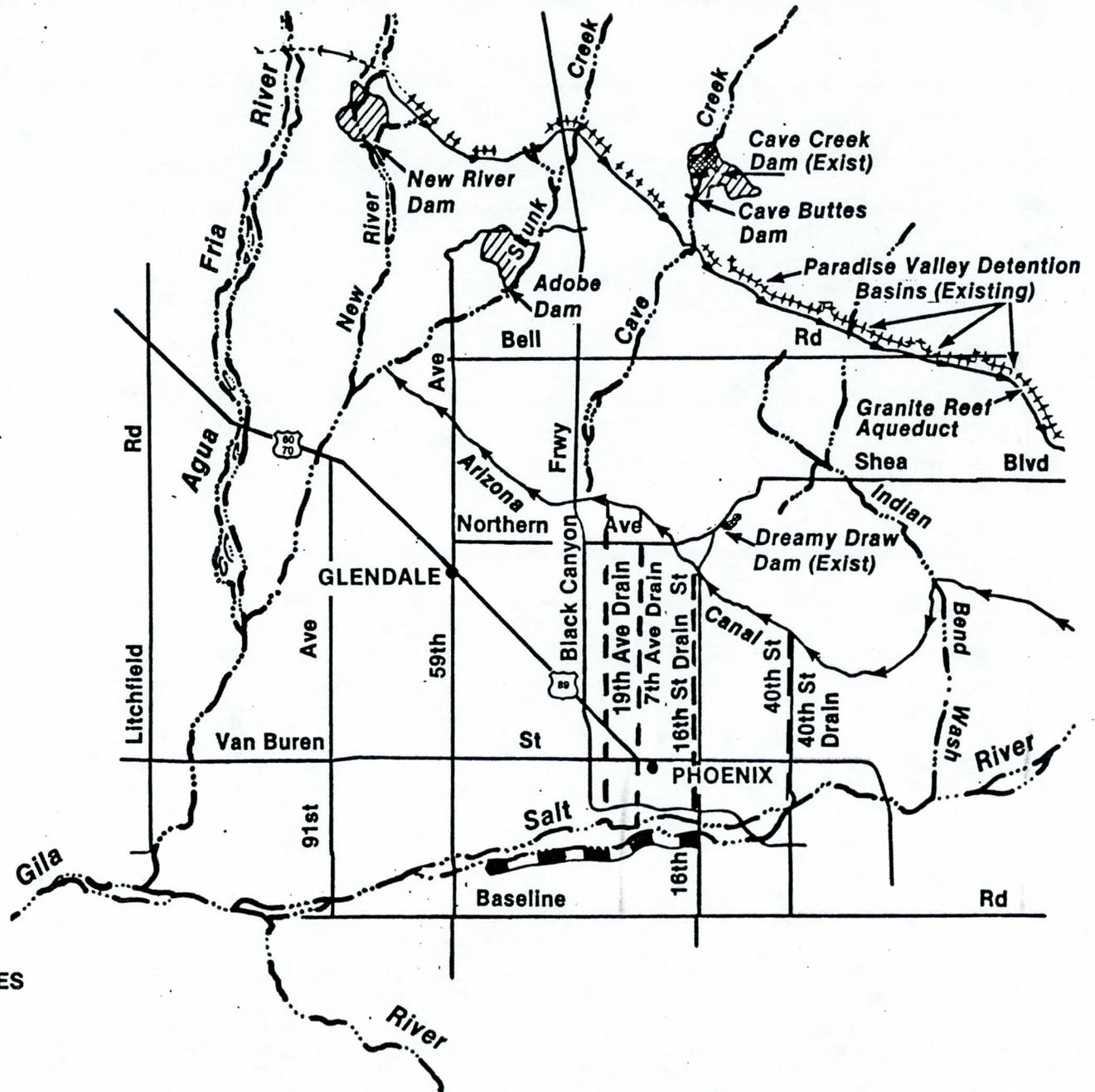
# REPLACE ACDC WITH CULVERTS



## LEGEND

-  DAM
-  CHANNEL
-  LEVEES & DIKES
-  FLOWAGE EASEMENT
-  COVERED CHANNEL

SCALE  5 MILES



**PHOENIX, ARIZONA AND VICINITY  
ALTERNATIVE—REPLACE ACDC WITH CULVERTS  
ALONG 19TH AVE, 7TH AVE, 16TH ST AND 40TH ST**

**COST:**

Flood control \$650,000,000 (1975 prices).

**BENEFIT TO COST:**

Not determined.

**REASON FOR REJECTION**

High cost without compensating benefits.

**REMARKS:**

Differs from selected plan by—eliminates ACDC, adds four covered channels from ACDC to Salt River. Eight siphons would be required—four at the Arizona Canal and four at the Grand Canal. Ten miles of channelization along the Salt River would be required to drain the culverts because of invert depths of culverts.

**REFERENCE SOURCE:**

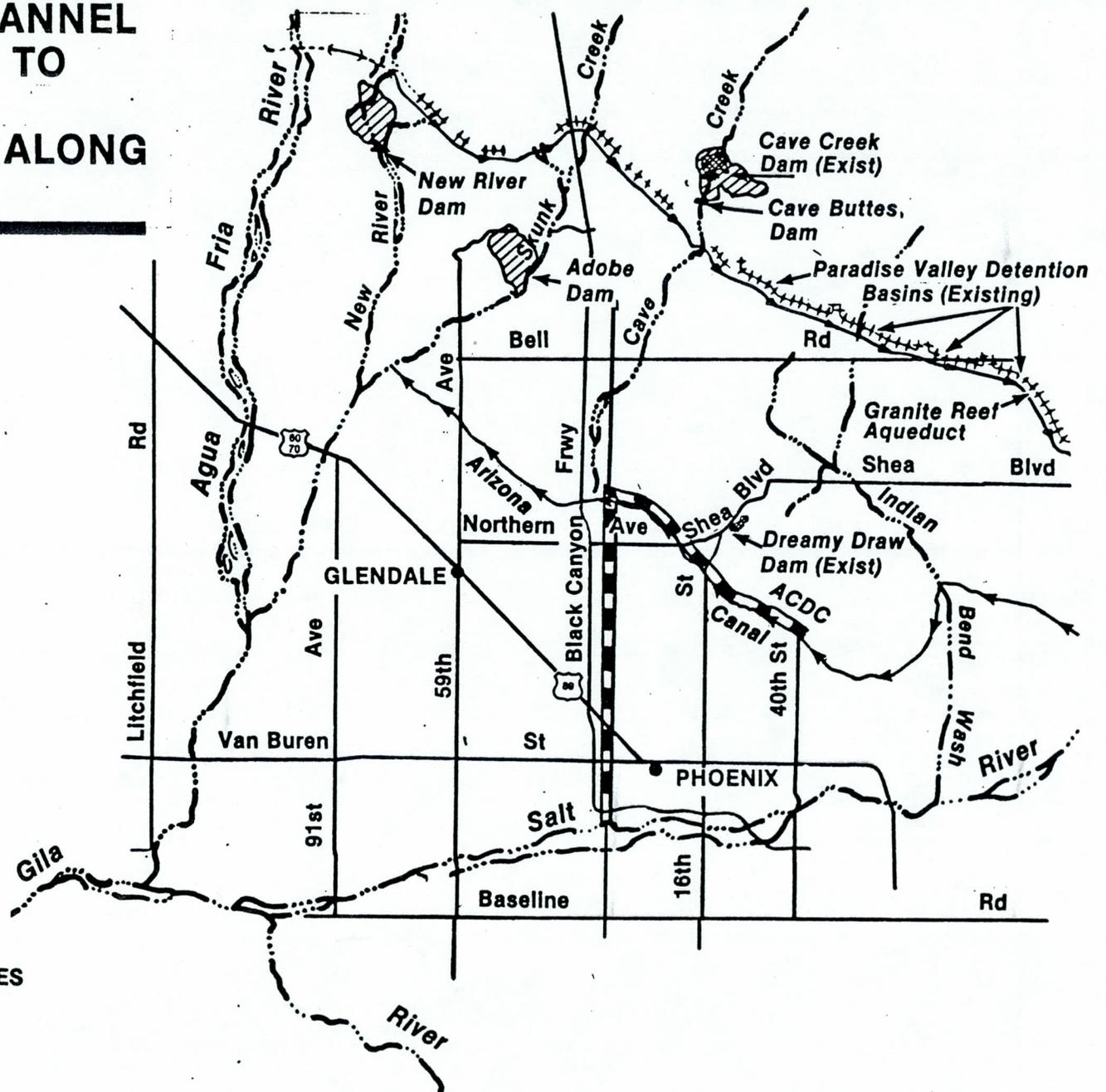
1976 General Design Memorandum—Phase I.

# CAVE CREEK CHANNEL ARIZONA CANAL TO SALT RIVER OPEN CHANNEL ALONG 19TH AVENUE



- LEGEND**
-  DAM
  -  CHANNEL
  -  LEVEES & DIKES
  -  FLOWAGE EASEMENT

SCALE 1 0 1 2 3 4 5 MILES



**PHOENIX, ARIZONA AND VICINITY  
ALTERNATIVE—REPLACE CAVE CREEK TO SKUNK  
CREEK REACH OF ACDC WITH OPEN CHANNEL  
ALONG 19TH AVE**

**COST:**

Flood control—excess of \$210,000,000 (1975 prices).

**BENEFIT TO COST RATIO:**

Not determined, less than selected plan.

**REASONS FOR REJECTION:**

Cost higher than selected plan without compensating additional benefits.

**REMARKS:**

Differs from selected plan by —western reach of ACDC from Cave Creek to Skunk Creek replaced by open channel down 19th Ave. from ACDC to Salt River.

**REFERENCE SOURCE:**

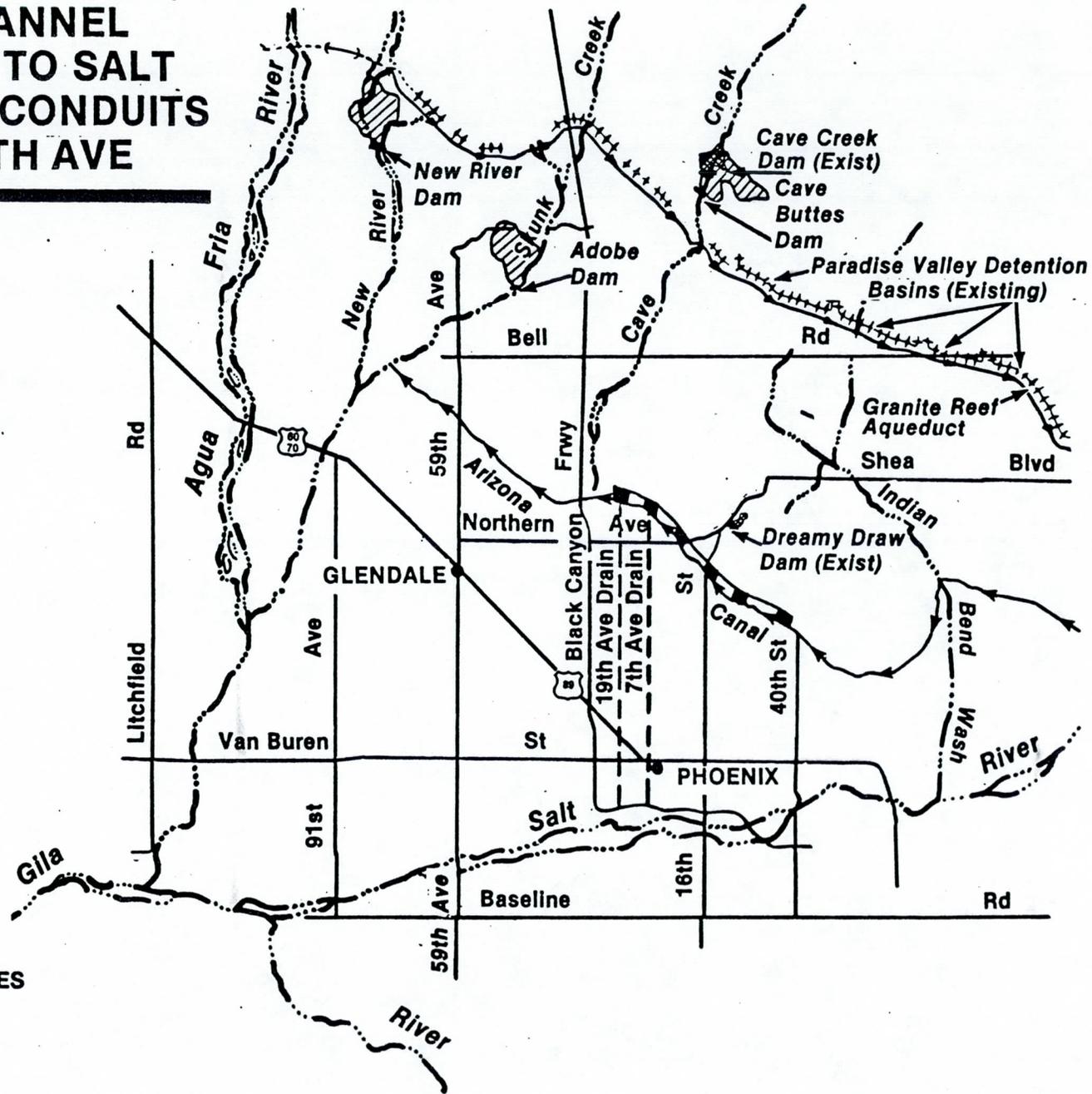
1976 General Design Memorandum—Phase I.

# CAVE CREEK CHANNEL ARIZONA CANAL TO SALT RIVER COVERED CONDUITS 7TH AVE AND 19TH AVE



- LEGEND**
-  DAM
  -  CHANNEL
  -  LEVEES & DIKES
  -  FLOWAGE EASEMENT
  -  COVERED CHANNEL

SCALE 1 0 1 2 3 4 5 MILES



**PHOENIX, ARIZONA AND VICINITY  
ALTERNATIVE—REPLACE REACH OF ACDC FROM  
CAVE CREEK TO SKUNK CREEK WITH COVERED  
CHANNELS DOWN 19TH AVE AND 7TH AVE**

**COST:**

Flood control—excess of \$330,000,000 (1975 prices).

**BENEFIT TO COST RATIO:**

Not determined.

**REASON FOR REJECTION:**

Higher cost than selected plan without compensating additional benefits.

**REMARKS:**

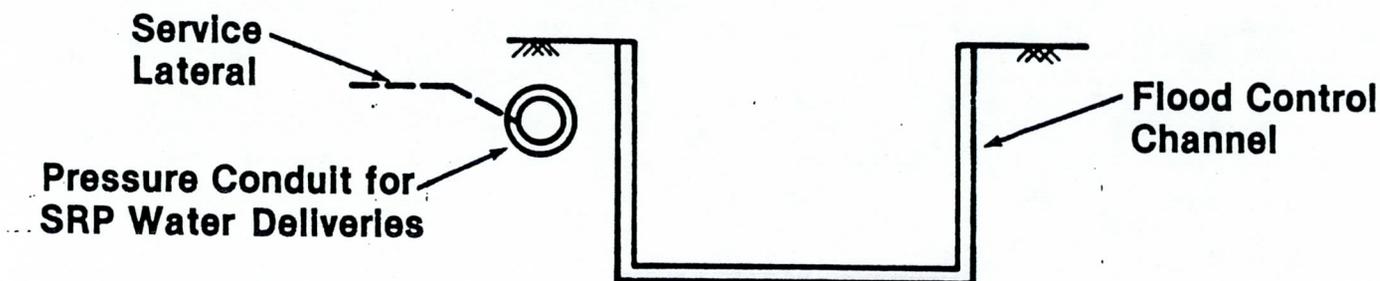
Differs from selected plan by—western reach of ACDC from Cave Creek Skunk replaced by covered drains down 19th Ave. and 7th Ave. from ACDC to Salt River.

**REFERENCE SOURCE:**

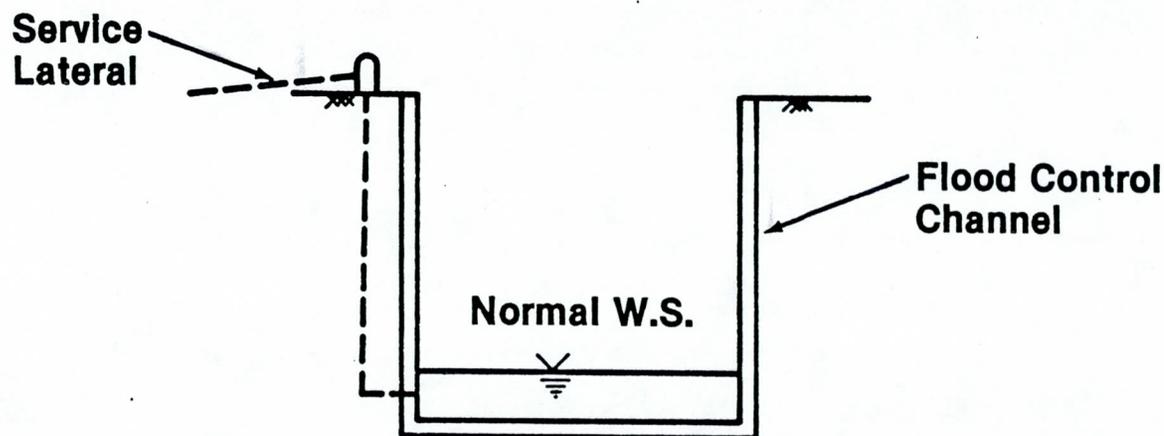
1976 General Design Memorandum—Phase I.

# PHOENIX, ARIZONA AND VICINITY ALTERNATIVE—COMBINE ACDC AND ARIZONA CANAL (CONT)

## C. Pressure pipe system



## D. Open and combined channel and canal using pumps for delivery to laterals



**PHOENIX, ARIZONA AND VICINITY  
ALTERNATIVE—COMBINE ACDC AND  
ARIZONA CANAL**

**COST:**

Not determined.

**BENEFIT TO COST RATIO:**

Not determined.

**REMARKS:**

Four schemes for combining the Arizona Canal and the ACDC were considered. None were acceptable to the Salt River Valley Water Users Association (SRVWUA).

**PHOENIX, ARIZONA AND VICINITY  
ALTERNATIVE—COMBINE ACDC AND  
ARIZONA CANAL (CONT)**

- A. Dual purpose concrete-lined channel with collapsible check dams.**  
Purpose of dams would be to raise water surface for delivery to laterals. Unacceptable to SRVWUA because operation of the canal for water supply and maintaining flood control capability at the same time would be impractical. Even with the existing extensive warning system, flood warnings are not accurate enough to prevent substantial losses of water from “dumping” of the channel in response to a storm warning followed by insufficient runoff to refill the channel.

**PHOENIX, ARIZONA AND VICINITY  
ALTERNATIVE—COMBINE ACDC AND  
ARIZONA CANAL (CONT)**

- B. A pipe conduit under the flood control channel berm. Unacceptable to SRVWUA because insufficient storage capacity would be provided for proper operation of the water distribution system. Also, a pipe system would cause serious maintenance problems in removing sediment deposits.**
- C. A pressure pipe system. Unacceptable to SRVWUA because insufficient storage capacity would be provided for proper operation of the water distribution system. Also, a pipe system would cause serious maintenance problems in removing sediment deposits.**

**PHOENIX, ARIZONA AND VICINITY  
ALTERNATIVE—COMBINE ACDC AND  
ARIZONA CANAL (CONT)**

- D. An open combined channel and canal using pumps for delivery to laterals. Unacceptable to SRVWUA because of maintenance problems and operation costs associated with pumps. SRP currently has some pumps in use, and, even with automatic trash racks, the pumps are inoperative about 50 percent of the time due to sediment-and-moss-caused breakdowns.**

**REFERENCE SOURCE:**

**1976 General Design Memorandum—Phase I.**

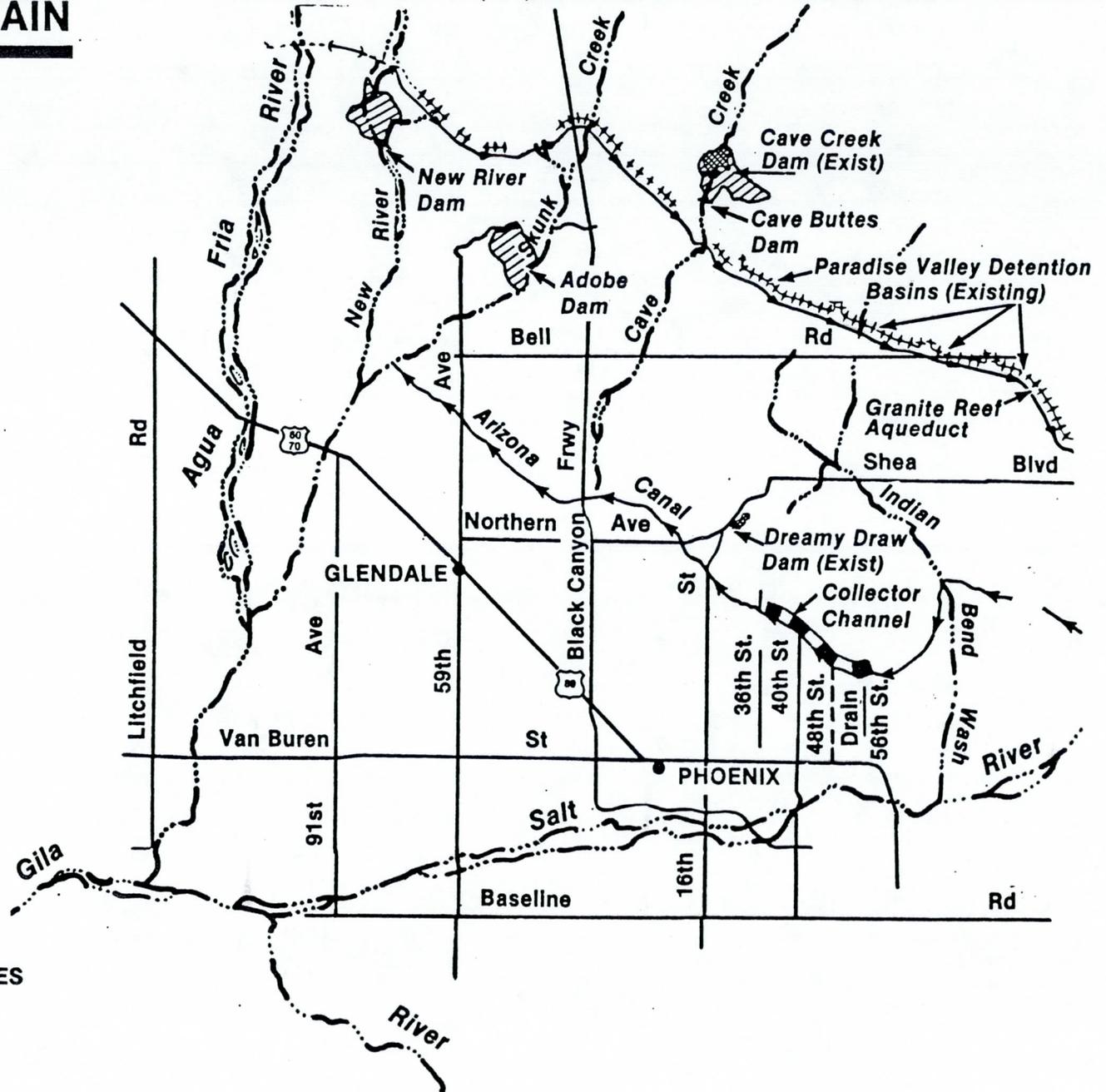
# 48TH STREET DRAIN



## LEGEND

- DAM
- CHANNEL
- LEVEES & DIKES
- FLOWAGE EASEMENT
- COVERED CHANNEL

SCALE 0 1 2 3 4 5 MILES



**PHOENIX, ARIZONA AND VICINITY  
ALTERNATIVE—REPLACE 40TH ST TO DREAMY DRAW  
REACH OF ACDC WITH COLLECTOR CHANNEL AND  
COVERED DRAIN DOWN 48TH ST TO SALT RIVER**

**COST:**

**Not Available.**

**BENEFIT TO COST RATIO:**

**Not Available.**

**REASON FOR REJECTION:**

**Low benefit to cost ratio resulting from high cost of improvement.**

**REMARKS:**

**Differs from selected plan by—40th St. to Dreamy Draw Reach of ACDC replaced by Collector Channel north of ACDC from 56th St. to 36th St. and an outlet channel down 48th St. to Salt River.**

**REFERENCE SOURCE:**

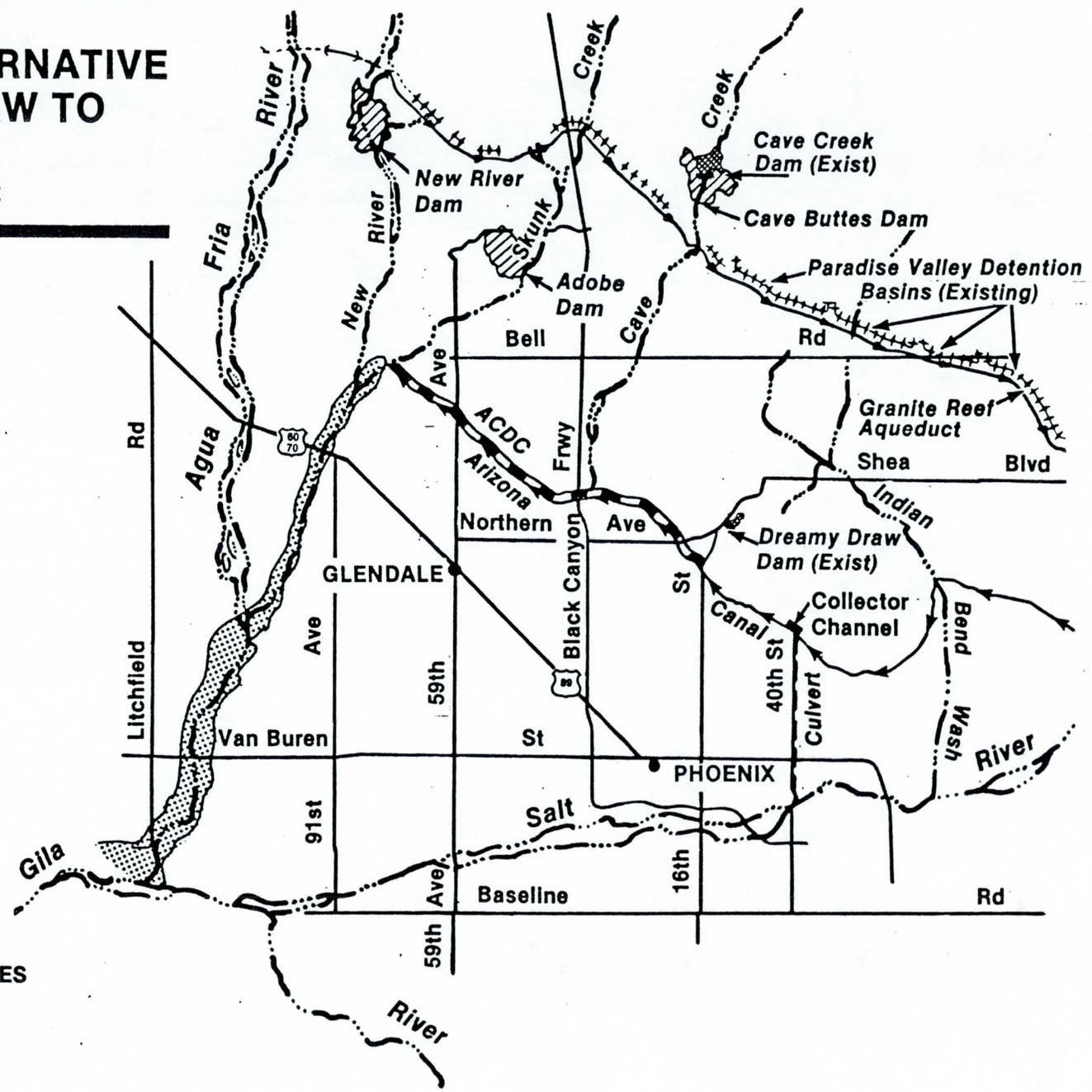
**1964 Review Report.**

**40TH STREET  
CULVERT—ALTERNATIVE  
TO DREAMY DRAW TO  
40TH STREET  
REACH OF ACDC**



- LEGEND**
-  DAM
  -  CHANNEL
  -  LEVEES & DIKES
  -  FLOWAGE EASEMENT
  -  CULVERT

SCALE 1 0 1 2 3 4 5 MILES



**PHOENIX, ARIZONA AND VICINITY  
ALTERNATIVE—REPLACE 40TH ST TO DREAMY  
DRAW REACH OF ACDC WITH A COLLECTOR  
CHANNEL AND A COVERED CHANNEL  
DOWN 40TH ST**

**COST:**

Flood control \$45,000,000 (1975 prices)  
\$69,000,000 (1982 prices—new estimate)

**BENEFIT TO COST RATIO:**

1.5 based on 1975 cost and benefits. The benefits were assumed same as those for 40th St. to Dreamy Draw Reach.

**REASON FOR REJECTION:**

Higher cost and lower benefit to cost ratio than selected plan.

**REMARKS:**

Differs from selected plan by—replaces 40th St. to Dreamy Draw Reach of ACDC with a collector channel from about 36th St. to 40th st. and a covered channel down 40th St. to Salt River.

**REFERENCE SOURCE:**

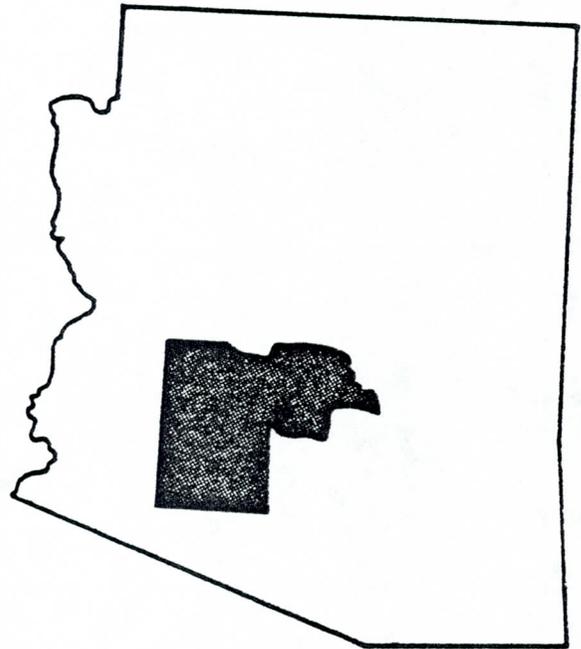
1976 General Design Memorandum—Phase I.

# FLOOD INSURANCE STUDY



OCT 28 1981

**CITY OF PHOENIX,  
ARIZONA  
MARICOPA COUNTY**



Federal Emergency Management Agency

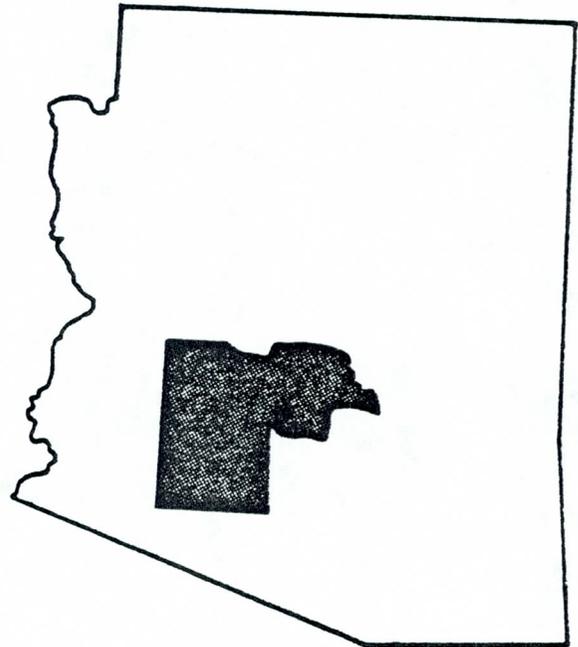
COMMUNITY NUMBER - 040051

# FLOOD INSURANCE STUDY



OCT 28 1981

**CITY OF PHOENIX,  
ARIZONA  
MARICOPA COUNTY**



Federal Emergency Management Agency

COMMUNITY NUMBER - 040051

TABLE 1 - SUMMARY OF DISCHARGES - continued

FLOODING SOURCE AND LOCATION	DRAINAGE AREA (sq. miles)	PEAK DISCHARGES (cfs)			
		10-YEAR	50-YEAR	100-YEAR	500-YEAR
<b>ECHO CANYON WASH</b>					
200 feet East of 40th Street	4.30	1,900	4,200	5,900	14,000
At confluence with Arizona Canal	5.13	2,000	4,600	6,600	18,000
<b>MOON VALLEY WASH</b> <i>(Sweetwater Channel)</i>					
At Confluence with Cave Creek	6.52	<del>2,000</del> 1,325	<del>5,000</del> 2,970	<del>7,300</del> 3,720	<del>21,000</del> 12,633
<b>SCATTER WASH</b>					
At mouth	1.25	1,000	2,400	3,000	3,700
<b>MYRTLE AVENUE WASH</b>					
At mouth	0.87	600	1,000	1,300	2,800
<b>FLYNN LANE WASH</b>					
At Flynn Lane and Lincoln Dr.	0.63	400	800	1,100	2,300
At Ocotillo Road	0.98	700	1,300	1,700	3,300
<b>TENTH STREET WASH</b>					
At Cheryl Drive	0.81	385	*	1,440	3,650
At Hatcher Road	1.59	910	*	3,400	8,600
At Alice Avenue	2.25	1,170	*	4,390	11,110
At Griswold Road	2.69	1,265	*	4,740	12,000
<b>DREAMY DRAW WASH EAST</b>					
At mouth	0.38	300	750	1,000	1,700
<b>SALT RIVER</b>					
At Mill Avenue bridge	13,260	47,000	130,000	178,500	368,000
At confluence with the Gila River	13,700	37,000	104,000	145,000	290,000

\*Data not available

### 3.2 Hydraulic Analyses

Analyses of the hydraulic characteristics of the flooding sources studied in detail were carried out to provide estimates of the elevations of floods of the selected recurrence intervals along each of these flooding sources.

Cross section data for all streams except Cave Creek and East Fork Cave Creek were obtained from topographic maps at a scale of 1:1,200 with a contour interval of two feet (Reference 6). Cross



ACDC LOCAL COSTS AS OF JULY 25, 1985

	<u>CURRENT</u>			<u>PROJECTED</u>			Total
	Lands	Roads, Bridges & Utility Relocation	Subtotal	Lands	Roads, Bridges & Utility Relocation	Subtotal	
Reach I	17,258,230	7,033,000	24,291,230	-0-	2,707,000	2,707,000	26,998,230
Reach II	10,720,034	2,500,000	13,220,034	3,714,000	9,500,000	13,214,000	26,434,034
Reach III	10,931,697	12,000	10,943,697	1,500,400	6,488,000	7,988,400	18,932,097
Reach IV	6,534,130	22,500	6,556,630	4,567,000	6,277,500	10,844,500	17,401,130
Total	45,444,091	9,567,500	55,011,591	9,781,400	24,972,500	34,753,900	89,765,491

ACDC ACQUISITION COST (CURRENT AND PROJECTED) AS OF JULY 25, 1985

<u>Reach</u>	<u>CURRENT</u>									<u>PROJECTED</u>		
	<u>Title Reports(1)</u>	<u>Appraisal Cost</u>	<u>Acquisition Cost</u>	<u>Title &amp; Escrow Service(2)</u>	<u>Legal Fees</u>	<u>Relocation Expense(3)</u>	<u>Spoil Site Cost</u>	<u>Other(4)</u>	<u>Total</u>	<u>Acquisition Cost</u>	<u>Relocation Cost</u>	<u>Total</u>
	9,642	43,047	8,183,340	57,134	124,761	307,101	8,182,865	350,340	17,258,230	39,000	-0-	39,000
II	6,566	65,286	9,163,414	45,638	57,724	1,287,277		94,129	10,720,034	3,325,000	350,000	3,675,000
III	12,199	93,408	9,485,727	55,107	90,164	1,157,576		37,516	10,931,697	1,500,400	-0-	1,500,400
IV	5,999	28,396	5,629,867	21,721	74,523	761,901		11,723	6,534,130	4,147,000	170,000	4,317,000
										250,000 (5)		250,000
Total	34,406	230,137	32,462,348	179,600	347,172	3,513,855	8,182,865	493,708	45,444,091	9,261,400	520,000	9,781,400

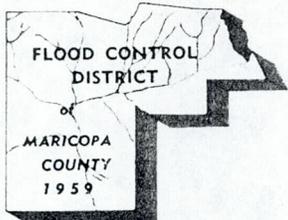
(1) Includes preliminary title reports only.

(2) Includes title insurance policies and escrow service charges.

(3) Does not include engineered relocations, i.e., utilities, bridges, or roads.

(4) Includes litigation guarantees, personal property, special surveys, crop damages and miscellaneous expenses.

(5) Includes projected costs for preliminary title reports, title and escrow service, appraisal costs and legal fees.



# FLOOD CONTROL DISTRICT

of

Maricopa County

3335 West Durango Street • Phoenix, Arizona 85009  
Telephone (602) 262-1501

D. E. Sagramoso, P.E., Chief Engineer and General Manager

BOARD of DIRECTORS  
Tom Freestone, Chairman  
George L. Campbell  
Carole Carpenter  
Fred Koory, Jr.  
Ed Pastor

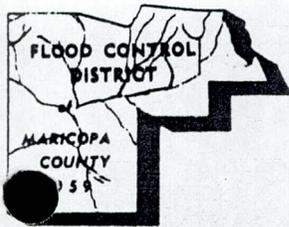
## Flood Control District Expenditures (as of December 1984)

### For Projects Affecting the City of Phoenix

#### \*Phoenix and Vicinity (Including New River):

Dreamy Draw Dam (complete)	\$ 42,000
Cave Buttes Dam (complete)	3,687,000
Adobe Dam (complete)	11,618,000
New River Dam (complete)	5,310,000
** Arizona Canal Diversion Channel (under design)	<u>52,376,000</u>
Subtotal	\$73,033,000
Cost Sharing in Projects Managed by the City of Phoenix	<u>2,810,000</u>
Total	<u>\$75,843,000</u>

\$ 20.7 million



FLOOD CONTROL DISTRICT of Maricopa County

Interoffice Memorandum

CMT. NO. SUBJECT: SKUNK CREEK, NEW AND FRIA  
FRIA RIVER FLOODWAY ESTIMATE COSTS  FILE  DESTROY

TO: DES FROM: J.E. RODRIGUEZ DATE: JULY 25, 1985  
SLS  
EDO  
HPK  
RP

VANCE CARSON HAS INFORMED ME BY TELEPHONE THE THE FOLLOWING ARE THE CURRENT COST ESTIMATES THE CORPS WILL USE IN THE I.D.M.

AGUA FRIA

FLOODWAY - \$5,950,000  
FRINGE - \$7,050,000  
\$ 13,000,000

NEW RIVER

FLOODWAY - \$3,840,000  
FRINGE - \$1,810,000  
\$ 5,650,000

SKUNK CREEK

FLOODWAY - \$2,060,000  
FRINGE - \$1,010,000  
\$ 3,070,000

TOTAL \$ 21,720,000\*

\* (FLOODWAY - \$11,250,000)  
 (FRINGE - \$9,870,000)

\$ 21,720,000

DACW09-85-B-0023  
 ARIZONA CANAL DIVERSION CHANNEL  
 MARICOPA COUNTY, AZ

BIDS Opened by: TERRY BUCKLEY  
 ON: 13 AUG 85  
 1:00 PM.

BID No.	BIDDER	ACKN. AM 1-5	BID BOND	TOTAL ESTIMATED AMOUNT
1	RICHARD P. MURRY CONST. CO. INC. P.O. DRAWER G CHANDLER, AZ 85224			\$16,227,450
2	THE ARJEE CORP. OF IOWA (EN) 7979 E. TUFTS AVE PARKWAY DENVER, CO. 80237			\$15,498,700
3	GEUPAL CONST. COMP. INC P.O. Box 20911 COLUMBUS, OHIO 43220-0911			\$15,563,550
4	BALL, BALL & BROSAMER INC. P.O. Box 1007 DANVILLE, CA 94526			\$13,116,500
5	KIEWIT WESTERN CO. P.O. Box 1209 8235 NORTH 83RD AVE PEORIA, AZ 85345			\$12,660,000
6	JULI CONTRACTING CO. INC. 4525 E. UNIVERSITY DRIVE PHOENIX, AZ 85034			\$14,966,900
GOVT EST -				\$21,062,767





CITY OF PHOENIX

TO Mr. Lee, Chairman

DATE July 22, 1985

FROM Mr. Attebery  
City Engineer

SUBJECT ARIZONA CANAL DIVERSION CHANNEL (ACDC) TASK FORCE

FLD 060202

A member of the ACDC Task Force asked staff to provide some information about City storm sewers relative to the ACDC. The information requested was in the form of questions. Below are the five questions immediately followed by the answer to each.

The answers are based on the following assumptions:

- A. All cost figures are in 1985 dollars.
- B. Costs are for only construction costs and do not include any engineering, right of way, or legal costs.
- C. All pertain to only the major trunk lines and do not include laterals, street paving, and major connections which may be necessary to make the system function.
- D. Lines are for a future drainage system which would be designed for runoff from a 2-year storm 1/2 mile wide.

QUESTION NO. 1: How many miles of storm sewer under (downstream) the Arizona Canal have been constructed?

ANSWER: Downstream of the Arizona Canal, between 43rd Avenue (west boundary of city limits) and 40th Street, 95 miles of major trunk storm sewers have been constructed. Each trunk line was designed on the basis that no stormwater would cross the Arizona Canal from the north. Costs are estimated at \$76,000,000, or roughly \$800,000/mile.

QUESTION NO. 2: How many miles of storm sewer under the Arizona Canal are yet to be built?

ANSWER: Downstream of the Arizona Canal, between 43rd Avenue and 40th Street, 53 miles of major trunk storm sewers need to be built. The estimated cost is \$42,400,000.

QUESTION NO. 3: How many miles of storm sewer above the Arizona Canal have been built?

ANSWER: Upstream of the Arizona Canal, between 51st Avenue (west boundary of city limits) and 40th Street, 8 miles of major trunk storm sewers have been constructed. The estimated costs are \$6,400,000.

QUESTION NO. 4: How many miles of storm sewer above the Arizona Canal are yet to be built?

ANSWER: Upstream of the Arizona Canal, between 51st Avenue and 40th Street, at least 36 miles of major trunk storm sewers need to be built. The cost is estimated to be \$28,800,000.

QUESTION NO. 5: How would failure to build the ACDC impact the City storm sewer program financially?

ANSWER: If the ACDC is not constructed, the 44 miles of storm sewers (either constructed or planned) upstream of the Arizona Canal must have another means of being drained. Without an outlet, storm sewers cannot be planned or constructed; therefore, the costs cannot be defined. Funds for the storm sewer not built here would probably be allocated to other areas of the city.

Both downstream and upstream of the Arizona Canal, all existing storm sewers were designed and constructed on the assumption that the ACDC would be constructed. All future storm sewers were planned with the same assumption. A total of 103 miles have been constructed and projected storm sewer needs total 89 miles. So, roughly, 54% of the area has storm sewers and 46% still need storm sewers. See attached sketch for area boundaries.

Our current rate of expenditures for storm sewer is about \$15,000,000 per year (less than 20 miles per year). It should be emphasized that our system provides only storm sewer drainage and not flood control.

I trust this information will be helpful to the Task Force. If any additional information is needed, please advise me.

J. E. ATTEBERY, City Engineer

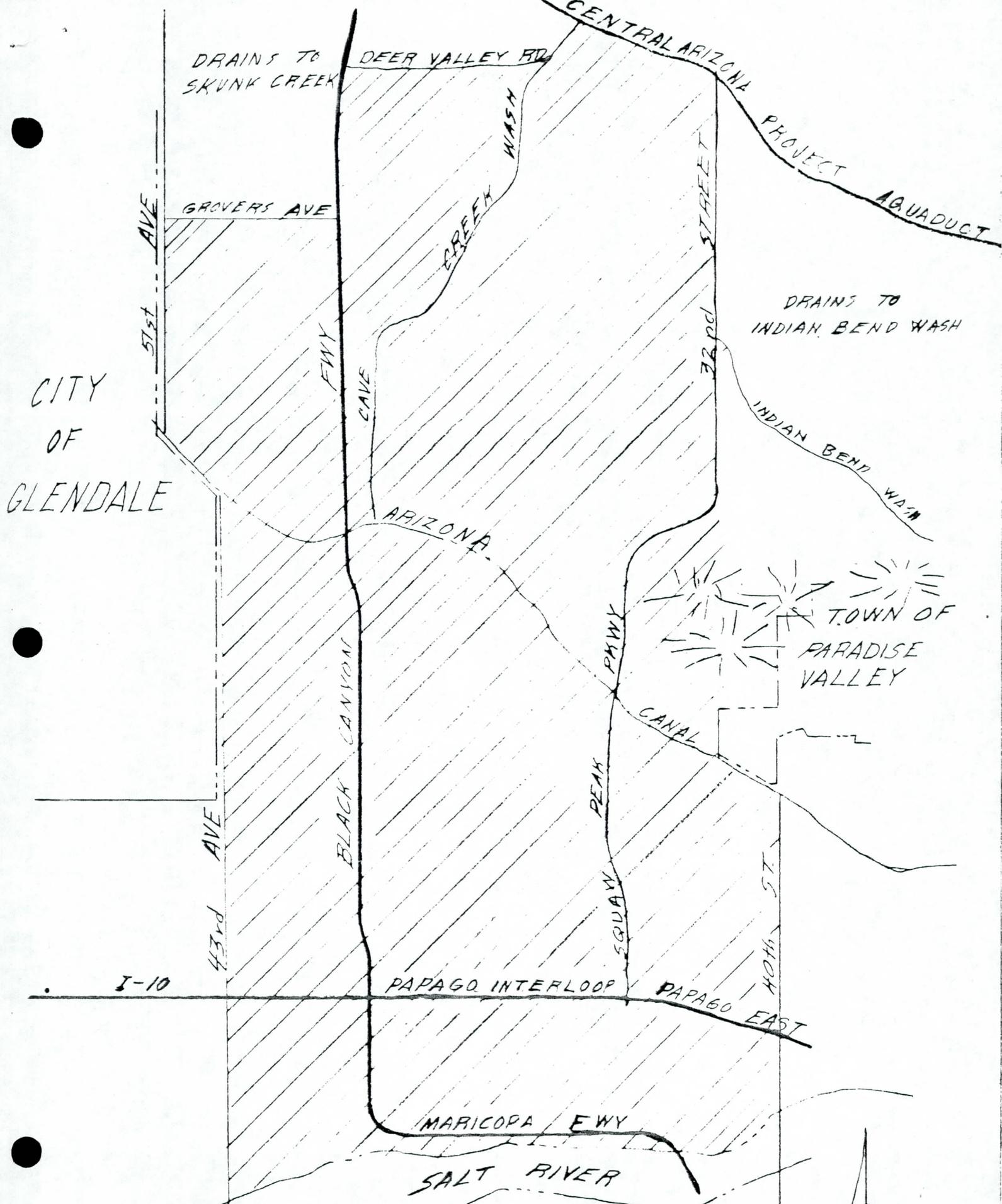


DAVID HARMON  
Assistant City Engineer

DAW/DBH:gjs

Attachment

c: Mr. Attebery  
Ms. Cale  
Mr. Esquivel  
Mr. Williams



DRAINS TO SKUNK CREEK

DEER VALLEY RD

CENTRAL ARIZONA PROJECT AQUADUCT

57th AVE

GROVERS AVE

FWY

CANYON CAVE

GREEN WASH

32nd STREET

DRAINS TO INDIAN BEND WASH

CITY OF GLENDALE

INDIAN BEND WASH

ARIZONA

PAWY

TOWN OF PARADISE VALLEY

CANAL

43rd AVE

BLACK CANYON

SQUAW PEAK

HOTEL ST

I-10

PAPAGO INTERLOOP

PAPAGO EAST

MARICOPA FWY

SALT RIVER

ACDC TASK FORCE  
JULY 22, 1985



NO SCALE

Information pertinent to Reach 3 of the ACDC

1. One of the larger washes, the 10<sup>th</sup> Street wash, outfalls into the ACDC in Reach 3. The estimated 10-year return period event for the 10<sup>th</sup> Street wash is 1785 cfs. The 100-year return period event is 3900 cfs.

2. A number of the city of Phoenix storm sewers and waterways are affected by the ACDC in Reach 3; Those which are located upstream of the ACDC depend upon the ACDC for an outfall. Those which are located downstream of the ACDC were designed using the assumption that the ACDC would be built — thus reducing the size of the storm sewers.

Upstream of ACDC

19<sup>th</sup> Avenue

15<sup>th</sup> Avenue

Central Avenue (Hatcher & Dunlap)

7<sup>th</sup> Street

Cave Creek Road

10<sup>th</sup> Street Wash 3900 cfs

Northern Avenue

Dreamy Draw 1300 cfs

Downstream of ACDC

23<sup>rd</sup> Avenue

19<sup>th</sup> Avenue

15<sup>th</sup> Avenue

7<sup>th</sup> Avenue

Central Avenue

7<sup>th</sup> Street

12<sup>th</sup> Street

Are these  
all built?

If Reach 3 of the ACDC is not to be constructed the downstream storm sewers

are undersized. But the situation upstream is much worse — there literally is no adequate outfall without the ACDC.

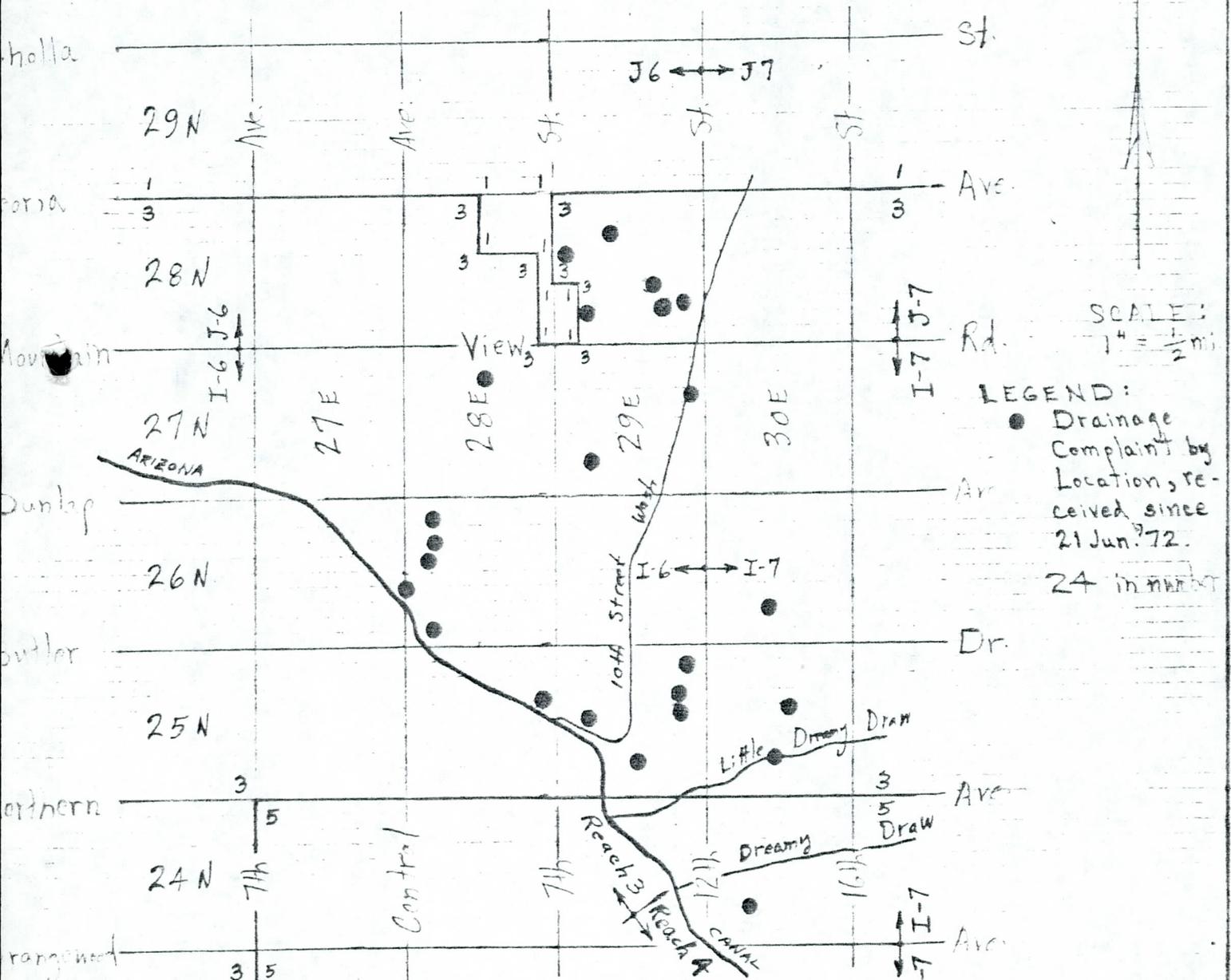
3. As everyone is aware the Arizona Canal acts as a dam to storm water reaching it on the upstream side. This results in very serious drainage problems for many City of Phoenix Citizens whose homes are located upstream adjacent to the Arizona Canal. Whereas we have on record many complaints all along the Arizona Canal the construction of the ACDC is welcomed because it would completely alleviate the drainage problems adjacent to the Arizona Canal. The area, located in Reach 3, that has an unusually high number of such complaints is between Central Avenue and 12<sup>th</sup> Street. Twenty such complaints are on record and many more homes are affected but the occupants have not made a formal complaint to the City. This area is especially critical because of the large amount of runoff coming from the nearby mountains to the North and the lack of any appropriate sites to detain the storm water.

REACH 3 OF ARIZ. CANAL DIV. CHANNEL

CENTRAL AVENUE to DREAMY DRAW

W.O. 20833

SUMMARY OF PERTINENT DRAINAGE COMPLAINTS WHICH HAVE COME TO MY ATTENTION ~~WITHIN THE PAST TEN YEARS~~



Done William G. Pool STORM DRAINS GROUP  
 HYDRAULICS SEC., DESIGN DIV., ENGINEERING DEPT.  
 DATE 25-Jun-85 PAGE 1 OF 1  
 CITY OF PHOENIX



# FLOOD CONTROL DISTRICT

of

Maricopa County

3335 West Durango Street • Phoenix, Arizona 85009  
Telephone (602) 262-1501

---

BOARD of DIRECTORS  
Tom Freestone, Chairman  
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D. E. Sagramoso, P.E., Chief Engineer and General Manager

**AUG 07 1985**

MEMO TO: Arizona Canal Diversion Channel Task Force  
FROM: D. E. Sagramoso, Chief Engineer and General Manager  
SUBJECT: ACDC Peak Flow Routing

The attached paper was developed by Dave Johnson, Chief Hydrologist, in response to concerns that have been raised regarding the relationship between the peak flows generated by the ACDC contributing drainage areas and the resultant peak (design) flow in the Diversion Channel. The paper uses a simplified example to explain the relationship.

D. E. Sagramoso

## ARIZONA CANAL DIVERSION CHANNEL FLOW ROUTING

When flows into a river or channel are computed to determine the maximum (peak) flow there is often a misconception that the maximum (peak) flows from the contributing drainage areas are simply summed together.

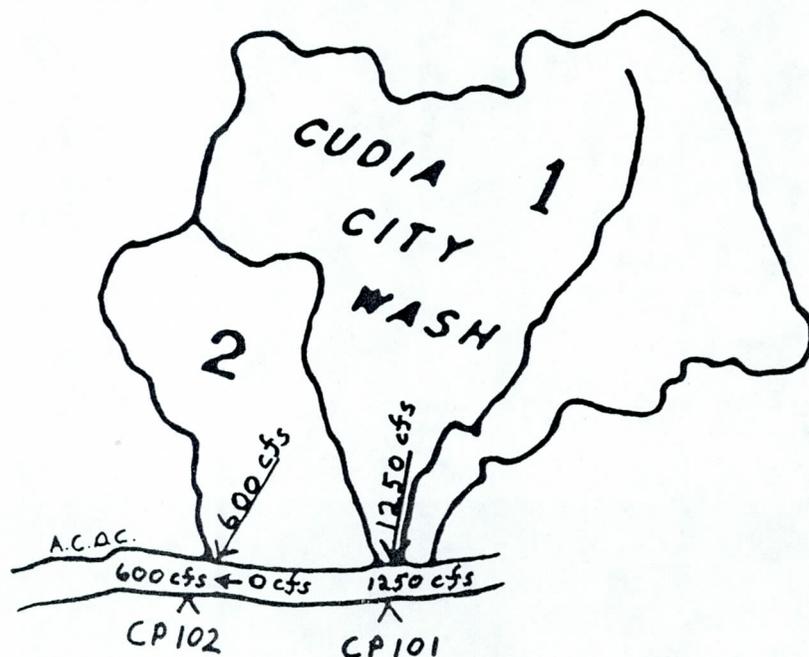
The reason peak flows are not summed together is simply a matter of timing. Each drainage area is different and those differences impact on how long it takes the water to drain off. The characteristics of a drainage area which most affect the time to drain off are as follows:

- **Size** - Generally, the larger the drainage area the greater time it takes to drain because of a greater travel distance for the runoff.
- **Shape** - A long narrow drainage area has a longer distance for the runoff to travel than a short, wider drainage area of the same size.
- **Slope** - The steeper the land surface the faster the water moves over the surface toward the stream channels and the faster the flows in the channels.
- **Cover Type** - The more vegetation the slower the runoff, while the more urbanization or rock surface the faster the runoff as a result of less resistance to flow.
- **Drainage Collection System** - The more defined channels there are in the drainage area the more quickly it drains. The longer the runoff is flowing over the surface toward a channel the longer the drainage area takes to drain.

The following simplified example illustrates the concept of the timing of runoff from drainage areas. It uses the Arizona Canal Diversion Channel Reach 4 drainage areas 1 and 2 and the design peak flows at concentration points (CP) 101 and 102 along the ACDC.

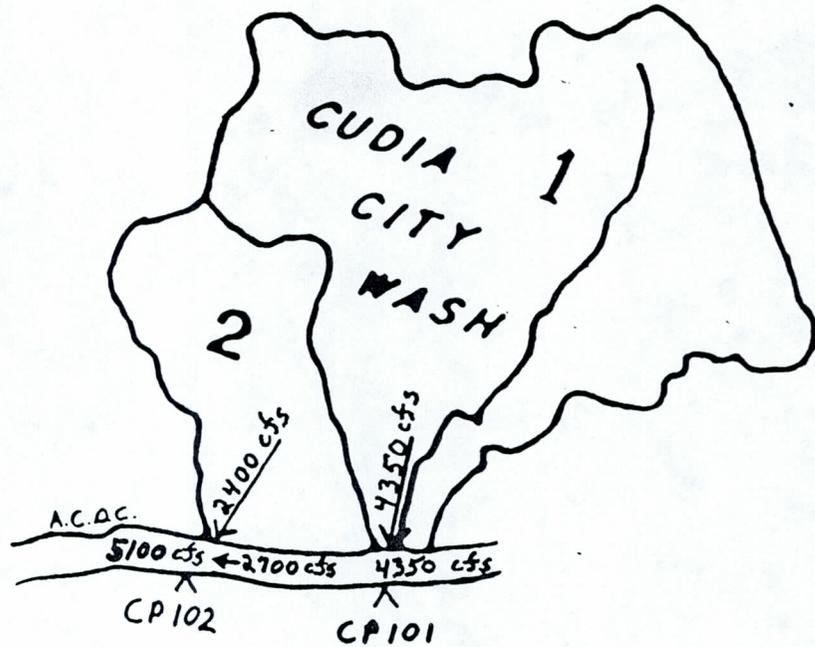
### Beginning Time

- Runoff occurring
- Peak flow rates have not been reached for either drainage area
- Flow from drainage area 1 has not reached CP 102.



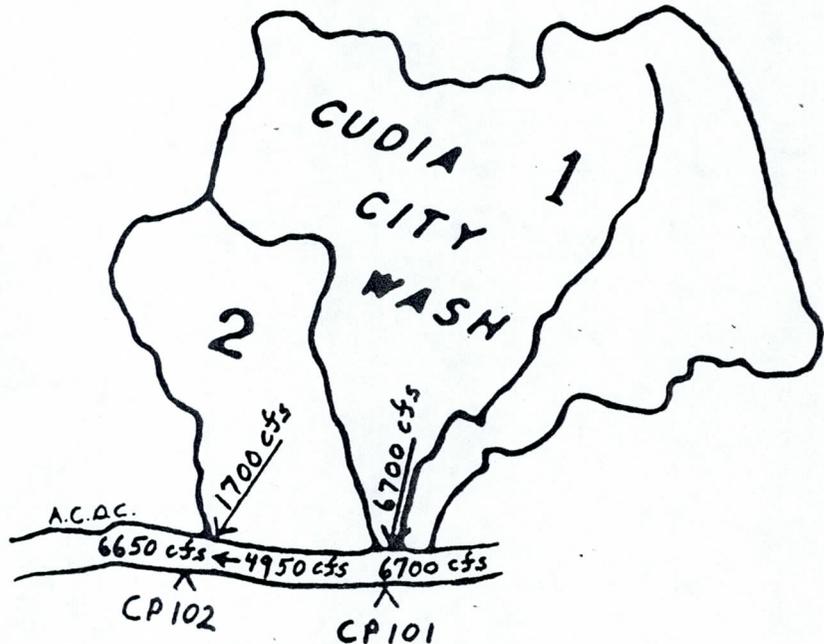
Later

- Peak flow rate for drainage area 2 has been reached. (smaller drainage area and greater slope therefore drains more quickly than drainage area 1).
- Flow of 2700 cfs has traveled down the ACDC channel to CP102 and is additive to the drainage area 2 flow



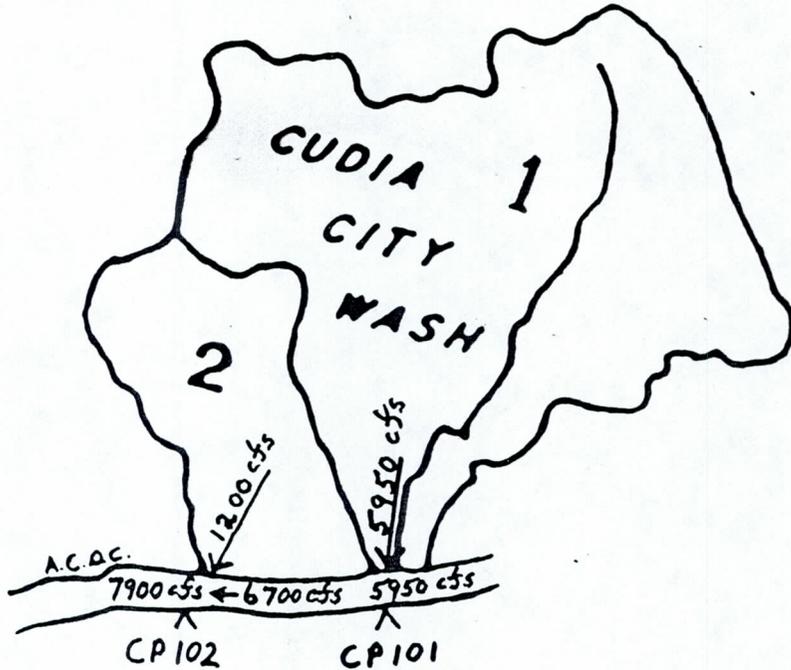
Still Later

- Peak flow rate for drainage area 1 has been reached. (Larger drainage area and lesser slope therefore drains more slowly than drainage area 2)
- Flow of 4950 cfs has travelled down the ACDC channel to CP102 and is additive to the drainage area 2 flow.



Even Later

- Peak flow rate occurring at CP102. The peak flow of 6700 cfs from drainage area 1 has worked its way down to CP102 and combined with 1200 cfs flow from drainage area 2 to produce 7900 cfs.
- Drainage subsiding from both drainage areas.



As seen by this example the peak flow at CP102 is not merely the sum of the peak flows from drainage areas 1 and 2. Rather, it is the combination of concurrent flows from the two drainage areas determined by the timing of the flows produced by the drainage areas and the time for the flow in the ACDC to move from CP101 to CP102.



PHOENIX, ARIZONA AND VICINITY (including New River)  
LIST OF DOCUMENTS

1. Design Memorandum No. 1, Feature Design for Dreamy Draw Dam, was published in January 1972. The report is exclusively devoted to the evaluation of Dreamy Draw Dam from economic, social, environmental, and engineering viewpoints. The evaluation led to the favorable decision to construct Dreamy Draw Dam. (1)
2. Design Memorandum No. 2, Hydrology, Part 1, was published in October 1974. The report details the meteorologic and hydrologic characteristics of the Phoenix area and defines the hydrologic design criteria for the proposed dams and channels. (2)
3. Design Memorandum No. 3, General Design Memorandum -- Phase I, Plan Formulation, was completed in March 1976. The report reviews the authorized plan and reformulates a plan (including Dreamy Draw Dam) more suitable to existing conditions by updating the basic design criteria for the study area -- its resources, problems, and needs. Alternative flood-control and recreational plans were considered before final selection of the recommended plan. (2)
4. Design Memorandum No. 3, General Design Memorandum -- Phase II, Project Design, Part 1, Cave Buttes Dam (including Cave Creek to Peoria Avenue), was completed in July 1976. The report summarizes the plan recommended in the Phase I report and updates the plan and cost estimates for the entire project. Appendix 1 presents the detailed design of Cave Buttes Dam. Appendix 2 discusses the analysis of the Cave Creek floodplain between Cave Buttes Dam and the Arizona Canal and presents a delineation of the floodway and floodway fringes to be managed by local interests. (1)
5. Design Memorandum No. 3, General Design Memorandum -- Phase II, Project Design, Part 2, Adobe Dam (including Skunk Creek to Arizona Canal), was completed in April 1979. The report summarizes the plan recommended in the Phase I report and updates the plan and cost estimates for the entire project. Appendixes 1 and 1a of Part 2 discuss the detailed design of Adobe Dam and Skunk Creek channel and levees. Appendix 2 presents (a) an analysis of the Skunk Creek floodplain between Adobe Dam and the proposed ACDC and (b) a delineation of the floodway and floodway fringes to be managed by local interests. (1)
6. Supplemental Report to Design Memorandum No. 1, Floodway Delineation for Dreamy Draw (Dreamy Draw Dam to the Arizona Canal), was completed in June 1979. The report presents the future 100-year floodplain and floodway and operation and maintenance requirements for Dreamy Draw. (2)

7. Design Memorandum No. 4, Overall Master Plan, New River and Phoenix City Streams, Arizona, was completed in September 1980. The report addresses the necessity of viewing the entire Phoenix, Arizona, and Vicinity (Including New River) Flood Control Project as an entity for planning purposes, outlines the relationship of the project to recreational facilities developed or proposed by other agencies; discusses the resources of the project area; and describes the general land-use plan for the entire project. (1)
8. Design Memorandum No, 5, Master Plan and Feature Design for Recreation, Dreamy Draw Dam, was completed September 1982. The report analyzes the resources of the area, describes a specific plan for recreational development, and provides a basis for preparation of plans and specifications. (3)
9. Design Memorandum No. 2, Hydrology, Part 2, was published in April 1982. The report updates hydrologic studies since the Phase I Design Memorandum was published in March 1976. (1)
10. New River Dam (including New River to Skunk Creek) Design Memorandum No. 3, General Design Memorandum -- Phase II, Project Design, Part 3, was completed in November 1982. The report summarizes the plan recommended in the Phase I report, updates the plan and cost estimates for the entire project, and presents the feature design for the New River Dam. (1)
11. Arizona Canal Diversion Channel (including Cave Creek Channel and Sediment Basins on Cave Creek and Cudia City Wash), Design Memorandum No,3, General Design Memorandum -- Phase II, Project Design, Part 5, was completed in March 1985.. The report summarizes the plan recommended in the Phase I report, evaluates alternative design considered since the Phase I report, nd presents an updated recommended plan with revised cost estimates. Feature design for the first reach of the Arizona Canal Diversion Channel is presented. The general design for the remainder of the Arizona Canal Diversion Channel is displayed along with an updated environmental assessment, geologic analysis, recreation plan, and sedimentation study. (1)
12. Interim Report on Survey for Flood Control, Phoenix, Arizona, and Vicinity (including New River) was published in January 1964. This report describes investigations made to develop a comprehensive plan that would serve as a framework for all flood control work in the Phoenix metropolitan area. (2)
13. Flood Insurance Study -- Phoenix, Arizona was published in September 1973. This report contains flood overflow information for the National Flood Insurance Program. (2)
14. Gila River Basin, New River and Phoenix City Streams, Design Memorandum No. 3, General Design Memorandum -- Phase I, Plan Formulation Main Report was completed in March 1976. The purpose of this report was to review the authorized project, and either reaffirm the plan or reformulate a plan more suitable under existing conditions. (2)

*Same as No. 3*

15. Gila River Basin, New River and Phoenix City Streams, Design Memorandum No. 3, General Design Memorandum - Phase I, Plan Formulation, Appendices was completed in March 1976. Contains technical appendices for Hydrology; Geology, Soils and Material, Site Selection of Dams; Alternative Plans; Hydrualic Design and Overflow Areas; Economics; Recreation and Esthetic Treatment; and Cost Estimates. (2)
16. Gila River Basin, New River and Phoenix City Strems, Design Memorandum No. 3, General Design Memorandum - Phase I, Plan Formulation, Supplement to Main Report, Correspondence (March 1976) (2)
17. Gila River Basin, New River and Phoenix City Streams, Arizona, Alternative Plans for Flood Control and Recreational Development was completed in April 1974. This brochure presented the feasible alternatives studied, for evaluation by local citizens at a public meeting held in Phoenix on April 25, 1974. (2)
18. Report on Flood of 22 June 1972, Phoenix Metropolitan Area, Arizona was finished in October 1972. The report describes the storm and flood in the Phoenix metropolitan area during the period June 21-22, 1972 and presents the resultant flood damages. (2)
19. February 1979 Flood Damage Report describes the storms and floods in Maricopa County, Arizona, during the period of February 27 through March 6, 1978, and presents the resultant flood damages. (2)
20. Flood Damage Report, Phoenix Metropolitan Area, December 1978 Flood was published in November 1979. This report is an assessment of damages resulting from the floods of December 17-23, 1978. (4)
21. Phoenix Flood Damage Survey February 1980 was completed in April 1981. This report is an assessment of flood damages in Maricopa County resulting from the floods of February 13-22, 1980. (2)
22. Gila River Basin, New River and Phoenix City Streams, Arizona, Letter From The Secretary of the Army Transmitting A Letter From The Chief of Engineers, Department of the Army, dated 21 May 1965, Submitting a Report, Together with Accompanying Papers and Illustrations, On an Interim Report On Gila River Basin, New River and Phoenix City Streams, Arizona, Authorized by the Flood Conttol Act Approved June 28, 1938. This is the submittal to Congress of the District Engineers' Interim Report on Survey for Flood Control, Phoenix, Arizona and Vicinity (Including New River). (2)
23. Amplification to the Final Environmental Impact Statement, New River and Phoenix City Streams Flood Control Project, Maricopa County, Arizona was completed in December 1977. The report provided information regarding the preservation of historic resources within the Cave Buttes Dam project area, specifically the effect of the project on Cave Creek Dam. (3)

24. Floodplain Information Study for Maricopa County, Arizona, Vol. V, New River Report was completed in April 1967. This report was prepared to provide information on flood hazards along New River for the guidance of the State of Arizona and the Flood Control District of Maricopa County in (a) advising county and city planning organizations and private land developers about those hazards and (b) setting up appropriate controls to insure optimum and prudent use of the floodplain. (3)

25. Floodplain Information, Agua Fria River, Maricopa County, Arizona was completed in March 1968. This report was prepared to provide information on flood hazards along the Agua Fria River for the guidance of the State of Arizona and the Flood Control District of Maricopa County in (a) advising county and city planning organizations and private land developers about those hazards and (b) setting up appropriate controls to insure optimum and prudent use of the floodplain. (3)

26. Floodplain Information Study for Maricopa County, Arizona, Vol. II, Cave Creek Report was completed in November 1964. This report was prepared to provide information on flood hazards along Cave Creek for the guidance of the State of Arizona and the Flood Control District of Maricopa County in (a) advising county and city planning organizations and private land developers about those hazards and (b) setting up appropriate controls to insure optimum and prudent use of the floodplain. (2)

27. Final Sediment Transport Report for Lower Agua Fria River was finished in November 1984 by Simons, Li and Associates. This report presents an analysis of the sediment conditions for the lower Agua Fria River. This information is then incorporated into the detailed analysis to determine the flood areas for the establishment of floodway and floodway fringe easements. (3)

28. Final Sediment Transport Report for Lower Skunk Creek and Lower New River (ACDC outlet to Agua Fria River) was finished in February 1985 by Simons, Li and Associates. This report presents an analysis of the sediment conditions for the lower New River and lower Skunk Creek. This information is then incorporated into the detailed analysis to determine the flood areas for the establishment of floodway and floodway fringe easements. (3)

29. Summary Sediment Study Report, Arizona Canal Diversion Channel, Phoenix, and Vicinity, Maricopa County, Arizona was completed in June 1983. This report summarized seven other reports dealing with sediment conditions for the Arizona Canal Diversion Channel (ACDC). Sediment inflow, transport, deposition, and hydraulic analysis are covered in support of final design for the ACDC to ensure that the project will function properly during various flow conditions. (2)

30. Arizona Canal Diversion Channel, Part of the Authorized Flood Control Project of the US Army Corps of Engineers for Phoenix and Vicinity was published in June 1982. This paper presented planning and technical information on the design of the Arizona Canal Diversion Channel. (1)

31. Arizona Canal Diversion Channel, Part of the Authorized Flood Control Project of the US Army Corps of Engineers for Phoenix and Vicinity was published in June 1985. This paper presented planning and technical information on the design of the Arizona Canal Diversion Channel. This is a revision to the June 1982 paper. (1)

32. Proposed Plan for Flood Control and Recreational Development was prepared in October 1975. This brochure presents the details of the plan recommended for flood control and recreational development in the Phoenix area. It also describes the various alternatives studied and the basis for the selection of the recommended plan. (1)

33. Phoenix Urban Study was completed in August 1978. This report was a joint effort by the Corps and local government to develop a coordinated water resource management plan that would be consistent with other urban programs. (2)

34. Final Environmental Impact Statement, New River and Phoenix City Streams, Maricopa County, Arizona was completed in March 1976. The Environmental statement complies with the National Environmental Policy Act of 1969 (Public Law 91-190) and describes (a) the recommended plan for the project, (b) the environmental setting without the project, (c) the relationship of the project to existing land use plans, (d) the probable impact of th project on the environment, e) the alternatives to the recommended plan for the project, (f) the relationship between the short-term use of the environment and the maintenance and enhancement of long-term productivity, (g) the irreversible and irretrievable commitments of resources which would be involved in the project should it be implemented, and (h) the coordination effort which has taken place. (4)

(1) Provided to library file, to be returned to Corps upon completion of committee report.

(2) Document of which only one or a very few copies are available and that must be retained for Corps of Engineers records. A copy will be made available at the Corps office in Phoenix (2721 N. Central Ave., tel. 241-2003) Portions will be photocopied for committee members upon request.

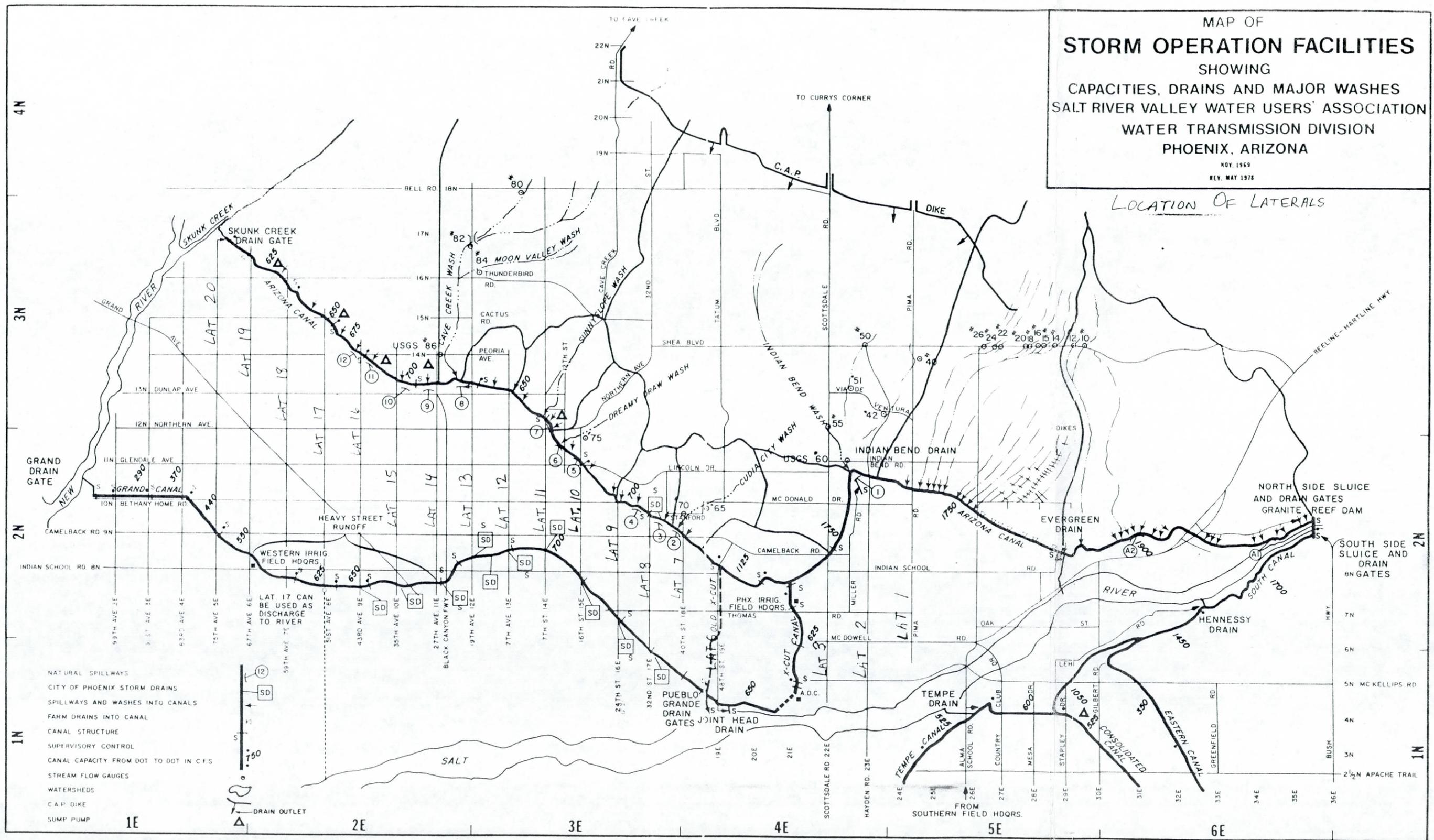
(3) Probably of little or no interest to committee. Will be made available upon request.

(4) Already available in library.



MAP OF  
**STORM OPERATION FACILITIES**  
 SHOWING  
 CAPACITIES, DRAINS AND MAJOR WASHES  
 SALT RIVER VALLEY WATER USERS' ASSOCIATION  
 WATER TRANSMISSION DIVISION  
 PHOENIX, ARIZONA  
 NOV. 1969  
 REV. MAY 1978

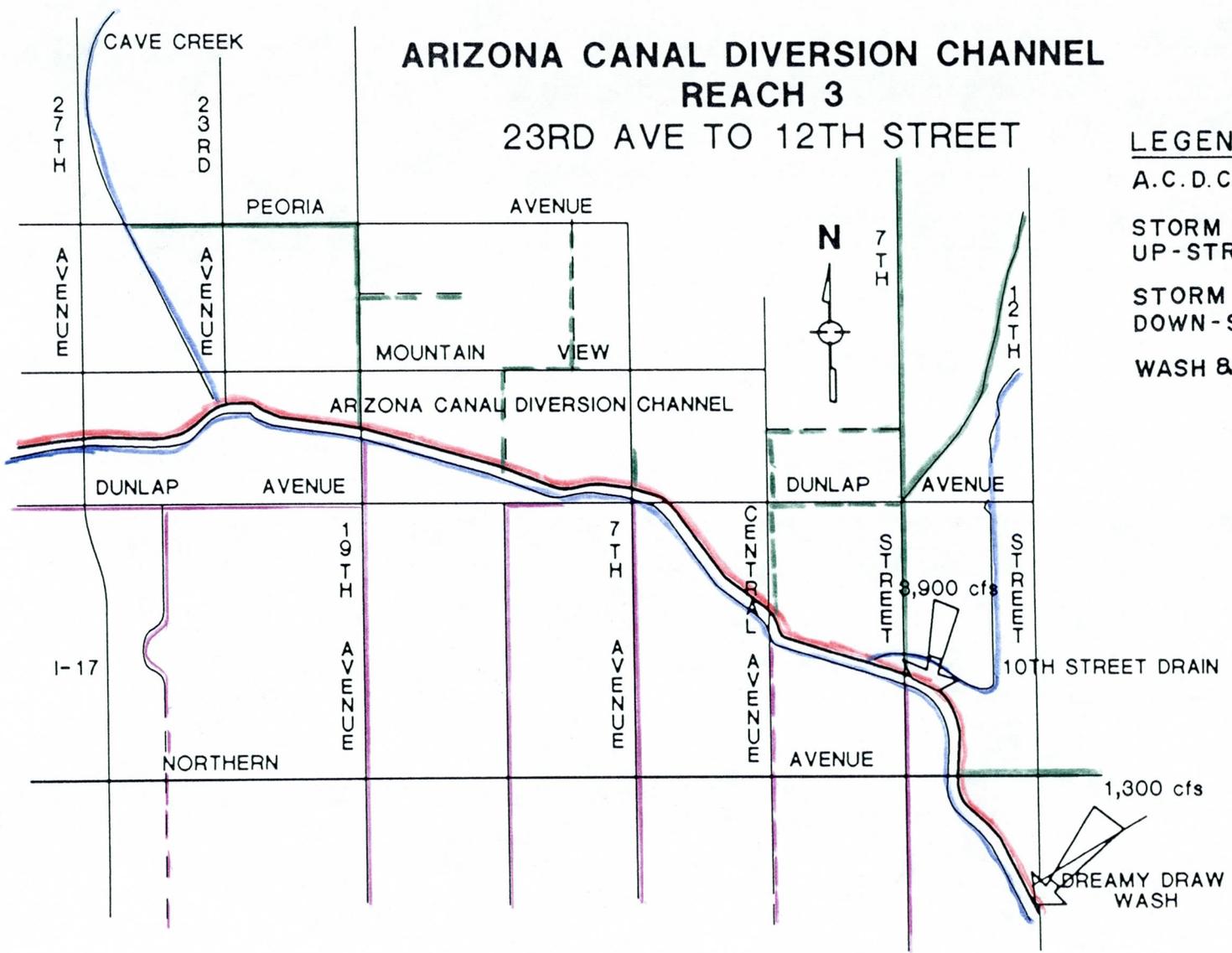
LOCATION OF LATERALS



**COST OF REACH 3  
ARIZONA CANAL DIVERSION CHANNEL  
( ACDC )  
1984 DOLLARS**

CHANNEL CONSTRUCTION	\$ 29,000,000
ENGINEERING & DESIGN	2,900,000
SUPERVISION & ADMINISTRATION	2,900,000
LANDS & DAMAGES	21,300,000
RELOCATION OF UTILITIES	1,030,000
RELOCATION OF ROADS & BRIDGES	3,120,000
	<hr/>
TOTAL	\$ 60,250,000

# ARIZONA CANAL DIVERSION CHANNEL REACH 3 23RD AVE TO 12TH STREET





**FLOOD CONTROL DISTRICT**  
of  
**Maricopa County**

3335 West Durango Street • Phoenix, Arizona 85009  
Telephone (602) 262-1501

BOARD of DIRECTORS  
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Ed Pastor

D. E. Sagramoso, P.E., Chief Engineer and General Manager

Memo To: City of Phoenix, ACDC Task Force

From: D.E. Sagramoso, Chief Engineer and General Manager

Subject: Flood Control District Capital Expenditures

Date: August 5, 1985

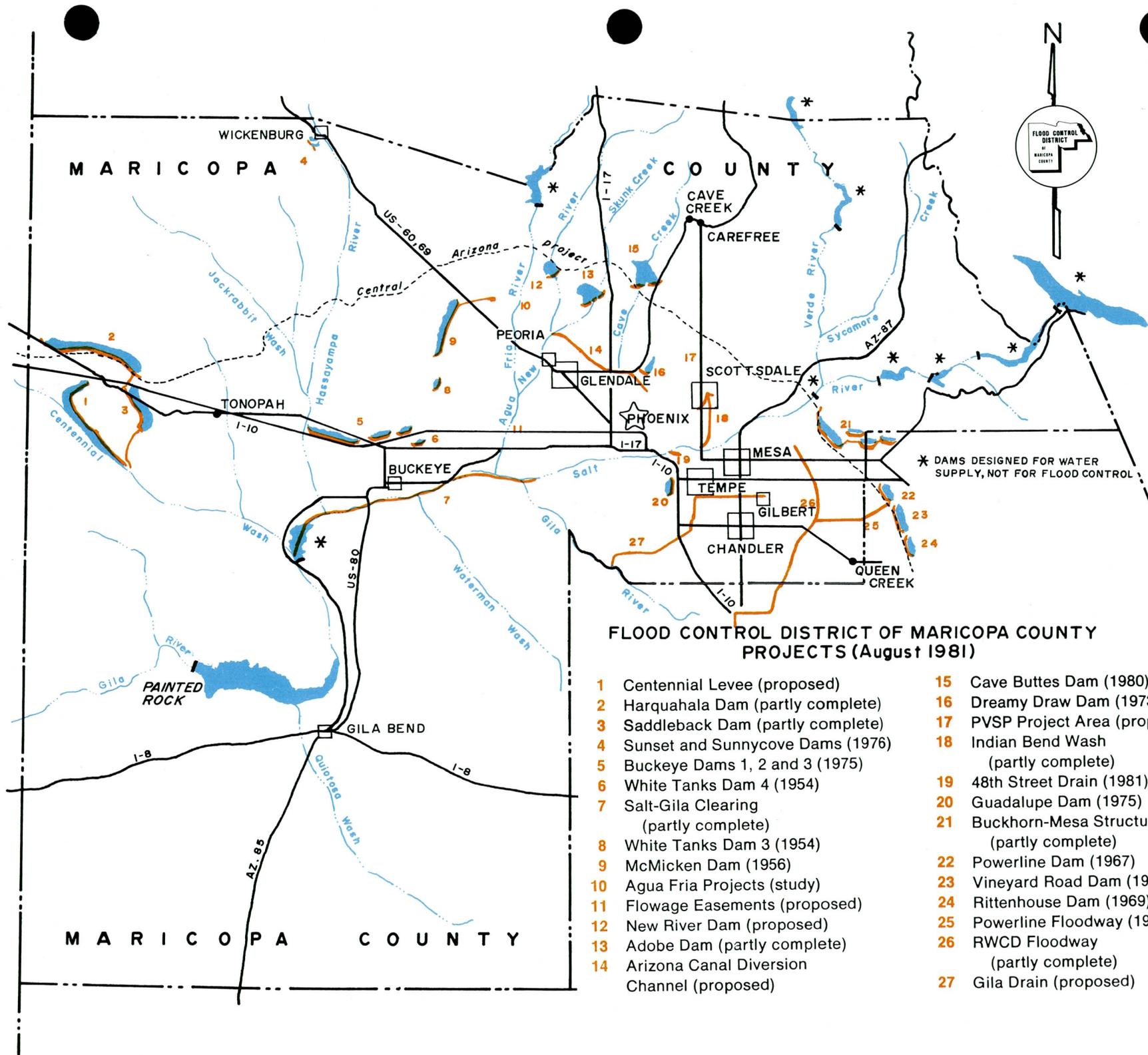
Since the Flood Control District of Maricopa County was formed in August of 1959, we have acted as sponsor for major flood control measures constructed by the Soil Conservation Service and the US Army Corps of Engineers for the benefit and protection of the citizens of the County. Today, we own and operate 20 major flood control dams, including the four that are a part of the Phoenix and Vicinity Project of which the ACDC is a part. We also own and operate 10 significant flood control channels. The enclosed map shows the facilities that had been completed or where in the planning stages in August 1981, including the ACDC.

As you can readily see from the map, most of the capital expenditures of the District from formulation to date, have been outside of the corporate boundaries of the City of Phoenix. To this point we have cost shared \$2,810,000 with the City for the construction of some storm drain or detention facilities. We have previously told you that 55 percent of our tax base is within the City of Phoenix.

Since 1961, the Flood Control District has collected \$136,622,257 in tax revenues, most of which has been expended for the acquisition of rights-of-way, relocation assistance to land owners displaced by projects, relocations of utilities, design coordination, and operations and maintenance of the major flood control measures depicted on the enclosure.

D.E. SAGRAMOSO, P.E.

Enclosure



**FLOOD CONTROL DISTRICT OF MARICOPA COUNTY  
PROJECTS (August 1981)**

- |   |   |
|---|---|
| 1 Centennial Levee (proposed)                 | 15 Cave Buttes Dam (1980)                     |
| 2 Harquahala Dam (partly complete)            | 16 Dreamy Draw Dam (1973)                     |
| 3 Saddleback Dam (partly complete)            | 17 PVSP Project Area (proposed)               |
| 4 Sunset and Sunnycove Dams (1976)            | 18 Indian Bend Wash (partly complete)         |
| 5 Buckeye Dams 1, 2 and 3 (1975)              | 19 48th Street Drain (1981)                   |
| 6 White Tanks Dam 4 (1954)                    | 20 Guadalupe Dam (1975)                       |
| 7 Salt-Gila Clearing (partly complete)        | 21 Buckhorn-Mesa Structures (partly complete) |
| 8 White Tanks Dam 3 (1954)                    | 22 Powerline Dam (1967)                       |
| 9 McMicken Dam (1956)                         | 23 Vineyard Road Dam (1968)                   |
| 10 Agua Fria Projects (study)                 | 24 Rittenhouse Dam (1969)                     |
| 11 Flowage Easements (proposed)               | 25 Powerline Floodway (1968)                  |
| 12 New River Dam (proposed)                   | 26 RWCD Floodway (partly complete)            |
| 13 Adobe Dam (partly complete)                | 27 Gila Drain (proposed)                      |
| 14 Arizona Canal Diversion Channel (proposed) |   |

\* DAMS DESIGNED FOR WATER SUPPLY, NOT FOR FLOOD CONTROL

Wayne W. Linthacum, P.E.  
Consulting Engineer  
3002 E. Montecito  
Phoenix, Arizona 85016

Richard H. Lee, Chairman  
Arizona Canal Diversion Channel  
Task Force

Dear Mr. Lee, and Members of the Task Force:

In your Charge by the City of Phoenix to review, study and make recommendations and give advice to the City Council. There are several things that could or should be done to aid in the evaluation process.

Ask Yourself:

- Why, when and how was the ACDC proposed?
- Was it started for self-interest or Public benefit?
- Was it started and planned for a specific local area or for widespread flood protection?
- Why was the Flood Control District of Maricopa County established by the Legislature? What was it's responsibility and is it fulfilling that obligation?
- Is each statement or question by the various interests really relevant to the ACDC, such as (Rio Salado and Plan 6)?
- Is cost, or flood protection, the most important?  
Isn't it best to determine what is needed and then to do it in the most economical manner?
- Are the statements made to you by the several parties true or questionable? Do they put forth inuendos that would lead you or tend to lead you to believe something that isn't so or is in a grey area?
- Do Petitions signed on basis of information presented by one side give a true indication of what the signee would think after due consideration and having information from both sides?

Here are a few general comments for consideration:

- The ARIZONA CANAL is a canal that "BUILT THE VALLEY". The ARIZONA CANAL DIVERSION CHANNEL will be a floodway channel to protect people and property below the canal from probable floods and floodwaters generated above the Arizona Canal and which have increased over the natural flows as a result of urban development.
- REACH 4 is an area that has a substantial history of floods and damage as a result of storms of sufficient magnitude to cause breaks and overflows of the Arizona Canal. The storm of July 22, 1972 (about a 70 year storm) caused flooding, damage and hardship to a very large area. 2600 homes were damaged. This storm probably affected more people than any other storm in the valley.

**Wayne W. Linthacum, P.E.**  
Consulting Engineer  
3002 E. Montecito  
Phoenix, Arizona 85016

- When Talley Industries gave the Right-of-way for the ACDC through the Biltmore property it was in accord with the ACDC program. Also, when present owner bought the Biltmore property they were surely informed of and knowledgeable about the right-of-way for the ACDC.
- To evaluate the statement by the owners of the Biltmore that the facilities would have to be shut down for 12 months during the construction of the channel it, is suggested that a reputable major construction firm such as M. M. Sundt or Tanner Construction Co. be asked to appear before the Committee and describe what length of time would be reasonable to build the channel through the Biltmore area and what physical disruption would probably be anticipated.
- Public costs for Non-ACDC Alternatives. This could range from an absolute "do nothing" to a lot of various small or large projects and range from zero to different kinds and amounts of protection at various places. Whatever would be done would likely be piecemeal and more likely than not could benefit a few but likely not the vast majority.
- Regarding Local Cost, the owners of residential and business property within the inflow and outflow flood area in Reach 4 would only pay a very small part of the Flood Control District's share of the costs as the Flood Control tax is county wide. The taxes paid by the local people also goes to pay for Flood Control in all parts of the County.
- If REACH 4 were deleted from the ACDC Project, and no suitable alternatives were constructed, homeowners would likely have to be self insured or have no insurance at all.
- Regarding AESTHETICS, beauty is in the eyes of the beholder. Therefore there are many different concepts. The final planning and design should be acceptable to the majority of the people and this can be accomplished by having a good interface between planners, designers and representatives of the various interested groups.
- Regarding comparison of various engineer, planning and design data output. All engineers go by basic engineering principals and formulas. there are, as to be expected, some matter of judgement in selecting coefficients or other factors to use in the basic equations which may result in slightly different answers. Occasionally some differences of a major nature are resolved by a review by a Board of Peers.

**Wayne W. Linthacum, P.E.**  
Consulting Engineer  
3002 E. Montecito  
Phoenix, Arizona 85016

- Regarding Costs, in our todays society and economy, there is no way for anyone to make "hold fast" cost projections on Government funded long term projects. There are so many changes in the economy, inflation and other factors including the changes brought about by various pressure groups of all kinds. For these reasons too the Benefit-Cost ratios are not the same throughout as the costs and benefits continually change.

Respectfully submitted,

Wayne W. Linthacum, P.E.

Wayne W. Linthacum, P.E.  
Consulting Engineer  
3002 East Montecito  
Phoenix, Arizona 85016

AUG 12 1985

Richard H. Lee  
Arizona Canal Diversion Channel  
Task Force

Dear Mr. Lee, and members of the Task Force

This is to respond to your request to comment on the Gookin Report of May 1982.

I have read the Report. There are some statements in the Report that concern me as they likely would most other civil engineers who have some long time experience in design and construction. My comments are based on strictly engineering principals and judgement.

My comments follow:

- The Gookin Report states that "ACDC project will result in considerable disruption to the surrounding area both during and after construction".

There will be some disruption during construction, however there should be none after the work is completed and the area cleaned and dressed up in accordance with the Contract and Specifications.

- The Report, page 3, para. 1, stated that there would "include a total interruption of traffic across the canal at various points during construction".

This is inconceivable. Actually, contract specifications and construction documents would surely call for constructing and maintaining temporary detours for the time needed, then restoration of permanent service as soon as the structures and other work is completed to where it can be used. This has long been common practice in the engineering and construction industry. An example, which the Task Force saw first hand, was the advance construction of the bridge across the alignment of the ACDC at 25th Avenue by the Flood Control District. This will be done at all street crossing.

- The Report, page 7, para. 4 and 5, states that "Our Firm's studies showed that the 100-year flood on Cudia City Wash to be about 7200 cfs instead of 6800 cfs". The Corps responded that the difference was small. This variation, by different engineers, is not unusual or significant.

Actually, in practice, the engineers probably used the same governmental charts and used their best judgement in determining the several factors and coefficients to select the "curves" to be used. Also, there is the judgement to be exercised regarding the watershed and the percentage of contributing area that may be subject to infiltration and how much rainfall the various sections of the area can absorb and how much of it will be complete runoff except for re-entry (evaporation) into the atmosphere.

Summarizing, there are a number of variable in computing storms and flood runoff. In making this type of analysis, long time engineer experience together with team review will logically produce the most reliable results.

- The Report, on page 8, para. 1 and 2, questions the methodology for computing the amount of flood flows and talks of the two common techniques - one by SCS (Soil Conservation Service) and the other, the HEC-1 Computer program used by the Corps of Engineers.

Both systems have been used and are currently being used in the engineering industry. In my years of experience, the Government agency in charge usually sets the standards and criteria for the project. It is a fact that of the two Agencies, the SCS, through Congress works on small projects and the Corps of Engineers works on Rivers, Harbors, large Flood Control projects as well as Military projects.

- The Gookin Report, page 8, para. 3 and page 9, para. 1 and 2 questioned "N" factors, methods and design factors.

The Corps stated they were using an 0.014 N and were designing on basis of a complex backwater analysis.

The backwater analysis is not ordinarily done on most projects due to substantial engineering time and cost, however, when it is done, it is "going the extra mile" to provide the best end results.

- The Gookin Report, page 9, para. 4 questioned the wisdom of using a roughness factor of 0.014 in the design of the channel.

In studying the Corps' report, the design is based on the use of varied "N" and coefficient factors to provide safety and economy. A roughness factor K of 0.002 was used for troweled-cement finish and 0.003 was used for rail-mounted slip traveling forms. Also 0.002 was selected for the design water surface profile to correspond to troweled surfaces and 0.007 was used to determine freeboard depths. The channel design in the cost study was made using an "N" value of 0.014 for water surface profile and using 0.016 for top of wall elevations.

The use of the above variations results in providing somewhat more freeboard and consequent safety.

The design also includes the consideration and computation for sediment loads.

Also the specifications and the quality of inspection play a substantial part of a project being completed and performing in accordance with the Engineer's designs.

In my experience, the National Park Service, Corps of Engineers and Bureau of Reclamation have an excellent reputation for top quality job inspection.

- The Gookin Report, page 10, para. 2, discusses and questions the Corps design for freeboard.

The discussion is not pertinent as the Gookin comparison is based on a combination of roughness factors instead of the 0.014 that Gookin used. See the item previous page.

- The Gookin Report, page 10, para. 3 stating a concern for, or "catastrophic failure" of the carrying capacity of the covered system as related to inadequate freeboard being acerbated by the change from an open channel to a rectangular covered conduit does not have merit.

From information contained in the Corps' Design Report, Appendix 1, Plate 15 it appears that there would be 2 feet of freeboard between the surface of the flood flow at the design capacity (8300 cfs) at the Biltmore Golf Course bridge which would be the start of the covered section. Based on the design data on said Plate 15, if an additional 500 cfs were added to the design flow, for a total of 8800 cfs, there would still be 0.3 feet of clear opening between the water surface and the underside of the concrete top. If the flow should happen to be much greater, then the water surface would rise and if it rose above the underside of the deck, the flow through the closed box section would become a pressure conduit and the flow would increase as the head on the conduit increased. Before much of this would occur though, water would begin to overflow the south side channel wall at a low elevation (similar to an Arizona Canal Spillway) and excess flood water would flow over to the Arizona Canal.

Therefore, it does not appear that there could or would be a catastrophic failure of the system.

- The Gookin Report asked for assurance that no water would enter the Biltmore property on the north side of the ACDC project that would presently not occur.

It is my understanding, from the Corps Report, that nothing would be done to alter the existing drainage and runoff patterns above the ACDC right-of-way so there would be no change over present conditions.

• The Gookin Report, page 12, para. 2, implies that the Corps would be importing flood waters for floods in excess of a 100-year storm frequency.

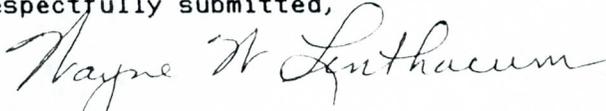
The fact is that the project would not import any storm water. The ACDC system would intercept the storm waters at the various natural and existing washes and then the ACDC would carry off the flood waters of design capacity and perhaps a little more.

The amount of floodwater above the 100-year storm would then overflow the south wall of the ACDC and enter into the Arizona Canal, and if the Canal could not take the excess water, it would overflow at its spillways as is currently the case.

The above comments are given to let you know that there are many fundamental and fixed basic laws of physics that are used in engineering problems and calculations. Throughout all engineering work there are many variables that have to be considered in the respective problems. The emergency field is so broad that one engineer is not and could not be a master of all the various types of engineering. Therefore, almost all engineers specialize in a particular field.

Our government agencies, such as the Corps of Engineers, Bureau of Reclamation, and others, with their big staffs having specialists in the various engineering fields do a very thorough and competent research and design service in the projects they undertake.

Respectfully submitted,



Wayne W. Linthacum, P.E.

MONTHLY AND ANNUAL MEAN TEMPERATURES

(Degrees and tenths, Fabr.)

Year	Jan.	Feb.	Mar.	Apr.	May	June	July	Aug.	Sept.	Oct.	Nov.	Dec.	Annual
1896	55.7	55.7	62.0	68.7	74.4	83.4	88.6	82.9	71.0	59.6	51.2	70.2	
1897	51.4	54.8	68.7	77.6	82.6	88.0	89.0	83.4	68.1	60.4	48.8	68.7	
1898	58.8	67.0	71.7	73.4	84.8	92.0	89.8	84.2	71.5	57.4	48.8	69.7	
1899	50.4	60.0	68.8	71.2	84.7	91.0	87.5	86.5	68.9	60.9	53.0	69.7	
1900	56.1	65.6	63.0	77.6	86.1	91.0	86.2	78.9	71.3	62.8	53.7	70.7	
1901	53.2	56.2	69.9	65.6	75.0	82.8	82.9	82.4	73.2	63.9	52.2	70.6	
1902	52.6	57.4	69.8	68.8	76.4	82.9	89.8	83.6	74.0	58.0	51.8	70.8	
1903	51.8	59.8	68.8	74.8	85.4	90.0	90.8	81.7	71.0	62.4	53.4	69.7	
1904	48.4	58.9	68.0	77.0	86.8	88.4	88.0	80.5	70.8	62.2	52.7	70.3	
1905	55.2	54.4	60.0	64.4	70.5	83.6	89.6	90.0	84.2	71.6	58.5	50.0	69.5
1906	51.2	54.2	60.8	65.3	72.4	84.0	91.4	85.7	81.7	71.6	58.6	54.3	69.7
1907	51.7	59.2	59.8	68.6	72.4	80.8	89.4	87.7	82.8	70.7	59.8	52.7	69.6
1908	53.4	54.2	61.0	67.6	71.5	81.8	86.6	87.9	81.7	66.8	61.4	53.2	69.7
1909	55.6	53.5	56.8	67.0	77.0	84.8	86.7	86.8	81.0	71.1	59.2	48.1	68.8
1910	51.2	54.1	65.6	70.0	79.1	83.1	89.6	89.6	86.2	72.3	60.2	54.6	71.5
1911	53.2	53.0	63.6	67.3	74.1	83.8	86.0	87.7	83.2	72.7	60.9	46.6	68.9
1912	53.0	54.2	58.6	62.1	72.2	88.6	88.3	84.6	82.4	71.8	57.2	49.6	68.2
1913	47.2	52.1	52.7	67.7	73.8	81.9	86.7	86.7	81.7	69.6	61.6	50.7	68.0
1914	54.8	53.1	63.6	68.5	75.6	84.6	88.6	89.2	84.5	71.2	63.9	50.3	70.8
1915	50.0	53.8	58.6	66.4	70.8	83.4	87.3	89.1	78.9	73.8	59.2	51.6	68.7
1916	50.8	59.6	64.0	68.2	74.0	83.9	89.0	87.0	80.9	66.2	55.8	47.1	70.9
1917	49.0	53.8	56.2	64.2	69.0	84.4	90.0	87.2	83.2	72.7	60.9	54.6	68.9
1918	49.6	55.2	62.4	67.5	72.2	88.6	88.3	84.6	82.4	71.8	57.2	49.6	68.9
1919	50.8	51.2	57.5	62.9	76.9	85.4	88.6	88.6	81.5	66.7	57.0	54.2	68.9
1920	53.3	57.6	58.4	64.6	75.9	84.4	90.6	86.4	80.4	67.0	58.6	49.7	68.9
1921	52.0	57.6	64.7	66.1	73.6	84.8	89.6	87.1	82.6	73.8	60.9	56.0	70.7
1922	48.6	54.4	57.0	63.2	76.4	86.2	90.6	89.4	85.0	71.6	55.0	53.0	69.4
1923	55.4	55.3	58.9	66.6	77.6	80.8	89.2	87.2	80.2	67.3	59.1	52.0	69.1
1924	50.4	58.8	56.6	63.0	78.8	87.8	90.2	89.4	83.6	71.2	62.8	52.0	70.7
1925	52.0	60.6	65.0	70.8	81.2	86.2	92.7	87.2	80.4	68.4	57.8	53.5	71.3
1926	49.4	58.1	63.9	68.6	75.8	87.0	89.6	88.9	83.4	73.5	61.6	51.2	68.9
1927	56.2	58.8	59.1	67.3	76.0	83.7	91.3	87.8	82.6	71.5	63.2	50.9	70.9
1928	53.2	55.1	64.1	67.8	79.4	85.9	91.8	88.4	85.2	72.6	60.2	51.4	71.2
1929	50.1	53.0	60.4	66.2	78.0	86.4	92.0	89.6	84.0	74.7	57.9	58.4	70.8
1930	52.0	60.4	60.6	72.2	71.7	86.8	91.3	89.6	82.2	70.4	60.2	52.2	70.7
1931	51.9	57.8	62.8	72.4	80.5	87.0	95.7	89.3	85.9	72.8	57.2	49.7	72.0
1932	47.0	56.8	63.9	69.2	77.3	85.0	91.8	92.1	87.0	71.3	63.0	49.3	71.0
1933	48.6	49.8	61.9	64.7	72.8	87.6	95.0	92.4	86.8	76.8	62.7	51.6	71.1
1934	54.5	60.8	70.0	74.8	83.2	83.8	94.0	90.0	84.8	75.5	61.4	56.0	74.1
1935	53.8	57.9	57.6	69.4	74.1	89.2	92.0	88.4	84.6	72.6	57.2	54.3	70.9
1936	52.8	56.4	64.6	73.1	81.7	90.3	93.2	91.4	83.6	73.2	61.8	53.7	72.9
1937	42.2	53.7	59.9	67.6	78.4	85.3	92.2	89.2	84.8	74.8	62.3	56.2	71.2
1938	52.6	54.4	57.8	66.6	78.7	83.4	88.2	88.2	84.4	69.2	55.2	53.6	69.2
1939	50.7	47.0	61.0	70.0	77.3	84.6	92.0	90.3	82.0	69.4	62.5	55.5	70.2
1940	54.6	55.2	63.6	69.5	80.8	89.1	92.0	91.3	85.0	72.7	57.7	55.6	72.2
1941	53.3	57.3	58.4	61.6	74.5	80.6	88.6	86.2	79.2	66.4	60.0	52.3	68.2
1942	52.4	51.0	57.0	64.8	73.4	83.2	91.8	87.6	83.3	70.6	61.9	54.5	69.3

MONTHLY AND ANNUAL PRECIPITATION

(Inches and hundredths.)

Year	Jan.	Feb.	Mar.	Apr.	May	June	July	Aug.	Sept.	Oct.	Nov.	Dec.	Annual
1896	0.16	0.05	0.39	0.06	T.	T.	4.25	1.77	1.18	1.02	0.64	0.67	10.48
1897	8.67	0.47	0.63	T.	0.01	0	0.59	0.61	8.67	0.15	0	0.17	9.87
1898	1.63	T.	0.03	0.18	0.01	0.05	0.24	1.03	0.04	0	1.01	1.70	5.96
1899	1.28	0.10	T.	T.	0	0.75	0.87	0.69	0.87	0.80	0.56	0.06	5.19
1900	0.11	0.01	0.22	1.12	0.12	0	1.70	0.01	0.12	0.22	1.73	0	5.89
1901	0.43	1.46	0.33	T.	0.10	0	0.35	1.74	T.	0.46	0.01	0	4.87
1902	0.79	0.10	0.46	T.	T.	0.12	0.82	0.66	1.46	T.	0.01	1.06	6.88
1903	T.	0.64	0.42	0.45	T.	0.18	0.70	0.70	8.16	0.22	0	0.14	6.61
1904	0.11	0.26	0.12	0	T.	0	1.29	1.61	1.23	T.	0	0.85	6.57
1905	3.31	4.64	2.38	2.59	.04	.15	.28	.92	1.23	.00	3.61	.58	19.73
1906	.35	.99	.67	.48	T.	T.	2.18	.80	.02	2.00	.21	T.	8.17
1907	1.15	.26	.93	.25	.27	T.	2.98	.81	.51	.32	.36	1.94	10.68
1908	.35	1.87	.41	.90	.03	T.	1.00	1.94	.42	.00	.28	1.02	6.17
1909	.09	.88	.67	.07	T.	T.	1.00	1.94	.42	.00	.28	1.02	6.17
1910	.50	T.	.61	.29	T.	T.	.65	.14	T.	.18	1.61	.34	4.32
1911	1.14	.66	.64	.02	.00	T.	6.47	1.68	1.16	2.24	T.	.11	14.12
1912	.00	.00	1.96	.52	.58	.01	1.25	.72	.13	.01	.83	.27	5.39
1913	.38	1.93	.07	.51	.06	.00	.94	.32	.30	T.	2.30	1.00	3.09
1914	.30	.71	.92	.10	T.	.05	.21	.30	T.	2.30	1.00	3.09	8.98
1915	1.79	1.21	.33	.88	.17	.48	1.12	.25	.10	T.	.54	2.54	9.41
1916	2.24	.13	.37	.15	T.	.00	.77	.30	1.66	.65	.00	.39	6.76
1917	2.30	.95	.15	1.22	.45	.00	3.97	.11	.55	T.	.00	.00	9.60
1918	1.14	.45	.93	.02	T.	.08	1.02	3.47	.39	.52	1.92	1.16	11.10
1919	1.22	.75	.97	.17	.06	T.	1.05	2.40	1.93	.25	2.38	.13	10.31
1920	1.42	1.46	1.35	.00	.42	T.	.25	.75	.10	.46	T.	T.	6.21
1921	1.13	1.11	.03	.02	.17	.04	.38	1.62	.33	.11	.04	.87	3.85
1922	1.29	.42	.99	.24	.26	T.	.74	.57	.13	T.	1.04	.28	5.96
1923	2.28	.46	1.08	.05	.08	.00	.77	.65	.97	.22	2.84	2.23	9.63
1924	.00	T.	.99	.22	.01	T.	.09	.14	.12	.30	T.	1.16	3.03
1925	.03	.02	.33	.51	.03	.21	.03	.61	.95	.92	.12	.40	4.16
1926	1.00	.10	1.63	3.36	.18	T.	1.31	.11	3.52	.07	.01	2.68	13.97
1927	.01	1.06	.24	.35	.17	.13	.24	.69	.83	.57	1.04	1.30	5.73
1928	T.	1.33	.13	T.	.03	.00	.11	1.47	.44	1.31	.16	1.01	6.19
1929	.97	.28	.13	.43	.01	T.	.79	.20	.19	.08	.11	T.	5.04
1930	1.69	.19	1.77	.20	1.31	.16	.68	.86	.51	.16	.51	T.	8.04
1931	.02	3.71	.07	.40	T.	.02	.02	1.70	.23	.22	3.18	.75	10.32
1932	.10	2.12	.05	.00	.00	.23	.11	.19	.34	1.73	.00	1.84	6.67
1933	2.31	.15	.00	1.11	T.	.23	.30	.38	1.62	.38	.62	T.	7.10
1934	.40	.99	.10	.07	.10	.03	.11	1.07	.66	.00	.63	1.71	5.87
1935	.95	3.18	1.39	.09	.14	.00	.93	1.27	1.30	.13	.56	.39	10.33
1936	8.01	1.01	.30	.14	T.	T.	2.49	.22	.43	.13	.35	2.12	8.29
1937	.82	.76	1.58	T.	.08	T.	.49	.05	1.17	T.	.90	.14	2.37
1938	.51	.88	.77	.02	T.	.36	.08	.97	T.	.00	.90	1.62	5.01
1939	.27	.59	.11	.11	.00	.00	.77	1.18	4.23	.10	.47	T.	7.83
1940	.01	.51	T.	.04	T.	T.	.33	.54	1.47	1.05	.29	3.94	8.18
1941	.97	2.02	4.16	2.10	.81	T.	.79	.85	1.82	.52	1.16	1.06	16.26
1942	.36	.21	.22	.69	.00	.00	1.14	1.29	.07	.60	T.	.29	4.87

Average Temperature

Year	Jan	Feb	Mar	Apr	May	June	July	Aug	Sept	Oct	Nov	Dec	Annual
1943	51.7	57.4	63.2	70.7	77.5	83.4	88.0	87.4	83.0	71.1	59.4	52.0	70.8
1944	49.4	51.6	64.0	70.4	78.4	84.0	89.0	83.0	71.2	56.4	52.0	64.7	
1945	50.4	56.6	55.8	65.									

PRECIPITATION (inches)

PHOENIX, ARIZONA

YEAR	JAN	FEB	MAR	APR	MAY	JUNE	JULY	AUG	SEP	OCT	NOV	DEC	ANNUAL
1955	2.41	0.09	T	T	0.02	0.95	4.19	1.80	T	0.13	0.05	0.18	9.82
1956	0.67	0.64	0.00	0.03	T	0.01	0.92	0.46	0.02	0.06	0.00	0.01	2.82
1957	1.57	0.21	0.53	0.12	0.43	0.26	0.72	0.85	0.00	2.66	0.02	0.23	7.60
#1958	0.07	1.15	1.94	0.89	0.08	0.05	0.31	0.72	2.25	0.50	0.16	0.00	8.12
1959	0.23	0.63	0.00	0.05	T	T	0.45	1.36	0.04	1.75	0.43	3.46	8.40
1960	0.85	0.04	0.57	0.00	T	T	0.25	0.82	0.12	0.67	T	0.07	3.39
1961	0.23	0.01	0.41	T	T	T	0.40	2.11	0.22	0.08	0.12	0.85	4.43
1962	1.20	0.83	0.50	0.00	T	0.12	0.10	0.25	0.39	T	0.03	0.48	3.90
1963	0.55	1.16	0.30	0.33	T	0.00	0.03	2.68	T	1.46	0.73	T	7.24
1964	0.22	0.01	0.37	0.10	T	0.00	0.60	1.29	1.80	0.17	0.35	1.09	6.00
1965	1.22	0.91	1.39	1.35	0.16	0.91	0.16	0.18	0.60	0.20	0.92	3.19	11.19
1966	0.35	0.95	0.34	T	T	0.22	0.09	2.17	2.00	0.25	0.38	0.52	7.27
1967	0.25	0.00	0.43	0.08	0.05	0.47	0.99	0.02	0.13	0.67	1.27	3.98	8.34
1968	0.19	1.20	1.04	T	T	0.00	1.70	0.59	0.00	0.35	0.91	0.69	6.67
1969	1.37	0.78	0.56	0.03	0.26	0.00	0.28	0.14	2.11	0.08	0.65	0.68	6.94
1970	T	0.30	2.26	T	T	0.00	0.48	1.02	2.85	0.44	0.02	0.26	7.63
1971	0.22	0.35	T	0.13	T	0.00	0.24	0.99	0.92	0.27	T	0.47	3.59
1972	0.00	T	T	T	T	1.70	0.72	1.20	0.28	4.40	1.01	1.56	10.87
1973	0.13	1.36	1.69	0.07	0.10	T	1.30	T	0.00	0.00	1.36	0.00	6.01
1974	0.57	0.02	1.37	0.01	0.00	0.00	0.84	1.15	1.07	2.12	0.44	0.59	8.18
1975	0.02	0.33	0.63	0.43	T	T	0.38	T	0.82	0.23	0.55	1.12	4.51
1976	T	0.47	0.40	0.67	1.06	0.09	1.48	0.12	1.69	0.70	0.43	0.85	7.96
1977	0.35	0.06	0.27	0.06	0.16	0.10	0.30	0.18	0.53	0.61	T	0.54	3.16
1978	2.33	2.21	2.14	0.20	T	0.01	1.44	1.79	T	0.35	2.30	2.46	15.23
1979	2.16	0.09	1.78	0.02	0.76	0.04	0.34	1.18	0.09	0.09	0.12	0.13	6.80
1980	1.58	2.09	0.86	0.44	0.21	0.03	0.56	0.06	0.13	0.02	0.00	0.08	6.06
1981	0.71	1.08	0.98	0.20	0.03	T	1.14	0.11	0.18	1.34	0.95	0.00	6.72
1982	0.81	0.67	1.30	T	0.50	T	0.43	1.97	0.12	T	2.50	1.64	9.94
1983	0.70	1.17	3.17	0.18	0.00	0.00	0.38	2.48	2.43	0.71	0.43	1.16	12.81
1984	0.31	0.00	0.00	0.91	0.18	0.18	5.15	0.87	3.36	0.31	0.71	2.93	14.91
Record Mean	0.76	0.74	0.73	0.34	0.14	0.10	0.93	1.02	0.80	0.51	0.63	0.90	7.59

See Reference Notes on Page 6B.  
Page 4A

AVERAGE TEMPERATURE (deg. F)

PHOENIX, ARIZONA

YEAR	JAN	FEB	MAR	APR	MAY	JUNE	JULY	AUG	SEP	OCT	NOV	DEC	ANNUAL
1955	48.7	50.9	61.6	66.7	75.6	83.7	86.7	86.6	82.9	75.7	59.1	55.8	69.5
1956	56.0	50.9	61.6	66.1	76.9	86.9	87.9	85.8	84.6	69.7	57.8	53.3	69.8
1957	54.0	61.4	61.8	66.5	72.9	87.1	91.4	88.0	83.2	70.6	56.4	55.0	70.7
#1958	53.0	58.0	57.0	66.7	81.3	89.1	93.6	92.7	86.6	76.6	61.4	56.0	72.7
1959	53.8	53.9	63.6	73.5	76.3	90.3	94.0	88.1	83.3	72.7	60.9	53.6	72.0
#1960	48.5	51.5	65.1	70.4	77.8	90.0	92.4	89.7	85.9	70.6	60.5	50.5	71.1
1961	54.2	55.6	59.6	69.2	75.6	88.6	91.7	88.6	80.6	69.6	57.1	52.3	70.2
1962	51.5	55.7	56.0	72.3	73.5	83.1	90.2	91.7	84.3	71.6	61.9	55.0	70.6
1963	48.4	60.2	61.0	65.8	80.0	81.7	92.0	87.1	85.1	76.2	61.9	51.8	71.0
1964	46.7	49.3	56.5	65.2	73.7	82.6	90.6	86.2	80.9	74.9	55.5	52.0	67.8
1965	52.7	52.4	56.1	63.4	71.8	79.0	91.0	89.0	79.2	73.8	62.1	52.9	68.6
1966	48.2	49.7	61.2	69.8	80.1	86.8	93.0	90.9	82.9	70.9	60.5	52.0	70.5
1967	50.7	55.7	62.8	62.4	75.1	81.1	91.6	91.0	84.8	73.5	63.9	48.2	70.1
1968	52.4	59.7	59.9	66.7	76.6	86.2	90.2	86.5	83.6	72.7	59.2	49.5	70.3
1969	54.9	53.0	56.9	68.5	78.3	84.2	93.1	94.4	86.0	69.5	62.1	54.8	71.3
1970	52.1	60.2	59.5	64.7	79.6	88.1	95.0	92.5	82.2	69.1	61.4	52.6	71.4
1971	52.2	56.3	63.3	66.5	73.3	85.3	94.9	89.6	85.6	69.3	59.7	50.2	70.5
1972	51.4	59.1	70.6	71.4	78.3	87.8	94.4	89.9	84.8	71.9	58.1	52.1	72.5
1973	51.2	57.5	56.6	67.2	80.9	88.1	93.5	93.4	84.7	74.4	60.8	55.4	72.0
1974	54.0	56.7	64.5	70.6	80.2	92.2	92.4	91.2	87.2	75.9	61.5	50.6	73.1
1975	52.3	54.0	59.0	62.6	76.7	86.6	94.3	91.9	86.2	72.9	60.9	54.8	71.0
1976	55.4	60.7	61.5	68.7	80.7	87.9	91.6	90.7	83.0	74.0	64.1	55.6	72.8
1977	53.8	61.7	60.8	73.5	75.7	91.4	95.0	94.1	87.6	78.7	65.8	59.9	74.9
1978	56.6	58.7	65.6	69.2	78.5	90.9	94.6	91.4	86.3	78.6	61.5	51.7	73.6
1979	50.1	55.7	60.4	70.1	78.1	89.5	93.8	89.4	90.2	77.2	58.2	55.9	72.4
1980	56.6	60.6	60.7	69.8	76.0	88.9	95.6	92.2	87.3	75.6	64.1	61.3	74.0
1981	59.2	61.4	63.8	76.0	80.5	93.4	95.2	95.8	89.2	73.6	66.1	58.6	76.0
1982	53.9	60.1	62.4	72.5	80.4	88.1	93.7	93.7	86.7	73.5	61.9	54.1	73.4
1983	56.0	58.4	62.2	66.6	80.6	88.6	95.5	92.6	91.0	77.2	62.4	57.2	74.0
1984	57.4	60.1	67.6	70.7	87.0	88.9	91.7	91.2	87.5	71.4	61.9	53.7	74.1
Record Mean	51.9	55.9	60.7	68.0	76.3	85.7	91.2	89.3	83.9	72.1	60.1	52.8	70.7
Max	65.1	69.4	74.7	83.1	92.1	101.8	104.3	102.1	97.9	87.0	74.7	66.0	84.8
Min	38.7	42.3	46.7	52.9	60.6	69.5	78.0	76.6	69.9	57.2	45.6	39.5	56.5

See Reference Notes on Page 6B.  
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TO Arizona Canal DATE August 1, 1985  
 Diversion Channel Taskforce

FROM <sup>KC</sup> Kathy Cale, Management Assistant  
 Management and Budget Department

SUBJECT INFORMATION REQUESTS

Attached are lists of Information Requests submitted by Taskforce members.

Included are:

1. List dated July 22, 1985 by Jasper Hawkins
2. Addendum to above list (July 22, 1985), dated July 29, 1985 by Jasper Jawkins
3. List by Richard Lee dated July 22, 1985.

jo

*LJR - deal w/ addendum  
IC*

AGENDA ITEM 10 (documents and/or information to be requested for T.F.)

1. City of Phoenix and/or Maricopa County and their effected departments.

- ACD ✓ A. Financial obligations incurred to date on the ACDC with Reach Four separate.
- ACD ✓ B. Financial obligations projected for future ACDC work with Reach Four separate.
- ACD ✓ C. Legal obligations relative to flooding with and without construction of Reach Four.
- ACD ✓ D. Official actions relative to approving continuance of Reach Four expenditures after defeat of Bond Issue by the public.
- ACD ✓ E. Official actions relative to consideration of any alternatives to the current Reach Four proposal. (Incl. AV)

2. Corps of Engineers and/or Maricopa County Flood Control District

- ACD ✓ A. Agreement between PRC and the Maricopa County Flood Control District.
- COE ✓ B. Details of all alternatives considered in relationship to the current Reach Four Proposal.
- COE ✓ C. A listing of all factors to be considered in a cost/benefit ratio analysis and the weighting given each factor.
- COE ✓ D. Expenditures to date on ACDC with Reach Four separate.
- COE ✓ E. Listing of all ACDC records destroyed by the Corps.
- COE ✓ F. List of all consultants utilized for development of alternatives to the current Reach Four proposal.
- COE ✓ G. Date for issuance of up-dated cost/benefit ratio on ACDC requested by Congressman Rudd.
- COE ✓ H. Soils test data indicating the degree of difficulty to be encountered for excavation requirements for Reach Four.

3. SRP

- A. A Reach Four map depicting location of canal breaks, description of each, and an estimate of magnitude of normal canal flow diverted through the various breaks during the 1972 Flood.
- B. Description of the impact of the cross-cut canal conversion on potential future flooding in Reach Four.

page 2

- C. Description and map showing where potential over-topping of canal could occur in the Reach Four area based on the existing elevation of the canal banks and Reach Four not in place.
- SRP 4, 00 ✓ D. Description of potential flooding north of the canal at the Cudia City wash outlet and along Reach Four if the ACDC were not in place.
- E. Description of any change in SRP liability for flooding if Reach Four is or is not constructed.

AGENDA ITEM 6 (Documents and/or Information to be requested for the T.F.)

1. City of Phoenix and/or Maricopa County Flood Control District

- ACD* ✓ A. Report describing the potential use of all or portions of Reach Four and Reach Three floodwaters for re-charging of aquifers in the same general area or other areas deemed more appropriate. If determined to be technically feasible, then the report should include a description of the methodology and an estimate of the costs involved.
- CITY* B. A map depicting all storm sewers proposed for construction, under construction or existing that are planned to flow into Reach Four and Three of the ACDC. Map should designate the individual flows projected at their entrance into the ACDC. Map to be accompanied by a report describing all alternatives to the sewers flowing into the ACDC and set forth any additional costs to be incurred for each alternative and the entity or entities responsible for such costs.
- CITY* ✓ *ACD* C. Legal Assessment of the responsibilities of the Town of Paradise Valley to physically share in the mitigation of the Cudia City Wash flood flows, of which 90% emanate within the Town of Paradise Valley. This assessment should include the legal ramifications of the development that has been permitted within the Town of Paradise Valley since 1972, that has increased the rate of flow of flood waters in the Cudia City Wash.
- SRP* ✓ D. Legal assessment of the responsibilities of SRP relative to flooding damage caused North of the canal due to the "daming effect" of the elevation of the canal above the adjacent ground level, causing storm waters to pond and collect on the North side of the canal.
- CITY* ✓ E. Legal assessment of the responsibilities of any entities for permitting development since 1972 in the natural Cudia City Wash runoff area South of the Arizona Canal as well as any responsibilities for constructing the Arizona Canal across the Cudia City Wash and creating a Dam effect on the normal flow of water down the Cudia City Wash.
- COE* ✓ F. A report that establishes the flood control need for extending the ACDC from East of 12th Street to 36th Street, assuming no contribution of Cudia City Wash flows and that they will be handled otherwise.

ACDC TASK FORCE

CITY OF PHOENIX

JULY 29, 1985

- PCD* ✓ G. A list of what specific work items are to be assigned to PRC under their current agreement with County Flood Control.
- COE* H. A study of the alternative of conducting Cudia City Wash flood flows down (a) 40th St. (b) 44th St. (c) 48th St. (cross-cut canal) to the Salt River. Study should describe technical feasibility and costs inclusive of a cost/benefit analysis for each.

2. Corps of Engineers

- COE* A. A project by project listing of all storm drainage projects from 1965 to present, that the Federal share of the initial budget was in excess of fifty million dollars. The date and dollar amount of each initial budget, and whether the project was designed for standard project or 100 year flood flows, the name of the individual to contact at the local agency and their phone number.
- COE* ✓ B. A description of the analysis made to determine whether the design criteria for a project should be a standard project flood or 100 year flood flow. What entity makes such an analysis and ultimately what entity legally adopts such design criteria.
- COE* C. Description of what criteria establishes flood water control as different from storm water control, and whether local storm water control costs are a part of the ACDC costs to be borne by the Federal government.

3. Congressman Eldon Rudd

- Rudd* A. Description of How and Why cost benefit analysis is used by the Congress in evaluating the merits of a storm drainage project for funding and How and When the cost benefit analysis is up-dated due to the extreme longevity of most projects from initial authorization to completion. Are there examples of historical precedence for discontinuance of projects that due to their longevity and or changes in local area conditions, no longer meet Congressional standards for the cost benefits to be derived by the public?

4. S.R.P.

- SRP* A. What systems/devices/programs have been put in place since June, 1972 to mitigate the impact of flood waters on the Arizona Canal? Specifically describing those that have an impact on the Reach Four area.

## POSSIBLE INFORMATION REQUESTS

Richard Lee, Chairman

- COE* 1. Costs of increasing or reducing the carrying capacity of Reach IV or the balance of the project. Costs for changes in Reach IV and the resulting costs for the balance of the project.
- COE of CITY* 2. Information on City plans for Parks and Recreational projects along the ACDC, particularly Reach IV. What new recreational facilities will be created, all costs which will be borne by the City in connection with these facilities, the contribution of the Corps of Engineers with respect to these facilities, the total costs of building these facilities and the costs of maintaining these facilities. Estimates on the value/usefulness of the new recreational areas. What would the City do if there were no federal funds available for these recreational projects? How would the City spend the funds for this project if it were not used on this project and what do they believe is the value of the resulting improvements?
- CITY* 3. Information from City Engineering files - all relevant reports.
- CITY* 4. Copies of all memos, documentations, and resolutions presented to or acted on by the Phoenix City Council pertaining to ACDC.
- Committee* 5. Information from Congressional offices such as Rudd's and Udall's on the ACDC project.
- Committee* 6. Information available from the Environmental Defense Fund and possibly the Sierra Club concerning the performance of Corps of Engineers flood control projects, specifically their cost projections, and actual costs including over-runs.

8/12/85

ACDC TASK FORCE DISCUSSION ON

INFORMATION REQUESTS/LIST OF ISSUES TO ADDRESS

1. Dave Harmon

- Copies of <sup>FEMA</sup> ~~Fema~~ Flood Control Maps and Underlying Studies/Documents of areas that Reach III and Reach IV will impact and asked that an outline of study be put in Library.

2. needs clarification  
city map handles this (1972 overflow)

Drainage patterns impacted by Reach IV and how much of actual flooding is defined by the lay of the land versus where the break happens to be placed.

Don SRP

✓ - <sup>Furnished at meeting of 8/20/85</sup>

Figures on Salt River Project's costs and damages/repairs by flood. Mr. Weesner indicated that he did not think costs were broken down this way, but he will investigate it.

4. see (John will check)  
1972 Flood Report

✓ - Regarding 1972 Flood Report by the City, and detail extent of information on flood damage is broken out to determine costs borne by City, private individuals, County, Salt River Project and Federal facilities involved. He indicated staff to present status on this information at next meeting.

## 5. liability

5 tentatively on Wed Aug 21 Agenda Verbal Report

- Information on liability issues from both Attorney's Office and Salt River Project. In addition, a general comment on the change in liability on public institutions. He noted that ~~traditionally~~ additionally, municipalities and State institutions were not subject to suit. The trend was "Sovereign Immunity", in which government can do no wrong. However, this protection has been eroding rather rapidly.

- General comments on the change in liability of the Flood Control District with respect to the construction of the ACDC both as a matter of law in terms of the assumption of the duties pursuant to the contract. He noted that Dan Sagramoso can direct staff to the right documentation. Within legal contract, is there a pattern where in which Federal Government has assumed liability for design flaws or defects?

6. Mr. Lee noted he is very interested in obtaining information on City costs in addition to property damage. An example would be any additional costs other than property damage borne by the City such as the increase in Police and Fire Protection, Sanitation etc.

Engineering  
BARRIS

Information on how costs were shifted by insurance in the case of the 1972 flood. He indicated that flood insurance is not required now in this area. In connection with the ~~FEMA~~ <sup>FEMA</sup> Studies the flood ~~insurance~~ <sup>plain management</sup> spokesman may have some general comments or brochures on flood insurance.

How much did insurance companies pay for?  
Was there a flood plain ordinance at that time?

FCP  
+  
Corps 8 ✓

Any information concerning any liability incurred by the Corps of Engineers or any local sponsors that resulted from any sort of failure from any flood control project.

Mr. Lee moved that staff pursue these requests. Motion was seconded. Motion passed.

19. on spot.

Mr. Lee requested information by SRP on the frequency of overtopping the canal other than the canal breaks over the years and damage information about the results. ~~Mr. Stan Lutz~~ <sup>Mr. Weesner</sup> responded that researching every report on this area would be a massive project. Mr. Lee asked if within the last four to five years has overtopping resulted into flood damage. ~~Mr. Lutz~~ responded that no major damage has resulted in the public streets. Mr. Lee asked by concentrating on the canal breaks would really be identifying the damages of the ACDC; thus safely assuming that the overtopping of the spillways are not the major source of costs? Mr. ~~Lutz~~ <sup>Weesner</sup> responded it depends on the magnitude.

SRP

COE  
Corps 10 ✓ on spot.

Mr. Lee requested information from the Flood Control District and the Corps of Engineers of what the costs would be for the changing the carrying capacity of Reach IV either up or down and the effects if the capacity was changed all the way down the line. Mr. Sagramoso responded that this question is too difficult to answer as it is too general. Basically, if the capacity goes up, the costs go up and vice versa. Every increment will result in a different answer as it requires a lengthy analysis to answer with any precision.

Mr. Lee asked if there was a relationship between the size of the increase or decrease and the costs. Mr. Sagramoso responded there was no relationship. Mr. Lee <sup>asked as</sup> described an example ~~as a lot of questions were asked about it~~; what would be the effect on the balance of the ACDC if it was downsized (e.g. Reach IV was eliminated) and if the remainder of the project were not left as it is in anticipation of Reach IV. What would the effect be on the costs? Also, if the capacity was increased to cover a <sup>200</sup>~~100~~-year flood, would this require additional right-of-way and what would be the increase in costs? Mr. Lee noted that he referred to both increased capacity and increased width. Mr. Lutz responded that these requests could not be answered without extensive analysis. However, the cost to downsize the canal and drop out Reach IV would result in \$15 million in savings downstream, ~~in addition to cost of drilling and adding Reach IV~~. To Mr. Lee's inquiry Mr. Lutz responded that in 1982 PRC Engineering did this analysis as part of the alternative where the canal was downsized through the use of a detention basin. \$15 million represented 1982 dollars.

11/6 Information on City plans for Parks and Recreational projects along the ACDC, particularly Reach IV. What new recreational facilities will be created, all costs which will be borne by the City in connection with these facilities, the contribution of the Corps of Engineers with respect to these facilities, the total costs of building these facilities and the costs of maintaining these facilities. Estimates on the value/usefulness of the new recreational areas.

*Tentatively set for Aug 19 Agenda Verbal report*

What would the City do if there were no federal funds available for these recreational projects? How would the City spend the funds for this project if if were not used on this project and what do they believe is the value of the resulting improvements?

12. All relevant reports from City Engineering files. Copies of all memos, formal actions, documentations and resolutions presented to or acted on by the Phoenix City Council pertaining to ACDC. Mr. Attebery responded that this information should be available at the next meeting.

Mr. Lee moved that staff research this request. Ms. Wolf seconded the motion. Motion passed.

Mayor ~~Tom~~ <sup>Joan</sup> Lincoln of Paradise Valley indicated that the City would <sup>also</sup> respond to some of these information requests.

13. Information of the first costs <sup>(Capital)</sup> (in actual or constant dollars) for the project in Reach IV and the breakdown of costs for flood aesthetics and parks, detail of sources of funding (federal, county, local). Information on what has already been spent and the estimate of what will be spent. Need for consistency in dollars for comparison purposes.

14. Information on the Corps of Engineers' costs which include imputed costs such as the value of the land taken or purchased; <sup>i.e.</sup> ~~the~~ Arizona Biltmore.   
 *what was the value attributed to the easements*

*Information has been submitted will be available in library*

*See TAB 6, Table 11 in Tour Notebook (Document C-2)*

*COE*

Mr. Lee asked, with regard to the Biltmore property, what costs are included in the ~~corps~~ <sup>Corps</sup> figures for the equivalent of that easement <sup>P 15</sup> If Reach IV was

eliminated, what would be the market value of the <sup>land</sup> right-of-way <sup>already acquired</sup>.  
(How much cost can be recovered?)

FCD  
15 ✓

Information on the construction scheduling and timing of the canal which would affect business and facilities.

16 ✓  
COE

To Mr. Lee's inquiry, Mr. Sagramoso stated that the City, Corps and District can respond to some of this information within one week. Certain requests will require lengthy research which could result in not having this information available by the end of September. Mr. Lee requested that staff present a status of this information by the end of the week. Mr. Sagramoso responded that <sup>some</sup> cost information has already been provided.

Mr. Hawkins requested an explanation of the value given to the Biltmore property. Mr. Sagramoso responded that the \$7 million figure reflects the out-of-pocket expenditures of the Flood Control District. Mr. Lee noted that the Corps' cost include imputed costs as well. Mr. Sagramoso indicated that

<sup>District</sup> the Corps has spent ~~\$7~~ <sup>55</sup> million. The Flood Control District's <sup>total</sup> costs <sup>are</sup> ~~estimated at~~ <sup>amount to</sup> \$90 million.

Mr. Sagramoso noted that staff could come in and present an overview of the recreational issues, etc. <sup>Staff will</sup> He will provide a list of possible meeting <sup>dates and subjects</sup> ~~times~~ at the next meeting of the Task Force for review.

*Discussion of Information Requests from list prepared by Jasper Hawkins (see Attached list).*

i. City of Phoenix, Maricopa County and Effected Departments:

Items A, B and C should be covered when staff responds to Mr. Lee's information requests that were previously mentioned.

Mr. Lee noted that Item D refers to official actions by the City of Phoenix, Paradise Valley and the District relative to approving continuance of ACDC expenditures after defeat of Bond Issues by the public.

Item E should be addressed to the City, Maricopa County and Town of Paradise Valley regarding official actions relative to the alternatives of the current ACDC proposal. Mayor Lincoln, Paradise Valley, responded that this information will be presented to the Task Force when it becomes available.

Mr. Lee moved that information outlined in Item D and E be formally requested with the understanding that official actions need not particularly related to Reach IV. The motion was seconded and passed.

Corps of Engineer and/or Maricopa County Flood Control District:

Item A has already been given to the Task Force. Item B can be answered in existing documents. Mr. Attebery noted that the public reports address this information.

Item C will be addressed in the Economic Report being developed by staff. Mr. Lutz indicated that Item D can not be specifically addressed as only the costs for the whole project are available; the County or Corps have not separate the costs with Reach IV. To Mr. Lee's inquiry, Mr. Lutz responded that the Corps' costs on Reach IV reflect only the design costs. However, staff will estimate costs incurred as well as future costs.

The Corps will try to obtain a listing of all destroyed ACDC records (Item E) by obtaining input from various individuals. In addition, Item F (list of consultants) will also be researched by the Corps of Engineers.

Mr. Sagramoso indicated that a design report is being prepared to address Item H (soils test data). However, the date of completion is the end of September. Mr. Lee added Item I in which staff would prepare a memorandum to the Task Force on the information addressed in this report as well as when this report will be completed. Mr. Lee further requests City and Salt River Project's comments on the soils test data. To Mr. Lee's inquiry, the information on the soil was based on staff's observations rather than on the U.S. Conservation Service Reports.

Mr. Lee moved that the Corps and/or Maricopa County on Items B, D, E, F, H & I. The motion was seconded and passed.

Salt River Project:

The Task Force has a map to address Item A. Mr. Lee asked, when the canals broke, how much water in the canal also filtered out. Mr. Weesner responded that hardly no water left as 48th Street had been dumped much earlier in the morning. By the time the canal broke, only flood waters remained. Salt River Project had diverted ordered water at 7:30 that morning. To Mr. Lee's inquiry, Mr. Weesner responded that ordered water is defined as irrigation water coming from the dams.

Regarding Item B, Mr. Hawkins asked if there has been any increase in the carrying capacity in the old cross-cut canal since 1972, or the ability to get water from the Arizona canal into the cross-cut canal. Mr. Weesner responded that no changes other modifying the gates in order to move the design capacity of the canal through the old cross-cut canal to move it down to the river. Mr. Lee questioned the changes in the gates. Mr. Weesner responded that the vertical type gate were just modified and updated.

Item C and D have already been given to the Task Force. SRP will follow up on Item E regarding any changes in SRP liability for flooding with or without Reach IV.

Mr. Pickrell further requested two other areas to be studied:

- Cost comparison between using <sup>ADIGHT</sup> rod iron fences versus chain link fence due to the aesthetic concerns of project
- Comments on pigmentation/coloration of the channel

Mr. Lee moved that the Task Force formally request this information. Ms. Cody seconded the motion. Motion passed.

Mr. Pickrell discussed the vulnerability of homes north and south of the canal now built on slabs rather than on foundations. He asked if either the Corps or City can obtain information on the effect of changing the construction standards on flooding for different types of foundations. Mr. Sagramoso noted that there is more concern over the first floor elevation than the type of foundation. The changes in the building code determine construction. Ms. Cody noted that this information is unnecessary. Mr. Pickrell withdrew his request.

The Task Force discussed information requests listed under Agenda Item 6. Item B has already been given to Task Force.

Mr. Lee requested that Item 1A be discussed in detail by the Task Force on Monday. Mr. Weesner noted that the soils report should indicate that portions of Reach IV cannot be used for recharging aquifers in the same area.

Mr. Lee proposed that the July 29 addendum to Mr. Hawkins' list be discussed on Monday.

AGENDA ITEM 10 (documents and/or information to be requested for T.F.)

1. City of Phoenix and/or Maricopa County and their effected departments.

- duplicates questions on preceding list*  
*See Table in Document C-2*
- A. Financial obligations incurred to date on the ACDC with Reach Four separate.
  - B. Financial obligations projected for future ACDC work with Reach Four separate.
  - C. Legal obligations relative to flooding with and without construction of Reach Four.
  - D. Official actions relative to approving continuance of Reach Four expenditures after defeat of Bond Issue by the public.
  - E. Official actions relative to consideration of any alternatives to the current Reach Four proposal.

2. Corps of Engineers and/or Maricopa County Flood Control District

- FCD*
- A. Agreement between PRC and the Maricopa County Flood Control District.
  - B. Details of all alternatives considered in relationship to the current Reach Four Proposal.
  - C. A listing of all factors to be considered in a cost/benefit ratio analysis and the weighting given each factor.
  - D. Expenditures to date on ACDC with Reach Four separate.
  - E. Listing of all ACDC records destroyed by the Corps.
  - F. List of all consultants utilized for development of alternatives to the current Reach Four proposal.
  - G. Date for issuance of up-dated cost/benefit ratio on ACDC requested by Congressman Rudd.
  - H. Soils test data indicating the degree of difficulty to be encountered for excavation requirements for Reach Four.

3. SRP

- SRP*
- A. A Reach Four map depicting location of canal breaks, description of each, and an estimate of magnitude of normal canal flow diverted through the various breaks during the 1972 Flood.
  - B. Description of the impact of the cross-cut canal conversion on potential future flooding in Reach Four.

- C. Description and map showing where potential over-topping of canal could occur in the Reach Four area based on the existing elevation of the canal banks and Reach Four not in place.
- D. Description of potential flooding north of the canal at the Cudia City wash outlet and along Reach Four if the ACDC were not in place.
- E. Description of any change in SRP liability for flooding if Reach Four is or is not constructed.

JULY 29, 1985

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BY

JASPER HAWKINS

(Addendum to list  
dated July 22, 1985)

AGENDA ITEM 6 (Documents and/or Information to be requested for the T.F.)

1. City of Phoenix and/or Maricopa County Flood Control District

- FCD*
- A. Report describing the potential use of all or portions of Reach Four and Reach Three floodwaters for re-charging of aquifers in the same general area or other areas deemed more appropriate. If determined to be technically feasible, then the report should include a description of the methodology and an estimate of the costs involved.
- City Engineering*
- B. A map depicting all storm sewers proposed for construction, under construction or existing that are planned to flow into Reach Four and Three of the ACDC. Map should designate the individual flows projected at their entrance into the ACDC. Map to be accompanied by a report describing all alternatives to the sewers flowing into the ACDC and set forth any additional costs to be incurred for each alternative and the entity or entities responsible for such costs.
- FCD*
- C. Legal Assessment of the responsibilities of the Town of Paradise Valley to physically share in the mitigation of the Cudia City Wash flood flows, of which 90% emanate within the Town of Paradise Valley. This assessment should include the legal ramifications of the development that has been permitted within the Town of Paradise Valley since 1972, that has increased the rate of flow of flood waters in the Cudia City Wash.
- SRP*
- D. Legal assessment of the responsibilities of SRP relative to flooding damage caused North of the canal due to the "daming effect" of the elevation of the canal above the adjacent ground level, causing storm waters to pond and collect on the North side of the canal.
- Engineering*
- E. Legal assessment of the responsibilities of any entities for permitting development since 1972 in the natural Cudia City Wash runoff area South of the Arizona Canal as well as any responsibilities for constructing the Arizona Canal across the Cudia City Wash and creating a Dam effect on the normal flow of water down the Cudia City Wash.
- COE*
- F. A report that establishes the flood control need for extending the ACDC from East of 12th Street to 36th Street, assuming no contribution of Cudia City Wash flows and that they will be handled otherwise.

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CITY OF PHOENIX

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FCD

G. A list of what specific work items are to be assigned to PRC under their current agreement with County Flood Control.

COE

H. A study of the alternative of conducting Cudia City Wash flood flows down (a) 40th St. (b) 44th St. (c) 46th St. (cross-cut canal) to the Salt River. Study should describe technical feasibility and costs inclusive of a cost/benefit analysis for each.

2. Corps of Engineers

COE

- A. A project by project listing of all storm drainage projects from 1965 to present, that the Federal share of the initial budget was in excess of fifty million dollars. The date and dollar amount of each initial budget, and whether the project was designed for standard project or 100 year flood flows, the name of the individual to contact at the local agency and their phone number.
- B. A description of the analysis made to determine whether the design criteria for a project should be a standard project flood or 100 year flood flow. What entity makes such an analysis and ultimately what entity legally adopts such design criteria.
- C. Description of what criteria establishes flood water control as different from storm water control, and whether local storm water control costs are a part of the ACDC costs to be borne by the Federal government.

3. Congressman Eldon Rudd

?

A. Description of How and Why cost benefit analysis is used by the Congress in evaluating the merits of a storm drainage project for funding and How and When the cost benefit analysis is up-dated due to the extreme longevity of most projects from initial authorization to completion. Are there examples of historical precedence for discontinuance of projects that due to their longevity and or changes in local area conditions, no longer meet Congressional standards for the cost benefits to be derived by the public?

4. S.R.P.

SRP

A. What systems/devices/programs have been put in place since June, 1972 to mitigate the impact of flood waters on the Arizona Canal? Specifically describing those that have an impact on the Reach Four area.

Met with Verne  
Schweigert on 8/14/85  
and agreed to make the  
penciled changes.  
- DeDagranoto

I-6

Revised 8/12/85

REVISED LIST

SUMMARY OF ARGUMENTS AGAINST REACH IV

COST/BENEFIT ISSUES

1. Reach IV will not be cost effective, i.e. benefits will be less than construction costs.
2. Discount rate of 3 1/4 used by Corps of Engineers to figure cost/benefits is unrealistically low.
3. Costs of the project have been underestimated and actual costs will be much higher.
4. Reach IV jeopardizes the entire ACDC Project because of its poor cost/benefit ratio. (Congress may withdraw funding.)
5. Costs estimates for Reach IV vary between \$70 and \$114 million.
6. New predictions of sediments from washes will reduce the 100-year flood design without ~~\$25 million in local funds~~ for sediment basins.  
\$3.6
7. Local costs have been underestimated because liability for damages in connection with the construction (such as the closure of the Biltmore Hotel) have not been considered.
8. Annual operations and maintenance costs have been underestimated for structural maintenance and aesthetic treatment.
9. The 65 feet of easement obtained from the Biltmore is not adequate. Substantial additional local costs may be incurred to acquire more easement.
10. The Biltmore Hotel will have to be closed down for one year during construction of Reach IV, forcing the layoff of 1,100 employees, severe monetary losses to many businesses that provide goods and services to the Hotel, serious loss of tourism business in Phoenix with commensurate ripple effect on the Phoenix economy of about \$40 million, and possible serious long term damage to the local tourism industry during future years due to loss of tourists to other states and countries.

\$ 200  
Note: This change was made at  
a Task Force meeting. I agree  
with nothing in this paragraph.  
- DeD

DESIGN/SAFETY ISSUES

1. Reach IV actually increases flooding hazard by introducing floodwaters from the Cudia City Wash in the area of 24th Street to 32nd Street where risk of severe flooding is now relatively low.

OMIT 2. ~~Estimated flow rate for 100-year flood is too low.~~

OMIT 3. ~~The flow estimate does not properly recognize flow resistance from wear and tear on channel walls.~~

4. Flow estimate fails to recognize flow reduction caused by the proposal to cover sections of the channel such as in the Biltmore area.

5. Inadequate capacity design creates significant probability of system failure and thus increases risk of flood damage.

6. Deletion of this extension would increase the flow capacity of the rest of the ACDC project.

7. There are other more effective alternative methods for controlling floodwaters.

8. Reach IV does not provide complete flood protection, and therefore jeopardizes property not previously flooded.

9. Phoenix and Maricopa County will have full liability for flood damages caused by the inadequate design of this project. Potential exist for substantial liability costs.

OTHER ISSUES

1. Reach IV is obsolete and unnecessary. Flood Insurance Rates Maps (FIRM) indicate flood insurance is no longer needed in the area south of Reach IV because of recent flood protection improvements.

2. Changes in population and building patterns make reconsideration of Reach IV necessary.

3. Upstream measures are necessary to protect north side residents from flooding in washes.

4. The open channel is a safety hazard.

5. The ACDC is an ugly ditch aesthetically unpleasing, <sup>22-24</sup> 24-feet deep, <sup>36-40</sup> 50-foot wide <sub>in Reach 4.</sub>

6. ACDC will reduce property values in the area adjacent to channel.
7. ACDC will be lined with ~~chain link fence topped with barb wire on top.~~ *fencing of as yet unspecified type.*
- omit* 8. ~~The ACDC will be even more unsafe without barb wire.~~
9. Reach IV will devastate the area during construction and will inalterably change the neighborhoods.
10. ACDC will destroy the park-like ambience of the Arizona Canal.
11. ACDC will cause the removal of existing natural features, vegetation, etc.
12. The ACDC will be a collector of debris, trash, cans, bottles, etc.
13. The ACDC will be an ugly scar across the City visible from street crossings.
14. ACDC causes displacement of long time residents from their homes and forces relocation of businesses.
15. ACDC does not address water conservation issue. Money set aside for ACDC could be used to fund flood control measures that conserve water.
16. Serious consideration should be given to finding ways to utilize the Arizona Canal for the mutual purposes of flood control and irrigation. The Canal is a Federal project and therefore the Government should find ways of saving money by utilizing existing canals instead of building a parallel one.
17. Thousands of people have signed petitions expressing concern about Reach IV.

#### HISTORICAL ISSUES

1. The Corps destroyed documentation on Alternatives to Reach IV. Phoenix City Council did not have information on alternatives when it endorsed Reach IV.
2. Details *ed design* of Reach IV *has* *published* ~~have not yet been made public.~~ It will become more difficult to stop or alter as construction grows near.
3. Reach IV was quickly conceived in an overreaction to the 1972 Flood.
4. Other alternatives were not given adequate study or consideration.

#### ARGUMENTS AGAINST REACH III

Many or all of the arguments used against Reach IV may be applied to Reach III.

Meeting w/ Kluewert.

8/14/81

Summary of arguments against ACR extension

C/B

1. No agreement
2. "
3. "

Main issue is benefit/cost, from taxpayers viewpoint.

4. No agreement
5. agree on #63
6. agree this statement is true.
7. Not possible to quantify
8. Statement may be true, but FCO will maintain whatever it takes.
9. No agreement (Verne feels easement is not 65' wide - what we have on ~~plot~~ photo includes SRP R/W, which Baltimore claims) Plot up easement. Parcel 2 (Collin, William) is in dispute between Baltimore & SRP.
10. Clarified language. → Reford w/ 2C from 221. (attal 3).
11. No agreement.

#21

Design Issues

1. No agreement.
2. agree on 6700 cfs. Removes issue.
3. Remove as issue
4. No agreement until Verne sees final design.  
(Feb.)

5. → No agreement (left for mutual agreement)

6.

7. Agree

8. No agreement,

9.

10.

11.

12.

13.

14. ~~Intent: use detentor business instead of channel,~~  
Agree.

### Other cases

1. No agreement

2. Partial agreement.

3. No agreement.

4. ~~not~~ agree as modified

5. omit.

6. No agreement,

7. " "

8. " "

9. " "

10. " "

11. Agree

### Historical Issues

1. No agreement, on 2<sup>nd</sup> part,

2. Agree (Doctrine of laches) Discuss w/ LTR.

3. No agreement.

venue is hung up on RB/RC → Clarify.

4. No agreement.

5. (Reaches 3 Issue - Verne Pas is parition).

6. No agreement.

7. I don't know.

This is the final list. 8/12/85

Revised 8/7/85

REVISED PRELIMINARY LIST

SUMMARY OF ARGUMENTS AGAINST ACDC EXTENSION

(Objections Raised by Citizens Against Reach IV)

Met with Verne Schwagerl on 8/14/85 and agreed to the penciled changes, -Ded

COSTS / Benefits

1. Extension will not be cost effective, i.e. benefits will be less than construction costs.
2. Discount rate of 3 1/4 used by Corps of Engineers to figure cost/benefits is unrealistically low. ~~A more realistic cost/benefit ratio is 1 to .89.~~
3. Costs of the project have been underestimated and actual costs will be much higher.
4. Reach IV jeopardizes the entire ACDC Project because of its poor cost/benefit ratio. (Congress may withdraw funding.)
5. Costs of Reach IV is between \$70 and \$114 million.
6. New predictions of sediments from washes will reduce the 100-year flood design without ~~\$25 million in local funds~~ <sup>3.6</sup> for sediment basins.
7. Local costs have been underestimated because liability for damages in connection with the construction (such as the closure of the Biltmore Hotel) have not been considered.
8. Annual operations and maintenance figures have been underestimated for structural maintenance and aesthetic treatment.
9. The 65 feet of easement obtained from the Biltmore is not adequate. Substantial local funds may be required to acquire more easement.
10. ~~Phoenix and Maricopa County~~ <sup>The Flood Control District</sup> will have full liability for flood damages caused by the ~~inadequate~~ design of this project. ~~Potential exist for substantial liability costs.~~
11. The Biltmore Hotel will have to be closed down for one year during construction of Reach IV, forcing the layoff of 1,100 employees, severe monetary losses to many businesses that provide goods and services to the Hotel, serious loss of tourism business in Phoenix with commensurate ripple effect on the Phoenix economy of about ~~\$40 million~~, and possible serious long term damage to the local tourism industry during future years due to loss of tourists to other states and countries.

\$200 million

MAJOR DESIGN/SAFETY FLAWS - ISSUES

1. Extension actually increases flooding hazard by introducing floodwaters from the Cudia City Wash in the area of 24th Street to 32nd Street where risk of severe flooding is now relatively low.
2. ~~Estimated flow rate for 100-year flood is too low.~~
3. ~~The flow estimate does not properly recognize flow resistance from wear and tear on channel walls.~~
4. Flow estimate fails to recognize flow reduction caused by the proposal to cover sections of the channel such as in the Biltmore area.
5. Inadequate capacity design creates significant probability of system failure.
6. Extension was designed for too little capacity, thus increasing risk of flood damage.
7. Deletion of this extension would increase the flow capacity of the rest of the ACDC project.
8. There are other more effective alternative methods for controlling floodwaters.
9. Reach IV is obsolete and unnecessary. Flood Insurance Rates Maps (FIRM) indicate flood insurance is no longer needed in the area south of Reach IV because of recent flood protection improvements.
10. Reach IV is redundant to measures already taken.
11. None of the properties south of Reach IV is currently subject to a 100-year flood.
12. Reach IV jeopardizes property not previously flooded because it is poorly designed. (i.e. does not provided complete flood protection.)
13. Changes in population and building patterns make reconsideration of Reach IV necessary.
14. Upstream measures are necessary to protect north side residents from flooding in washes.

OTHER ISSUES

NEGATIVE IMPACTS CN SURROUNDING AREA

1. The open channel is a safety hazard.
2. The ACDC is an ugly ditch aesthetically unpleasing, 24-foot deep, 50-foot wide in Reach 4.

22-24' 36-40

3. ACDC will reduce property values in the area adjacent to channel.
4. ACDC will be lined with <sup>fencing of as yet unspecified type</sup> ~~chain link fence topped with barb wire on top.~~
5. ~~The ACDC will be even more unsafe without barb wire.~~
6. Reach IV will devastate the area during construction and will inalterably change the neighborhoods.
7. ACDC will destroy the park-like ambience of the Arizona Canal.
8. ACDC will cause the removal of existing natural features, vegetation, etc.
9. The ACDC will be a collector of debris, trash, cans, bottles, etc.
10. The ACDC will be an ugly scar across the City visible from street crossings.
11. ACDC causes displacement of long time residents from their homes and forces relocation of businesses.

#### HISTORICAL ISSUES

#### ~~OTHER CONSIDERATIONS~~

1. The Corps destroyed documentation on Alternatives to Reach IV. Phoenix City Council did not have information on alternatives when it endorsed Reach IV.
2. Details <sup>ed design</sup> of Reach IV have not yet been <sup>published.</sup> made public. It will become more difficult to stop or alter as construction grows near.
3. Reach IV was quickly conceived in an overreaction to the 1972 Flood.
4. Other alternatives were not given adequate study or consideration.
5. ACDC does not address water conservation issue. Money set aside for ACDC could be used to fund flood control measures that conserve water.
6. Serious consideration should be given to finding ways to utilize the Arizona Canal for the mutual purposes of flood control and irrigation. The Canal is a Federal project and therefore the Government should find ways of saving money by utilizing existing canals instead of building a parallel one.
7. The ACDC extension is opposed by thousands of people.

#### ARGUMENTS AGAINST REACH III

The same arguments used against Reach IV may be applied to Reach III.

— Revised Preliminary List —

CITIZENS AGAINST REACH IV

8-5-85

Arguments Against ACDC Extension

- o Extension will not be cost effective, i.e. benefits will be less than construction costs.
  1. Costs of the project have been underestimated and actual costs will be much higher.
  
- o Extension actually increases flooding hazard by introducing floodwaters from the Cudia City Wash in the area of 24th Street to 32nd Street where risk of severe flooding is now relatively low.
  
- o Funding the non-cost effective extension jeopardizes funding for the entire New River City Streams Project.
  
- o Extension has major design/safety flaws:
  1. Estimated flow rate for 100-year flood is too low.
  2. The flow estimate does not properly recognize flow resistance from wear and tear on channel walls.

3. Flow estimate fails to recognize flow reduction caused by the proposal to cover sections of the channel in the Biltmore area.
4. Inadequate capacity design creates significant probability of system failure.
  - o Extension was designed for too little capacity, thus increasing risk of flood damage.
  - o The City and Maricopa County will have full liability for flood damages caused by the inadequate design of this project.
  - o Deletion of this extension would increase the flow capacity of the rest of the ACDC project.
  - o The open channel is a safety hazard.
  - o The open channel is aesthetically objectionable.
  - o ACDC will reduce property values in the area adjacent to channel.
  - o There are other more effective alternative methods for controlling floodwaters.
  - o Reach IV is obsolete and unnecessary. Flood rates insurance maps (FIRM) indicate flood insurance is no longer needed in the area south of Reach IV because of recent flood protection improvements.

- o ACDC will be lined with chain-link fence topped with barb wire on top.
- o A <sup>410</sup>\$110 million projected cost of ACDC is underestimated.
- o Deleting Reach IV will improve flood control capacity of the other three Reaches.
- o The Corps destroyed documentation on Alternatives to Reach IV. Phoenix City Council did not have information on alternatives when it endorsed Reach IV.
- o Changes in population and building patterns make reconsideration of Reach IV necessary.
- o Discount rates of 3 1/4 used by Corps of Engineers to figure cost benefits is unrealistically low. A more realistic cost benefit ratio is 1 to .89.
- o The 65 feet of easement obtained from the Biltmore is not adequate. Substantial local funds may be required to acquire more easement.
- o Liability for damages in connection with the construction (such as the closure of the Biltmore Hotel) have not been considered in the local costs.
- o Reach IV jeopardizes the entire ACDC Project because of its poor cost benefit ratio. (Congress may withdraw funding.)

- o Reach IV jeopardizes property not previously flooded because it is poorly designed. (i.e. does not provided complete flood protection.)
- o The rate of flow used by the Corps to calculate 100-year flow is questionable.
- o Covering the channel in places will result in a sudden and substantial decrease in the carrying capacity of the channel due to friction.
- o Local governments have all liability for flood damages.
- o The ACDC is an ugly ditch aesthetically unpleasing, 24-feet deep, 50-feet wide.
- o The ACDC will be unsafe without barb wire.
- o Reach IV will devastate the area during construction and will inalterably change the neighborhoods.
- o Details of Reach IV have not yet been made public. It will become more difficult to alter as construction grows near.
- o Annual operations and maintenance figures have been underestimated for structural maintenance and aesthetic treatment.
- o New predictions of sediments from washes will reduce the 100-year flood design without \$25 million in local funds for sediment basins.

- o Costs of Reach IV is between \$70 and \$114 million.
- o Reach IV was quickly conceived in an overreaction to the 1972 Flood.
- o None of the properties south of Reach IV is currently subject to a 100-year flood.
- o Reach IV is redundant to measures already taken.

0710i

CITIZENS AGAINST REACH III

Arguments Against ACDC

- o With the ACDC Project, the risk of flooding on the northside of the canal is increased.
  
- o There are other more effective alternative methods for controlling floodwaters; it may be possible that with the completion of Dreamy Draw and Cave Buttes Dams the ACDC project will not be necessary.
  
- o The open channel is a safety hazard.
  
- o ACDC will reduce property values in the area adjacent to the channel.
  
- o Benefits of ACDC will be less than costs to build.

0710i

REPORT LANGUAGE

FY86 Mark-up, House Appropriations Subcommittee for Energy and Water Development:

The Committee directs that the U. S. Army Corps of Engineers conduct a cost-benefit ratio analysis, using current Federal guidelines and policy directives, of that portion of the Phoenix, Arizona and Vicinity (including New River) Flood Control Project known as Reach 4 from Dreamy Draw to Cudia City Wash, and provide this analysis to the Committee for its review.

MATERIAL DISTRIBUTED AT OR FOR  
ACDC TASK FORCE MEETINGS

Meeting No. 1, July 15, 1985

- A-1 o Agenda
- A-2 o List of Task Force members, with mailing addresses
- A-3 o ACDC Task Force Appointments memo from Mayor Terry Goddard, Policy Agenda, June 18 and 25, 1985
- A-4 o ACDC Reach IV, City Council Report from Peter F. Starrett, Information Item, May 7, 1985 (with attached report from Army Corps of Engineers)
- A-5 o Reach 4, Arizona Canal Diversion Channel Information Report from Jim Attebery, May 14, 1985 (FLD 060202)
- A-6 o Minutes of Formal Council Meeting, ACDC Public Hearing, May 15, 1985
- A-7 o ACDC Briefing Paper, prepared by U.S. Army Corps of Engineers, June 1985, 12 pages with attachments
- A-8 o Response Summary - Workshops for Esthetic Design for ACDC, November - December, 1984
- A-9 o Letter from Representative Eldon Rudd, to Kemberly Clark, July 3, 1985 with attachments including cost information
- A-10 o Newspaper clippings - distributed by Kemberly Clark

Meeting No. 2, July 22, 1985

- B-1 o Agenda
- B-2 o Minutes of July 15 meeting
- B-3 o List of materials distributed to Task Force
- B-4 o List of proposed rules and procedures
- B-5 o Pamphlet on open meeting law  
  
Distributed at Meeting:
- B-6 o Alternative Meeting Locations
- B-7 o Memo regarding Storm Sewers for ACDC Task Force to Mr. Lee from Mr. Attebery dated July 22, 1985

- B-8 o Letter from D. E. Sagramoso to Mr. Dellriarte dated May 21, 1985 with attached regarding Reach 4, ACDC.
- B-9 o Fact Sheet on Reach 4, ACDC prepared by Staff of City of Phoenix Engineering Department and Flood Control District of Maricopa County, May 1985.
- B-10 o Letter to Col. John C. Lowry from Jim Attebery, regarding Flood Control Program - Arizona Canal Channel, January 12, 1973
- B-11 o Flood Control in the Desert, a Progress Report, prepared by D.E. Sagramoso, Flood Control District, May 28, 1985
- B-12 o Concerns Regarding the Arizona Canal Diversion Channel, Kemberly Clark, July 1985
- B-13 o Position Statement (1-page), Citizens Against Reach Three, updated
- B-14 o Citizens Against Reach Four Position Paper - (7 pages)

Meeting No. 3, July 27, 1985 (Saturday Tour of Reaches 3 and 4)

- C-1 o Agenda
- C-2 o Notebook from Maricopa County Flood Control District prepared for Tour, July 27, 1985
- C-3 o Glossary of Terms, titled "Phoenix, Arizona and Vicinity (Including New River) - for Notebook (See C-2) Tab 10 "Other Information"

Meeting No. 4, July 29, 1985

- D-1 o Agenda
- D-2 o Minutes of July 22 Meeting with attachments (No. 1 - List of Information Requests by Jasper Hawkins; No. 2 - List of Possible Information to be Requested by Richard Lee).
- D-3 o List of Material Distributed at or for ACDC Task Force Meetings - Updated
- D-4 o Memo from Kathy Cale to Task Force Listing Public Hearing Locations and Dates and Regular Meeting Schedule

Distributed at Meeting:

- D-5 o List(s) of Arguments Against ACDC Extension, Citizens Against Reach IV and Citizens Against Reach III (prepared by staff as preliminary document July 1985), 2 pages

- D-6 o Summary of Markiewicz Lawsuit dated July 29, 1985, 1 page
- D-7 o Proposed Agenda for July 31 Public Hearing
- D-8 o Sample of Card to be Used at Task Force Public Hearings
- D-9 o Copy of letter from Richard Lee regarding Public Hearings (mass mailed), dated July 29

Meeting No. 5, July 31, 1985 - Public Hearing

- E-1 o Agenda
- E-2 o Statement by Charles Pickrell regarding Reach IV alternative Dated July 31, 1985 (1 page).
- E-3 o Notebook prepared by Vern Schweigert, Citizens Against Reach IV

Meeting No. 6, August 5, 1985

- F-1 o Agenda
- F-2 o Minutes - July 27, 1985
- F-3 o Minutes - July 29, 1985
- F-4 o Materials Distributed - Revised August 1, 1985
- F-5 o Information Requests Lists
- F-6 o Revised Fact Sheet on Reach IV - Dated July 30, 1985 - Replaces Document B-9, distributed at Meeting No. 2, July 22, 1985
- F-7 o Summary of Alternative Plans provided by Maricopa County Flood Control District (undated)
- F-8 o Draft of Agenda - August 7, 1985.

ARIZONA CANAL DIVERSION CHANNEL  
TASK FORCE

MONDAY, AUGUST 19, 1985  
4:00 P.M.

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A. INTRODUCTION

1. NAME *(Dave Bernis)*
2. TITLE & BACKGROUND WITH CITY
3. PURPOSE - TO ACQUAINT TASK FORCE WITH CITY'S ROLE IN REGULATING NEW DEVELOPMENT TO PREVENT FLOOD DAMAGES. SPECIFICALLY TO EXPLAIN HOW WE USE THE FLOOD INSURANCE RATE MAPS FOR THAT PURPOSE.

B. HISTORY OF DRAINAGE/FLOOD CONTROL ACTIVITIES.

1. PRIOR TO 1971 CITY HAD NO AUTHORIZATION TO REGULATE NEW DEVELOPMENT.
2. IN 1971 VOTERS APPROVED AMENDMENT TO CITY CHARTER AUTHORIZING POWER TO REGULATE.
3. JOINED NATIONAL FLOOD INSURANCE PROGRAM - EMERGENCY PHASE - 1971
4. COUNCIL ADOPTED GRADING AND DRAINAGE ORDINANCE - 1972.
5. STATE PASSED LEGISLATION REQUIRING REGULATION OF FLOODPLAINS - 1973
6. ADOPTED FIRST FLOODPLAIN ORDINANCE - 1974
7. JOINED NATIONAL FLOOD INSURANCE PROGRAM - REGULAR PHASE - 1979

C. DESCRIPTION OF PRESENT FLOOD/DRAINAGE POLICIES.

1. STORM DRAINAGE SYSTEM
2. ON-SITE RETENTION - DRAINAGE REVIEW AND APPROVAL
3. FLOOD DETENTION BASINS - FLOOD CHANNELS
4. FLOODPLAIN MANAGEMENT
5. SUPPORT FEDERAL PROJECTS

D. HISTORY & FUNCTION OF FEMA/FIA

1. CONGRESS PASSED THE FLOOD CONTROL ACT OF 1968 IN RESPONSE TO CONTINUALLY RISING FLOOD DAMAGES INSPITE OF CONSTANTLY INCREASING EXPENDITURES FOR FLOOD CONTROL PROJECTS.

2. ACT PROVIDED FOR SALE OF SUBSIDIZED FLOOD INSURANCE TO SPREAD COST OF FLOOD DAMAGES (PRIOR TO 1968 FLOOD INSURANCE WAS NOT AVAILABLE FROM PRIVATE COMPANIES)
3. SALE OF INSURANCE WAS PREDICATED UPON EACH COMMUNITY VOLUNTARILY JOINING THE PROGRAM AND AGREEING TO ENFORCE MINIMUM REGULATIONS SET FORTH BY FEMA
4. THE MINIMUM STANDARDS WERE CONTAINED IN REGULATIONS AND MAPS PUBLISHED BY FEMA - GIVE EXAMPLES
5. THIS WAS THE PROGRAM PHOENIX JOINED IN 1971
6. BECAUSE THE LACK OF PARTICIPATION, CONGRESS PASSED THE 1973 AMENDMENT THAT REQUIRED PARTICIPATION BY EVERY COMMUNITY WITH AN IDENTIFIED FLOOD HAZARD
7. FAILURE BY ANY COMMUNITY TO PARTICIPATE WOULD RESULT IN RATHER SEVERE ECONOMIC SANCTIONS
8. IN AN EFFORT TO BALANCE THE FEDERAL BUDGET, PRESIDENT REAGAN HAS DIRECTED FEMA TO MAKE THE PROGRAM ACTUARILY SOUND WITHIN THREE YEARS.
9. NATIONALLY, THE PRESENT ANNUAL COST OF THE AVERAGE FLOOD INSURANCE POLICY IS \$240. TO BE SELF SUPPORTING, THIS MUST BE INCREASED TO \$400.
10. FROM THE BEGINNING SEVERE RESTRICTIONS HAVE BEEN PLACED ON FEMA'S MAPPING BUDGET IN AN EFFORT TO SHIFT THE COST OF MAPPING AND MAP UPDATES TO LOCAL GOVERNMENT
11. THIS HAS RESULTED IN MANY FLOOD HAZARD AREAS NOT BEING MAPPED OR NOT BEING ADEQUATELY MAPPED TO REFLECT THE TRUE HAZARD
12. NATIONWIDE, 40% OF ALL FLOOD CLAIMS PAID BY FEMA ARE LOCATED IN AREAS THAT HAVE BEEN MAPPED AS ZONE B OR C
13. ZONE B IS DEFINED AS THAT AREA WHICH WOULD BE INUNDATED BY A FLOOD GREATER THAN THE 100 YEAR AND LESS THAN THE 500 YEAR EVENT
14. ZONE C IS DEFINED AS HAVING NO APPRECIABLE FLOOD HAZARD

E. DISCUSSION OF PHOENIX FIRM

1. IN 1971, FEMA HIRED THE CORPS OF ENGINEERS TO PRODUCE A FLOOD INSURANCE STUDY FOR CITY OF PHOENIX
2. IN YOUR HANDOUT PACKETS YOU HAVE A COPY OF A PRELIMINARY PANEL PRODUCED BY THE CORPS OF ENGINEERS AND SUBMITTED TO FEMA FOR REVIEW.
3. THE YELLOW AREAS SHOWN ON MY COPY WAS DESIGNATED AS SUBJECT TO FLOODING FROM A 100 YEAR EVENT OR LESS. PLEASE DON'T CONFUSE THE ZONE LABEL ON THE MAP WITH THE ZONES THAT ARE PRESENTLY USED.

4. FEMA DID NOT ACCEPT THE MAPPING AS SUBMITTED AND DELETED ALL THE DESIGNATED FLOOD ZONES BELOW THE ARIZONA CANAL BECAUSE THERE WAS NO MATHEMATIC BASIS FOR THEIR DEPTH OR AREAL EXTENT.
5. REMEMBER THAT THE PRIMARY PURPOSE OF THE MAPS IS TO PROVIDE THE BASIS FOR FLOOD INSURANCE SALES MINIMUM MANAGEMENT CRITERIA. FEMA MUST HAVE A MATHEMATICALLY SOUND BASIS TO SET INSURANCE RATES. THEREFORE, APPROXIMATE DELINEATIONS SUCH AS YOU HAVE BEFORE YOU, EVENTHOUGH THEY ARE BASED UPON OBSERVED EVENTS, ARE UNACCEPTABLE.
6. THE COMPLETED STUDY WAS THEREFORE SHIPPED TO THE CITY ON DECEMBER 18, 1973 WITHOUT ANY SPECIAL FLOOD HAZARD AREAS SHOWN BELOW THE ARIZONA CANAL
7. WITH THE EXCEPTION OF SEVERAL MINOR CHANGES TO THE TRIBUTARY WASHES UPHILL OF THE CANAL, THE PRESENT MAPS ARE ALMOST IDENTICAL TO THOSE DELIVERED TO US IN 1973
8. SITUATIONS SUCH AS THIS ARE FAIRLY COMMON THROUGH THE CITY AND FEMA ENCOURAGES US TO USE THE BEST INFORMATION WE HAVE OR TO DEVELOP OUR OWN MAPPING FOR PURPOSES OF DEVELOPMENT REGULATION.

F. CRITERIA FOR REGULATION OF FLOODPLAIN DEVELOPMENT

1. FIRM ARE MINIMUM STANDARDS REQUIRED BY FEMA
2. WE ARE AWARE OF MANY FLOOD PRONE AREAS THAT ARE NOT SHOWN ON THE MAPS AND ARE ENCOURAGED BY FEMA TO USE ANY LATER OR BETTER INFORMATION THAT WE MAY HAVE
3. TYPICAL AREAS ARE:
  - 40TH STREET WASH
  - AHWATUKEE
  - 10TH STREET WASH
  - DREAMY DRAW WASH
  - 43RD AVENUE & BURGESS
  - RECENTLY ANNEXED AREAS
  - BELOW THE ARIZONA CANAL
4. THE CITY REVIEWS ALL DEVELOPMENT PROPOSALS. THOSE THAT ARE IN KNOWN FLOOD HAZARD AREAS ARE TRANSMITTED TO THE FLOODPLAIN MANAGEMENT SECTION FOR CLOSER INSPECTION
5. ACCEPTABLE COUNTERMEASURES INCLUDE BUT ARE NOT LIMITED TO:
  - ELEVATING STRUCTURES

REORIENTING STRUCTURES

REDUCING DEVELOPMENT DENSITY

CONSTRUCTING BERMS & DIKES

CONSTRUCTING & ENLARGING DRAINAGE CHANNELS

G. PHOENIX HAS DUTY TO PROTECT ITS CITIZENS FROM FLOOD DAMAGES

1. I BRIEFLY TOUCHED ON THE BROAD SCOPE OF OUR EFFORTS TO PROTECT OUR CITIZENS FROM FLOODING. MOST OF OUR EFFORTS HAVE BEEN DIRECTED TOWARD CONSTRUCTION OF PHYSICAL FACILITIES.
2. WE HAVE NOT CONSIDERED FLOOD INSURANCE TO BE A VERY EFFECTIVE TOOL BECAUSE IT WILL NOT PREVENT FLOODS BUT MERELY PARTIALLY COMPENSATE THE VICTIMS
3. FOR EXAMPLE, FLOOD INSURANCE DOES NOT COVER DAMAGES TO AUTOMOBILES, OUT BUILDINGS OR THEIR CONTENTS, SWIMMING POOLS, LANDSCAPING, FENCES, BUILDING CONTENTS (UNLESS A SEPARATE SECOND POLICY IS PURCHASED), LOST WAGES, DEATH OR INJURY.
4. IF JUST THE 2600 HOMES THAT WERE FLOODED DURING THE 1972 WERE REQUIRED TO PAY FOR FLOOD INSURANCE AS AN ALTERNATIVE TO THE PROTECTION THAT WOULD BE PROVIDED BY THIS PROJECT, IT WOULD AMOUNT TO AN ANNUAL EXPENDITURE OF ABOUT \$1,040,000. AT THE PRESENT DISCOUNT RATE, THIS ALONE WOULD JUSTIFY A PRESENT INVESTMENT OF \$13,631,000.
5. OBVIOUSLY. THESE NUMBERS WILL JUSTIFY THE ADDITIONAL MAPPING AND STUDIES THAT WOULD BE NECESSARY TO SECURE FEMA'S APPROVAL TO INCLUDE THE AREA BELOW THE CANAL AS A DESIGNATED FLOODPLAIN.
6. CITY STAFF WOULD BE SERIOUSLY REMISS TO NOT RECOMMEND THIS ALTERNATIVE TO COUNCIL IF REACH 3 & 4 ARE NOT CONSTRUCTED.

H. THANK YOU FOR YOUR ATTENTION. ARE THERE ANY QUESTIONS?

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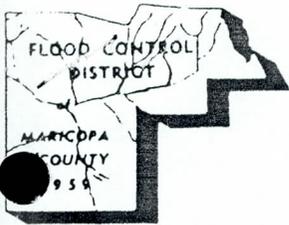
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FLOOD CONTROL DISTRICT of Maricopa County

Interoffice Memorandum

CMT. NO.	SUBJECT: <b>Alternate Plan for Diminished Neighborhood Impact Reaches 3 &amp; 4 ACDC</b> <i>(Central to 14th St.)</i>	<input type="checkbox"/> FILE _____ <input type="checkbox"/> DESTROY _____
	TO: <b>DES</b>  FROM: <i>BJM/afm</i>  via EDO	DATE: <b>10/02/85</b>
<p>Jim Culbertson and I did a review of additional parcels that need acquiring in this alternate plan. The acquisitions began at Coronado Street and continue in a general easterly direction through to 14th Street. They will impact a total of 55 single family dwellings; one duplex, 14 apartment units, 8 condominium units, 1 vacant commercial lot, 1 mortuary, and 1 shoe store.</p> <p>It has been estimated that the total acquisition cost including relocation will be \$6,943,000.</p>		

MEMORANDUM

TO: Executive Committee  
FROM: ACDC Committee  
SUBJECT: Recommendations for further action.

The ACDC Committee recognizes its membership reflects the same perspectives as the public at large. The membership perceives there are fundamental philosophical differences on solutions. There are aesthetic and socio-economic considerations which divide us and the public, i.e. the poll conducted by committee member Burt Lewkowitz (attached) which reveals those living in the affected area have serious reservations about channel construction.

The Committee believes it should make a recommendation on one of the following conclusions, but it needs time to receive more information on two solutions.

The decision points are:

- No Action Alternative*
1. Alternative Number One - This alternative would consist of a voluntary insurance program for land owners down-gradient from the Arizona Canal in the area of Reach 4 to possibly include all areas affected by the 1972 flood. This alternative also might include some incentive or action forcing mechanism implemented by the Phoenix City Council.
  2. Alternative Number Two - This alternative would consist of an insurance program coupled with the designation of a floodplain below the Arizona Canal in the area of Reach 4. The Phoenix City Council would actively pursue the designation of such a floodplain by the Federal Emergency Management Agency (FEMA). FEMA would examine the entire area flooded in 1972 and other areas possibly affected by the occurrence of anything up to a 100-year flood above the Arizona Canal and the area of Reach 4.
  3. 40th Street - The collector channel along the Arizona Canal from 36th Street to 40th Street and the 40th Street culvert would avoid introduction of increased floodwaters into the ACDC.
  4. 48th Street (Old Cross-Cut Canal) - Conveys water from Cudia City Wash to an improved old Cross-Cut Canal and carries to the Salt River.
  5. Reach 4 as presently conceived.

The public has to make a choice and must be given the data upon which to make the choice. The Valley Forward ACDC Committee believes it should make a recommendation based on one of these solutions.

4000 \$  
400  
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1,600,000

Alt 1 & 2  
Quantity Insurance costs.  
How much premium / house ↑  
Get these #'s to counter  
the Lantowitz pole.  
Use overflow area, assumed  
in & out of floodplain.

REVISED LIST

SUMMARY OF ARGUMENTS AGAINST REACH IV

(Objections Raised by Citizens Against Reach IV)

COST/BENEFIT ISSUES

1. Reach IV will not be cost effective, i.e. benefits will be less than construction costs.
2. Discount rate of 3 1/4 used by Corps of Engineers to figure cost/benefits is unrealistically low.
3. Costs of the project have been underestimated and actual costs will be much higher.
4. Reach IV jeopardizes the entire ACDC Project because of its poor cost/benefit ratio. (Congress may withdraw funding.)
5. Costs estimates for Reach IV vary between \$70 and \$114 million.
6. New predictions of sediments from washes will reduce the 100-year flood design without \$3.6 million (\$460,000 in local funds) for sediment basins in 1984 dollars.
7. Local costs have been underestimated because liability for damages in connection with the construction (such as the closure of the Biltmore Hotel) have not been considered.
8. Annual operations and maintenance costs have been underestimated for structural maintenance and aesthetic treatment.
9. The 65 feet of easement obtained from the Biltmore is not adequate. Substantial additional local costs may be incurred to acquire more easement.
10. The Biltmore Hotel will have to be closed down for one year during construction of Reach IV, forcing the layoff of 1,100 employees, severe monetary losses to many businesses that provide goods and services to the Hotel, serious loss of tourism business in Phoenix with commensurate ripple effect on the Phoenix economy of about \$200 million, and possible serious long term damage to the local tourism industry during future years due to loss of tourists to other states and countries.

DESIGN/SAFETY ISSUES

1. Reach IV actually increases flooding hazard by introducing floodwaters from the Cudia City Wash in the area of 24th Street to 32nd Street where risk of severe flooding is now relatively low.

2. Flow estimate fails to recognize flow reduction caused by the proposal to cover sections of the channel such as in the Biltmore area.
3. Inadequate capacity design creates significant probability of system failure and thus increases risk of flood damage.
4. Deletion of this extension would increase the flow capacity of the rest of the ACDC project (or cut costs).
5. There are other more effective alternative methods for controlling floodwaters.
6. Reach IV does not provide complete flood protection, and therefore jeopardizes property not previously flooded.
7. Phoenix and Maricopa County will have full liability for flood damages caused by the inadequate design of this project. Potential exist for substantial liability costs.

#### OTHER ISSUES

1. Reach IV is obsolete and unnecessary. Flood Insurance Rates Maps (FIRM) indicate flood insurance is not needed in the area south of Reach IV because of recent flood protection improvements.
2. Changes in population and building patterns make reconsideration of Reach IV necessary.
3. Upstream measures are necessary to protect north side residents from flooding in washes.
4. The open channel is a safety hazard.
5. The ACDC is an ugly ditch aesthetically unpleasing, 22-24 feet deep, 36-40 feet wide in Reach IV.
6. ACDC will reduce property values in the area adjacent to channel.
7. ACDC will be lined with fencing of as yet unspecified type.
8. Reach IV will devastate the area during construction and will inalterably change the neighborhoods.
9. ACDC will destroy the park-like ambience of the Arizona Canal.
10. ACDC will cause the removal of existing natural features, vegetation, etc.
11. The ACDC will be a collector of debris, trash, cans, bottles, etc.
12. The ACDC will be an ugly scar across the City visible from street crossings.
13. ACDC causes displacement of long time residents from their homes and forces relocation of businesses.

14. ACDC does not address water conservation issue. Money set aside for ACDC could be used to fund flood control measures that conserve water.
15. Serious consideration should be given to finding ways to utilize the Arizona Canal for the mutual purposes of flood control and irrigation. The Canal is a Federal project and therefore the Government should find ways of saving money by utilizing existing canals instead of building a parallel one.
16. Thousands of people have signed petitions expressing concern about Reach IV.

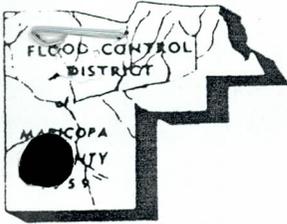
#### HISTORICAL ISSUES

1. The Corps destroyed documentation on Alternatives to Reach IV. Phoenix City Council did not have information on alternatives when it endorsed Reach IV.
2. Detailed design of Reach IV has not yet been published. It will become more difficult to stop or alter as construction grows near.
3. Reach IV was quickly conceived in an overreaction to the 1972 Flood.
4. Other alternatives were not given adequate study or consideration.

#### ARGUMENTS AGAINST REACH III

Many or all of the arguments used against Reach IV may be applied to Reach III.

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FLOOD CONTROL DISTRICT of Maricopa County

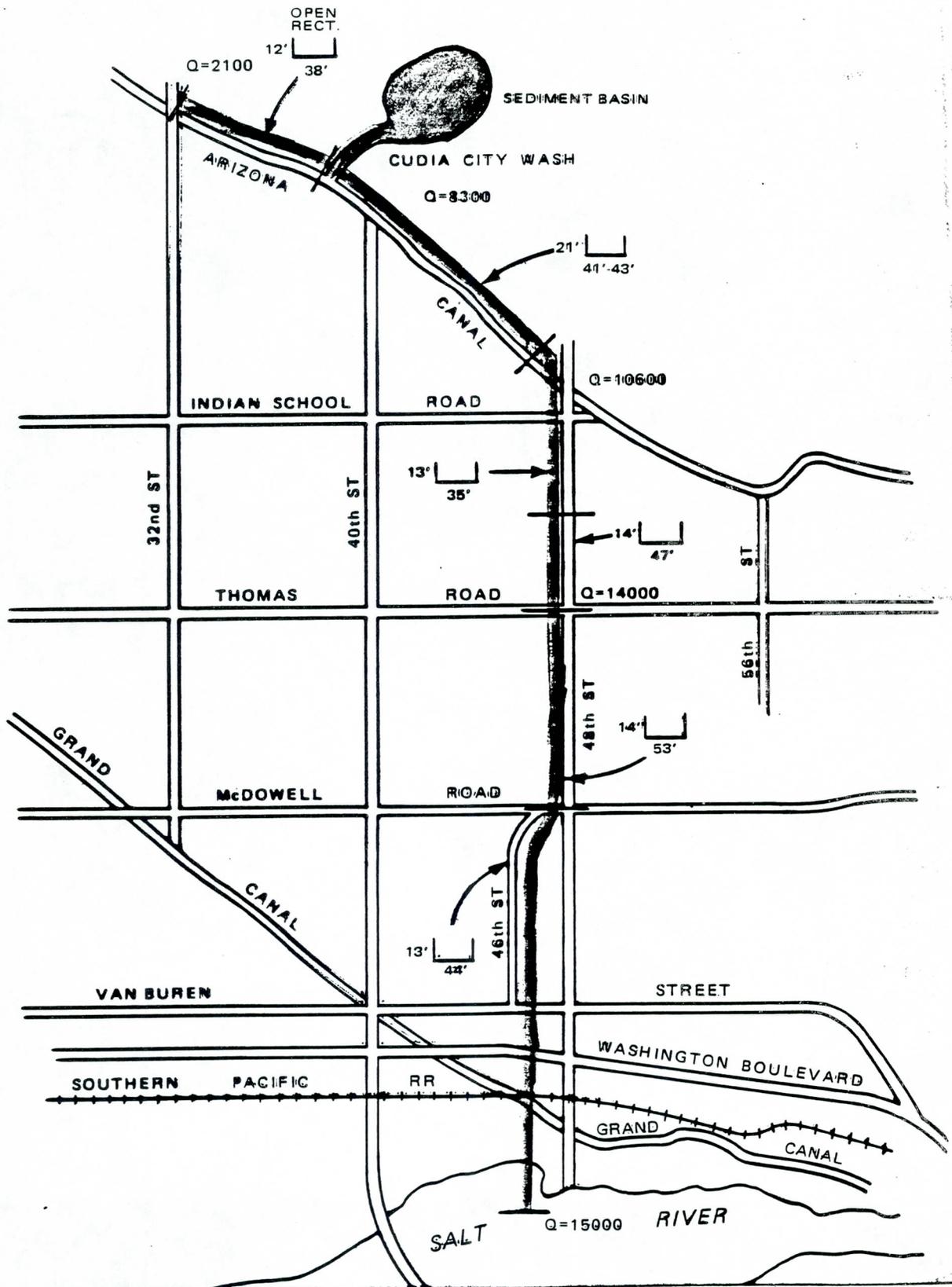
Interoffice Memorandum

CMT. NO.	SUBJECT: ACDC Alternate 48th Street Drain	<input type="checkbox"/> FILE _____ <input type="checkbox"/> DESTROY
	TO: DES  FROM: <i>RJM</i>  via EDO	DATE: 9/30/85
<p>This alternate runs from the Cudia City Wash adjacent to the north side of the ACDC in a southeasterly direction to the 48th Street Drain. My investigation showed that between Arcadia Drive and 42nd Place, there are a total of 61 single family homes that would be affected by this proposed channel. These homes range in value from \$105,000 to approximately \$200,000. Adjacent to 42nd Place to the northwest, is an apartment complex called Villa Green Apartments. A total of 12 units would have to be acquired in addition to 18 covered parking spaces. Adjacent to this complex, is the Camelback Castille Condominium Units. A total of 13 units would fall within the proposed channel in addition to the swimming pool, supply room, playground and a number of parking spaces. A short distance north on the north side of Camelback is the Northbank Apartments, some 73 parking spaces in addition to lights and landscaping are located within the proposed floodway. The loss of the parking and one of the main access driveways would cause a great deal of disruption during the construction period. Across from the Northbank Apartment on the west side of 40th Street and the northerly side of the Arizona Canal is the Northbank Restaurant. As a result of this floodway, all of the parking will be disturbed during the construction period. The final values reported below assume that the channel will be covered adjacent to the Northbank Apartments and Restaurant. Adjacent to the restaurant is the Northbank Office Park. There are 2 existing 2 story office buildings that have in excess of 75,000 square feet of area with a number of covered parking spaces. Also a new multi-story office building is presently under construction. All of these structures would have to be removed for the proposed floodway.</p> <p>The properties needed for this alternate route are estimated to have a value of \$23,255,000, this includes relocation costs.</p>		

## ALTERNATIVES TO REACH 4

- 48TH STREET CHANNEL (OLD CROSS-CUT)
- 40TH STREET (COVERED CHANNEL)
- PARADISE VALLEY DETENTION BASINS

# ALTERNATIVE PLANS TO REACH 4 Old Cross Cut



OLD CROSS CUT CANAL

ADVANTAGES

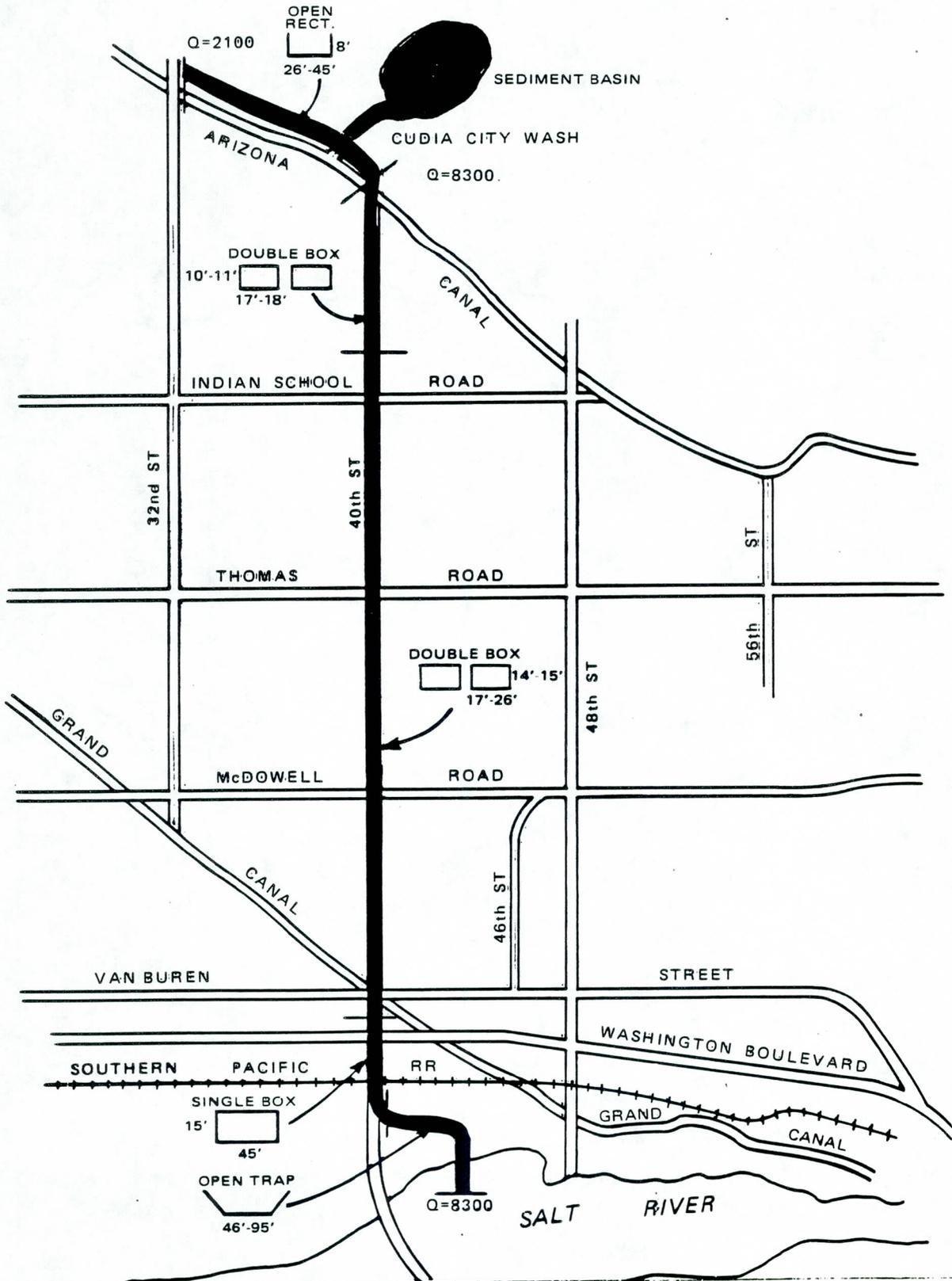
- Free R/W at canal
- "Steep" slope at canal allows smaller channel
- Eliminates esthetic problems 32nd Street to Dreamy Draw
- Provides flood protection west of Old Cross Cut canal

DISADVANTAGES

- Takes 64 homes and 3 major office buildings
- Does not control drainage areas west of 32nd Street or eliminate ponding north of the Arizona Canal
- Can't implement under existing COE authority (would have to be justified at "current" discount rate - 8 3/8 percent now and increasing 1/8 percent per year)



# ALTERNATIVE PLANS TO REACH 40th Street (Box Culvert)



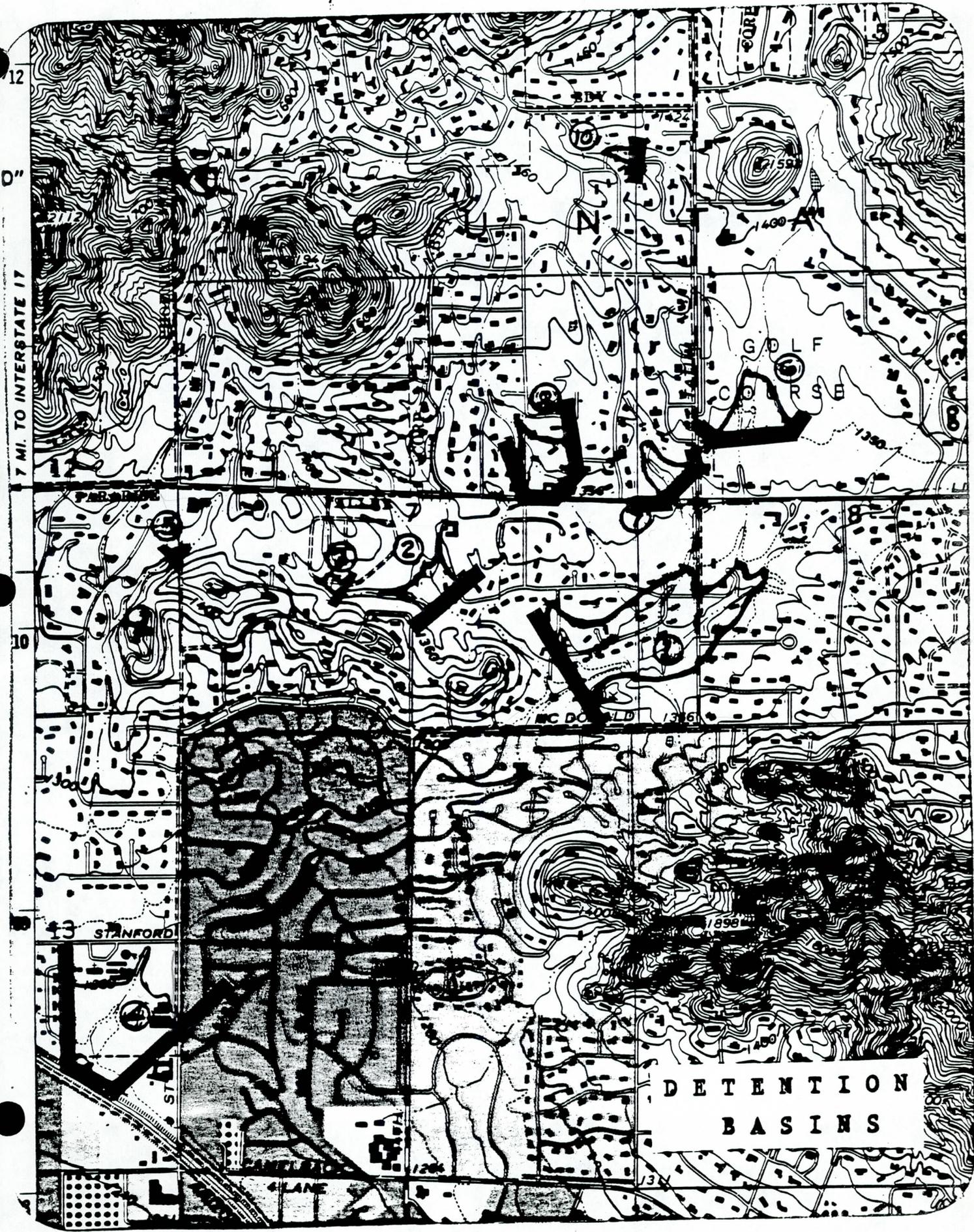
40th STREET

ADVANTAGES

- No additional homes taken
- Eliminates esthetic problems 32nd Street to Dreamy Draw (assuming no channel)
- Reduced channel size Dreamy Draw to Cave Creek

DISADVANTAGES

- Takes 4 office building
- Does not control drainage areas west of 32nd Street or eliminate ponding north of the Arizona Canal
- Probably can't be implemented under current authorization
- 1 to 1½ year disruption of major streets
- Major disruption to homes and businesses along 40th Street



## PARADISE VALLEY DETENTION BASINS

### ADVANTAGES

- Reduced channel sizes through Reaches 3 and 4
- Reduces esthetic problems from 32nd Street to Dreamy Draw

### DISADVANTAGES

- Takes 55 homes, 8 commercial buildings, Phoenix Country Day School, and portion of golf course at Paradise Valley Country Club
- Implementation under current authority questionable
- Proposed reservoirs extend across major street

ALTERNATIVE PLANS TO REACH 4  
COST ESTIMATES (1985 Dollars)

<u>PLAN</u>	<u>COST</u>	<u>RELOCATIONS</u>
REACH 4	\$ 48,700,000 <u>LI</u>	20 HOMES
40th St. (BOX CULVERT)	\$ 111,800,000	4 COMMERCIAL BLDGS.
OLD CROSS-CUT	\$ 80,000,000	64 HOMES 3 COMMERCIAL BLDGS.
PARADISE VALLEY DETENTION BASINS	\$ 69,200,000	55 HOMES 8 COMMERCIAL BLDGS. 1 SCHOOL

LI REMAINING COST